Montana Chronic Wasting Disease Management Plan

Photo: Mike Hopper, Kansas Department of Wildlife, Parks and Tourism

A CWD-afflicted white-tailed deer. This animal will die soon.

Montana Fish, Wildlife & Parks
CWD Action Team
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CHAPTER 1.

INTRODUCTION AND BACKGROUND

This document builds off the 2014 Montana Fish, Wildlife and Parks' Decision Notice (Montana Fish, Wildlife and Parks 2014) that provided the agency direction on chronic wasting disease (CWD) surveillance and management. It provides the logistical details necessary for executing CWD surveillance, management, and communications. It was assembled by the efforts of FWP's internal "CWD Action Team" (see page 9), which incorporated previous management plans (Montana Fish, Wildlife and Parks 2005, 2013, 2017), reviewed professional literature, other states' and provinces' plans, and consulted with agency staff and other experts nationally and internationally. In addition, a "CWD Citizen's Advisory Panel" consisting of public stakeholders from across the state representing wildlife and livestock perspectives, scientific and recreation interests, commerce and tourism, and local and state government was formed in Spring 2017. This panel provided input on the plan and assisted with communication and educational outreach efforts to the larger public.

In March 2020, both the CWD Action Team and the CWD Citizens Advisory Panel convened to provide input and updates to this plan. Changes were recommended based on knowledge gained from Montana's CWD management implemented during 2017 – 2019 and ongoing programs in other states and provinces. This revised plan closely follows the Western Association of Fish and Wildlife Agencies (WAFWA 2017) recommendations for management and has been reviewed by the Montana Department of Livestock (DOL) and the Department of Public Health and Human Services (DPHHS) to address concerns about possible effects on the agricultural community and human health.

The intent of previous FWP plans and this update are to: 1) manage any new detections of CWD where it has not been previously found in Montana, 2) limit the spread of CWD in Montana, 3) maintain or reduce the prevalence of CWD in specific locations once detected, 4) improve communication and educational outreach on CWD with the public, other agencies, and within FWP, and 5) provide hunters opportunities to have their harvested animal tested for CWD.

Actions relating to the *prevention* of CWD arriving in Montana have been implemented since 2006. These actions may continue depending on the status of CWD in Montana and any advances concerning the prevention of transmission and potential treatment of CWD. Actions related to the *initial and long-term management* of CWD have been revised and will be initiated in a localized area around any first or new detection of CWD in free-ranging Montana deer, elk, moose, or caribou (cervids). Plans for *communication and outreach* aim to support FWP's goals of CWD prevention and management and include ongoing efforts and a detailed communication plan to be implemented following any new detection of CWD in Montana's wild herds.

This plan, especially concerning surveillance for CWD and FWP's response to a detection,

generally focuses on mule deer and white-tailed deer for several reasons:

1. Where deer, elk, and moose overlap, mule deer and/or white-tailed deer tend to exhibit the highest prevalence.
2. Even if CWD is first detected in elk or moose, it is extremely likely that mule deer or white-tailed deer in the area are also infected, and likely at a higher prevalence.
3. Deer are well distributed across the state and serve as good sentinels for CWD detection.

When CWD is detected in an elk or moose, FWP's response will likely still focus on deer as outlined in Chapter 3; elk and moose will be sampled dependent on each individual circumstance.

AUTHORITY

Several sections of the Montana Code Annotated (MCA) grant FWP and the Fish and Wildlife Commission (Commission) the responsibility for the management of all wild, native cervids, including the following:

- MCA § 87-1-201(1) grants FWP the authority to "supervise all the wildlife, fish, game, game and nongame birds, waterfowl, and the game and fur-bearing animals of the state…."
- MCA § 87-1-301(1)(a) grants the Commission the authority to "set the policies for the protection, preservation, management, and propagation of the wildlife, fish, game, furbearers, waterfowl, nongame species, and endangered species of the state and for the fulfillment of all other responsibilities of the department related to fish and wildlife as provided by law…." Additionally, § 87-1-301(1)(b) provides that the Commission "shall establish the hunting, fishing, and trapping rules of the department."
- MCA § 87-1-304 further grants the Commission the authority to "fix seasons, bag limits, possession limits, and season limits" and to "open or close or shorten or lengthen seasons on any species of game…."

BACKGROUND

<u>Biology, Distribution, and Population Impacts</u>

Chronic Wasting Disease (CWD) is a fatal neurologic disease of elk, deer, moose, and caribou for which there is no known cure. It belongs to a group of diseases called transmissible spongiform encephalopathies (TSEs), a group which also includes bovine spongiform encephalopathy ("mad cow

disease") in cattle, scrapie in sheep, and Creutzfeldt-Jakob disease in humans. The causative agent in TSEs is an abnormally folded prion protein (referred to as a "prion") that causes normal cellular prion proteins found in the body to mis-fold into disease-causing forms (Prusiner 1998). Mis-folded prions accumulate in infected animals and cause neuronal cell death that eventually leads to fatal nerve and brain damage. CWD prions have been detected throughout the body of infected individuals, including the brain and central nervous system (Williams 2005), tonsils and lymph nodes (Sigurdson et al. 1999, O'Rourke et al. 2003), saliva and blood (Mathiason et al. 2006, Haley et al. 2011), the intestinal tract, bladder, urine, and feces (Tamguney et al. 2009), muscle (Angers et al. 2006), fat (Race et al. 2009), antler velvet (Angers et al. 2009), and semen (Kramm et al. 2019). CWD can be transmitted through animal-to-animal contact, in-utero from mother to offspring (Selariu et al. 2015), and through contact with a prion-contaminated environment, such as grass and soil. Infected animals shed prions in saliva, feces, and urine during most of their infection and via bodily tissues and fluids upon death. These prions may remain infectious in the environment for at least 2 years (Miller et al. 2004). CWD has an average incubation period from infection to clinical signs of approximately 16 months, and the clinical phase may last an additional 4-9 months, culminating in death (Williams and Miller 2002, Williams et al. 2002, Tamguney et al. 2009). There are no documented recoveries from infection.

An elk in the final stages of chronic wasting disease. (Beth Williams photo, University of Wyoming)

To date, CWD has been detected in captive or free-ranging wildlife populations in 26 US states (Colorado, Wyoming, Montana, Utah, New Mexico, Texas, Kansas, Nebraska, Oklahoma, North Dakota, South Dakota, Minnesota, Iowa, Missouri, Arkansas, Wisconsin, Illinois, Michigan, Ohio, Pennsylvania, Tennessee, West Virginia, Virginia, Maryland, Mississippi, and New York), the Canadian provinces of Alberta and Saskatchewan, as well as Norway, Sweden, Finland, and South Korea; its range continues to expand annually. In October 2017, CWD was first detected in free-ranging deer in Montana. It was detected in captive game farms in Montana in 1999 and again in 2020. Many US states and Canadian provinces have documented the gradual spread of CWD despite attempts at managing it. One common observation is the patchy distribution of infections on the landscape (Conner and Miller 2004, Miller and Conner 2005, Farnsworth et al. 2006, Joly et al. 2006, Osnas et al. 2009, Heisey et al. 2010). Social, matrilineal, or breeding aggregations, habitat refugia, or "hot spots" of environmental contamination may be important amplifiers of transmission that lead to patchy prevalence across the landscape.

Determining the population effects of such a slow-moving disease is difficult, however, several field studies and computer models suggest that populations could be substantially reduced over time (Gross and Miller 2001, Miller et al. 2008, Wasserberg et al. 2009, Almberg et al. 2011, Monello et al. 2014, Geremia et al. 2015, Edmunds et al. 2016, DeVivo 2015, Samuel and Storm 2016). Radio-collaring studies have documented significantly lower survival for deer and elk infected with CWD, and some

have measured declines in annual population growth rates (Miller et al. 2008, Monello et al. 2014, Geremia et al. 2015, Edmunds et al. 2016, DeVivo 2015, Samuel and Storm 2016). Several simulation modeling studies have predicted moderate to dramatic cervid population declines, including local extinction, over long timescales (>20 years) (Gross and Miller 2001, Wasserberg et al. 2009, Almberg et al. 2011). Documented CWD-related, herd-level declines in mule deer include a 21% annual decline in Wyoming (at 21-27% CWD prevalence; DeVivo 2015, DeVivo et al. 2017) and a 45% decline in Colorado (from 1987- 2007 given prevalence of up to 41% in males and 20% in females; Miller et al. 2008). Among white-tailed deer in Wyoming, Edmunds et al. (2016) found a 10% annual decline in population size where prevalence was 33%, and a corresponding decline in buck age structure. While uncertainty remains over the size and extent of any future CWD-associated impacts, high prevalence and increased spatial spread of the disease are likely to correspond to population-level declines.

Existing Management Tools and Evidence for their Efficacy

Once CWD is present in a wild population, it is extremely difficult, if not impossible, to eliminate. New York may be the only state to have eliminated a CWD outbreak after its detection. That state responded aggressively to what appears to have been very early in a small outbreak (Miller and Fischer 2016). Typically, CWD is discovered after it has been established for some time. The approximately 16-month incubation period, during much of which an animal is infectious and shedding potentially long-surviving prions into the environment, makes it difficult to detect an emerging epidemic before it is well established.

There are currently no effective treatments or vaccines for CWD. Prevention is critical to the control of CWD over large landscapes. Preventative tools include restricting the transport of carcasses from CWD-infected areas or states, banning the transport or translocation of wild cervids, and requiring the responsible disposal (e.g. incineration or disposal in certified landfills) of carcasses from infected regions. Many states also restrict the baiting and feeding of wild cervids to help limit artificial aggregations that might facilitate more rapid disease transmission. In addition, some states and provinces have moved to regulate the use of cervid lures to prevent hunters from inadvertently spreading CWD-contaminated materials on the landscape.

Despite the low likelihood of eliminating CWD from a wild population, there are several promising tools for slowing or controlling its spread and prevalence (WAFWA 2017). To date, many states have attempted a combination of population density reduction, disease “hot-spot” culling, and reducing large aggregations of cervids. Contact rate, and hence transmission rate, is often thought to be positively related to population density, however, due to cervid social behavior and the potential for transmission of CWD via the environment, this may not always be the case (Storm et al. 2013, Potapov et al. 2013). Thus, population density reductions alone may have only modest impacts on maintaining or reducing CWD prevalence. In Montana, as well as other states, there has been little public support for large-scale population reductions. “Hot-spot” culling, the strategic removal of animals from a local area, uses public hunting and/or agency staff to dramatically reduce cervids in a restricted portion of a population or

geographic region centered around known CWD infections. The goal is to remove a cluster of infected animals and thereby reduce prevalence in the larger population. Reducing large groups of deer and elk either by eliminating food attractants (e.g. fencing haystacks, removing mineral licks), changing habitat structure, or through hunting pressure may also help reduce contact rates and transmission.

Several computer-simulation studies predict that increasing male harvest and reducing male to female sex ratios in cervids may be one of the most effective tools for reducing CWD prevalence (Jennelle et al. 2014, Potapov et al. 2016). In most study systems, male deer are 2-3 times more likely to be infected than females (Miller and Conner 2005, Heisey et al. 2010, DeVivo 2015, Samuel and Storm 2016; but see Edmunds et al. 2016), presumably due to behavioral differences. Targeting males may thus be an efficient way to reduce overall transmission. Furthermore, it has been suggested that increasing male harvest during or after the breeding season may remove infected males at higher rates than during the early fall and may be another tool for reducing prevalence (WAFWA 2017). While anecdotal evidence from several jurisdictions may provide support for these hypotheses, neither have been tested experimentally.

The aforementioned tools – increased male harvest, targeted hot-spot removal, and reducing artificial aggregations of deer – have been officially recommended by the Western Association of Fish and Wildlife Agencies (2017) for standardized implementation and evaluation. Where possible, western states and provinces have been asked to implement these tools and evaluate their ability to reduce CWD prevalence using a before-after-control-impact experimental design and standardized monitoring guidelines.

Research from Wisconsin, Illinois, and Colorado suggests that combinations of some of these management tools may indeed help maintain or reduce CWD prevalence. Wisconsin attempted aggressive population reductions from 2003 to 2007, during which CWD prevalence remained relatively stable (Heisey et al. 2010), however, when agency-led culling was stopped because of public opposition (Holsman et al. 2010), prevalence increased (Heisey et al. 2010, Manjerovic et al. 2014). In contrast, neighboring Illinois continued population reduction and hot-spot culling, and CWD prevalence remained stable (Manjerovic et al. 2014, Mateus-Pinilla et al. 2013).

Similarly, work by Geremia et al. (2015) in Colorado suggests that population density reductions and hot-spot culling may have contributed to declines in CWD prevalence in some herds; however, not all jurisdictions have detected declining prevalence in response to management (Conner et al. 2007).

Predation and CWD

Natural predation, particularly by selective predators, has been predicted to help stabilize or reduce CWD prevalence (Hobbs 2006, Miller et al. 2008, Krumm et al. 2010, Wild et al. 2011). This led to the suggestion to consider predators when devising control strategies for CWD in natural populations (Wild et al. 2011).

Limited empirical and modeling work to date suggests predators are good at preferentially selecting CWD-infected prey, including selecting infected animals before symptoms can be noticed by humans. Krumm et al. (2010) found that mountain lions were more likely to kill infected deer than non-infected ones, and Miller et al. (2008) found that infected deer were four times more likely to die from cougar predation than were uninfected individuals. However, Miller et al. (2008) found no evidence this controlled the spread of CWD in the heavily infected population they studied (41% prevalence among males and 20% among females); prevalence remained high despite highly selective predation. The authors speculated that, "the tendency for predation to promote social grouping among herbivores could help sustain transmission by maintaining relatively high effective densities even as overall deer abundance declines," and concluded, "our data show that prion infection in a natural population can surge seemingly unabated even in the face of intense selective predation."

Theoretical modelling by Wild et al. (2011) suggests that coursing predators like wolves would be even more efficient at selectively removing infected individuals, and this could substantially limit CWD prevalence and spread. However, questions remain about how wolves may alter the group size, distribution, and behavior of their prey and how this may affect disease transmission rates, or how dynamics are likely to play out in systems where the disease is most prevalent in deer but where wolves prey more intensively on elk. Wolves also reduce coyote numbers (Berger and Gese 2007), which are themselves efficient predators of deer, especially fawns. Therefore, any benefit of CWD reduction due to increased wolf predation may be mitigated by reduced coyote numbers. We currently lack definitive proof that predators can control CWD, but there is reason to believe they could help and additional research on the topic is warranted.

