Montana Fish, Wildlife, and Parks' 2017 Chronic Wasting Disease Surveillance and Special Hunt Report

Federal Aid in Wildlife Restoration Grant W-171-M

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Background

Chronic Wasting Disease (CWD) is a fatal neurologic disease of cervids (deer, elk, moose and caribou) for which there is no known cure. CWD is caused by an infectious, mis-folded prion protein which is shed by infected individuals for much of their approximately 2-year infection and which is transmitted via direct animal-to-animal contact and through the ingestion of prion-contaminated materials in the environment. Since CWD was discovered in Colorado in 1967, it has been documented in captive or free-ranging cervid populations in 25 US states, two Canadian Provinces, Norway, Finland, and South Korea. CWD is a relatively slow-moving disease, and if left unmanaged, may take decades to reach prevalences of 20-30%. However, at such high prevalences, significant herd-level declines are predicted (Gross and Miller 2001, Wasserberg et al. 2009, Almberg et al. 2011), and have been documented among mule deer and white-tailed deer in Wyoming (DeVivo 2015, Edmunds et al. 2016) and Colorado (Miller et al. 2008). Surveillance programs aimed at detecting CWD early are essential to providing the best options for managing the spread and prevalence of the disease. While CWD is not known to infect humans, health authorities advise against consuming meat from a CWD-positive animal and recommend that hunters have their deer, elk, or moose tested if it was harvested within a CWD-endemic area.

Introduction

Surveillance programs for CWD are essential to the early detection of the disease in wild cervid populations. Detection of CWD while prevalence is still low is thought to be critical to the success of managing the disease. Nationally, surveillance efforts for CWD have varied over time and have fluctuated in response to funding and public interest. This has been true for Montana as well. More recently, renewed concerns over the potential risk to human health (Czub et al. 2017), the discovery of CWD in wild cervids in several new states, and renewed national legislative discussion on CWD have fueled interests to increase surveillance once again. With additional surveillance and concerted efforts at managing the disease, such as those outlined in the Western Association of Fish and Wildlife Agencies' 2017 recommendations for adaptive management of CWD in the West, we will hopefully reach a point where we can effectively manage the disease in wild populations and stave off the worst of the predicted population declines.

Montana Fish, Wildlife, and Parks (FWP) has been doing surveillance for CWD since 1998, with varying levels of intensity. In 2017, with the help of an internal CWD Action Team and a CWD Citizen's Advisory Panel, FWP renewed its CWD surveillance and management plans. FWP's new plan outlines a strategy to efficiently use finite resources of staff and funding to maximize our ability to detect CWD in high-risk areas where it is not known to exist. This entails (1) continuing to test any symptomatic deer, elk, or moose statewide, (2) focusing systematic

surveillance primarily on mule deer, the most susceptible species within Montana, and (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. High priority surveillance areas (Figure 1) are currently defined as those areas within Montana that have both high mule deer densities and are within sixty miles of the nearest known cases of CWD (Russell et. al 2015). In the fall of 2017, FWP began CWD surveillance in south-central Montana.

