Montana Gray Wolf Conservation and Management Plan

2023

EXECUTIVE SUMMARY

This document provides the foundation for Montana Fish, Wildlife, and Parks' (hereafter, FWP) recommendations regarding conservation and management of gray wolves (*Canis lupus*; hereafter, wolves). The assessment of this plan at the state level has followed the Montana Environmental Policy Act (hereafter, MEPA) and Environmental Impact Statement (hereafter, EIS) process. After development of the 2003 Montana Gray Wolf Conservation and Management Plan (hereafter, 2003 Wolf Plan), new and improved research and management tools have been introduced and implemented. These tools have been incorporated into Montana's comprehensive wolf management program, through the flexibility and adaptability contemplated by the 2003 Wolf plan. The 2023 Montana Gray Wolf Conservation and Management Plan (hereafter, 2023 Wolf Plan) includes updates in wolf-related research and describes new management tools that FWP may employ. The 2023 Wolf Plan also provides FWP with the flexibility needed to incorporate new science and tools as they become available, ensure continued transparency related to wolf management practices, and describes the public engagement process. The 2023 Wolf Plan reflects existing laws, regulations, and policies as of 2023, as well as inter-governmental commitments made by FWP and the Montana Fish and Wildlife Commission (hereafter, commission). The commission does not play a role in MEPA and Montana Administrative Procedures Act (MAPA) processes.

Montana remains committed to maintaining the long-term viability of wolves. Wolf recovery in Montana began in the early 1980s. From 1974–2011 (with a gap in 2009 when wolves were first briefly delisted), the U.S. Fish and Wildlife Service (hereafter, USFWS) managed wolves in the Northern Rocky Mountains (hereafter, NRM), under the authority of the Endangered Species Act (hereafter, ESA), as either "endangered" or "experimental nonessential." The federal wolf recovery goal of 30 breeding pairs, defined as an adult male and female wolf that have produced at least 2 pups that survived until December 31, for 3 consecutive years in the NRM (with a minimum of 10 breeding pairs and 100 wolves for each state) was met by 2002. FWP developed the existing 2003 Wolf Plan and an associated EIS to analyze potential impacts to the physical environment and human population. The Final EIS considered five alternative approaches that captured the philosophical spectrum of peoples' values, opinions, and beliefs—the social factors that need to be considered in addition to the biological factors. In September 2003, a Record of Decision was released identifying Alternative 2 from the FEIS, the "Updated Council," as Montana's Wolf Management Plan. In October 2003, Montana, along with Idaho and Wyoming, submitted wolf management plans to the USFWS. Because Wyoming's wolf management plan was not accepted by the USFWS, in January 2004, the USFWS announced they would not move forward with delisting until all NRM states had approved wolf management plans. FWP developed a contingency plan alternative in the event that delisting was delayed, and in May 2004, the Record of Decision was amended to the contingency alternative until wolves were delisted. Although wolves were still listed under the ESA and under ultimate authority of the USFWS, day-to-day monitoring and management of wolves (excluding harvest) in the state of Montana was delegated to FWP.

In 2011, wolves were delisted and Montana has managed them under state authority ever since then (annual reporting to the USFWS was required as part of the post-delisting monitoring plan from 2011–2016). The 2009 final delisting rule published in the federal register set a *minimum* of 150 wolves and 15 breeding pairs for Montana to ensure the population never falls below recovery goals (USFWS 2009). The minimum population in the 2003 Wolf Plan and associated EIS reflected that of the federal register. The 2003 Wolf Plan also established an incremental approach to wolf management that allows managers

latitude to adjust wolf numbers and distribution and allows for a regulated harvest of wolves as a wildlife management tool. Implementation of the 2003 Wolf Plan has been ongoing since delisting and, using a combination of hunting license dollars and federal Pittman-Robertson funds (excise tax on firearms, ammunition, and hunting or trapping equipment), FWP has monitored the wolf population (i.e., distribution and abundance), mitigated conflict including livestock depredation and other wolf control resulting from interactions that generated conflict, coordinated and authorized research and collaring, conducted public outreach, and developed and used contemporary population estimation tools since 2004. FWP has managed harvest consistent with state law and Commission regulation (i.e., hunting and trapping seasons) since wolves were delisted from the ESA.

Wolves are now well established in Montana. By the end of 2004, there was an estimated 835 wolves and 66 breeding pairs in the NRM. In Montana, there were about 153 wolves in 15 breeding pairs. From the time recovery goals were met to delisting, the wolf population in the NRM tripled. Once wolves were delisted and designated under the management of FWP and the 2003 Wolf Plan, hunting seasons were implemented in 2009 and trapping seasons were implemented in 2012 (with no wolf harvest in 2010). Population numbers have remained six to eight times above the federal recovery minimum threshold of 15 breeding pairs and 150 wolves in Montana since 2011. From 2011–2022, the population appears to have stabilized, with an average of 194 packs and 1,165 wolves per year. Wolves occupy much of the predicted distribution area in Montana. In the last decade, expansion in distribution (i.e., recolonization of new areas) has subsided, although amount and availability of suitable habitat is not a limiting factor. Since delisting and transition to state management, harvest increased and depredation removals decreased, but since 2018, both have remained stable. FWP aims to balance wolf distribution and densities with the diverse needs of the public and private landowners, and the various land uses in Montana. Montana has maintained an estimated population of 1,087 to 1,260 wolves from 2011–2022, with a harvest of 166 to 327 wolves annually. The average harvest by license year since 2012, when both hunting and trapping have been legal, is 256 wolves. Legal hunting and trapping harvest is the leading cause of mortality for wolves in Montana, followed by agency control efforts. Other types of human-caused mortality are minimal and negligible to population dynamics.

FWP implements flexible management strategies so that it can ensure population sustainability as ecological and sociopolitical environments change to create or accommodate changes in law, and to incorporate new and available science into practical and implementable management strategies. What is consistent in the wolf program, however, are the following objectives that guide implementation. These management objectives were originally developed to inform the commission's setting of the 2010 wolf hunting season, before wolves were relisted later that year, as described in Runge et al. (2013). The originally written third objective was changed from listing "livestock producers, hunters, and other stakeholders" to "all stakeholders" to be inclusive of the diversity of values pertaining to wolves. The management strategies are as follows:

1. Maintain a viable and connected wolf population in Montana.
2. Maintain authority for the State of Montana to manage wolves.
3. Maintain positive and effective working relationships with all stakeholders.
4. Reduce wolf impacts on:
    a. livestock; and
    b. big game populations.
5. Maintain sustainable hunter opportunity for wolves.

6. Maintain sustainable hunter opportunity for ungulates.
7. Increase broad public acceptance of sustainable harvest and hunter opportunity as part of wolf conservation.
8. Enhance open and effective communication to better inform decisions.
9. Learn and improve as we go.

Intensive year-round and field-based population monitoring methods were appropriate and achievable when the wolf population was small and recovering. In the early years, most wolf packs had radio-collared individuals and intensive monitoring was possible to identify new packs and most individuals within packs. Weekly updates were once produced and distributed to provide information on the wolf population (e.g., new packs, documentation of wolf-livestock conflict) on a regular basis. When the wolf population was smaller, this effort was practical. However, in later years, the minimum count of wolves approached or exceeded 500 individuals distributed across more than 25,000 square miles of mostly rugged and remote terrain in western Montana. Therefore, the ability to count every pack, every wolf, and every breeding pair became expensive, cumbersome, and unrealistic. Additionally, preparation of weekly updates became unnecessary and inconsistent with reporting with other common wildlife species. Relying solely on these data points for population estimation is not cost-effective nor practical, especially given the fact that wolves are elusive and difficult to monitor comprehensively on the ground. This approach consistently undercounted total numbers and did not generate population estimates, yet the minimum counts were often treated as population estimates. Out of necessity and practicality, FWP has moved to more cost-effective methods for monitoring wolves, which more accurately and reliably estimate population size and account for uncertainty by providing statistically credible intervals.

FWP first began considering alternative approaches to monitoring the wolf population in 2006 through a collaborative effort with the University of Montana Cooperative Wildlife Research Unit. The primary objective was to find an alternative approach to wolf monitoring that would yield statistically reliable estimates of the number of wolves, the number of wolf packs, and the number of breeding pairs (Glenn et al. 2011, Rich et al. 2013). The integrated patch occupancy model (hereafter, iPOM) is a modern, scientifically peer-reviewed, and cost-effective means of monitoring wolves, and is a very efficient method to document wolf population numbers and trends accurately across the distribution of wolves in Montana (Sells et al. 2020, Sells et al. 2021, Sells et al. 2022a, Sells et al. 2022b). The iPOM method uses annual hunter surveys, known wolf pack locations, habitat covariates, and estimates of wolf territory size and pack size based on field data to estimate wolf distribution and population size (Sells et al. 2020, Sells et al. 2022b). With iPOM, an occupancy model estimates the extent of wolf distribution in Montana, while a territory model predicts territory sizes. Altogether, these models predict the number of wolf packs in the occupied area. A group size model predicts pack sizes. Total abundance estimates are derived by combining the estimated number of packs and pack sizes, while also accounting for lone and dispersing wolves. iPOM estimate of wolf population size is currently the preferred monitoring method due to the accuracy, incorporation of statistical uncertainty, and cost efficiency. FWP will use iPOM to monitor wolves until better science-based methods become available and are practical with implementable strategies across the vast portion of Montana occupied by wolves.

FWP is confident that the wolf population estimate and trends that iPOM provides are accurate and scientifically valid evidence that can be used to assess wolf status relative to the criteria outlined in the 2023 Wolf Plan. However, wolf specialists and area biologists still regularly collect data on wolves in the

field. The iPOM tool is regularly supplemented through visual confirmations of radio-collared individuals and their packs, minimum counts, non-invasive surveys, and demographics of harvested and conflict-related removals. These datasets are collected and assembled annually for trend information but alone do not provide accurate population estimation. FWP uses well-documented scientific methodologies (i.e., iPOM) to estimate population sizes and distributions from which hunting and trapping regulations are developed and recommended.

At present, wolves are under state authority and classified as a "species in need of management" (§ 87-5-131, Montana Code Annotated [MCA]). FWP maintains the population baseline derived from the federal recovery definition of 150 wolves *and* 15 breeding pairs (or another stated minimum threshold if modified, in coordination with the USFWS benchmark for ESA recovery [50 CFR Part 17, Docket No. FWS–R6–ES–2011–0032; 92220–1113–0000; ABC Code: C6]). Further, the minimum baseline metric used may be modified to the number of wolves needed to sustain and maintain a viable wolf population. By dividing the mean estimate of population size from iPOM by the mean number of documented breeding pairs in Montana from 2011–2017, then multiplying that number by 15 (the federal minimum requirement for breeding pairs), an estimate of the number of wolves needed to ensure Montana has at least 15 breeding pairs can be calculated.

To be cautious in maintaining delisted status and state management of wolves, FWP will use 450 wolves as the benchmark to ensure the population maintains at least 15 breeding pairs, which also surpasses the minimum requirement of 150 wolves. While minimum counts and documented breeding pairs provided valuable information on wolf population trends in the early days, after recovery, those metrics became increasingly difficult to document at a meaningful scale and less representative of the overall population with the rapidly growing wolf population. To address this concern, Montana progressed to population estimation via iPOM to balance resources with population monitoring needs. Because this update also led to changes in field monitoring methods, recent efforts to document breeding pairs may not be consistent with earlier years. Ultimately, the shift from reporting the minimum number of breeding pairs to the number of wolves equivalent to the number of breeding pairs will improve consistency with updated population monitoring methods and outputs from iPOM (total estimated number of wolves) that would ensure the metric used for a minimum threshold is current relative to monitoring methods.

While a minimum baseline is used to ensure Montana maintains management authority for wolves, FWP does not administratively declare an upper limit of wolves in the state in the sense of a "cap." Section 87-1-901, MCA, passed as Senate Bill 314 (67th Montana Legislative Session), states "the commission shall establish by rule hunting and trapping seasons for wolves with the intent to reduce the wolf population in this state to a sustainable level but not less than the number of wolves necessary to support at least 15 breeding pairs." To clarify, FWP manages according to legislative and commission direction to reduce the population. Should the wolf population decline to the point where it approaches 450 wolves (the minimum number of wolves needed to ensure 15 breeding pairs), FWP would recommend to the commission shifting management strategies. FWP does not have specific objectives for the distribution of wolves.

FWP communicates to all affected parties regarding the relevance and credibility of the wolf program, while acknowledging the diversity of values amongst stakeholders. Wolf regulations (i.e., season dates, boundaries of units, bag limits, quotas, allowed methods for harvest) are reviewed no less frequently than every other year by the commission, but in practice get reviewed annually due to public interest and their controversial nature. Over time, harvest rules, regulations, and hunting and trapping boundaries have

changed based on wolf population status, sociopolitical tolerance, and direction from the commission and or the legislature. Additionally, quotas may differ by regions or wolf management units (WMUs), depending on wolf distribution or specific objectives. Quotas are established to provide harvest opportunity with an upper limit on harvest allowed. FWP acknowledges that it would require >25–30% harvest from the wolf population to cause negative population growth and a decline in abundance. Recommendations made by FWP for certain harvest strategies stem from laws and policies, given wolf population estimates and trends, as well as hunter and trapper success rates. If liberalized harvest is determined to pose a risk to long-term population persistence, then the FWP recommendation may shift to be more conservative. Harvest regulations are decided and adopted by the commission. The commission retains delegated decision-making authority from the legislature.

Montana wolves routinely encounter livestock on both private land and public grazing allotments and will continue to do so into the future. To address wolf-livestock conflicts, FWP uses an integrated wolf-livestock conflict program, which is comprised of non-lethal and lethal management tools, and actively partners to implement non-lethal proactive conflict mitigation projects across the state. The desired outcomes of these programs are to mitigate producer-predator conflicts, reduce livestock losses, reduce wolf mortalities associated with conflict, find livestock carcasses and remove them, document the presence of predators, and alert producers of predator activity. These efforts are collaborative and FWP actively engages in the sharing of data and technical expertise on proactive conflict prevention, as well as results of relevant ongoing research. While non-lethal management strategies are actively promoted and used, over time or in certain contexts, lethal measures are necessary. Considerations of what management strategies (lethal and non-lethal) should be employed often include time and financial costs to the livestock producer, as well as that of state and federal agencies.

FWP maintains a Memorandum of Understanding (MOU) with United States Department of Agriculture Animal and Plant Health Inspection Service Wildlife Services (WS) that documents and enhances the cooperative relationship between FWP and WS for planning, coordinating, and implementing wildlife damage control programs to reduce damage caused by grizzly bears, wolves, black bears, and mountain lions to agriculture, animal husbandry, forestry, wildlife, and public health and safety. Under the MOU, WS is responsible for investigating, confirming, and responding to livestock depredations by wolves. WS provides reports of investigation findings to the affected landowners and producers, who may then send it to the Montana Livestock Loss Board (MLLB) for reimbursement consideration. The Montana Livestock Loss Program addresses the economic impacts of verified wolf-caused livestock losses through compensation and application of prevention tools and incentives to reduce risk of losses. The purposes of the MLLB are: 1) to provide financial reimbursements to producers for losses caused by wolves based on the program criteria, and 2) to proactively apply prevention tools and incentives to decrease the risk of wolf-caused losses and reduce the number of livestock killed by wolves through proactive livestock management strategies. MLLB is attached to the Montana Department of Livestock.

FWP's wolf program outreach and education efforts take a variety of forms including field site visits, phone and email conversations to share information and answer questions, presentations to school groups and other agency personnel, media interviews, and formal and informal presentations (e.g., Wolf Trapper Education seminars). In addition to these efforts, FWP prepares and distributes a variety of media releases to help Montanans become more familiar with changes to Montana's wolf management. FWP publishes regular reports providing updates on contemporary science, wolf population trends, harvest and conflict-

based removal data, and changing regulations and policies (i.e., annual reports published by the Montana Gray Wolf Program: https://fwp.mt.gov/conservation/wildlife-management/wolf). To enhance public understanding of Montana's wolf monitoring and management strategies, FWP will develop opportunities to improve transparency and provide information to the public.

The public has the opportunity for continuous and iterative input into specific decisions about wolf harvest throughout the legislative and public season-setting processes. Opportunity for public comment is always available and welcomed. All past and upcoming commission meetings and associated agendas, which include memorandums of items discussed and their specific public processes and outcomes, are available on the FWP website (https://fwp.mt.gov/aboutfwp/commission). In addition, opportunity for public comment is provided for all commission proposals (via email, phone, surveys). Further, the public is encouraged to attend commission meetings where an opportunity to speak directly to the commission is provided. Harvest regulations are decided and adopted by the commission, within the constraints and delegation of authority provided for under statutes and administrative rules. Legislative processes are the mechanism for the adoption, amendment, or repeal of statutes, and administrative rules result from public rule-making processes intended to more precisely implement statutes. Statutes are the laws by which FWP, as a state agency, is required to implement, and strategies for implementation are developed during the season-setting process under legislative authority that has been delegated to the commission. Statutes and administrative rules work hand-in-hand and allow FWP and the commission to implement the legislature's mandates.

FWP collaborates and partners with federal agencies on wolf management and mitigation of wolf-livestock conflicts, as well as with other agencies, universities, and Tribal Nations to conduct biological and social research and monitoring. Much of the monitoring and management of the wolf population, by FWP and through these partnerships, are funded by hunting license revenue (§ 87-1-708, MCA). Federal funding matches state license dollars (§ 87-1-601, MCA) to fund wildlife surveys, research, hunter education, and various support functions. Budgets are developed internally, with authority to spend funds coming from the legislature. All budgets are reviewed by the legislative budget committee and must be approved by both the Montana House and Senate. The governor's office can also approve budget amendments between legislative sessions. The commission reviews and approves the agency's budget.

FWP has demonstrated successful management of wolves through the creation and implementation of the 2003 Wolf Plan, which serves as the backbone for the 2023 Wolf Plan. Although annual wolf reports have been published since the adoption of the 2003 Wolf Plan, as a means to provide transparency of wolf monitoring and management, the 2003 Wolf Plan fails to provide details on how wolves are currently monitored and managed cohesively. While the 2003 Wolf Plan allows for contemporaneous and scientific approaches to wolf management as well as flexibility to changing biological and sociopolitical environments, ultimately allowing FWP to monitor and manage wolves using the methods and tools employed today, it does not describe the history of the Montana wolf population and the evolution of how FWP monitors and manages wolves since its publication. More specifically, the 2003 Wolf Plan does not address recent research regarding monitoring methods and management strategies (e.g., iPOM, surveys on wolf tolerance, non-lethal preventative strategies), the authority of WS in making wolf-livestock conflict decisions, current population status and trends, changes in harvest structure and statutes, new tools to provide public information (i.e., dashboards), the transition of the population metric from breeding pairs to number of individuals, among other notable differences. Over the last 20 years, the wolf population

has recovered and remained stable, withstanding a series of continually evolving harvest seasons adopted by the commission and new statutes developed through legislative action. Further, FWP has considered complex varying opinions on wolf monitoring and management, via public engagement processes, incorporating them as allowed within our legal bounds and as monitoring and management tools became available and were practically implementable to us.

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Part I: Introduction

Scope of This Document

This document provides the foundation for FWP's recommendations regarding conservation and management of gray wolves at the state level. Wolves in Montana are native, iconic carnivores that have high value to people and cultures across the state and play important roles in Montana ecosystems. At the same time, they can and do injure or kill livestock, as well as cause property damage and economic loss, which may disproportionately affect certain individuals. Additionally, wolves contribute to top-down effects

within the ecological community, potentially impacting prey population dynamics, densities, and distributions. Wolves also receive national and international recognition outside Montana state lines. Following the MEPA and EIS processes, this 2023 Wolf Plan is consistent with commitments made by existing agreements with federal, state, and tribal agencies. The foundations of the plan are to recognize wolves as part of Montana's wildlife heritage, to approach wolf management like other wildlife species, to manage with flexibility, and to address and resolve conflicts. The 2023 Wolf Plan does not preempt the commission's authority to formulate annual rules, set hunting and trapping season regulations, or implement emergency actions in response to unexpected events or circumstances. Whereas the commission cannot modify the plan per se, it does have statutory authority to evaluate and modify how certain elements are implemented. These statutes and legislative actions are further described here within.

Purpose and Need

FWP's intent is to provide management guidance for wolves within the state of Montana under a new programmatic plan. The 2023 Wolf Plan assures ongoing, contemporaneous, sound science-based, and flexible management methodologies through incorporation of the following elements:

- New wolf-related research and associated science-based information;
- New and available wolf management tools and methods employed by FWP;
- Continued public transparency related to wolf management practices in Montana;
- Compliance with existing laws, regulations, and policies, as well as inter-governmental commitments made by FWP and the commission; and
- Recognition of the need for adaptable wolf management strategies to accommodate ever-changing wolf population dynamics influenced by:
    - Changes in wolf density and distribution in response to varying human-caused mortality;
    - Environmental factors;
    - Human developments;
    - Prey availability; and
    - Contextual changes in the sociopolitical climate.

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by the commission and new statutes developed through legislative action. Further, FWP has considered complex varying opinions on wolf monitoring and management, via public engagement processes, incorporating them as allowed within our legal bounds and as monitoring and management tools became available and were practically implementable to us.

Wolves are now well established in Montana and FWP remains committed to maintaining the long-term viability of wolves, consistent with a long history of wildlife conservation in the state. The challenge is balancing conflicting values and addressing the diverse needs of wolves and humans in the context of the Legislative directive. This document provides the foundation for contemporary and future FWP and commission decisions regarding conservation and management of wolves that is flexible in addressing varying considerations, both biological and sociopolitical, at the state level.

Part II: Background

Ecology of Wolves

Mech and Boitani (2003) and Boyd et al. (2023) were key scientifically-reviewed references used as a resource for basic information on wolf characteristics, ecology, and behavior described in this section.

Physical Characteristics

Wolves are mammals that belong to the family Canidae, which includes coyotes, fox, and domestic dogs. Wolves may resemble coyotes, particularly when wolves are young. Wolves may also be confused with some large domestic dog breeds. In many instances, skull morphometrics, genetic data, or behavioral data are used to distinguish wild wolves from wolf-dog hybrids and domestic dogs (Boyd et al. 2001, Duman 2001). Wolves are typically gray or black and both color phases may be found in a pack or in one litter of pups. On average, adult male wolves, in Montana, weigh 80–110 pounds, and adult females weigh 75–90 pounds, although individuals can be smaller or larger than these averages. Full-grown wolves are about 2.5 feet tall and 6 feet long. Their tracks are normally 4.5–5.5 inches long.

Pack Size

Wolves are highly social predators and mostly live in packs. However, 10–15% of wolf populations are comprised of lone or dispersing wolves (Fuller et al. 2003, Holyan et al. 2013). Packs are formed when male and female wolves develop a reproductive bond, breed, and produce pups. Each pack typically consists of a socially dominant breeding pair, defined as an adult male and a female wolf that have produced at least 2 pups that survived until December 31, offspring from the previous 1–2 years, and new pups of the current year (Montana Wolf Conservation and Management Planning Document 2002). Other breeding-aged adults may be present in a pack, and they may or may not be related to the others. Wolf packs display cooperative behavior, regularly hunting, feeding, traveling, and resting together. The pack members also share pup-rearing responsibilities like tending to pups at the den or at a series of rendezvous sites.

Breeder loss due to human-caused mortality leads to an increased probability of pack dissolution, decreased denning and recruitment rates (i.e., pack persistence and reproduction, Brainerd et al. 2008,

Cassidy et al. 2023), as well as the potential for the loss of learned behaviors within the pack (Haber 2013). Although there may be impacts to within-pack dynamics associated with level of harvest (i.e., potential for reduced pack size which may negatively influence dependent biological processes; Cassidy et al. 2023), the abundance and distribution of packs in a population usually remains stable (Borg et al. 2014, Bassing 2017). Ausband et al. (2017) found that harvest was not associated with frequency of breeder turnover or number of breeders in a pack. Pack size is highly variable across landscapes and states, ranging from as few as three to as many as 37 individuals (USFWS et al. 2001). In Montana, annual mean group size ranges from 4.86–7.03 with an overall average of 5.92, where most groups are relatively small with ≤8 members. Pack size is positively associated with local wolf density and prey density, and negatively associated with harvest intensity (Sells et al. 2022a).

Reproduction

Wolves normally do not breed until at least 22 months of age (Mech 1970). On average, first reproduction occurs between 2–3 years of age, and age at first reproduction is influenced by population size and rate of inbreeding (Wikenros et al. 2021). Reproductive success has been found to be influenced by the presence of helpers in the pack (i.e., conspecifics; Solomon and French 1997, Sparkman et al. 2010, Stahler et al. 2013, Ausband et al. 2017), distance from wolf dens to prey migration routes (Frame et al. 2007), wolf density (Hayes and Harestad 2000, Gude et al. 2012, Stenglein et al. 2015), ungulate biomass (Boertje and Stephenson 1992, Huggard 1993, Post et al. 1999, Mech and Peterson 2003), and landscape (Llaneza et al. 2012, Rich et al. 2013, Bassing et al. 2019) and environmental characteristics (Mech 1970, Peterson 1974, Mech et al. 1998, Mech and Fieberg 2015). In the NRM, the breeding season peaks in mid- to late February (Boyd et al. 1993). Wolves localize their movements around a den site prior to pupping, have a 63-day gestation period, and whelp in late March to late April. After the pups are about eight weeks old, they are moved to a series of rendezvous sites, which are defined as gathering sites primarily used for pup rearing during the summer.

In northwestern Montana, litter size averaged 5.3 (range 1-9; Pletscher et al.1997), and most litters contain 4–6 pups (Sells et al. 2020). Litter size is often associated with prey resource availability and wolf density (Harrington et al. 1983, Roffler et al. 2023). Pup survival is highly variable and influenced by several factors, including disease, predation, prey availability (Harrington et al. 1983, Mech and Goyal 1993, Johnson et al. 1994), and diets at natal den sites (Roffler et al. 2023). Typically, pup survival is high with mortality attributed to both human or natural causes (Pletscher et al. 1997, Bangs et al. 1998, Smith et al. 2000, Mills et al. 2008), and heavily dependent on pack member provisioning of food (Packard et al. 2003, Ruprecht et al. 2012). Mean recruitment rate of pups to 5 months of age in Montana ranged from 3.25–4.21 wolves per pack, whereas mean recruitment rate to 17 months of age ranged from 1.40–3.06 wolves per pack (Sells et al. 2020).

Food Habits

Wolves are opportunistic carnivores and adapted to hunt large and medium-sized prey species, typically wild ungulates. Wolves may also prey on smaller species (Stahler et al. 2006), scavenge carrion or even eat vegetation; diet composition in different territories and times of the year depends on the relative abundance and distribution of available prey (Newsome et al. 2016). White-tailed deer (*Odocoileus virginianus*), mule deer (*Odocoileus hemionus*), elk (*Cervus canadensis*) and moose (*Alces alces*) make up the majority of wolf diets (Mech and Peterson 2003, Peterson and Ciucci 2003). By switching among prey

species, wolves are insulated from fluctuations in prey availability of a single species (Cupples 2013). In northwestern Montana, white-tailed deer comprised most of wolf kills compared to elk and moose (Kunkel et al. 1999, Derbridge 2010), however the proportion of moose consumed by wolves was greater than predicted (Derbridge et al. 2012). Wolf kills in Yellowstone National Park (hereafter, YNP) are dominated by elk (Smith et al. 2000, 2004, Hamlin and Cunningham 2009, Metz et al. 2012). Similar findings in replicated studies have verified that wolves in Montana eat elk when available in high densities, and otherwise eat mostly deer (Garrott et al. 2007, Cascaddan 2016).

Neonates are often an important food source in early summer (Garrott et al. 2008), with diversity of prey increasing as summer progresses to include smaller prey items, vegetation, and adult ungulates. Carrion becomes a contributor to wolf diet during hunting seasons with gut piles and carcasses left on the landscape (Gable et al. 2018). Similarly, wolves also scavenge opportunistically on vehicle-killed ungulates, winterkill, and on kills made by other carnivores, particularly mountain lions. In areas with high coyote densities, prey resource partitioning occurs with wolves focusing on larger prey (Arjo et al. 2002). Wolves also kill and feed upon domestic livestock such as cattle, sheep, llamas, horses, or goats (Morehouse and Boyce 2011). They may also kill domestic dogs but usually do not feed on the carcass.

Movements and Territories

A pack establishes an annual home range or territory and defends it year-round (Mech and Boitani 2003) through howling, scent marking, and conspecific aggression (Harrington and Mech 1979, Cassidy et al. 2017). The pack hunts and raises pups within the territory. Pack territory boundaries and sizes may vary from year to year based on environmental conditions, food resource availability and accessibility, and or wolf density (i.e., conflict with conspecifics; White et al. 1996). Because the attributes of each pack's territory are so unique (elevations, land use, land ownership patterns, prey species present and relative abundance), it is difficult to generalize about wolf territories and movements. Wolves maintain a territory influenced by food, competition, and mortality risk. For example, smaller territories are a result of greater food abundance (i.e., greater ungulate densities), competitor density, pack size, and density of low-use roads. Territory size often increases before decreasing in response to terrain ruggedness, harvest mortalities, and greater levels of mortality risk (Sells et al. 2020). As a result, pack boundaries and territory sizes may vary spatiotemporally. Central-based foraging with non-breeders hunting and returning to den and rendezvous sites with food for pups often occurs in the summer, whereas nomadism of the pack often occurs in the winter.

After recolonizing the Glacier National Park (hereafter, GNP) area in the 1980s, individual wolves dispersed and established new packs and territories on a variety of property ownerships and land uses. Wolves demonstrated a greater tolerance of human presence and disturbance than previously thought characteristic of the species, colonizing an array of landscapes including rural development. Early in their recovery, it was predicted that wolves would occupy high elevation public lands (Fritts et al. 1994). While this was true for some packs, many preferred lower elevation and gentler terrain likely because of concentrations of wintering ungulates (Boyd-Heger 1997). As a result, wolves disproportionately occupied areas with higher prey abundance, which are also used for livestock production, thereby providing opportunity for wolves to kill livestock where the wild and domestic prey items overlap, thus increasing conflict potential.

