Wyoming Chronic Wasting Disease Management Plan

Wyoming Game and Fish Department

Cheyenne, Wyoming

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Acknowledgments

The Wyoming Chronic Wasting Disease (CWD) Management Plan is a product of efforts from many stakeholders as part of the collaborative CWD Working Group process. The Wyoming Game and Fish Department (Department) recognizes the dedication and hard work of those who served on the CWD Working Group during the development of this Plan. This group included: Justin Caudill (State Agency, Wyoming Department of Agriculture); Kent Connelly (Local Government, Lincoln County Commissioner); Millie Copper (Sportsperson); Joshua Coursey (Conservation NGO, Muley Fanatic Foundation); Jeff Daugherty (Conservation NGO, Rocky Mountain Elk Foundation); Nick Dobric (Conservation NGO, Theodore Roosevelt Conservation Partnership); Luke Esch (State Agency, Wyoming Department of Environmental Quality); Garret Falkenburg (Landowner or Agricultural Community); Sy Gilliland (Outfitter, President, Wyoming Outfitters and Guides Association); Kristen Gunther (Conservation NGO, Wyoming Outdoor Council); Dave Gustine (Federal Agency, Grand Teton National Park); Karinthia Harrison (General Public); Martin Hicks (Wyoming Game and Fish Department); Larry Hicks (Wyoming State Legislature, Senate District 11); Lyle Lamb (State Agency, Wyoming Department of Transportation); Libby Lankford (Landowner or Agricultural Community); Bruce Lawson (Sportsperson); Tony Lehner (Local Government, Converse County Commissioner); Jim Logan (State Agency, Wyoming Livestock Board, State Veterinarian); Janet Marschner (Sportsperson); Steve Martin (Sportsperson); Dax McCarty (Outfitter); Laura Meadows (Conservation NGO, Wyoming Wildlife Federation); Shane Moore (General Public); Richard Pallister (Sportsperson); Andrew Pils (Federal Agency, USDA Forest Service); Mike Schmid (Wyoming Game and Fish Commission); Brant Schumaker (Scientist, University of Wyoming); Dan Smith (Wyoming Game and Fish Department); Joe Tilden (Local Government, Park County Commissioner); and James Wright (Federal Agency, Bureau of Land Management). Joshua Coursey and Kristin Gunther served as co-chairs of the CWD Working Group. Alternates who participated in the process included: Ambrosia Brown (Outfitter); Sarah Dewey (Federal Agency, Grand Teton National Park); Craig McOmie (State Agency, Wyoming Department of Environmental Quality); and Steve Robertson (Conservation NGO, Rocky Mountain Elk Foundation). The CWD Working Group was facilitated by Dr. Jessica Western, Senior Research Scientist, Human Dimensions and Natural Resources, Director of the Collaboration Program in Natural Resources, Ruckelshaus Institute, University of Wyoming.

The Department's CWD Management Team developed and provided technical information and oversight to the collaborative CWD Working Group process. Members include: Greg Anderson (North Lander Wildlife Biologist); Chris Baird (Kemmerer Game Warden); Justin Binfet (Casper Region Wildlife Management Coordinator); Corey Class (Cody Region Wildlife Management Coordinator); Justin Dodd (Kaycee Game Warden); Scott Edberg (Deputy Chief, Wildlife Division); Hank Edwards (Wildlife Health Laboratory Supervisor); Brad Hovinga (Jackson Region Wildlife Supervisor); Lee Knox (Laramie Wildlife Biologist); Jordan Kraft (South Pinedale Game Warden); Bart Kroger (Worland Wildlife Biologist); Janet Milek (Casper Region Public Information Specialist); and Dr. Mary Wood (Wildlife Veterinarian). The original deer hunter perspective survey was developed in Colorado by Dr. Mike Quartuch (Ph.D., Human Dimensions Specialist/Researcher, Colorado Parks and Wildlife, Policy and Planning Section). Analysis of the Wyoming deer hunter perspective survey regarding CWD was provided by Emily Gates (Harvest Survey Coordinator).

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Message from the Director

Message from the Wyoming Game and Fish Department Director, Brian Nesvik

Chronic wasting disease (CWD) was first discovered in Wyoming more than three decades ago. Since that time, the Wyoming Game and Fish Department has strived to gain a better understanding of the disease through research and on the ground monitoring. We have spent years working in cooperation with other researchers evaluating vaccines, considering genetics, and searching for diagnostic test options, all while gathering over 30 years of prevalence data.

We are still learning more about this disease and its effects on Wyoming's deer and elk populations, but for the first time, there is clear evidence that CWD is adversely affecting the overall health and viability of some herds.

As wildlife managers, it's our job to tackle this difficult issue, but we can't do it alone. Wyoming's wildlife are public resources highly valued by our citizens and it's in this spirit that the Department launched a robust collaborative CWD Working Group made up of members of the public. We hosted public meetings and took public comment before and after the group did their work to ensure this plan considers a wide range of ideas. Recommendations on the management actions we considered in developing this revised CWD management plan are strongly based on the newest science and those ideas we heard from the public. The time and commitment the Department and the CWD Working Group dedicated to the development of this document was substantial and greatly appreciated.

Our's and the public's work doesn't end with the creation of this plan. Our next steps are putting these management actions into practice and adapting this plan based on what we learn. This plan outlines some immediate actions we can do to curb this disease, but many of the strategies listed here are long-term efforts that may take over a decade to see through to completion. Some of the actions are things we can do as wildlife managers, while others are things we will ask the public to help us with.

As we move forward to take on this issue, I ask for people to remain engaged. We will provide information to the public on the management actions we deploy, and there may be changes to regulations. If you have a question about what we are doing, ask, and when there are public meetings, please attend.

As I mentioned earlier, the Department cannot take on this issue alone. We will continue to conserve wildlife and serve people in the face of this challenging disease that affects deer, elk, and moose in Wyoming.

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Definitions

The following words or terms are found within this Plan or other popular articles and peer-reviewed publications related to chronic wasting disease.

Age structure: the distribution of animals by age within a population. Often expressed as relative numbers of animals by given age categories, such as fawns, yearlings, mature animals, or by individual ages: 0, 1, 2, 3, 4, … years of age.

Bovine spongiform encephalopathy (BSE): a transmissible spongiform encephalopathy (see below) affecting cattle, caused by a prion.

Captive cervid herd: a herd of deer or elk that is confined and managed as a herd of domestic animals would be.

Central nervous system: the brain and spinal cord.

Cervids: a mammal of the family Cervidae (deer family), which includes white-tailed deer, mule deer, elk, and moose.

Clinical signs: something abnormal, relevant to disease in an animal, and detected by an observer. Animals are considered to have clinical signs instead of "symptoms."

Culling: the intentional removal of animals from a population to improve the status of the base population. Generally, culling is accomplished via lethal removal usually by governmental employees or contracted agents.

CWD-positive: the designation for an animal determined to have been infected with the CWD prion.

CWD endemic area: geographic area in which animals affected with CWD are found.

Environmental contamination: the process whereby prions shed from carcasses or from live animals via urine, feces, and saliva, enter the environment (soils, plants, surfaces) and remain infectious to cervids.

Epidemiology: the incidence, distribution, and possible control of diseases and other factors relating to health.

Free-ranging: refers to cervids that are not confined within a high fence and are able to move freely across the landscape.

Herd Unit: the delineation of a population of big game animals bound by natural (geographic) or human-made barriers that restrict interchange with adjacent populations to less than 10% of the population's size. Herd unit boundaries should contain all necessary seasonal ranges (habitats) to accommodate the entire lifecycle of the animals in that population. Hunt areas are established within herd units to achieve harvest objectives and to distribute hunting pressure.

Lymph node: a small bean-shaped structure that is part of the body's immune system. Lymph nodes filter substances that travel through the lymphatic fluid, and they contain lymphocytes (white blood cells) that help the body fight infection and disease.

Monitoring: efforts to track changes and prevalence of a disease (e.g., CWD) once detected within a population over time.

Obex: the section of the brainstem between the brain and the spinal cord frequently used to test for CWD.

Population dynamics: the changes in population size and the factors affecting whether a population is stable, declining, or expanding.

Prevalence/Prevalence rate: the percentage of cervids in a population (herd unit) or hunt area that are CWD-positive at a point in time or over a specified period of time and is based on an adequate sample size and that is well distributed across the herd unit based on animal distribution.

Prion: an abnormal protein particle that is the cause of brain diseases such as CWD, scrapie, and Creutzfeldt–Jakob disease. Prions are not visible microscopically, contain no nucleic acid, and are highly resistant to destruction.

Retropharyngeal lymph nodes: lymph nodes (see above) located in the back of the upper throat of the animal. In harvested cervids, they are frequently used as the sample for CWD testing.

Surveillance: efforts to detect the occurrence of a disease (e.g., CWD), within a specific species and geographic area where the disease has not yet been documented.

Targeted surveillance: efforts to detect the occurrence of a disease (e.g., CWD) within an individual animal exhibiting clinical signs of the disease.

Transmissible spongiform encephalopathies (TSEs): diseases caused by abnormal forms of prions that convert normal cellular proteins to abnormal prions. The net effect of this conversion is the formation of plaques of protein in nervous or lymphoid tissue (usually the brain), which eventually create spaces or "holes" in that tissue. "Spongiform" refers to the sponge-like appearance of this tissue under a microscope, while "encephalopathy" refers to the resulting abnormal function of the brain.

Chronic Wasting Disease Management Plan Guide

Summary

This Chronic Wasting Disease Management Plan (Plan) provides an overview of the biology, current prevalence and distribution, and potential management of CWD, a prion disease that increasingly threatens cervids (e.g., deer, elk, moose) in Wyoming. Potential management strategies outlined within this Plan are grounded in best-available science and accepted wildlife management practices, as well as recommendations from wildlife management experts from around the nation. This Plan was formulated through recommendations from a large public stakeholder working group, input from the general public garnered through public meetings around the state, as well as consideration of large-scale survey data from the Wyoming hunting public. See Appendices B and C for more information regarding the public process that underlies the creation of this Plan.

Contents

This Plan addresses the following topics:

- The biology of CWD, historic/current prevalence, and distribution within Wyoming;
- CWD testing/surveillance protocols and laboratory testing capacity;
- Science-based disease management strategies for consideration in herds or subpopulations with varying population dynamics and levels of CWD prevalence, including general guidelines for public engagement prior to management implementation, and the need to thoroughly evaluate any strategy implemented;
- Issues surrounding elk feedground management and the emerging threat of CWD, including direction for an upcoming comprehensive public input process regarding elk feedgrounds, and;
- Priority CWD research topics.

How will this Plan be implemented?

This Plan outlines planned surveillance/monitoring of CWD and a suite of potential strategies managers may implement in an attempt to manage the prevalence and distribution in Wyoming's cervid herds. This Plan is intended to be dynamic and flexible, and will be revised periodically as new information emerges. The decision of where and when to propose any type of CWD management will rest with local managers, and will consider specific issues within identified herds or subpopulations. Prior to implementation, any proposed management strategy that could result in significantly elevated hunter harvest or cervid density reductions must have public support, and ultimately Wyoming Game and Fish Commission (Commission) approval. This Plan does not provide for a statewide or regional approach to CWD management. Strategies will be tailored to local herd and disease dynamics, and broad and diverse public support must be garnered before being implemented. Once implemented, effectiveness of disease management strategies must be thoroughly evaluated, with results being widely disseminated to bolster the broader understanding of CWD management. Additionally, this Plan identifies various research priorities designed to enhance scientific understanding of CWD, as well as the need to pursue funding. In summary, this Plan provides an array of potential management strategies and research needs for local managers to consider for the long-term health and sustainability of Wyoming's wildlife populations.

Executive Summary

This Wyoming Chronic Wasting Disease Management Plan provides general and strategic guidance for the Wyoming Game and Fish Department in the management of chronic wasting disease in Wyoming cervid populations. These CWD management recommendations were developed with public input through a collaborative working group (CWD Working Group) process in coordination with the Department. This Plan will also guide Department internal and external communications and the development of informational and educational material regarding issues related to CWD.

Chronic wasting disease is a chronic, fatal disease affecting the central nervous system of members of the deer family (*Cervidae*). In Wyoming, CWD affects mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*), elk (*Cervus canadensis*), and moose (*Alces americanus*). This disease was first documented in free-ranging mule deer in Wyoming in 1985, and has since been documented in all Wyoming cervid species and across most of the state. As of February 2020, CWD has been identified in 31 of 37 (84%) Wyoming mule deer herds, nine of 36 (25%) elk herds, and generally wherever white-tailed deer occur. Increasing prevalence and distribution of CWD has the potential to cause widespread and long-term negative impacts to Wyoming's cervid populations. Prevalence of this disease in chronically infected Wyoming deer herds has exceeded 40%, with one elk herd exhibiting nearly 15% prevalence. The Department will continue to conduct surveillance and monitoring to estimate the spatial distribution and prevalence of CWD at the herd unit level on a rotating basis throughout the state. The Department will strive to test 200 samples per herd unit over a three-year period to estimate prevalence. In addition to surveillance and monitoring, the Department will continue to provide avenues for testing of hunter-harvested cervids for the general public.

As the known distribution of CWD continues to expand throughout North America and elsewhere, viable disease management strategies are needed for free-ranging cervid populations given eradication is not currently feasible. As such, the Department will implement and evaluate management actions to slow the spread and/or reduce/limit prevalence of the disease statewide while maintaining healthy and sustainable wildlife populations. The desired long-term objective for managing CWD in Wyoming is to reduce or limit prevalence and spread where possible.

This Plan presents a suite of prospective management strategies designed to reduce CWD prevalence by mitigating artificial sources of cervid concentration, utilizing hunter harvest to maximize the removal of animals most likely to be positive, and pursuing or enforcing statutory and regulatory provisions regarding CWD. To reduce artificial cervid concentrations, the Department will pursue statewide or local feeding bans where possible, identify points or sources of concentration, and develop strategies to decrease cervid concentrations to minimize CWD transmission. Experimental hunter harvest strategies may be proposed in some areas to increase harvest of mature male deer and/or reduce cervid densities. Hunter harvest strategies that focus on significant reductions in male deer and/or overall densities will only be implemented in areas where broad and diverse public support exists, and will ultimately require Commission approval. These strategies will not be proposed on a large scale (i.e., within numerous herd units or across large geographic areas) in the absence of peer-reviewed published research indicating they are a viable means to reduce CWD over the long term. In the event such hunter harvest strategies are proven to effectively reduce CWD prevalence, the Department will initiate additional communication and outreach efforts with the public and update the Commission accordingly. Similar harvest management strategies may then be proposed in additional areas pending broad public support and Commission approval. By implementing such harvest management strategies in select areas, the Department will foster the

broader understanding of CWD management. Requisite outreach, communication, and public involvement will be key to garner and maintain public support for the successful implementation of long-term CWD management strategies. Where conducted, experimental harvest management strategies will be implemented over a sufficient timeframe to allow for robust evaluation of their efficacy. Assessments will be shared with the public and appropriate agencies and institutions within and outside Wyoming to bolster the broader understanding of CWD management.

The Department will identify CWD issues specific to each cervid herd where appropriate. These issues will be chronicled within the Department's annual Job Completion Reports (JCRs) and will be considered when formulating annual management recommendations and long-term objectives. The Department will continue to surveil for CWD in areas where this disease has not yet been documented, including within elk herds associated with feedgrounds. Due to the complex nature of elk feedgrounds and disease management, the Department will initiate a collaborative process in Teton, Sublette, and Lincoln counties to gather stakeholder input to develop a supplemental management plan. While the feedground public input process will be localized, there will be opportunity for statewide input.

As opportunities and resources allow, the Department will pursue funding and participate in CWD research, and will coordinate with other state, federal, tribal, and international agencies as well as entities of higher education, universities, and other researchers. In addition, the Department will develop a comprehensive communication plan to inform the public and garner support for the implementation of local and statewide CWD management strategies. Current and accurate CWD information and educational material will be provided to the public on an ongoing basis via the Department's website and other public and media outlets. Finally, the Department's internal CWD Management Team will meet regularly to chronicle, review, and evaluate applied management strategies throughout the state.

Goals and Purpose

This Plan provides guidance for the Wyoming Game and Fish Department to manage the prevalence and distribution of CWD within Wyoming's cervid herds. In addition, the Plan provides for the continued coordination of management strategies and research with other state, federal, tribal, and international agencies, as well as institutions of higher learning. Despite significant advances in our understanding of CWD, there is little published information on which management strategies are effective in reducing CWD prevalence (Miller and Fischer 2016, Uehlinger et al. 2016). In the absence of definitive CWD management measures, a long-term adaptive approach will be developed for CWD management. Adaptive management enables the experimental application and thorough evaluation of CWD suppression strategies whereby lessons learned inform future management strategies. Given the nature of CWD epidemiology, this will require long-term planning, implementation, and evaluation to thoroughly understand the efficacy of any strategy. Utilizing an adaptive management framework to reduce the spread and prevalence of CWD will require the Department to invest considerable resources into public input gathering, communications, experimental design, evaluation, and data collection. Prior to any management action, broad and diverse public support for proposed strategies must be garnered before and during implementation.

It is incumbent upon wildlife managers to explore ways to manage CWD prevalence and contribute to the broader understanding of effective CWD management. Since the initial discovery of CWD in 1985 in a free-ranging mule deer in Wyoming, the Department has not implemented any formal strategies to combat the spread or prevalence of this disease. Unfortunately, CWD has since been documented throughout most of the state, with many mule deer and white-tailed deer herds now exhibiting CWD prevalence levels high enough to potentially impact population performance. The need to develop proven methods to manage CWD is now readily apparent, and doing nothing to combat this disease is no longer acceptable, a sentiment strongly echoed within hunter survey data.

Introduction

Chronic wasting disease is a chronic, fatal disease affecting the central nervous system of members of the deer family (*Cervidae*). In Wyoming, CWD affects mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*), elk (*Cervus canadensis*), and moose (*Alces americanus*). This disease belongs to the group of rare diseases called transmissible spongiform encephalopathies (TSEs). These diseases are caused by abnormal proteins called "prions," which are proteins devoid of nucleic acid. Prions have similar amino acid sequences compared to normal cellular proteins, but in an altered conformation. Prions cause a conformational change in the normal cellular protein structure, and disease is induced when the normal cellular protein is converted into the abnormal prion protein. The accumulation of prions leads to central nervous system cell death (Forloni et al. 1993). The disease progresses as more nervous system cells are lost, ultimately ending in the death of the animal. There is currently no cure for CWD or other prion diseases, partly because the immune system of an infected animal does not recognize prions as a source of infection. Therefore, there is no immune response, making the development of a vaccine or other treatments very difficult.

Early in the course of CWD, animals show no clinical signs. As the disease advances, affected animals show weight loss, reluctance to move, excessive salivation, droopy ears, increased drinking and urinating, and lethargy. No immunity, recovery, or absolute resistance to CWD has been documented. This disease is always fatal, and most animals die from the disease within about 2.5 years of infection (Miller et al. 2012, Miller et al. 2008). However, natural genetic variation in host species can extend survival time following infection. Infected animals do not typically exhibit clinical signs until late in the course of the disease, resulting in the majority of hunter-harvested animals that test positive for CWD appearing to be in normal body condition. Infection can be detected in carcasses as well as in live animals, and diagnostic tests become increasingly reliable as CWD progresses (Miller and Fischer 2016). Chronic wasting disease is infectious, and prions are shed from several routes during most of the disease course, exposing other cervids either directly or through environmental contamination. Prions can persist for years in the environment, and their binding to soil elements (e.g., clay) enhances persistence and infectivity (Johnson et al. 2007). The environmental persistence of prions complicates disease management and control, especially once prevalence is high (Miller and Fischer 2016).

Initial modeling efforts predicted CWD would drive affected cervid populations to extinction (Gross and Miller 2001). More recent projections suggest CWD may have significant population-level impacts in Rocky Mountain National Park elk (Monello 2013, Monello 2014), Wyoming white-tailed deer (Edmunds et al. 2016), and Wyoming mule deer (DeVivo 2017). Other research suggests certain populations may be able to survive, bolstered by genetic selection and some level of hunting season restrictions (Robinson 2012, Williams 2014). Regardless, endemic CWD will likely depress some cervid populations at an unknown but potentially significant level. As such, management efforts designed to reduce the spread and prevalence of CWD are warranted.