Research has shown that prions can pass through the digestive tracts of American crows and coyotes and remain infectious (Nichols et al. 2015, VerCauteren et al. 2012). This has led some to question whether predators and scavengers might contribute to the spread of CWD on the landscape. Currently, we have no evidence that this is happening or making a difference in disease dynamics. Prions that pass through scavengers' digestive tracts do lose some of their infectivity. Furthermore, there may be a benefit to having predators and scavengers consume infectious material and dilute and redistribute the material at the landscape level (Fischer et al. 2013).

The larger question with any plan to enhance predator numbers to address CWD is that of social acceptance. Predator management, particularly wolves, is controversial, and FWP's current wolf management has successfully met wolf management objectives outlined in the 2002 wolf management plan (Montana Wolf Management Advisory Council 2002), and integrated wolves into a 21st century landscape with minimum social conflict. There may, however, be opportunity to promote increased predator densities in areas where social tolerance would allow it, and there is public interest in pursuing additional research on this topic.

CWD and Human Health

To date, several lines of evidence suggest that humans are at low risk of contracting CWD. There have been no documented cases of CWD causing disease in humans, despite epidemiological investigations of known or suspected exposures (Belay et al. 2004, MaWhinney et al. 2006). Several studies have demonstrated that normal prion proteins in humans, either in cell-free culture (Raymond et al. 2000) or as expressed in transgenic mice (Kong et al. 2005, Tamgüney et al. 2006, Sandberg et al. 2010, Wilson et al. 2012), do not readily convert to the diseased form when challenged with CWD prions. Furthermore, studies published to date suggest that exposure experiments in cynomolgus macaques, a primate considered a close experimental model for humans, do not result in disease expression (Race et al. 2009, Race et al. 2014, Race et al. 2018). However, one unpublished animal study suggests CWD poses a risk to certain types of non-human primates, like monkeys, that eat meat from CWD-infected animals or come in contact with brain or body fluids from infected deer or elk (Czub et al. 2017). To date no reported cases of CWD infection has occurred in humans.

If CWD could spread to people it would most likely occur through eating of infected deer, elk or moose. Because of this, scientists and human health officials agree that it is prudent to minimize human exposure to CWD. People should avoid consuming the brain, spinal cord, eyes, spleen, tonsils, and lymph nodes of any harvested game animal. The Centers for Disease Control (CDC) and the World Health Organization (WHO) advise against consuming any animal known to be infected with CWD. Hunters should not shoot, handle, or consume meat from any deer, elk, or moose that look sick, act strange, or are found dead, including roadkill, unless tested and found to be negative for CWD. In addition, CDC recommends that hunters strongly consider having their animals tested before eating the meat when hunting in areas where CWD is known to be present. If the animal tests positive for CWD, do not eat the meat from that animal.

Some simple precautions should be taken when field dressing deer, particularly in CWD surveillance/endemic areas:

- Wear rubber gloves and eye protection when field dressing game animals.
- Don't use kitchen utensils or household knives for field dressing game animals
- Minimize the handling of brain and spinal tissues.
- Wash hands thoroughly after field dressing is completed.
- Wash instruments thoroughly after field dressing is completed. Concentrated (40% solution) household bleach, or hypochlorous acid (HOCl, Briotech Inc.) may be useful in decontaminating instruments if immersed for up to five minutes (Hughson et al. 2016 and Williams et al. 2019).

History of CWD Surveillance and Planning in Montana

FWP conducted active surveillance for CWD across the state from 1998 through 2011 and more limited, opportunistic surveillance from 2012-2016. From 1998 to 2016, over 17,000 wild deer, elk, and moose

were sampled for CWD with no positive detections (for a detailed history of CWD surveillance in Montana, see Anderson et al. 2012). The intensity and distribution of surveillance varied over time with the most intensive efforts from 2002 to 2011 coinciding with the availability of federal funding. Following a detection of CWD in a captive game farm outside of Phillipsburg in 1999, FWP began focusing surveillance efforts on "high- risk" areas of known proximity to CWD detections. In 2013, FWP released a report titled "Selected Results from Surveys of Resident Big Game Hunters and Private Landowners Regarding the Topic of Chronic Wasting Disease" (Lewis et al. 2013), in which the agency reported on hunter and landowner awareness of CWD and their preferences regarding CWD management. In 2014, FWP modified its CWD Management Plan for Free Ranging Wildlife in Montana (Montana Fish, Wildlife and Parks 2013, 2014) and called for a renewed surveillance effort in high-risk areas using a weighted surveillance strategy (Walsh 2012), alternating efforts among areas annually. In collaboration with FWP, Russell et al. (2015) combined information on distance to the nearest known CWD cases along Montana's borders and relative mule deer densities within our state to predict the areas within Montana at highest risk of becoming infected through the natural spread of the disease. Their work identified several areas on the northern and southern borders of the state that have since been used to define the agency's priority surveillance areas (see Chapter 2). In addition, several research projects have examined mule deer movements near our borders with Wyoming (Carnes 2009), Alberta, and Saskatchewan (Montana Fish, Wildlife and Parks 2017) to better inform our risk assessments and potential management responses. In 2016, FWP began regularly convening its internal CWD Action Team and in 2017 assembled the CWD Citizen Advisory Panel for surveillance and management planning purposes.

Alternative Livestock Operations (Game Farms) in Montana

Ballot Initiative 143, passed in 2000, prohibited the creation of any new game farms in Montana. In 2017, there were 29 licensed facilities, and 21 of them had animals totaling about 775 captive cervids. Existing game farm animals are regulated by the Department of Livestock, and FWP is responsible for inspecting the properties to ensure appropriate fencing is maintained. Regulations include a mandatory CWD testing program for all licensed farms and provisions for depopulation and decontamination should CWD be detected. If CWD were detected within a Montana game farm, FWP would work with the Department of Livestock to determine whether additional surveillance in the surrounding hunting districts was warranted. State of Montana law prohibits the disclosure of the location of a diseased livestock premise.

PREVENTION

The following statutes and policies help prevent the introduction and spread of CWD into Montana:

Baiting and Feeding

Feeding of big game animals facilitates the transmission of disease by concentrating and aggregating animals. Baiting and feeding of big game animals is illegal in Montana under MCA § 87-6-216(1)(c), which states, "a person may not provide supplemental food attractants to game animals by purposely or knowingly providing supplemental feed attractants in a manner that results in an artificial concentration of game animals that may potentially contribute to the transmission of a disease or that constitutes a threat to public safety."

Scents and Lures

MCA § 87-6-221 prohibits the use or sale of deer or elk urine to mask human odor if the urine originated in a state or province with documented occurrences of CWD. The FWP Commission has authorized exceptions to this prohibition if individual facilities meet Archery Trade Association certification of being CWD-free.

Carcass Transport

CWD prions in animal excreta or carcasses have been shown to remain infectious for at least two years in the environment (Miller et al. 2004). Due to the concern over indirect, environmental transmission, 41 states (including Montana) and seven Canadian provinces have restricted the import of hunter-harvested cervid parts (www.cwd-info.org). To prevent the spread of Chronic Wasting Disease from areas in Montana known to be infected to other parts of the state, the head and spinal column of harvested animals should remain in the field at the location of the kill site or disposed of in a class II landfill. Montana law (MCA § 87-6-420) prohibits the import of heads and spinal columns of cervids harvested in states or provinces that have CWD in wild or captive populations. A list of those states and provinces is posted on FWP's website and in the big game regulations and kept current by agency personnel. Importing processed meat, quarters, hides, antlers and/or clean skull caps, ivories, de-boned meat, finished mounts, and finished European mounts without any attached flesh are allowed.

Rehabilitation/Translocation

Currently, live animal tests for CWD are invasive, expensive, and less sensitive than post-mortem tests. Movement of live cervids within Montana or importing live cervids from outside Montana risks introducing or spreading CWD. As of 2005, FWP no longer rehabilitates orphaned elk calves and deer fawns (Montana Fish, Wildlife, and Parks 2008). This policy eliminates the potential spread of CWD that could occur by mixing CWD infected and non-infected orphaned animals at the rehabilitation facility and later releasing those animals in the wild.

FWP has not moved wild cervids within the state since 1997, when elk from the Moiese Bison Range were transplanted to Region One. FWP's current policy restricts the import or movement within the state of wild cervids. Intra- and interstate movement of game farm animals is regulated by the Department of Livestock. Movement of captive cervids from other states or within Montana requires assurance that the herd of origin has been under an active CWD surveillance plan for 5 years with no incidence of CWD.

Carcass Disposal

Environmental contamination through dispersal of carcass waste, especially heads and spinal columns, has the potential to introduce or spread CWD in wild populations. The U.S. Environmental Protection Agency (EPA), the State of Wisconsin, and the U.S. Department of Agriculture have identified appropriate carcass disposal methods to include burying waste in municipal solid waste landfills (MSWLFs), incineration, alkaline hydrolysis tissue digestion, or on-site burial. The EPA currently recommends using Municipal Solid Waste Landfills (MSWLFs) for the large-scale disposal of potentially CWD-contaminated carcasses and wastes.

Carcass waste of animals harvested from areas in Montana where CWD has been detected should be disposed in an approved (40 CFR Part 258) MSWLF. The Montana Department of Environmental Quality, Solid Waste Division, regulates and certifies MSWLFs and provided a list of Class II sanitary landfills qualified to dispose of potentially CWD-contaminated materials (Table 1). Carcasses and carcass waste with CWD may also be incinerated.

FWP will continue to educate the public, meat processors, taxidermists, and MSWLF operators on the proper disposal of carcasses and carcass parts of cervids.

Table 1. Class II municipal solid waste landfills (MSWLFs) in Montana.

County	City	Service Area
Beaverhead County	Dillon	Beaverhead and Madison Counties
Big Horn County	Hardin	Big Horn County
Cascade County	Floweree	Great Falls and 60-mile radius; towns of Lincoln, Lewistown, and Livingston
Custer County	Miles City	School Districts 1, 3, and 63
Daniels County	Scobey	Daniels County
Dawson County	Glendive	Dawson, Prairie, and McCone Counties
Fallon County	Baker	Southeastern Montana and Southwestern North Dakota
Flathead County	Kalispell	Flathead County
Gallatin County	Manhattan	Gallatin County, Big Timber, and portions of Broadwater, Jefferson, and Madison Counties
Hill County	Havre	Hill, Blaine, and Chouteau Counties
Jefferson County	Montana City	Helena and 35-mile radius; Broadwater, Jefferson, and Park Counties
Lake County	Polson	Lake County and Dixon Refuse District
Lewis & Clark County	Helena	City of Helena, Scatch Gravel Solid Waste District
Liberty County	Chester	Town of Chester and portions of Liberty County
Lincoln County	Libby	Lincoln County
Missoula County	Missoula	Western Montana and Central Idaho

Park County	Livingston	Park County
Phillips County	Malta	City of Malta and some outlying areas
Pondera County	Conrad	City of Choteau, Pondera County, and Glacier County, excluding Blackfeet Reservation
Powder River County	Broadus	Powder River County
Powell County	Deer Lodge	Powell County
Richland County	Sidney	Township, North Dakota
Roosevelt County	Wolf Point	Wolf Point, Poplar, Fort Peck Tribes, and Circle
Rosebud County	Forsyth	Rosebud County
Sheridan County	Plentywood	Sheridan County
Silver Bow County	Butte	Silver Bow and Anaconda-Deer Lodge Counties
Toole County	Shelby	Shelby, Sunburst, Kevin, and portions of Toole County
Valley County	Glasgow	Glasgow, Valley, and Phillips Counties; Frazer, Nashua, Jordan, and St. Maries
Yellowstone County	Billings	Yellowstone, Carbon, Stillwater, Treasure, and Musselshell Counties; Pryor and Big Timber

People Involved in Developing Montana's CWD Management Plan

FWP CWD Action Team Members (past and current, alphabetical by last name)

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Scott Hemmer, Wildlife Biologist, Havre, 2017-present
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John Vore, Former Game Management Bureau Chief & Chair, Helena, 2017-2019
Zach Zipfel, Legal Counsel, Helena, 2017-present

Montana CWD Citizen Advisory Panel Members

Bret Barney, Wyola, Region 5, Sunlight Ranch Wildlife Manager

Ed Bukoskey, Rosebud, Region 7, Sportsman, served on Brucellosis, Private Land Public Wildlife, and Elk Archery Working Groups

Joe Cohenour, East Helena, Region 3, Active sportsman, helped draft and pass 2 CWD bills into law, RMEF Volunteer, former PLPW and CAC member, Brucellosis Working Group member

Dr. Richard Douglass, Butte, Region 3, Emeritus professor of biology at MT Tech, serves on Brucellosis Working Group

Tim Feldner, Helena, Region 3, Retired FWP Commercial Wildlife Permit Manager, co-author 2005 CWD Plan

Dr. Tom Geary, Miles City, Region 7, Research Animal Scientist USDA Agriculture Research Services

Henry Gordon, Chinook, Region 6, Former Citizen Advisory Council member, Landowner and Rancher

James Haggerty, Belt, Region 4, Rancher, RMEF & BCHA member

Chad Klinkenborg, Bozeman, Region 3, Mule Deer Foundation Montana Regional Director at time of initial plan development.

Dr. Charles Noland, Worden, Region 5, Former Citizen Advisory Council member, Landowner, Livestock Veterinarian

Dr. Brent Race, Corvallis, Region 2, Research veterinarian at Rocky Mountain Lab working on prions

Dr. Ben Rossetto, Kalispell, Region 1, Physician, Hunter, non-consumptive user, former Chief of Staff Kalispell Regional Medical Center

CHAPTER 2.