The earliest colonizing wolves had large territories. Ream et al. (1991) reported an average of 460 square miles (mi^2), but average territory size decreased as wolf numbers and density increased and new territories filled in suitable, unoccupied habitat. Recent studies have found wolf territory establishment is economical, to maximizing benefits and reducing costs associated with maintaining a territory. Territories are smaller for packs with a larger group size and in areas with greater densities of competitors, prey, and low use roads. Larger territories are associated with increasing harvest mortalities and terrain ruggedness (Sells and Mitchell 2020, Sells et al. 2021). In 1999, in the Northwestern Montana Recovery Area , the average territory size was 185 mi^2 (8 packs). Territories in the Greater Yellowstone Area (hereafter, GYA) were larger, averaging 344 mi^2 (11 packs). Individual pack territories ranged from 33 to 934 mi^2. Individual territories were highly variable in size (USFWS et al. 2000). In Montana, mean territory size has stabilized at about 175 mi^2 (Sells et al. 2020).

Dispersal

When wolves reach sexual maturity (1–2 years of age), some remain with their natal pack while others leave, looking for a mate to start a new pack of their own (Mech and Boitani 2003). Dispersal may be to nearby unoccupied habitat near their natal pack's territory, or it may entail traveling several hundred miles before locating vacant habitat, a mate, or joining another pack. Dispersing wolves use scent-marking behavior and howling to locate other wolves, and frequently use similar travel paths. Dispersal is more common for males than females and for adults than yearlings. Males often have longer dispersal distances than females. About 10–15% of wolves disperse annually (Fuller et al. 2003, Holyan et al. 2013). Dispersal occurs year-round, but peaks with courtship and the breeding season in February and March. Wolves that formed new packs were more likely to reproduce compared to those that joined an already existing pack. Similarly, success of dispersal increased with decreased pack densities (Jimenez et al. 2017).

Dispersal averaged 60 mi (range 10–158 mi) and mean duration averaged 5.5 months (Boyd and Pletscher 1999, Jimenez et al. 2017). This played an important role during recovery, influencing the expansion of wolves across the state and larger NRM landscape (Boyd et al. 1995, Bangs et al. 1998, Smith et al. 2000, USFWS et al. 2000). There is large variability of dispersal age and rate, direction, distance, duration, and success due to multiple individual, social and environmental determinants. Dispersal rate is higher at low and high population densities, and human-caused mortality reduces distance, duration, and success of dispersal events, with wolves often avoiding interaction with anthropogenic landscape features (Morales-Gonzalez et al. 2021). Prey abundance, availability of vacant territories, and survival rates of breeding wolves also influence dispersal rates and success. For example, as the population grows, dispersal toward areas with higher wolf densities than that found in their natal areas (i.e., greater pack sizes or greater number of packs) is common (Boyd and Pletscher 1999, Jimenez et al. 2017). Lone wolves are often separated from total population counts because the pack is the mechanism by which wolves reproduce and populations grow, and packs are far easier to locate and monitor than individual or dispersing wolves.

Mortality

Wolves die from a variety of natural and human causes. Naturally caused mortalities result from territorial conflicts between packs, injuries while hunting prey, old age, disease, starvation, or vehicle collisions. However, in the NRM, outside of national parks, natural mortality is unlikely to regulate populations. Humans are the largest cause of wolf mortality and the only cause that can significantly affect

populations at recovery levels (USFWS 2000, Murray et al. 2010). Human-caused mortality includes control actions to resolve conflicts, legal harvest, poaching, and vehicular collisions. Further, human-caused mortality rates have increased with wolf population growth, although wolf populations have been documented to remain stable when human-caused mortality is between 15–48% (Keith 1983, Fuller 1989, Fuller et al. 2003, Adams et al. 2010, Creel and Rotella 2010, Gude et al. 2012). Based on a subjective analysis of what would be socially acceptable, a more conservative percentage harvested from the population has been recommended by Smith et al. (2016; 5–7% of the YNP wolf population each year, and no more than 20% in any given pack) within protected areas. Wolves in closer proximity to human development exhibit lower survival due to increased risk of harvest, poaching, and livestock-conflict (Murray et al. 2010, Barber-Meyer et al. 2021). Legal harvest accounts for most mortality in Montana (Sells et al. 2020). Poaching is a cause of mortality for wolves world-wide and generally increases when and where hunting of other species is occurring (Santiago-Avila and Treves 2022), particularly in areas where the harvest of wolves is or was recently prohibited (Chapron and Treves 2016). However, this is not a leading cause of mortality in Montana (Parks et al. 2023). While canid diseases may threaten pup survival in some areas, diseases and parasites are negligible in impacting wolf populations in the NRM to date (USFWS 2000). Adult survival rates vary annually and are greatest during years without harvest (70% compared to 50%). Nevertheless, seasonal wolf survival during hunting and trapping seasons was high during years with legal harvest (74%; Inman et al. 2021).

Genetics

The application of genetic techniques to the study of wildlife populations permits managers to address issues of genetic diversity and population viability. Various genetic projects have yielded information relevant to wolf conservation and management in the NRM. Wolf recovery advanced due to the combination of natural recolonization of northwestern Montana by wolves from Canada, and the reintroduction of wolves into YNP and central Idaho. In northwestern Montana, the initial founding population was small, and inbreeding among closely related individuals was possible. Fortunately, genetic variation among the first colonizers was high (Forbes and Boyd 1996), and ongoing natural dispersal to and from Canadian wolf populations was adequate to minimize close inbreeding and assure long-term population viability. There were similar concerns about inbreeding and lack of genetic variation for the relatively small founding population reintroduced to YNP and central Idaho, but research showed that genetic variation among reintroduced wolves (and the source populations from which they came) was also high (Forbes and Boyd 1997). Overall, genetic diversity was similar among samples of wolf population founded by natural recolonization, reintroduced individuals, and the Canadian source populations. Because wolf packs in the NRM are demographically and genetically connected by high rates of long-distance dispersal (Mech and Boitani 2003, Bassing et al. 2020), loss of genetic variation and potential inbreeding depression is highly unlikely under current conditions (i.e., large population size with high connectivity). However, wolves are prone to close-inbreeding and inbreeding depression when isolated (e.g., see Hoy et al. 2023), emphasizing that dispersal and gene flow between subpopulations is critical for maintaining the genetic viability of wolves in the NRM.

With wolf distribution broadly distributed across Montana and high-rates of individual dispersal among packs, the population is sufficiently connected to maintain genetic viability and diversity (e.g., vonHoldt et al. 2010, Jimenez et al. 2017, Hendricks et al. 2019). FWP has a MOU with other NRM states and the USFWS to maintain consistent monitoring of wolf genetics to ensure that functional connectivity

and genetic variation do not decline. A recent genetic analysis of wolves (excluding Mexican wolves) across occupied range in the western United States led by the USFWS found that current genetic diversity is high, and the wolf population is well-mixed across the western United States (Paetkau 2022). Inter-state collaborations and analysis on wolf genetics may occur under an updated MOU in the future.

Population Growth

Wolf populations increase or decrease through the combination and interaction of mortality, wolf densities (i.e., competition and conflict with conspecifics) and prey densities (i.e., food resource availability and accessibility), among a variety of other environmental and landscape factors. The degree and type of legal protection, agency control actions, and regulated harvest also influence the amount of human-caused mortality and therefore population trends. Significant declines in wild prey availability often result in increased livestock depredation events (Jedrzejewski et al., 2000, Gula, 2004, Mech and Peterson, 2003, Klich et al. 2021), and, consequently, potential lethal removal. Availability of suitable, vacant habitat will influence dispersal and population growth rates. Once established, wolf populations can withstand human-caused mortality rates up to about 15–48% of the mid-winter population (Keith 1983, Fuller 1989, Fuller et al. 2003, Adams et al. 2010, Creel and Rotella 2010, Gude et al. 2012). In Montana, population growth rates were highest during population recovery and expansion and have since declined and stabilized. Observed decreases in measured recruitment rates may also be artificial effects of monitoring capabilities because of difficulty in documenting reproductive rates in a large population size (Gude et al. 2012). Population growth of wolves in Montana has been stable in recent years (Parks et al. 2023).

Interactions with Other Species

The relationships between carnivores and other species, and the ecosystems in which they live, is extremely complex and dependent on ecological, environmental, and landscape factors (Estes 1996). Despite volumes of published literature on wolves, there is limited evidence of the precise nature, degree, and mechanisms by which wolves affect ecosystems via cascading effects across trophic levels (i.e., trophic-cascades; Silliman and Angelini 2012, Hale and Koprowski 2018). Density-dependent factors (Kauffman et al. 2010), weather and climate change (Despain 2005), and independent population dynamics of other species (Wolf et al. 2007, Bilyeu et al. 2008) also influence prey population fluctuations.

Ungulate populations are influenced by a combination of top-down effects, such as predation and legal harvest, and bottom-up factors, such as habitat and climate (Crête 1999, Griffin et al. 2011, Johnson et al. 2013). There are many non-predation related mechanisms (e.g., disease, intensity of harvest, environmental conditions, habitat changes) that drive declines in ungulate populations (Vucetich et al. 2005, White and Garrott 2005, Wright et al. 2006, Middleton 2012). Some of these factors can be confounded with predation and affect conclusions about whether wolf predation is additive versus compensatory mortality (Melis et al. 2009, White et al. 2010). Prey populations well below the carrying capacity may be more at risk of being limited by predation, and these populations seem to respond best to predator removal efforts (Ballard et al. 2001). Severe winter or drought conditions, in combination with predation effects, can result in prey population declines and difficulty in population rebounds. A commonly documented example is increased predation rates and elk (adult and calf) mortality associated with increased snow depth (Barber-Meyer et al. 2008, Brodie et al. 2013, Horne et al. 2019). However, it is difficult to determine if ungulates are increasingly vulnerable to predation or if they experience decreased fitness due to energy loss and food stress (Hebblewhite et al. 2002, Hebblewhite 2005, Hamlin and

Cunningham 2009, Middleton 2012, Pierce et al. 2012). Wolves typically occur with other predators, and predator guild composition and densities influence the degree of susceptibility of prey species and effects of predation on prey population dynamics differently (Barber-Meyer et al. 2008, Hamlin et al. 2009, White et al. 2010, Griffin et al. 2011). Limitation of ungulate populations by predation is often associated with a reduction in recruitment or the survival of young, and wolf predation has been associated with limited elk recruitment when they occur with other large carnivores (Hamlin et al. 2009, Griffin et al. 2011, Proffitt et al. 2014) and in habitats with nutritional limitation (Garrott et al. 2008). When combined with low recruitment, human harvest of adult female ungulates can lead to population declines or limitation (e.g., Vucetich et al. 2005, White and Garrott 2005, Wright et al. 2006) and changes to population structure and distribution (White et al. 2010). For this reason, the opportunity for antlerless hunting by humans is often reduced in areas with established wolf populations. However, the impact of wolf predation on prey populations varies and can be minimal for some species and in some situations. For example, mortality rates of adult female mule deer due to wolves in northwestern Montana were relatively low (1–3%; DeCesare et al. 2021). Similarly, wolf predation was not an important factor limiting elk recruitment in western Montana's Bitterroot Valley (Eacker et al. 2016, Rotella et al. 2020). Wolves are the most common predator associated with predation-caused mortality of adult female moose across Montana, but the sum of all predation-related mortality is lower than that due to health-related causes (e.g., parasites of malnutrition; DeCesare et al. 2022). Predator control has positive but variable results in increasing recruitment or size of some prey populations (Clark and Hebblewhite 2020), but prey populations at carrying capacity generally do not increase with predator removal (Ballard et al. 2001).

Wolves often select more vulnerable individuals (i.e., physically disadvantaged and older- or younger-aged prey) that might otherwise succumb to natural causes of mortality (Husseman et al. 2003, Vucetich et al. 2005, Atwood et al. 2007, Barber-Meyer et al. 2008, Metz et al. 2012). Additionally, in a resource-poor context, wolf predation may be compensatory with mortalities caused by nutritional deficiencies or starvation (Barber-Meyer et al. 2008, Garrott et al. 2009). Wolves may cull sick, weak, or crippled animals (including those belonging to livestock herds), and thereby may also assist in reducing the prevalence and spread of diseases (e.g., chronic wasting disease; Wild et al. 2011), but this is heavily dependent on predator selectivity of diseased prey, densities and composition of prey species, demography and body condition of prey, as well as age-specific infection rates (Brandell et al. 2022). For predators to have a significant influence on disease transmission and spread, the level of selection for diseased individuals and predation rate would have to occur at higher levels than currently documented and would likely cause intolerable declines in prey populations. Regardless of wolf impacts on prey populations, they do kill ungulate prey year-round. A wide variety of scavengers and other carnivores benefit from carrion being readily available from wolf kills year-round, rather than just a pulse in the early spring because of winterkill (Stahler et al. 2001, Wilmers et al. 2003).

Wolves may directly or indirectly compete for food with other carnivores by selecting similar prey, or by usurping kills (Kunkel et al. 1999, Arjo et al. 2002). Intraguild predation and antagonistic encounters involving wolves are common (Ballard et al. 2003, Akenson et al. 2005, Donadio and Buskirk 2006, Kortello et al. 2007, Ruth and Murphy 2010). Because wolves are socially cooperative, they often dominate interactions with other solitary carnivores. For example, wolves may have direct and indirect effects of competition with mountain lions, negatively influencing their survival and abundance (Elbroch et al 2018). Interactions between large carnivores and the effects of those interactions on ungulate predation rates are complex (Atwood et al. 2007, Elbroch et al. 2015, Elbroch et al. 2020, Tallian et al. 2021). Examples of wolf

populations negatively influencing coyote densities are also well documented (Crabtree and Sheldon 1999, Berger and Gese 2007, Berger et al. 2008, Hebblewhite and Smith 2009), thereby perhaps relieving pressure on other mesocarnivores or small mammal populations.

Wolves may indirectly influence the behavior of prey populations, specifically ungulate resource selection, herd size, movement rates, and migration route in response to predation risk (Cupples 2013). This predator-prey interaction may force prey populations to occupy poor quality habitat with limited forage or nutrition, thereby reducing fitness (Creel et al. 2009). Ungulates may select for steeper terrain or open landscapes they perceive as means of protection from predation that were ultimately characteristics of ecological traps (Kauffman et al. 2007). Some herds have abandoned their migration to summer range or fawn- or calf-rearing grounds altogether, residing nearby human development for safety (Hebblewhite et al. 2005. Other herds have formed large groups to balance predation risk with forage quality (Proffitt et al. 2009), as well as vigilance behavior and energy expenditure (Laundré et al. 2001). Wolf-induced fear exhibited by prey populations has been hypothesized to influence pregnancy rates, recruitment, and population productivity as a result of stress (Creel et al. 2007, Creel et al. 2009, Hamlin et al. 2009, Creel et al. 2011, White et al. 2011). However, empirical data found no evidence of a population-level trade-off between forage quality and wolf risk for mule deer or elk in Montana (i.e., no avoidance of wolves and selection of poorer quality habitat; Paterson et al. 2022a), nor predation risk-related resource selection that resulted in biologically meaningful changes in body fat or pregnancy rates (Paterson et al. 2022b). Although debated, reduced prey abundance and changes in behavior of prey populations as a result of wolf presence and density may impact habitats and the greater landscapes within YNP (Ripple et al. 2001, Fortin et al. 2005, Vucetich 2021), such as by benefiting the understory of forest stands, minimizing soil erosion, and alleviating pressure off riparian areas (Brown et al. 1999, Smith et al. 2003, Beschta and Ripple 2006, Bump et al. 2009, Painter et al. 2015). Other studies have found no elk response to wolf predation risk (Mech et al. 2001, Creel and Winnie Jr. 2005), that the magnitude of the effect was not biologically meaningful (Kauffman et al., 2010, Schmidt & Kuijper, 2015, Paterson et al. 2022b), or that the effect was highly variable in space and time (Creel et al. 2005, Creel et al. 2008, Gaynor et al. 2019, Cusack et al. 2020). Population size and density of wolf prey (elk and other cervids) outside of National Parks is intensely debated and managed based on competing human desires, further complicating the process of isolating and quantifying the impacts of wolf predation versus human influence on prey density and distribution in such areas.

Suitable climate and primary productivity (i.e., habitat quality and quantity) are vital for healthy and sustainable prey populations, regardless of the influence of predators. Reductions in prey populations are due to a combination of factors, such as harsh environmental conditions, reduced forage, and harvest, some or all of which may act in concert with predation (Cupples 2013). Habitat conservation, restoration, and management are mechanisms to increase ungulate forage biomass and quality, which ultimately can have bottom-up positive impacts on prey populations.

History of Wolves in Montana

The wolf was extirpated from the western United States during the 1900s, primarily due to loss of habitat, conflicts with people, and widespread persecution. Although wolf packs were eliminated from Montana by the 1930s, tracks, scat, and or observations of large wolf-like canids were reported or killed up

until the 1970s. Most are thought to have been dispersers from Canada, and little to no successful breeding activity was identified or sustained consistently through time. The USFWS listed all wolf populations, including those in the NRM, as endangered under the ESA in 1973.

Wolf recovery in Montana began in the early 1980s, via natural immigration from Canada. In 1995 and 1996, wolves were reintroduced into central Idaho and YNP by the USFWS. Wolves were not released within Montana, but wolf populations in YNP and central Idaho grew rapidly and soon became a source of dispersers to Montana, via natural emigration. New packs formed outside the earliest core wolf areas, and overall wolf distribution expanded. Wolf dispersal has been documented between and among populations in the NRM including those in Montana, Idaho, and Wyoming. From 1974–2011 (with a gap in 2009 when wolves were first briefly delisted), the USFWS has managed wolves in the US, under the authority of the ESA, as either "endangered" or "experimental, nonessential." The federal wolf recovery goal of 30 breeding pairs for 3 consecutive years in the NRM of Montana, Idaho, and Wyoming (i.e., 10 breeding pairs and 100 individuals in each recovery area: NW Montana, central Idaho, and Greater Yellowstone) and all other necessary criteria for delisting were met by 2002.

In anticipation of the delisting of wolves and potential management under state authority, Gov. Marc Racicot convened a 12-member Wolf Management Advisory Council (hereafter, the advisory council) in 2000, consisting of livestock producers, hunters, educators, outfitters, conservationists, and other citizens. The advisory council identified 26 "Guiding Principles" that addressed public interest, public safety, maintaining wildlife populations, and protecting the livestock industry, and determined it was appropriate for FWP to develop a wolf program. In 2002, FWP released the Montana Wolf Conservation and Management Planning Document and pursued public scoping in full compliance with the legal requirements of MEPA. This public process involved the mailing of 1,000 postcards and 12 community work sessions across the state, and receipt of 6,700 written or electronic comments. The advisory council and the commission reviewed a summary of public comments, from which FWP drafted the 2003 Wolf Plan and EIS. As a requirement of delisting under the ESA, the state of Montana, along with Idaho and Wyoming, were required to develop state management plans. The goal of each management plan was to ensure that regulatory mechanisms were in place to ensure each state would maintain a recovered population of wolves. The EIS, prepared for the 2003 Wolf Plan, analyzed five alternatives that represented the public's values, opinions, and beliefs.

After another extensive public comment period of 60 days, involving 14 community work sessions and receipt of 5,500 written and electronic comments, "Alternative 2 – Updated Council" was selected to guide FWP's conservation and management efforts to maintain a recovered population and integrate wolves into Montana's wildlife management programs upon federal delisting. This preferred alternative described a spectrum of management activities that maintain viable populations of wolves and their prey, resolve wolf-livestock conflicts, and assure human safety, as well as mirrored public comments calling on FWP to seek common ground between wolf advocates and those most directly affected by wolf presence. Further, Alternative 2 – Updated Council described a wolf program based on principles of adaptive management that was consistent with modern wildlife management practices similar to those of other managed wildlife species. Strategies implemented would be driven by the status of the wolf population and incorporate public outreach, conservation education, law enforcement, and landowner relations. Importantly, regulated wolf harvest "would take place within the larger context of multi-species management programs, would be biologically sustainable, would not compromise the investments made to recover the

wolf population… and should advance overall conservation goals by building social tolerance, interest in, and value for the species among those who would otherwise view wolf recovery as detrimental to their ungulate hunting experiences."

The USFWS approved Montana's 2003 Wolf Plan but delayed federal delisting due to concerns with Wyoming's management plan. Anticipating this delay, FWP developed a contingency alternative to provide Montana with more direct involvement in day-to-day monitoring and management of wolves (excluding harvest) while the species remained federally listed and under ultimate authority of the USFWS. With an amended Record of Decision in 2004, the contingency alternative was implemented. By the end of 2004, there was an estimated 835 wolves and 66 breeding pairs in the NRM. In Montana, there were about 153 wolves in 15 breeding pairs at that time. From the time recovery goals were met to delisting, the wolf population in the NRM tripled. The NRM population segment of wolves was first delisted in 2009 (USFWS 2009). The delisting rule claimed that the carrying capacity of the NRM wolf population was likely around 1,500 wolves, and wolves "will be managed by the states, National Park Service, and Service to average over 1,100 wolves, fluctuating around 400 wolves in Montana, 500 in Idaho, and 200 to 300 in Wyoming…maintaining the NRM gray wolf population at or above 1,500 wolves in currently occupied areas would slowly reduce wild prey abundance in suitable wolf habitat. This would result in a gradual decline in the number of wolves that could be supported in suitable habitat. Higher rates of livestock depredation in these and surrounding areas would follow. This too would reduce the wolf population because problem wolves are typically controlled." The 2009 final delisting rule published in the federal register set a benchmark of a *minimum* of 150 wolves and 15 breeding pairs for Montana to ensure the population never falls below recovery goals (USFWS 2009).

After being relisted on the ESA in 2010 because Wyoming lacked an approved state plan and laws, the NRM population segment of wolves in Montana and Idaho was congressionally delisted in May 2011. Wolves in Montana have been managed under state authority as a "species in need of management" since that time (annual reporting to the USFWS was required as part of the post-delisting monitoring plan from 2011–2016). Therefore, wolf management in Montana has been guided by Alternative 2 in the EIS, which constitutes the 2003 Wolf Plan. The minimum population benchmark in the 2003 Wolf Plan and associated EIS reflected that of the federal register. The 2003 Wolf Plan also established an incremental approach to wolf management that allows managers latitude to adjust wolf numbers and distribution and allows for a regulated harvest of wolves as a wildlife management tool. Implementation of the 2003 Wolf Plan has been ongoing since delisting and, using a combination of license dollars and federal Pittman-Robertson funds (excise tax on firearms, ammunition, and hunting and trapping equipment), FWP has monitored the wolf population (i.e., distribution and abundance), mitigated conflict including livestock depredation and other wolf control, coordinated and authorized research, conducted public outreach, and developed and used contemporary population estimation tools. FWP has managed harvest consistent with state law and Commission regulation (i.e., hunting and trapping seasons) since wolves were delisted from the ESA. Montana has maintained an estimated population of 1,087 to 1,260 wolves from 2011–2022, with a harvest of 166 to 327 wolves annually without demonstrable negative effect on population viability.

Current Status of Wolves in Montana

From the early 2000s to the time wolves were delisted, a steady increase and expansion of wolf population size and distribution was observed. Once Montana assumed full management authority for wolves, annual hunting was implemented immediately (in 2009 and then again in 2011) and trapping was implemented beginning in 2012. Subsequently, wolf population growth stabilized and expansion of occupied area slowed. Additionally, territory sizes decreased over time, potentially allowing more packs in the same total occupied area. Since 2011, population numbers have remained considerably above the federal recovery minimum threshold of 15 breeding pairs and 150 wolves in Montana. From 2011–2022, the population appears to have become somewhat stabilized with an average of 194 packs and 1,165 wolves per year (Figures 1-4; 191 packs and 1,138 wolves per year, 2016–2022). Since delisting and transition to state management, harvest increased and depredation removals decreased, but in more recent years have remained stable. Region 1 holds about 41% of the state's wolf population, which has declined slightly and stabilized at around 73 packs and 460 wolves. Region 2 holds about 26% of the population, which has declined slightly and stabilized at around 44 packs and 286 wolves. Similarly, Region 3, which holds about 20% of the population, has declined slightly over time and stabilized at around 36 packs and 219 wolves. At present, the area occupied by wolves is about 67,879 km^2 (39,126–77,958 km^2 from 2007–2022), mean territory size is about 450 km^2, and mean pack size is about 5.4 individuals (and estimated to be similar across Montana). Annual population and harvest metrics can be found in the annual reports produced by the Montana Gray Wolf Program (fwp.mt.gov/conservation/wildlife-management/wolf).

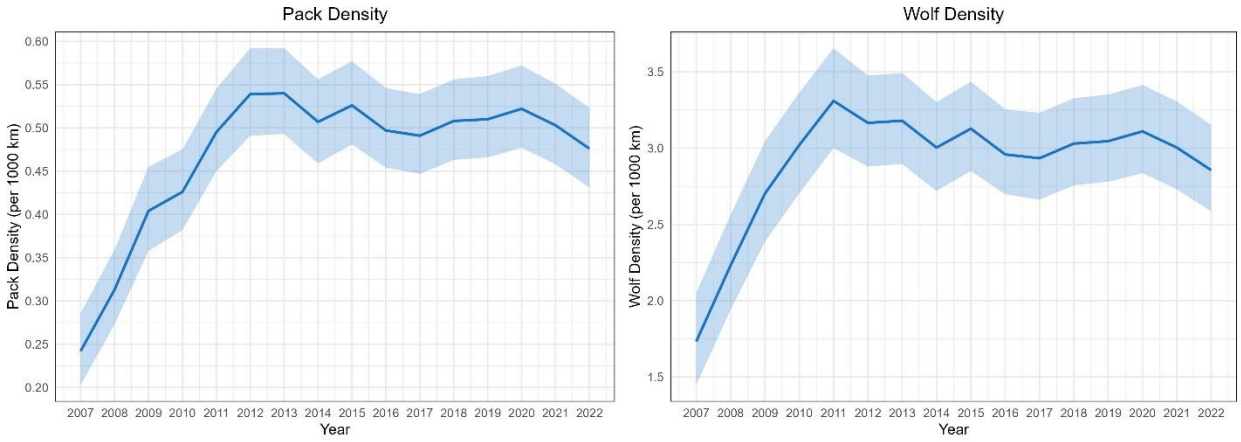

Figure 1. Statewide pack and wolf density (per 1000 km) by calendar year following the population estimate, from 2007–2022 (Parks et al. 2023).

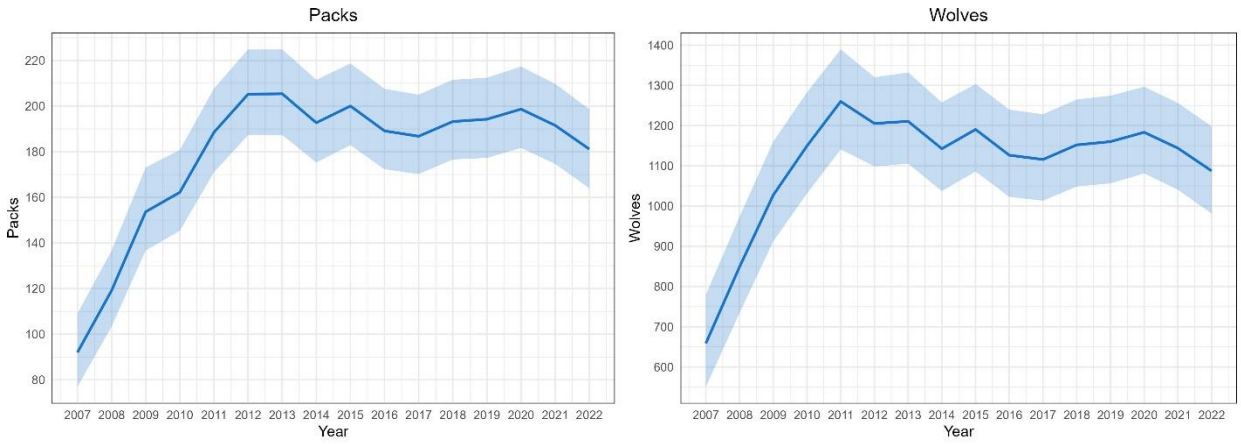

Figure 2. Number of packs and wolves in Montana by calendar year following the population estimate, from 2007–2022 (Parks et al. 2023).

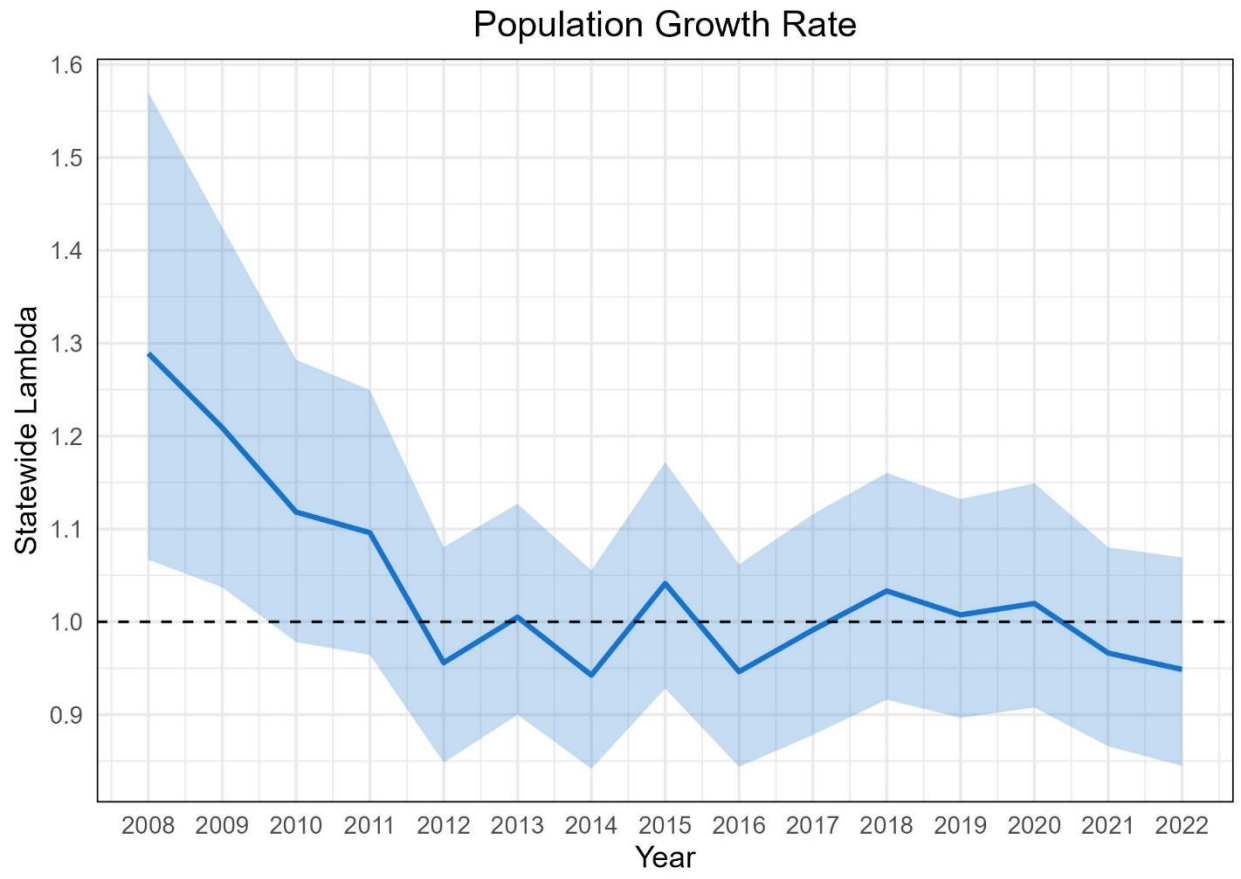

Figure 3. Population growth rate (lambda) in Montana by calendar year following the population estimate, from 2008–2022 (Parks et al. 2023).