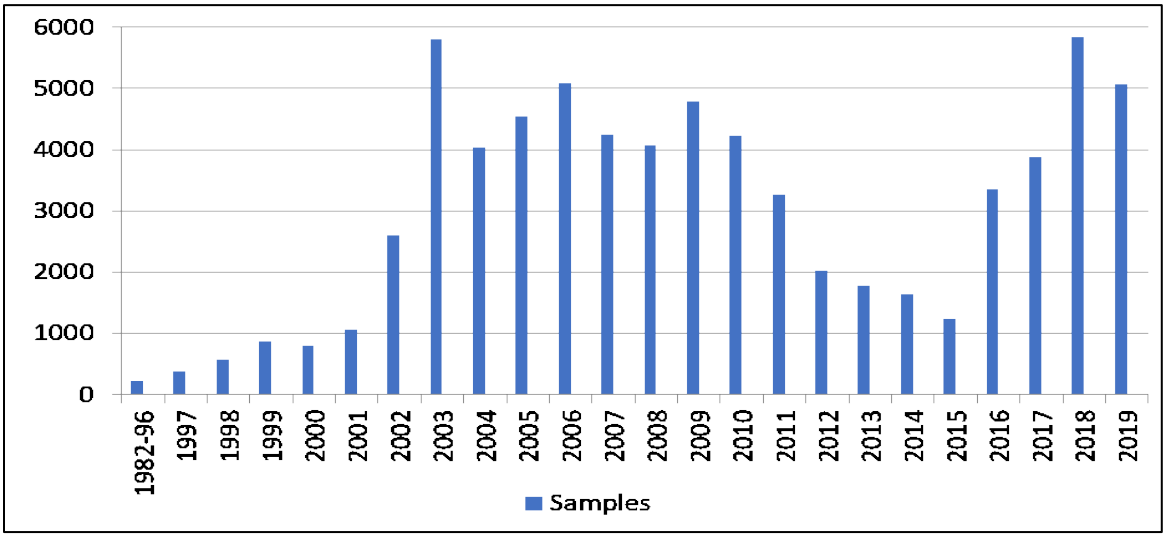
Chronic Wasting Disease in Wyoming

Chronic wasting disease was first recognized in 1967 in captive mule deer in a facility near Fort Collins, Colorado (Williams and Young 1980), and was later detected in Wyoming in the 1970s at the Department's Tom Thorne/Beth Williams Wildlife Research Center north of Laramie. Initially, CWD was thought to be related to nutrition but was later identified as a TSE by Dr. E.S. Williams in

1978 (Williams and Young 1980). The timing of the introduction of CWD into Wyoming, as well as its origin, remains unknown. In Wyoming, this disease was first identified in free-ranging mule deer in 1985, elk in 1986, white-tailed deer in 1990, and moose in 2008.

Prior to 2000, CWD was poorly understood and of little interest at the national level. Starting in the late 1990s and early 2000s, concern over CWD rapidly increased as more jurisdictions began to detect the disease, and questions about human health arose. In 1996, bovine spongiform encephalopathy (BSE) was linked to variant Creutzfeldt-Jakob Disease in people in the United Kingdom (Bruce 1997). The similarities of CWD and BSE led to human health fears over the consumption of CWD-positive cervids. From 2002 to 2012, human health concerns resulted in federal funding for CWD surveillance across the nation. This funding enabled Wyoming to greatly increase surveillance, although surveillance efforts waned after funding declined in 2010. Decreasing public and agency interest in CWD, from both a wildlife and human health perspective, led to further decline in disease surveillance efforts (Figure 1). That trend was reversed when emerging research identified the potential negative effects of CWD on western deer and elk populations (Geremia et al. 2015, Edmunds et al. 2016, DeVivo et al. 2017, Monello et al. 2014). Concern also increased within the Department when sharp increases in prevalence were detected in deer herds outside of what was then considered to be Wyoming's core endemic area (southeastern Wyoming), such as in the Bighorn Basin and along the eastern slope of the Bighorn Mountains.

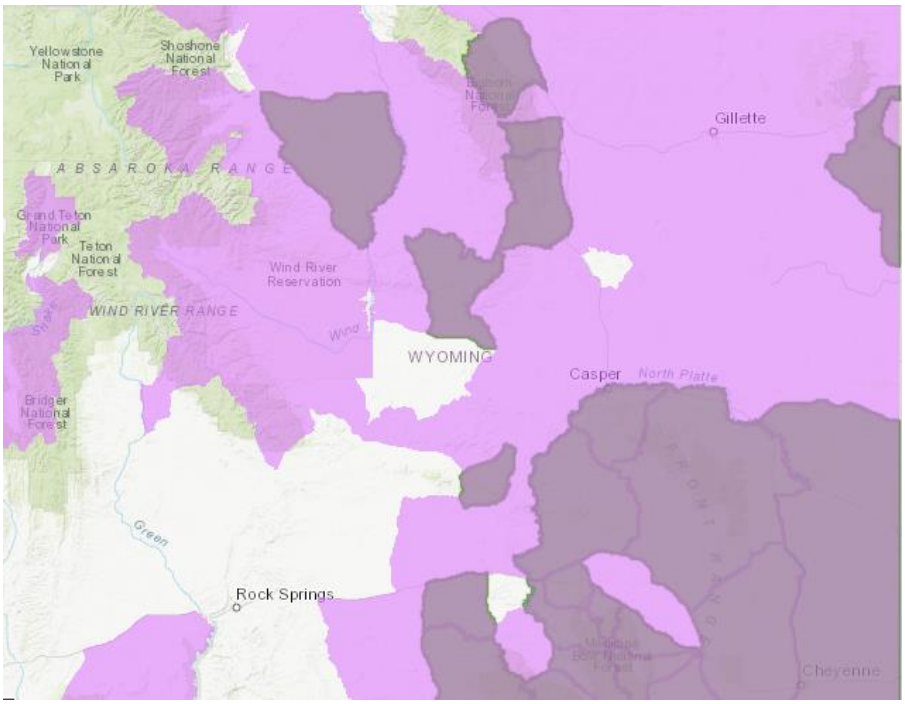
Figure 1. Total CWD samples tested by year in Wyoming (1982-2019).



Since the discovery of CWD in southeast Wyoming in a free-ranging mule deer in 1985 and in a free-ranging elk in 1986, this disease has now been documented throughout most of the state (Figure 2). As of February 2020, CWD had been identified in 31 of 37 (84%) of the state's mule deer herds, in nine of 36 (25%) of the state's elk herds, and generally wherever white-tailed deer occur in Wyoming (white-tailed deer herd units are loosely defined in Wyoming outside of the Black Hills). In contrast, CWD remains very rare in moose, and has only been detected in one targeted moose in 2008, with 1,198 moose tested to date. Prevalence estimates vary between herds, although deer herds generally exhibit significantly higher prevalence than sympatric elk herds (Table 1). In the majority of mule deer herd units where statistically significant sample sizes have been obtained, prevalence has steadily increased since its initial discovery within that herd. However, in some southeastern Wyoming mule

deer herds where the disease has long been established, CWD prevalence has either somewhat declined from peak levels and/or has remained relatively static, albeit at levels high enough to likely impact population performance. Overall, prevalence tends to be higher in southeastern Wyoming, where the disease has long been established, but is quickly becoming more common and widespread in much of the state.

Figure 2. Known CWD distribution in Wyoming deer and elk hunt areas (2019).



*Purple areas depict deer hunt areas where CWD has been documented in mule deer and/or white-tailed deer. Dark shaded areas depict elk hunt areas where CWD has been documented in elk.

Table 1. CWD prevalence in sympatric Wyoming mule deer and elk herd units based on adult mule deer bucks and adult male and female elk (2016-2018).

Species and Herd Unit	Sample Size	Prevalence	95% C.I.
Mule Deer - Platte Valley	222	8%	4.2% - 12%
Mule Deer - Laramie Mountains	415	23%	15.6% - 27.7%
Mule Deer - Bates Hole/Hat Six	199	28%	16.9% - 34.9%
Mule Deer - South Converse	105	40%	21.1% - 48.2%
Elk - Snowy Range *(compare to Platte Valley mule deer)*	271	2%	0.6% - 4.3%
Elk - Laramie Peak / Muddy Mountain *(compare to Laramie Mountains, Bates Hole / Hat Six & South Converse mule deer)*	441	7%	4.5% - 9.8%
Elk - Iron Mountain *(compare to Laramie Mountains mule deer)*	168	14%	7.9% - 18.4%

Chronic Wasting Disease Outside of Wyoming

Chronic Wasting Disease has now been documented in captive and/or free-ranging cervids in 26 U.S. states, four Canadian provinces, Norway, Sweden, Finland, and South Korea. See the United States Geological Survey (USGS) National Wildlife Health Center website for a map of current CWD distribution in North America (https://www.usgs.gov/media/images/distribution-chronic-wasting-disease-north-america-0).

Surveillance and Monitoring

The Department has conducted surveillance for CWD since 1997. Surveillance to detect CWD in new areas is conducted utilizing three primary sources for testing: hunter-harvested cervids, targeted cervids (animals exhibiting clinical signs of CWD), and road-killed cervids. Targeted and road-killed cervids have a greater likelihood of testing positive for CWD and are therefore valuable in detecting the disease in new areas, but are not used to estimate prevalence. Disease monitoring to estimate prevalence primarily utilizes hunter-harvested cervids.

Initially, surveillance focused on the detection of CWD in new areas of the state while monitoring disease prevalence occurred in southeastern Wyoming where it was first detected. The current broad and expanding distribution of this disease necessitates a shift in surveillance from detection of the disease on the leading edge of the known endemic area to monitoring its prevalence. Monitoring changes in CWD prevalence is important in understanding the potential impacts of the disease, as well as evaluating the efficacy of management actions.

To adequately monitor this disease while balancing the testing capacity of the Wildlife Health Laboratory (WHL), the Department will employ a rotating, multi-year program that will focus surveillance in one or two herd units in each Department region of the state each year. Because CWD is a slow-moving disease with only gradual changes in prevalence, measuring prevalence every five years will provide adequate data to detect trends. Rotational surveillance will follow a set five-year schedule within each Department region, although scheduling will remain adaptive and flexible to meet changing surveillance needs (e.g., to gauge the efficacy of experimental management strategies), population objectives, as well as to incorporate current knowledge of disease epidemiology whenever possible.

Surveillance efforts for each deer and elk herd unit are based on the feasibility of collecting a minimum of 200 samples from adult male deer or adult elk within one to three years, as well as with consideration of additional Department priorities for monitoring and management actions. The success of sampling efforts is dependent upon a suite of factors including harvest strategy (i.e., general versus limited quota hunting, female harvest allowances, season length, etc.), the overall size of the herd unit, landownership patterns, hunter access, hunter participation in the surveillance program, likelihood of the harvested animal being field-checked, and other demands on Department personnel and resources. CWD sample collection in focal surveillance herd units is an expectation of all Department employees. Within some herd units, collecting 200 samples within a single year is feasible, while it may not be possible to collect even 100 samples over a three-year period in others. These factors are considered when formulating annual CWD surveillance plans within each Department region. It must be recognized that achieving sufficient sample sizes for valid prevalence estimates may not be feasible for all cervid herds in Wyoming. In addition, the Department may consider testing road-killed animals to augment surveillance in areas where adequate sample sizes are difficult to obtain through hunter harvest, especially for female mule deer. However, prevalence data from road-killed animals should be interpreted with caution as CWD-positive animals are more likely to be hit by a vehicle given diminished behavioral awareness (Krumm at al. 2005).

Sample size requirements vary considerably depending on the overall goal of surveillance. When estimating prevalence, sample size requirements increase as prevalence increases in a herd unit. A sample size of 200 was selected as a uniform goal across the state, reflecting 90% – 96% confidence, given the known CWD prevalence of most herd units. However, when assessing changes in

prevalence over time (e.g., evaluating the effectiveness of management actions), sample size requirements increase when attempting to measure small changes in prevalence. Details on sample size calculations based on statistical confidence are provided in Appendix A.

Chronic wasting disease prevalence in mule deer is based on adult males (≥2 years old), a standard metric that allows for comparisons of disease demographics across North American jurisdictions. The selection of males is based on monitoring data that demonstrates prevalence in adult males is significantly higher than adult females within the same herd. Moreover, infection is less common in yearlings, and relatively rare in fawns. In addition, because female mule deer harvest is limited in Wyoming, sampling hunter-harvested adult males provides larger sample sizes for assessment of long-term trends in prevalence. Although the focus is on adult males, assessment of yearling male and adult female prevalence is also monitored in those herds where harvest is sufficient to achieve meaningful sample sizes.

For CWD monitoring in white-tailed deer, prevalence can be measured in adult males for cross-jurisdictional comparisons, but can also be adequately measured in females in many areas in Wyoming due to liberal harvest strategies. However, white-tailed deer populations are not well defined at the herd unit level in Wyoming as they are a lower priority for population demographic data collection in most of the state. In elk, CWD prevalence is also measured in adults of both sexes due to the significant level of male and female harvest attained within many of Wyoming's elk herds.

Testing for Hunter-Harvested Cervids Outside of Department Focal Herd Units

The Department recognizes some members of the public wish to have their deer, elk, or moose tested for CWD each year due to human health concerns. These concerns result in an influx of sampling from cervids harvested outside of focus surveillance areas for a given year. Despite WHL testing capacity considerations, the Department will continue to test unsolicited samples to the extent possible and will provide several sample collection options to accommodate this demand. Heads from harvested animals may be taken to any Department regional office during regular business hours for sampling, and they may be left if no personnel are immediately available. The head or removed retropharyngeal lymph nodes may also be submitted to the Wyoming State Veterinary Laboratory for a fee, with results being available within ten working days. Additionally, the Department will continue to provide sample collection training and educational opportunities to members of the public wishing to collect their own samples. Samples may be also collected in the field upon sportsperson request by Department personnel when available.

Collecting samples outside of annual priority areas may not be feasible in many instances due to funding and personnel limitations. Budgetary constraints and caps on the number of temporary employees that can be hired by the Department must be balanced with other agency needs and priorities. When possible, the Department will pursue additional funding opportunities, including personnel allowances, to assist in sample collection in communities outside of roving priority areas. However, efforts to collect adequate samples in focal areas will be prioritized.

Wildlife Health Laboratory Testing Capacity

Testing capacity of CWD samples at the WHL is limited. With the utilization of other Department laboratories and purchase of required equipment, testing capacity has increased to 15,000 samples per year. Substantial infrastructure and personnel will be required to exceed that level of testing.

Establishing additional testing laboratories throughout the state may decrease shipping times while increasing testing capacity. However, this would require substantial funding for infrastructure and personnel. In addition, new labs are required to conform to regulatory requirements as they must be federally accredited for CWD testing.

Disease Management Strategies

As the known distribution of CWD continues to expand, viable disease management strategies are needed for free-ranging cervid populations given eradication is not currently feasible (https://www.usgs.gov/media/images/distribution-chronic-wasting-disease-north-america-0). In 2018, the Western Association of Fish and Wildlife Agencies (WAFWA) published "*Recommendations for Adaptive Management of Chronic Wasting Disease in the West*" to facilitate the assessment of three CWD suppression strategies using an adaptive management framework in western states (WAFWA 2017). The three primary strategies include: 1) reduction of artificial points of host concentration; 2) hunter harvest management; and 3) harvest targeting disease foci, otherwise known as "hot spots". Furthermore, WAFWA recommends using a Before-After-Control-Impact (BACI) design to determine what treatments most effectively influence CWD prevalence. The Department is well-suited to use a BACI design given a reasonable understanding of herd unit dynamics across the state.

Experimental management actions will be evaluated thoroughly (pre, post, and during implementation), and will enhance the national and international understanding of CWD management. To this end, the Department will pursue and implement CWD suppression strategies under an adaptive management framework. Many management strategies will require a BACI design for robust evaluation, while other strategies are more simplistic and may not require thorough analysis (i.e., fencing an individual haystack to reduce deer concentration). Management strategies will be determined at the local level and specifically tailored to each herd unit or localized sub-population, with consideration given to differences between migratory and non-migratory populations.

Although eradication is not feasible at this time, it is incumbent upon wildlife managers to attempt to manage CWD prevalence and distribution for the long-term health and sustainability of cervid populations. The Department will therefore consider and evaluate management actions to slow the spread and/or reduce prevalence of the disease statewide while maintaining healthy and sustainable wildlife populations. Such management actions will be based on the best available scientific information and accepted wildlife management practices. The Department acknowledges some management strategies are experimental in nature, and may be met with controversy from the public. As such, the Department will not proceed with any CWD management actions unless broad and diverse public support exists. Public support is imperative, and localized public input and education processes will be developed as necessary. Ultimately, any CWD management strategies involving hunter harvest will also require Commission approval through the traditional season setting or other regulatory processes.

Management strategies designed to reduce CWD prevalence will emphasize reducing artificial cervid concentration and hunter harvest management. Implementation of management strategies outlined within this Plan is either ongoing, will begin immediately, or will necessitate long-term planning and public input prior to management action. Implementation timeframes will vary, although most management actions will need to be implemented over a long period of time (e.g., ten years or longer) to fully evaluate their efficacy. Even though CWD has the most significant population-level impacts where prevalence is high, the greatest potential for successful CWD management likely occurs in areas where prevalence is low and environmental contamination plays a smaller role in disease transmission. Management of this disease is therefore recommended at all prevalence levels.

Artificial Sources of Cervid Concentration

High concentration of cervids may exacerbate CWD transmission via animal-to-animal contact and increased environmental contamination due to prion accumulation. Large concentrations of cervids are commonly observed on traditional deer and elk winter ranges given their natural life history and survival strategies. Artificial sources of concentration consist of modified habitats or food/water sources that attract cervids in densities that would normally not occur. These sources can be found in urban and rural communities where private citizens intentionally feed wildlife, or there is an abundance of irrigated green space (i.e., parks, golf courses, etc.). Across Wyoming, a common source of human-caused cervid concentration stem from traditional agricultural practices. Throughout North America, agricultural operations play a vital role in the long-term health and sustainability of our wildlife populations by providing key habitat components such as food, water, and cover. As a result, cervid populations may congregate around certain agricultural practices for long periods of time and/or in high densities (i.e., mineral licks, water developments, haystacks, irrigated hayfields, etc.). Many of these practices are beneficial to wildlife in the absence of disease. However, given the increased distribution and prevalence of CWD, reducing wildlife concentrations at these points or features on the landscape may be prudent to minimize disease transmission. Finally, the Department recognizes the increased potential for disease transmission associated with elk feedgrounds, which will be addressed in a separate section of this Plan.

The Department will pursue the following actions to reduce artificial cervid concentrations to reduce CWD transmission potential:

- The Department will develop a recommendation to the Wyoming State Legislature to provide the Commission authority to regulate intentional feeding of wild cervids unless otherwise specified in law or authorized by the Department. Agricultural practices will not be included in this recommendation.

- The Department will continue to work with local governments as needed to develop and implement ordinances on artificial feeding of cervids within their jurisdiction, unless otherwise specified in law or authorized by the Department.

- The Department will identify areas with unnaturally high concentrations of cervids with endemic CWD while also engaging the agricultural community to explore ways to minimize cervid concentrations without impacting traditional agricultural operations. At those points the Department will:
    - Work with landowners to decrease cervid concentrations through hunting seasons or culling.
    - Work with landowners to eliminate the source or to make the source unavailable to cervids (e.g., fencing/stackyards, salt/mineral feeders that exclude wildlife, etc.).
    - The Department will engage the agricultural community to develop recommended management practices and provide informational material to reduce cervid concentrations around irrigated hayfields, haystacks, water developments, mineral/salt licks, and other sources of cervid concentration.

- The Department is currently collaborating with the University of Wyoming, USGS, and individual landowners to assess cervid use around livestock salt/mineral supplement sites. Potential recommendations to reduce cervid use of salt/mineral sites may be developed following this assessment.

- The Department will assess the efficacy, need, value, and placement of water developments for wildlife (e.g., guzzlers) given the presence or threat of CWD. Water developments are obviously beneficial to wildlife in the absence of disease, and can serve to better distribute animals across the landscape. However, water developments also concentrate animals, and may potentially facilitate disease transmission in some situations. Mitigation measures to reduce environmental contamination/transmission around water developments will be explored on a site-specific basis.

- The Department will continue to implement habitat treatment projects across the state to benefit wildlife populations. Habitat treatments will be implemented as funding and permitting allows and in accordance with the Department's Strategic Habitat Plan (https://wgfd.wyo.gov/Habitat/Habitat-Plans/Strategic-Habitat-Plan). Prescriptive treatments in key habitats will promote healthier wildlife populations and can lead to improved distribution of affected cervids. When conducted on a meaningful scale, habitat improvement projects may help buffer the impacts of disease and other factors affecting cervid populations.

Hunter Harvest Management

Efforts to manage CWD through harvest are focused on mechanisms to reduce or limit increases in CWD prevalence with the understanding that eradication is not currently feasible. These strategies are based on information gathered through significant research and improved understanding of CWD dynamics across the U.S. and Canada. One of the most consistent observations with CWD in deer is that prevalence in bucks tends to be twice that of does, and prevalence in mature bucks (≥ 4 years old) in a population is highest (Miller et al. 2000, Grear et al. 2006, DeVivo et al. 2017). This observation has emerged in multiple areas where CWD has been extensively studied in Colorado, Alberta, Wisconsin, and in some areas of Wyoming. Additional research suggests that within higher density populations, dispersal of infected animals and increased contact between social groups may also contribute to the spread of CWD (Storm et al. 2013).