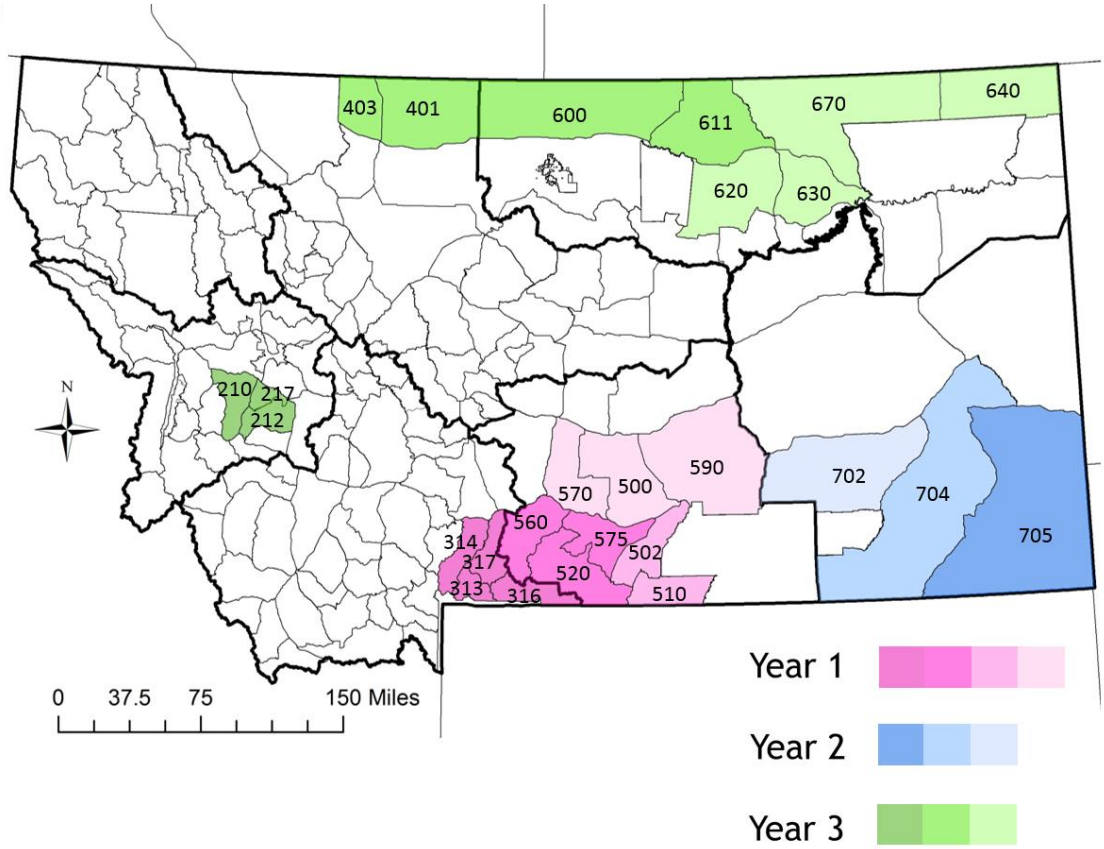


Figure 1. Currently identified high priority CWD surveillance areas in Montana. Areas were based on proximity to known CWD cases in neighboring states/provinces and mule deer densities in Montana from Russell et al. (2015). Hunting Districts 210, 212, and 217 (in west-central Montana) surround the captive elk facility that tested positive for CWD in 1999. High-priority areas may change depending on new detections of CWD in surrounding states and provinces or in Montana. Surveillance regions are color-coded based on year of visitation, and different shades of the same color represent minimum surveillance units. Deer/elk hunting districts are displayed.

During the fall 2017 surveillance effort, FWP detected its first cases of CWD among wild mule deer and white-tailed deer in south-central Montana. In addition, a GPS-collared mule deer

buck that was harvested north of Chester, MT, also tested positive for CWD. As part of FWP's new CWD management plan, the agency called two special hunts to collect samples to measure prevalence and distribution of CWD within the affected populations. Below, we report on the results and lessons learned from both the 2017 CWD surveillance effort as well as the Bridger and Sage Creek Special CWD Hunts.

Methods

Surveillance

Montana Fish, Wildlife, and Parks has identified priority surveillance areas around the state that have both high mule deer densities (within the upper quartile, based on resource selection functions integrated with count data) and are within the lowest quartile of distances to the nearest known cases of CWD (Russell et. al 2015) (Figure 1). In 2017, FWP focused its surveillance efforts on the south-central priority area. The south-central priority surveillance area was divided into four minimum surveillance units (Figure 1). Each minimum surveillance unit was defined as an aggregation of hunting districts meant to capture discrete and well-mixed population units of deer with ≤15,000 mule deer (Table 1). Within each minimum surveillance unit, we employed a weighted surveillance strategy aimed at detecting 1% CWD prevalence with 95% confidence (Walsh 2012). Under the weighted surveillance framework, different demographic groups (age, sex, or cause of death categories) of a species are assigned different point-values based on their relative risk of being infected (Table 2). A total of 300 points were necessary to establish our detection goals within each minimum surveillance unit. Sample size goals were specific to a single species within a minimum surveillance unit, and our efforts prioritized the sampling of mule deer since they appear to have the highest prevalences among the different cervid species where they overlap (Miller et al., 2000). However, we also opportunistically sampled elk, white-tailed deer, and moose.