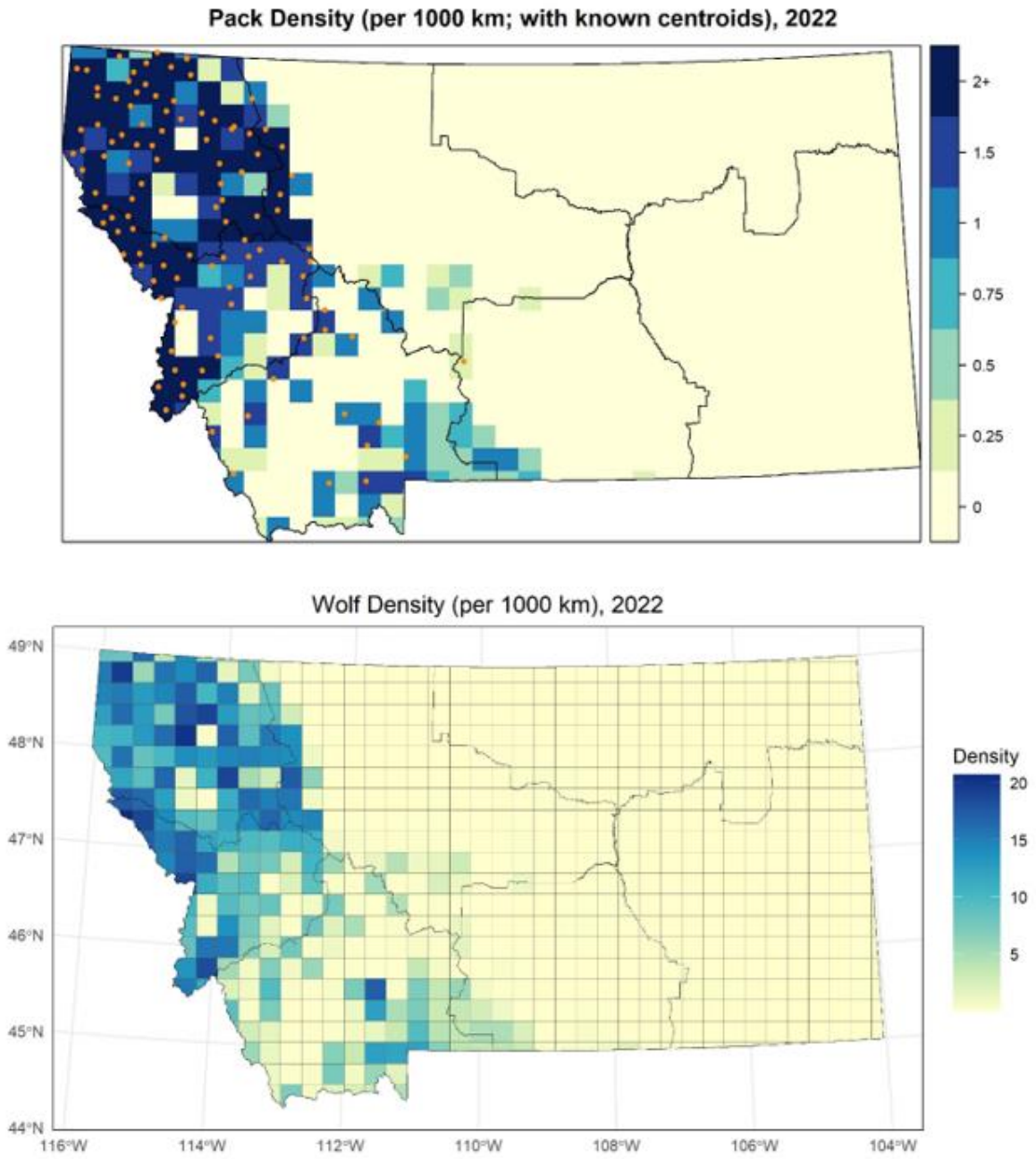

Figure 4. Estimated pack and wolf densities in Montana, 2022, per 1,000 km2. Orange points demarcate territory centroids identified through monitoring in 2022 (pack density map), (Parks et al. 2023).

Because wolves are currently under state authority, state laws are the primary regulatory and legal mechanisms guiding management. Two titles within Montana statutes describe the legal status and management framework for wolves. Title 87 pertains to fish and wildlife species and oversight by FWP. Title 81 pertains to the Montana Department of Livestock (MDOL) and its responsibilities related to predator control. In 2001, the Montana Legislature passed Senate Bill 163, which amended several statutes in both

Titles. Governor Martz signed Senate Bill 163 on April 21, 2001. Through passage of Senate Bill 163, provisions in § 81-7-101 to 81-7-104, MCA, automatically removed wolves from the state endangered species list, concurrent with federal action concluding that wolves are no longer endangered. This action removed their designation as "predatory in nature," thereby assuring that wolf-livestock conflicts are addressed and resolved using management strategies described in the 2003 Wolf Plan.

Wolves are currently classified as a species "in need of management" (§ 87-5-131, MCA). This designation could change through legislative or commission action. Regardless of classification as a species in need of management, game animal, or furbearer, FWP will use available tools to manage populations in accordance with the regulatory framework that the legislature and Commission have established.

Values Associated with Wolves in Montana

Although largely rural (only the Billings and Missoula areas are considered "metropolitan" by the U.S. Census Bureau) and more ethnically homogenous (88.6% white, 6.4% Native American) and older than most states (23.2% 62 years or older), Montana contains a population with a diversity of values and attitudes toward wildlife. Based on a large-scale public opinion survey in 19 western states conducted in 2004, Teel and Manfredo (2009) developed a typology of value orientations they termed "traditionalists," "mutualists," "pluralists," and "distanced." "Traditionalists," also known as "utilitarian," scored high on measures valuing use of animals and hunting, and tended to emphasize that wildlife should be used and managed for the benefit of people. "Mutualists" scored higher on measures such as social affiliation and caring and tended to view wildlife as part of their extended social network. "Pluralists" scored high on both sets of measures, with context and situations controlling which might dominate in any given issue. Those categorized as "distanced" scored low on both sets of measures, and thus were more apathetic generally about wildlife.

A nationwide survey conducted in 2004 found that Montana had a greater percentage of respondents categorized as "traditionalists" than the national average (47.4%; Teel et al. 2005), which was similar to the 44.6% estimated using similar methodology in 2017 (Lewis et al. 2018). Montana also had a similar percentage of respondents categorized as "mutualists" than the national average (18.9%; Teel et al. 2005), which was similar to the 17.5% estimated using similar methodology in 2017 (Lewis et al. 2018). Manfredo et al. (2018) found the percentage of respondents to be down considerably for "traditionalists" (38.9%) and up considerably for "mutualists" (24.7%), although the methodologies employed were different, making direct comparisons difficult. Montana had among the highest percentage among the 19 western states categorized as "pluralists" (27.0–31.0%), almost unchanged from 2004. Montana had among the lowest percentage of respondents among western states categorized as "distanced" (6.7–7.7%). In short, Montanans don't all share the same value orientation toward wildlife, but very few are apathetic (Teel et al. 2005, Lewis et al. 2018, Manfredo et al. 2018). Manfredo et al. (2018) also found that, among all 50 states, only Alaska (62.9%) and Wyoming (62.1%) exceeded Montana's 60.8% of respondents agreeing that local communities should have more control than they currently do over management of fish and wildlife by the state. Montana was among 5 states with the highest percentage of respondents agreeing that wolves that kill livestock should be lethally removed by state managers (Manfredo et al. 2018). FWP licensing data shows that in any 5-year period, 55% of eligible Montanans hold a hunting or fishing license. Thirty-seven

percent of Montana respondents reported being active wildlife viewers, a percentage exceeded only by the 40.7% in Alaska. Montana, Alaska, and Wyoming stood apart as states with high percentages of active wildlife viewers while also having high percentages of "traditionalists" (who might otherwise be assumed to hunt wildlife but not watch it; Manfredo et al. 2018).

Generally, attitudes towards wolves are based on experience with or proximity to wolves (Williams et al. 2002, Karlsson and Sjostrom 2007, Houston et al. 2010, Eriksson and Ericsson 2015), diversity of values and beliefs (i.e., the right for wolves to exist and corresponding emotional responses; Bright and Manfredo 1996, Slagle et al 2012), and demographics (i.e., attitudes are often correlated with age, income, and urban or rural residence; George et al. 2016). Most world-wide studies have documented positive attitudes towards wolves and wolf reintroduction efforts in the last half-century (Williams et al. 2002), as well as in more recent years (Niemiec et al. 2020). Visitors to YNP enjoy viewing wolves among other wildlife and scenery (USFWS 1994a). However, associating visitation exclusively with wolf-viewing is near impossible. Wolves were reported as "extremely important" or "very important" for 23–53% of respondent visitors in YNP (National Park Service 2016), and 44% of visitors listed wolves as one of the top three species they would most like to see (Duffield et al. 2006). Additionally, 62% of respondents in a national survey indicated that they were satisfied just knowing that wolves would be present in YNP (Duffield et al. 1993). Additionally, civilians and recreationists have embedded values regarding wolves on the landscape as wolf management indirectly impacts their livelihoods (i.e., ecotourism; Duffield et al. 2006) and experiences, respectively. Most negative impacts (e.g., safety of pets, loss of big game hunting opportunities, personal safety, and wolf-livestock conflicts) can be more easily quantified than subjective matters such as values and beliefs, and thereby are at times more often displayed in media coverage (Niemiec et al. 2020).

As a result, there is a large amount of contention surrounding the polarized perspectives of stakeholders. FWP has conducted regular surveys as part of human dimensions research specific to wolves and will continue to do so in systematic installments. In Montana, tolerance for wolves remains relatively low but has increased slightly (Figure 5; Lewis et al. 2018), echoing other studies in other locations that documented significant increases in positive attitudes associated with wolves (Williams et al. 2002, George et al. 2016). Although most Montanans support wolf hunting (with 47–88% of respondents stating they were very tolerant), there were varied opinions on trapping. For example, 50-63 percent of the respondents for the landowner, wolf license holder, and deer/elk holder surveys think the trapping season is not long enough while 42 percent of the respondents to the household survey think the trapping season is too long. Further, there was little agreement among Montana respondents regarding the sufficiency of and satisfaction with harvest regulations, though responses toward FWP's ability to manage wolves were favorable. Respondents of the Montana Household Survey tended to be more dissatisfied and intolerant of trapping and harvest regulations compared to resident private landowners, resident wolf license holders, and resident deer or elk license holders (Lewis et al. 2018). Other states have found a similar discrepancy between user groups; livestock producers, hunters, and trappers more often support wolf harvest seasons and lethal management strategies to address wolf-related conflict compared to the general public. Further, the average demographics and experiences of these user groups likely play a role on their values and beliefs, as well as trust in state government agencies. Despite diverse views toward harvest seasons and management strategies, survey results indicate widespread public misunderstanding and lack of knowledge about wolf population status, management strategies, and harvest regulations (Duda et al. 2019, Schroeder et al. 2020, Bradshaw et al. 2022, Riley et al. 2022).

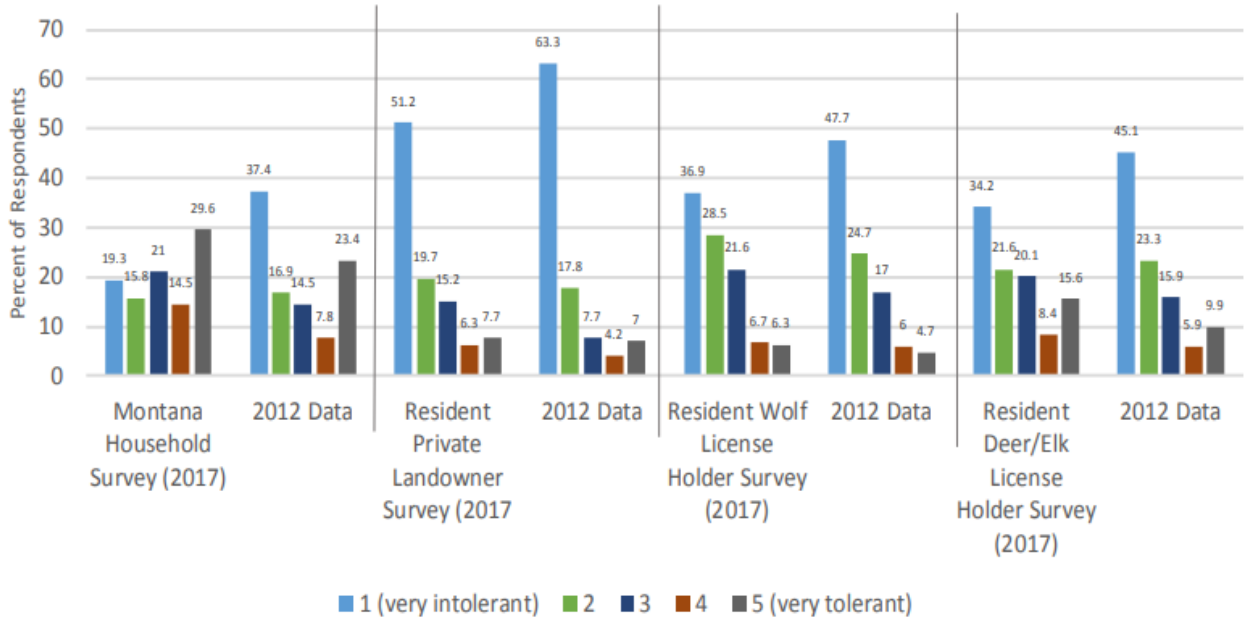

Figure 5. Response to..."On a scale from 1 (very intolerant) to 5 (very tolerant), how tolerant are you with wolves being on the Montana landscape?" Note: The general Montana household survey included a diverse array of Montanans (including private landowners, hunters, and non-hunters). The resident private landowner, resident wolf license holder, and resident deer or elk license holder surveys focused on specific subsets of Montanans (Lewis et al. 2018).

Benefits and Challenges of Wolf Presence in Montana

Biological

Predators such as wolves are influential to the integrity of many ecosystems (Estes 1996), though ecological communities still persist without apex predators. Interactions between top-level carnivores and prey species through evolutionary time has shaped and fine-tuned each one morphologically and behaviorally into what they are today. In the absence of those functional relationships, ecological systems may not be balanced (Fritts et al. 1994). Several ecological benefits and challenges of top-level carnivores are described in depth in the "*Ecology of Wolves"* section of this plan. Wolves provide carrion for other species, cull sick or weak animals, and indirectly alleviate limiting factors for other flora and fauna. Wolves may also directly influence population dynamics of ungulates.

Today, wolf-prey relationships are influenced by many factors, including habitat modification by humans, land management activities, changes in prey species distribution and numbers, economics, and social and political factors, all of which, in and of themselves, are highly dynamic. Predator-prey relationships have been studied extensively, yet the results of each study are most closely tied to the study area and the conditions prevailing at the time the research was conducted (e.g., predator species present, predator density, prey species present, prey density, winter severity). Predator and prey populations are expected to fluctuate and change through time due to a variety of compounding factors. Despite

technological and quantitative advances, our ability to understand population dynamics and predict how predator and prey populations respond to management activities will always contain some degree of uncertainty due to the complex nature of interspecific interactions and relationships wildlife have with their environment.

Broader habitat management and conservation purposes are also served by the presence of large carnivores (Fritts et al. 1994). Providing and sustaining an adequate prey base for wolves, requires that ungulates and their habitats be carefully managed, which ultimately benefits entire plant and animal communities. Because wolves and their prey have large home ranges, attention should be focused on the habitat values of both public and private lands. Voluntary habitat conservation efforts, such as land or vegetation management plans and conservation easements will ultimately benefit many wildlife species.

Social

The social, cultural, and aesthetic values people hold toward wolves today grow out of a long and colorful history of interactions between wolves and humans. Early Native Americans shared the landscape with wolves prior to European settlement, which ultimately led to their attainment of cultural significance. In the days of European settlement and for decades thereafter, settlers viewed wolves unfavorably because they killed livestock during a period of dramatic declines in native prey populations. Wolves were also perceived as a negative, controlling influence on prey populations. However, public opinion about predators, wolves in particular, evolved through the 1960s and 1970s. Wolves came to symbolize changing attitudes about wildlife, the environment, and public lands. With the passage of the ESA and similar laws in the US, changing attitudes were institutionalized. Increasingly, the national public embraced the wolf as a symbol of wilderness and the call to save imperiled species. Wolves symbolize the diversity of American thought, values, and opinions, coming full circle from persecution and extirpation to recovered sustainable populations. Yet, there remains a great diversity in the social, cultural, and aesthetic values that Montanans assign to wolves, as described in detail in the "*Values Associated with Wolves in Montana"* section of this plan.

The greatest challenges of wolf management come from social and political issues rather than biological issues. Active management of wolf densities and distributions is necessary given their reproductive potential and dispersal capabilities, and it is unrealistic to expect that wolves could exist in 21st century settings as they did at the time of Lewis and Clark. Management, including lethal removal, is necessary to address and reduce conflicts with livestock and humans, which are more prevalent on the landscape than ever before (Mech 1995, Mech 2001). However, the same public sentiments that promoted wolf recovery and protection often oppose management and lethal removal of wolves (Mech 1995). This dichotomy has led many wolf experts to emphasize the need for a balanced public outreach program that incorporates wolf control as a part of any wolf restoration program (Fritts et al. 1995).

Some livestock organizations and hunting advocates in the northern Rockies spoke out against wolf recovery and restoration efforts in the GYA and central Idaho, as well as against the legal protections afforded wolves by the ESA (USFWS 1994b). Opposition stemmed from concerns about wolf depredations on livestock and the associated economic losses, loss of management flexibility by federal land management agencies, land-use restrictions, human safety, impacts to big game populations, and reduced hunting opportunity. Despite many legal challenges, wolves were released in 1995. The USFWS worked to increase the tolerance and acceptance of wolves by those who expressed the greatest opposition or who

would be affected the most by wolf presence. Resolution of wolf-livestock conflicts in a safe, efficient manner is still a federal and state priority.

Montana will continue to face similar challenges and polarization of opinions on the presence of wolves. With a dispersed rural population, an urban population concentrated in a few populous counties, an economy in which agriculture ranks among the top three (3) industries, several ecotourism destinations, and expanses of public land that support wolves, the spectrum of human values and attitudes about wolves ranges from total protection of the species to total elimination. These values are highlighted by urban and rural differences, by differences between state residents and the national public, and by differences in the knowledge and understanding of wolf biology and the education of individual respondents (USFWS 1994a, George et al. 2016, Duda et al. 2019, Schroeder et al. 2020, Bradshaw et al. 2022, Riley et al. 2022). These differences in values, attitudes, and opinions create a challenging environment to manage a controversial species.

Economic

Wildlife in Montana has contributed to increased tourist interest and visitation to the state. Visitors rated mountains, Glacier and Yellowstone national parks, rivers, open space, and wildlife as the top six attractions to the state, respectively (Parrish et al. 1997, Dillion and Nickerson 2000). In 2017, nonresident visitors to Montana spent $3.36 billion, supported 53,380 jobs and contributed to 58% of all dollars in the state. Montana ranks second of western US states in visitor spending per capita, with the travel industry focused in the western half of the state and 40% of vacationers participating in wildlife viewing (Nickerson et al. 2019). Since the reintroduction of wolves, the visitation to YNP has increased an estimated 3.7% due to wolf presence, specifically. Wolf centric ecotourism has brought an estimated $35.5 million (confidence interval of $22.4 to $48.6 million) additional tourism dollars into the local economies in the GYA (Duffield et al. 2006). Wildlife-viewing is associated with an influx of cash and sales amounts during the third quarter of the year in western Montana, with spending predominately in retail and grocery (41%) and tourism (e.g., restaurants and lodging, 34%; Montana Dept. of Commerce 2021). However, these quantifications are not wolf-specific. The 2010 mean per capita income for Montana cities in the GYA ranged from $17,810–$31,618 (Gardiner, West Yellowstone, Red Lodge, and Cooke City; 2010 Demographic Profile Data, US Census Bureau 2010). Although ecotourism is touted as a viable, sustainable way of generating economic activity through “low-impact” use of natural resources, ecotourism has potentially negative consequences. Risks to resources include increased infrastructure development, habitat degradation, wildlife disturbance, and an erroneous perception that ecotourism leads to long-term protection of environmental assets (Isaacs 2000). Positive economic benefits are expected for businesses related to tourism, outdoor recreation, and national park visitation.

In contrast to the benefits wolves provide for the ecotourism industry, other segments of the economy can be negatively affected by wolves. Livestock producers may experience significant direct and or indirect economic impacts due to wolf presence or depredation. In the most recent published report, the percentage of calf deaths attributed to predators increased steadily from 3.5% in 1995 to 11.1% in 2015. In Montana, total cattle and calf losses cost about $55,135,000, with injuries due to predators costing an additional $223,000. However, only 2.0% of cattle deaths and 9.8% of calf deaths were due to predators, with 10.2% and 12.8%, respectively, of those depredations attributed to wolves (USDA 2015). Losses due to predators amounted to 5% of the 2020 sheep and lamb supply and 47.2% of all sheep and lamb deaths, costing about $3.57 million in losses, though coyotes are the primary culprit of sheep depredations

(Sommer 2021). From 1987–2003, livestock producers in the NRM that experienced wolf-livestock depredations averaged $11,076.49 per year in losses (Muhly and Musiani 2009). Specific wolf-livestock depredation compensation can be found in Part IV of this document. Producers could have other losses beyond what is confirmed and documented, and it is difficult to estimate economic losses due to unconfirmed or undocumented livestock losses or the indirect economic costs associated with wolf presence. Indirect financial expenses of wolf presence may include non-lethal predator control, increased human resources to prevent predator conflicts, and stress-induced declines in livestock health and weight gain as a result of harassment by wolves. However, Ramler et al. (2014), found no evidence that wolves had any detrimental effects on calf weights and other non-wolf factors (e.g., climate, husbandry practices) better explained variation in calf weight. For hunting-related businesses such as outfitting, economic losses may be associated with decreased hunter opportunity (i.e., reduced tags) or fewer recreational days afield (i.e., shorter seasons), which ultimately may reduce hunter expenditures or participation rates. Declines in predicted annual big game hunter spending associated with ungulate declines and restrictive harvest opportunities, was estimated to be $187,000 to $464,000, with Wyoming estimating a reduced hunter spending of about $2.9 million (Duffield et al. 2006). Hunter opportunity may fluctuate based on prey densities and distributions as they relate to population objectives. As a result, the license dollars and revenue that funds wildlife and habitat management efforts, may be negatively impacted (*see* Part V).

Part III: Wolf Conservation and Management

Population Monitoring and Research

History of Population Monitoring

The wolf monitoring program documents population status and trends through time. Wolf packs were intensively monitored year-round beginning with their return to the northwestern part of Montana in the 1980s, via natural immigration from Canada. Objectives for monitoring during the period of recovery were driven by the USFWS's recovery criteria–30 breeding pairs for 3 consecutive years in Montana, Idaho, and Wyoming. Similar metrics of population status were used from the time recovery criteria were met in 2002, through delisting in 2011, and for the 5 years thereafter when the USFWS retained oversight after delisting. These population monitoring criteria and methods were appropriate and achievable when the wolf population was small and recovering. In the early years, most wolf packs had radio-collared individuals and intensive monitoring was possible to identify new packs and most individuals within packs. Weekly updates were appropriate during this time because monitoring a smaller population was practical and necessary. In later years, the minimum count of wolves exceeded 500 individuals distributed across more than 25,000 square miles of mostly rugged and remote terrain in western Montana. Therefore, the wolf population effectively outgrew the staffing and funding necessary to maintain this highly resource-intensive monitoring strategy. Further, this approach consistently underestimated the total number of wolves and was thereby ineffective in providing accurate population estimation (Figure 6). Out of necessity and practicality, FWP has moved to more cost-effective modeling methods for monitoring wolves which more accurately and reliably describes population estimates and accounts for uncertainty (credible

intervals). Contrarily, continuing to produce a minimum count when populations are large more accurately reflects total effort (dollars and related resources spent) than an accurate population abundance estimate.

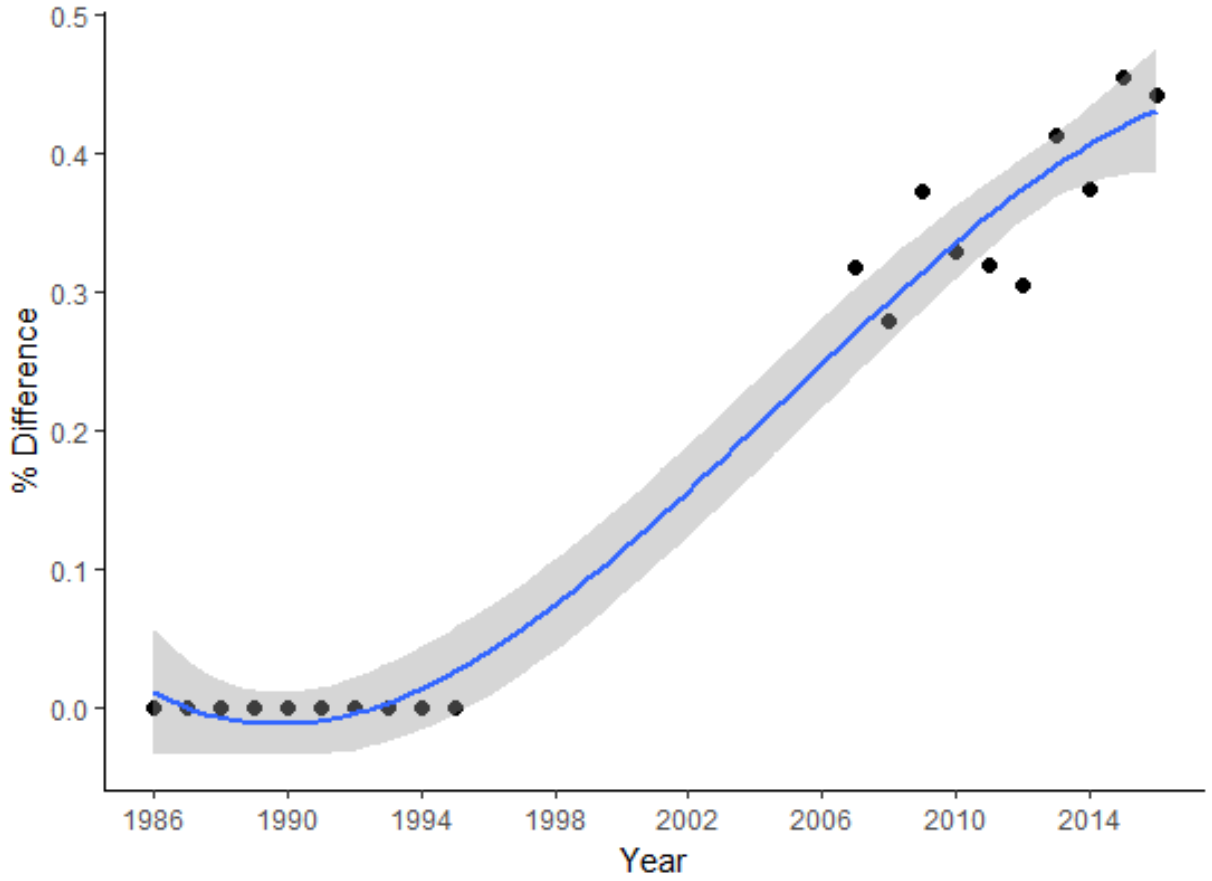

Figure 6. Predicted % difference in abundance estimates and minimum counts over time (blue line) with 95% confidence limits and the actual % difference in abundance estimates and minimum counts (black circles). With increased population sizes in recent years, minimum counts are not accurate or cost-effective when compared to contemporary population abundance estimate techniques. Minimum counts data from 1986–1995 were accurate and assumed to represent a census of the small population at the time, therefore the percent difference between abundance estimates and minimum counts was 0. From 2006 to present, population estimates were calculated using POM, thereby producing differences between abundance estimates and minimum counts (FWP 2018).

FWP first began considering alternative approaches to monitoring the wolf population in 2006 through a collaborative effort with the University of Montana Cooperative Wildlife Research Unit. The primary objective was to find an alternative approach to wolf monitoring that would yield statistically reliable estimates of the number of wolves, the number of wolf packs, and the number of breeding pairs (Glenn et al. 2011). Field-based counting of individual wolves and packs is costly, cumbersome, and less effective with larger population sizes, and therefore adversely impacts agency resources necessary to effectively manage wolves while often underestimating population abundance, the accurate estimation of which is key to proper management. As a result, a method applicable to a sparsely distributed and elusive carnivore population was developed that used hunter observations as a cost-effective means of gathering biological data to estimate the area occupied by wolves in Montana (i.e., the patch occupancy model, or POM). POM was sensitive to sizes of packs and territories, and required accurate and reliable estimates for both.