Building on this knowledge, several field and modeling efforts have looked into harvest-based management strategies. Evidence from field efforts suggests density reductions in Colorado may have resulted in reduced prevalence (Geremia et al. 2015). Preliminary data from density reduction efforts in Wisconsin and targeted culling/removal strategies in Alberta suggest those efforts may have slowed the disease, though robust data are not available to evaluate those efforts (Manjerovic et al. 2014, Pybus 2012). More targeted harvest and culling approaches in Illinois appear to have limited increases in CWD prevalence compared to that of nearby areas over the same time-frame (Manjerovic et al. 2014, Mateus-Pinella et al. 2013). Observations from Colorado suggest there is a relationship between late season harvest and increases in removal of CWD-positive animals that may reduce CWD prevalence (Conner et al. 2007). Finally, evidence from multiple modeling efforts suggests harvest can be utilized as a management tool to reduce or limit CWD (Al-Arydah et al. 2016, Potapov et al. 2016, Jennelle et al. 2014, Wasserberg et al. 2009). The following excerpt comes from the 2017 WAFWA recommendations:

> *"Male deer appear to have a higher likelihood of CWD infection than females (Miller et al. 2000, Grear et al. 2006, DeVivo et al. 2015). Focusing harvest of sufficient intensity on the segment of the population most likely to be infected could help reduce disease prevalence and subsequent transmission (e.g., Potapov et al. 2016). Exploiting potential biases in removal of infected*

animals via harvest also could be used to enhance the efficacy of harvest as a control strategy (Wild et al. 2011). For example, targeting mature males via increased harvest pressure during or after the breeding season may selectively remove a higher proportion of infected individuals than harvest in early autumn (Conner et al. 2000). Such strategies would allow agencies to modify existing harvest management approaches to emphasize CWD suppression and thus should be relatively sustainable in the long-term with minimal additional personnel time or cost.

Alternatively, multiple CWD management programs have targeted winter culling around known CWD-infected animals because of spatial clustering of the disease on the landscape (e.g., Connor et al. 2007, Pybus 2012, Mateus-Pinilla et al. 2013). Data from these management attempts suggest effectiveness in limiting CWD (Pybus 2012, Mateus-Pinilla et al. 2013, Geremia et al. 2015). Due to the poor success in implementing long-term agency culling programs, an alternative approach might be to use hunting seasons targeting specific winter ranges or disease foci."

Harvest strategies for CWD management would focus on reducing or limiting CWD through two primary mechanisms: 1) by optimizing harvest to increase the number of infected animals that are removed each year by increasing male harvest, increasing mature male harvest, or by focusing harvest in areas of known disease foci; or 2) by decreasing population densities through increased harvest pressure to reduce the frequency of contacts between social groups, increase removal of CWD-positive animals (both male and female), and reduce the potential for dispersal of infected animals.

The Department will therefore consider a suite of prescribed hunter harvest strategies to reduce CWD prevalence and transmission. The majority of the strategies outlined within this section emphasize harvest management in mule deer, but may also be applicable to white-tailed deer and elk. Managers should consider CWD management in elk and white-tailed deer, as both species overlap with mule deer throughout much of the state and also contribute to accumulation of prions in the environment. Moose densities are too low in Wyoming to utilize prescribed hunter harvest strategies as a viable CWD management tool, although targeted agency removal of suspected positive animals may be beneficial. Experimental hunter harvest strategies to reduce CWD prevalence and evaluate management efficacy will likely be most effective in mule deer populations for the following reasons: 1) mule deer are the most widespread and commonly hunted cervid in Wyoming; 2) the evaluation of any experimental harvest management strategy will be more robust in mule deer given the Department's emphasis on mule deer demographic data collection and ability to detect population trend (as compared to white-tailed deer and elk); and 3) CWD prevalence data sets are more robust in mule deer than in other cervid species due to sampling history and feasibility.

Experimental hunter harvest strategies that focus on significant reductions in male deer and/or overall densities will only be implemented in areas where broad and diverse public support exists, and will ultimately require Commission approval. These strategies will not be proposed on a large scale (i.e., within numerous herd units or across large geographic areas) in the absence of peer-reviewed published research indicating they are a viable means to reduce CWD over the long term. In the event such hunter harvest strategies are proven to effectively reduce CWD prevalence, the Department will initiate additional communication and outreach efforts with the public and update the Commission accordingly. Similar harvest management strategies may then be proposed in additional areas pending broad public support and Commission approval.

Where implemented, harvest management strategies will be determined at the local level and specifically tailored to each herd unit or localized sub-population, with consideration given to differences between migratory and non-migratory populations. Requisite outreach, communication, and public involvement will be key to garner and maintain public support for the successful implementation of long-term CWD management strategies. Harvest goals and resulting cervid densities (both male and female) from experimental harvest management strategies will be clearly articulated and developed with public input prior to and during implementation. Harvest management strategies will be implemented over a sufficient amount of time in conjunction with robust monitoring and surveillance (BACI design) to allow for rigorous evaluation of such actions. By implementing experimental harvest management strategies in select areas, the Department will foster the broader understanding of CWD management.

The Department will pursue the following actions to reduce CWD prevalence using hunter harvest strategies:

- The Department will incorporate CWD management considerations in all cervid herd units when formulating annual and long-term herd management decisions (i.e., hunt season strategies, population objective, and male:female ratio management goals).
    - For all cervid herd units, CWD management considerations will be incorporated into annual herd unit JCRs. The JCRs will include current prevalence estimates and corresponding sample size and distribution within the herd unit, as well as any potential CWD management strategies that may be implemented.
        - The WHL will provide preliminary CWD prevalence estimates and pertinent sampling information to Department regions by February 1 of each year. Final prevalence estimates will be updated annually for previous years.
        - Within JCRs, discussion regarding CWD for herd units with insufficient sample sizes to adequately estimate prevalence will acknowledge data limitations.
    - The Department will consider herd-specific CWD issues when reviewing herd unit management objectives.
    - The Department will evaluate the need to identify an alternative CWD-centric management objective for approval by the Commission whereby the sole management goal will be to attempt to decrease CWD prevalence and/or maintain it at a reduced level. Such an objective may be appropriate where a numeric postseason population size objective is inappropriate or unattainable due to high CWD prevalence. Numeric population objectives are the preferred management objectives by the Department.
    - The Department will assess if CWD prevalence thresholds are appropriate to use as a trigger to require variable management considerations. Should thresholds be integrated into routine management recommendations, prevalence data must be based on adequate sample size and distribution within a given herd unit.

- The Department will identify select herd units, hunt areas, or subpopulations where appropriate to develop hunting season strategies to reduce or limit CWD prevalence. Within identified herd units or areas, the Department will develop BACI-based experimental harvest management projects. Attempts should be made to measure effects of prevalence on both the male and female segments of the population where possible. These projects will vary in scope and duration depending upon issues within the herd unit, public support, and current CWD

prevalence. The Department will consider the following hunting season strategies within herd units or areas identified:

- Increase mature male harvest to lower CWD prevalence and transmission. This may include altering season timing (earlier or later) and length or increasing license issuance.
- Reduce populations to decrease densities within areas of concern (i.e., herd unit, hunt area, or subpopulation). Maintain reduced densities for a sufficient time, perhaps ten years or more, to adequately evaluate the effects on CWD prevalence. This will require some level of sustained female harvest.

- The Department will develop and implement lethal removal strategies to reduce cervid densities around disease foci locations ("hot spots"). Hunter harvest is the preferred method for addressing disease foci. Focused agency removal and other designated methods may be necessary in cases where hunter harvest cannot be used. For example, urban deer reduction programs have occurred in various Wyoming municipalities (where public discharge of firearms is prohibited) via the use of local law enforcement officers in accordance with a lethal take permit issued by the Department.

- The Department will continue to engage landowners to maintain or increase hunter access on both private and landlocked public/state lands. The Access Yes program and other hunter access programs will continue to be heavily utilized and will be tailored for specific management actions or harvest needs.

- The Department will disseminate formal assessments of experimental hunter harvest management actions to bolster the broader understanding of their efficacy to reduce CWD.

Additional Regulatory and Agency Actions

Additional regulatory and agency actions regarding CWD are either ongoing or will be pursued. These include actions to address carcass disposal, captive cervid facilities, cervid translocation and importation, targeted removal, and interagency coordination.

The Department will pursue the following additional regulatory and agency actions to reduce CWD:

- The Department will continue to engage the Wyoming Department of Environmental Quality, the Wyoming Department of Transportation, the Wyoming County Commissioners Association, and relevant solid waste operators to facilitate proper disposal of cervid carcasses at approved landfills and/or transfer stations throughout Wyoming.

- The Department will continue to promote and enforce the Wyoming statutory prohibition of cervid ownership in Wyoming, and the Commission's Chapter 10 regulation governing Importation, Possession, Confinement, Transportation, Sale, and Disposition of Live Wildlife. Wyoming has stringent laws and regulations pertaining to the private ownership and importation of live cervids. These laws and regulations were developed to protect Wyoming wildlife from threats associated with disease, genetic pollution, and other ecological and environmental issues. The Chapter 10 Regulation addresses CWD in relation to the only privately owned elk facility permitted in Wyoming by statute. Any captive cervid imported into Wyoming must originate from facilities certified to be free of CWD in accordance with

federal regulations (9 CFR, parts 55 and 81) and Commission regulation. Future establishment of captive, commercial native cervid facilities in Wyoming is prohibited by statute.

- Live free-ranging cervids originating within Wyoming will not be moved to other locations within or outside of Wyoming for any reason without prior review, approval, or permitting by the Department and/or Commission.

- Department personnel will continue with targeted removal of cervids exhibiting clinical signs of CWD. Research has shown that such targeted surveillance / lethal removal is effective to document the presence of CWD in new areas as well as remove sources of infection (Miller et al. 2004). When possible, Department personnel will collect appropriate biological samples (including whole carcasses for complete necropsy if necessary) for disease testing, and properly dispose of euthanized cervid remains to minimize CWD transmission and environmental contamination.

- The Department will continue to enforce the Commission's Chapter 2 General Hunting regulation regarding the control of the importation, exportation, and transportation of harvested cervids and/or cervid parts taken both from within and outside of Wyoming.

- The Department will continue to collaborate with other state, federal, tribal, and international agencies as well as institutions of higher learning to exchange information regarding effective CWD suppression strategies both within and outside of Wyoming.

- The Department will continue to engage taxidermists and meat processors to provide information on relevant regulations and recommended practices regarding the handling and disposing of potentially infected cervid carcasses and parts.

- In accordance with a directive provided annually by the Department's Wildlife Division, all cervid carcasses donated by the Department will be tested for CWD regardless of carcass origin or how it came into the Department's possession. Any carcass testing positive for CWD shall not be donated and will be properly disposed of.

- The Department will continue to partner with the University of Wyoming to develop a statewide genetic database of cervid genotypes (for PrPc coding loci) for hunter-harvested and/or research cervids. This database will be used for future evaluations of potential genetic shift that may be attributed to endemic CWD. This database will also contain a whole cervid genome sequence that will provide information on biological structure of, and gene flow among, cervid populations. This genomic database will be important for assessing population-level effects of CWD and providing information for predictive models of future CWD spread and impacts.

- The Department will work with other applicable agencies and local governments to take the necessary steps to develop recommendations to the Wyoming State Legislature to authorize the use of existing funds to be allocated to solid waste operators for proper disposal of cervid remains.

- The Department will take the necessary steps to develop a recommendation to the Wyoming State Legislature to provide the Commission the authority to regulate the use of cervid urine.

- The Department will pursue funding for partnership programs to facilitate the proper disposal of cervid remains in communities across the state, with an emphasis on areas without approved landfills or transfer stations.

- The Department will use the current budgetary process and seek additional outside funding to maintain and increase CWD monitoring and WHL testing capacity as needed.

Voluntary and Mandatory Sample Submission for CWD Management Actions

Understanding the efficacy of any CWD management strategy is paramount for the future of CWD management. Wherever CWD-specific management strategies are implemented, details of prescribed management actions and CWD prevalence, both baseline and post-treatment, will be documented and thoroughly evaluated. To achieve this, Department personnel will utilize voluntary and/or mandatory CWD sample submission of hunter-harvested cervids to obtain statistically valid sample sizes to enable detection of any resulting changes in prevalence. Voluntary sample submission is preferred, although the Department may require mandatory sample submission in accordance with Commission's Chapter 2 General Hunting regulation if necessary. Informing hunters prior to and during any mandatory CWD sample submission regime will be critical.

Elk Feedgrounds

Elk have been fed in northwest Wyoming since the early 1900s. Currently, there are 23 elk feedgrounds in Wyoming, with 22 operated by the Department and the National Elk Refuge (NER) operated by the United States Fish and Wildlife Service. Supplemental feeding of elk during winter was initiated to mitigate for the loss of winter range, reduce human/elk conflict, and increase elk overwinter survival. While elk feedgrounds continue to address those issues, they now also facilitate spatial and temporal separation of elk and cattle to reduce the spread of brucellosis.

Supplemental winter feeding of elk creates complex biological, social, economic, and political issues. Wildlife disease adds to this complexity. Potential impacts from CWD on feedground elk populations are largely unknown, although it is possible that CWD prevalence within feedground elk may exceed that of unfed elk. In general, disease transmission can be correlated to the density of animals in a given area, as well as the frequency of contact between animals. It is assumed that if the disease becomes established, artificially concentrating elk on feedgrounds may result in more rapid spread of CWD and contribute to increased persistence of prions in the soil and uptake by vegetation (Pritzkow et al. 2015).

Due to the complex nature of elk feedgrounds and disease management, the Department is planning to initiate a localized collaborative process in Teton, Sublette, and Lincoln counties. This collaborative group is envisioned to serve in an advisory capacity to the Department on how to best manage CWD in relation to Department-operated elk feedgrounds. Although this process is more localized in nature, it shall include statewide interests with representation from the general public and other interested parties and agencies. This process will begin after the Commission has approved this Plan. This collaborative process will likely be tasked with the following: 1) review management plans, policies, and literature related to CWD and feedgrounds; 2) develop feedground-specific disease management plans that encompass not only CWD, but brucellosis, necrotic stomatitis, and other diseases; 3) conduct site-specific feedground evaluations; 4) address proper carcass disposal for suspected CWD-positive elk that die on or near feedgrounds; and 5) evaluate research and monitoring opportunities and needs.

Surveillance

In addition to focusing on the annual five-year rotational sampling program under the statewide surveillance plan, the Department conducts additional CWD surveillance work related to feedgrounds in the Pinedale and Jackson regions. In northwest Wyoming, considerable effort is put into monitoring for CWD. Road-kill, targeted, and hunter-harvested cervids are all tested, in addition to animals that perish on and near elk feedgrounds during the feeding season.

Grand Teton National Park (GTNP) and the NER have implemented mandatory CWD sampling requirements for hunter-harvested elk. This mandatory sample submission in the Jackson Elk Herd Unit provides sufficient samples to detect CWD occurring at 1% prevalence with 95% confidence. Chronic wasting disease has yet to be detected in the Jackson Elk Herd, although it has been detected in mule deer in Teton, Sublette, and Lincoln counties.

Feeding Management Strategies for Disease Reduction

Disease reduction strategies were first implemented on elk feedgrounds during the winter of 2008 to decrease brucellosis prevalence in feedground elk by reducing disease transmission through systematic implementation of science-based management actions. Specifically, these strategies were designed to reduce disease transmission during feeding by employing low-density feeding to reduce elk densities on feedlines and shortening the supplemental feeding season to reduce the amount of time elk inhabit feedgrounds. These strategies are not always feasible on every feedground, and other factors must be considered prior to implementation, including the number of elk on feed, the size/topography of available feeding area, elk-cattle commingling risk, and the availability of native forage.

The Department will continue to utilize the following feeding management strategies:

- Low-density (LD) feeding is a technique designed to reduce intraspecific brucellosis transmission (i.e., elk-fetus contacts) by reducing elk densities on feedlines through providing multiple travel routes. Hay is dispersed along numerous rows in a checkerboard pattern, reducing elk densities while attending feedlines. LD feeding discourages elk from feeding along a single path of travel by allowing them to move in all directions from hay pile to hay pile, reducing the chances that an elk will contact an aborted fetus. When conducted consistently, reductions in brucellosis prevalence are expected over time. The utility of LD feeding to reduce or mitigate CWD transmission potential is unknown, although differences in environmental persistence between bacteria and prions should be considered.

- A reduction of the feeding season minimizes the time animals are in close proximity at a feeding location. This reduction in time animals spend in close proximity to each other likely reduces disease transmission among elk on feedgrounds.

- Where possible, elk feeders work to expand their feeding areas in order to feed on clean snow and new areas to increase the opportunity for elk to feed on areas with less biological contamination each day. This helps reduce the effects of environmental contamination of the feeding area.

These strategies are not always feasible on every feedground, and other factors must be considered prior to implementation, including the number of elk on feed, the size/topography of the available feeding area, elk-cattle commingling risk, and the availability of native forage before and after the feeding season. While these strategies were originally developed to mitigate brucellosis transmission risk, they may also be applicable in the management of other diseases including CWD, necrotic stomatitis, and digital limb infections (e.g., digital necrobacillosis).

Additional Ongoing and Interim Feedground Plan Requirements

Additional ongoing and interim feedground plan requirements and actions are already in place regarding disease surveillance and monitoring, habitat management, interagency coordination, research, and disease risk reduction.

The Department will continue to pursue the following regarding elk feedgrounds:

- The Department will identify, remove, and test all cervids exhibiting signs consistent with CWD on and around elk feedgrounds.

- The Department will continue coordination with appropriate state and federal agencies regarding CWD issues in northwest Wyoming.

- The Department will continue to coordinate CWD surveillance and elk hunter harvest in northwestern Wyoming with the NER and GTNP. Additionally, the Department will coordinate with GTNP and the NER in the development and implementation of their CWD management plans.

- The Department will work with the NER, GTNP, and United States Forest Service – Bridger-Teton National Forest on implementing the 2007 Jackson Elk and Bison Management Plan (www.fws.gov/bisonandelkplan/) to manage wintering populations and reduce their reliance on supplemental feed.

- The Department will collaborate with stakeholders to acquire critical winter range habitat and migration corridors where possible to protect elk from human disturbance.

- The Department will work with state and federal land management agencies and non-governmental organizations to develop, fund, and implement habitat improvement projects for elk to reduce dependence on feedgrounds.

- Based on research that grass plants can bind, retain, uptake, and transport prions (Pritzkow 2015), the potential prion transmission risk of contaminated hay harvested from the CWD endemic area being fed at state elk feedgrounds should be considered. Prior to hay being purchased and transported to elk feedgrounds, the Department will consider the spatial and temporal relationships between the location of potential source hay fields and the prevalence and distribution of CWD in cervids in these areas. Additionally, the Department will communicate with the appropriate land management agency(s) as it pertains to hay use and CWD at elk feedgrounds.

- The Department will review the Commission Supplemental Feeding of Elk/Wild Bison Policy to determine if changes are warranted to address CWD.

- The Department will determine if closures of specific feedgrounds can occur where dispersal of elk will not cause damage, conflict, or co-mingling issues with private property (i.e., stored crops, and domestic livestock) or create a need to drastically reduce overall elk numbers.

- The Department will consider CWD dynamics when developing herd unit population objectives, feedground quotas, hunting seasons, and other management recommendations.

Documentation of CWD-related issues will occur in annual JCRs as deemed appropriate. The Department will strive to meet herd population objectives and feedground quotas by considering all contributing factors and influences.

- The Department will continue with intensive CWD surveillance and monitoring in the Jackson and Pinedale regions as WHL capacity and available resources allow.

- If CWD is detected in elk inhabiting feedgrounds, Department personnel will monitor the feedground and surrounding area intensively. Any elk exhibiting clinical signs of CWD shall be lethally removed, sampled, tested, and properly disposed of in a timely manner. Large-scale culling of elk on a feedground and on native winter range is not an anticipated action to address CWD.

- To the extent possible, the Department will continue to: 1) maximize the feeding area to decrease animal-to-animal contact (low-density feeding) and feed on clean snow; 2) decrease days of feeding to promote the dispersion of elk; and 3) take additional actions to decrease elk concentration provided such actions are consistent with other necessary wildlife management and feedground practices.

- The Department will utilize proper carcass disposal methods at feedgrounds to limit potential soil contamination and the spread of CWD; this may include incineration or other acceptable methods of disposal to minimize prion contamination.

- The Department will continue with and expand research and monitoring of cervid migration and dispersal routes in the Jackson and Pinedale regions, which will facilitate further understanding of underlying mechanisms behind the spread of CWD.

- The Department will continue to monitor predatory animal presence and their impacts on feedground elk, including the implementation of proper management actions for gray wolves that are causing unacceptable impacts to elk at any state-operated feedground in accordance with Wyoming Statute §23-1-304 and Commission Chapter 21 Gray Wolf Management regulation.

- The Department will continue to consider the potential role of predators and scavengers to remove CWD-infected animals and carcasses to reduce CWD transmission (Krumm 2010, Wild 2011).