Table 1. Minimum CWD surveillance units within the 2017 south-central priority surveillance area and estimated mule deer population sizes (2015 estimates).

Minimum CWD surveillance units for mule deer populations (Aggregations of hunt districts)	Estimated mule deer population size
Unit 3A: 313, 314, 316, 317	5000
Unit 5A: 570, 500, 590	11500
Unit 5B: 520, 560, 575	8500
Unit 5C: 510, 502	4500

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 & Otis, 2012) and white-tailed deer in Wisconsin's CWD management zone (Jennelle et al., *in review*).

	Weight/Points		
Demographic Group	**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	0.001	NA

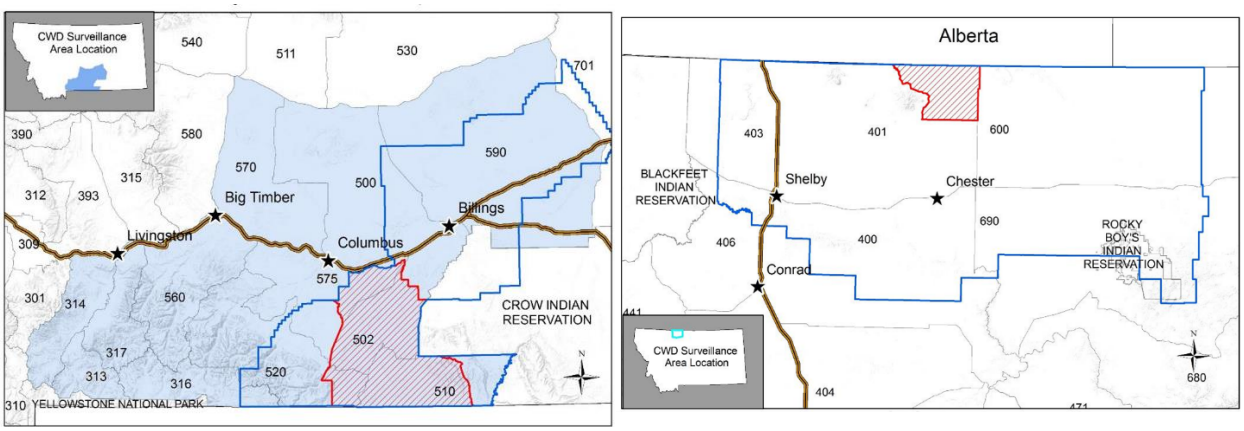
FWP staff collected samples between August 1, 2017 – February 15, 2018 from mule deer, white-tailed deer, elk, and moose that were either hunter-harvested, road-killed, symptomatic and euthanized, or found dead. An animal was considered symptomatic if they appeared extremely sick and/or displayed symptoms consistent with CWD (emaciation, lack of coordination, drooping head/ears, excessive salivation, etc). FWP used a variety of tools to obtain samples including working with Montana Department of Transportation, Highway Patrol, hunters at check stations, processors and taxidermists, outfitters, landowners, and by sending letters to license holders notifying them of the surveillance effort. For each cervid sampled as part of the CWD surveillance program, field and laboratory staff collected retropharyngeal lymph nodes (Hibler et al. 2003) or an obex sample (both lymph nodes and obex were collected from moose), an incisor tooth for aging, and a small genetic sample (muscle tissue). Field staff worked with hunters or others to gather precise location information on where the animal was harvested/found, species, age, and sex information for each sampled animal. Lymph nodes and obex from deer and elk were frozen for subsequent enzyme-linked immunosorbent assay (ELISA) testing, whereas lymph nodes and obex from moose were fixed in 10% buffered formalin for immunohistochemistry (IHC) testing. Samples were submitted to Colorado State Veterinary Diagnostic Laboratory on a weekly basis. Testing costs ranged from $17/sample for the ELISA, and $35/sample for IHC (used primarily to confirm positive test results). Results from hunter-harvested animals were posted on FWP's website as soon as results were received from