However, this approach was developed prior to the implementation of wolf hunting and trapping seasons associated with public harvest, and, with the cessation of federal funding for wolf monitoring, a reduction in reliance on intensive counts of the wolf population was necessary. Therefore, models to estimate pack and territory size were developed and integrated into POM. This refined tool to estimate the state's wolf population is the integrated patch occupancy model (iPOM).

iPOM is a modern, scientifically peer-reviewed, and cost-effective means of monitoring wolves, and is the most efficient method to document wolf population numbers and trends accurately across the distribution of wolves in Montana (Sells et al. 2020, Sells et al. 2021, Sells et al. 2022a, Sells et al. 2022b). The iPOM method uses annual big game hunter surveys, known wolf locations, habitat covariates, and estimates of wolf territory size and pack size to estimate wolf distribution and population size across the state (Sells et al. 2020). iPOM estimates the extent of wolf distribution in Montana, and a territory model predicts territory sizes; together, these models predict the number of packs in a given area. A group size model predicts pack sizes. Total abundance estimates are derived by combining the estimated number of packs and pack sizes, while also accounting for lone and dispersing wolves, which are generally not accounted for with other strategies. iPOM estimates of wolf population size are the preferred monitoring method due to accuracy, confidence intervals, and cost efficiency, and FWP will use iPOM as relevant and appropriate.

Integrated Patch Occupancy Modeling Methods

Occupancy Model

To predict where wolves occur in Montana each year, FWP fits a multi-season false-positives occupancy model in a Bayesian context (Bassing et al. 2019). This work built on an earlier occupancy model (Miller et al. 2013, Rich et al. 2013, Inman et al. 2020). Following those authors, FWP uses an observation "iPOM grid" across Montana, composed of 600 km^2 cells. FWP assigns locations of wolves in packs to grid cells, based on monitoring effort by FWP wolf specialists and wolf sightings reported by hunters each fall. Wolf specialists monitor packs each year to verify presence using trail cameras, visual observations, and telemetry collars, and use these data sets to demarcate approximate territory centroids for packs. FWP conducts annual Hunter Harvest Surveys of a random sample of 50,000–80,000 resident deer and elk hunters annually to obtain wolf sighting reports. Hunters spend 1.8–2.2 million hunter days (total number of days spent hunting by all licensed hunters) each fall pursuing deer and elk. This results in hunters acting as observers across Montana, despite their intended goal. Hunters are queried about dates and locations of any sightings of groups of 2–25 wolves. To develop encounter histories, FWP divides the 5-week general rifle season (occurring each year around late October through November or early December) into one-week encounter periods and then maps locations of pack centroids and hunter observations for each week. Based on past work (Miller et al. 2013, Rich et al. 2013, Inman et al. 2020), FWP includes model covariates for detection as: 1) hunter days per km^2 in each hunting district (an index to spatial effort), 2) proportion of mapped wolf observations (a correction for effort, accounting for number of hunter observations with coordinates versus total reported, including any sightings with vague location descriptions), 3) densities of low-use forested and non-forested roads (indices of spatial accessibility), 4) a spatial autocovariate (proportion of neighboring cells with wolves seen out to a mean dispersal distance of 100 km), and 5) patch area sampled (because smaller cells on the border of Montana, National Parks, and tribal lands have less hunting activity and therefore less opportunity for hunters to see wolves). FWP also includes cell size as a nuisance parameter to account for varying cell sizes. Model covariates for

occupancy, colonization, and local extinction include a principal component constructed from several autocorrelated environmental covariates (percent forest cover, slope, elevation, latitude, percent low use forest roads, and human population density), and recency (number of years with verified pack locations in the previous 5 years). Using these pack locations and model covariates, FWP fits the multi-season false-positives occupancy model to estimate psi, the probability of occupancy (ψ). FWP uses pack centroids to estimate probabilities of false positives, true positives, and false negatives (Miller et al. 2013). FWP estimates ψ for tribal lands and national parks, where no hunter survey data are available, via modeled covariates. FWP uses Markov chain Monte Carlo (MCMC; Brooks 2003) methods in a Bayesian framework to fit the occupancy model using program R 3.4.1 (R Core Team 2020) and package rjags (Plummer et al. 2019) that calls on program JAGS 4.2.0 (Plummer 2003). FWP runs 3 chains for 10,000 iterations, after an adaptation phase of 10,000 iterations and a burn-in of 10,000 iterations. MCMC chains are not thinned.

Territory Model

FWP uses a recently developed mechanistic territory model to predict territory size (Sells and Mitchell 2020, Sells et al. 2020, 2021). The territory model is a spatially-explicit, agent-based model representing the hypothesis that wolves are adapted to select economical territories that maximize food benefits and reduce costs of travel, competition, and mortality risk. After calibrating the model using wolf location data collected from 2014–2018 (Sells et al. 2020), the model provides territory size predictions through simulations in NetLogo 6.1.1 (Wilensky 1999). The model demonstrates the strong effect of competition on resulting space use (Sells and Mitchell 2020; Sells et al. 2020, 2021). Accordingly, FWP applies the model to predict territory sizes at a wide range of possible pack densities and resulting levels of competition. FWP uses a density identifier model (Sells et al. 2020) to predict levels of competition in each area of Montana for each year. FWP then uses the territory sizes predicted at the given level of competition as estimates of territory size in each area of the state.

Group Model

FWP uses a recently developed group size model (Sells et al. 2020) to predict pack sizes in each 600 km^2 iPOM grid cell. The model is based on mechanisms hypothesized to influence wolf pack size and developed using 14 years of wolf pack data. The generalized linear mixed effects model includes effects of pack density, terrain ruggedness, harvest intensity, and control removals. Pack density is the long-term (2005–2018) mean pack density in the iPOM grid cell, which served as an index to density trends (Sells et al. 2020). Ruggedness is terrain ruggedness in the iPOM grid cell. Harvest intensity is categorized as "none" when no harvest was allowed, "restricted" if 2009 and 2011 rules were followed (statewide harvest was limited by a quota, seasons were shorter, bag limits were low, and trapping was prohibited), and "liberal" if 2012–2021 rules were followed (statewide harvest quotas were removed, seasons were longer, bag limits were higher, and trapping was allowed). Control removals are reported numbers of wolves removed for depredations in the iPOM grid cell that year. Ecoregion defines in which ecoregion the iPOM grid cell fell (epa.gov). The unique identifier for the iPOM grid cell is included as a random effect to account for repeated observations among years. FWP applies the model to each iPOM grid cell, each year, to predict local pack size.

Model Integration

FWP estimates numbers of packs and wolves for each year by combining predictions from the 3 models (Figure 7) using an integrated approach (Sells et al. 2022b). FWP first calculates mean estimated

occupancy ($\bar{\psi}$) across iPOM grid cells, then calculates area occupied ($area_{occupied}$) as $area_{occupied} = \bar{\psi}$ x $\sum grid_{area}$ where $\sum grid_{area}$ was the sum of grid cell areas. FWP calculates number of estimated packs as $N_{packs} = area_{occupied} \div territory_{size}$ where values for $territory_{size}$ were drawn with replacement for each iteration of the MCMC chain from the distribution of territory sizes predicted by the territory model at the specific grid cell. Values for $territory_{size}$ were therefore spatially explicit and biologically appropriate to local conditions each year and accounted for uncertainty. FWP then calculates number of wolves as $N_{wolves} = N_{packs}$ x $pack_{size}$ x $lone_{rate}$ where $lone_{rate}$ accounted for lone and dispersing wolves. For $pack_{size}$ FWP draws for each iteration of the MCMC chain a value from the distribution of group sizes predicted at the specific grid cell. This provided spatially explicit and biologically appropriate values for local conditions each year while incorporating model uncertainty about pack size. FWP models $lone_{rate}$ by drawing for each iteration of the MCMC chain values from a normal distribution assuming a mean of 1.125 and standard deviation of 0.025. This yielded a disperser rate of 12.5% and incorporated variation and uncertainty around this rate, as 95% of values drawn were 7.6–17.4%. We selected these values based on studies documenting that 10–15% of wolf populations are comprised of lone or dispersing wolves (Fuller et al. 2003). This is consistent with Idaho's calculations for lone wolves (Holyan et al. 2013) and slightly more conservative than Minnesota's calculations, which add 15% (Erb et al. 2018). To account for uncertainty and calculate credible intervals (CI's) for all parameters, FWP retains posterior estimates of 10,000 values for each and calculated the median value and 2.5% and 97.5% values (creating 95% CI's) for $area_{occupied}$, $territory_{size}$, $pack_{size}$, N_{packs}, and N_{wolves}. FWP calculates density of packs per 1,000 km^2, wolves per 1,000 km^2, and population growth (lambda, λ). FWP repeats these calculations for FWP management administrative regions by completing each step described above at each subsetted group of grid cells by region. Grid cells were categorized by the region in which the majority of their areas fell. The development, justification, and implementation of the iPOM model are described in peer-reviewed scientific publications and can be found under the Research tab and Population Monitoring section of the FWP website (fwp.mt.gov/conservation/wildlife-management/wolf).

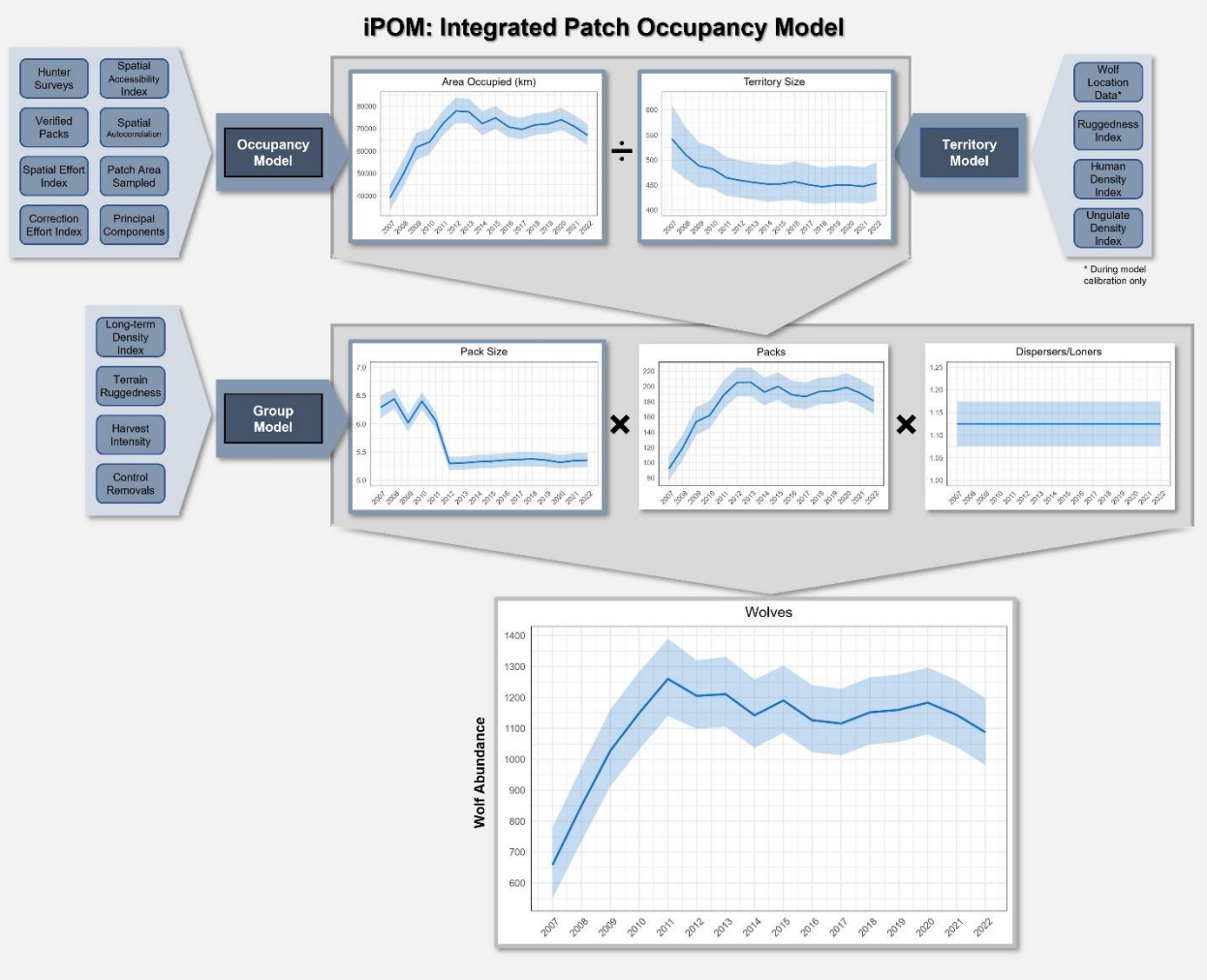

Figure 7. Schematic for method of estimating the area occupied by wolves, number of wolf packs and number of wolves in Montana by calendar year following the population estimate, 2007–2022 using an Integrated Patch Model. Graphs show statewide estimates over time. Ribbons indicate 95% credible intervals (Parks et al. 2023).

Wolves will continue to be monitored using contemporary science-based methodologies. If new and improved techniques become available based on new research and the peer-review process (and through validation with empirical and simulated data), those methods may be implemented when practical and appropriate at large scales. Accurate and timely information about any wildlife population is critical to make informed management decisions, and minimum counts and breeding pairs have become increasingly difficult to document with the current wolf population in the state. Although once the primary tools to monitor wolves, with larger wolf populations and even when combined, these data are no longer representative of abundance, density, and population estimates because of the discrepancy between minimal number of observations relative to the overall population size. FWP emphasizes and deeply values the use of scientific principles to estimate population sizes and distributions and uses these estimates to inform wolf harvest management recommendations.

Field Monitoring, Data Collection, and Research

FWP is confident the wolf population estimate and trends provided by iPOM are accurate and scientifically valid evidence that can be used to assess wolf status relative to the criteria outlined in the 2023 Wolf Plan. However, wolf specialists and area biologists still regularly collect data on wolves in the field. Because wolf specialists continue to radio-collar wolves (§ 87-5-132, MCA) and conduct non-invasive surveys in the field, the iPOM model will be regularly supplemented with field data along with data collected from harvested and conflict-removed individuals. For example, wolf specialists verify hunter observations with known wolf pack centroids to improve occupancy estimation and collect conflict removal data for integration into population estimation. While this data is incorporated into iPOM, other data is collected for general monitoring of trend and use in future evaluations. Spatiotemporal data from radio-collared wolves, for example, provides information on wolf pack distribution, individual territory boundaries, how a pack moves through and uses its territory, locations of wolf den and rendezvous sites, dispersal, and interactions between packs. "Non-invasive" monitoring methods gather information without live-capturing and handling animals. Examples of non-invasive methods are track counts to document pack size (best with snow cover), howling surveys (best at rendezvous sites where pups are present), observation report summaries, remote photography (Loonam et al. 2020), and profiling of genetic material obtained passively from hair or scat samples (Bischof et al. 2020). These methods can yield valuable information on occupancy, distribution, densities, and abundance; however, for some monitoring objectives, these processes are not efficient, effective, accurate, or precise.

Although FWP personnel carry out the primary monitoring duties, opportunities for research collaboration with other agencies, universities, non-profit organizations, volunteers, and tribal wildlife authorities will be pursued. Permits to conduct research, particularly if live capture is required, are issued by FWP to ensure that the work is scientifically justified and conducted in an ethical, responsible manner. FWP partners with University of Montana, Montana State University, USFWS, United States Forest Service (USFS), National Park Service (NPS), private landowners, and others to conduct research pertaining to predator-prey interactions (*see* References for peer-reviewed scientific literature that includes FWP sponsorship, partnership, and or participation). FWP capitalizes on opportunistic ways to collect data, such as DNA sampling from harvested or removed individuals to continue surveillance of population genetic connectivity and viability. Additionally, human dimensions studies use surveys and questionnaires to quantify human values, beliefs, and attitudes toward wolves on various topics. FWP conducts human dimensions research and identifies problems or areas of public concern so that targeted work efforts are more effective. Research updates regarding human dimensions can be found in Part I. These efforts help to identify special management needs, opportunities, and constraints.

Additionally, FWP and the Montana Cooperative Wildlife Research Unit at the University of Montana are partnering to develop a wolf harvest management strategy evaluation (hereafter, MSE; Punt et al. 2016). MSE is a tool to simulate the workings of a harvested population and allows managers to test whether potential management strategies can achieve pre-defined fundamental objectives (Bunnefield et al. 2011). MSE considers a full range of uncertainty and helps decision-makers consider long-term trade-offs among the management objectives, thus focusing on wolf population viability and longevity alongside the implementation of harvest management strategies to forecast populations into the future. Models will be constructed based on current understanding and data, and then management strategies are simulated through time to provide predictions about their relative effects and performance at meeting fundamental

objectives. Simulated management strategies include different monitoring programs or levels of monitoring intensity, as well as varying levels of harvest control rules (for example, liberal or restrictive regulations applied when populations are above or below some threshold, respectively) and uncertainty in the effects of regulations on realized harvest to reflect that regulations do not always prescribe exact harvest levels. MSE would allow FWP to better examine how or if management decisions (or the population) might be affected with different combinations of monitoring schemes and harvest control rules. Further, incorporating structural uncertainty about how the population works (e.g., the relative effect of harvest or density dependence on population trend) along with variable monitoring and harvest control rules in an MSE permits analyses related to whether or what type of additional monitoring or research data would help select harvest control rules that ensure population conservation. Several different performance metrics related to fundamental objectives can then be tracked and summarized for each management strategy based on the simulations, essentially allowing for experimental application of different strategies to help choose those more likely to be effective over the long term compared to other alternatives (Marasco et al. 2007). A wolf harvest MSE could (1) incorporate uncertainty in population size, effects of regulations on total and regional harvest, effects of harvest or density dependence on population size and trend at statewide and regional scales, and the effects of harvest methods and total harvest on public sentiment, and (2) help elucidate and evaluate tradeoffs in management strategies (monitoring strategies and harvest control rules) over longer time frames than the current short-term (annual) decisions on harvest management.

Population Management

FWP implements flexible management strategies to ensure population sustainability and longevity as ecological and sociopolitical environments change, to accommodate changes in law and political leadership, and to incorporate new and available science into practical and applied management strategies. Adaptive management refers to the formal structured decision-making process but is a term often used when meaning flexible management. Management decisions are based on the current and predicted future status of resources (e.g., FWP staffing, funding), considering uncertainty, objectives, and constraints. Research and management monitoring of wolf density and distribution are conducted to evaluate outcomes of previous decisions. Management actions change over time based on current wolf population status and trends compared with management objectives. As a result, FWP evaluates and periodically changes how wolves are monitored and managed. Further, FWP incorporates new wolf-related science and information as it becomes available and modifies its management approach as appropriate and practical. What is consistent in the wolf program, however, are the following objectives that guide implementation. These management objectives were originally developed to inform the commission's setting of the 2010 wolf hunting season, before wolves were relisted later that year, as described in Runge et al. (2013). Since that time, these objectives have been incorporated into most wolf season proposals drafted by FWP and acted upon by the commission. The originally written third objective was changed from listing "livestock producers, hunters, and other stakeholders" to "all stakeholders" to be inclusive of the diversity of values pertaining to wolves. These management objectives include:

1. Maintain a viable and connected wolf population in Montana;
2. Maintain authority for State of Montana to manage wolves;

3. Maintain positive and effective working relationships with all stakeholders;
4. Reduce wolf impacts on:
    a. Livestock; and
    b. big game populations.
5. Maintain sustainable hunter opportunity for wolves;
6. Maintain sustainable hunter opportunity for ungulates;
7. Increase broad public acceptance of sustainable harvest and hunter opportunity as part of wolf conservation;
8. Enhance open and effective communication to better inform decisions; and
9. Learn and improve as we go.

FWP will maintain the population baseline derived from the federal recovery definition of 150 wolves and 15 breeding pairs (or another stated minimum threshold if modified, in coordination with the USFWS benchmark for ESA recovery [50 CFR Part 17, Docket No. FWS–R6–ES–2011–0032; 92220–1113–0000; ABC Code: C6]). Further, the minimum baseline metric used will be modified to the number of wolves and wolf packs needed to sustain and maintain a viable wolf population. By dividing the mean estimate of population size from iPOM and the mean number of documented breeding pairs in Montana from 2011–2017, the number of wolves per breeding pair can be estimated. By then multiplying the number of wolves needed per breeding pair by 15 (the federal minimum requirement for breeding pairs), an estimate of the number of wolves needed to ensure Montana has at least 15 breeding pairs can be calculated.

Using iPOM population estimates for the statewide number of wolves and documented breeding pairs from 2011 to 2017 generates 29.15 wolves/breeding pair. For comparison, the newer numbers (2018–2022) provide an estimate of 20.36 wolves/breeding pair. The long-term 10-year average (2012–2022) gives an estimate of 24.65 wolves/breeding pair. These estimates suggest a range of 305–437 wolves would be needed to support 15 breeding pairs, with a 10-year average of about 370 wolves. This range is higher than the number of individuals predicted to equate to 15 breeding pairs based on a linear regression (Figure 8; Mills and Thompson 2023).

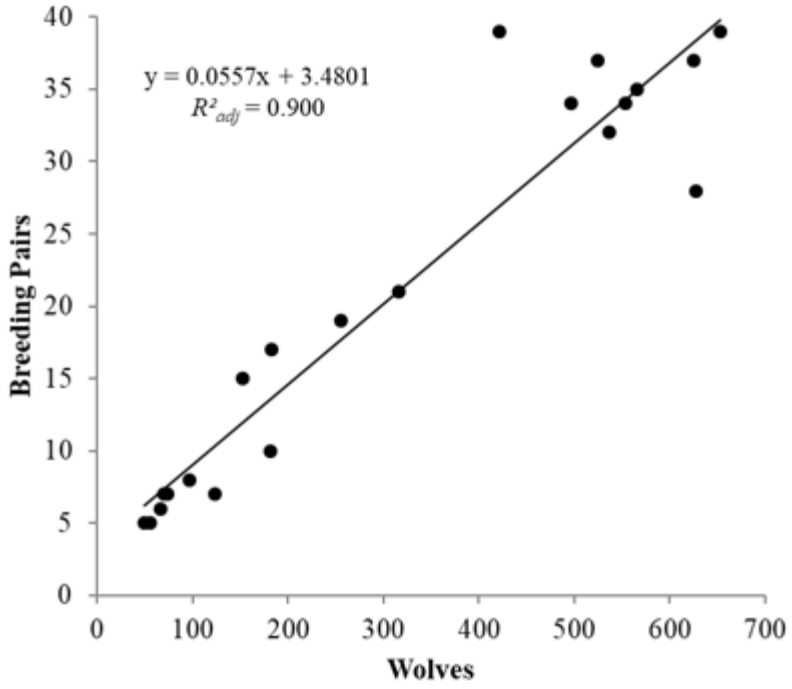

Figure 8. Linear regression relationship between number of wolves and respective number of breeding pairs present in Montana at the end of each calendar year, 1995–2015 (Mills and Thompson 2023).

To be cautious in maintaining delisted status and state management of wolves, FWP will use 450 wolves as determined by iPOM, as the benchmark to ensure the population maintains at least 15 breeding pairs, which also surpasses the minimum requirement of 150 wolves. That number may change if the monitoring methods change in the future. While minimum counts and documented breeding pairs provided valuable information on wolf population trends in the early days after recovery, those metrics became increasingly difficult to document at a meaningful scale and less representative of the overall population with the rapidly growing wolf population. To address this concern, Montana progressed to population estimation via iPOM to balance resources with population monitoring needs. Because this update also led to changes in field monitoring methods, recent efforts to document breeding pairs may not be consistent with earlier years. Ultimately, the shift from reporting the minimum number of breeding pairs to the number of wolves equivalent to the number of breeding pairs will improve consistency with updated population monitoring methods and outputs from iPOM (total estimated number of wolves) that would ensure the metric used for a minimum threshold is current relative to monitoring methods.

While a minimum baseline will be used to ensure Montana maintains management authority for wolves, FWP does not administratively declare an upper limit of wolves in the state in the sense of a “cap.” Section 87-1-901, MCA, passed as Senate Bill 314 by the 2021 Montana Legislature, states that, "the commission shall establish by rule hunting and trapping seasons for wolves with the intent to reduce the wolf population in this state to a sustainable level, but not less than the number of wolves necessary to support at least 15 breeding pairs.” The population at the end of 2020, prior to passage of Senate Bill 314 was 1,177 (1,069–1,290) wolves. To clarify, FWP will manage according to legislative and commission

direction to reduce the population. Should the wolf population decline to the point it approaches 450 wolves (the minimum number of wolves needed to ensure 15 breeding pairs) FWP would shift management strategies.

FWP will continue using iPOM for population monitoring, especially when the wolf population is large. iPOM produces valid population estimates, but uncertainty resulting from the use of relatively coarse data inputs and compounding errors is a concern. Therefore, if the population were to approach the minimum number of wolves necessary to sustain 15 breeding pairs or 450 wolves, more intensive monitoring would be required to ensure the population remains healthy and is reproducing at an acceptable rate. This might necessitate a return to former monitoring strategies using minimum counts of wolves, packs, and breeding pairs based on intensive radio-collaring and monitoring of radio-collared animals, which, as stated, has its own limitations (i.e., bias toward underestimating population size). Any need for more detailed, field-based minimum counts may require more funding and staff than it previously had, given the wider distribution of wolves compared to 10-20 years ago and wariness of wolves due to public harvest, thereby making wolves more difficult to radio-collar and observe. Funding is described in Part VIII. Additionally, FWP will continue to invest in applied science (by FWP and others) to improve the monitoring and management of wolves into the future. FWP will adopt the findings and recommendations from future applied science as warranted and then practically implementable.

Wolves occupy much of the predicted distribution area in Montana (Figure 9). In the last decade, expansion in wolf distribution (i.e., recolonization of new areas) has subsided although amount and availability of suitable habitat is not a limiting factor. Wolves primarily occupy western Montana, and wolf distributions are discontinuous because of marginal habitat conditions for ungulates or concentrated human settlements in intermountain valleys. In eastern Montana, the higher frequency with which wolves conflict with livestock on public and private land makes it unlikely that a wolf pack could be sustained over the long term, although dispersing wolves travel through some unsuitable habitats. However, wolf distribution would not be artificially restricted if social tolerance permits wolf presence. Indeed, the general distribution of all wildlife species in Montana is determined by the interaction of species' ecological requirements and human tolerance. FWP intends to balance wolf distribution and densities with the diverse needs of the public, private landowners, and the various land uses in Montana. FWP does not have specific objectives for the distribution of wolves. Wolves could occur and persist anywhere in the state where they are tolerated (i.e., based on wolf conflict).

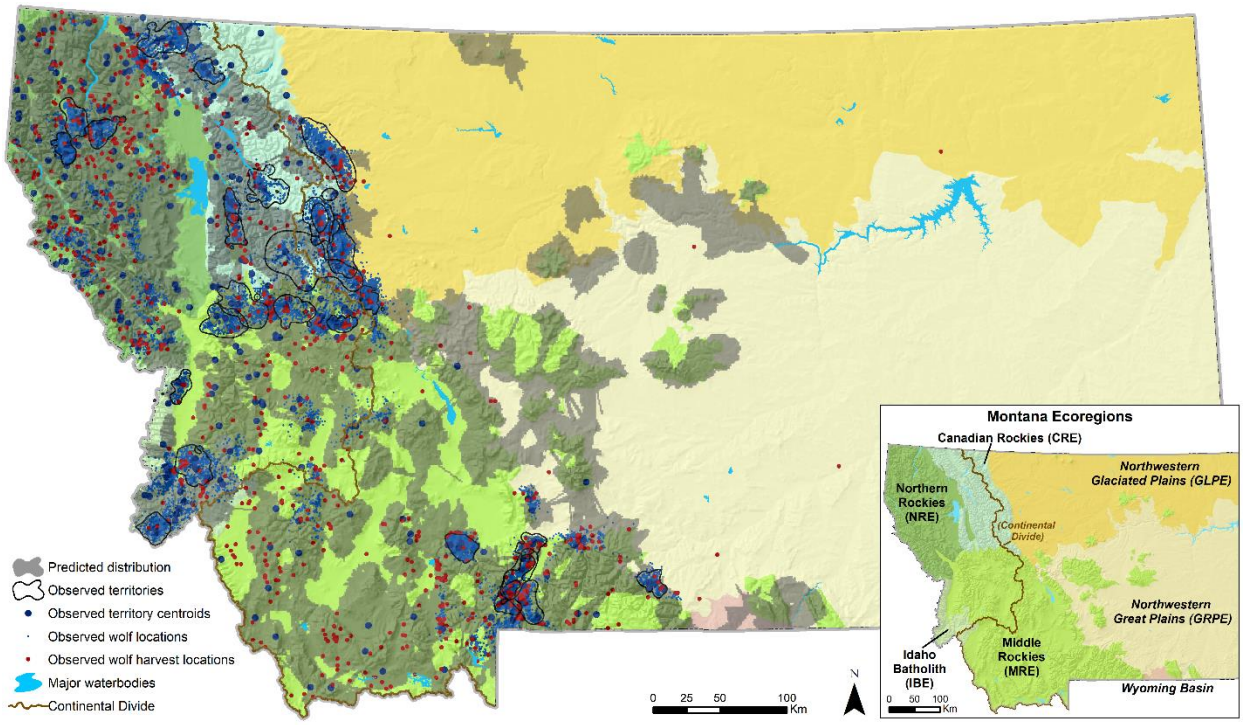

Figure 9. Predicted distribution of territories for 2014–2019 on a 1-km^2 grid (gray shading), alongside observed locations of wolves during this period (territory centroids–large blue dots, GPS locations for collared individuals-small blue dots, and harvest mortality locations-red dots). Observed territories are outlined in black (Sells et al. 2020).

Populations and distributions will likely fluctuate because of changes in policy, advocacy, harvest seasons and their results, specific localized social issues, and ecological processes. FWP staff will continue to use population modeling to provide decision-makers (FWP Director, Fish and Wildlife Commission, Governor, and legislators) with predictions about the possible outcomes of public harvest seasons and the effects they would have on wolf population sizes to inform their decisions about overall population status and trends. As Montana's wolf population fluctuates, FWP will continue to manage wolves with a primary objective of maintaining a healthy, sustainable population above federal ESA listing criteria (15 breeding pairs or 450 wolves). Further, this plan affords the commission the ability to direct local differences in the level of wolf harvest to reach specified population objectives, or other management objectives, at the statewide scale.

Montana's landscape is extremely diverse, with a complex mix of differing prey bases, land ownership, land uses, social tolerance levels, and potential for conflict. Wolf presence is encouraged on large contiguous blocks of public land, managed primarily as backcountry areas or national parks where there is the least potential for conflict with livestock or big game hunting opportunities. Wolf packs in areas of mixed public and private lands will be managed similarly to that of other free-ranging wildlife in Montana and will depend on wolf population status, type and severity of conflict, land ownership, and social tolerance. While this plan will guide FWP management of wolves, some agency discretion and flexibility will be exercised to accommodate the unique attributes of each pack, its history, the site-specific characteristics of its home range, landowner preferences, or other factors that cannot be reasonably predicted at this time. Management flexibility will be crucial in addressing all of the public interests that surround wolves.