Research and Coordination

Researchers and wildlife managers across the nation and abroad are working to better understand CWD and the underlying mechanisms of transmission, environmental and population persistence, and its ultimate influence on long-term cervid population dynamics. The development of CWD management strategies and requisite evaluations outlined within this Plan signify the Department's contribution toward this endeavor. Pertinent information resulting from CWD management actions will be disseminated through appropriate channels both within and outside Wyoming. Conversely, any relevant information regarding successful CWD management strategies implemented outside of Wyoming will be thoughtfully considered by the Department for potential application. Finally, the Department will continue to partner with appropriate entities and pursue funding for meaningful CWD research to further the understanding of this disease in wildlife populations.

Depending upon the scope of the project, CWD research within free-ranging wildlife populations is typically expensive due to the long timeframe required to study CWD dynamics as well as complexities associated with testing and following live animals. The Department is not a primary research agency and does not contain a research branch, therefore limiting its ability to conduct large-scale CWD research. Regardless, the Department will continue to request funding from the Commission for surveillance, research, and management to the extent possible, recognizing the myriad funding needs required for overall Department operations.

The Department will continue to collaborate with external entities (e.g., state, federal, tribal, and international agencies as well as institutions of higher education) on research priorities, projects, and funding to facilitate continued expansion of knowledge of CWD. The Department is committed to a long-term investment in research and "on the ground" management strategy implementation and evaluation. Finally, the Department will continue to monitor published research on CWD and contribute to relevant conferences, symposiums, and other collaborative forums to ensure the most current and comprehensive data and scientific information is considered in the formulation of CWD and cervid management decisions.

The Department has identified the following potential research priorities:

- Evaluate the effect and management implications of hunter harvest strategies on CWD prevalence and transmission.

- Collaborate on research to evaluate the correlation between environmental prion contamination with disease prevalence and transmission.

- Assist in the validation of experimental assays for CWD prion detection (e.g., PMCA, RT-QuIC, and field testing).

- Continue to pursue collaborative research programs to better understand the role of cervid genetics in CWD dynamics and resulting potential management implications.

- Investigate the relative importance of direct versus indirect transmission of CWD prions.

- Initiate projects with willing landowners to evaluate acceptable techniques to reduce cervid concentrations around agricultural practices such as feed, mineral/salt, and water sites to reduce CWD transmission potential.

- Conduct research to determine if non-agriculture sources of artificial cervid concentration are increasing CWD prevalence (e.g., underpasses/overpasses, intentional artificial feeding, etc.).

- Pursue research to evaluate how cervid habitat selection may influence CWD prevalence and transmission. In addition, evaluate how prescriptive habitat improvements may affect cervid population demographics and distribution within herds with endemic CWD.

- Evaluate the effect and management implications of predators/large carnivores on CWD prevalence and transmission. Within cervid populations where CWD occurs, predation may be an additive source of mortality further exacerbating population decline, or may potentially reduce CWD transmission by selectively removing infected animals. These dynamics are not well understood.

- Study the effects of inter-specific cervid competition on CWD prevalence.

- Evaluate regional differences in CWD dynamics.

- Continue to collaborate with the research and evaluation of CWD vaccines, although the Department acknowledges the development of an efficacious vaccine that can be administered within free-ranging cervid populations is unlikely at this time.

Internal CWD Management Team

The Department formed its internal CWD Management Team (CWDMT) in 2017 as an extension of an existing internal ad hoc committee. This team consists of representation from the Department's Veterinary Services Program and Wildlife Division personnel from each Department region. To date, the roles and responsibilities of the CWDMT included internal communication within the agency regarding CWD issues and the implementation of the CWD collaborative process. Going forward, the CWDMT team will meet regularly to discuss and chronicle CWD management actions and emerging research/information.

The Department's CWDMT will do the following:

- The CWDMT will assist regional efforts to identify, develop, implement, and evaluate CWD management strategies as needed.

- The CWDMT will chronicle management actions implemented within and outside of Wyoming to inform adaptive management strategies. Both successes and failures will be cataloged. Periodic summaries of CWD management actions will be made available for the public and Commission.

- As needed, the CWDMT will assist the WHL and Department regions in developing strategies for surveillance and monitoring throughout the state.

- The CWDMT will stay apprised of emerging research and pertinent information with respect to CWD and its management and will convey relevant information to the regions.

- The CWDMT will ensure necessary internal and external communications regarding CWD occur, including the implementation of the CWD Communication and Implementation Plan.

Human Health and CWD

The Wyoming Game and Fish Department is not a human health agency. The Department will continue to rely on the Centers for Disease Control and Prevention (CDC) and the Wyoming Department of Health (WDH) for recommendations regarding potential human health risks associated with CWD. Currently, the CDC provides information on CWD and associated human health concerns at https://www.cdc.gov/prions/cwd/index.html. To date, there have been no documented cases of CWD in humans. However, public health officials recommend CWD-positive animals not be consumed.

The Department will continue the following:

- The Department will continue to work cooperatively with the WDH, CDC, and other human health organizations to monitor current research and recommendations on CWD and human health to provide up-to-date information to the public.

- The Department will continue to test all cervids in the meat donation program. All deer, elk, and moose carcasses donated to the public by the Department shall be tested for CWD. Any deer, elk, or moose in the Department's possession testing positive for CWD shall be disposed of in an approved landfill or incinerator. In situations where a deer, elk, or moose in the Department's possession cannot be tested for CWD, the carcass or parts will not be donated for human consumption.

- The Department will work with the WDH and the Wyoming Department of Agriculture to develop recommendations for the donation of game meat from cervids for meat donation programs outside of the Department, including food banks, urban deer removal programs, etc.

CWD Communication and Outreach

Chronic wasting disease is of significant interest to a wide variety of stakeholder groups at local, national, and international levels. As the agency charged with managing Wyoming's wildlife populations, the Department has an obligation to provide timely, complete, accurate, and unbiased information about CWD to the public. To date, the Department has conducted substantial information and education efforts regarding CWD, both within the agency and for the general public. However, additional outreach efforts will be required for the successful implementation of this Plan. The Department recognizes that extensive communication, outreach, and involvement is a critical step for garnering public support to implement meaningful CWD suppression strategies. Concerned constituents will be more likely to support long-term management actions if they have been thoroughly informed about and are involved with CWD-related issues including the necessity for action, the short- and long-term objectives of such actions, and how these actions may affect them, their hunting and recreational opportunities, and wildlife populations.

The Department will pursue the following to facilitate CWD communication and outreach:

- In conjunction with a recommendation stemming from the CWD Working Group, the Department will develop a comprehensive "CWD Communication and Implementation Plan" focusing on three aspects of implementation.
    - Section 1 will concentrate on CWD topics that need recurrent communication including but not limited to the following: 1) distribution of CWD in Wyoming; 2) public health information from public health experts; 3) disease monitoring efforts; 4) efforts to learn more about disease epidemiology; 5) potential impacts to deer, elk, or moose populations; 6) laws and regulations related to CWD; 7) carcass transportation and disposal; 8) artificial sources of cervid concentration and environmental contamination; and 9) how the public can help reduce the spread and prevalence of CWD.
    - Section 2 will communicate management strategies outlined within this Plan.
    - Section 3 will focus on communication strategies regarding management actions, both experimental and long-term, and will occur on local and statewide levels.

- To assist in the development of the "CWD Communication and Implementation Plan," results from the 2019 CWD Hunter Perspective Survey and those from public surveys conducted during the development of the Department's Strategic Plan will be used to determine the best methods to deliver CWD messaging to the public.

- The Department will utilize all existing avenues to increase awareness of ongoing and emerging issues regarding CWD including how those issues are being addressed, and how the public and other stakeholders can further engage and participate.

- The Department's annual JCRs will be used to chronicle current conditions and management data regarding CWD issues within all cervid herd units.

- The Department will continue to actively engage and involve the public in the management of cervid populations and CWD during annual season setting public meetings.

- Communications regarding CWD will acknowledge public concern with harvest management strategies as the need arises, and will articulate the scope of proposed CWD management strategies at a local and statewide level.

- Communications will emphasize the impacts of CWD on cervid populations.

Wyoming CWD Management Plan – Public Input

The Department recognizes the need for increased public involvement and support to best manage CWD. To accomplish this, the Department engaged in an extensive public collaborative process to gather information, ideas, and opinions. This process focused on the development of a stakeholder CWD Working Group and two rounds of public meetings in Laramie, Casper, Sheridan, Worland, and Pinedale. The Department also surveyed resident and nonresident deer hunters to gauge perspectives and understanding of CWD and its impact in Wyoming. During the collaborative process, input from the general public was also gathered via the Department's website. Finally, public comments on this revised Wyoming CWD Management Plan were solicited and accepted online, and were considered by the Department and Commission in the spring of 2020. Public participation was vital for all stages of the development of this Plan.

CWD Collaborative Process

In 2018, the Department began working with the Ruckelshaus Institute, Haub School of Environment and Natural Resources at the University of Wyoming to start planning a collaborative public process to engage key stakeholders and the public regarding CWD issues and concerns. This process enabled the Department to better develop this revised Plan to incorporate the best available science in addition to recommendations developed and supported through the collaborative public process.

As part of the collaborative public process, the Wyoming Game and Fish Director appointed the CWD Working Group through an application process. The CWD Working Group included 31 members representing local government, the Wyoming State Legislature, agriculture/landowner community, outfitting interests, federal agencies, state agencies, sportspersons, conservation non-governmental organizations, scientists, general public, and the Department and Commission. Those who served on the CWD Working Group during this planning process are listed under the "Acknowledgements" section of this Plan. The Ruckelshaus Institute developed a charter outlining the purpose, roles, responsibilities, and decision-making process of this group. All CWD Working Group and public meeting agendas, presentations, recommendations, and the Wyoming Game and Fish Department Chronic Wasting Disease Collaborative Process Final Report can be found at https://wgfd.wyo.gov/get-involved/cwd-working-group. Recommendations from the CWD Working Group that were incorporated into this Plan are detailed in Appendix B.

The four phases of the collaborative process were as follows:

- Phase 1 – Input through Public Meetings: The first set of public meetings was conducted to elicit issues and management options related to CWD from the general public (including non-CWD Working Group citizens). Meetings were held in Laramie, Casper, Sheridan, Worland, and Pinedale. Attendees were presented with CWD information and were then divided into breakout groups to work with a facilitator to record ideas and suggestions on big game management with endemic CWD. There were 147 participants in these meetings across five locations. A total of 273 management options in 50 categorized themes were developed.

- Phase 2 – CWD Working Group Meetings: Following the public meetings, the CWD Working Group met on three different occasions. These meetings took place in July, August, and September of 2019. Information was provided by Department personnel as well as from

outside agency experts from Colorado and Wisconsin to ensure members were knowledgeable on topics and issues related to CWD. The information included an overview of the disease, epidemiology and transmission, impacts to big game populations, management of big game populations, and disease surveillance and monitoring. The CWD Working Group also learned about human health in relation to CWD from the WDH. In these meetings, the CWD Working Group reviewed input from the public meetings and ultimately drafted recommendations for CWD management to the Department. There were nine recommendations and 43 sub-recommendations stemming from this process that the Department considered when revising this Plan.

- Phase 3 – Reporting to the Public: In December of 2019, the Ruckelshaus Institute facilitated the second series of five public meetings to present the CWD Working Group's recommendations and the Department's draft revised Plan. Meetings took place in the same communities as the initial series. The public again had the opportunity to interact with CWD Working Group members in attendance and provide feedback on all recommendations. There were 143 public participants in these meetings. The Department received 148 individual comments pertaining to the draft version of this Plan.

- Phase 4 – CWD Working Group Final Input and Review: In February 2020, the CWD Working Group convened to review the final results from the public meetings and assess whether their recommendations to the Department needed to be amended based on public input. Any modified or new recommendations were again tested for consensus with the CWD Working Group. Based on these final recommendations, the Department finalized the revised Plan and presented it to the Commission in the spring of 2020 for adoption.

2019 Hunter Perspective Survey

From February through April of 2019, the Department surveyed both resident and nonresident deer hunters to garner insight on hunter perspectives regarding CWD in deer in Wyoming. Colorado Parks and Wildlife conducted a similar survey, and results from both states will be compared to provide a broader understanding of hunter perspectives on CWD. The purpose of this survey was to learn what resident and nonresident hunter interests are in relation to CWD, their potential concerns regarding this disease, and the ways the Department might effectively manage impacted deer herds in the state.

A sample of 3,000 deer hunters received the survey, including 2,000 resident and 1,000 nonresident hunters. Hunters were selected from respondents to the Department's 2017 and 2018 deer harvest surveys. Both limited quota and general license holders who reported hunting in areas with known high (>10%) or low (≤5%) CWD prevalence were surveyed. Surveys were initially sent by email. A paper copy was sent via U.S. Postal Service if they did not respond to the email survey. A total of 1,201 hunters (622 from high prevalence hunt areas and 579 from low prevalence hunt areas; 751 residents and 450 nonresidents) responded to the survey.

Results from the survey were considered during the development of this revised Plan. In addition, hunter perspectives inform Department communication strategies by providing valuable insight into what information is most important to the hunting public. Similar future surveys may also be conducted to gauge shifts in hunter perspectives regarding CWD over time. A copy of the survey and a summary of responses to relevant questions can be found in Appendix C.

Key preliminary results from this survey were:

- A relative majority of hunters (48% high CWD prevalence [HCWD] group, 45% low CWD prevalence [LCWD] group) do not agree that concerns about CWD have been exaggerated, and a large majority (82% HCWD group, 78% LCWD group) agree that effort should be taken to reduce the rate of infection in deer.
- A majority of hunters are very concerned about the health of affected deer herds (59% HCWD group, 58% LCWD group), the potential for CWD to reduce deer hunting opportunity (61% HCWD group, 59% LCWD group), and future generation's ability to enjoy deer hunting (61% HCWD group, 58% LCWD group).
- Surveyed hunters were presented with three scenarios tailored to the high or low CWD prevalence of the original hunt area in which they hunted: one in which CWD prevalence stayed about the same; one in which CWD prevalence approximately doubled; and one in which CWD prevalence increased by approximately four to five times.
    - Under all three scenarios, a large majority (more than 80%) of hunters are likely to support taking measures to control CWD.
    - The proportion of hunters likely to look for alternative areas to hunt increased as theoretical CWD prevalence increased.
    - A majority of hunters indicated they are very unlikely to stop hunting for deer in Wyoming under all three scenarios.
- A majority of deer carcasses in Wyoming are either disposed of in the trash or landfill (28% HCWD group, 25% LCWD group), or edible meat was removed and the remaining carcass left in the field (34% HCWD group, 37% LCWD group).
- About 20% of hunters are unaware of carcass transportation regulations.
- About 65% of the HCWD group and 64% of the LCWD group reported harvesting a deer during the 2017 or 2018 hunting season. Of the HCWD group, 10% reported having ever harvested a CWD-positive deer versus <2% from the LCWD group.
- The most acceptable CWD control management action among hunters was the use of special management hunts to remove deer in localized areas of especially high prevalence with minimum impact on overall deer numbers. This was followed by using hunters to reduce the total deer population (bucks and does) and then by increasing the number of buck licenses available during later seasons in affected hunt areas.
- Taking no action and letting CWD take its natural course was the most unacceptable management action among a majority of hunters (74% HCWD group, 75% LCWD group).
- A majority of hunters indicate striking a balance between controlling CWD and preserving hunting opportunities should be a priority for the Department (82% HCWD group, 84% LCWD group).
- To receive information about CWD, hunters most preferred the Department's website followed by the hunting regulation brochure. The third most preferred source of information depended on the hunter's age. Those under age 50 preferred social media and those over age 50 preferred hunting magazines.

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Adopted by the Wyoming Game and Fish Commission on July 16, 2020.

Signed: _____

Peter J. Dube, President

Appendix A – Measuring CWD Prevalence

The following statistical tables detail required sample sizes when measuring CWD prevalence within a herd unit (Table 1), as well as samples size requirements when evaluating the effectiveness of disease management strategies (Table 2). The point system used to survey areas where this disease has not been detected along with associated confidence levels is provided in Table 3. The Department strives for the highest level of statistical confidence that can be achieved given the constraints of sample collection with a given herd unit.

Table 1. Sample sizes required for assessing prevalence relative to estimated CWD prevalence in the herd unit and corresponding confidence level (based on 98% sensitivity and 99% specificity of the CWD ELISA).

Confidence	1% Prev	2% Prev	5% Prev	10% Prev	20% Prev	50% Prev
98%	556	821	1,584	2,748	4,670	7,188
96%	139	206	396	687	1,168	1,797
90%	23	33	64	110	187	288
80%	6	9	16	28	47	72
60%	2	3	4	7	12	18

Source: Humphry RW, Cameron A, Gunn GJ, 2004. A practical approach to calculate sample size for herd prevalence surveys. *Prev. Vet. Med.* 65: 173-188

When evaluating the effectiveness of management actions to control CWD within a herd unit, statistically valid sample sizes are dependent on the initial prevalence as well as the expected change resulting from the management action. Table 2 specifies sample sizes required to detect changes in prevalence following treatment (P1 vs. P2), assuming 95% confidence and 80% power. For example, if the starting CWD prevalence was 20% (P1) and management efforts were expected to reduce prevalence to 10% (P2), then approximately 199 samples would be required to document that change in prevalence with 95% confidence and 80% power.

Table 2. Sample sizes required to measure changes in CWD prevalence within a herd unit.

	P2 = 2.5%	P2 = 5%	P2 = 10%	P2 = 20%	P2 = 30%	P2 = 40%	P2 = 50%
P1 = 2.5%	NA	906	163	50	28	18	13
P1 = 5%	906	NA	435	76	36	22	15
P1 = 10%	163	435	NA	199	62	32	20
P1 = 20%	50	76	199	NA	294	82	39
P1 = 30%	28	36	62	294	NA	356	93
P1 = 40%	18	22	32	82	356	NA	388
P1 = 50%	13	15	20	39	93	388	NA

Sample sizes calculated using power.prop.test in Program R. Source: Recommendations for Adaptive Management of Chronic Wasting Disease in the West (WAFWA 2018).

In hunt areas where CWD has not been detected, a weighted surveillance program will be utilized. Weighted surveillance considers the sample source and type (e.g., road-killed female, hunter-killed

male, etc.) to determine an overall value toward surveillance (Table 3). These values are used toward a total point-goal, rather than a set sample size of hunter-harvested animals. Following calculations outlined by Walsh et al. (2012), 230 total points are required for 90% confidence and 300 points for 95% confidence in the detection of the disease occurring at 1% prevalence, assuming even distribution of disease on the landscape.

Table 3. Points for demographic categories of samples for mule deer and elk.

Sample Group	Weight/Points	
	Mule Deer	Elk
Targeted female	13.6	18.75
Targeted male	11.5	8.57
Road-kill (male or female)	1.9	0.41
Other Mortality	1.9	0.41
Harvested adult male	1	1.16
Harvested adult female	0.56	1
Harvested yearling male	0.33	0.23
Harvested yearling female	0.19	0.23
Harvested fawns or calves	0.001	0

Source: Walsh, D.P.,ed., 2012, Enhanced surveillance strategies for detecting and monitoring chronic wasting disease in free-ranging cervids: U.S. Geological Survey Open-File Report 2012–1036. 42 p.

Because CWD tends to occur in clusters on the landscape, best efforts to distribute surveillance evenly throughout the unit are employed. Road-kill and targeted samples tend to be clustered with roads and human access points, so hunter-harvested animals outside of these areas are included in the annual sampling effort. Robust sampling for detection will likely occur every five years when a regional focus on hunter samples will make a greater contribution to point totals. However, annual monitoring of road-killed, targeted, and opportunistic hunter-killed sampling allows for continued surveillance over time.