MONTANA'S CWD SURVEILLANCE PLAN

Montana Fish, Wildlife, and Parks' CWD surveillance plan is designed to maximize our ability to detect CWD in areas where it is not known to exist. This entails (1) continuing to test any symptomatic cervid (deer, elk, or moose) statewide, (2) focusing systematic surveillance on mule deer and white-tailed deer, (3) employing a weighted surveillance strategy aimed at detecting 1% CWD prevalence with 95% confidence (Walsh 2012) that rotates among high-priority CWD surveillance areas, and (4) offering free, state-wide testing to hunters across Montana. High priority surveillance areas (Fig. 1) are currently defined as those hunting districts within Montana that are within forty miles of the nearest known cases of CWD. Although FWP will prioritize the sampling of mule deer and white-tailed deer, the species likely to have the highest prevalence within Montana, we will also sample elk and moose on an opportunistic basis. Samples will be collected from symptomatic animals, animals necropsied from research projects, hunter harvested animals, and road-killed animals. These efforts are likely to evolve, but are projected to require (1) the hiring of regional CWD coordinators, regional headquarter technicians, and field technicians to staff CWD sampling check stations (for up to 10 weeks around the general season) to assist with sample collection and processing, and (2) increased educational outreach during hunting seasons. FWP Wildlife Health Program staff and the technicians (supervised by the Disease Ecologist) will be primarily responsible for implementing the surveillance program with additional support from regional staff. Hunters who harvest animals outside of a surveillance area and want to have their animal tested may visit a CWD sampling check station or a regional headquarter office or may mail their sample to the Wildlife Health Lab by following instructions on our website.

<u>Priority Surveillance Areas, Minimum Surveillance Units, and Rotation Schedule</u>

FWP's initial approach to identifying priority surveillance areas was based on the work of Russell et al. (2015), which combined information on distance to the nearest known CWD cases along Montana's borders and relative mule deer densities to predict the areas within Montana at highest risk of becoming infected through the natural spread of the disease. This approach was very effective at identifying CWD-infected areas in Montana. In 2020, we decided to switch to a simple distance model, since it yields nearly identical suggestions for priority surveillance areas and is easier to update on an annual basis. Hunting districts will now be identified for future surveillance based on whether they intersect a 40-mile buffer on known CWD positives within the state (Figure 1). Since CWD could be present in areas far from known positives, we will continue to monitor the remaining parts of the state through voluntary hunter submissions and through the testing of symptomatic cervids, with the long-term goal of systematically surveying every part of the state.

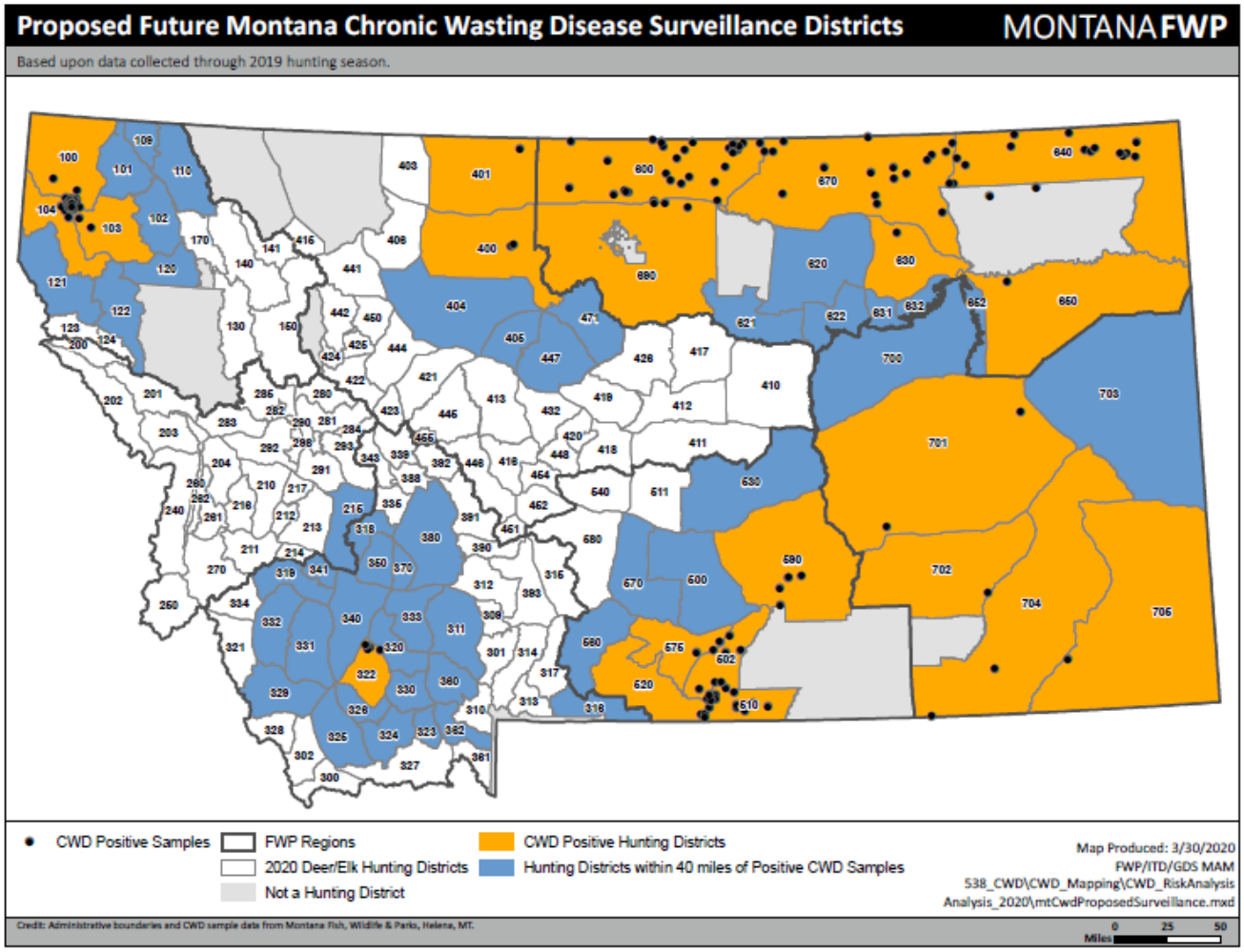


Figure 1. High priority chronic wasting disease (CWD) surveillance districts in Montana (in blue), identified by a 40-mile buffer on known positives (black dots) as of 3/1/2020. High-priority areas may change depending on new detections of CWD in Montana or in surrounding states or provinces. CWD positive hunting districts are depicted in orange. Deer and elk hunting districts are displayed.

Priority surveillance areas are divided into spatially defined sampling units in which surveillance will be conducted. These "minimum surveillance units" are defined as aggregations or portions of deer hunting districts that aim to encompass populations of ≤15,000 of one species of deer based on available information (Figure 2).

Figure 2. Map of proposed minimum CWD surveillance/monitoring units being considered for targeted sampling in 2020, each displayed in a different color. Some of these units are in their second year of surveillance/monitoring to meet sampling goals. These units will be updated on an annual basis.

Weighted Surveillance, Sample Size, and Sampling Distribution

Within each minimum surveillance unit, we will use a weighted surveillance strategy (Walsh 2012). Weighted surveillance incorporates the relative risk of different demographic groups (age, sex, or cause of death categories) to economize sampling efforts. For example, previous studies on mule deer in Colorado have shown that within CWD-endemic areas, symptomatic individuals are much more likely to be CWD-positive than apparently healthy, hunter-harvested animals (Walsh 2012). Similarly, at least with mule deer, animals that have died due to vehicle collisions, predation or other unexplained mortalities are more likely to be infected with CWD. Adults of either sex are more likely to be infected than young animals, as they have had more time to become infected, and males are more likely to be infected than females. These differing probabilities of infection have been used to create a weighted point system, where animals that are more likely to be infected with CWD are given more points towards meeting a sample size goal (Table 2) (Walsh 2012). These estimated points are unique to each

cervid species and cannot be combined across species.

Table 2. The relative weights or "points" associated with each demographic group of deer and elk that count towards meeting a sample size goal using a weighted surveillance strategy based on data from mule deer and elk in CWD-positive areas in Colorado (Walsh and Otis 2012) and white-tailed deer in Wisconsin's CWD management zone (Jennelle et al. 2018).

Demographic Group	Weight/Points		
	Mule Deer	White-tailed Deer	Elk
Symptomatic female	13.6	9.09	18.75
Symptomatic male	11.5	9.09	8.57
Road-killed males/females	1.9	0.22	0.41
Other mortalities (predation, other unexplained in adults and yearlings)	1.9	7.32	0.41
Harvest-adult males	1	3.23	1.16
Harvest-adult females	0.56	1.30	1.00
Harvest-yearling females	0.33	0.85	0.23
Harvest-yearling males	0.19	1	NA
Harvest-fawns/calves	0.001	0.04	NA

Using weighted surveillance, our goal is to detect CWD with 95% confidence if it is present at ≥1% prevalence. The required sample size, using the standard equation for calculating the number of samples needed to demonstrate freedom from disease, is 300 (Dohoo et al. 2009, and see sample size calculations to detect disease presence with 95% confidence on page 19).

Thus, with 300 weighted surveillance sample points we expect to be able to detect at least one positive with 95% confidence if CWD were present at ≥1% prevalence within a minimum surveillance unit. Sample size requirements are relatively invariant to population size if trying to detect the disease at a specified prevalence (Walsh 2012). In addition, sample size estimates are specific to a single species within a minimum surveillance unit. Our surveillance efforts will focus on both mule deer and white-tailed deer since both species are infected at a higher prevalence than either elk or moose (Miller et al., 2000). If a surveillance unit is dominated by one of these two deer species, we may focus our efforts on the dominant species and sample the other species opportunistically.

As an example, if we tested 10 symptomatic female mule deer (worth 13.6 points each) and 164 hunter-harvested adult male mule deer (worth 1 point each) broadly sampled from across a minimum surveillance unit, the 300-point goal would be met after having only sampled 174 animals (e.g. 10 X 13.6 + 164 X 1 = 300 points). Understanding these relative weights allows us to maximize the value of our limited resources.

Within each minimum surveillance unit, every effort must be made to broadly distribute the sampling effort to maximize the detection of infection (Walsh 2012). CWD infections are highly localized when they do occur (Conner and Miller 2004, Miller and Conner 2005, Farnsworth et al. 2006, Joly et al. 2006, Osnas et al. 2009, Heisey et al. 2010), and we are less likely to detect an infection if sampling is highly clustered or biased to one portion of the minimum surveillance unit. While road-kills and symptomatic animals are most valuable, they are also most likely to be collected within a small portion of the surveillance unit (e.g. roadways, human-populated areas). Therefore, such samples must be augmented with a broader distribution of hunter-harvested samples.

If we are unable to meet sample size requirements within a surveillance area in a given year, we may continue to collect a limited number of samples in subsequent years to achieve our 300-point sample goal within a two to three-year period. CWD is a relatively slow-moving disease at the population level, and since prevalence is unlikely to substantially change over a two to three-year period, aggregating samples over this time frame is reasonable. Sampling beyond the primary surveillance year will require FWP staff and hired technicians to continue to sample symptomatic, road-killed, and hunter-harvested animals.

Sample Collection, Storage, Testing, and Reporting Schedule

FWP will collect samples at designated CWD check-stations and regional offices and will accept samples collected and mailed by hunters to FWP's Wildlife Health Laboratory. FWP may also work with Montana Department of Transportation, Highway Patrol, processors and taxidermists, outfitters, and landowners to obtain additional samples. For each cervid sampled as part of the CWD surveillance program, field and laboratory staff will collect retropharyngeal lymph nodes from deer and elk (Hibler et al. 2003) and an obex sample from moose (obex may also be sampled from deer and elk if the lymph nodes are not available), an incisor tooth for aging, and a small genetic sample (muscle tissue) when possible. In addition, field staff will work with hunters or others to gather precise location information on where the animal was harvested/found, species, age, and sex. Lymph nodes and obex from deer and elk will be frozen for subsequent enzyme-linked immunosorbent assay (ELISA) testing, whereas lymph nodes and obex from moose will be fixed in 10% buffered formalin for immunohistochemistry (IHC) testing. As new validated testing methods become available, they may be considered. Samples will be submitted to a National Animal Health Laboratory (NAHL) Network-accredited diagnostic laboratory (e.g. Colorado State University Diagnostic Laboratory and/or the Montana Veterinary Diagnostic Laboratory) as soon as possible, with an expected turn-around time for results of 1-2 weeks. Results from hunter-harvested animals will be posted on FWP's website as soon as results are received from the lab, which is generally within 2-3 weeks from the time the sample was collected. If a harvested animal tests positive for CWD, FWP will directly contact the associated hunter to inform them of the test results, that the meat may be legally disposed of, confirm location of harvest, and determine the disposition of carcass parts. An annual surveillance report will be published by April 1 following the end of the previous hunting season. Press releases will be issued as needed to keep the public informed.

FWP will provide additional information on sample collection and submission on their website (fwp.mt.gov/cwd).

Surveillance after detecting CWD

Upon any new detection of CWD, FWP may mount a separate, intensive effort within an Initial Response Area (IRA) or the surrounding hunting districts to determine prevalence and distribution of the disease (see Chapter 3 - Montana's Response to a Detection of CWD). We will develop a monitoring program to track changes in distribution and prevalence over time and in response to management actions. Established, CWD-positive areas may be dropped from the surveillance rotation. Statewide surveillance outside of established positive areas will be expected to continue as described in this plan. CWD detections outside of Montana, but within 10 miles of the border, will be evaluated on a case by case basis by the FWP CWD Action Team as to whether to increase surveillance or initiate a Special CWD Hunt.

Sample size calculations to detect disease presence with 95% confidence

The basic equation for calculating the number of weighted-sample "points" needed (n) to establish freedom from disease at a specified prevalence level (P; or proportion of the population testing positive) and with a desired level of statistical confidence (α), assuming the number of positive cases follow a Poisson distribution is (Dohoo et al. 2009):

$$n = \frac{-\ln(1-a)}{P}$$

There are variations on this equation that account for population size or for imperfect test sensitivity (ability of a test to correctly identify those with the disease) and specificity (ability of a test to correctly identify those without the disease). However, since the number of weighted sample points needed is relatively invariant over the range of animal population sizes commonly encountered with ungulates and there are errors associated with field estimates of ungulate population sizes, we have chosen to use the above, conservative equation. Similarly, test sensitivity and specificity are both high for the CWD ELISA test, and therefore we have chosen to use the simple calculation. For a weighted surveillance strategy, the above calculation is used to determine the number of "points" needed (as opposed to the number of animals) to establish freedom from disease at a specified prevalence level and with a desired level of confidence (Walsh 2012) (Table 3).

Weighted surveillance allows one to incorporate previous estimates of the relative risk of various demographic groups (age, sex, or cause of death categories) to economize sampling efforts. Animals that are more likely to be infected are given more points towards meeting a sample size goal.

Table 3. Weighted sample points needed to detect a specified prevalence (*P*; proportion of the population testing positive) with 95% confidence.