Public Harvest Opportunities

Regulation History

In Montana, the goal of wolf management is to balance wolf numbers and distribution within the constraints of the biological, social, and political landscapes. “Management” implies that FWP actively engages in activities which assure long-term population welfare and reduce the potential for conflict or resolve conflict where and when it develops. Agency actions are selected from a spectrum of possibilities and are aimed at matching the appropriate management tools to the situation. “Management” is not synonymous with lethal control. On the contrary, wolf population management includes the full range of tools from non-lethal to lethal and incorporates other agency functions such as public outreach, conservation education, law enforcement, and landowner relations. Wolves do not exist in isolation from their environment, nor should an effective management program isolate wolves from their environment. Management actions are evaluated in light of prevailing conditions or extenuating circumstances. Wolf populations fluctuate as a result of management actions, natural mortality, legal harvest, illegal take, wolf productivity, and ungulate population fluctuations.

Over time, harvest rules, regulations, and hunting and trapping boundaries have changed based on wolf population status, sociopolitical tolerance, and direction from the commission and or the legislature. The 2007 Legislature created a wolf hunting license for residents and nonresidents (Senate Bill 372). The first season in 2009 had a quota of 75 distributed among 3 wolf management units. At the start of FWP’s regular wolf harvest season in 2011, a statewide wolf quota of 220 was established and partitioned into fourteen individual wolf management units (WMUs). From 2009–2012, season lengths were gradually extended. In 2012 and 2013, bag limits were increased to 3 and 5 wolves, respectively. A quota was retained in WMU 110 from 2012–2020. Quotas in WMU 313/316 (separation or consolidation differed by year, WMU 313 was established in 2013) persisted from 2012–2022, with no quotas in these WMUs in 2021. Since 2021, the number of wolf hunting licenses allowed for an individual and the number of wolves allowed to be legally harvested with one trapping license have both increased to 10 each, and scale of management transitioned from WMUs (except WMU 313, which has remained despite the transitions) to Trapping Districts to regions. Quotas may differ by regions and WMUs depending on wolf distribution, biological and sociopolitical environments, and or specific objectives. In the future, more specifically defined areas with associated quotas (i.e., zones with under-objective ungulate populations or WMUs around national parks) may be considered.

Since the congressional delisting of wolves in 2011 (and briefly in 2009), FWP has developed and implemented wolf harvest strategies that maintain a recovered and connected wolf population, reduce wolf-livestock conflicts, reduce wolf impacts on low or declining ungulate populations and ungulate hunting opportunities, and effectively communicates to all affected parties the relevance and credibility of the harvest while acknowledging the diversity of values among those parties. Wolf harvest (i.e., season dates, boundaries of units, bag limits, quotas, allowed tools and equipment) is currently reviewed annually due to public interest and its controversial nature, and while unlikely and not anticipated, this frequency may change. The legislature creates and adopts statutes that govern management of wildlife, and it is FWP’s responsibility to implement those statutes, regardless of the agency’s stance, data or science, and personal beliefs (*see* Appendix B). If, by chance, the legislature changes statutes or new statutes are added,

regarding gray wolf management, FWP is required to implement wolf management within the scope of those changes. Annual changes to the wolf harvest seasons and associated hunting and trapping regulations are established in the season-setting process under commission authority and described in the annual "Wolf, Furbearer, and Trapping - Montana FWP Trapping and Hunting Regulations" (https://fwp.mt.gov/hunt/regulations/wolf). If the USFWS relisted wolves under the ESA, the USFWS would become the ultimate authority on wolf management and public wolf harvest would likely cease.

Several changes to wolf harvest season resulted from the 2021 Montana Legislative Session. Specifically, the legislature mandated the commission to establish "hunting and trapping seasons for wolves with the intent to reduce the wolf population in this state to a *sustainable level*, but not less than the number of wolves necessary to support at least 15 breeding pairs." § 87-1-901, MCA. The purpose of the change was to increase individual harvest opportunity, balance ecological and sociopolitical needs and tolerance, and ensure the maintenance of a healthy wolf population in compliance with federal recovery mandates. Because the wolf population is considerably greater than the federal recovery threshold, there remains a great deal of flexibility to both reduce the wolf population and still maintain a sustainable population. Three sections of the MCA are of significance to recent changes in wolf harvest and season structure that provide the tools that may be used to achieve the population reduction. As a result of House Bill 225 (67th Montana Legislature), § 87-1-304, MCA, provides the commission with the authority to initiate a wolf trapping season that begins the first Monday after Thanksgiving and closes on March 15, while also providing the commission with the latitude to adjust the start of the trapping season for specific wolf management units based on regional recommendations. As a result of House Bill 224 and Senate Bill 314 (67th Montana Legislature), § 87-1-901, MCA, states that trapping seasons must allow for use of snares by holders of a trapping license, mandates the commission to reduce Montana's wolf population to a lower, sustainable level, but no lower than the number of wolves needed to maintain 15 breeding pairs, and provides the commission with the authority to apply different management techniques depending on conditions in each administrative region. Some of these techniques include allowing unlimited take of wolves on a single wolf hunting or trapping license, allowing use of bait while hunting or trapping wolves, and allowing hunting of wolves on private lands outside daylight hours with use of artificial light or night vision scopes. Section 87-6-214, MCA, as a result of Senate Bill 267 (67th Montana Legislature), allows for reimbursement of costs incurred related to the hunting or trapping of wolves for individuals licensed to hunt or trap wolves.

Since 2012, the average annual harvest by license year, while both hunting and trapping have been legal, is 256 wolves. Wolf harvest (Figure 10) and harvest rate (Figure 11) has been stable in recent years and has never exceed 30%. The number of active wolf hunters ranged from 7,457–15,570 and hunter days ranged from 85,882–228,181 (Figure 12). The number of active trappers ranged from 228–572, wolf trapper days ranged from 7,524–21,653, traps set ranged from 2,340–4,528 and trap days ranged from 59,062–174,135 (Figure 13). Legal harvest is the leading cause of mortality for wolves in Montana, followed by agency control efforts (*see* subsequent section). Other causes of mortality (e.g., § 87-1-901, MCA, [SB200] which allows private landowners to shoot threatening wolves, vehicle collisions, and illegal take) are negligible to minimal compared to wolf population size at present (Figure 14).

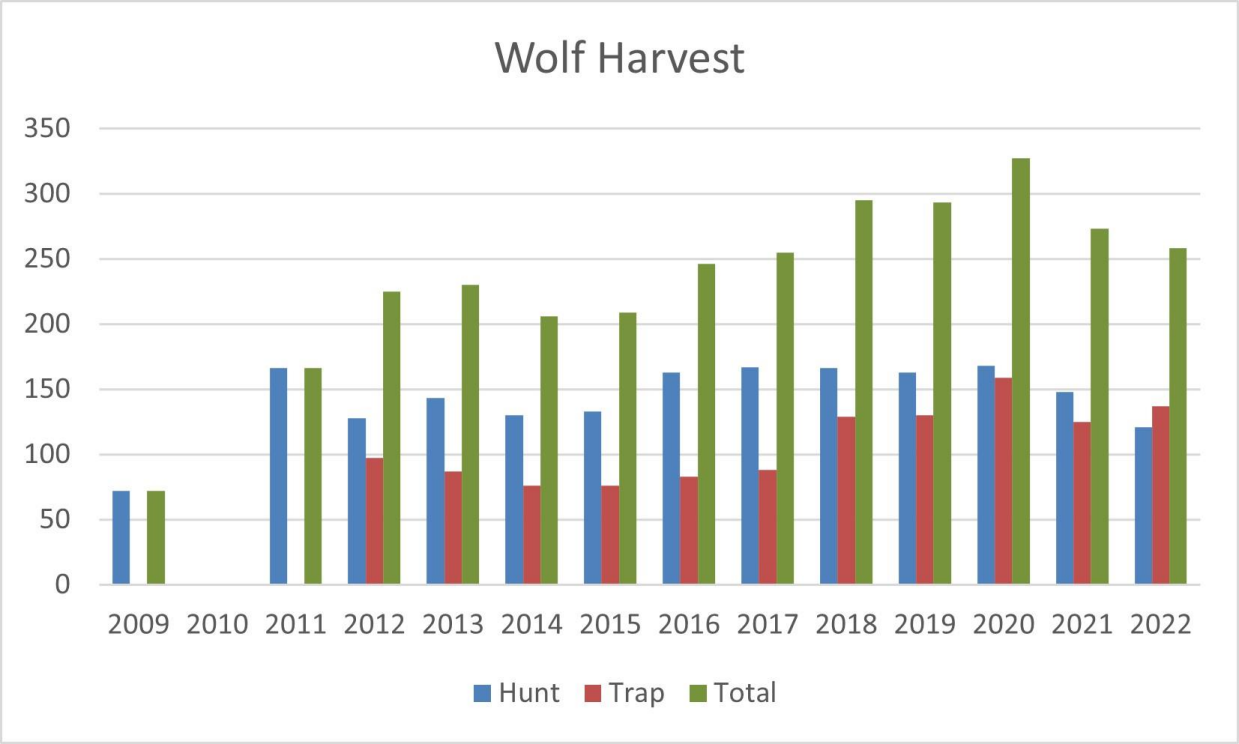

Figure 10. Number of wolves harvested in Montana by license year, separated by hunting and trapping, 2009–2022. Values drop to 0 in 2010 because wolves were briefly relisted on the ESA (Parks et al. 2023).

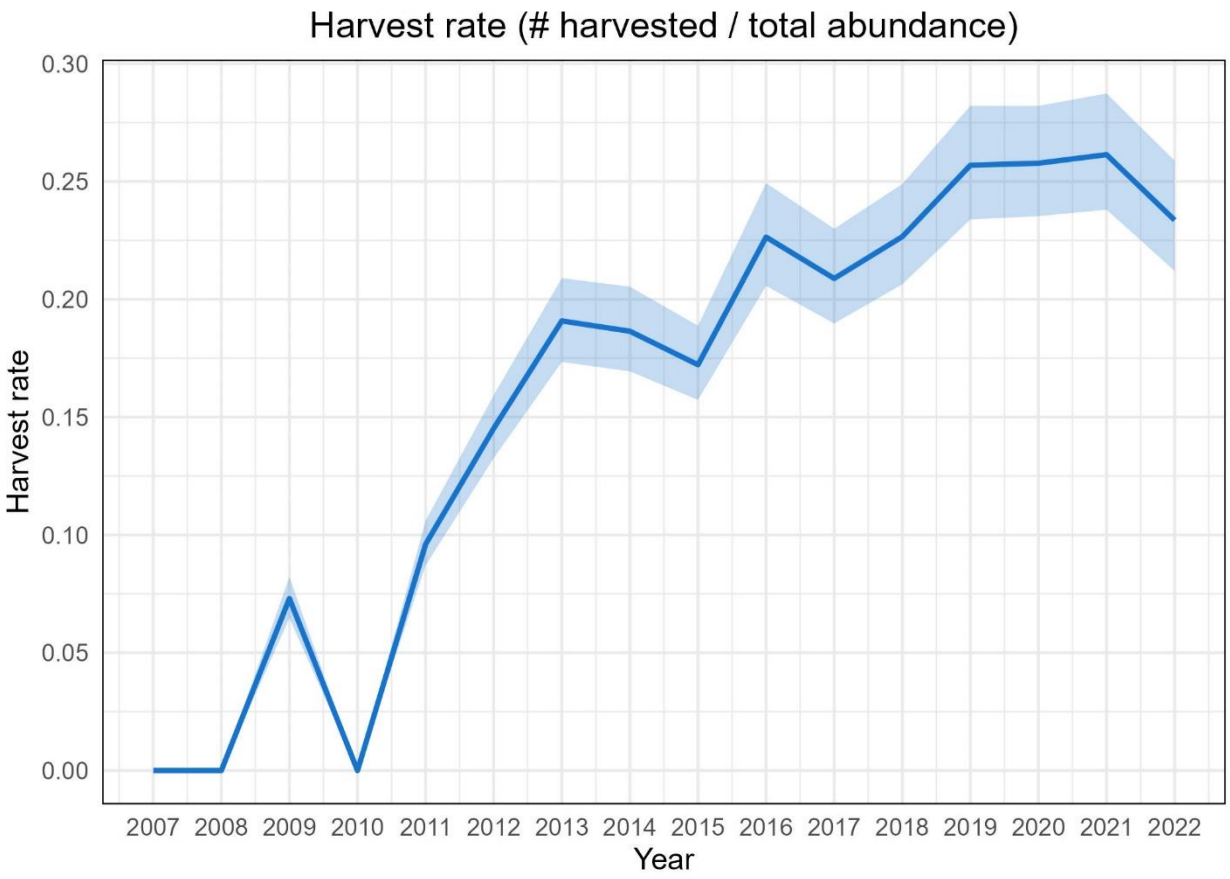

Figure 11. Harvest rate (number harvested / total abundance) of wolves in Montana by calendar year following the population estimate, 2007–2022 (Parks et al. 2023).

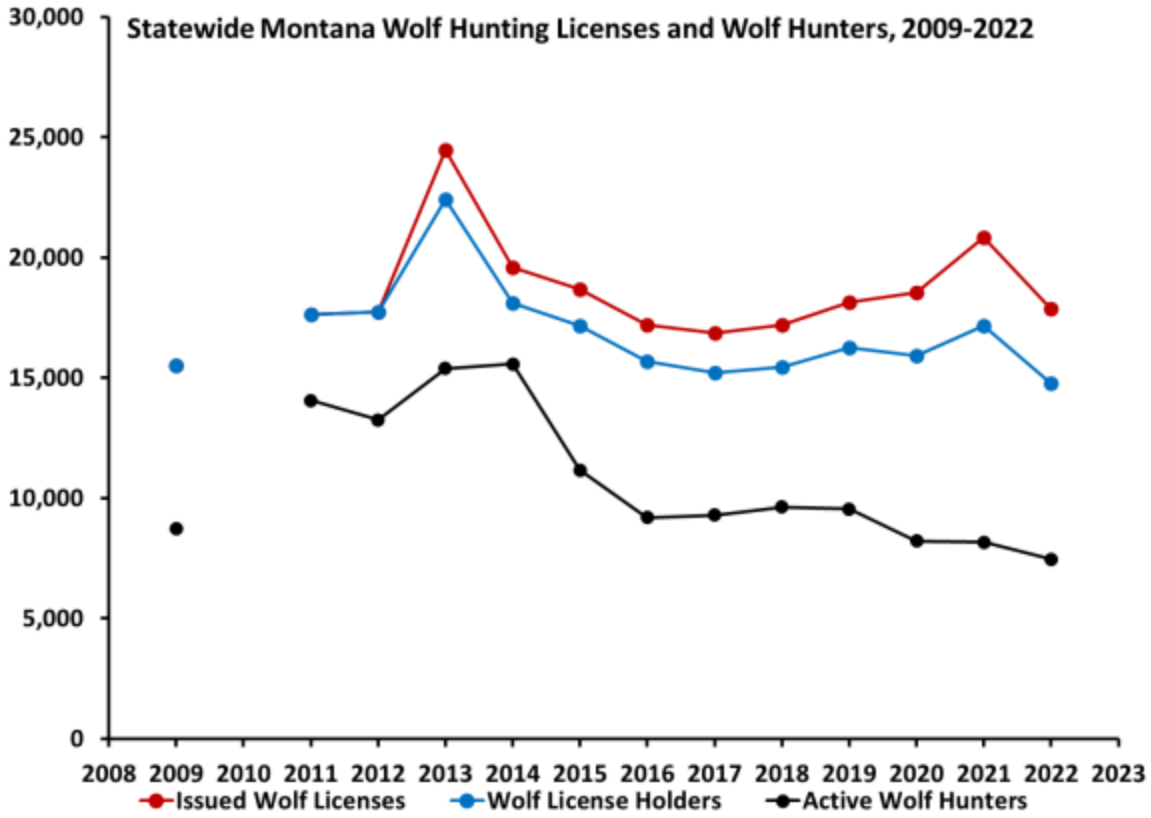

Figure 12. Number of wolf hunting licenses issued, number of hunters issued >= 1 wolf hunting license, and number of active wolf hunters estimated from Hunter Surveys in Montana, 2009–2022 (Parks et al. 2023).

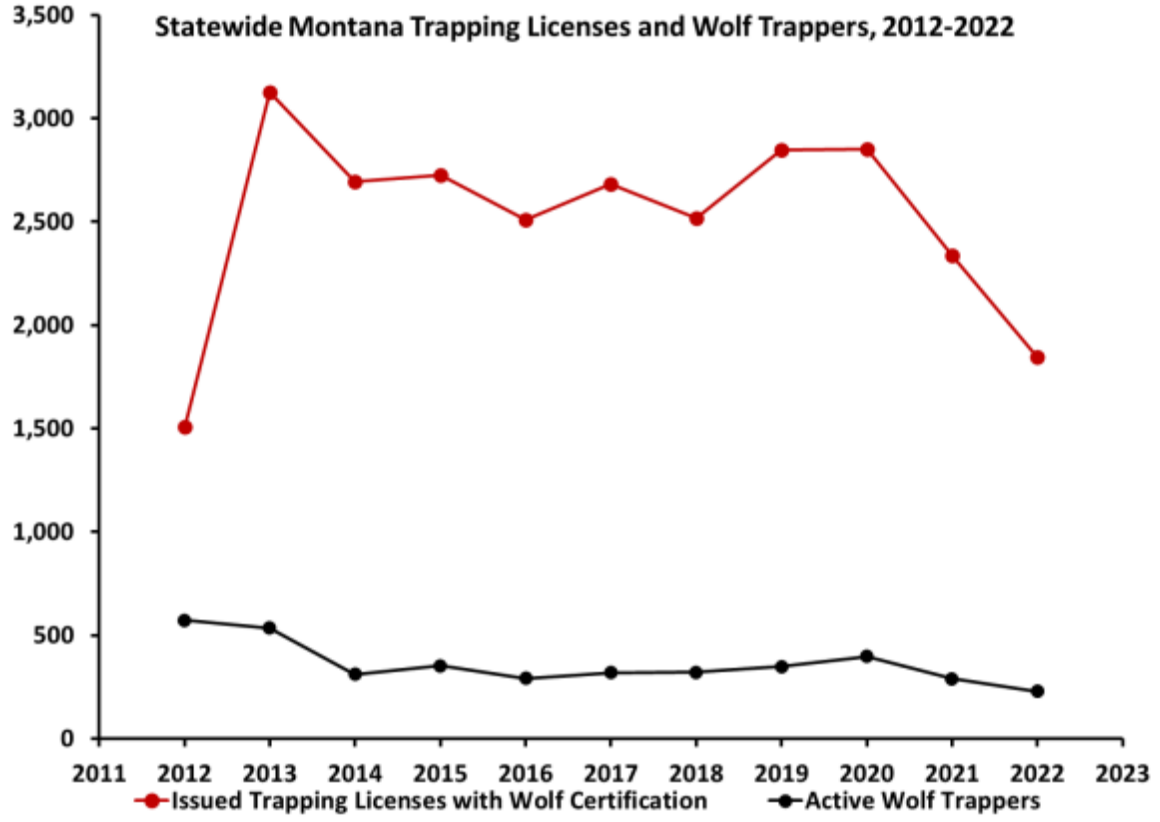

Figure 13. Number of trapping licenses issued to trappers with wolf trapping certification and number of active wolf trappers estimated from Harvest Surveys in Montana, 2012–2022 (Parks et al. 2023).

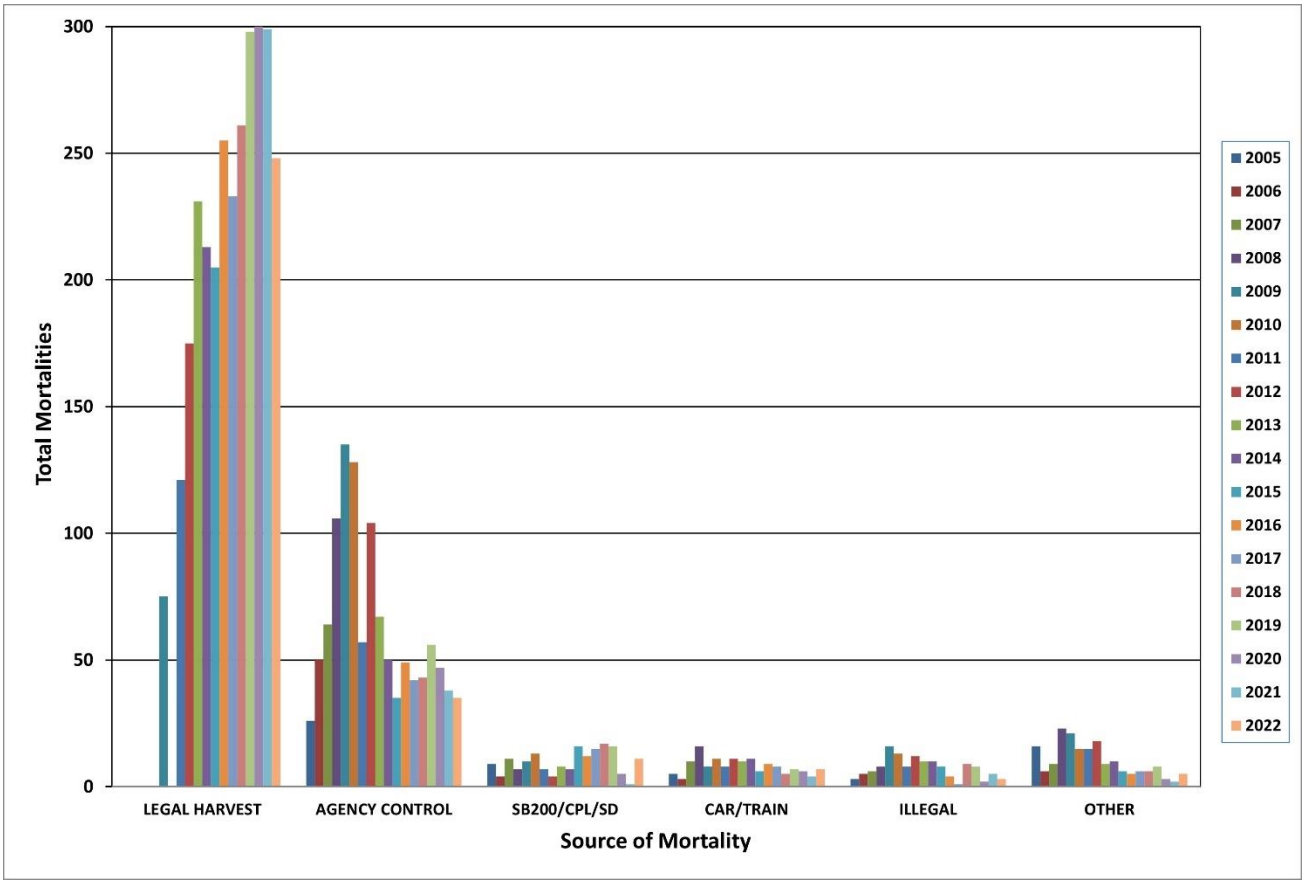

Figure 14. Documented wolf mortalities by cause by calendar year (2005–2022). The third category from the left refers to SB200, citizens protecting livestock, and self-defense (Parks et al. 2023).

From 2012–2017, FWP documented 349 incidental non-target captures, 55% of which survived. Only 10% of these non-target captures were in traps intended for wolves. Seventy-three percent of the incidental captures in wolf sets were released, and 27% died. Species that died or were euthanized included 2 bobcats, 1 deer, and 4 mountain lions. Species released from wolf traps included 1 deer, 1 elk, 8 domestic dogs, 1 grizzly bear, 1 lynx, and 7 mountain lions (Inman 2018). From 2018–2022, FWP documented 310 incidental non-target captures, 67% of which survived. Twenty-four percent of these non-target captures were in traps intended for wolves. Seventy-four percent of non-target captures in wolf sets were released and 26% died. Ninety percent of the non-target captures in wolf sets were in footholds and 10% were in snares. Species that died or were euthanized included 1 bobcat, 5 deer, and 10 mountain lions. Species released from wolf traps included 28 domestic dogs, 12 mountain lions, 4 moose, 3 deer, 3 wolverines, and 2 black bears (Kluge 2023). Incidentally captured dogs were either running at large or out of sight or command (i.e., beyond regulatory set-back distance of 50 ft. from road or trail).

Future Harvest Management

Harvest management will proceed flexibly, but all hunting and trapping would likely be restricted if the statewide wolf population approaches 15 breeding pairs or 450 wolves. As the wolf population fluctuates, FWP will continually assess population status and analyze and adjust harvest management

strategies. After wolf harvest seasons began in Montana, FWP determined the amount of human-caused mortality has not negatively influenced the probability a pack will contain a successful breeding pair, despite the lack of significance of the relationship which was likely influenced by the difficulty of identifying breeding pairs (Figure 15). However, if human-caused mortality reaches a level that significantly reduces the population size and the ability to maintain 15 breeding pairs or 450 individuals, the harvest strategy would be reevaluated. This plan is not prescriptive and does not specify more precise population targets beyond those levels set forth in § 87-1-901, MCA, which are subject to change via future legislation, nor at what point more conservative regulations will be enacted or more liberal regulations restricted. These decisions and the associated risk-tolerance are under the purview of the elected or appointed public trustees, including the FWP Director, the Governor, the commission, and the legislature. FWP season proposals will ultimately be decided on by the commission, including decisions about season types and the associated risk tolerance under delegated authority from the legislature, unless or until new laws passed by the legislature further define the parameters of commission decision making authority. All these decisions and processes will be informed by the latest science and information. However, the policy direction, regulations, and, ultimately, the wolf population are likely to fluctuate through time as elected and appointed trustees change. At their discretion, the commission may use FWP recommendations and wolf season options to guide harvest structure based on population trends.

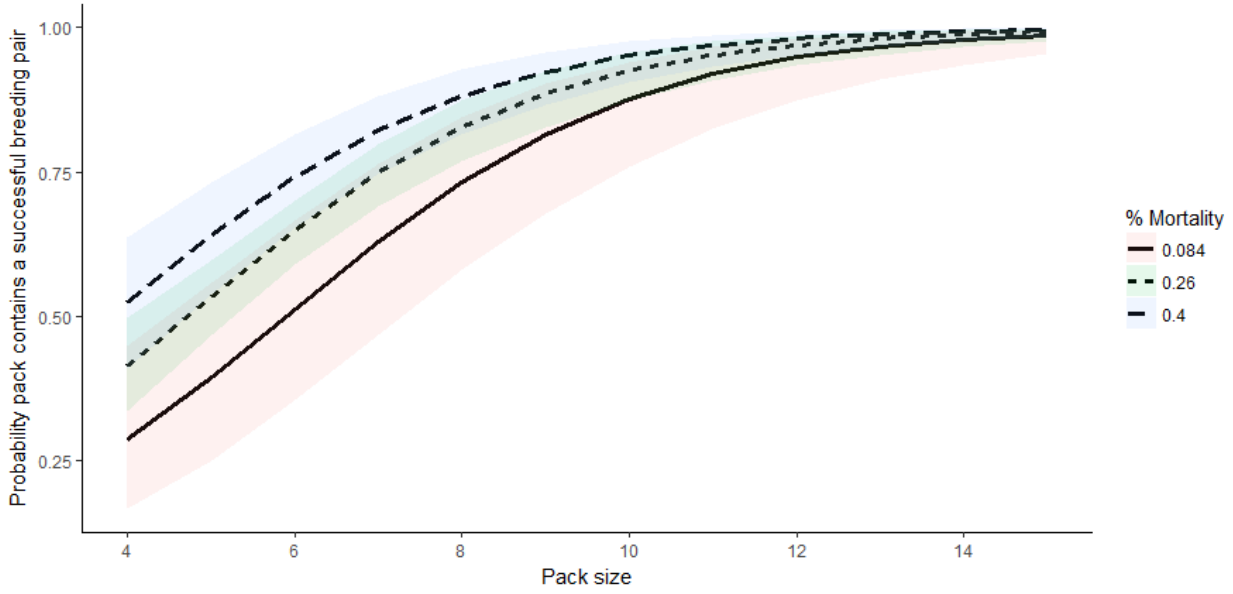

Figure 15. Probability a pack contains a successful breeding pair against pack size with the minimum, mean, and maximum % human-caused mortality at the population level and the average population growth rate for wolves in Montana during the delisted period (2009, 2011–2016; FWP 2018).

Strategies FWP will use to increase take opportunity with the goal of reducing wolf population abundance include, but are not limited to:

- Season extensions or timing of the season;
- Increase or removal of quotas;
- Increase in bag limits (i.e., number of wolf hunting and trapping licenses per individual);
- Implementation of additional equipment (e.g., electronic calls [House Bill 73 (63rd Montana Legislature)]); and
- Allowance of tools to facilitate harvest (e.g., bait, night-hunting).

Alternatively, other strategies to decrease wolf harvest may be used to alleviate sociopolitical concerns or to reduce additional stressors on the wolf population. Strategies FWP will use to decrease take opportunity with the goal of increasing wolf population abundance include, but are not limited to:

- Shortened seasons or timing of the season;
- Decrease of quotas;
- Decrease in bag limits;
- Restrictions on use of certain equipment;
- Limits on methods of take; and
- Mitigate for public safety concerns (e.g., setback distances) or take of recovering species (e.g., foothold sizes or floating season dates).