Appendix B - CWD Working Group Final Recommendations

CWD Working Group Final Recommendations RECOMMENDATIONS and SUBRECOMMENDATIONS	Did the Wyoming Game and Fish Department incorporate recommendation into the Wyoming CWD Management Plan?		
	YES	NO	Location in Management Plan/Comments
RECOMMENDATION 1: REDUCTION OF ARTIFICIAL CONCENTRATIONS **We recommend WGFD takes action to reduce artificial points of concentrations.**	✓		
1.1 We recommend the WY Legislature provide the WGF Commission the authority to regulate the intentional private feeding of wild cervids, unless otherwise specified in law or authorized by the WGFD, exempting agricultural practices.	✓		Disease Management Strategies; Artificial Sources of Cervid Concentration
1.2 We recommend WGFD collaborate at a local level to reduce artificial points of cervid concentrations where possible.	✓		Disease Management Strategies; Artificial Sources of Cervid Concentration
1.3 WGFD should work closely with municipalities and counties to eliminate artificial feeding and/or to reduce density of cervids, unless otherwise specified in law or authorized by the WGFD.	✓		Disease Management Strategies; Artificial Sources of Cervid Concentration
1.4 WGFD will work collaboratively with public stakeholder working groups to evaluate feeding practices of elk at feed grounds where possible to reduce risk and minimize negative impacts on elk population.	✓		Elk Feedgrounds
RECOMMENDATION 2: CERVID REMAINS **We recommend a multi-prong approach to addressing the proper disposal of cervid remains and carcasses.**	✓		
2.1 We recommend WGFD works with individuals/NGOs/businesses to facilitate proper disposal of cervid remains/carcasses through funding partnerships.	✓		Disease Management Strategies; Additional Regulatory and Agency Actions
2.2 We recommend WGFD work with DEQ, local solid waste operators and WY DOT to properly dispose of carcasses statewide and provide information about proper disposal sites.	✓		Disease Management Strategies; Additional Regulatory and Agency Actions
2.3 We recommend the WY legislature provide authorization for use of existing funds to be used by local solid waste operators to properly dispose of cervid remains to reduce CWD prion prevalence.	✓		Disease Management Strategies; Additional Regulatory and Agency Actions

CWD Working Group Final Recommendations RECOMMENDATIONS and SUBRECOMMENDATIONS	Did the Wyoming Game and Fish Department incorporate recommendation into the Wyoming CWD Management Plan?		
	YES	**NO**	**Location in Management Plan/Comments**
2.4 We recommend the WY Legislature provides statutory authority to the WGF Commission to regulate the use of cervid urine.	✓		Disease Management Strategies; Additional Regulatory and Agency Actions
RECOMMENDATION 3: EDUCATION AND COMMUNICATION	✓		
3.1 We recommend WGFD create a thoroughly articulated and deliberate CWD communication plan. The first priority of this communication plan is to build public support to be able to implement the recommendations from the CWD Plan. This plan should target all stakeholders to include, but not limited to: general public, hunters, hunter education, travel & tourism (chambers), meat processors, taxidermists, outfitters, landowners, state & federal agencies, tribal, and elected officials. The communication plan should address all CWD related issues including: transportation (interstate and intrastate) & disposal of carcasses (e.g. Quarter & Go), CWD pathology basics, artificial point sources, transmission, potential management strategies, importance of testing, human health, surveillance, up to date science, not feeding wildlife and the implication feeding has with spreading CWD and the essential role of hunting in disease management, unknowns, etc. Pursue this outreach plan with local organizations and NGOs. This communication plan needs to be very carefully thought through in order to avoid misperceptions. Involve all working group members. WGFD will create materials that are easily usable by other entities and organizations.	✓		CWD Communication and Outreach
3.2 We recommend WGFD explore hiring a third party communications contractor to help implement the outreach plan.	✓		While not specifically mentioned in the Plan, this recommendation will be explored in the development of the CWD Communication and Implementation Plan.
RECOMMENDATION 4: HABITATS AND CWD **Combine habitat management and research to support cervid health.**	✓		
4.1 Incorporate CWD consideration in WGFD's Strategic Habitat Plan to improve habitat and promote better distribution of cervids.	✓		Disease Management Strategies; Artificial Sources of Cervid Concentration

CWD Working Group Final Recommendations RECOMMENDATIONS and SUBRECOMMENDATIONS	Did the Wyoming Game and Fish Department incorporate recommendation into the Wyoming CWD Management Plan?		
	YES	NO	Location in Management Plan/Comments
RECOMMENDATION 5: CERVID AND CWD MANAGEMENT ACTIONS **We recommend the Department consider experimental application of CWD suppression strategies utilizing an adaptive management framework with consideration to the "WAFWA Recommendations for Adaptive Management of CWD in the West" (Link doc) document. Management strategies should be implemented for a minimum of 10 years with a robust monitoring program to estimate prevalence with statistically significant sample sizes at least every 5 years. This would support a regional effort to gather valuable data to contribute to broader understanding of CWD suppression strategies. All management recommendations generated by this working group should be considered for experimental application and evaluation under this framework.**	✓		Disease Management Strategies
5.1 Research suggests the greatest potential for successful CWD management actions occurs when prevalence is low. Therefore, CWD management is recommended at all prevalence levels, but local options to implement more aggressive management should be pursued once statistically valid prevalence reaches/exceeds 5%.	✓	✗	The Plan specifically recommends CWD management occur at all prevalence levels, although the 5% threshold is not in the plan. However, the Plan does state (within Hunter Harvest Management section), "The Department will assess if CWD prevalence thresholds are appropriate to use as a trigger to require variable management considerations. Should prevalence thresholds be integrated into routine management recommendations, prevalence data used must be based on adequate sample size and distribution within a given herd unit."
5.2 Option 1: Specific management decisions should be determined at the local level and tailored to the population unit. Ensure education and outreach in order to gain and maintain public support for the CWD management actions. The following management recommendations are supported by this working group and should be considered either alone or in combination.	✓		Disease Management Strategies
5.2 Option 2: Increase mature buck harvest in order to lower CWD prevalence from current levels by a percentage deemed appropriate through local processes and with consideration to the WAFWA Document (https://www.wafwa.org/Documents%20and%20Settings/37/Site%20Documents/Committees/Wildlife%20He	✓		Disease Management Strategies; Hunter Harvest Management

CWD Working Group Final Recommendations RECOMMENDATIONS and SUBRECOMMENDATIONS	Did the Wyoming Game and Fish Department incorporate recommendation into the Wyoming CWD Management Plan?		
	YES	NO	Location in Management Plan/Comments
alth/docs/CWDAdaptiveManagementRecommendations_WAFWAfinal_approved010618.pdf).			
5.2 Option 3: Alter the timing of buck harvest in order to increase harvest of mature bucks. E.g. taking advantage of seasonal behaviors.	✓		Disease Management Strategies; Hunter Harvest Management
5.2 Option 4: Reduce cervid populations to measurably decrease densities within an area of concern (e.g. herd unit, hunt area, portion of a hunt area). Maintain reduced densities for the appropriate amount of time to adequately evaluate effects on CWD (i.e. greater than 10 years). This may require a sustained increase in female harvest. Density and harvest goals must be clearly articulated and developed with public input prior to and during implementation.	✓		Disease Management Strategies; Hunter Harvest Management
5.2 Option 5: Where possible, reduce areas of artificial concentration of cervids (feed, mineral, salt, water etc.) by working with landowners, producers, local, state and federal agencies.	✓		Disease Management Strategies; Artificial Sources of Cervid Concentration
5.2 Option 6: Utilize a robust monitoring program to identify areas with a high density of CWD positive cervids (i.e. "hot spots"). Develop and implement lethal removal strategies to maximize removal of cervids (male and female) around locations of known "hot spots", including but not limited to hunter harvest (preferred), targeted agency removal, and other designated methods.	✓		Disease Management Strategies; Hunter Harvest Management
5.3 Encourage a multifaceted approach to use experimental design or management strategies to reduce CWD prevalence. Acknowledge relative study time frames and need for continually engaging the public to gain informed support.	✓		Disease Management Strategies
5.4 WGFD will consider CWD in the adjustment of harvest and population objectives and associated management strategies to manage cervid numbers (male & female) in areas of concern.	✓		Disease Management Strategies; Hunter Harvest Management

CWD Working Group Final Recommendations RECOMMENDATIONS and SUBRECOMMENDATIONS	Did the Wyoming Game and Fish Department incorporate recommendation into the Wyoming CWD Management Plan?		
	YES	NO	Location in Management Plan/Comments
5.5 Utilize a combination of voluntary and mandatory testing in areas where specific CWD management is being applied in order to obtain statistically valid sample sizes to evaluate the efficacy of any such management strategy.	✓		Disease Management Strategies; Voluntary and Mandatory Sample Submission for CWD Management Actions
5.6 Develop an adaptive monitoring plan based on prescribed management for a time frame of 10 years (to be assessed at 5 year intervals) for all cervids.	✓		This Plan repeatedly acknowledges the necessity to implement and monitor prescribed management strategies over long and sufficient timeframes for robust evaluation, with suggestions of "(i.e., ten years)" being used. The recommendation that management actions be specifically tailored to localized herd unit issues occurs within the Disease Management Strategy section, so it was unnecessary to describe definitive timeframes.
5.7 Consider options to refund license fees for cervids that test CWD positive in areas where an experimental management strategy is in place.		✗	The Department will evaluate this recommendation if experimental hunter harvest management strategies are implemented and there is insufficient hunter participation due to an inability to receive a license refund if their harvested animal tests positive for CWD.
5.8 We recommend WGFD cooperate with landowners to increase hunter access for CWD management.	✓		Disease Management Strategies; Hunter Harvest Management
RECOMMENDATION 6.0: CWD AND MIGRATORY HERDS **We recommend that management actions are implemented in migratory cervid herds to reduce disease transmission risk and keep CWD prevalence at low or reduced levels.**	✓		Disease Management Strategies
6.1 Support systematic monitoring across the state to detect "hot spots" and CWD prevalence information.	✓		Disease Management Strategies; Artificial Sources of Cervid Concentration
6.2 Consider issuing licenses and associated hunting seasons in relation to migratory herds that are intended to specifically address CWD management actions.	✓		Disease Management Strategies
RECOMMENDATION 7.0: SURVEILLANCE & MONITORING **Support surveillance efforts necessary to detect changes in CWD prevalence. Use sample sizes collected over a maximum of a 3-year time frame as per the WGFD-CWD Surveillance Plan (Link doc).**	✓		

CWD Working Group Final Recommendations RECOMMENDATIONS and SUBRECOMMENDATIONS	Did the Wyoming Game and Fish Department incorporate recommendation into the Wyoming CWD Management Plan?		
	YES	NO	Location in Management Plan/Comments
7.1 Utilize various licensing options to increase sample size in hunt areas where statistically significant sample sizes are needed (i.e. increased reduced price license/female harvest, late season, etc.).	✓	✗	The Plan acknowledges that statistically valid sample sizes may not be obtained in some herd units due to logistical issues or harvest regimes. It does not state that we will specifically alter hunting season framework (e.g., license types/quotas) merely to achieve more CWD samples.
7.2 WGFD to create non-monetary incentives to increase CWD sample sizes where needed.	✓		While non-monetary incentives are not explicitly mentioned in this Plan, Recommendation 7.2 will be addressed in the CWD Communication and Implementation Plan. This recommendation is similar to current strategies the Department has in place for brucellosis testing.
7.3 Analyze & mine data for population and disease demographic information including male:female ratio, gender specific disease prevalence, survival rates, pre and post management.	✓		This is part of an ongoing effort with multiple western states and Alberta. Additional work was done on this in October 2019. This will also be further addressed by requiring WGFD biologists to discuss CWD issues and available data in annual Job Completion Reports and formal objective reviews.
7.4 Pursue increased funding to support testing, monitoring and additional laboratory capacity.	✓		Disease Management Strategies; Additional Agency and Regulatory Actions
RECOMMENDATION 8: RESEARCH **We recommend the WGFD enhance its CWD research and testing capacity by diverse means to enable science-based cervid management.**	✓		Research and Coordination
8.1 Continue to rigorously pursue collaborative genetic research programs with state and federal agencies, universities and private entities to better understand the role genetics plays in CWD in cervid populations and potential management implications. This should include, but not be limited to: monitoring frequency of genotypes in cervid populations and the fitness traits associated with these genotypes.	✓		Research and Coordination
8.2 We recommend WGFD pursue research (e.g. a survey) to determine public attitudes on CWD.		✗	The Department has not committed to conducting a public attitude survey of the general public. For the purposes of this Plan and communication strategies to follow, the Department will rely on information gathered from the 2019 Hunter Perspective Survey and input received through the CWD Collaborative Process.

CWD Working Group Final Recommendations RECOMMENDATIONS and SUBRECOMMENDATIONS	Did the Wyoming Game and Fish Department incorporate recommendation into the Wyoming CWD Management Plan?		
	YES	NO	Location in Management Plan/Comments
8.3 Investigate the relative importance of direct vs. indirect transmission of CWD prions.	✓		Research and Coordination
8.4 Assist in the validation of experimental assays for CWD prion detection (e.g. PMCA, rt-quic, and field testing).	✓		Research and Coordination
8.5 Evaluate regional differences in CWD dynamics.	✓		Research and Coordination
8.6 Increase emphasis on pursuing funding for collaborative CWD research and management efforts. Explore funding sources including but not limited to: private, non-profits, general state funds, grants, federal sources, CWD management stamp, non-consumptive users, WY Governor's Big Game License Coalition, Commissioner's license.	✓		Research and Coordination
8.7 We recommend WGFD explore the possibility of creating an additional dedicated license with revenue specifically ear marked for CWD research and management.		✗	There was strong non-consensus from the CWD Working Group for this recommendation. In addition, significant public opposition has been expressed regarding other special or "set aside" licenses. Finally, there is concern with the precedent of developing special licenses that are earmarked for funding specific purposes.
8.8 Incorporate CWD data collection into current and future research where appropriate.	✓		Research and Coordination and Disease Management Strategies
8.9 Evaluate the effect of predators/large carnivores at a local level on CWD prevalence, transmission, and management implications.	✓		Research and Coordination
8.10 Begin a research project at feed, mineral, water, and salt sites working with willing landowners to explore techniques to reduce CWD transmission.	✓		Research and Coordination and Disease Management Strategies; Artificial Sources of Cervid Concentration
8.11 We recommend WGFD collaborate on research on how environmental prion contamination correlates with disease prevalence and transmission.	✓		Research and Coordination
8.12 Conduct field studies to determine if artificial cervid aggregation is increasing CWD prevalence (e.g. underpasses/overpasses, water holes, feed grounds, etc).	✓		Research and Coordination
8.13 Pursue habitat research on CWD to include: 1) How cervid habitat selection affects CWD prevalence, 2) How habitat improvements affect population demographics and distribution in the face of CWD.	✓		Research and Coordination

CWD Working Group Final Recommendations RECOMMENDATIONS and SUBRECOMMENDATIONS	Did the Wyoming Game and Fish Department incorporate recommendation into the Wyoming CWD Management Plan?		
	YES	NO	Location in Management Plan/Comments
8.14 We recommend WGFD continue to collaborate nationally and internationally regarding CWD strategies and management actions and associated outcomes and research - in order to adaptively manage CWD.	✓		Research and Coordination
8.15 We recommend WGFD collaborate in research and evaluation of a CWD vaccine.	✓		Research and Coordination
8.16 Study the effects of competition among cervid species on CWD prevalence.	✓		Research and Coordination
RECOMMENDATION 9: MEAT PROCESSING	✓		
9.1 Recommend the WY Dept. of Health and WY Dept. Agriculture work with pertinent stakeholder groups to develop recommendations for meat processors.		✗	Regulation of meat processors does not fall within the authority of the Department or Commission. Any best management practices developed for meat processors would need to go through the appropriate agencies.
9.2 Recommend the WY Dept. of Health and WY Dept. Agriculture work with pertinent stakeholder groups to develop recommendations for donation of game meat.	✓		Human Health and CWD

Appendix C - Hunter Perspective Survey

2019 Hunter Perspective Survey

From February through April of 2019, the Department surveyed both resident and nonresident deer hunters to garner insight on hunter perspectives regarding CWD in deer in Wyoming. Colorado Parks and Wildlife conducted a similar survey, and the Department intends to compare results from both states to provide a broader understanding of hunter perspectives on CWD. The purpose of this survey was to learn what resident and nonresident hunter interests are in relation to CWD, their potential concerns regarding this disease, and the ways the Department might effectively manage impacted deer herds in the state.

A sample of 3,000 deer hunters received the survey, including 2,000 resident and 1,000 nonresident hunters. Hunters were selected from respondents to the 2017 and 2018 Wyoming Game and Fish Department deer harvest survey, allowing both limited quota and general license holders who reported hunting in areas with known high or low CWD prevalence to be surveyed. Hunt areas with CWD prevalence of 5% or less were considered low prevalence areas, while those with at least 10% CWD prevalence were considered high prevalence areas. A total of 1,201 hunters (622 from high prevalence hunt areas and 579 from low prevalence hunt areas; 751 residents and 450 nonresidents) responded to the survey. Hunters surveyed were contacted by email initially but were then sent a paper copy if they did not respond to the email survey.

Results from the survey were considered during the development of this revised Plan. In addition, hunter perspectives inform Department communication strategies by providing valuable insight into what information is most important to the hunting public. Similar future surveys may also be conducted to gauge shifts in hunter perspectives regarding CWD over time. A copy of the survey and a summary of responses to relevant questions follows.

Key preliminary results from this survey were:

- A relative majority of hunters (48% high CWD prevalence [HCWD] group, 45% low CWD prevalence [LCWD] group) do not agree that concerns about CWD have been exaggerated, and a large majority (82% HCWD group, 78% LCWD group) agree that effort should be taken to reduce the rate of infection in deer.
- A majority of hunters are very concerned about the health of affected deer herds (59% HCWD group, 58% LCWD group), the potential for CWD to reduce deer hunting opportunity (61% HCWD group, 59% LCWD group), and future generation's ability to enjoy deer hunting (61% HCWD group, 58% LCWD group).
- Surveyed hunters were presented with three scenarios tailored to the high or low CWD prevalence of the original hunt area in which they hunted: one in which CWD prevalence stayed about the same; one in which CWD prevalence approximately doubled; and one in which CWD prevalence increased by approximately four to five times.
    - Under all three scenarios, a large majority (more than 80%) of hunters are likely to support taking measures to control CWD.
    - The proportion of hunters likely to look for alternative areas to hunt increased as

theoretical CWD prevalence increased.

- A majority (more than 50%) of hunters indicated they are very unlikely to stop hunting for deer in Wyoming under all three scenarios.

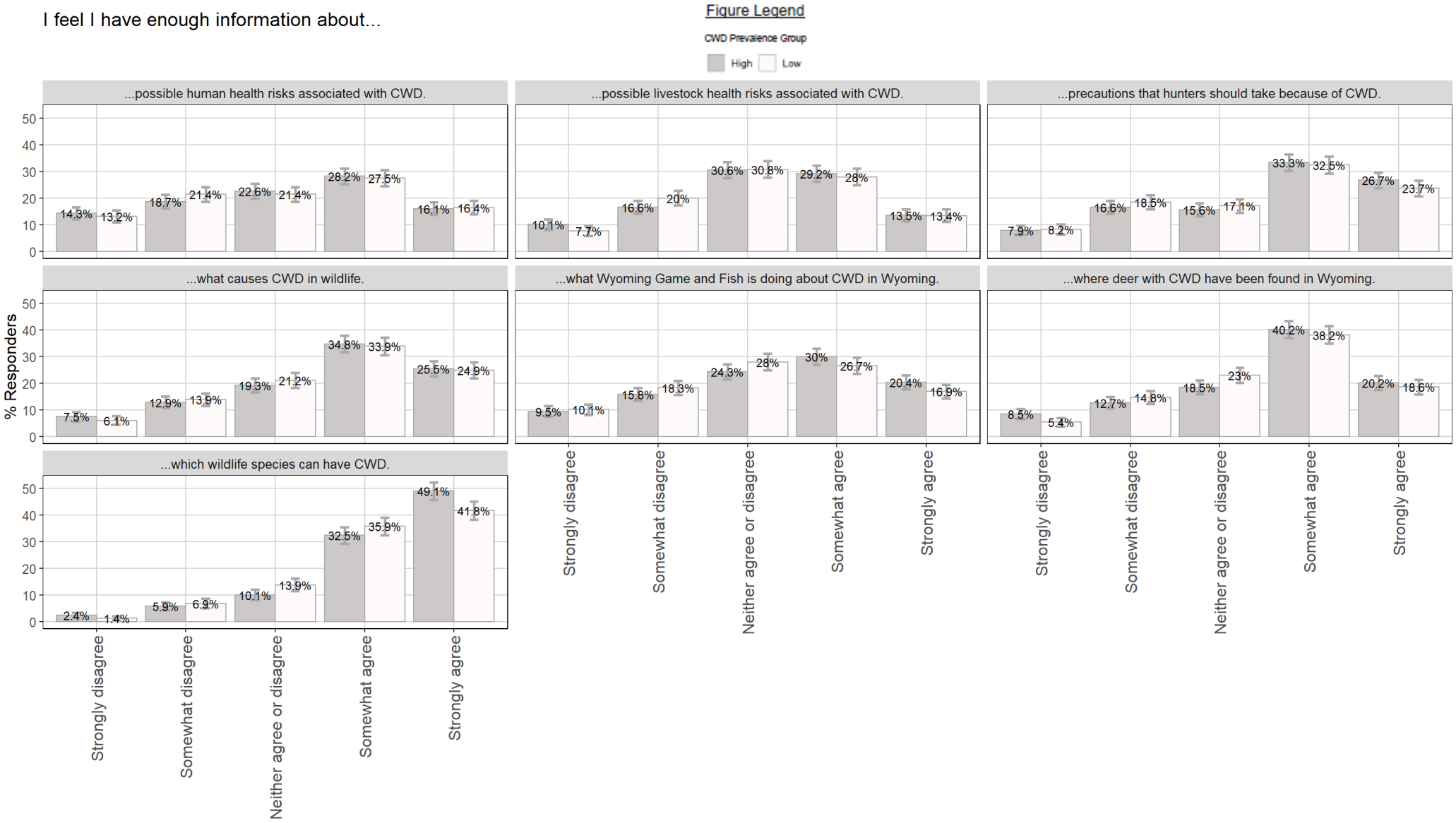
- A majority of deer carcasses in Wyoming are either disposed of in the trash or landfill (28% HCWD group, 25% LCWD group), or edible meat was removed and the remaining carcass left in the field (34% HCWD group, 37% LCWD group).
- About 20% of hunters are unaware of carcass transportation regulations.
- About 65% of the HCWD group and 64% of the LCWD group reported harvesting a deer during the 2017 or 2018 hunting season. Of the HCWD group, 10% reported having ever harvested a CWD-positive deer versus <2% from the LCWD group.
- The most acceptable CWD control management action among hunters was the use of special management hunts to remove deer in localized areas of especially high prevalence with minimum impact on overall deer numbers. This was followed by using hunters to reduce the total deer population (bucks and does) and then by increasing the numbers of buck licenses available during later seasons in affected hunt areas.
- Taking no action and letting CWD take its natural course was the most unacceptable management action among a majority of hunters (74% HCWD group, 75% LCWD group).
- A majority of hunters indicate striking a balance between controlling CWD and preserving hunting opportunities should be a priority for the Department (82% HCWD group, 84% LCWD group).
- The Department's website is currently the best available and preferred resource from which hunters get information about CWD. For all hunters, the Department's website and hunting regulation brochures are the top two preferred methods of getting information about CWD. However, for hunters under 50 years of age, social media is the top third preferred method while hunting magazines are the top third preference for hunters over 50 years of age.