Prevalence (*P*)	Points Needed
0.1%	2996
1%	300
5%	60
10%	30

CHAPTER 3.

MONTANA'S RESPONSE TO A DETECTION OF CWD

The following are the actions Montana Fish, Wildlife and Parks (FWP) may take upon any new detection of CWD in the state. These efforts are designed to minimize spread among herds and maintain low prevalence in infected herds. This response plan is broken into two phases, each with several steps. Phase I is the response to CWD detection in a new area. Phase II is the long-term management of the area once prevalence and distribution of the disease is better known.

While we focus on mule deer and white-tailed deer, similar actions would be considered for a detection in elk or moose, as warranted.

Objectives for CWD Management

- Minimize effects of CWD on cervid populations
- Minimize health risks of CWD for humans
- Maximize recreational opportunities
- Maintain public trust and support
- Increase understanding of CWD impacts on cervid populations and human health
- Use Adaptive Management to evaluate management effectiveness
- Minimize cost
- Work effectively with elected officials at all levels, land managers, public health professionals, landowners, and tribes to achieve objectives.

FWP's goal in managing CWD is to reduce prevalence to and/or maintain it at 5% or lower within the affected population to minimize population effects and disease spread. Regardless of prevalence, any detection of CWD needs to be addressed through management. The geographical size of the area to be managed long-term in Phase II will depend on the results of sampling during an initial response described below but would most likely be at least at the hunting district or county scale. This goal takes into consideration that once discovered, CWD prevalence in the local cervid population may already exceed 10%. If this is the case, reducing prevalence to ≤5% may prove difficult or impossible.

Phase I: Response to a New Detection

Step 1. CWD Team

When an initial detection of a CWD positive animal outside of a current management zone occurs, the objectives will be to measure prevalence and distribution. CWD detections outside of Montana, but within 10 miles of the border and game farm positives, will be evaluated on a case by case basis as to whether an increase in surveillance or management actions are warranted. There may be different methods used to achieve these objectives. Regional staff in collaboration with the Disease Ecologist, and possibly other appropriate department staff, will determine communication, logistical, and personnel needs and issues, initial response procedures, immediate and long-term communication needs and determining the need for holding public meetings. Field operations (training, enforcement, check stations) and ongoing contingency response needs will be addressed. Other individuals involved in initial response may include, but are not limited to, representatives from the Montana Department of Livestock, Montana Department of Public Health and Human Services, and representatives from adjacent tribes.

Defining an Initial Response Area (IRA)

Immediately following a new detection of CWD, FWP may define at least a 10-mile radius around the site of the detection and use this as a guide to legally define the Initial Response Area (IRA). In certain cases, an IRA may be established based on a positive detection outside of Montana, but within 10 miles of the border. The IRA will be legally described using boundaries such as roads, creeks, ridge tops, etc. to facilitate ease of understanding and subsequent management actions. The entire hunting district may be defined as the IRA. FWP may put up signs at major access points identifying the area as an IRA and that special hunting and other regulations apply. The Area Biologist and Regional Wildlife Manager will estimate the herd size, distribution, age and sex ratios, and density and will identify important movement corridors and connectivity with neighboring populations. Subsequent survey flight data may be used to modify the original IRA boundary.

Step 2 – Define CWD Management Zone

Once a new detection of CWD occurs, FWP will define a CWD Management Zone. The CWD management zone will be at least as large as the IRA but may initially be at the hunting district level. The CWD management zone may be expanded to include multiple adjacent Hunting Districts as additional CWD positives are detected. Hunting districts that are within 10 miles of a known CWD detection may also be included in a CWD Management zone prior to the detection of a CWD positive in that hunting district. The CWD Management Zone will identify the area in which CWD is considered to be present for public information purposes and is recommended hunters consider having their deer tested. If carcass transport restrictions are implemented, the CWD management zone would be the boundary outside which the transport of whole heads or spinal cords would not be allowed. The CWD management zone may be expanded outside the hunting district to include adjacent communities or portions of highways if it is determined practical by regional staff.

Step 3 – FWP Director, Regional Supervisor, Wildlife Program Manager, and local F&W Commissioner determine the need for and authorize a Special CWD Hunt

Not every new detection of CWD will require a Special CWD Hunt. For example, if there is a new detection during a general hunting season, we may choose to hold a Special CWD Hunt as part of the general season the following year. This would allow for any additional positive animals harvested during the ongoing season to be considered in defining a more comprehensive IRA and CWD Management Zone and allow for rules and regulations to be included in hunting regulations for the following year. FWP may choose to issue more B licenses valid only within the IRA for the general season Special CWD Hunt. This approach would require significant public education efforts to inform hunters of the impending Special CWD Hunt, the area where it will take place, its special rules and regulations, and the need for mandatory sampling as outlined below. It is important that public outreach clearly conveys that because CWD moves slowly through populations, delaying action for a year is not expected to increase prevalence or spread significantly. Enough animals may be sampled during a general hunting season or general season Special CWD Hunt that a late hunt is not needed.

If an IRA and Special CWD hunt are defined and authorized, changing the parameters of the hunt while it is ongoing should be avoided. Changing these parameters would lead to hunter confusion.

Step 4 – Begin public information campaign
Immediately following verification of a new detection of CWD, FWP's Communication and Education division will begin an aggressive information campaign as described in the Montana CWD Public Information Plan (Chapter 4). The information campaign will identify the site of the detection, the actions FWP is going to take, and, most importantly, the reasons such actions are necessary. Public education concerning CWD is critical in maintaining support for our management efforts and maintaining public trust and support.

Step 5 – Determine CWD prevalence and distribution within the Initial Response Area (IRA)
After initial detection, FWP will start to collect samples to determine CWD prevalence and distribution within the IRA. This may be done during the general season but could also include a Special CWD Hunt. Prevalence will be assessed primarily using samples from hunter-harvested or agency sampled animals using a non-weighted sampling design that differs from the surveillance plan sampling used pre-detection. FWP's disease ecologist will determine the sample size necessary to describe prevalence with 95% confidence within a 3% margin of error, accounting for the estimated number of deer within the IRA. This could result in required sample sizes ranging from 100-200 animals (Table 4, see also Sample size calculations for measuring CWD prevalence at the end of this chapter for a more detailed explanation). Samples should be collected as evenly as possible from across the IRA and in rough proportion to the available sexes within the population to achieve an unbiased estimate of prevalence. There is evidence to suggest that prevalence differs between the sexes. If prevalence is significantly different between the sexes, sample design may be adjusted to target a specific sex.

Table 4. Examples of sample size needed to determine CWD prevalence with a 3% margin of error and 95% confidence in cervid populations of different sizes based on a predicted 5% prevalence using sample size calculations found on page 19.

Size of deer or elk population in the IRA	Sample size needed to determine prevalence
250	112
500	145
750	152
1000	169
2000	184
3000	190
5000	195

These sample size goals will be applied to target species as determined through surveillance, however, all other cervid species within the IRA will be sampled opportunistically. FWP will continue to collect samples from symptomatic and road-killed animals to inform the distribution of CWD within the IRA, but for statistical sampling reasons that require an unbiased sample, these will not contribute to our estimates of prevalence.

Sampling to measure prevalence and distribution will be achieved using public hunting however, there may be situations where public hunting is not suitable or unlikely to achieve desired results such as within populated areas. In these cases, other sampling means like special permits to landowners or agency lethal removal may be considered. In these cases, meat may be donated for human consumption by FWP after samples have been collected and submitted for CWD testing. If the first detection occurs when a hunting season could be authorized (August 15 – February 15) a public hunting effort will be the priority. Seasonal movements and concentrations will be considered when determining the timing of hunts.

FWP staff will sample animals harvested within the IRA. FWP's Wildlife Disease Ecologist (currently Dr. Emily Almberg) will determine when the sampling requirements, as defined above, have been satisfied. At minimum, animals will be sampled by age and sex in proportion to their estimated availability in the population. If a sex is under-sampled, additional sampling may be required.

Establishing a Special CWD Hunt in the Initial Response Area (IRA)

Special CWD Hunts within the IRA will require regulations that will differ significantly from regular hunting season regulations, even if the hunt occurs during the general season. The following are some of the special regulations, rules and reporting requirements that participants must follow. Additional special regulations may be warranted. Violation of these special regulations is punishable under Commission

rules and regulations.

- The IRA boundaries and special regulations for hunt participation will be publicized by FWP's Communication and Education Division through press releases, social media, the FWP website, radio, TV, and other venues. This will include a definition of the IRA and any transport restrictions, pertinent special hunt rules and regulations, and hunt dates.
- Licenses – During any ongoing general archery or firearms seasons existing A and B licenses will continue to be valid in the hunting district(s), including the IRA, but hunters using those licenses in the IRA will be subject to all the special rules and regulations of the Special CWD Hunt. Additionally, hunters may purchase Special CWD Hunt B Licenses, valid only within the IRA during the Special CWD Hunt. A hunter may not possess more than seven deer B licenses per year. There may be two different types of Special Hunt B licenses offered: either-sex licenses or antlerless-only licenses, based on sampling need. A limited number of licenses of each type will be offered depending on sampling needs. Only in this or another special hunt circumstance can a hunter in Montana harvest more than one antlered buck per year. In the case of a Special CWD Hunt, a license holder could harvest one antlered buck with a regular A license during the general archery or firearms seasons in any open area within the state, as well as one or more antlered bucks within the IRA with a Special CWD Hunt either-sex license during the Special CWD Hunt. Other Special CWD Hunt B Licenses will be for antlerless-only. The creation and sale of Special CWD Hunt Licenses will be coordinated with the FWP licensing bureau. To avoid overcrowding of hunters, Special CWD Hunt B Licenses may be valid only for a specified time within the hunt. For example, a license may only be valid for a one to two-week period, to stagger hunters throughout the duration of the hunt.
- The Special CWD Hunt may be open to any legal weapon unless conditioned by a landowner providing access to private property. This means that hunters might use rifles during what would otherwise be an archery-only season.
- All animals harvested during the Special CWD Hunt must be checked at a FWP Special CWD Hunt Check Station or another designated sampling location within three days. FWP may establish one or more check stations at access points to the IRA to collect samples and aid hunters. Check station operation parameters (time, location, duration) may vary by location, but should not change without adequate notice to participating hunters. These check stations will be operated only as part of the CWD management action. The stations will be staffed by FWP personnel and possibly volunteers or staff from partner agencies. Hunters will be required to document the exact location of the kill using a GPS, a USGS Topographic Map, or a map available by FWP at check in. Hunters who quarter or bone out their animal must bring the head, lymph nodes, or obex to the check station for inspection.
- Submission of a sample for CWD testing will be mandatory for all cervids harvested in the IRA during a Special CWD Hunt regardless of the type of license used. Species, sex, and age of the

animal will be recorded and retropharyngeal lymph nodes and/or obex, a tooth for aging, and a genetic sample will be collected.

- Transport restrictions may apply to whole carcasses or whole heads and/or spinal columns of cervids harvested within the IRA. Cervids taken within the IRA and checked by FWP may be tagged with a tag reading "MTFWP CWD TEST" and a unique identification number. Heads of animals may be surrendered to FWP, although special accommodations may be made for heads destined for taxidermy. The carcass tag will identify the animal as having been checked by FWP. Unless prohibited by the private landowner, the spinal column may be left in the field at the kill site. Disposal in a class II landfill is another effective option. Carcass parts that may be removed from the CWD Management Zone, if transport restrictions are in place, include:
    - meat that is cut and wrapped or meat that has been separated from the bone
    - quarters or other portions of meat with no part of the spinal column or head attached
    - hides with no heads attached
    - skull plates or antlers with no brain tissue attached
    - skulls that have been boiled and cleaned to remove flesh and tissue
    - To reduce risk of CWD spread, hunters are strongly encouraged to dispose of hides, bones, brains, and trimmings at class II landfills
- Hunters will be encouraged to take precautions, including using gloves and eye protection, minimizing the handling of brain and spinal tissues, washing hands, and cleaning instruments thoroughly after field dressing an animal. Concentrated (40% solution) household bleach, or hypochlorous acid (HOCl, Briotech Inc.) may be useful in decontaminating instruments if immersed for up to five minutes (Hughson et al. 2016 and William et al. 2019).
- Avoid consuming brain, spinal cord, eyes, spleen, tonsils, and lymph nodes of any harvested animals.
- DOL and DPHHS developed best practices for meat processors, which FWP will distribute via letters and Frequently Asked Questions (FAQ) sheets.
- Any area where an IRA is established is likely to include private land. A Special CWD Hunt does not grant hunter access to any private land. Hunters must get landowner permission to hunt on private land. Access to state and federal public lands within the IRA will be coordinated with the land management agency.
- If the required number of samples are not collected by February 15, FWP may consider other options including, but not limited to:
    - Resuming the hunt the following August 15.

- Additional sampling during the general hunting season the following year.
- Continuing the Special CWD Hunt after February 15, which will require special Fish and Wildlife Commission action.
- In circumstances where special kill permits are issued to landowners or their agent or designee, meat shall be distributed to local charities or the general public or disposed of under authority of FWP. The landowner or their agent or designee will not be the recipient of animals harvested using a special kill permit. It will be the responsibility of the recipient of the meat to process and house the meat until CWD test results are available.
- In circumstances where agency lethal removal and sampling is employed, meat may be distributed to local charities or the general public with the understanding that the recipient may be responsible for processing and housing the meat until CWD testing results are available.

- The Special CWD Hunt may terminate once pre-determined goals for sample size and sampling distribution have been met, although any transport restrictions may remain in effect indefinitely for animals harvested in the CWD Management Zone [e.g. hunting district(s) or county(s)]. Goals are to estimate prevalence within a 3% margin of error with 95% confidence with broad sampling coverage across the IRA.
- FWP's Communication and Education Division will publicize the end of the hunt through press releases, social media, the FWP website, radio, TV, and other venues.
- At the conclusion of the established Special CWD Hunt, FWP will make available a hunt summary.

Most hunters will want to know the test results prior to consuming their meat. Every effort will be made to return test results from within the IRA to hunters in a timely manner; however, because test results may not be known for two weeks or more, hunters will likely have to process their meat before they have a test result in hand. FWP will attempt to contact hunters whose animal tests positive for CWD to inform them of the test results and that the meat may be legally disposed of and to determine the disposition of carcass parts. If the general season or Special CWD Hunt is still open, those hunters may receive a replacement license at no cost.