Quotas are established to provide harvest opportunity with an upper limit on harvest allowed and designed with historical harvest rates and population numbers in mind. More specifically, wolf quotas prevent overharvesting the population, which would thereby threaten viability and longevity, to the point where management authority of the state is jeopardized. Similarly, regions and WMU boundaries may be modified (i.e., by ecoregion, geography, or based on pack distributions), or a permit system (i.e., lottery) may be developed to further restrict wolf harvest and more appropriately manage the wolf population based on biological and sociopolitical contexts. After considering population densities, recruitment estimates, and total harvest each year, change in estimated population size has never exceeded ±15% from the previous year. Established wolf populations can withstand human-caused mortality rates ranging from 15–48% of the mid-winter population (Keith 1983, Fuller 1989, Fuller et al. 2003, Adams et al. 2010, Creel and Rotella 2010, Gude et al. 2012). Through modeling exercises, FWP has estimated that a reduction in population growth rate and abundances will occur when harvest is >25–30% of the previous year population estimate (Figure 16; Messmer 2021 and Godar et al. 2023). If a statewide quota of 450–700 individuals is consistently harvested over a 5-year period, and human-caused mortality levels remained stable on a declining wolf population, the wolf population size would approach levels that could not support 15 breeding pairs and the possibility of extirpation is present (Figure 17; Messmer 2021 and Godar et al. 2023). These scenarios do not represent harvest prescriptions or predictions of what the future harvest will be; rather they are intended to represent the possible consequences of varying levels of sustained harvest and increases that may result from more liberal regulations enacted by the commission. If any of the elevated human-caused mortality levels could be achieved, harvest levels would likely need to be reduced after 1-3 years to prevent the population from decreasing below the level needed to support 15 breeding pairs, as set in state and federal law. As a result, if liberalized harvest is determined to pose a risk to long-term population persistence, then FWP's recommendation to the commission will be a shift to be more conservative. Liberal harvest is meant to reduce population size and restrictive harvest is intended to maintain or increase population size, however these efforts may not have the intended results. FWP

recommendations for harvest strategies are based on wolf population estimates, trends, as well as hunter and trapper success rates. Harvest regulations are decided and adopted as laws by the commission. The commission has discretion and ultimate decision-making authority.

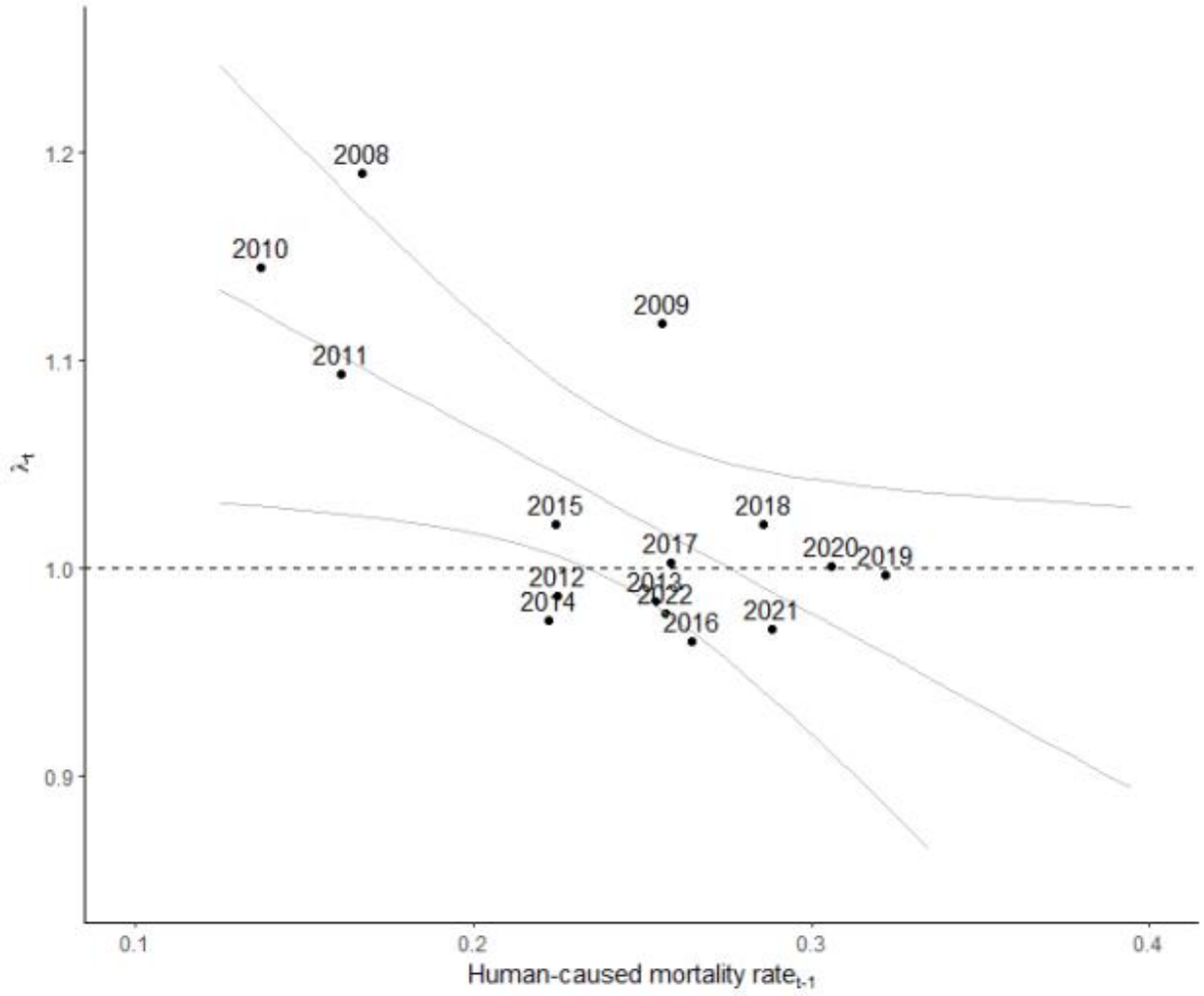

Figure 16. Estimated linear relationship and 90% credible intervals (grey lines) between annual population growth rate ($\boldsymbol{\lambda_t}$) and human-caused mortality rate (human-caused mortalities$_t$ / iPOM wolves$_{t-1}$). The human-caused mortality rate resulting in an expected stable population (λ= 1) is about 27.5% (Godar et al. 2023).

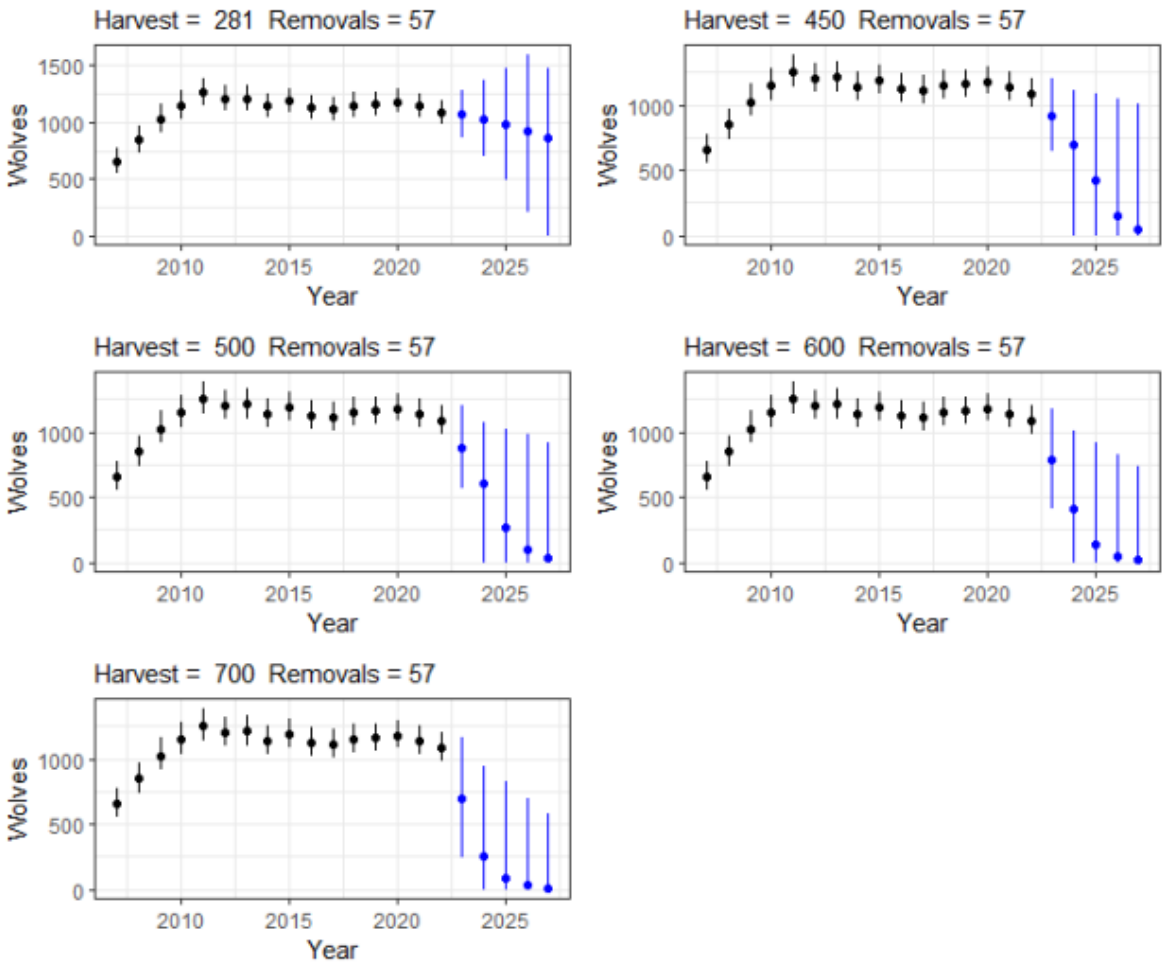

Figure 17. Wolf population model predictions under FWP commission requested human-caused harvest and removal scenarios. The 'Harvest=281" scenario represents the recent 5-year mean hunting and trapping harvest from 2018-2022. Black points and error bars are iPOM estimates with 95% credible intervals; blue points and error bars are simulation results for future years with 90% prediction intervals. Panel titles reflect the human-caused mortality scenario each year into the future (Godar et al. 2023).

Additional mechanisms may be used to regulate take and minimize incidental captures. This includes rigorous tracking of harvest in each region and WMU through mandatory harvest reporting and a 24-hour closure notice process. If wolf harvest exceeds a designated quota, the region or WMU is closed for the season. The commission also adopted a set of regulatory components to reduce human safety concerns, reduce risk of overharvest, and reduce probability for take of federally protected lynx and grizzly bears. These mechanisms have been put in place to ensure harvest does not exceed acceptable limits and that there is no risk to the wolf population that would place it in need of ESA recovery, or to other species as a result of the wolf regulations. Similarly, wolf regulations should not impact other federally listed species or the ability to delist or keep delisted those species. For example, the commission restricted wolf trapping in occupied grizzly bear habitat by adopting a floating open season date. Wolf trapping in occupied grizzly habitat will open December 31st unless otherwise determined by FWP due to evidence the majority of grizzly bears in these areas have begun hibernation, as a means to avoid incidental take (i.e., floating season start date). Under current Commission adopted regulations, non-target capture of a single grizzly

bear or lynx would initiate a commission review of the current harvest structure with potential for rapid in-season adjustments to hunting and trapping regulations. Additionally, the commission can adjust seasons annually, regionally, and on short notice to address harvest rate and population trajectory or concerns to species like lynx or grizzly bears.

Harvest regulations are presented as formal recommendations, and FWP solicits public comment on such proposals (*see* Part VIII). Following public comment, a final recommendation is forwarded to the commission for their consideration. Through annual commission oversight and public input, hunting and trapping take place under designated seasons and regulations which describe legal means of take, license requirements, and reporting and tagging requirements. This process is similar to that of all other game or furbearing species. Regulated hunting and trapping of wolves will take place within the larger context of multi-species management programs, rather than the context of single species management. Specific harvest objectives depend on regional densities, distributions, trends, and sociopolitical environment. Wolves could be promoted (on remote public lands) or discouraged (in areas with high livestock densities) depending on harvest objectives, district boundaries, and pack distribution. Harvest of wolves is not permitted in National Parks. Tribal government maintain wildlife management authority on their respective Native American Reservation. Some tribal governments implement a wolf season.

The FWP Law Enforcement Division enforces harvest regulations and rules, along with other Montana statutes related to wildlife and human safety. FWP enforcement personnel coordinate with federal, state, local, and or tribal authorities as necessary. Game wardens will proceed similar to other managed game and furbearing species, with penalties for violations and restitution values established in Montana statute. Wanton waste rules (§ 87-6-205, MCA) do not apply to wolves; however, if a hunter or trapper wants to retain possession of the hide or skull, it must be presented to FWP within 10 days after harvest for the purpose of tagging the hide prior to transfer of possession (§ 87-6-411, MCA). If any part of the animal moves across state lines, a Convention on International Trade in Endangered Species (CITES) tag is required (and often required by taxidermists and tanneries; 50 CFR 23.69(b)(3)). The US Dept. of Interior and the USFWS have found that the State of Montana has specific measures to control wolf harvest, and the export of wolves legally taken during harvest seasons will not be detrimental to the survival of the species (FWS/DMA/CEP 1-07). FWP has a 1-800-telephone hotline (TIP-MONT) to receive anonymous reports of observed or suspected violations of laws. This is an important tool for game wardens to receive information and respond to public requests for assistance or of concern, including possible illegal activity concerning wolves. After an investigation, violations of the statutes, rules, or regulations are prosecuted in cooperation with the county or district attorney for state or federal cases, respectively. In cooperation with the Courts of Limited Jurisdiction, penalties and restitution are established for unlawful takings and rule violations. Montana's penalties are commensurate with other wildlife species to discourage criminal activity, particularly repeat offenses. Game wardens and or biologists work with landowners to address their concerns, handling or referring livestock damage calls, responding to wolf sightings and perceived threats to public safety, addressing hunter concerns and complaints associated with wolves, and responding to reports of injured or road-killed wolves.

Possessing parts of animals that died illegally or of unnatural causes (including those from conflict-based, protection of property, or self-defense events) is not permitted. The entire carcass of wolves killed by private individuals in defense of life or property will be returned to FWP and remain state property, regardless of whether the incident occurred on public or private lands. Upon confiscation, carcasses

resulting from illegal killings also remain the property of FWP. If the hide, bones, and or skull are in good condition, they can be salvaged and used for research, tribal cultural use, and educational purposes. These specimens may be transferred to other government agencies, non-profit organizations, tribal authorities, or educational institutions for general public benefit. Parts unsuitable for these uses are destroyed.

Other Considerations

Travel and Access Management

Wolves do not demonstrate any particular behavioral aversion to roads. In fact, wolves may show an affinity for roads in less-populated areas because of the ease of travel they provide in heavily-forested or steep terrain (Sells et al. 2021). The responsibility for managing human access and travel on public lands resides with the administering land management agency, whether state or federal. Human access can be managed by time period (e.g., seasonal closures) or by localized area restrictions. Outside of Yellowstone and Glacier National Park, most federal lands used by wolves are administered by USFS while most state lands are administered by the Department of Natural Resources and Conservation (DNRC). The USFS and DNRC manage access and motorized travel to meet management objectives and legal requirements. The National Park Service heavily restricts motorized travel, while foot and horse travel is permitted most places. In some circumstances, even foot travel is seasonally restricted in areas of concentrated wildlife activity. FWP closes most of its Wildlife Management Areas (WMAs) to public access during the winter to prevent disturbance to wintering ungulates. Whereas, FWP consults with land management agencies about access and travel management, FWP has no legal authority to implement access or travel restrictions on land it does not own. Presently, there are no restrictions on road use or road-density on any federal lands due to the presence of wolves. Although increased road use by wolves is positively associated with human-caused wolf mortality (Boyd-Heger 1997), FWP does not anticipate a need to suggest amendments to federal or state travel plans because of wolf activity. FWP encourages land management agencies to continue their assessments of habitat security for all wildlife species. Changes in this policy do not appear necessary. Land-use or travel restrictions are not necessary for private lands, either.

Den and Rendezvous Sites

Wolves respond differently to human disturbance, but there is no evidence that human disturbance directly influences pup survival. National Forest land managers in Montana have not instituted area closures or travel restrictions specifically because of localized wolf activity. However, the USFS may request information from FWP on sensitive areas for wolves when they are planning silviculture and logging practices (e.g., restriction of dates that correspond to denning). Human recreational use of these lands is often of a dispersed, sporadic nature. Area closures around den or rendezvous sites in national parks are sometimes instituted because of high visitation numbers and the strong public desire to view wolves. FWP is not recommending any localized closures near wolf den or rendezvous sites on public lands outside national parks as they do not appear necessary. However, FWP encourages land management agencies to consider the locations of wolf den and rendezvous sites in their future planning activities as they would for ungulate winter range or bald eagle nests. Ultimately, land management agencies may adopt seasonal or area restrictions independently from FWP.

Captive Wolves and Wolf-Dog Hybrids

Hybrids result from the breeding of wolves with domestic dogs (*C. l. familiaris*), resulting in variable combinations of physical traits and behaviors. Much of the normal predatory behaviors of wild wolves disappeared in domestic dogs. But the predatory instincts are still present to an unknown and unpredictable degree in wolf-dog hybrids. The potential for genetic pollution of wild populations, human safety, and erosion of public acceptance for wild wolves are commonly cited problems with private ownership of captive or hybrid wolves. There is no genetic or other evidence that captive wolves, wolf-dog hybrids, domestic dogs, or coyotes interbreed with native wolves in the NRM. It is unlikely that a released captive or hybrid wolf would survive long enough to reproduce with wild wolves. Released captives and hybrids will typically associate with humans and loiter near human settlements, or become problematic animals and be euthanized. FWP is concerned about the potential for captive wolves or wolf-dog hybrids to compromise human safety if they are released or escape from their owners. The animal's large size, lack of fear, and unpredictable behavior make it especially problematic. Negative experiences with rogue captives or hybrids can taint future public opinions about wild wolves and undermine tolerance for wild, free roaming wolves that normally fear humans.

It is legal to possess captive wolves and wolf-dog hybrids in Montana. Citizens may keep them as personal pets without a permit. Citizens wishing to publicly display captives or wolfdog hybrids to attract business must have a permit from FWP. Montana statutes (§ 87-1-232 to 87-1-234, 87-6-701, MCA) and administrative rules (Administrative Rules of Montana [ARM] 12.6.1901-05) require the permanent tattooing of any wolf held in captivity, where "wolf" means a member of the species *Canis lupus*, including any canine hybrid which is one-half or more (>50%) wolf. FWP Enforcement Division maintains the database of tattooed captive wolves and wolf-dog hybrids. The take of wolves from the wild into legal ownership is illegal unless a scientific collectors permit is obtained. When wolves are trapped by license holders, they must be immediately dispatched. At this time, FWP does not seek to further regulate the ownership of captive wolves or wolfdog hybrids. However, the State of Montana may seek statutory authority to do so in the future in the interest of public safety. Owners are responsible for compensation and damages to personal property caused by any wolf that is held in captivity or that escapes from captivity. WS, local animal control, sheriff's county officers, or other law enforcement officers will respond to incidents of free-ranging captive wolves or wolf-dog hybrids, or pet-related issues. FWP may also respond depending on the particular situation. If these animals loiter near people, their homes, or compromise public safety, they will be lethally removed. Incidents involving human injury will be treated as if the animal were wild and non-vaccinated. Free-roaming captives or hybrids captured at livestock depredation sites will be euthanized if attempts to locate the owner are unsuccessful.

FWP Staff and Locations

As currently, FWP wolf specialists are and will continue to be strategically located around the state. Additional positions may be created based on expanding populations and if increasing densities present the need for additional conflict prevention or management. Area and regional biologists as well as technicians and seasonal staff will continue to assist the wolf program as necessary. Upper-level management coordinates those within the wolf program to ensure efficiency and efficacy. FWP personnel have and will continue to regularly communicate with private landowners, livestock producers, and members of the public regarding wolf populations and distributions of packs.

FWP allocates wolf license dollars toward collaring wolf packs in livestock areas (§ 87-1-623, MCA). The purpose of these efforts is to be able to more readily understand which wolf pack may have been involved in a livestock depredation and so that WS can be more efficient and effective at controlling packs that depredate on livestock. Radio-collars also provide spatiotemporal data on wolf individuals and packs (e.g., territory size, seasonal space use or resource selection, assist with visual verification of breeding pairs or pack size) that may help inform iPOM. Wolf specialists and technicians capture wolves and deploy radio-collars during winter helicopter capture efforts and spring through fall trapping efforts. These include intended captures (with radio-collaring wolves as the primary objective) and incidental captures (opportunistic radio-collaring of wolves during other FWP efforts). Wolf specialists also deploy camera traps across the landscape to understand wolf occupancy and distributions, as well as to supplement iPOM.

When wolves are handled in any capacity by FWP personnel (live-capture and radio-collaring to harvested check-ins), age-class and sex is recorded and biological samples (e.g., hair, tissue, blood) may be collected. Not only will this allow for health and disease surveillance, but also genetic monitoring (*see* Part I). Genetic connectivity implies that wolves are functionally connected through emigration and immigration events followed by successful breeding, resulting in the exchange of genetic material between subpopulations. During live capture operations, overall wolf health is assessed, including presence of external parasites. Blood tests can indicate exposure to canine parvovirus, distemper, and other potentially detrimental diseases. Necropsies may be performed on wolf carcasses to determine cause of death, condition, age, reproductive status, and food habits. With recent expansion of Highly Pathogenic Avian Influenza (HPAI) in not only avian species but carnivores as well, sample collection and testing for wolves will be conducted as needed. Carcasses and biological samples are submitted to the FWP Wildlife Health Program in Bozeman. If warranted, biological samples may be forwarded to other laboratories for any specialized testing or forensic investigations. Over the last 20 years, baseline mortality data has been compiled. Therefore, the need for routine necropsies has diminished and the submission of carcasses has been reduced to special forensics or disease-related cases. FWP will continue informal consultation and cooperation with external wolf researchers and managers. Currently, FWP does not have concerns regarding wolf health, disease, and genetics, yet surveillance will continue to be routine.

Part IV: Wolf-Livestock Conflicts

Addressing wolf-livestock conflicts entails two separate, but parallel elements; management and compensation. Management activities are primarily conducted by state and federal agencies working in tandem with landowners and livestock producers and aim to reduce the potential for wolf-livestock conflicts and to resolve the conflicts where and when they develop. Examples include providing technical assistance to producers, investigating complaints, and implementing conflict prevention measures (lethal and non-lethal strategies) that reduce the probability of a new or chronic depredation incident. These management programs are funded, administered, and implemented by FWP and WS, though many non-governmental organizations (NGOs) also have programs and work closely with landowners to prevent wolf-livestock conflict. The second element, compensation, addresses the economic losses when livestock are killed or

injured by wolves or assist in funding prevention measures. This element is funded, administered, and implemented by the Montana Livestock Loss Board. Program funding for the Livestock Loss Reduction and Mitigation Program is primarily from appropriations made by the Montana legislature (§ 17-2-102, MCA). These two elements (management and compensation), are funded, administered, and implemented separately and independently of one another, although parallel and united in the goal of maintaining a viable wolf population and addressing wolf-livestock conflicts.

Conflict Prevention: Non-Lethal Methods

History of Non-lethal Methods

In Montana, wolves routinely encounter livestock on both private and public land, but most depredations occur on private land (83% in 2005–2015; DeCesare et al. 2018). Wolves are opportunistic predators, most often seeking wild prey. However, some individual wolves and packs learn to prey on livestock which can be difficult to stop if the whole pack is involved (Harper et al. 2005). Once a pack has learned to kill livestock, the probability of depredation recurrence is high without intervention (Bradley et al. 2015). Because livestock depredation is a learned behavior, preventive methods may be most effective when employed proactively before a depredation occurs. Wolf depredations on private land are more likely to occur where natural prey is present, if pastures are larger in size, if there is a greater abundance of cattle, and if cattle graze farther from human-developed areas (Mech et al. 2000, Bradley and Pletscher 2010). To address wolf-livestock conflicts, FWP uses an integrated program of non-lethal and lethal conflict management tools (Bangs et al. 2006, Gese et al. 2021), and actively partners on non-lethal proactive conflict mitigation projects across the state (Wilson et al. 2017). For wolves, harvest and lethal removal following conflicts are important management tools, although neither are enough to completely resolve or prevent future conflicts (Bradley et al. 2015, DeCesare et al. 2018). The intent of non-lethal methods is to prevent or resolve a wolf conflict without killing the wolf or wolves in question but may sometimes be used in conjunction with lethal methods. There are a variety of non-lethal tools and many have proven successful in certain contexts (Moreira-Arce et al. 2018, Bruns et al. 2020), such as when applied conditionally (e.g., based on terrain, proximity to den or rendezvous sites, avoiding overexposure to techniques that would result in habituation; Stone et al. 2017). In Montana, as of 2015, the percentage of livestock operations using non-lethal methods to control predators was 14.5% (USDA 2015). Strategies to mitigate wolf-livestock conflicts include:

- Carcass pickup and composting programs–removing attractants from wintering and birthing pastures or near water and bedding areas in open pastures. Physical removal or composting can be difficult due to terrain or carcass conditions . These measures must also comply with other land-use policies (e.g., USFS and Department of Agriculture regulation) and may not be allowed in certain situations. This strategy prevents wolves from getting accustomed to easily attained food.
- Penning and fencing livestock–keeping livestock in proximity to human structures and best used for small pastures, small herds, or when stock is gathered in a reasonably protected area.
- Fladry–flagging (can be electrified) on fencing as a visual deterrent (Musiani et al. 2003, Davidson-Nelson and Gehring 2010). Best used as mobile protection on a short-term basis for effective use as it requires regular maintenance and wolves may become habituated.

- Livestock guard dogs to accompany and protect livestock (Gehring et al. 2010, Urbigkit and Urbigkit 2010, Kinka et al. 2021). This strategy depends on the level of wolf activity in the area, size of grazing area, and behavioral characteristics of the dogs. Some guarding breeds used in the United States were selected decades ago to protect livestock from coyote predation and may not be as successful at protecting livestock from wolves. Other aggressive breeds of animals (e.g., donkeys, llamas) may help protect against wolves but should be considered experimental. Livestock guard dogs may be at risk of injury or death as they are viewed as a threat to wolves, and may not be effective at repelling wolves away. Thereby, this strategy is most effective in combination with increased human presence.
- Range rider programs involve regular and planned patrol and monitoring of livestock and surrounding landscapes to document and or deter wolf activity to minimize wolf-livestock interactions (Parks and Messmer 2016, Wilson et al. 2017). This is most effective when wolves are most active (dusk to dawn), during a birthing pulse, and when range riders are equipped with hazing tools. Similarly, herders can be employed for sheep operations. In general, this increased human presence requires flexibility, a significant amount of time, and depending on the size and distribution of the livestock operation(s), several personnel.
- Use of light and sound devices as visual and auditory deterrents–best used in small pastures and requires frequent position changes for effective use as wolves may become habituated.
- Hazing–can be non-injurious (e.g., firing blanks from a gun) or non-lethal injurious (e.g., pursuit, rubber bullets, paintball gun, bear spray) harassment.
- Husbandry changes to avoid wolf-livestock interactions and reduce vulnerability. This includes use of alternative grazing routes or fields, night feeding to encourage congregation, calving season changes (i.e., earlier so that young are larger when moved to open pastures) and control (i.e., managing the herd to calve in the same short period of time), changing herd structure (i.e., adults with young) and timing of rotation into forested areas (i.e., after the birthing pulse of wild ungulates). Livestock handling is stressful to the animals, and may lead to poor animal health, less efficient movement, and creates noise, thereby perhaps providing an attractant to wolves.
- Other experimental practices such as bio-fencing, belling cattle, using wolf-savvy cattle, may be effective non-lethal strategies, but their outcomes are still not yet known.

Future Non-lethal Conflict Prevention

FWP will work cooperatively with livestock producers, NGOs, and WS to reduce risk of wolf-livestock conflicts by implementing these tools when deemed appropriate. FWP will actively engage by sharing information, technical expertise, equipment, materials, and hands-on field assistance. Furthermore, FWP will continue to collaborate on research designed to improve our understanding of current and developing proactive non-lethal tools. With increasing need for funding and technical assistance to make proactive conflict prevention tools available to livestock producers, FWP will encourage coordination of all stakeholders striving to reduce wolf-livestock conflicts and support working lands and wildlife.

Individual livestock producers are encouraged to take voluntary measures to reduce the potential for wolf-livestock conflict. Examples include reducing conflict availability by altering turnout dates, type of livestock, or the timing of breeding and calving cycles. If problems are chronic, a livestock producer might have the option to move or receive payment from a private organization for retiring a public grazing

allotment, with agreement from the land management agency. Federal land management agencies do not have administrative or budgetary procedures to pay a producer to retire an allotment. Such funds must be secured from other sources. However, the federal land management agencies do have administrative flexibility to address chronic wolf-livestock conflicts by working with individual producers or grazing cooperatives to modify grazing practices to the mutual agreement and benefit of all interests. Producers should also be rewarded for their willingness to cooperate in experimental protocols testing non-lethal management tools, such as scaring devices or noise-makers. Because wolves learn quickly and may habituate to certain management tools, no single non-lethal technique will work in all situations or for extended periods of time. The National Wildlife Research Center (the research arm of WS), in conjunction with other partners, has been actively developing and field-testing methods to discourage wolves from approaching livestock.

More research evaluating the effectiveness of non-lethal tools for carnivore-livestock conflict is warranted (Kinka et al. 2021). As part of a Conservation Innovation Grant (CIG), awarded to Heart of the Rockies Initiative and carried out by non-FWP project staff referred to as the Conflict on Workings Lands CIG Team, research pertaining to conflict prevention strategies has been initiated. The objective of this research is to address key questions to provide the Natural Resources Conservation Service (NRCS) with information to add or modify existing "Conservation Practices" that would provide cost-sharing opportunities to ranchers to fund non-lethal strategies that reduce conflict. Specifically, this research will determine the effectiveness of three non-lethal tools with the most potential and greatest need for further testing; range riding, carcass management, and fencing. The intent with this research is to assist livestock producers in finding more effective ways for living with large carnivores and to do so by integrating ranchers into the research process (i.e., study design and implementation). This project is part of an initiative involving 7 western states and 11 landowner collaboratives representing more than 600 producers with the purpose of developing recommendations for NRCS and landowners to create templates and potential for long-term funding to support these preventative methods via the Farm Bill. Not only will this highly collaborative effort harbor a strong partnership in applied research and adaptive management with FWP, WS, and several NGOs and universities, but it will also increase the probability of finding solutions for proactive techniques that add value to agricultural operations and improve habitat for wide ranging species like grizzly bears and wolves. FWP will continue to conduct research and partner with external researchers to develop and evaluate methods for wolf-livestock conflict prevention.