Preliminary Results

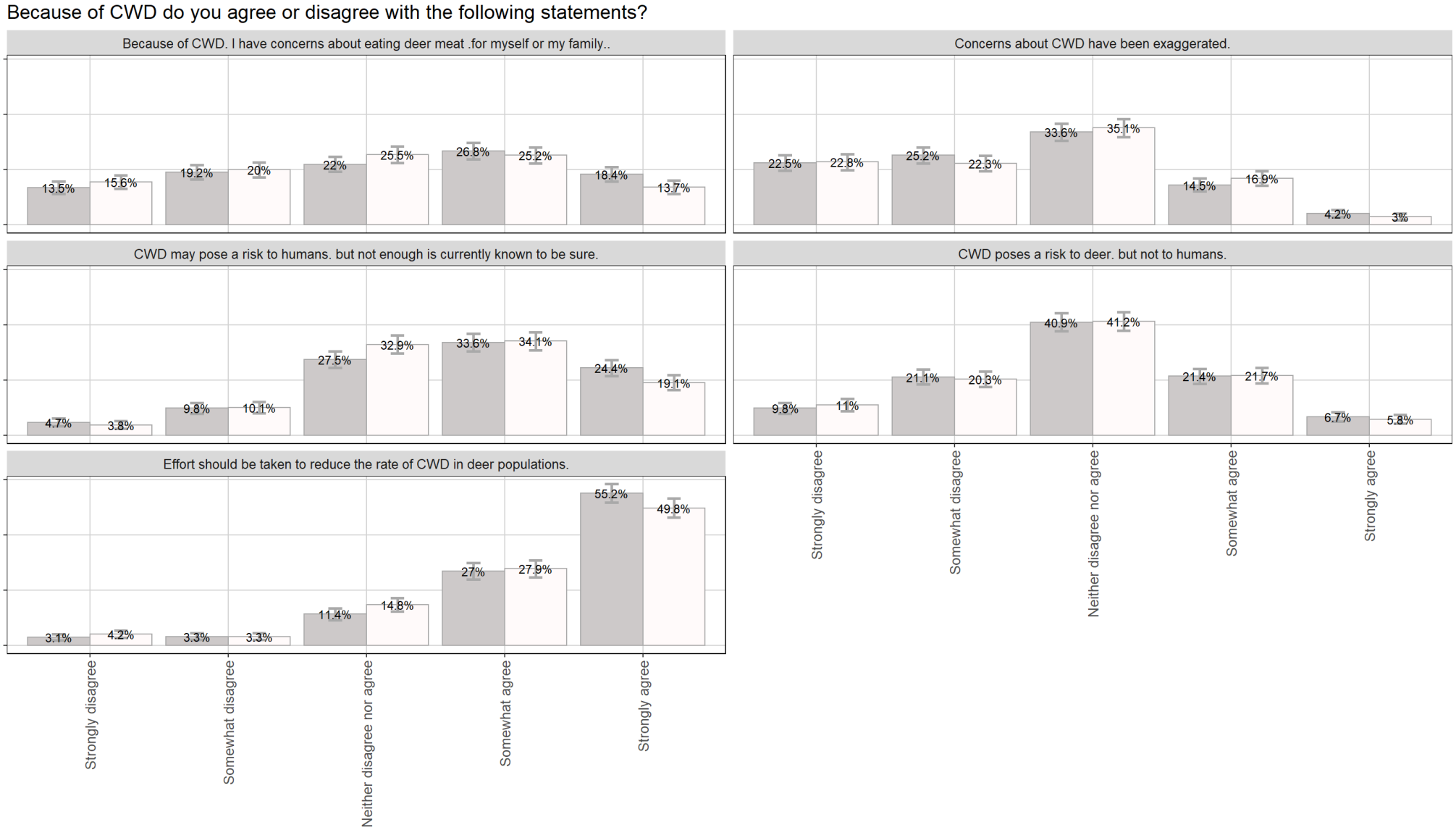
Survey Response Summary:

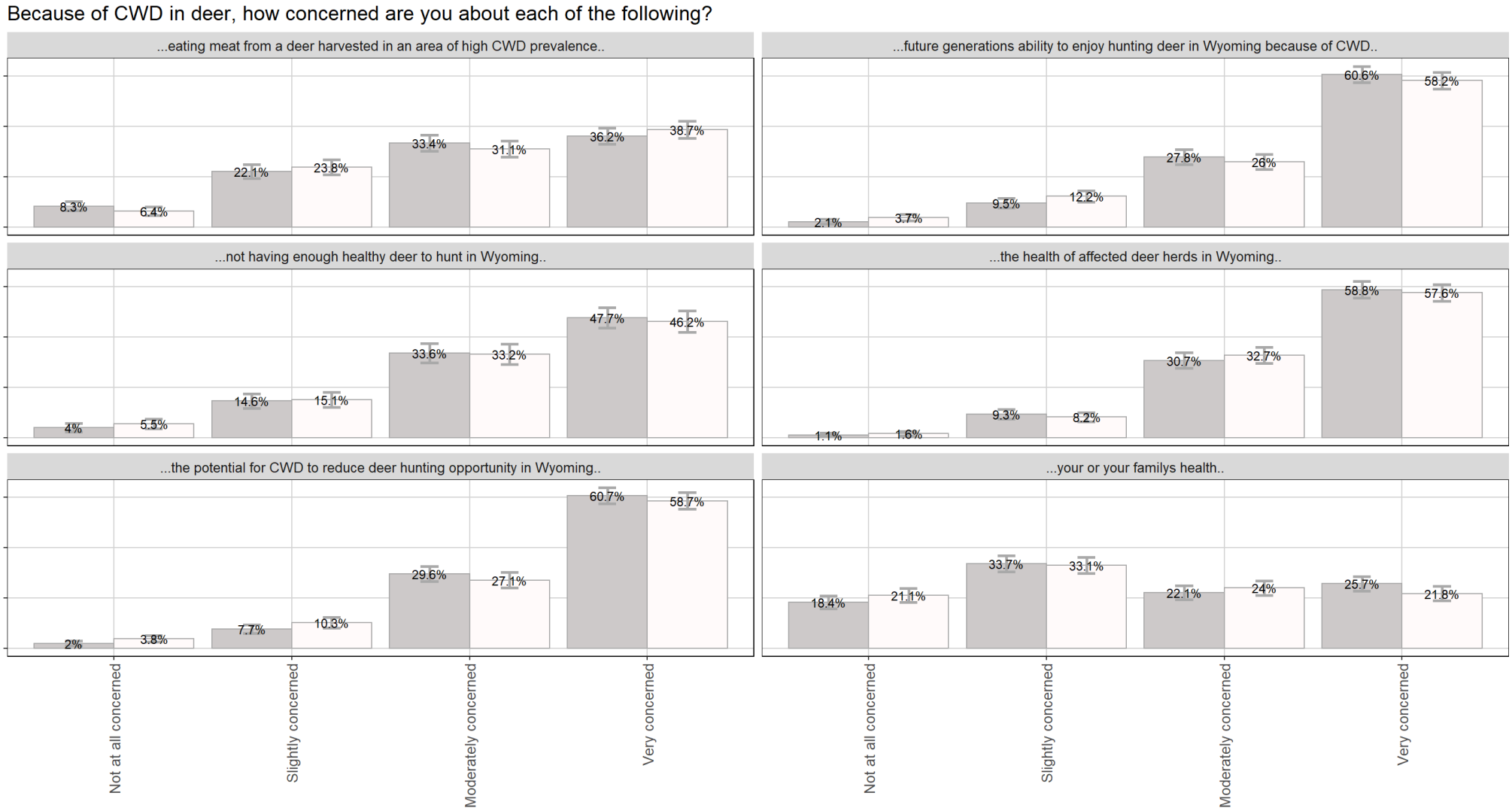
CWD Prevalence	Residency	# Responded	Response Rate
High	NR	243	48.6%
High	R	379	37.9%
Low	NR	207	41.4%
Low	R	372	37.2%
Total	Total	1201	40.0%

I feel I have enough information about...

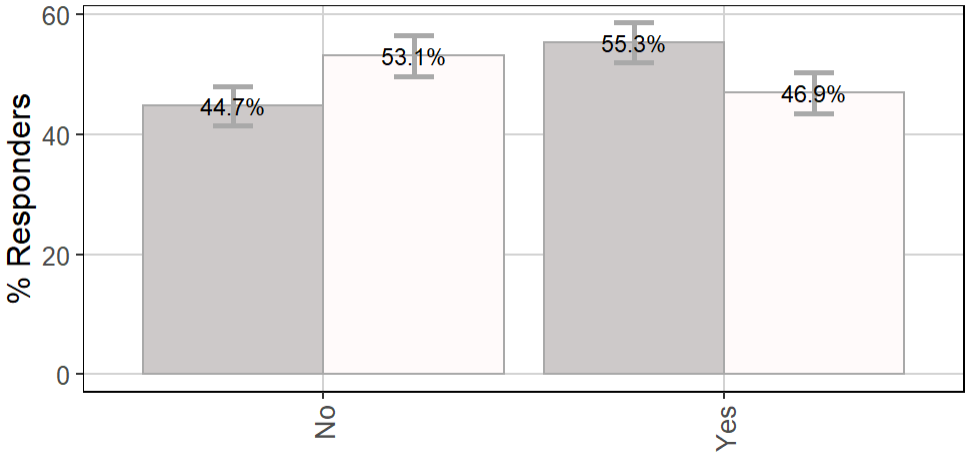


Note: All error bars are 90% MOE for “% Responders” within the “High” sample group or “Low” sample group.

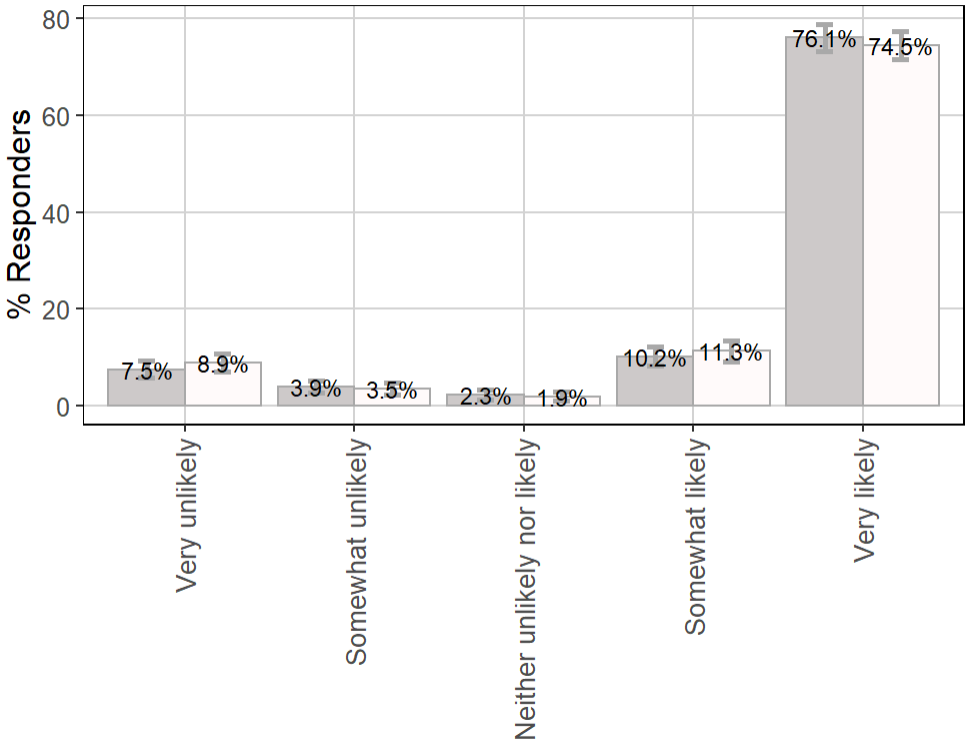

Because of CWD do you agree or disagree with the following statements?
Because of CWD. I have concerns about eating deer meat .for myself or my family..
13.5%
15.6%
19.2%
20%
22%
25.5%
26.8%
25.2%
18.4%
13.7%
Concerns about CWD have been exaggerated.
22.5%
22.8%
25.2%
22.3%
33.6%
35.1%
14.5%
16.9%
4.2%
3%
CWD may pose a risk to humans. but not enough is currently known to be sure.
4.7%
3.8%
9.8%
10.1%
27.5%
32.9%
33.6%
34.1%
24.4%
19.1%
CWD poses a risk to deer. but not to humans.
9.8%
11%
21.1%
20.3%
40.9%
41.2%
21.4%
21.7%
6.7%
5.8%
Effort should be taken to reduce the rate of CWD in deer populations.
3.1%
4.2%
3.3%
3.3%
11.4%
14.8%
27%
27.9%
55.2%
49.8%
% Responders
0
20
40
60
Strongly disagree
Somewhat disagree
Neither disagree nor agree
Somewhat agree
Strongly agree


Because of CWD in deer, how concerned are you about each of the following?
...eating meat from a deer harvested in an area of high CWD prevalence..
...future generations ability to enjoy hunting deer in Wyoming because of CWD..
...not having enough healthy deer to hunt in Wyoming..
...the health of affected deer herds in Wyoming..
...the potential for CWD to reduce deer hunting opportunity in Wyoming..
...your or your familys health..
% Responders
0
20
40
60
8.3%
6.4%
22.1%
23.8%
33.4%
31.1%
36.2%
38.7%
2.1%
3.7%
9.5%
12.2%
27.8%
26%
60.6%
58.2%
4%
5.5%
14.6%
15.1%
33.6%
33.2%
47.7%
46.2%
1.1%
1.6%
9.3%
8.2%
30.7%
32.7%
58.8%
57.6%
2%
3.8%
7.7%
10.3%
29.6%
27.1%
60.7%
58.7%
18.4%
21.1%
33.7%
33.1%
22.1%
24%
25.7%
21.8%
Not at all concerned
Slightly concerned
Moderately concerned
Very concerned

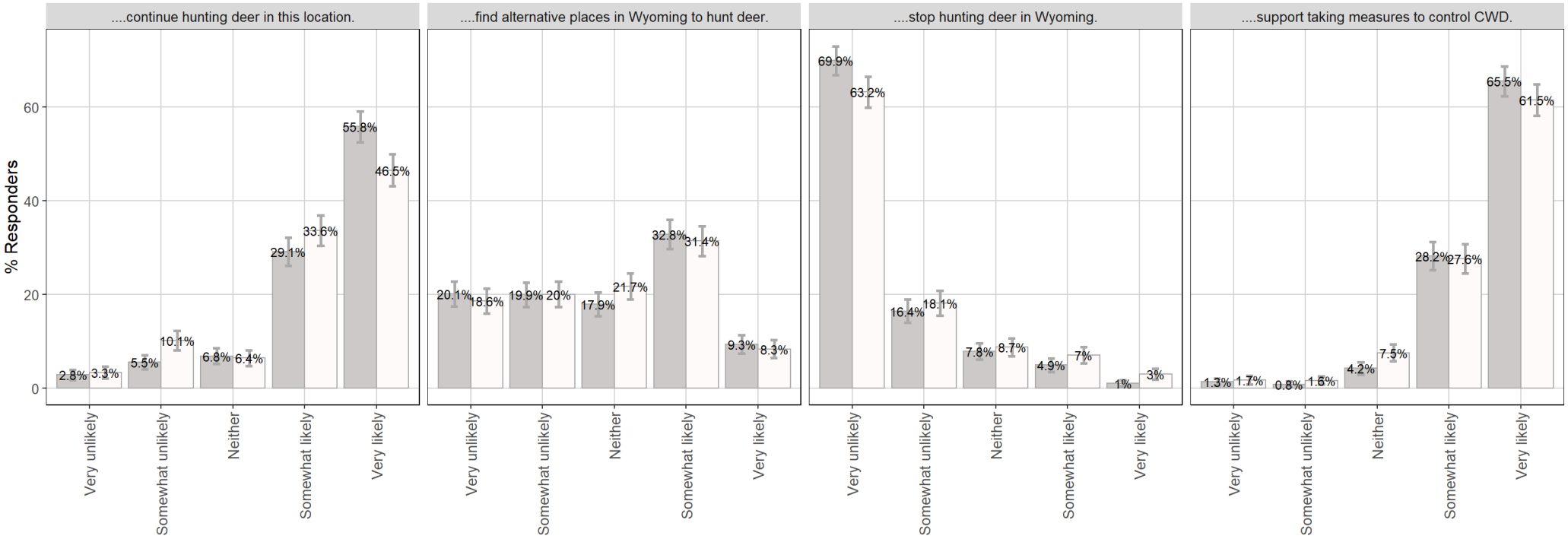
Were you aware of the CWD prevalence in your hunt area?



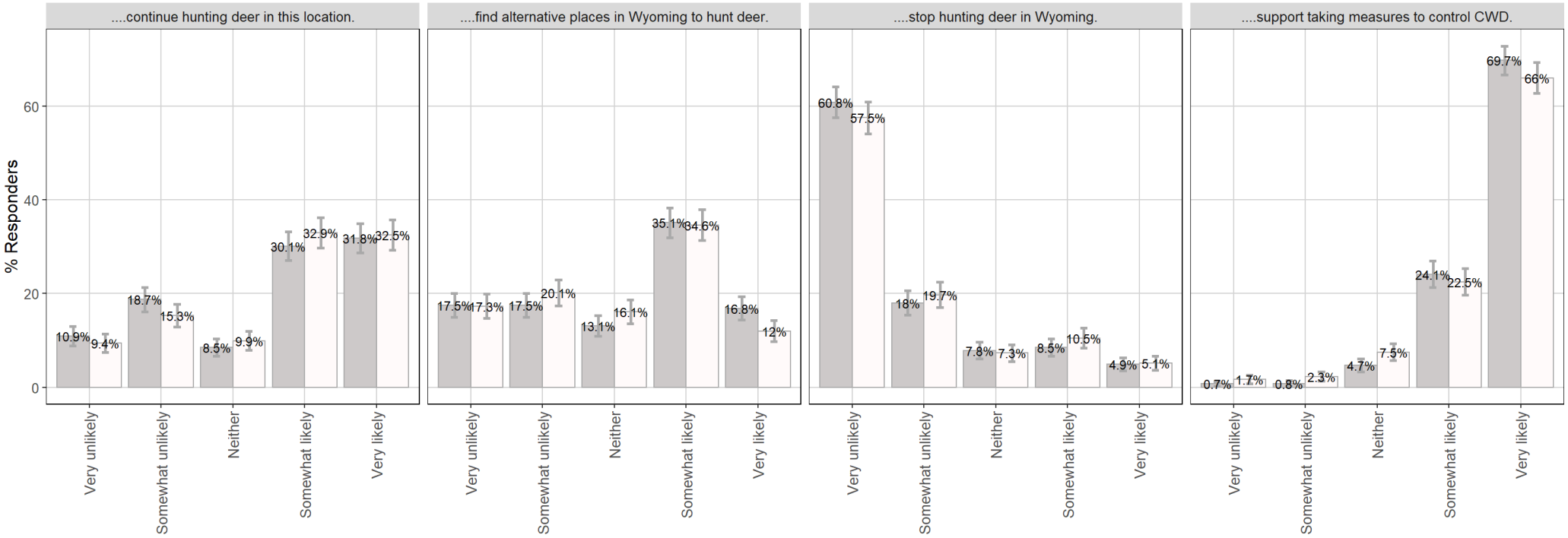
How likely are you to hunt in Wyoming the next 3 years?