Success of the hunt will in many cases be largely determined by private landowners' participation. Therefore, it is again vitally important the messages to the public and to individual landowners stress the threat of CWD, the importance of action, and the steps in this action plan. FWP will make every effort to address individual landowners' concerns related to participation in a CWD hunt. Block management cooperators will be contacted and may choose to make their lands available to the public during a CWD hunt. If the hunt extends past the period eligible for payment, they will not be compensated for the additional hunter days.

Potential Complications

As with any response of this nature, unpredicted circumstances are likely to arise. While this plan attempts to prepare for many of those, some could result in a level of situational complexity that will require widespread attention by department staff. For instance, if in our efforts to determine prevalence, the IRA expands dramatically by finding more positives, say from approximately 314 square miles (one positive = 10-mile radius IRA) to 3,000 square miles (10 positives depending on where they're found), the logistical complexity of our response will increase dramatically. This plan allows for that increased complexity by providing clear direction on requirements for estimating disease prevalence and guidelines for trying to contain the disease within the IRA. Additionally, though we understand that more complex scenarios will increase involvement with the public, stakeholders and the media, our communication plan can expand appropriately. Furthermore, FWP recognizes that with complexity comes additional requirements of staff, and cooperation from FWP employees from across the state will be vital. Because this plan is adaptive, FWP will make prudent management decisions based on the circumstances of each situation.

CWD in Special Regulation Buck Hunting Districts

Some hunting districts in Montana are managed for older buck mule deer where a hunter must possess a permit that is used in combination with a regular license to harvest an antlered buck. Given CWD concerns, hunting seasons designed to manage for older age class bucks should be proposed for removal during routine season setting processes (WAFWA 2017). There are currently 38 hunting districts managed with one of two kinds of permits: an unlimited permit, which is guaranteed to the hunter if he/she applies for it, or a limited permit, which is awarded to successful applicants through a random lottery draw. There are similar opportunities for elk. Some of these, especially the limited permits, are highly coveted and drawing odds are very low.

Special buck management districts pose additional issues for CWD management if CWD is found there. First, it is known that older bucks are the most likely to become infected with and spread CWD. Second, instituting a Special CWD Hunt to determine prevalence and distribution and any long-term change in management is likely to meet opposition from some hunters and outfitters. Yet, if CWD is detected in a special buck management district, it is just as important to address it as in any other district, perhaps more important because of the increased likelihood of older bucks acting as vectors to other areas. It will be important that FWP increase its efforts of public education regarding the risks involved with an unmanaged CWD-infected herd.

If CWD is found in either an unlimited or limited-permit special buck hunting district (e.g. HDs 270, 380, or 530), an IRA would be established but a Special CWD Hunt would not take place until after the general season so that permit holders could still use their permit. Permit holders would be notified and required to submit harvested animals for CWD sampling within the IRA. Once CWD is detected in these types of districts, regardless of prevalence, FWP would propose an antlered-buck or either-sex mule deer

season for the district.

Urban Area CWD Management

Detection of CWD within an urban area poses additional management challenges. In many urban areas across the state, deer exist at relatively high densities, potentially leading to higher CWD prevalences than in more natural settings. Local residents may have differing opinions concerning "town" deer; some perceive them as a nuisance or safety issues, while others perceive them in a positive light. These differing opinions pose additional challenges for management. In some urban areas, standard CWD response plans may be adequate and additional steps may not be needed. In situations where they are not, the following guidelines are meant to help navigate an urban area infection.

1. Establish immediate communication with the local city and county commissions, as well as local law enforcement agency.

2. In some cases, an additional surveillance area encompassing the urban zone may be established to determine prevalence. Sampling requirements will need to be established for this area as well but should be centered around the initial urban detection.

3. Host multiple public meetings for outreach to local residents.

4. If there is interest or need for management of deer within city limits, it should be addressed in a city deer management plan. Early communication with city officials is essential to begin this process when a management plan is not in place.

5. Department sampling may be necessary in the urban zone after the completion of general season and any special CWD hunts. This will require additional staff.

Step 6 – Evaluate results of Phase I

The first sampling efforts through the Special CWD Hunt will inform us about the prevalence and distribution of CWD within the Initial Response Area. Prevalence will be reported for all cervids by species and sex. Depending on what is learned, the geographic size of the IRA may be increased, and Response Phase I efforts may continue. If other positives are detected more than five miles from the index case, FWP will evaluate and has the option of expanding the initial IRA as well as the CWD Management Zone based on regional FWP staff input. Depending on what is known about animal habitat use and movements, it may be desirable to radio-collar an appropriate sample of animals to better determine seasonal movements and distribution.

If satisfied with Response results, we will proceed to Phase II.

Phase II: Long-Term Management Plan

Long-term management in CWD Management Zones will be designed to reduce or maintain prevalence below 5% and limit distribution. A program designed to reduce density and/or modify age or sex structure may be necessary. Even if prevalence is below 5%, FWP will initiate CWD management to keep prevalence low and help prevent disease spread.

A monitoring strategy will be developed to detect the spread of CWD and track CWD prevalence over time among susceptible cervid species in the infected area. This may entail annual or periodic surveillance, depending on available resources, surveillance needs elsewhere in the state, and objectives related to assessing management success. As in the initial response effort, prevalence will be tracked primarily using samples collected from hunter-harvested animals. Road-kills and symptomatic animals will also contribute to the monitoring of the distribution of the disease. Sample collection may entail the use of "head barrels" where hunters can deposit heads of harvested animals, increased sampling at area game check stations, or other means as determined necessary by Regional staff.

A "one size fits all" approach to CWD management is not possible given the diversity of habitats where cervids exist. FWP personnel and local stakeholder or constituent groups may develop herd or population plans tailored specifically to circumstances, populations, or areas at a hunting district or larger scale. FWP will cooperate with neighboring states/provinces on CWD management and will strive to follow guidelines for management and monitoring as outlined in the Western Association of Fish and Wildlife Agencies' Recommendations for the Adaptive Management of CWD (WAFWA 2017). Depending on what would be covered in a herd plan, it may be necessary to seek Commission approval. Management actions may consist of one or more of the following alternatives or additional alternatives not included in this list:

- Increased harvest, especially of antlered deer. This could manifest as expanded opportunity for all age/sex classes.
- Hot spot culling/targeted removal in limited areas around CWD detections.
- Reducing cervid aggregations within the management zone by removing or fencing highly localized attractants, hazing, dispersal hunts or by other means.
- Transport restrictions. FWP would work with processors and taxidermists to help enforce these restrictions.
- Additional methods developed and proven effective in other states and provinces.
- Experimental approaches with scientific research designs and a commitment to monitor effectiveness.

Preemptive Management in Hunting Districts Adjacent to CWD-Positive Areas

FWP should preemptively manage to prevent CWD in hunting districts adjacent to CWD-positive areas.

Evaluation of Program Efficacy

If a CWD management plan has been developed, completed, and approved for a specific herd or population, a monitoring program will be developed to assess management efficacy. Depending on existing CWD prevalence and management goals, this may entail securing additional funding for more intensive surveillance or research.

Communication and Educational Outreach

The Public Information Plan for Chronic Wasting Disease in Montana (Chapter 4) is intended to guide Montana Fish, Wildlife, and Parks' communication about CWD in Montana. It includes key messages to various audiences, including the general public, hunters, stake holders, landowners and other state agencies; communication techniques that will be used; timing of strategies; overall communication objectives, and personnel responsible for executing each piece of the plan.

We must inform the public about the seriousness of CWD and bolster support for proposed agency action. We must also plan for the effective communication of Montana Fish, Wildlife, and Parks' response to CWD. An efficient response will depend greatly on our efforts at communication with key audiences.

After any action, such as surveillance or a Special CWD Hunt, FWP will follow up with a report summarizing actions via all venues of public information. The purpose is to close the current 'chapter' of CWD management for the IRA and set the stage for future actions.

Sample Size Calculations for Measuring CWD Prevalence

Upon any new CWD detection, FWP will define an IRA and coordinate a special hunt to measure the prevalence and distribution of the disease. We want to ensure that we measure prevalence with a high level of precision while accounting for the estimated cervid population size within the IRA. This is a random sampling design and is not the same as the weighted sampling used during surveillance. Weighted sampling is used only to determine the presence of CWD.
The sample size necessary (n) for estimating the disease prevalence ($\hat{p}$) in a small finite population of size N with (1-α)100% confidence and error no larger than ϵ is calculated as: $n = \frac{m}{1 + \frac{m-1}{N}}$
where $m = \frac{z^2_{\alpha/2}\hat{p}(1-\hat{p})}{\epsilon^2}$ is the sample size necessary for estimating the disease prevalence ($\hat{p}$) for a large population (https://onlinecourses.science.psu.edu/stat414/node/264).

Thus, to estimate prevalence with a 3% margin of error ($\epsilon = 0.03$) with 95% confidence ($z^2_{\alpha/2}$ = 1.962), assuming prevalence is 5% ($\hat{p} = 0.05$) and the target population size (N) is 1000:
m = (1.962*0.05*0.95/(0.032)) = 203 and n = 203/(1 + (203-1)/1000) = **169**
animals needed in our random sample design.

CWD RESPONSE FLOW CHART

Detection of CWD

Phase I – Action Alert Phone Tree and Public Information initiated. Determine Initial Response Area (IRA)

CWD Phone Tree is initiated (See Chapter 4)

FWP Director, Regional Supervisor, Regional Wildlife Program Manager and local F&W Commissioner determine the need for and authorize a Special CWD Hunt if necessary.

Com Ed begins public information outreach

Area Biologist, Regional Wildlife Manager and Regional Warden Captain define IRA with reasonably described boundaries such as county roads, creeks, ridge tops, etc. to facilitate subsequent management actions.

Phase I Initial Response

Initial response will harvest enough deer to estimate CWD prevalence within a 3% margin of error and with 95% confidence as determined by the FWP **Disease Ecologist**. Harvest will be primarily through public hunting during the general season or a Special CWD Hunt, but in exceptional circumstances could include agency lethal removal, landowner kill permits, or other means. All cervids taken will be sampled. This will serve to determine the prevalence and start to determine the geographic extent of the disease.

Other Staff Involved: **Area Biologist, Regional Wildlife Manager, Regional Supervisor, Regional Warden Captain, Regional Information Officer, Game Management Bureau Chief, CommEd Information Bureau Chief, Director.**

Determine Result of Initial Response (Phase I)

Harvest during Initial Response of Phase I will inform us about the extent and prevalence of the disease in the Initial Response Area. Depending on what is learned, we may have to increase the geographic size of the IRA and continue with Initial Response Phase I efforts. If satisfied with Initial Response results, we will proceed to Phase II. Staff is the same as in Initial Response Phase I.

Outline Phase II Long-term Management

Long-term management of the area will vary depending on results of Phase I. This may include revised population objectives and/or changes in season structure, or other options. Staff is the same as in Initial Response Phase I.

CHAPTER 4.

MONTANA CWD PUBLIC INFORMATION PLAN

This public information plan is intended to guide FWP's communication efforts for CWD surveillance and our response to new detections of CWD in places where it hasn't been found in Montana. It includes key messages targeting various audiences such as the general public, hunters, stake holders, and other state agencies, as well as communication techniques that will be used, timing of strategies, overall communication objectives, and personnel responsible for executing each piece of the plan. The communication strategies will evolve over time with increased community awareness of the disease and the department's response.

Communication Problem

Montanans and those interested in hunting big game continue to show a huge interest in learning more about CWD as more animals test positive for the disease. However, they may not yet understand the full potential impact CWD poses to the state's wild ungulate populations.

Unmanaged, CWD could cause population declines of ≥40%, as have been seen in other states (see pg. 3 Biology, Distribution, and Population Impacts). CWD generates enormous interest from national and statewide media, from citizens concerned about public health risks, from hunters and conservation groups, landowners and agricultural producers concerned about impacts to wildlife populations and hunting opportunities, and from interest groups affected by specific management actions. We must inform the public about the seriousness of CWD and get appropriate buy-in on proposed agency actions. We must also plan for the effective communication of FWP response to CWD. An efficient response will depend greatly on our efforts communicating with key audiences.

This public information plan explores two specific areas of focus: general information about CWD and FWP's surveillance and communication following any new detection. The communication objective for each will be different.

- General information about CWD and FWP's surveillance: The objective for this phase of the plan is to increase awareness about CWD and FWP's surveillance and response plan, while generating support for the plan, as well as prevention and monitoring activities.

- Response to a new detection message: The objective in this phase is to generate awareness and understanding of response, getting buy-in/support from specific groups needed for an effective response (hunters, landowners, businesses, local officials), communicating the logistics of the response, and generating/maintaining support from stakeholders/public.

Communication Objective

This public information plan should accomplish the following:

- Increase awareness of CWD and current CWD management strategies amongst targeted audiences.
- Provide clear understanding of surveillance program, goals and accomplishments.
- Increase awareness and understanding of FWP's CWD response plan.
- Increase support for CWD response plan amongst targeted audiences.
- Generate support for response activities so response goals can be more easily met.