Non-lethal management strategies are actively promoted to prevent conflict (Bangs et al. 2006), but over time or in certain situations, lethal measures may be necessary. FWP will consider non-lethal management techniques if the wolf population is declining and approaching 15 breeding pairs or 450 wolves. However, even when livestock producers regularly use non-lethal strategies, they are not always enough to effectively prevent all conflicts. All management strategies (lethal and non-lethal) employed require time, financial, and personnel costs to the livestock producer as well as to state and federal agencies. The use of some non-lethal strategies to prevent predator conflicts (from equipment to increased human-hours) are about 10 times more costly than lethal strategies (USDA 2015). As a result, livestock producers may employ certain non-lethal preventative strategies (e.g., modified husbandry practices) but not others (e.g., range riders) because it is simply too expensive.

Citizens that encounter a wolf should rely on non-lethal harassment, however citizens can always kill a wolf in self-defense. § 87-1-901, MCA, does "allow a landowner or the landowner's agent to take a

wolf on the landowner's property at any time without the purchase of a Class E-1 or Class E-2 wolf license when the wolf is a potential threat to human safety, livestock, or dogs." If a wolf is killed in defense of life or property, citizens should protect the scene and carcass from disturbance and report it to FWP as soon as possible, but within 72 hours. FWP or WS will conduct a field investigation. Anytime a wolf is killed in defense of life or property, the entire carcass must be returned to FWP.

Depredation

History of Wolf-livestock Conflict

Directed wolf removal can be an effective tool to reduce wolf-livestock conflicts, particularly when compared to no action (Harper et al. 2010). Rapid response time and larger numbers of wolves removed reduces the occurrence of subsequent livestock depredations (Bradley et al. 2015) and reduces risk to neighboring livestock in the same area (DeCesare et al. 2018). FWP does not translocate wolves to reduce wolf-livestock conflicts. The USFWS translocated wolves away from depredation sites in the 1990s when wolves were first recovering but translocated wolves in Montana had poor success at reestablishing and surviving, and often continued depredating (Bradley et al. 2005). In addition, now that wolf populations are recovered, there are no longer suitable release sites where other wolves do not exist. Wolf depredations on private land are more likely to occur where natural prey is present, if pastures are larger in size, if there is a greater abundance of cattle, and if cattle graze farther from human-developed areas (Mech et al. 2000, Bradley and Pletscher 2010). Wolf depredations in Montana tend to recur in the same areas through time, and these areas tend to have higher densities of wolves and livestock (DeCesare et al. 2018). The type of livestock (i.e., breeds), their inherent behaviors (e.g., grouping), and how livestock producers respond (i.e., reading their behaviors when on range) may lead to lower risk of depredation threats for certain herds. Additionally, a neighbor's land, wildlife, and livestock management strategies may influence what occurs to another's livestock herd and the most effective resolution options available to them. Financial losses may result directly from wolf depredation. Indirect costs may accumulate because of increased management activities or changes to agricultural operations.

The vast majority of livestock losses are non-predator related. In Montana, in 2015, non-predator causes accounted for 96% of all adult cattle deaths and 90% of all calf deaths (USDA 2015). Losses due to wolves may be disproportionate to one or a few livestock producers because of where a wolf pack territory is established relative to livestock distribution, type of stock, and or grazing practices such as turnout dates. Most cattle depredations occur during the spring or fall months while sheep depredations occur more sporadically throughout the year. Missing livestock cannot be confirmed as wolf depredations, and the cause of death for livestock can be difficult to determine. Even with a carcass, cause of death may still be inconclusive if scavengers have destroyed the evidence, two or more carnivore species capable of killing livestock visited the site, or the carcass was completely consumed. In addition to livestock mortalities, producers have reported injured and stressed livestock, reduced weight gains, decreased pregnancy rates, and other complications when wolves are present. Questions about unconfirmed losses, best livestock management practices, or indirect effects of wolves on livestock productivity warrant additional research.

From 1987 to 2006, wolves killed 230 cattle and 436 sheep, with a total of 254 wolves being removed (Sime et al. 2007). The number of depredation reports received since those years has declined

from 233 in 2009 to about 100 or less from 2014–2022 (Figure 18). The general decrease in livestock depredations since 2009 may be a result of several factors, including more aggressive and rapid wolf control in response to depredations (Bradley et al. 2015, DeCesare et al. 2018) or the proliferation of non-lethal depredation deterrents. Since 1997, about 53% of wolf depredation reports received by WS have been verified as wolf-caused (Figure 19).

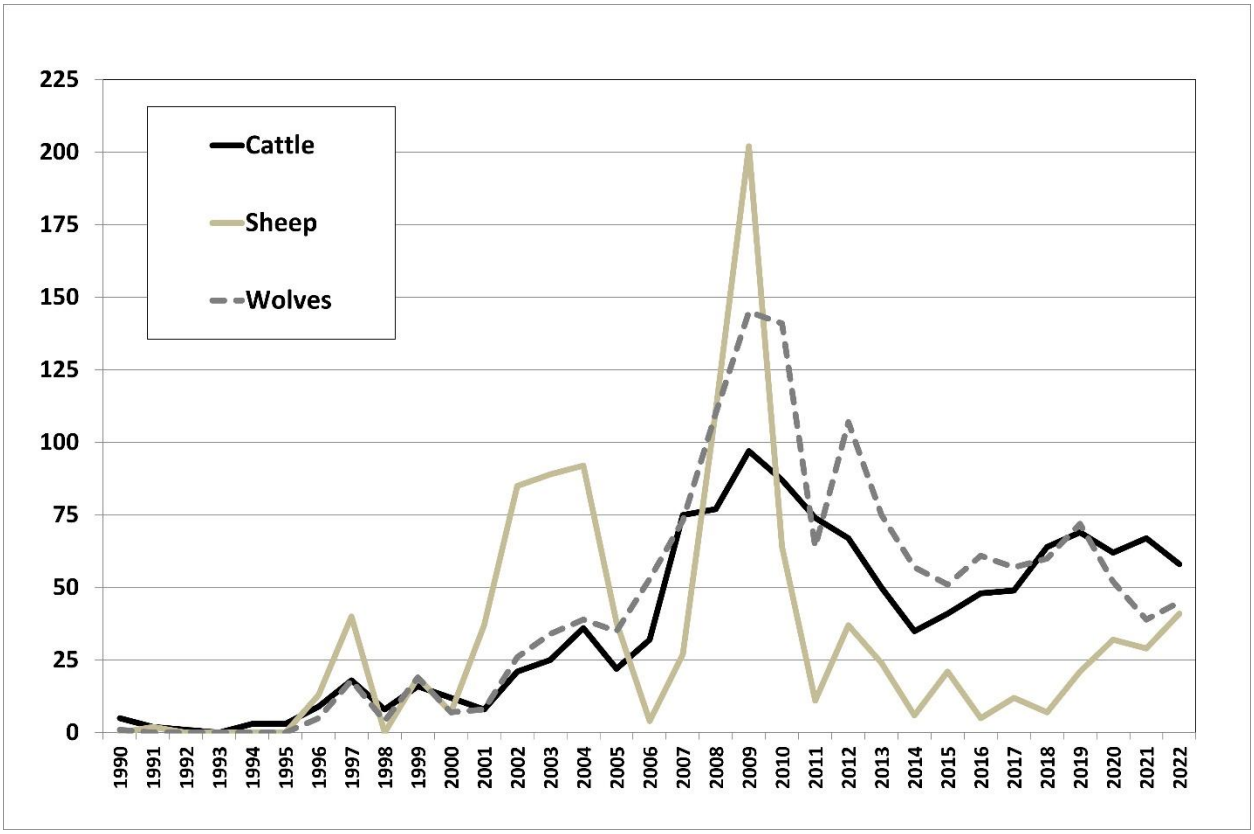

Figure 18. Number of cattle and sheep killed by wolves and number of wolves removed through agency control and legal depredation-related take by private citizens by federal fiscal year for livestock and calendar year for wolves, 1990–2022. Data collection on number of wolves removed per depredation is inconsistently recorded. Because removal efforts are targeted toward problematic packs, fewer total wolves are removed in livestock-related conflict mitigation (Parks et al. 2023).

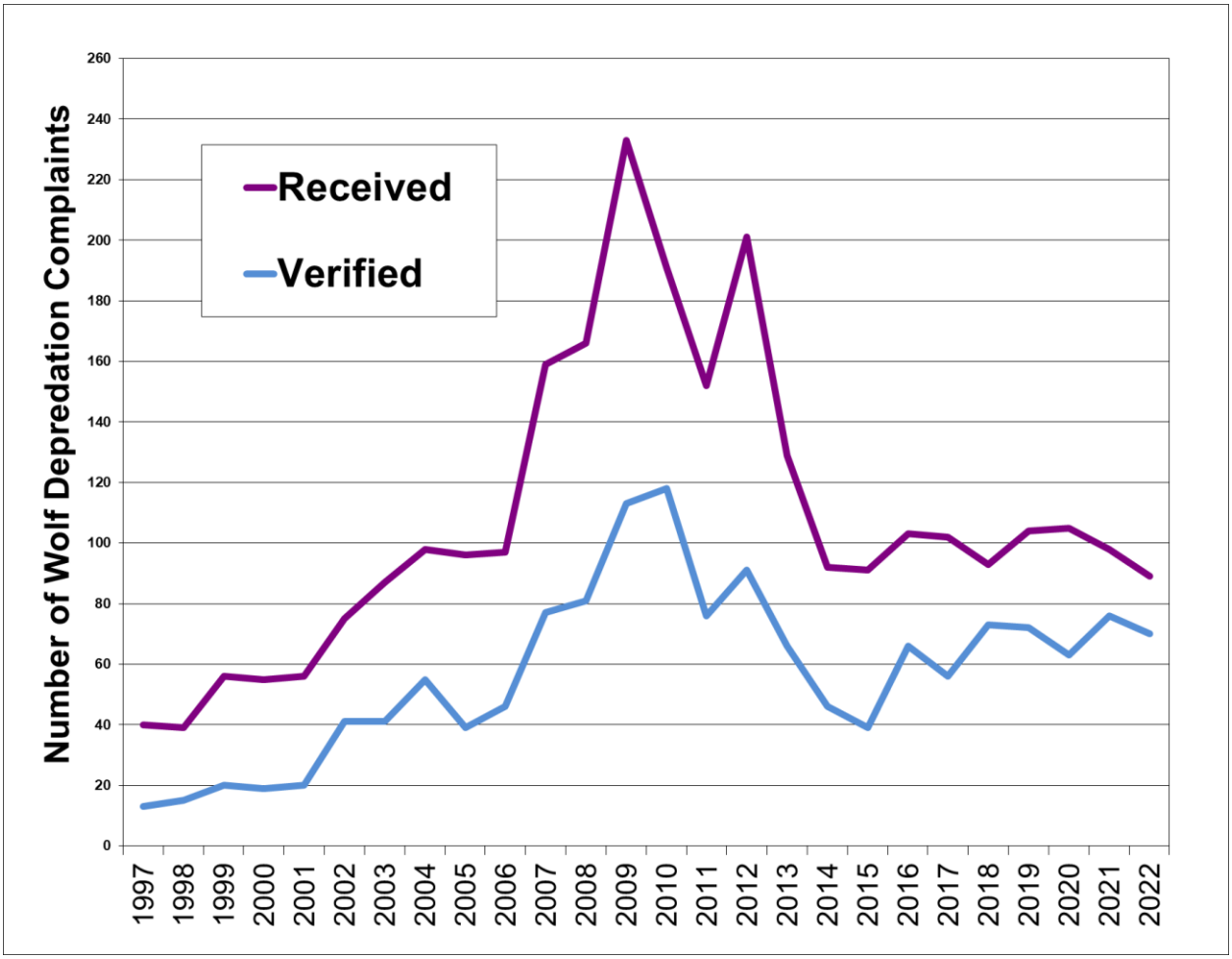

Figure 19. Number of complaints received by USDA Wildlife Services as suspected wolf damage and number of complaints verified as wolf damage by federal fiscal year, 1997-2022 (Parks et al. 2023).

Wolf-livestock Conflict in the Future

Because the wolf population is at a sustainable level and under state authority, landowners or their agents may non-lethally harass a wolf or wolves without a permit if wolves are disrupting livestock on public or private land to discourage wolf activity in close proximity to livestock. Additionally, several Montana laws provide lethal removal options to mitigate conflicts with wolves. A landowner or their agent may lethally take a wolf on the landowner's property if the wolf is a potential threat to human safety, livestock or dogs under § 87-1-901, MCA. Furthermore, if a wolf is in the act of attacking or killing a domestic dog, a citizen may lethally remove that wolf on public or private land under Montana state law known as the Lawful Taking To Protect Livestock Or Person statute (§ 87-6-106, MCA). If a wolf is killed under either of these state laws, the carcass must not be moved or disturbed, the scene must be secured, and the incident must be reported to FWP as soon as possible, but within 72 hours. The entire carcass must be returned to FWP. Game wardens (or biologists) have the primary responsibility for the field aspects of administration, implementation, and closing of these cases.

In lieu of a federal or state response, a licensed landowner, livestock producer, or their agent may also kill a wolf by adhering to the regulations for public harvest or conflict-related removals approved by the commission. A designated trapper or a licensed sportsperson may be authorized to lethally remove wolves on public or private lands, and are subject to licensing requirements and other public harvest regulations approved by the commission that govern the regulated hunting or trapping of wolves.

Wildlife Services

WS is the federal entity routinely called upon by state and federal agencies as well as the private sector to provide operational and technical assistance to control damage caused by wildlife. WS is a work unit of the Animal and Plant Health Inspection Service of the U.S. Department of Agriculture and operates under NEPA. Through a partnership between the United States Department of Agriculture and state agencies or the private sector, WS engages in a wide range of damage management activities, including research, consultation, control of problem animals, technical assistance, and public outreach. WS agents investigate depredation complaints, capture wolves for research and monitoring purposes, provide technical assistance to producers, develop and test non-lethal methods of depredation control, and remove wolves. Expenditures by WS related to wolf-livestock conflicts are funded by federal, state, and NGO entities (Table 1).

Table 1. Statewide WS expenditures by federal fiscal year, 2011–2022.

Year	Federal	FWP	RMEF	Livestock producers	MDOL Wolf Mitigation Fund	NGOs	MLLB	Total
2011-2012	$182,995.00	$110,000.00		$18,422.00				$311,417.00
2012-2013	$212,823.00	$110,000.00	$25,700.00	$28,700.00				$377,223.00
2013-2014	$138,548.00	$110,000.00	$25,000.00	$11,650.00				$285,198.00
2014-2015	$111,243.00	$110,000.00	$25,000.00					$246,243.00
2015-2016	$129,594.00	$110,000.00	$25,000.00					$264,594.00
2016-2017	$168,642.00	$110,000.00						$278,642.00
2017-2018	$205,070.00	$110,000.00						$315,070.00
2018-2019	$204,917.00	$110,000.00						$314,917.00
2019-2020	$230,600.00	$110,000.00						$340,600.00
2020-2021	$241,423.00	$135,000.00						$376,423.00
2021-2022	$349,275.00	$135,000.00			$98,259.00	$34,577.00	$20,601.00	$637,712.00

FWP maintains an MOU with WS that documents and enhances the cooperative relationship between FWP and WS for planning, coordinating, and implementing wildlife damage control programs to reduce damage caused by grizzly bears, wolves, black bears, and mountain lions to agricultural, animal husbandry, forestry, wildlife, and public health and safety. WS agents respond to landowner or livestock producer wolf depredation complaints, conduct field investigations, and carry out management actions. The likelihood of detecting injured or dead livestock is probably higher on private lands where there is greater human presence than on remote public land grazing allotments. The magnitude of under-detection of livestock loss on public lands and allotments is unknown. WS investigates incidents involving livestock, including working dogs, guarding animals such as llamas, and alternative livestock. WS provides their report to the landowners, who may send it to the Montana Livestock Loss Board (MLLB) for consideration of reimbursement. WS makes recommendations about the resolution of specific conflicts as well as ways of improving agency effectiveness and overall conflict resolution procedures. FWP provides WS with guidelines for capture operations and procedures, reporting of investigative findings, management activities and outcomes, and coordinates with other state or federal agencies as appropriate. Further, the MOU will be assessed annually to determine overall effectiveness relative to livestock losses, agency response times and related costs, and the status of the wolf population itself.

This MOU is a formal recognition and clarifies that investigations of possible livestock depredations by wolves are the responsibility of WS in cooperation with FWP personnel, when possible. Despite the fact that WS maintains most responsibility for livestock depredations by wolves, FWP still maintains state authority for wolf management. Almost all depredation incidents investigated by WS within Montana occur on private land. A rapid agency field response is imperative so that evidence may be examined as soon as possible after the incident. When a depredation occurs (on public or private lands), livestock producers should report any suspected wolf depredations (injuries or death) or the disruption of livestock or guarding animals to WS directly, as is the case for other wildlife species such as mountain lions or bears. Any evidence at the scene should be protected and secured from disturbance. WS agents complete an investigation and file a report form summarizing the type and extent of damage, physical evidence, and a description of the site. WS must provide the following information: date of depredation, date of investigation, number and type of livestock killed or injured, location of depredation, county of depredation, landownership, pack name (if known), and intended control action. FWP maintains a database to tabulate, summarize, and assess trends in wolf-livestock conflicts based on these reports.

Upon WS completing a depredation investigation and confirming wolves were the cause of injured or dead livestock, WS will notify FWP of the results and planned control actions within 24 hours. Subsequent management actions are guided by the specific recommendations of the investigator, the provisions of this plan and by the multi-agency MOU. WS is authorized to remove any offending individuals after a first offense when wounded or dead livestock are present, with clear evidence the injury or death was caused by wolves without prior consultation, and have the ultimate discretion to decide how to respond to a confirmed depredation, regardless of population status. WS may consult with FWP or initiate non-lethal or lethal control, as appropriate and according to the MOU. Conflict history of the pack, attributes of the pack (e.g., size or reproductive status), or the physical setting are considered before a management response is selected. Specific actions range from catch, collar, and release on site, to lethal removal. Management actions are directed at individual wolves to the extent that they can be identified and clearly implicated. Non-selective methods such as poison will not be used. When wolves are killed by WS, their carcasses may be sexed, aged, and genetically sampled as described in Part III.

WS conducts lethal control actions on wolves on private, state, and federal lands, as well as on the Blackfeet Nation and the Confederated Salish and Kootenai Tribes lands. WS can use all approved methods to target and remove offending wolves, including aerial gunning. The number of wolves taken, the method of removal in consultation with the livestock producer and or landowner, as well as the location and duration of control efforts are determined by WS. Throughout this entire process, there is an expectation of regular communication between FWP and WS field staff so that both agencies are informed and aware of the response and any special circumstances. When wolf numbers are low, WS may use more conservative management tools. For example, WS may take an incremental approach to wolf removals to address wolf depredations. WS may also non-injuriously harass wolves or otherwise non-lethally intervene in any case where wolves are observed in the vicinity of livestock or present a threat to livestock where landowner permission is granted.

FWP routinely monitors wolves through radio-collaring efforts. If the depredation or damage occurs in an area without a radio-collared pack and WS cannot determine which pack or wolves were involved, WS may attempt to radio-collar at least one wolf in the area. FWP wolf specialists may also radio-collar wolves that may have been involved in conflicts to reduce wolf-livestock conflict and assist in accurate individual or pack removal (§ 87-5-132, MCA). If no radio-collared pack or wolves can be linked to the depredation, lethal removal up to and including a full pack of suspected wolves may occur.

The Montana Livestock Loss Board

The Montana Livestock Loss Board (MLLB) and the Montana Livestock Loss Program, developed in 2007 (60th Montana Legislature), addresses the economic impacts of verified wolf-caused livestock losses through compensation and application of prevention tools and incentives to reduce risk of losses. The purposes of the MLLB are 1) to provide financial reimbursements to producers for losses caused by wolves, grizzly bears, and mountain lions based on the program criteria, and 2) to proactively apply prevention tools and incentives to decrease the risk of wolf-caused losses and reduce the number of livestock killed by wolves through proactive livestock management strategies. Indirect losses and costs are not directly covered. Eligible livestock losses are cattle, calves, hogs, pigs, horses, mules, sheep, lambs, goats, llamas, and guarding animals. Confirmed and probable loss are reimbursed at 100% of fair market value (Figure 20). Veterinary bills for injured livestock that are confirmed due to wolves may be covered up to 100% of fair market value of the animal when funding is available. Hides of wolves taken by WS in response to livestock depredation may be prepared and sold by the Livestock Loss Board to help fund prevention and reimbursement costs (§ 2-15-2113, MCA). MLLB is attached to the Montana Department of Livestock.

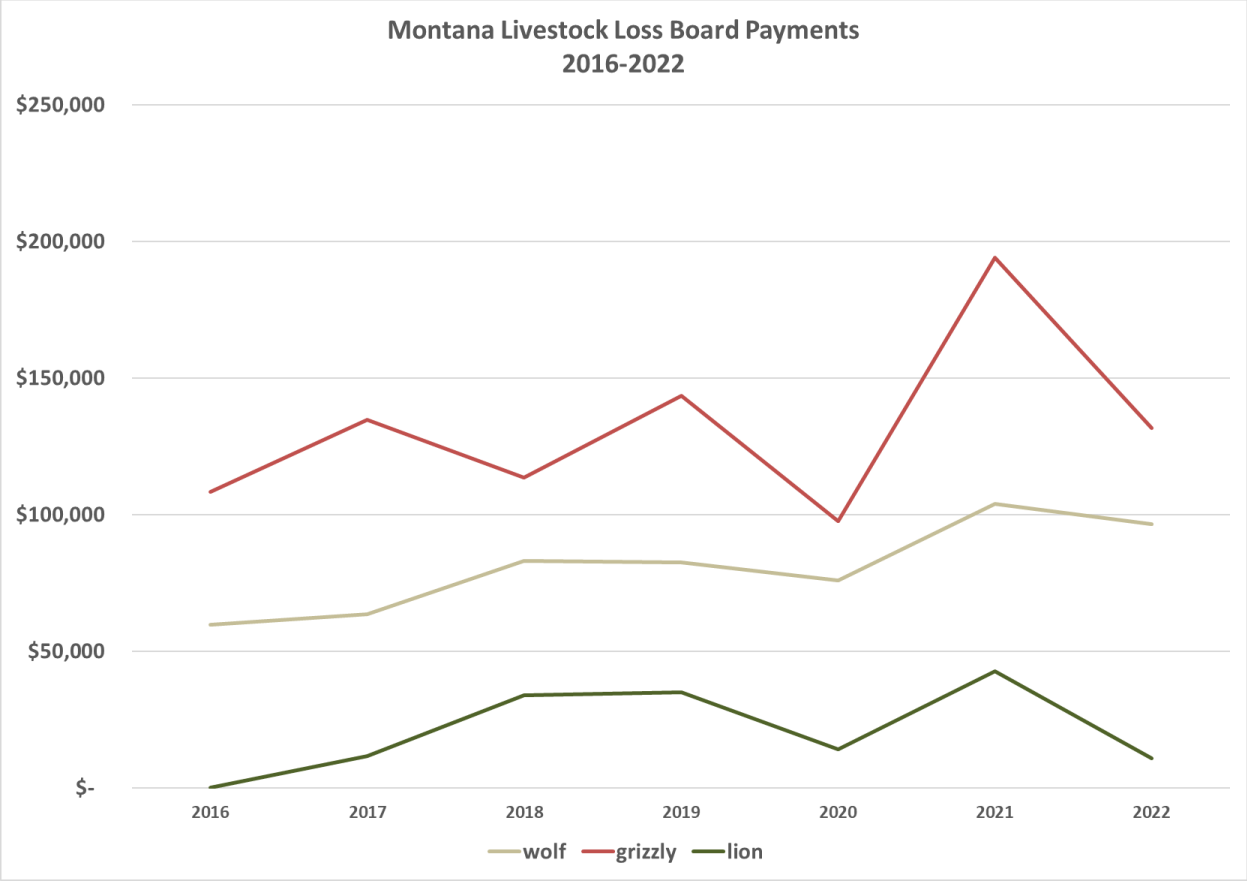

Figure 20. Dollars paid to livestock producers in MLLB payments by calendar year, 2016–2022 (Parks et al. 2023).

The MLLB has grants available to private landowners and livestock producers for conflict prevention. Grants pertaining to wolf conflict prevention require a 50% cost share by the applicant. Funds for these grants are authorized by the Montana Legislature. This cost-share program proactively implements measures to decrease the risk of predation on livestock as authorized by § 2-15-3111, MCA, with priority given to conflicts involving wolves and grizzly bears (§ 2-15-3110(6), MCA). Applicants must meet grant guidelines and grant selection is based on the magnitude and intensity of depredations, ranging from chronic occurrences to potential high-risk areas. Eligible applicants typically include livestock producers and grant amounts based on the average market value for the type and number of livestock to be targeted for prevention practices (https://liv.mt.gov/_docs/LLB/Forms/LLB-Grant-Application-2023.pdf). Other considerations include acreage, effectiveness of proposed preventative measures, and cost of preventative measures. All fencing proposals must meet the fencing requirements under Montana law (§ 81-4-101, MCA), and the potential influence these preventative practices will have on neighbors is weighed and considered. Funding expenses associated with guard dogs include acquisition costs, standard veterinary examinations and vaccinations, food and other expenses incurred while the dogs are with the protected livestock. Grant recipients are mandated to regularly report their evaluation of the implemented practices and their success. All reports must include any depredations while the prevention practices were in place as well as comparisons of past annual losses to current losses. All activities must comply to the terms of any conservation easements, leases, zoning, or land use restrictions applicable to the property

upon which the loss prevention practices will be conducted, as well as with what is permitted by state, tribal, and or federal entities in their respective lease terms, laws, and regulations.

Part V: Wolf-Human Conflicts in Montana

FWP defines a public safety problem related to carnivores as "any situation where an FWP employee reasonably determines that the continued presence poses a threat to human safety, an attack has resulted in the loss of livestock or personal pets, or that a human has been physically injured or killed," (*see* 2003 Wolf Plan). Although wolves generally avoid humans and often go unseen, they have the potential to attack, harm, injure, or kill humans and can habituate to humans or human activities. FWP will attempt to discourage habituation and conditioning for all wildlife species, but for carnivores in particular. In Montana, no wolf-human encounter has resulted in human injury or death. Statute ensures FWP's commitment to continuance of human safety (§ 87-1-217, MCA). In the unlikely event of human injury or death during a wolf-human encounter, the wolf or wolves will be lethally removed, and the carcasses forwarded to the FWP Wildlife Health Program. Carcasses will be tested for rabies or other pre-disposing health factors via forensic analysis. If a wolf bites a person during a capture and handling incident, a blood sample will be drawn so it can be tested for rabies. Lastly, wolf management can indirectly influence the occurrence of wildlife-vehicle collisions (Gilbert et al. 2017), which is documented by the Department of Transportation.

Generally, wolves are wary of people with the exception of cases where people may inadvertently walk into an activity site. Hikers, campers, and hunters are more likely to come upon areas of wolf activity such as a kill site, denning area, or resting site. After detecting a person's presence, some wolves may lope off quietly, others may bark or howl, or some may cautiously approach to get a better look. Once wolves have identified the disturbance, they generally leave the area. Vocalizing could go on for awhile as wolves regroup out of sight and pull back from the situation. If a wolf is killed, other wolves generally move off but may return to the site later.

Wolves are very territorial and see dogs as competition (Urbigkit and Urbigkit 2010). As a result, wolves are attracted to and will often try to kill domestic dogs. Traveling with a dog may therefore increase a person's chances of encountering a wolf. Dogs may even draw wolves into areas of human activity. Wolves have been documented killing livestock guard dogs and hounds pursuing mountain lions and spring black bears during legal hound handling seasons. Wolves and domestic dogs are susceptible to several canine diseases, however, most are treatable through veterinary care of pets and are more detrimental to the health of individual wolves and packs.

Unless precluded by federal law (e.g., ESA), Montana citizens have the right to protect or defend themselves or their property if threatened by wildlife. In the unlikely need for defense of human life during a wolf encounter, citizens may use any means, including lethal force, to address an imminent threat, regardless of wolf population status or whether the incident takes place on public or private land. Guarding and domestic dogs can also be defended using lethal means. Any wolves killed under these circumstances must be reported to FWP as soon as possible, but within 72 hours. Citizens must also turn in the entire

carcass. In the absence of a direct threat to life or property, citizens are encouraged to rely on non-lethal harassment to discourage wolf presence near their homes or person when recreating outdoors. FWP provides information to the general public about appropriate responses during wolf encounters (do's and don'ts) and how to reduce the potential for problems in anthropogenic settings. This material will also include information about wolf behavior, body posture, tail position, and vocalizations to help the public evaluate the situation, correctly interpret wolf behavior, and communicate the details accurately to agency personnel.

Part VI: Education and Outreach Program

FWP recognizes the importance, value, and need for an educational program to parallel wolf management activities. The objective is to provide scientifically based information regarding wolves and their management in Montana, to help the public become more knowledgeable about this species and its management. FWP takes a leadership role in formulating and disseminating educational materials. However, the information sources will be wide-ranging and may include materials from other state and federal agencies, NGOs, and Native American tribes. All material included in the wolf education program must be factual and have a foundation of scientific scrutiny. FWP's Communication and Education Division is responsible for content development.

FWP's wolf program outreach and education efforts will be ongoing. Outreach activities take a variety of forms including field site visits, phone and email conversations to share information and answer questions, presentations to school groups and other agency personnel, media interviews, and formal and informal presentations. Additionally, Wolf Trapper Education seminars are required for all trappers who have not been a licensed trapper for at least three previous seasons (https://www.register-ed.com/programs/montana/102-montana-wolf-trapping-certification-class). In addition to these efforts, FWP prepares and distributes a variety of media releases to help Montanans become more familiar with Montana's wolf management (e.g., a hands-on resource guide to reduce depredations: https://fwp.mt.gov/binaries/content/assets/fwp/conservation/wildlife-reports/wolf/wolfresourcesguide.pdf). FWP publishes regular reports providing updates on contemporary scientifically-sound monitoring techniques, wolf population trends, harvest and conflict-based removal data, and changing regulations and policies as well as annual FWP gray wolf program reports (https://fwp.mt.gov/conservation/wildlife-management/wolf).