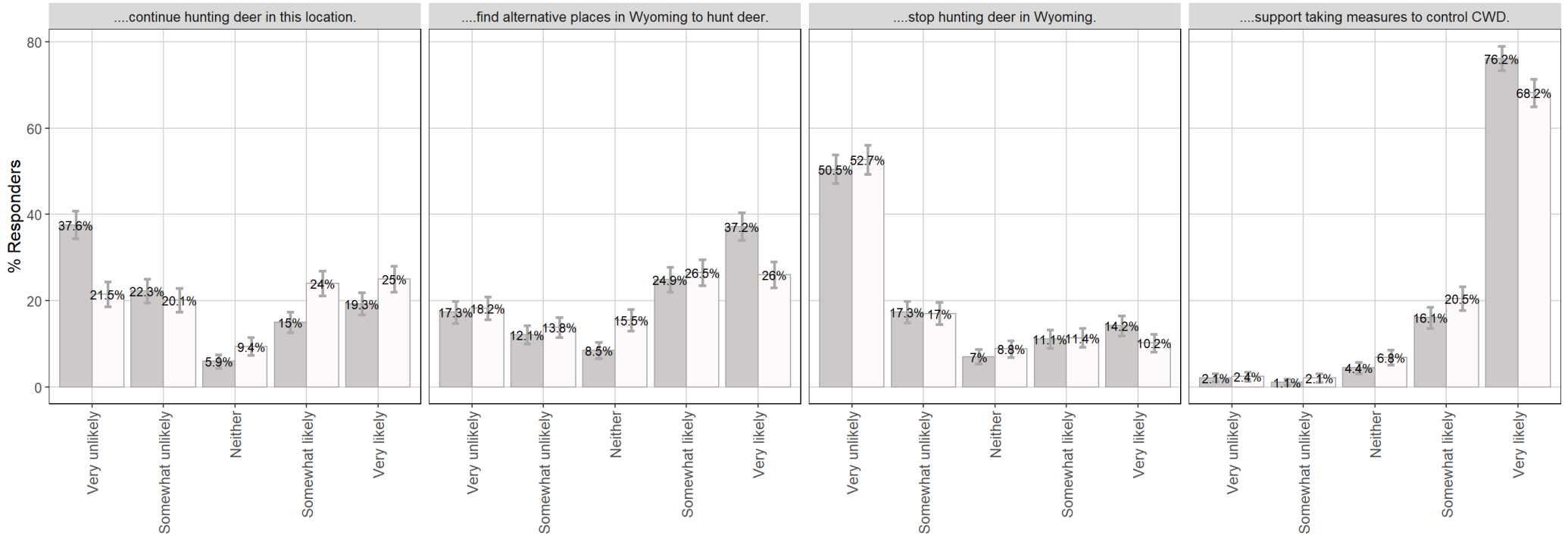
High CWD Prevalence: Given prevalence of at least 10%,
Low CWD Prevalence: If prevalence were at least 5%,
How likely are you to...



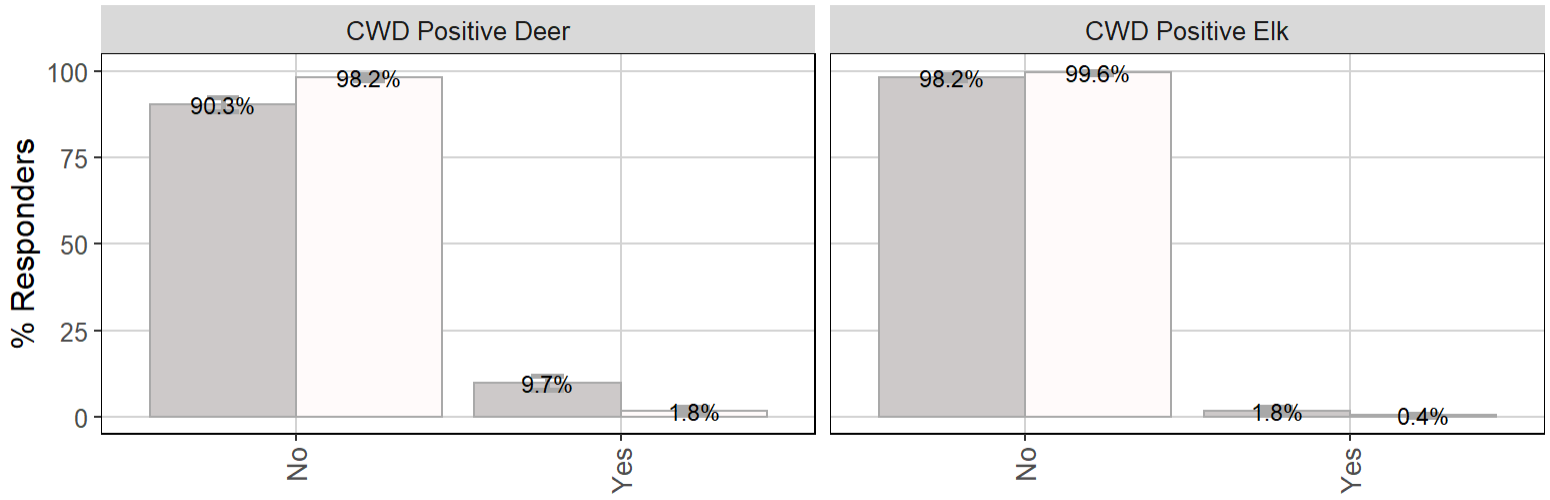
High CWD Prevalence: If prevalence were at least 20%
Low CWD Prevalence: If prevalence were at least 10%
How likely are you to...



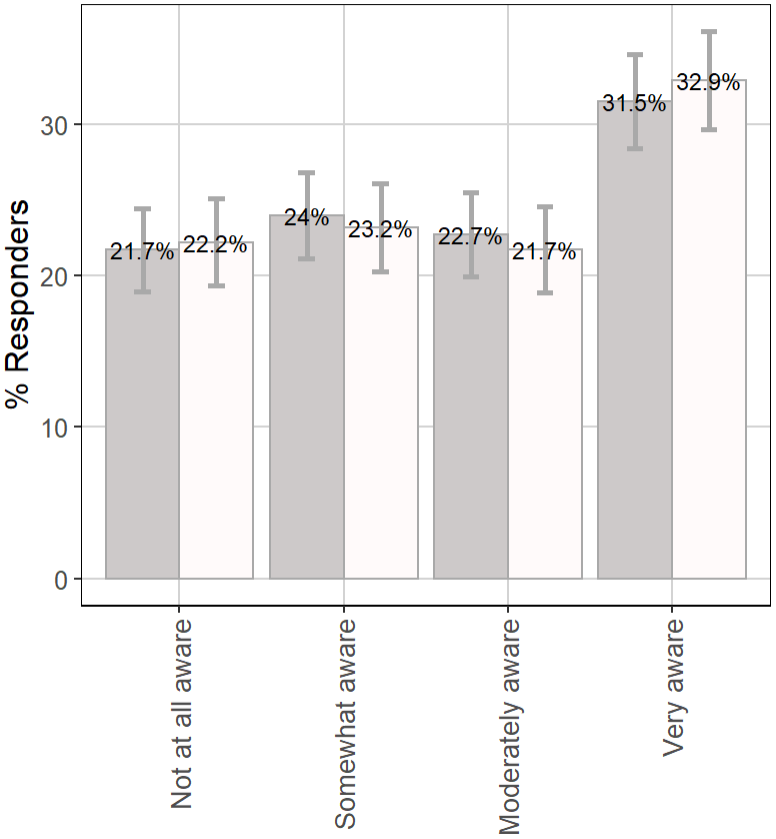
High CWD Prevalence: If prevalence were at least 50%
Low CWD Prevalence: If prevalence were at least 20%
How likely are you to...



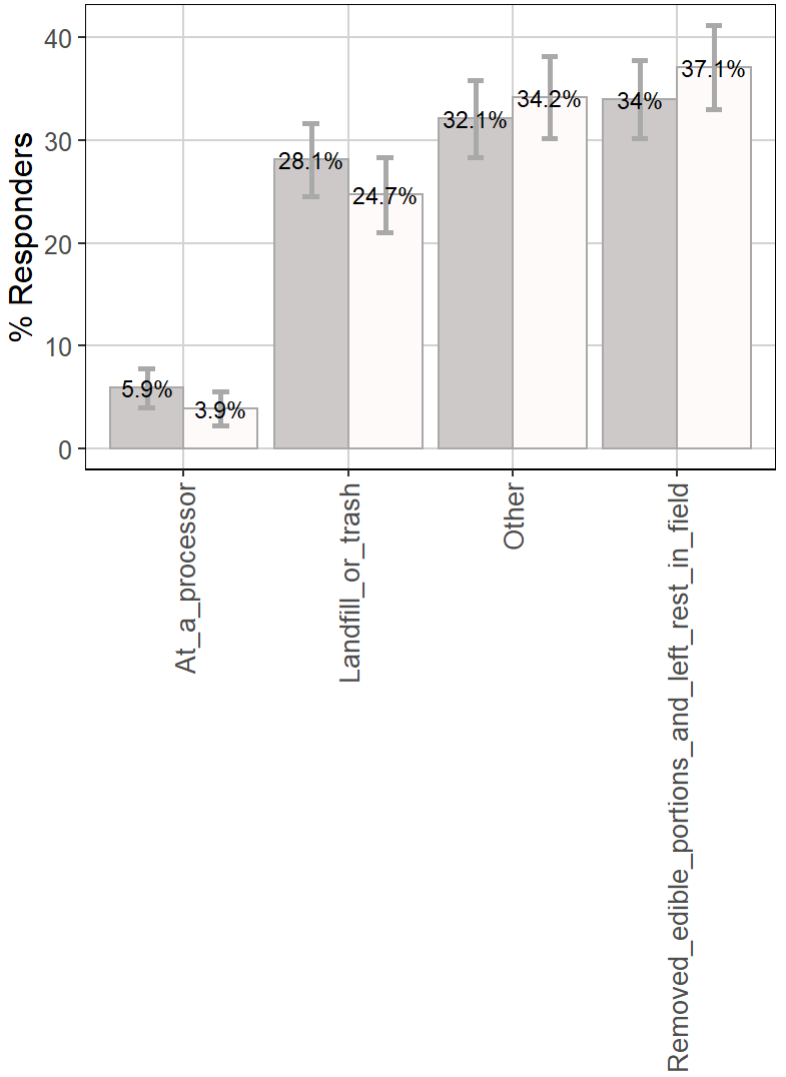
Have you ever harvested a...



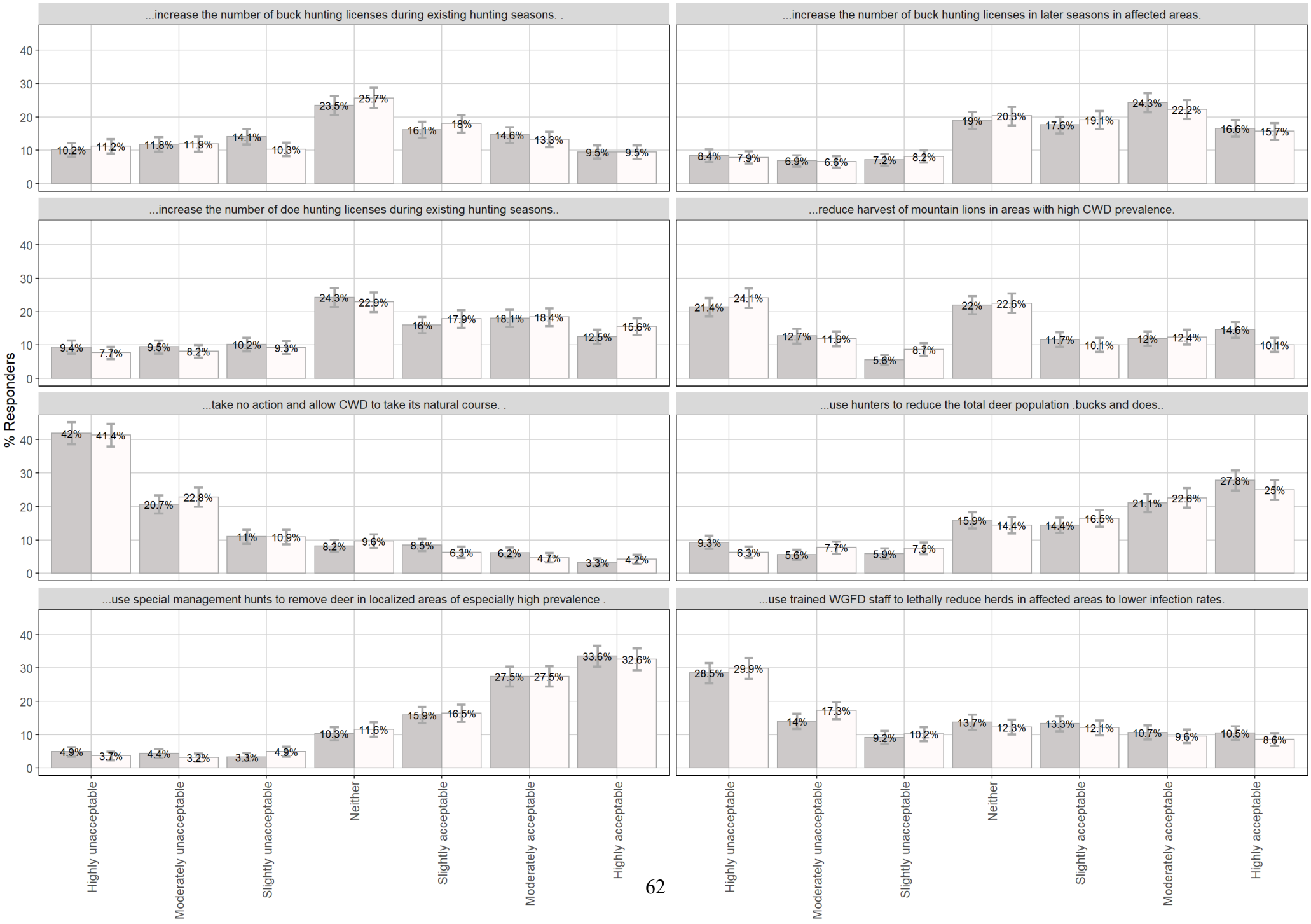
How aware are you of carcass transportation regulations?

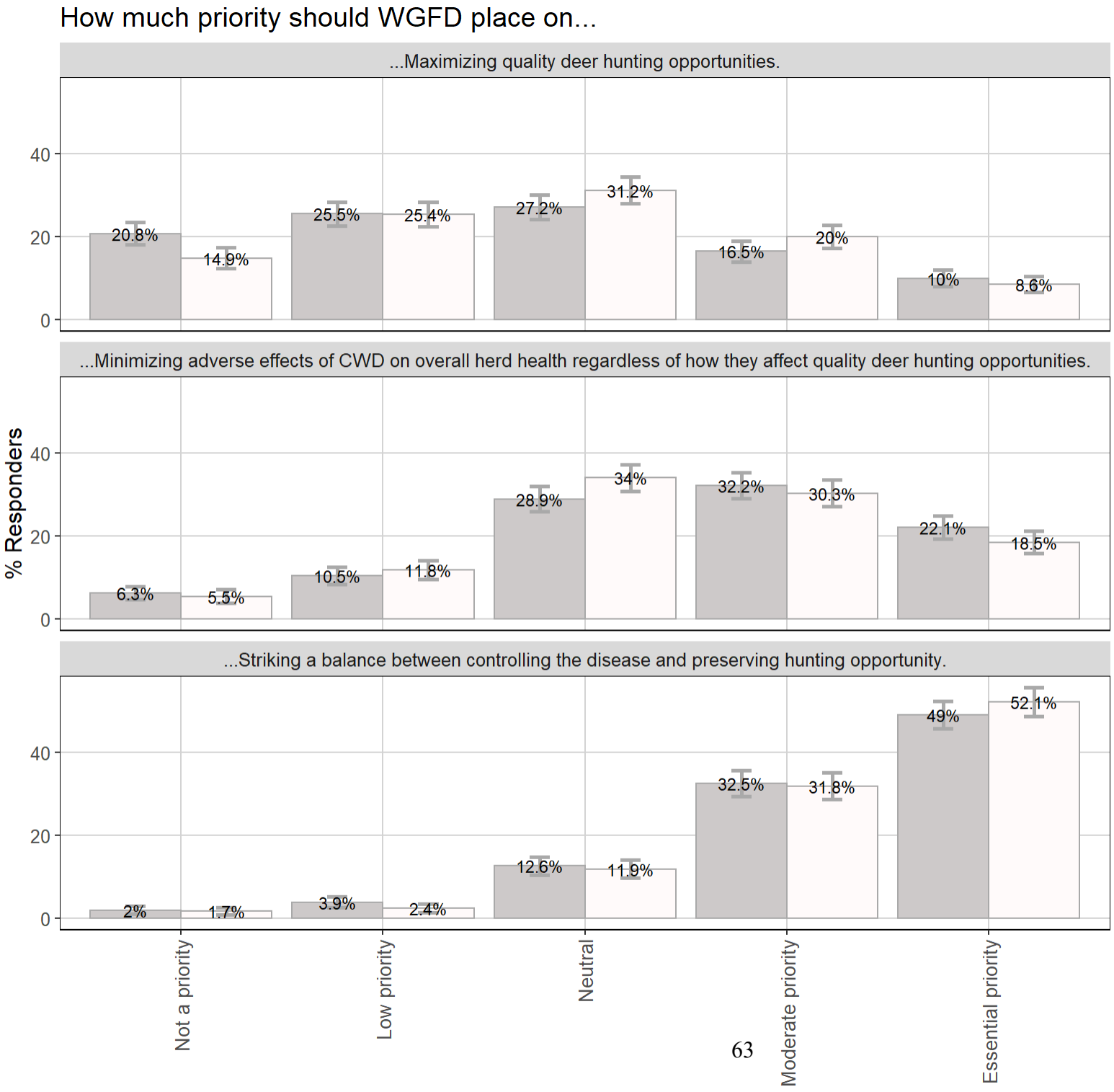


How do you dispose of carcasses?

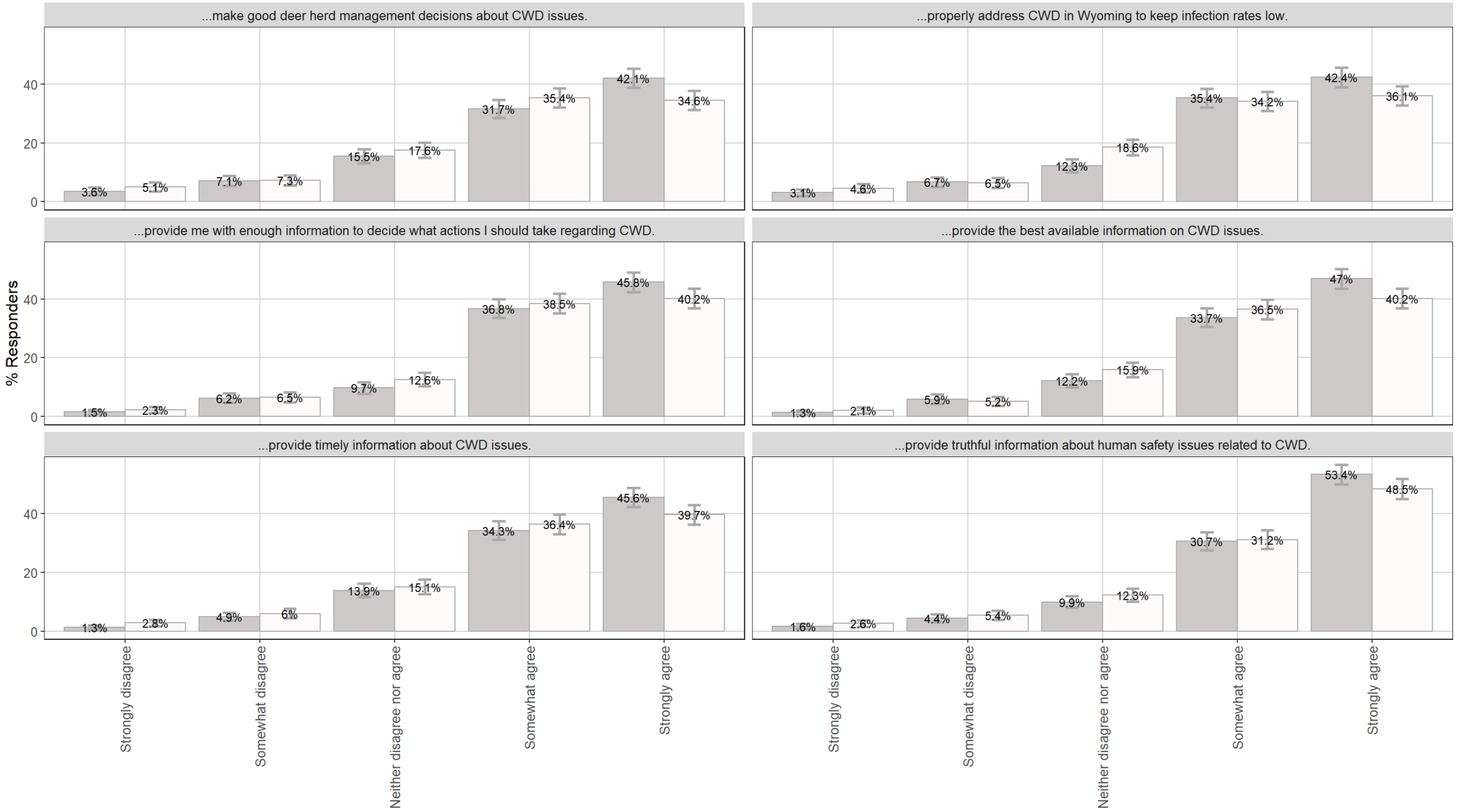


How acceptable would it be for WGFD to...