Audience

- Governor's Office
- FWP Commission
- FWP staff
- FWP Citizen Advisory Councils
- CWD Citizen Advisory Panel
- CWD Alliance
- State agencies – Dept. of Livestock, State Epidemiologist, State Veterinarian, Dept. of Health, DNRC, Board of Outfitters, Tourism, Department of Environmental Quality, Department of Transportation
- Montana Veterinarian Medical Assoc.
- Federal agencies – U.S. Geological Survey, U.S. Fish & Wildlife Service, BLM, National Park Service, Forest Service, USDA/APHIS, CDC, EPA
- Tribal governments
- Local jurisdictions – county commissions, county health departments, conservation districts, grazing associations, county sanitarian
- Wildlife agencies in neighboring jurisdictions
- Stockgrowers, alternative livestock associations, Ag-related organizations and landowner organizations, Northern International Livestock Exposition, Montana Agriculture Exposition, etc.
- Media – local, statewide newspapers, radio, TV, websites, national magazines, western media (CO, WY, ID, ND, SD, Alberta, Saskatchewan, etc.)
- Legislators
- License agents
- Resident and non-resident hunters
- Commercial meat processors/taxidermists
- Outfitters/MOGA
- Statewide conservation groups and local sportsmen's clubs

- Hunter Ed and Bowhunter Ed instructors
- Universities
- Landfills, waste facilities

Messages

All communication should consider these speaking points when appropriate and necessary:

General information about CWD and FWP's surveillance Speaking Points

- FWP had been monitoring wild cervid populations for nearly 20 years before it was found in hopes of discovering CWD early when it arrives in Montana.
- FWP's deer management to date has generally emphasized hunter opportunity over trophy bucks, which has led to a younger age structure in the buck segment and may have helped keep CWD at bay, because older bucks are the most likely to be infected and to infect other deer. This strategy is consistent with keeping disease prevalence low.
- FWP staff and leaders worked diligently to prepare for CWD in wild Montana cervids. Our response plan reflects these efforts and is our best way to control CWD in the immediate cervid population.
- There is no known cure for CWD.
- If left unmanaged:
    - CWD could have long-term dramatic impacts to cervid population numbers, and shift the population towards younger, immature, sub-prime-aged deer.
    - The prevalence of CWD will increase. High prevalence leads to population declines.
    - CWD will lead to the decrease in wildlife related recreational opportunities like hunting and viewing.
    - CWD could spread to other areas and/or other species.
    - Broader negative repercussions could include economic, hunting legacy, predator management, plant community management and hunting interest.
- FWP's initial response to a new CWD detection will be to sample cervids to determine disease prevalence and distribution.
- Initial management actions to determine prevalence and distribution may involve some level of herd reduction, dependent on individual circumstances.
- Determining disease prevalence and distribution is critical to assess risk and prepare for overall disease management.
- FWP's sampling effort will utilize public hunting and will likely include a Special CWD Hunt; however, if enough samples are not obtained by hunters, the agency may explore other options including landowner kill permits and agency sampling.
- FWP will use science to guide decisions when determining specific management decisions, but other

factors will also be considered. These will include landowner cooperation, social acceptance of management decisions, access to animals in need of harvest, hunter willingness to participate, and financial impacts.

- Hunters should never eat meat from an animal that appears sick. Even in a healthy animal the brain, spinal column or lymphatic tissues should not be consumed. CWD has never been proven or suspected to pass from an infected animal to a human. However, the Centers for Disease Control (CDC) and the World Health Organization (WHO) advise against consuming meat from CWD-positive animals. Furthermore, the CDC recommends that hunters strongly consider having their animals tested before eating the meat when hunting in areas where CWD is known to be present.
- Meat from CWD positive animals should be disposed of properly in a class II landfill, as provided in MCA § 75-10-431 et seq.
- In executing our management actions, FWP will work with local law enforcement, state, local, and tribal governments, landowners, and land management agencies.
- Seek alternative funding for surveillance, prevention, and management.

Response to a New Detection Speaking Points

- FWP will respond to the new discovery of CWD, as per the approved response plan. The department will work closely with local communities, the public, and other state and federal agencies.
- An Initial Response Area (IRA) may be established and encompass the area where the infected animal was found.
- Specific details about FWP's response include:
    - Specific species, age, sex, geographic area, date and prior level of testing in the area where the infected animal was harvested
    - Herd population numbers and susceptible species in the area.
    - Specific management actions recommended in FWP's Management Plan, with rationale for action stressing need to determine the prevalence and distribution of disease before other long-term management plans are implemented.
    - Accompanying the above, a statement that FWP's management actions aren't meant to eradicate the disease, but rather to estimate prevalence and distribution, reduce prevalence if possible, and halt the spread of CWD. Inaction is not a valid alternative.
- Announcement of any public meeting in affected area and in all FWP administrative regions to discuss incident and department responses.
- FWP has created a web page devoted to CWD issues in general and the specific current incident.
- FWP has been looking for the disease, with specific attention to "high-risk areas" and is not surprised at its arrival. Include maps showing distribution of samples collected since 1998.
- Nationwide distribution of CWD and an overview of management responses and outcomes in other states.

- Review of risk of transmission to humans and consumption advisories ("Hunters should never eat meat from an animal that appears sick, and even in a healthy animal, the nervous and lymphatic tissues should not be consumed."). Refer to language detailed in FWP's Chronic Wasting Disease web page.
- Assurance that FWP has contacted the hunter who harvested the positive animal and has waived requirement that meat be consumed.
- Assurance that FWP is contacting landowners and land-management agencies in affected area, specifically requesting access, where appropriate, to conduct management activities.
- Assurance that FWP has been in contact with the state Department of Livestock (DoL), the Department of Public Health and Human Services (DPHHS), and the Department of Environmental Quality (DEQ).
- In subsequent seasons, hunters in the IRA may need to submit heads of deer, elk and moose for testing. Results of tests will be expedited and made available to the participating hunters.
- Requirements for disposal of carcass wastes and/or contaminated carcasses, especially from IRA.
- Details on contacting FWP and Health and Human Services (county health departments, regional and statewide phone numbers), plus respected sources of CWD information (web sites, etc.), including Centers for Disease Control, World Health Organization, CWD Alliance, etc.
- Q&A format addressing basic questions of disease and its implications.

Communication Methods, Responsibilities, and Timing

Method (Pre-Detection)	**Responsible**	**Timing**
News releases on CWD monitoring effort or other newsworthy items (advisory panel meeting, testing efforts, new developments, etc)	CommEd/Regional Info Officers	When necessary
Public meetings with key stakeholder groups at the regional and state level	CommEd/CWD Action Team/Regional Staff	When Necessary
Presentation with regional Citizen Advisory Committees	CWD Action Team and Regional Staff	Pre- and post-detection
FAQs on CWD to include monitoring efforts and information about response plan	Information Bureau Chief	Ongoing
Montana Outdoors article on CWD planning and monitoring efforts	Montana Outdoors Editor	Ongoing
Social media posts about CWD – specifically tied to events (salvage permits, monitoring events).	Information Bureau Chief/Regional Info Officers	Ongoing

Public Service Announcements with key CWD messages (hunters look for symptomatic animals, salvage permits, etc.)	Information Bureau Chief	Ongoing
Method (Post-detection for new area)	**Responsible**	**Timing**
Initiate phone tree	Response Team	ASAP
Develop FAQs on detection and initial response	Information Bureau Chief	ASAP
Issue news release upon detection confirmation. Attach FAQs*	Information Bureau Chief/Regional CommEd Staff	ASAP
Update CWD web page, social media sites, and direct email to public with latest information, news release, and FAQs.	CommEd Division	ASAP
Speaking points to regional information officers	Information Bureau Chief/Regional CommEd Staff	ASAP

*All news releases will be done in conjunction with website and social media posts.

Action Alert Phone Tree to Implement Initial Response to a New Detection

- A positive test result is reported to FWP Wildlife Disease Ecologist (currently Dr. Emily Almberg, 577-7881), the FWP Wildlife Veterinarian (currently Dr. Jennifer Ramsey, 577- 7880), or the Montana State Veterinarian (currently Dr. Martin Zaluski, 444-2043 or 475- 2569) or the after-hours DOL emergency line (444-2976).
- The Disease Ecologist, Wildlife Veterinarian, and/or Montana State Veterinarian calls the FWP Director's Office (444-3186) and Wildlife Division (444-2612).
- Wildlife Division or Director's Office calls FWP Communication and Education Division Administrator (currently Greg Lemon, 444-4038), Information Bureau Chief (currently Peggy O'Neill, 444-3051), Game Management Bureau Chief (currently vacant), Regional Supervisor of affected region, local Fish & Wildlife Commissioner, and CWD Action Team chairman (currently Quentin Kujala, 444-5672).
- FWP Information Bureau Chief and the Information and Education Manager in the affected region prepare news release.
- FWP Disease Ecologist contacts the Department of Public Health and Human Services if a suspect carcass has gone to a processor.
- Enforcement Division contacts hunter and landowner and any other affected state, tribal or county jurisdictions, including other states if a harvested animal has been transported out of state.
- Information Bureau Chief distributes information via email to FWP All.
- CommEd Administrator and Information Bureau Chief contact first-tier media.

- Information Bureau Chief distributes news release and fact sheet to statewide media.

Example FAQs

Example of General Information about CWD and FWP's surveillance FAQs

Q. What is Chronic Wasting Disease and how do deer, elk, and moose catch it?

A. Chronic wasting disease (CWD) is one type of a class of diseases called Transmissible Spongiform Encephalopathies (TSEs) that infects members of the deer family, including deer, elk, moose, and caribou. TSEs are caused by infectious, mis-folded prion proteins (not a virus, bacteria, or fungus) which cause normal prion proteins throughout a healthy animal's body to mis-fold, resulting in organ damage and eventual death. These prions are found throughout bodily tissues and secretions and are shed into the environment before and after death. When other animals come in contact with the prions, either from infected animals or from contaminated environments, they can be infected. The disease is slow acting, degenerative, and always fatal. The name comes from the appearance of symptomatic animals, which get very skinny and sick-looking before they die.

Q. Where does CWD come from?

A. The origin of CWD is unknown. It was discovered in 1967 in mule deer at a research facility in Colorado. Shortly thereafter it was also found in captive mule deer and elk in Ontario, Colorado and Wyoming. By the 1990s, it was discovered in wild white-tailed and mule deer, elk and moose in Colorado and Wyoming and among captive animals in Saskatchewan, South Dakota, Montana and Oklahoma. By the early 2000s, CWD was found in the wild in Saskatchewan, Alberta, Illinois and Wisconsin. CWD has continued to spread. As of 2018, it has been found in captive or free-ranging herds in 26 states, three Canadian provinces, Norway, Finland and South Korea. CWD was found among wild deer in Montana in 2017.

Q. Is CWD found in Montana?

A. Yes. CWD was first found in the wild in October 2017. To date, CWD has been detected in northwestern, southwestern, southcentral, southeastern, eastern, and northern Montana.

Q. What is a CWD Management Zone?

A. A CWD Management Zone is one or more hunting districts, or portions of hunting districts, that contain an area where CWD was detected.

Q. What are the rules for carcass transportation and disposal within the state of Montana?

A. Deer, elk and moose taken in Montana may be transported within Montana to a camp, a private residence for processing, a taxidermist, a processor, or a CWD sample collection site in Montana, provided the head and all portions of the spinal column remain at the site of the kill or such parts are disposed of in any class II landfill in Montana.

Except as provided above, only the following parts of any deer, elk or moose taken in Montana may

be transported in Montana:

- parts suitable for food with no part of the spinal column or head attached
  cleaned hide without the head
- skull or skull plate or antlers that have been cleaned of all meat and brain tissue
- teeth
- finished taxidermy mounts

Nothing in this section shall apply to the transportation or disposal of deer, elk and moose taken by any governmental agency or educational institution.

Q. Can I transport a deer, elk or moose carcass from another state into Montana?

A. No. It is unlawful to transport into Montana a whole carcass, whole head, brain or spinal column from white-tailed deer, mule deer, moose or elk from states or Canadian provinces that have experienced CWD. CWD-positive states and provinces include Arkansas, Colorado, Illinois, Iowa, Kansas, Maryland, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Mexico, New York, North Dakota, Ohio, Oklahoma, Pennsylvania, South Dakota, Tennessee, Texas, Utah, Virginia, West Virginia, Wisconsin, Wyoming, Alberta, Saskatchewan, and Quebec.

Q. What animal parts can be brought into Montana from another state?

A. Meat that is cut and wrapped or meat that has been separated from the bone; quarters or other portions of meat with no part of the spinal column or head attached; hides with no heads attached; skull plates or antlers with no meat or tissue attached; skulls that have been boiled and cleaned to remove all flesh and tissue; upper canine teeth; head, partial body, or whole-body mounts prepared by a taxidermist.

Q. What is Montana doing to manage CWD?

A. Where CWD is detected, FWP will develop a herd management plan that will aim to keep prevalence of the disease at ≤5%in the affected population. Potential management tools include increasing harvest, especially of antlered animals; targeted removal in limited areas around CWD detections; minimizing large groupings of deer by removing or fencing attractants and through hazing or dispersal hunts; and carcass transport restrictions. In addition, FWP has several preventive measures in place including transport restrictions of live deer, elk or moose and their carcasses from CWD-positive states; the 2000 voter initiative ban on game farms; historic management emphasizing opportunity; laws banning the feeding of wildlife; and recent legislation regulating the use and import of cervid urine lures from CWD-positive states.

Q. Why is CWD management important?

A. Without management, CWD will spread, increase in prevalence, and may cause population declines in deer and elk as it has in other states. FWP is committed to doing all it can to keep our wildlife healthy so that hunting continues for generations to come. FWP's goal is to effectively manage the disease in wild populations and limit the prevalence and spread of CWD. There are no vaccines for CWD so management and prevention are critical to help prevent long-term population decline in infected herds, slow the decline of wildlife-related recreation opportunities, and control potential declines in property value.

Q. How did CWD get to Montana?

A. CWD infections along our northern and southern borders are likely the result of the natural spread of the disease from Alberta, Saskatchewan, and Wyoming to Montana. Alberta, Saskatchewan, and Wyoming have documented CWD-positive deer close to Montana's border. CWD is also found in neighboring North and South Dakota.

Q. Where is Montana looking for CWD?

A. FWP has identified priority surveillance areas based on known CWD positives within Montana and along our borders. These areas have been identified as those at highest risk of becoming infected through the natural spread of the disease. We will periodically update our priority surveillance areas as new information on CWD within the state becomes available. Since CWD could be spread through the inadvertent or illegal movement of a CWD-positive deer or elk carcass into the state, we also plan to periodically survey other areas of the state that fall outside of the high-priority surveillance zones.

Q. Can CWD be eradicated?

A. After decades of CWD management across the country, most agencies and researchers agree that CWD cannot be eradicated once it infects a herd. Other states have attempted eradication and set up unreasonable expectations with hunters and the public. Eradication is not the goal of FWP.

Q. Can humans be infected by CWD?

A. There is no known transmission of CWD to humans. However, The Centers for Disease Control and Prevention (CDC) recommends that hunters harvesting a deer, elk, or moose from an area where CWD is known to be present have their animal tested for CWD prior to consuming the meat, and to not consume the meat if the animal tests positive.

Some simple precautions should be taken when field dressing deer, particularly in CWD Management Zones:

- Wear rubber gloves and eye protection when field dressing your deer.
- Minimize the handling of brain and spinal tissues.
- Wash hands and instruments thoroughly after field dressing is completed.
- Avoid processing and consuming brain, spinal cord, eyes, spleen, tonsils and lymph nodes of harvested animals. (Normal field dressing coupled with boning out a carcass will essentially remove these parts.)