To enhance public understanding of Montana's wolf monitoring and management strategies, FWP will seek to continually improve transparency and provide information to the public. For example, in 2021 FWP developed a Wolf Harvest Dashboard website to provide real-time information on the status of wolf harvest in Montana for the current wolf hunting and trapping seasons (https://experience.arcgis.com/experience/34fbb4c9509e45959f6291965388c345/page/Summary/). The dashboard provides information on the number of wolves harvested in each region or WMU, the quota and quota status for each region or WMU, and detailed information for each harvest record. Additional harvest information can be found at https://fwp.mt.gov/hunt/regulations/wolf and https://myfwp.mt.gov/fwpPub/harvestReports. FWP also identified public confusion surrounding the floating

start dates for wolf trapping in areas of occupied grizzly habitat. In response, FWP developed the Wolf Trapping Season Status Map, which provides weekly updates in November and December on trapping season start dates based on FWP evaluation of grizzly bear denning activity and can be found at https://fwp.mt.gov/hunt/regulations/wolf. Through public engagement, FWP will continue to identify needs and create effective education and outreach the capture the wide breadth of stakeholders.

Part VII: Wolf Program Funding

State law authorizes FWP to collect fees from hunters, trappers, and anglers (§ 87-1-601, MCA). Most of these revenues are channeled back into management of fish and wildlife under spending authority from the Montana Legislature. In order to maintain FWP's eligibility to receive matching federal funding under the Federal Aid in Wildlife Restoration Act (Pittman-Robertson or PR), the Montana Legislature agreed to use hunting license revenue only for wildlife management (§ 87-1-708, MCA). Most of this funding is generated through excise taxes on firearms, ammunition, and archery equipment. Federal funding matches state license revenue to fund wildlife surveys, research, hunter education, and other management activities. Wildlife surveys and inventories and other approved projects typically receive 75% federal funding matched with 25% state funding from license revenues.

Funding for wolf conservation and management in Montana are described in § 87-1-623 and 87-1-625, MCA. Section 87-1-623, MCA, was created in 2011 (62nd Montana Legislative Session) by House Bill 363. This law requires that a wolf management account be set up and that all wolf license revenue be deposited into this account for wolf collaring and control. Specifically, it states that subject to appropriation by the legislature, money deposited in the account must be used exclusively for the management of wolves and must be equally divided and allocated for the following purposes: (a) wolf-collaring activities conducted pursuant to § 87-5-132, MCA; and (b) lethal action conducted pursuant to § 87-1-217, MCA, to take wolves that attack livestock. Section 87-1-625, MCA, was created in 2011 (62nd Montana Legislative Session) by Senate Bill 348. This law required FWP to allocate $900,000 annually toward wolf management. "Management" is defined as includes the entire range of activities that constitute a modern scientific resource program, including but not limited to research, census, law enforcement, habitat improvement, control, and education. The term also includes the periodic protection of species or populations as well as regulated taking. In 2015 (64th Montana Legislative Session), Senate Bill 418 reduced the amount FWP must spend on wolf management to $500,000 (§ 87-1-625, MCA).

Wolf license sales generate general revenue for fish and wildlife management in Montana (Figure 21). The number of wolf hunting licenses issued annually ranged from 15,520–24,478 and the number of trapping licenses issued to trappers with a required wolf trapping certification ranged from 1,508–3,124. Because trapping licenses for both residents and non-residents are not wolf-specific and response rate of trapper surveys is low (43–68%), FWP cannot accurately quantify the financial contribution that wolf trapping generates. Annual budget and expenditures also vary annually (Table 2). Budgets are developed internally, with authority to spend funds coming from the Legislature. All budgets are reviewed by the legislative budget committee and must be approved by both the Montana House and Senate. The governor's office can also approve budget amendments between legislative sessions. The commission

reviews and approves the agency's overall budget. Specific to the wolf program, some of this funding (i.e., PR, wolf, and general license dollars) is used to pay for FWP's field presence to implement population monitoring, collaring, outreach, hunting, trapping, and livestock depredation response. Other wolf management services provided by FWP include law enforcement, harvest and quota monitoring, legal support, public outreach, and overall program administration. Revenues from wolf license sales are incorporated into the general license funding account, and the majority of funding in this account is driven by ungulate hunting opportunities.

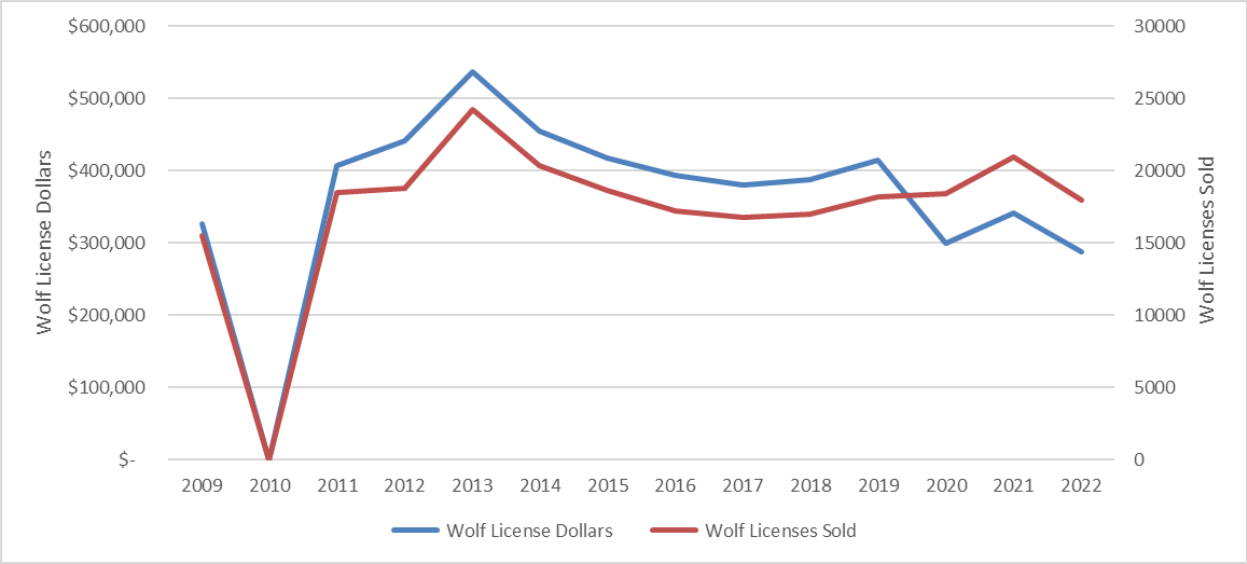

Figure 21. Number of wolf licenses (hunting) sold and revenue from wolf licenses in Montana by calendar year, 2009–2022. Values drop to 0 in 2010 because wolves were briefly relisted on the ESA.

Table 2. Wolf program budget by fiscal year, 2011–2022.

Year	Federal[1]	Pittman-Robertson (PR) Funds	State license dollars	HB363	Rocky Mountain Elk Foundation	Total
2011-2012	$625,000.00		$275,000.00	$163,000.00		$1,063,000.00
2012-2013	$625,000.00	$60,400.00	$214,600.00	$163,000.00		$1,063,000.00
2013-2014	$390,908.00	$153,102.00	$390,075.00			$934,085.00
2014-2015	$372,778.00	$216,000.00	$479,059.00		$50,000.00	$1,067,837.00
2015-2016	$257,653.00	$13,215.00	$355,174.00		$48,629.00	$626,042.00
2016-2017		$332,357.00	$357,759.00		$365.00	$690,116.00
2017-2018		$231,581.00	$594,573.00		$25,001.00	$826,154.00
2018-2019		$216,640.00	$489,599.00		$25,001.00	$706,239.00
2019-2020		$236,050.00	$492,437.50		$25,001.00	$728,487.50
2020-2021		$316,056.46	$492,437.50		$25,000.00	$808,493.96
2021-2022		$211,474.00	$767,474.00			$978,948.00

[1]USFWS cooperative agreement

Part VIII: Management Coordination

States have almost sole authority over wildlife management, except for federally protected species (e.g., migratory birds or ESA listings), reserved federal lands (e.g., National Parks), or Native American treaty rights. Because of the unique relationships between federal and state governments, tribes, the public, and wolves, effective management that ensures wolf population viability and longevity in the NRM requires collaboration between all stakeholders. Strong stakeholder engagement and collaboration is an important element of this plan. Further, FWP is dedicated to interagency coordination and the sharing of biological data between responsible agencies to maintain wolf population sustainability and presence on the landscape. Important issues include the population status and trend within each state, the disposition of cross-boundary packs, and whether there are foreseeable problems with achieving certain goals and objectives into the future. Information on wolf population status and trends as well as wolf population monitoring and management help with improvement of techniques and protocols. Collaborative research projects at regional scales may also be developed, coordinated, and implemented. Periodic administrative coordination may be required. Collectively, this will facilitate a problem-solving atmosphere for issues shared by all parties.

The Blackfeet Tribe and Confederated Salish and Kootenai Tribes, located in western Montana, have wolf management plans. The Blackfeet Tribe's wolf management plan can be found at http://blackfeetfishandwildlife.net/blackfeet-tribe-wolf-management-plan/. The Confederated Salish and Kootenai Tribe's wolf management plan can be found at http://csktnrd.org/wildlife/projects/cskt-wolf-management.

Part VIIII: Public Engagement Process in Wolf Management

As part of the 2023 Wolf Plan and associated EIS, an extensive public process was used. Public scoping provides an opportunity for public and agency involvement during the early planning stages of the analysis. The intent of the scoping process is to gather comments, concerns, and ideas from those who have an interest in or who may be affected by the proposed action. Several strategies were used to inform the public about and solicit comments on the proposed action. These internal and public processes serve to fulfill the scoping requirements of MEPA. FWP requested input from the public on the direct, secondary, and cumulative impacts on the physical and human environments. The 30-day public scoping period began with the publication of the Scoping Notice on Wednesday, March 22, 2023, and continued through Saturday, April 22, 2023. FWP considered all applicable input provided during the virtual public scoping meetings (Tuesdays, April 4 and 11, 2023, 6-8 p.m. MST), as well as all applicable input received or postmarked by Saturday, April 22, 2023, in defining the scope of 2023 Wolf Plan and associated EIS.

The 2023 Wolf Plan and associated DEIS were published on the FWP website on Friday, October 20th, 2023. This began the 60-day public comment period, which concluded on Tuesday, December 19th, 2023 at 5 p.m. FWP considered all applicable input received by email or postmarked by the end of the public comment period. Additionally, FWP will hold in-person public meetings and one virtual meeting to engage, interact, and discuss with attendees.

According to the applicable requirements of ARM 12.2.439, following preparation of the 2023 Wolf Plan and associated Draft Environmental Impact Statement (DEIS), the agency distributed copies to persons who have requested copies and the general public affected by the proposed and preferred alternatives. These are public documents and may be inspected upon request. Any person may obtain a copy of either document by making a request to FWP. To fulfill MEPA requirements, the 2023 Wolf Plan and associated DEIS have been distributed through the following methods:

- Public notice has been served on the FWP website at: https://fwp.mt.gov/aboutfwp/public-comment-opportunities/draft-wolf-mgmt-plan
- Public notice has been served on the Montana Environmental Quality Council's MEPA Document List website at: https://leg.mt.gov/mepa/search/.
- FWP maintains a mailing list of persons interested in a particular action or type of action. FWP has notified all interested persons and alerted them to this public comment opportunity. The interested persons mailing list is available upon request from FWP.
- For more information on how to submit comments electronically, visit: https://fwp.mt.gov/aboutfwp/public-comment-opportunities/draft-wolf-mgmt-plan
- FWP has also issued a press release for use by the media.

Copies of the 2023 Wolf Plan and associated DEIS have also been sent to the governor, other affected state agencies, USFWS, and the Montana Environmental Quality Council for review.

Legislative processes are the mechanism for adoption, amendment, or repeal of statutes, and administrative rules result from public rule-making processes intended to more precisely implement statutes. Both are based on biological and sociopolitical input. Currently, these actions are exempt from MEPA. While both are a result of legislation, the processes for the public to actively participate and comment differs for statutes and administrative rules. If a member of the public would like to comment on the adoption, amendment, or repeal of a statute, they would do so during the legislative session. Statutes are the laws that FWP, as a state agency, is required to implement, and strategies for implementation are developed during the season-setting process under legislative authority that has been delegated to the commission. However, if a member of the public would like to comment on the adoption, amendment, or repeal of administrative rules, they would do so during the commission process and or the Secretary of State's process. FWP releases public notices on its website for any upcoming decisions to be made related to administrative rules. Administrative rules are mechanisms by which FWP implements or further defines and reinforces the intent of statutes. Statutes and administrative rules work hand-in-hand allowing FWP and the commission to implement the legislature's mandates.

FWP collaborates and partners with federal agencies on wolf management and mitigation of wolf-livestock conflicts, as well as with other agencies, universities, and Tribal Nations to conduct biological and social research and monitoring. Eight Tribal affiliations were notified of and invited to consult on this plan and associated EIS: Blackfeet Tribe of the Blackfeet Indian Reservation of Montana, Confederated Salish and Kootenai Tribes of the Flathead Reservation, Chippewa Cree Tribe of Rocky Boy's Reservation, Fort Peck Assiniboine and Sioux Tribes of Fort Peck Indian Reservation, Crow Tribe of Crow Indian Reservation, Little Shell Tribe of Chippewa Indians of Montana, and Northern Cheyenne Tribe and Indian Reservation. Additional emails were sent to alert the Tribes and follow-up calls were made later in the comment period. To date, no concerns were communicated by any Tribe. Further consultation with the

Tribes will be pursued in accordance with Section 106 of the NHPA (54 USC § 306108) and its implementing regulations (36 CFR Part 800).

Regarding ongoing wolf management, the public has the opportunity for continuous and iterative input into specific decisions about wolf harvest throughout the legislative and public season-setting processes. Opportunity for public comment is always available and welcomed. All past and upcoming commission meetings and associated agendas, which include memorandums of items discussed and their specific public processes and outcomes, are available on the FWP website (https://fwp.mt.gov/aboutfwp/commission). Opportunity for public comment is provided for all commission proposals (via email, phone, surveys). Further, the public is encouraged to attend commission meetings where an opportunity to speak directly to the commission is provided. Harvest regulations are decided and adopted by the commission, within the constraints and delegation of authority provided for under statutes and administrative rules. Additionally, FWP may choose to obtain public input through other approaches (e.g., focus groups, citizens advisory groups, surveys) as deemed appropriate.

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Appendix A: List of Preparers

NAME[1]	RESPONSIBILITIES	EDUCATION	EXPERIENCE
Samantha Fino	Primary drafter of EIS and 2023 Wolf Plan	PhD Wildlife Science	8 years of wildlife management experience
Molly Parks	EIS and 2023 Wolf Plan	MS Wildlife Biology	>11 years of wildlife management experience
Brian Wakeling	EIS and 2023 Wolf Plan	MS Wildlife Biology	35 years of wildlife management experience
Justin Gude	EIS and 2023 Wolf Plan	MS Fish & Wildlife Management	25 years of wildlife management and research experience
Ken McDonald	EIS and 2023 Wolf Plan	MS Wildlife Biology	>30 years of wildlife management experience

[1]Several other FWP biologists, managers, specialists, and coordinators contributed to the materials (i.e., data, figures, tables, maps) presented in the EIS and 2023 Wolf Plan. These include: Lindsey Parsons (Deer and Elk Coordinator), Alix Godar (Population ecologist/biometrician), Nick DeCesare (Research Biologist), Kevin Podruzny (Biometrician), Cara Whalen (GIS Specialist), Alex Scolavino (Legal Counsel), Sarah Clerget (Legal Counsel), Kqyn Kuka (Tribal Liaison), Brenna Moloney (Natural Heritage), Rachel Reckin (Natural Heritage), Payton Schild (Licensing Business Analyst), Rick Northrup (Wildlife Habitat Bureau Chief), Jason Parke (Forester), James Colegrove (Lands Specialist), Austin Wieseler (Wildlife Health Biologist), Greg Lemon (CommEd), Peggy O'Neill-McLeod (CommEd), Missy Erving (CommEd), among many others. Additionally, wolf specialists (Wendy Cole, Tyler Parks, Nathan Lance, Subhadeep Bhattacharjee, and Sarah Zielke) as well as wildlife and regional managers (Warren Hansen, Marina Yoshioka, Neil Anderson, Lee Anderson, Liz Bradley, Randy Arnold, Cory Loecker, Gary Bertellotti, Scott Thompson, Drew Henry, Brett Dorak, Brad Schmitz) assisted on writing and including details within the plan.

Appendix B: Laws Governing Wolf Management in Montana

Montana Code Annotated—Title 87 Fish and Wildlife

§ 87-1-201. Powers and duties of the Department

§ 87-1-214. Disclosure of information -- legislative finding -- large predators

§ 87-1-217. Policy for management of large predators – legislative intent

§ 87-1-301. Powers of the Montana Fish and Wildlife Commission

§ 87-1-303. Rules for use of lands and waters

§ 87-1-304. Fixing of seasons and bag and possession limits

§ 87-1-601. Use of fish and game money

§ 87-1-623. Wolf management account

§ 87-1-625. Funding for wolf management

§ 87-1-708. Assent to Pittman-Robertson Act – authority of department

§ 87-1-901. Gray wolf management – rulemaking – reporting

§ 87-2-101. Definitions

§ 87-2-104. Number of licenses, permits, or tags allowed – fees

§ 87-2-523. Class E-1 – Resident Wolf License

§ 87-2-524. Class E-2 – Nonresident Wolf License

§ 87-2-813. Auction or lottery of wolf license

§ 87-5-131. Process for delisting of gray wolf – management following delisting

§ 87-5-132. Use of radio-tracking collars for monitoring wolf packs

§ 87-5-725. Notification of transplantation or introduction of wildlife

§ 87-6-106. Lawful taking to protect livestock or person -- findings

§ 87-6-202. Unlawful possession, shipping, or transportation of game fish, bird, game animal, or fur-bearing animal

§ 87-6-205. Waste of game animal, game bird, or game fish

§ 87-6-206. Unlawful sale of game fish, bird, game animal, or fur-bearing animal

§ 87-6-401. Unlawful use of equipment while hunting

§ 87-6-906. Restitution for illegal killing, possession, or waste of certain wildlife

§ 2-15-3110. Livestock loss board – purpose, membership, and qualifications

§ 2-15-3111. Livestock loss reduction program

§ 2-15-3112. Livestock loss mitigation program – definitions

§ 2-15-3113. Additional powers and duties of livestock loss board

§ 81-1-110. Livestock loss reduction and mitigation accounts

§ 81-1-111. Livestock loss reduction and mitigation trust fund

§ 81-7-123. Voluntary wolf mitigation account

Montana Administrative Rules–Title 12 Fish, Wildlife and Parks

12.9.1301 Commitment to Preservation of the Gray Wolf as Resident Wildlife in Need of Management

12.9.1302 Definitions

12.9.1303 Control Methods of the Gray Wolf Include Nonlethal and Lethal Means

12.9.1304 Allowable Nonlethal Control of the Gray Wolf

12.9.1305 Allowable Lethal Control of the Gray Wolf

Montana Administrative Rules–Title 36 Department of Natural Resources

36.11.430 Threatened and Endangered Species–Gray Wolf (REPEALED)

Appendix C: Abbreviations, Acronyms, and Glossary of Terms

Abbreviation / Acronym	Definition
BIR	Blackfeet Indian Reservation
BLM	United States Department of the Interior Bureau of Land Management
CITES	Convention on International Trade in Endangered Species
CSKT	Confederated Salish and Kootenai Tribes
Commission	Montana Fish and Wildlife Commission; the appointed body charged with making policy and regulations for FWP
DNRC	Montana Department of Natural Resources and Conservation
EIS	Environmental Impact Statement (DEIS refers to the draft version of the document)
ESA	Endangered Species Act
FIR	Flathead Indian Reservation
FWP	Montana Fish, Wildlife & Parks; an agency of Montana state government.
GNP	Glacier National Park
GYA	Greater Yellowstone Area
MCA	Montana Codes Annotated
MDOL	Montana Department of Livestock
MEPA	Montana Environmental Policy Act
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NPS	United States Department of the Interior National Park Service
ROD	Record of decision, sometimes called a decision document; a concise public notice that announces a state agency decision arrived at through the Montana Environmental Policy Act, explains the reasons for the decision, and explains any special conditions surrounding the decision or its implementation.
SDM	Structured Decision Making. A formal process to help identify issues and make decisions, particularly amidst uncertainty.
USDA	United States Department of Agriculture
USFS	United States Forest Service
USGS	United States Geological Survey (under which the Northern Rocky Mountain Science Center operates)
USFWS	United States Fish and Wildlife Service
WMA	Montana Fish, Wildlife & Parks Wildlife Management Area
WS	Wildlife Services, USDA

YNP	Yellowstone National Park

Term	Definition
Adaptive management:	A model for wolf conservation and management in which the number of wolf packs determines the appropriate management strategies; changes in the number of packs determined through a monitoring program directs selection of more conservative or liberal management strategies; model incorporates resource objectives, monitoring protocols, evaluation of predicted outcomes, and a decision process.
Aggressive behavior:	Behavior (defensive or offensive) that is threatening to people or property. Defensive behaviors can be associated with defense of itself, its young, or its food. Offensive behaviors can be related to overt attempts to obtain anthropogenic foods in the presence of people or active predation on people or property.
Anthropogenic food:	Foods or attractants having a human origin.
Attractant:	Anything that attracts a wolf to a site.
Aversive conditioning:	A learning process in which deterrents are continually and consistently administered to reduce the frequency of an undesirable behavior.
Breeding pair:	At least two adult wolves with at least two pups that survive to December 31.
Compensation:	Monetary payment to offset or replace the economic loss for a death or injury to livestock or guarding animals due to wolf activity; may also entail financial assistance to livestock producers to offset costs associated with modification to husbandry practices to reduce the potential for wolf-livestock conflicts.

Conditioning:	Learning triggered by receiving a reward or punishment for a given response to a given stimulus. Rewards of unsecured anthropogenic foods can lead to food-conditioning, whereby they learn to associate humans or their infrastructure with food. Although the characterization is usually used in a binary sense (i.e., either "conditioned" or not) because we typically lack both sufficient knowledge of the animal's behavior and intentions and also because we lack a nuanced vocabulary for describing it, conditioning almost certainly exists along a continuum (from mild to severe).
Conflict prevention:	Strategies and actions that aim to deter or prevent wolves from obtaining anthropogenic foods, killing or injuring livestock, damaging property, or injuring people.
Confirmed depredation:	Incident where WS conducts a field investigation of dead or injured livestock, at the request of the producer; depredation is confirmed in cases where there is reasonable physical evidence that an animal was attacked and or killed by a wolf. The primary confirmation would ordinarily be the presence of bite marks and associated subcutaneous hemorrhaging and tissue damage, indicating that the attack occurred while the victim was alive, as opposed to simply feeding on an already dead animal. Spacing between canine tooth punctures, feeding pattern on the carcass, fresh tracks, scat, hairs rubbed off on fences or brush, and or eyewitness accounts of the attack may help identify the specific species or individual responsible for the depredation. Predation might also be confirmed in the absence of bite marks and associated hemorrhaging (i.e., if much of the carcass has already been consumed by the predator or scavengers) if there is other physical evidence to confirm predation on the live animal. This might include blood spilled or sprayed at a nearby attack site or other evidence of an attack or struggle. There may also be nearby remains of other victims for which there is still sufficient evidence to confirm predation, allowing reasonable inference of confirmed predation on the animal that has been largely consumed.
Defense of life/property:	Release from criminal liability for killing or injuring a wolf if the wolf is attacking, killing, or threatening to kill a person, livestock, or a domestic dog (§ 87-6-106, MCA).

Delisting:	Removal of wolves from the list of "threatened or endangered" species that are managed by the USFWS under the ESA; delisting requires evaluation of current status of species compared to the delisting criteria with regard to habitat, over utilization, disease or predation, existing regulatory mechanisms, and other factors affecting the continued existence of the species; if the current status is secure in each of the 5 categories and the recovery criteria are met, a species is delisted and managed by the state or tribal fish and wildlife management authority.
Depredation:	An action generally associated with the killing of domestic livestock animals.
Ecosystem:	Use of this technical term recognizes the complex and, sometimes, unique interactions of many living and non-living components within large landscapes. In this document, reference to an ecosystem refers to the general area occupied by the resident wolf population.
Extirpate:	In population biology, this term typically means to eliminate locally. An entire species could be said to be "extinct" (e.g., the passenger pigeon, *Ectopistes migratorius*); in contrast, we'd characterize wolves in Montana to have once been "extirpated."
Guarding animals:	Domestic animals (e.g., dogs, llamas) that escort livestock to decrease likelihood of a depredation incident by aggressively defending livestock in the presence of wolves or other predators.
Habituation:	The waning of an innate response to a stimulus after repeated or prolonged presentations of that stimulus. Animals that are continually exposed to humans, with no negative consequences, can lose their innate avoidance behavior and become habituated or more precisely human-habituated. Although the characterization is usually used in a binary sense (i.e., either "habituated" or not) because we typically lack both sufficient knowledge of the animals' behavior and intentions and also because we lack a nuanced vocabulary for describing it, habituation almost certainly exists along a continuum (from mild to severe).
Hazing:	A technique where deterrents are administered to immediately modify the undesirable behavior.
Illegal mortality:	Mortality outside the provisions of a special kill permit, defense of life or property, agency management actions, a commission approved season, or outside other regulations established for wolves as a legally classified "species in need of management."

Legal mortality:	Lethal control or mortality of a wolf within the provisions of a special kill permit, defense of life or property, agency management actions, a commission-approved season, or the regulations established for wolves as a legally classified "species in need of management."
Lethal control:	Management actions that result in the death of a wolf.
Livestock:	Cattle, calf, hog, pig, horse, mule, sheep, lamb, goat, guarding animals, emu, ostrich, poultry.
Management	The collection and application of biological information for the purposes of increasing the number of individuals within species and populations of wildlife, up to the optimum carrying capacity of their habitat, and maintaining such levels. The term includes the entire range of activities that constitute a modern scientific resource program including but not limited to research, census, law enforcement, habitat improvement, and education. Also included within the term, when and where appropriate, is the periodic or total protection of species or populations as well as regulated taking (§ 87-5-102, MCA).
Management removal:	Lethal or non-lethal removal of an animal from the population by or at the direction of management personnel.
Management setting:	The combination of landownership patterns, land use, social factors, biological constraints, and physical attributes of the environment that describe a particular area or management situation.
Non-lethal control:	A variety of management activities intended to avert or resolve a conflict situation without killing the wolf or wolves in question; examples include non-lethal harassment to disrupt or interrupt wolf behaviors, frightening a wolf, monitoring of wolf location or using radio telemetry.
Non-lethal harassment:	An example of non-lethal control where a wolf is frightened or threatened, but is not mortally wounded or killed; purpose is to discourage wolf activity near people or livestock; examples yelling, radio-activated noise-makers, or firearms which discharge cracker shells.
Pack:	Used generically to mean a group of wolves holding a territory and capable of reproduction; more specific definitions are social group and breeding pair.

Probable depredation:	Incident where WS conducts a field investigation of dead or injured livestock, at the request of the producer; having some evidence to suggest possible predation, but lacking sufficient evidence to clearly confirm predation by a particular species, a kill may be classified as probable depending on a number of other factors such as (1) has there been any recently confirmed predation by the suspected depredating species in the same or nearby area? (2) How recently had the livestock owner or his employees observed the livestock? (3) Is there evidence (telemetry monitoring data, sightings, howling, fresh tracks etc.) to suggest that the suspected depredating species may have been in the area when the depredation occurred? All of these factors, and possibly others, should be considered in the investigator's best professional judgment.
Problem wolf:	Wolf that has attacked livestock, or is a nuisance animal that could potentially compromise human safety.
Public safety problem or threat:	Any situation where the continued presence of a carnivore poses a threat to human safety; or, an attack has resulted in the loss of livestock or personal pets; or a human has been physically injured or killed.
Recovery goal:	A total of 30 breeding pairs with equitable distribution throughout Montana, Idaho, and Wyoming for three successive years; breeding pair is defined as at least two adult wolves with at least two pups that survive to December 31; when the recovery goal was met, the USFWS initiated the process to remove wolves from the list of threatened and endangered species protected by the ESA.
Relisting:	Placing the a species back on the federal list of threatened or endangered species protected by the ESA; relisting criteria may or may not be similar to delisting criteria; relisting requires evaluation of current status of species compared to criteria with regard to habitat, over utilization, disease or predation, existing regulatory mechanisms, and other factors affecting the continued existence of the species; if current status is not secure with regard to the 5 areas, a species may be relisted.
Regulated public harvest:	Category of legal wolf mortality where wolves are killed under commission-approved seasons and regulations by licensed hunters or trappers; total harvest strictly controlled through permit or quota system; law enforcement as for other managed species.
Removal:	Capture and either lethal removal or placement of an animal in an authorized zoological or research facility.

Social group:	A more specific definition of a wolf pack; in this document social group is defined as four or more wolves traveling in winter which is holding a territory and capable of reproduction.
Special kill permit:	Written authorization granted to a property owner by FWP to kill or destroy a specified number of animals causing damage to private property; permits are only valid under a specific set of conditions or criteria.
Species in need of management:	Legal classification of nongame species that are designated by FWP as needing special management regulations; FWP, by regulation, establishes the limitations relating to taking, possession, transportation, exportation, processing, sale or offer for sale, or shipment considered necessary to manage nongame wildlife; Except as provided in regulations issued by the Department, it is unlawful for any person to take, possess, transport, export, sell, or offer for sale species designated by FWP as "in need of management" (§ 87-5-131, MCA).
Take:	To harass, hunt, capture, or kill or attempt to harass, hunt, capture, or kill wildlife.
Tri-state area:	States of Montana, Idaho, and Wyoming, making up the NRM wolf recovery area.
Unconfirmed:	Incident where WS conducts a field investigation of dead or injured livestock, at the request of the producer; lacking sufficient evidence to classify an incident as depredation in contrast to other possible causes of death, it is classified as unconfirmed; it is unclear what the cause of death may have been. The investigator may or may not have much of a carcass remaining for inspection, or the carcass may have deteriorated so as to be of no use; in the context of wolf management, cause of death is attributed to a cause other than wolf predation.
Undocumented:	Livestock losses for which there is no apparent explanation for the loss; usually in the context of a numerical discrepancy between the number of livestock head at the beginning of the grazing season and what is retrieved at the end of the grazing season; evidence documenting a death is usually not found.
Wolf-human conflict:	Where a public safety problem develops; a situation where an FWP employee reasonably determines that the continued presence poses a threat to human safety, an attack has resulted in the loss of livestock or personal pets, or that a human has been physically injured or killed.
Wolf-livestock conflict:	Where a wolf or wolves are loitering, testing, worrying, or otherwise disrupting livestock; also, a situation where a wolf is suspected to have killed or injured livestock or guarding animals.