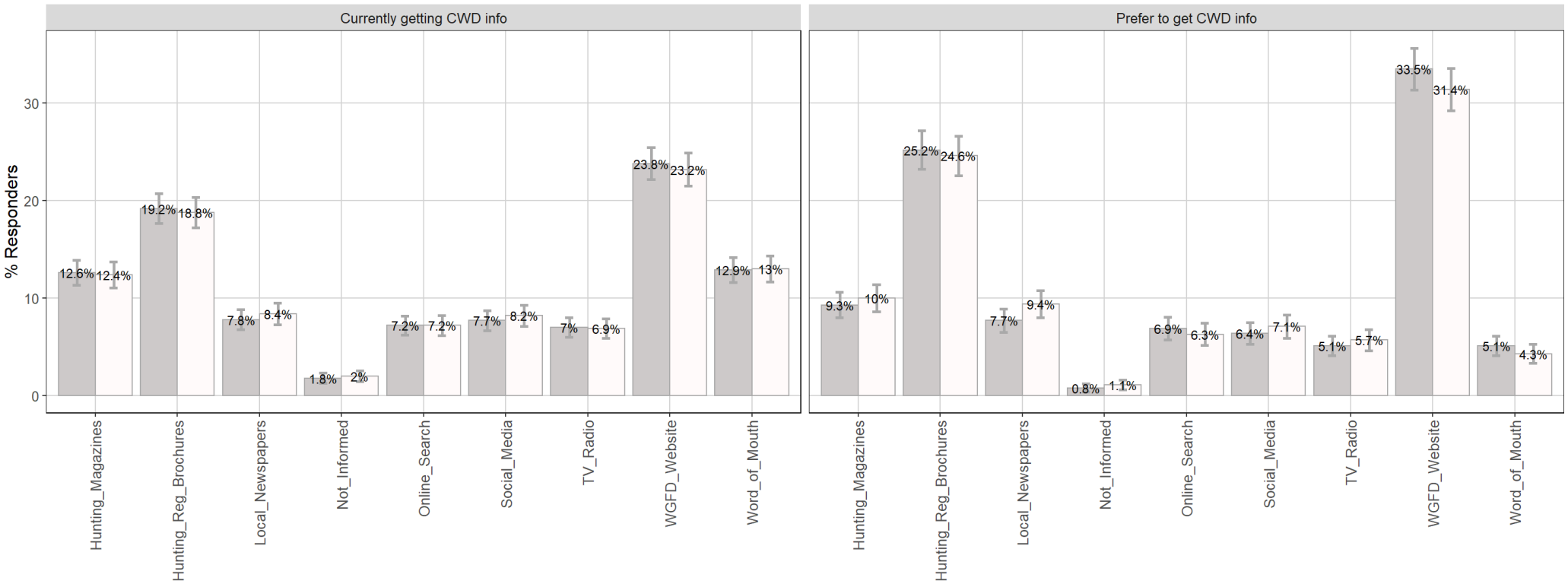



How much priority should WGFD place on...
...Maximizing quality deer hunting opportunities.
...Minimizing adverse effects of CWD on overall herd health regardless of how they affect quality deer hunting opportunities.
...Striking a balance between controlling the disease and preserving hunting opportunity.
% Responders
0
20
40
20.8%
14.9%
25.5%
25.4%
27.2%
31.2%
16.5%
20%
10%
8.6%
6.3%
5.5%
10.5%
11.8%
28.9%
34%
32.2%
30.3%
22.1%
18.5%
2%
1.7%
3.9%
2.4%
12.6%
11.9%
32.5%
31.8%
49%
52.1%
Not a priority
Low priority
Neutral
Moderate priority
Essential priority

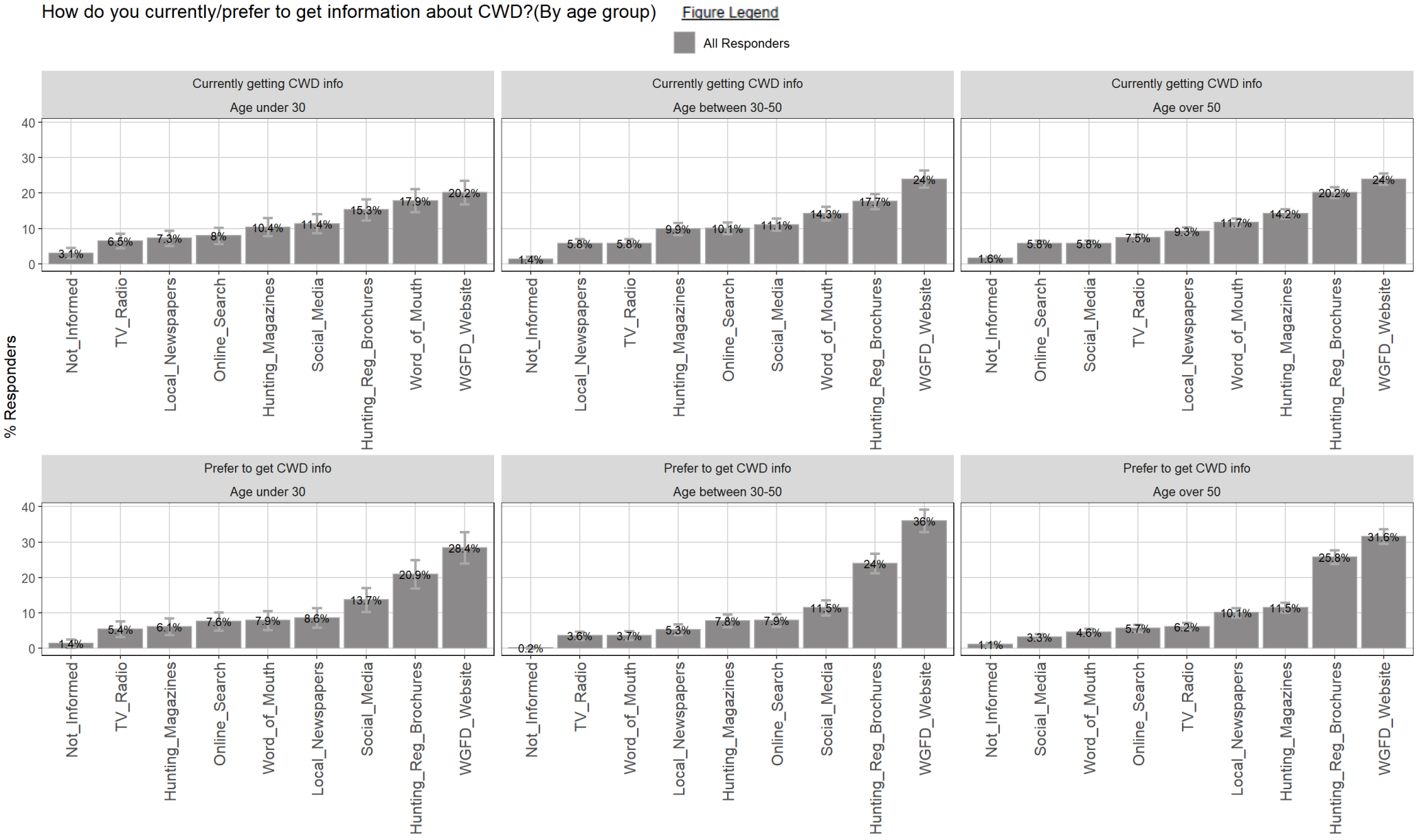
I am confident that WGFD will...



How do you currently/prefer to get information about CWD?



How do you currently/prefer to get information about CWD?(By age group) Figure Legend



Your Perspectives About Chronic Wasting Disease in Wyoming

* Required

1. **Survey ID:** *

Background Information

2. **Did you go deer hunting (mule deer or white-tailed deer) in Wyoming during the 2017 or 2018 deer hunting seasons?** *

Mark only one oval.

- ◯ Yes *Skip to question 3.*
- ◯ No *Skip to question 3.*
- ◯ No, and I have never hunted for deer in Wyoming. *Stop filling out this form.*

3. **Did you harvest any deer during the 2017 or 2018 deer hunting seasons in Wyoming?**

Mark only one oval.

- ◯ Yes *Skip to question 4.*
- ◯ No *Skip to question 5.*

4. **How did you dispose of your animal carcass(es) in 2017 and/or 2018?**

Check all that apply.

- ☐ At a landfill or trash container that goes to a landfill
- ☐ Removed edible portions and left the rest where animal was harvested
- ☐ Carcass was disposed of by processor
- ☐ Other: _____

5. **Overall, how satisfied were you with your deer hunting experience during the 2017 and/or 2018 hunting seasons?**

Mark only one oval.

- ◯ Very satisfied
- ◯ Somewhat satisfied
- ◯ Neither unsatisfied nor satisfied
- ◯ Somewhat unsatisfied
- ◯ Very unsatisfied

6. **How important to you is each of the following reasons to hunt deer in Wyoming?**

Mark only one oval per row.

	Not important	Slightly important	Moderately important	Very important
To spend time in nature	◯	◯	◯	◯
To harvest a trophy	◯	◯	◯	◯
To spend time with family/friends	◯	◯	◯	◯
To obtain wild game meat	◯	◯	◯	◯
To contribute to wildlife management	◯	◯	◯	◯
To contribute to the local community (e.g., financial benefits from hunters)	◯	◯	◯	◯
To test/improve my skills	◯	◯	◯	◯
For physical exercise	◯	◯	◯	◯
Other	◯	◯	◯	◯

7. **If you answered "Other", please specify your other reasons for hunting here:**

Opinions About Chronic Wasting Disease (CWD)

Please read the following description before continuing:

Chronic wasting disease (CWD) is a disease of deer, elk, and moose. It is caused by an abnormal protein called a prion. In the early stages of the disease, infected animals appear healthy. In later stages, infected animals show changes in behavior and may appear thin or uncoordinated. Infected animals always die. The disease agent passes from animal to animal through saliva, feces, and other means and can persist in the environment for some time (Please note: the questions on this page and most of the remaining pages of this survey ask your opinions about CWD in deer specifically, in Wyoming). Infection with CWD shortens the lifespan of a deer and -- if infection becomes too common in a deer herd -- CWD can affect the herd's ability to sustain itself. Within infected deer herds, bucks tend to contract CWD at twice the rate of does.

To what extent do you disagree or agree with each of the following statements related to CWD?

8. **I feel that I have enough information about…**

Mark only one oval per row.

	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
…where deer with CWD have been found in Wyoming	◯	◯	◯	◯	◯
...which wildlife species can have CWD	◯	◯	◯	◯	◯
...what causes CWD in wildlife	◯	◯	◯	◯	◯
...possible livestock health risks associated with CWD	◯	◯	◯	◯	◯
...possible human health risks associated with CWD	◯	◯	◯	◯	◯
...precautions that hunters should take because of CWD	◯	◯	◯	◯	◯
...what Wyoming Game and Fish is doing about CWD in Wyoming	◯	◯	◯	◯	◯

9. **To what extent do you disagree or agree with each of the following statements about CWD?**

Mark only one oval per row.

	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree
Concerns about CWD have been exaggerated	◯	◯	◯	◯	◯
Effort should be taken to reduce the rate of CWD in deer populations	◯	◯	◯	◯	◯
CWD poses a risk to deer, but not to humans	◯	◯	◯	◯	◯
CWD may pose a risk to humans, but not enough is currently known to be sure	◯	◯	◯	◯	◯
Because of CWD, I have concerns about eating deer meat (for myself or my family)	◯	◯	◯	◯	◯

10. **Because of CWD in deer, how concerned are you about each of the following?**

Mark only one oval per row.

	Not at all concerned	Slightly concerned	Moderately concerned	Very concerned
…your or your family's health?	◯	◯	◯	◯
…the health of affected deer herds in Wyoming?	◯	◯	◯	◯
...not having enough healthy deer to hunt in Wyoming?	◯	◯	◯	◯
…future generations ability to enjoy hunting deer in Wyoming because of CWD?	◯	◯	◯	◯
…the potential for CWD to reduce deer hunting opportunity in Wyoming?	◯	◯	◯	◯
…eating meat from a deer harvested in an area of high CWD prevalence (i.e., an area where 1 or more deer out of every 10 are infected)?	◯	◯	◯	◯

Hunting in Wyoming

Please read the following information before continuing:

Our records indicate that you may have hunted for deer in a hunt area where one out of every 20 or more harvested bucks are infected with chronic wasting disease (CWD).

11. **Were you aware that you may have hunted for deer in a hunt area where CWD rates were less than or equal to 5%?**
Mark only one oval.

- Yes
- No

12. **How likely are you to go deer hunting in Wyoming in the next 3 years?**
Mark only one oval.

- Very unlikely
- Somewhat unlikely
- Neither unlikely nor likely
- Somewhat likely
- Very likely

Low prevalence questions 13-15

13. **If at least 1 in every 20 deer (5%) were to become infected with CWD in the hunt area(s) where you currently hunt, how likely would you be to…**
Mark only one oval per row.

	Very unlikely	Somewhat unlikely	Neither	Somewhat likely	Very likely
…continue hunting deer in this location					
…support taking measures to control CWD					
…find alternative places in Wyoming to hunt deer					
…stop hunting deer in Wyoming					

14. **If at least 1 in every 10 deer (10%) were to become infected with CWD in the hunt area(s) where you currently hunt, how likely would you be to…**
Mark only one oval per row.

	Very unlikely	Somewhat unlikely	Neither	Somewhat likely	Very likely
…continue hunting deer in this location					
…support taking measures to control CWD					
…find alternative places in Wyoming to hunt deer					
…stop hunting deer in Wyoming					

15. **If at least 1 in every 5 deer (20%) were to become infected with CWD in the hunt area(s) where you currently hunt, how likely would you be to…**
Mark only one oval per row.

	Very unlikely	Somewhat unlikely	Neither	Somewhat likely	Very likely
…continue hunting deer in this location					
…support taking measures to control CWD					
…find alternative places in Wyoming to hunt deer					
…stop hunting deer in Wyoming					

13. **Given that at least 1 in every 10 deer (10%) are infected with CWD in the hunt area(s) where you currently hunt, how likely would you be to…**
Mark only one oval per row.

	Very unlikely	Somewhat unlikely	Neither	Somewhat likely	Very likely
…continue hunting deer in this location	◯	◯	◯	◯	◯
…support taking measures to control CWD	◯	◯	◯	◯	◯
…find alternative places in Wyoming to hunt deer	◯	◯	◯	◯	◯
…stop hunting deer in Wyoming	◯	◯	◯	◯	◯

14. **If at least 1 in every 5 deer (20%) were to become infected with CWD in the hunt area(s) where you currently hunt, how likely would you be to…**
Mark only one oval per row.

	Very unlikely	Somewhat unlikely	Neither	Somewhat likely	Very likely
…continue hunting deer in this location	◯	◯	◯	◯	◯
…support taking measures to control CWD	◯	◯	◯	◯	◯
…find alternative places in Wyoming to hunt deer	◯	◯	◯	◯	◯
…stop hunting deer in Wyoming	◯	◯	◯	◯	◯

15. **If at least 1 in every 2 deer (50%) were to become infected with CWD in the hunt area(s) where you currently hunt, how likely would you be to…**
Mark only one oval per row.

	Very unlikely	Somewhat unlikely	Neither	Somewhat likely	Very likely
…continue hunting deer in this location	◯	◯	◯	◯	◯
…support taking measures to control CWD	◯	◯	◯	◯	◯
…find alternative places in Wyoming to hunt deer	◯	◯	◯	◯	◯
…stop hunting deer in Wyoming	◯	◯	◯	◯	◯

16. **Have you ever personally harvested a CWD positive deer in Wyoming?**
Mark only one oval.

- ◯ Yes
- ◯ No

17. **Have you ever personally harvested a CWD positive elk in Wyoming?**
Mark only one oval.

- ◯ Yes
- ◯ No

18. **Are you aware of carcass transportation and disposal regulations because of CWD in Wyoming?**
Mark only one oval.

- ◯ Not at all aware
- ◯ Somewhat aware
- ◯ Moderately aware
- ◯ Very aware

19. **How unacceptable or acceptable would it be for Wyoming Game and Fish to take each of the following actions to stabilize or lower CWD infection rates (i.e., prevalence) in the hunt area(s) where you hunt deer?**

Please note: It will likely take years to measure the results and effectiveness of a prescribed management action.

Mark only one oval per row.

	Highly un-acceptable	Moderately un-acceptable	Slightly un-acceptable	Neither	Slightly acceptable	Moderately acceptable	Highly acceptable
...take no action and allow CWD to take its natural course.	◯	◯	◯	◯	◯	◯	◯
...increase the number of buck hunting licenses during existing hunting seasons.	◯	◯	◯	◯	◯	◯	◯
...increase the number of doe hunting licenses during existing hunting seasons.	◯	◯	◯	◯	◯	◯	◯
...use hunters to reduce the total deer population (bucks and does)	◯	◯	◯	◯	◯	◯	◯
...use trained WGFD staff to lethally reduce herds in affected areas to lower infection rates	◯	◯	◯	◯	◯	◯	◯
...increase the number of buck hunting licenses in later seasons in affected areas	◯	◯	◯	◯	◯	◯	◯
…use special management hunts to remove deer in localized areas of especially high prevalence with minimum impact on overall deer numbers	◯	◯	◯	◯	◯	◯	◯
…reduce harvest of mountain lions in areas with high CWD prevalence	◯	◯	◯	◯	◯	◯	◯

20. **How much of a priority should Wyoming Game and Fish place on the following herd and harvest management decisions in the area(s) where you currently hunt deer?**

Mark only one oval per row.

	Not a priority	Low priority	Neutral	Moderate priority	Essential priority
Striking a balance between controlling the disease and preserving hunting opportunity					
Maximizing quality deer hunting opportunities (i.e., trophy bucks), regardless of how they affect CWD prevalence or overall herd health					
Minimizing adverse effects of CWD on overall herd health regardless of how they affect quality deer hunting opportunities (i.e. harvesting a higher percentage of bucks in the population)					
Other					

21. **If you answered "Other", please specify other priorities the WGFD should have here:**

To what extent do you disagree or agree with each of the following statements regarding your confidence in Wyoming Game and Fish (WGFD)?

22. **I am confident WGFD will…**

Mark only one oval per row.

	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree
…provide the best available information on CWD issues					
...provide me with enough information to decide what actions I should take regarding CWD					
...provide truthful information about human safety issues related to CWD					
...provide timely information about CWD issues					
...make good deer herd management decisions about CWD issues					
...properly address CWD in Wyoming to keep infection rates low					

23. **How do you currently receive information or stay informed about CWD in Wyoming?**
Check all that apply.

- [ ] Social media (e.g., Facebook, Twitter, Instagram)
- [ ] Wyoming Game and Fish website
- [ ] Online searches (e.g., Google, Explorer, Safari, etc.)
- [ ] TV/Radio
- [ ] Hunting magazines (e.g., Field & Stream, Outdoor Life, Wyoming Outdoors)
- [ ] Local newspapers
- [ ] Word of mouth (from a friend/family member)
- [ ] Hunting regulations brochures
- [ ] Wyoming Game and Fish E-newsletter
- [ ] I do not stay informed about CWD
- [ ] Other: _____

24. **Which three options do you most prefer to use when learning about CWD?**
Check all that apply.

- [ ] Social media (e.g., Facebook, Twitter, Instagram)
- [ ] Wyoming Game and Fish website
- [ ] Online searches (e.g., Google, Explorer, Safari, etc.)
- [ ] TV/Radio
- [ ] Hunting magazines (e.g., Field & Stream, Outdoor Life, Wyoming Outdoors)
- [ ] Local newspapers
- [ ] Word of mouth (from a friend/family member)
- [ ] Hunting regulations brochures
- [ ] Wyoming Game and Fish E-newsletter
- [ ] I do not stay informed about CWD
- [ ] Other: _____

About You

25. **How old are you?**

_____

26. **With what gender do you identify?**
Mark only one oval.

- ◯ Female
- ◯ Male
- ◯ Prefer not to say
- ◯ Other: _____

27. **What is your current (residence) zip code?**

_____

28. **Approximately how many years have you lived in Wyoming? (If you are not currently a resident, please leave blank)**

_____

29. **How would you describe your racial or ethnic background?**
Mark only one oval.

- ◯ White, non-Hispanic/Latino
- ◯ Hispanic/Latino
- ◯ Black or African American
- ◯ American Indian or Native Alaskan
- ◯ Native Hawaiian or other Pacific Islander
- ◯ Asian
- ◯ Prefer not to answer
- ◯ Other: _____

30. **Please provide any additional comments you may have about chronic wasting disease in Wyoming:**

_____

_____

_____