Q. How will CWD impact Montana's deer and elk herds?

A. The short answer is we don't know. If CWD infects enough animals, it will probably reduce the herd in the long term. Other states have seen deer populations decline when CWD infects 20 to 40 percent of a herd. In Wyoming, heavily infected herds of mule deer declined 21 percent per year and whitetails declined by 10 percent. Colorado saw a 45 percent decline in infected mule deer herds over 20 years. Clearly, if left unchecked, CWD could result in large-scale population declines.

Because the distribution and intensity of CWD infections are variable across a broad landscape, the impacts across the landscape will also be variable. Keeping deer numbers down and dispersed, and reducing

buck:doe ratios, may keep the prevalence low and manageable. Fish, Wildlife & Parks' focus will be on managing CWD-infected areas for prevalence at 5 percent or lower and preventing spread. This may also mean keeping deer or elk numbers low.

Q. How do you test for CWD?

A. The standard test is to look at an animal's retropharyngeal lymph nodes or brainstem for evidence of CWD. These samples can only be collected from dead animals and are submitted to a certified CWD-testing diagnostic laboratory. Unfortunately, there are no non-invasive CWD tests for live animals. For research purposes, rectal or tonsil biopsies from live animals will work, but these tests are less sensitive and require capture, anesthesia and minor surgery, making them impractical for widespread surveillance.

Q. How long will it take for me to find out if my deer has CWD?

A. If your animal is sampled by FWP staff at a check station or regional office during the general surveillance season or during a special hunt, results will be posted online (fwp.mt.gov/cwd) within three weeks. We recommend obtaining results before consuming meat from deer killed within a CWD Management Zone. If your harvested deer is found to be positive, you can dispose of the meat appropriately at a landfill and FWP may provide you with a new license.

Q. How can you tell if an animal has CWD?

A. Animals with CWD cannot be diagnosed based on clinical signs because they are unspecific and mild at the beginning of the disease. Diagnosis is therefore made by testing tissues from the central nervous system and lymph nodes. Symptoms of infected animals can include emaciation, excessive salivation, lack of muscle coordination, difficulty swallowing, excessive thirst and excessive urination. Clinically ill animals may have an exaggerated wide posture, may stagger and carry the head and ears lowered, and are often found consuming large amounts of water. However, these symptoms don't appear until the terminal stage of the disease. It is important to remember that infected animals may not have symptoms but can still be shedding infectious prions. Most CWD-positive deer sampled appeared outwardly normal and healthy.

Q. What happens if I shoot a sick deer?

A. This circumstance will be handled on a case-by-case basis. In the past, FWP has provided new licenses for people who have harvested sick animals that were inedible. However, since circumstances vary, we do not have a blanket policy. Guidelines from the Centers for Disease Control and Prevention advise that if you hunt in a CWD-positive area, have your deer, elk, or moose tested before consuming the meat. If it tests positive, dispose of the meat in a landfill. If you have harvested an animal that appears sick, contact your local FWP office.

Q. What is a Special CWD Hunt?

A. A Special CWD Hunt may be initiated following the detection of CWD outside of existing CWD Management Zones. This hunt may be held during the following hunting season and will be designed to sample enough harvested animals to determine the prevalence and spatial distribution of the disease. Special rules and regulations will apply. Additional Special CWD Hunt B Licenses may be made available to accomplish the desired harvest level. All animals harvested during a special hunt must be brought to FWP

Special CWD Hunt check stations for sampling and to be tagged with a tag reading "MTFWP CWD TEST" and a unique identification number. To prevent spread of the disease, new CWD Management Zone boundaries may be defined, and brain and spinal column material of animals taken during a Special CWD Hunt will not be allowed out of the Management Zone boundaries. The Special CWD Hunt will end when enough deer are sampled to precisely measure the prevalence and spatial distribution of the disease, which is estimated to be between 150-400 animals.

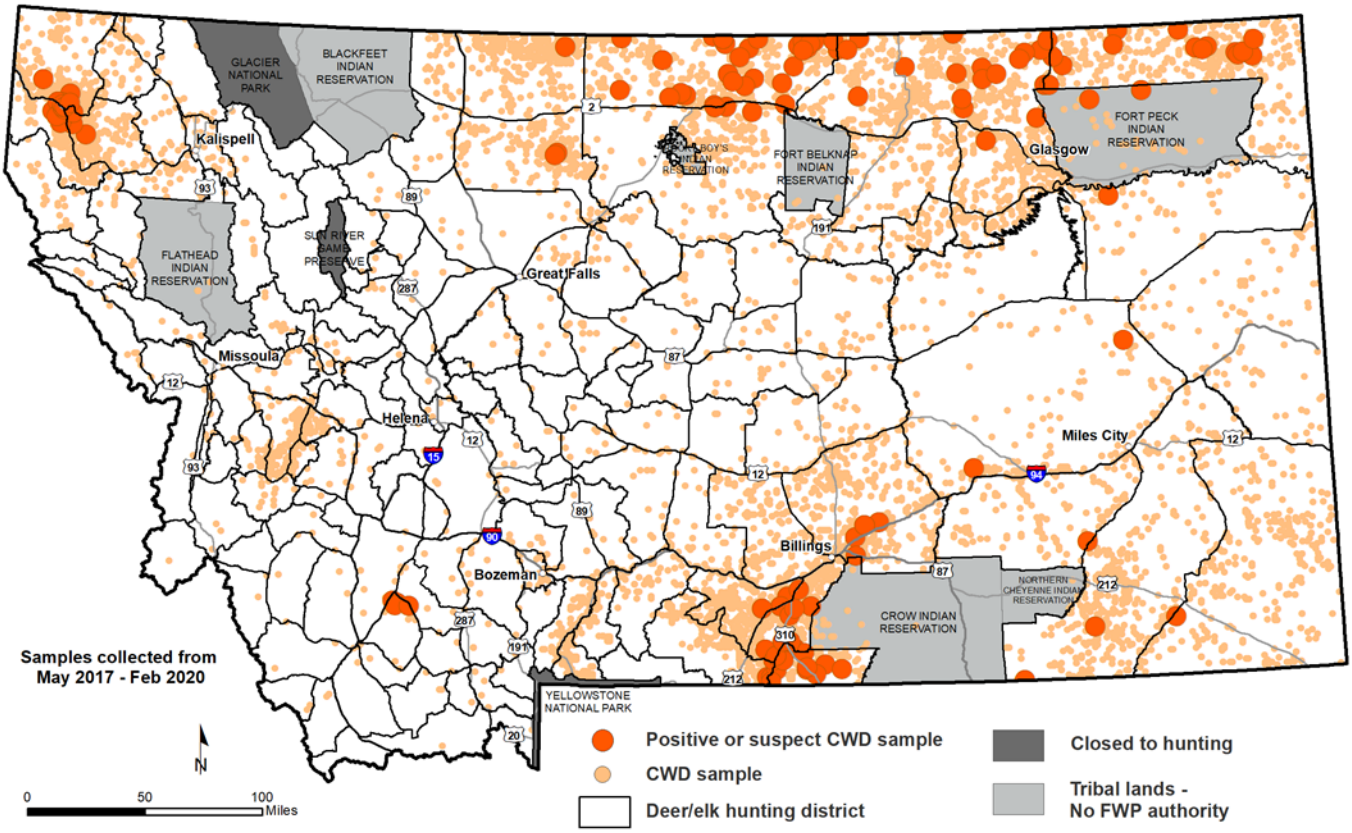
Q. Why should ranchers and farmers care about CWD?

A. FWP uses hunters as a key tool to help ranchers, farmers and other landowners manage the impact of wildlife on their property and to their crops and livestock. If CWD were to increase in prevalence, FWP anticipates some localized decline in hunting interest. Additionally, in many parts of the state, property values are tied to existing recreational values. Hunting and wildlife viewing are key components. If CWD was left unmanaged and prevalence were to increase uncontrolled, it may impact property values.

Recent research has shown that plants, including plants used for livestock food, can uptake CWD prions from the soil. If continued research shows that animals can catch CWD by eating infected plants, it could have huge repercussions on the agricultural industry. Concerns nationally and internationally about CWD transmission through feed has led many states and other countries to restrict the sale of such products from CWD-positive areas. It is already the case that deer and elk protein (mostly from game farms) from CWD areas cannot be used in livestock feed.

Q. Why should business owners care about CWD?

A. In Montana, outfitting and hunting make significant contributions to local economies. Across the state, deer, elk and antelope hunting brings in about $400 million. This includes hotels, restaurants and gas stations in big and small communities. We anticipate the possibility that CWD may initially slow interest in deer hunting in the affected area. Effective management will require participation from hunters and support from communities.


GLACIER NATIONAL PARK
BLACKFEET INDIAN RESERVATION
Kalispell
FLATHEAD INDIAN RESERVATION
SUN RIVER GAME PRESERVE
Great Falls
FORT BELKNAP INDIAN RESERVATION
Glasgow
FORT PECK INDIAN RESERVATION
Missoula
Helena
Miles City
Billings
Bozeman
CROW INDIAN RESERVATION
NORTHERN CHEYENNE INDIAN RESERVATION
YELLOWSTONE NATIONAL PARK
Samples collected from May 2017 - Feb 2020
N
0
50
100
Miles
Positive or suspect CWD sample
CWD sample
Deer/elk hunting district
Closed to hunting
Tribal lands - No FWP authority

LITERATURE CITED

Almberg, E.S., Cross, P.C., Johnson, C.J., Heisey, D.M. and Richards, B.J., 2011. Modeling routes of chronic wasting disease transmission: environmental prion persistence promotes deer population decline and extinction. *PloS one*, *6*(5), p.e19896.

Anderson, N., Ramsey, J., and Carson, K. 2012. *Chronic Wasting Disease Surveillance in Montana, 1998-2011: A Summary of Surveillance Efforts.* Montana Fish, Wildlife and Parks Internal Report, pp. 1-22.

Angers, R.C., Browning, S.R., Seward, T.S., Sigurdson, C.J., Miller, M.W., Hoover, E.A. and Telling, G.C., 2006. Prions in skeletal muscles of deer with chronic wasting disease. *Science*, *311*(5764), pp.1117-1117.

Angers, R.C., Seward, T.S., Napier, D., Green, M., Hoover, E., Spraker, T., O'Rourke, K., Balachandran, A. and Telling, G.C., 2009. Chronic wasting disease prions in elk antler velvet. *Other Publications in Zoonotics and Wildlife Disease*, p.46.

Berger, K.M. and E.M. Gese. 2007. Does interference competition with wolves limit the distribution and abundance of coyotes? Journal of Animal Ecology 76(6):1075-1085.

Belay, E.D., Maddox, R.A., Williams, E.S., Miller, M.W., Gambetti, P. and Schonberger, L.B., 2004. Chronic wasting disease and potential transmission to humans. *Emerging Infectious Diseases*, *10*(6), p.977.

Carnes, J. C., 2009. Mule Deer Population Ecology and Chronic Wasting Disease Study Southeast Montana-FWP Region 7, Final Report, July 2009. Montana Fish, Wildlife, and Parks. pp. 1- 51.

Conner, M.M. and Miller, M.W., 2004. Movement patterns and spatial epidemiology of a prion disease in mule deer population units. *Ecological Applications*, *14*(6), pp.1870-1881.

Conner, M.M., Miller, M.W., Ebinger, M.R. and Burnham, K.P., 2007. A meta-BACI approach for evaluating management intervention on chronic wasting disease in mule deer. *Ecological Applications*, *17*(1), pp.140-153.

Czub, S., Schulz-Schaeffer, W., Stahl-Hennig, C., Beekes, M., Schaetzl, H., and Motzkus, D. 2017. First evidence of intracranial and peroral transmission of Chronic Wasting Disease (CWD) into Cynomolgus macaques: a work in progress. Presentation at the PRION 2017 Conference, Edenborough, Scotland. https://www.youtube.com/embed/Vtt1kAVDhDQ.

DeVivo, M.T., 2015. *Chronic wasting disease ecology and epidemiology of mule deer in Wyoming*. Ph.D., Department of Veterinary Sciences, University of Wyoming.

DeVivo, M., D. Edmunds, M. Kauffman, B. Schumaker, J. Binfet, T. Kreeger, B. Richards, H. Schätzl, and Cornish, T., 2017. Endemic chronic wasting disease contributes to deer declines in Wyoming. Abstracts from the 2017 Deer & Elk Workshop, May 1-4, 2017, Sun Valley, Idaho. *In press*.

Dohoo, I., Martin, W., and Stryhn, H., 2009, Veterinary Epidemiologic Research, Second Edition: Charlottetown, Canada, VER, Inc., 865 p.

Edmunds, D., Kauffman, M., Schumaker, B., Lindzey, F., Cook, W., Kreeger, T., Grogan, R., and Cornish, T., 2016. Chronic Wasting Disease Drives Population Decline of White-Tailed Deer. *PLOS ONE*. 11 (8): e0161127 DOI: 10.1371/journal.pone.0161127

Farnsworth, M.L., Hoeting, J.A., Hobbs, N.T. and Miller, M.W., 2006. Linking chronic wasting disease to mule deer movement scales: a hierarchical Bayesian approach. *Ecological Applications*, *16*(3), pp.1026-1036.

Geremia, C., Miller, M.W., Hoeting, J.A., Antolin, M.F. and Hobbs, N.T., 2015. Bayesian modeling of prion disease dynamics in mule deer using population monitoring and capture-recapture data. *PloS one*, *10*(10), p.e0140687.

Gross, J.E. and Miller, M.W., 2001. Chronic wasting disease in mule deer: disease dynamics and control. *The Journal of Wildlife Management*, pp.205-215.

Haley, N.J., Mathiason, C.K., Carver, S., Zabel, M., Telling, G.C. and Hoover, E.A., 2011. Detection of chronic wasting disease prions in salivary, urinary, and intestinal tissues of deer: potential mechanisms of prion shedding and transmission. *Journal of Virology*, *85*(13), pp.6309-6318.

Heisey, D.M., Osnas, E.E., Cross, P.C., Joly, D.O., Langenberg, J.A. and Miller, M.W., 2010. Linking process to pattern: estimating spatiotemporal dynamics of a wildlife epidemic from cross-sectional data. *Ecological Monographs*, *80*(2), pp.221-240.

Hibler, C.P., Wilson, K.L., Spraker, T.R., Miller, M.W., Zink, R.R., DeBuse, L.L., Andersen, E., Schweitzer, D., Kennedy, J.A., Baeten, L.A. and Smeltzer, J.F. 2003. Field validation and assessment of an enzyme-linked immunosorbent assay for detecting chronic wasting disease in mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*), and Rocky Mountain elk (*Cervus elaphus nelsoni*). *Journal of Veterinary Diagnostic Investigation*, *15*(4), pp.311-319.

Hobbs, N.T. 2006. A model analysis of effects of wolf predation on prevalence of chronic wasting disease in elk populations of Rocky Mountain National Park. Estes Park, Colorado: National Park Service.

Holsman, R.H., Petchenik, J. and Cooney, E.E., 2010. CWD after "the fire": six reasons why hunters resisted Wisconsin's eradication effort. *Human Dimensions of Wildlife*, *15*(3), pp.180-193.

Hughson AG, Race B, Kraus A, Sangaré LR, Robins L, et al. (2016) Inactivation of Prions and Amyloid Seeds with Hypochlorous Acid. PLOS Pathogens 12(9): e1005914. https://doi.org/10.1371/journal.ppat.1005914

Jennelle, C.S., Henaux, V., Wasserberg, G., Thiagarajan, B., Rolley, R.E. and Samuel, M.D., 2014. Transmission of chronic wasting disease in Wisconsin white-tailed deer: implications for disease spread and management. *PloS one*, *9*(3), p.e91043.

Jennelle, C.S., Walsh, D.P., Samuel, M.D., Osnas, E.E., Rolley, R., Langenberg, J., Powers, J.G., Monello, R.J., Demarest, E.D., Gubler, R. and Heisey, D.M., 2018. Applying a Bayesian weighted surveillance approach to detect chronic wasting disease in white-tailed deer. *Journal of Applied Ecology*, *55*(6), pp.2944-2953.

Joly, D.O., Samuel, M.D., Langenberg, J.A., Blanchong, J.A., Batha, C.A., Rolley, R.E., Keane, D.P. and Ribic, C.A., 2006. Spatial epidemiology of chronic wasting disease in Wisconsin white- tailed deer. *Journal of Wildlife Diseases*, *42*(3), pp.578-588.

Kong, Q., Huang, S., Zou, W., Vanegas, D., Wang, M., Wu, D., Yuan, J., Zheng, M., Bai, H., Deng, H. and Chen, K., 2005. Chronic wasting disease of elk: transmissibility to humans examined by transgenic mouse models. *Journal of Neuroscience*, *25*(35), pp.7944-7949.

Kramm, C., R. Gomez-Gutierrez, C. Soto, G. Telling, T. Nichols and R. Morales. 2019. In vitro detection of chronic wasting disease (CWD) prions in semen and reproductive tissues of white-tailed deer bucks (Odocoileus virginianus). PLOS One. doi.org/10.1371/journal.pone.0226560

Krumm, C.E., M.M. Conner, N.T. Hobbs, D.O. Hunter and M.W. Miller. 2010. Mountain lions prey selectively on prion-infected mule deer. Biology Letters 6:209-211. doi:10.1098/rsbl.2009.0742

Lewis, M.S., Gude, J., Risley, D., and King, Z. 2013. Selected results from surveys of resident big game hunters and private landowners regarding the topic of chronic wasting disease. Montana Fish, Wildlife, and Parks, Helena, MT, pp 1-4.

Manjerovic, M.B., Green, M.L., Mateus-Pinilla, N. and Novakofski, J., 2014. The importance of localized culling in stabilizing chronic wasting disease prevalence in white-tailed deer populations. *Preventive Veterinary Medicine*, *113*(1), pp.139-145.

Mateus-Pinilla, N., Weng, H.Y., Ruiz, M.O., Shelton, P. and Novakofski, J., 2013. Evaluation of a wild white-tailed deer population management program for controlling chronic wasting disease in Illinois, 2003–2008. *Preventive Veterinary Medicine*, *110*(3), pp.541-548.

Mathiason, C.K., Powers, J.G., Dahmes, S.J., Osborn, D.A., Miller, K.V., Warren, R.J., Mason, G.L., Hays, S.A., Hayes-Klug, J., Seelig, D.M. and Wild, M.A., 2006. Infectious prions in the saliva and blood of deer with chronic wasting disease. *Science*, *314*(5796), pp.133-136.

MaWhinney, S., Pape, W.J., Forster, J.E., Anderson, C.A., Bosque, P. and Miller, M.W., 2006. Human prion disease and relative risk associated with chronic wasting disease. Emerging infectious diseases, 12(10), p.1527.

Miller, M.W., Williams, E.S., McCarty, C.W., Spraker, T.R., Kreeger, T.J., Larsen, C.T. and Thorne, E.T., 2000. Epizootiology of chronic wasting disease in free-ranging cervids in Colorado and Wyoming. Journal of Wildlife Diseases, 36(4), pp.676-690.

Miller, M.W., Williams, E.S., Hobbs, N.T. and Wolfe, L.L., 2004. Environmental Sources of Prion Transmission in Mule Deer. Emerging Infectious Diseases, 10(6), p.1003.

Miller, M.W. and Conner, M.M., 2005. Epidemiology of chronic wasting disease in free-ranging mule deer: spatial, temporal, and demographic influences on observed prevalence patterns. Journal of Wildlife Diseases, 41(2), pp.275-290.

Miller, M.W., Swanson, H.M., Wolfe, L.L., Quartarone, F.G., Huwer, S.L., Southwick, C.H. and Lukacs, P.M., 2008. Lions and prions and deer demise. PLoS one, 3(12), p.e4019.

Miller, M. W., and J. R. Fischer. 2016. The First Five (or More) Decades of Chronic Wasting Disease: Lessons for the Five Decades to Come. Transactions of the North American Wildlife and Natural Resources Conference 81: in press.

Monello, R.J., Powers, J.G., Hobbs, N.T., Spraker, T.R., Watry, M.K. and Wild, M.A., 2014. Survival and population growth of a free-ranging elk population with a long history of exposure to chronic wasting disease. The Journal of Wildlife Management, 78(2), pp.214-223.

Montana Fish, Wildlife, and Parks, 2005. Chronic wasting disease management plan for free ranging wildlife in Montana. Helena, MT. pp. 1-89.

Montana Fish, Wildlife, and Parks, 2006. Decision Notice: Chronic wasting disease management plan for free ranging wildlife in Montana. Helena, MT. pp. 1-16.

Montana Fish, Wildlife, and Parks, 2008. Policy on Intake, Rehabilitation, Holding, and Disposition of Injured and Orphaned Wildlife. Helena, MT. pp. 1-4.

Montana Fish, Wildlife, and Parks, 2013. Environmental assessment for detection and management of chronic wasting disease (CWD) in Montana. Helena, MT. pp. 1-43.

Montana Fish, Wildlife, and Parks, 2014. Decision Notice: Chronic wasting disease management plan for free ranging wildlife in Montana. Helena, MT. pp. 1-4.

Montana Fish, Wildlife and Parks, 2017. Interim Report: Targeted Chronic Wasting Disease Surveillance in HDs 600 and 401. Internal Report, pp. 1-5.

Montana Wolf Management Advisory Council. 2002. Montana Wolf Conservation and Management Planning Document. Downloaded January 11, 2018 from: http://fwp.mt.gov/fishAndWildlife/management/wolf/council/default.html

O'Rourke, K.I., Zhuang, D., Lyda, A., Gomez, G., Williams, E.S., Tuo, W. and Miller, M.W., 2003.
Abundant PrPCWD in tonsil from mule deer with preclinical chronic wasting disease.
Journal of veterinary diagnostic investigation, 15(4), pp.320-323.

Osnas, E.E., Heisey, D.M., Rolley, R.E. and Samuel, M.D., 2009. Spatial and temporal patterns of chronic wasting disease: fine-scale mapping of a wildlife epidemic in Wisconsin. Ecological Applications, 19(5), pp.1311-1322.

Potapov, A., Merrill, E., Pybus, M., Coltman, D. and Lewis, M.A., 2013. Chronic wasting disease: Possible transmission mechanisms in deer. Ecological Modelling, 250, pp.244-257.

Potapov, A., Merrill, E., Pybus, M. and Lewis, M.A., 2016. Chronic wasting disease: Transmission mechanisms and the possibility of harvest management. PloS One, 11(3), p.e0151039.

Prusiner, S.B., 1998. Prions. Proceedings of the National Academy of Sciences, 95(23), pp.13363-13383.

Race, B., Meade-White, K., Race, R. and Chesebro, B., 2009. Prion infectivity in fat of deer with chronic wasting disease. Journal of Virology, 83(18), pp.9608-9610.

Race, B., Meade-White, K.D., Miller, M.W., Barbian, K.D., Rubenstein, R., LaFauci, G., Cervenakova, L., Favara, C., Gardner, D., Long, D. and Parnell, M., 2009. Susceptibilities of nonhuman primates to chronic wasting disease. Emerging Infectious Diseases, 15(9), p.1366.

Race, B., Meade-White, K.D., Phillips, K., Striebel, J., Race, R. and Chesebro, B., 2014. Chronic wasting disease agents in nonhuman primates. Emerging Infectious Diseases, 20(5), p.833.

Race, B., Williams, K., Orrú, C.D., Hughson, A.G., Lubke, L. and Chesebro, B., 2018. Lack of transmission of chronic wasting disease to cynomolgus macaques. Journal of virology, 92(14), pp.e00550-18.

Raymond, G.J., Bossers, A., Raymond, L.D., O'rourke, K.I., McHolland, L.E., Bryant, P.K., Miller, M.W., Williams, E.S., Smits, M. and Caughey, B., 2000. Evidence of a molecular barrier limiting susceptibility of humans, cattle and sheep to chronic wasting disease. The EMBO Journal, 19(17), pp.4425-4430.

Russell, R.E., J.A. Gude, N.J. Anderson and Ramsey, J.M., 2015. Identifying priority chronic

wasting disease surveillance areas for mule deer in Montana. Journal of Wildlife Management 79(6): 989-997.

Samuel, M.D. and Storm, D.J., 2016. Chronic wasting disease in white-tailed deer: infection, mortality, and implications for heterogeneous transmission. Ecology, 97(11), pp.3195- 3205.

Sandberg, M.K., Al-Doujaily, H., Sigurdson, C.J., Glatzel, M., O'Malley, C., Powell, C., Asante, E.A., Linehan, J.M., Brandner, S., Wadsworth, J.D. and Collinge, J., 2010. Chronic wasting disease prions are not transmissible to transgenic mice overexpressing human prion protein. Journal of General Virology, 91(10), pp.2651-2657.

Selariu, A., Powers, J.G., Nalls, A., Brandhuber, M., Mayfield, A., Fullaway, S., Wyckoff, C.A., Goldmann, W., Zabel, M.M., Wild, M.A. and Hoover, E.A., 2015. In utero transmission and tissue distribution of chronic wasting disease-associated prions in free-ranging Rocky Mountain elk. The Journal of general virology, 96(Pt 11), p.3444.

Sigurdson, C.J., Williams, E.S., Miller, M.W., Spraker, T.R., O'Rourke, K.I. and Hoover, E.A., 1999.
Oral transmission and early lymphoid tropism of chronic wasting disease PrPres in mule deer fawns (Odocoileus hemionus). Journal of General Virology, 80(10), pp.2757-2764.

Storm, D.J., Samuel, M.D., Rolley, R.E., Shelton, P., Keuler, N.S., Richards, B.J. and Van Deelen, T.R., 2013. Deer density and disease prevalence influence transmission of chronic wasting disease in white-tailed deer. Ecosphere, 4(1), pp.1-14.

Tamgüney, G., Giles, K., Bouzamondo-Bernstein, E., Bosque, P.J., Miller, M.W., Safar, J., DeArmond, S.J. and Prusiner, S.B., 2006. Transmission of elk and deer prions to transgenic mice. Journal of Virology, 80(18), pp.9104-9114.

Tamgüney, G., Miller, M.W., Wolfe, L.L., Sirochman, T.M., Glidden, D.V., Palmer, C., Lemus, A., DeArmond, S.J. and Prusiner, S.B., 2009. Asymptomatic deer excrete infectious prions in faeces. Nature, 461, pp. 529–532.

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, pp. 42.

Walsh, D.P. and Otis, D.L., 2012. Disease surveillance: Incorporating available information to enhance disease-detection efforts, In: Enhanced surveillance strategies for detecting and monitoring chronic wasting disease in free-ranging cervids: U.S. Geological Survey Open-File Report 2012–1036, pp. 11-23.

Wasserberg, G., Osnas, E.E., Rolley, R.E. and Samuel, M.D., 2009. Host culling as an adaptive management tool for chronic wasting disease in white-tailed deer: a modelling study. Journal of Applied Ecology, 46(2), pp.457-466.

Western Association of Fish and Wildlife Agencies. 2017. Recommendations for Adaptive

Management of Chronic Wasting Disease in the West. WAFWA Wildlife Health Committee and Mule Deer Working Group. Edmonton, Canada and Fort Collins, USA.

Wild, M.A., Hobbs, N.T., Graham, M.S. and Miller, M.W., 2011. The role of predation in disease control: a comparison of selective and nonselective removal on prion disease dynamics in deer. Journal of Wildlife Diseases, 47(1), pp.78-93.

Williams, E.S. and Miller, M.W., 2002. Chronic wasting disease in deer and elk in North America. Revue Scientifique et Technique (International Office of Epizootics), 21(2), pp.305-316.

Williams, E.S., Miller, M.W., Kreeger, T.J., Kahn, R.H. and Thorne, E.T., 2002. Chronic wasting disease of deer and elk: a review with recommendations for management. The Journal of Wildlife Management, 66(3), pp.551-563.

Williams, E.S., 2005. Chronic wasting disease. Veterinary Pathology, 42(5), pp.530-549.

Williams, K., Hughson, A.G., Chesebro, B., and Race, B., 2019. Inactivation of chronic wasting disease prions using sodium hypochlorite. PLoSONE 14(10): e0223659.

Wilson, R., Plinston, C., Hunter, N., Casalone, C., Corona, C., Tagliavini, F., Suardi, S., Ruggerone, M., Moda, F., Graziano, S. and Sbriccoli, M., 2012. Chronic wasting disease and atypical forms of bovine spongiform encephalopathy and scrapie are not transmissible to mice expressing wild-type levels of human prion protein. Journal of General Virology, 93(7), pp.1624-1629.