the lab. When a harvested animal tested positive for CWD, FWP directly contacted the associated hunter to inform them of the test results, to let them know that the meat could be legally disposed of, and to discuss proper disposition of the carcass parts.

In addition to the focused surveillance efforts in south-central Montana, FWP collected or received a relatively small number of samples from symptomatic or hunter-harvested animals state-wide. Hunters that harvested an animal outside of the priority surveillance area that wished to have their animal tested were provided information on how to collect samples, submit them, and pay for their own testing. As part of that process, hunters had the option to sign a release allowing Colorado State University's Veterinary Diagnostic Lab to share the results with FWP.

Special CWD Hunts

CWD was detected among wild deer for the first time in south-central and north-central Montana in the fall of 2017. Following these detections, FWP initiated the Bridger and Sage Creek Special CWD Hunts. Boundaries of the special hunts were defined by drawing 10-mile buffers around the CWD positive cases and using that information to select identifiable physical boundaries for the hunts. Transport restriction zones (TRZ) were established around each hunt boundary to reduce the risk of CWD positive carcasses being taken to other areas of the state. Hunting quotas were set to obtain sufficient samples to estimate prevalence within a 3% margin of error (Figure 2; see CWD management plan for details). The Bridger Special Hunt ran from December 15, 2017- February 15, 2017 and included a quota for 200 mule deer and 200 white-tailed deer, whereas the Sage Creek Hunt ran from January 6 – February 15, 2018 and included a quota for 157 mule deer. Licenses were sold specifically for this hunt and hunters were required to present their animals for sampling at local check stations or the regional office.



Bridger Special CWD Hunt Area
Bridger Transport Restriction Zone

Sage Creek Special CWD Hunt Area
Sage Creek Transport Restriction Zone

Figure 2. Maps of hunt boundaries and Transport Restriction Zones for the Bridger (left) and Sage Creek (right) Special CWD Hunts.

Data summaries

Weighted surveillance points were calculated separately for mule deer, white-tailed deer and elk (relative risk of infection data currently does not exist for moose). For each species, we tallied the number of samples collected within each of the age/sex/cause of death categories outlined in Table 2, multiplied this by their assigned point value, and summed all points within a minimum surveillance unit. We then modified the equation for the sample size (*n*) needed to establish freedom from disease at a specified prevalence level (*P;* proportion of the population that is positive), with a desired level of statistical confidence (α),

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

to calculate our level of statistical confidence that we could detect at least one positive given our weighted surveillance points (*n*) and assuming prevalence was ≥1%:

$$\alpha = -e^{-Pn} + 1.$$

Following the special hunts, prevalence among hunter-harvested animals was summarized by species, age, and sex classes. We calculated 95% binomial confidence intervals using the Wilson method.

Results

Between July 1, 2017 and February 15, 2018, FWP collected 2003 samples from mule deer (n=1375), white-tailed deer (n=527), elk (n=97), and moose (n=4) across the state of Montana. Of these samples, 1406 were collected as part of our surveillance efforts within our four priority surveillance areas; an additional 348 samples were collected within the Bridger Special Hunt, and 123 samples were collected within the Sage Creek Hunt. Outside of our priority surveillance area, we collected and tested an additional 113 cervid samples statewide, 15 of which were from symptomatic animals. We received results from 11 samples collected, submitted, and paid for by hunters. Through the combined sampling efforts of general surveillance and the ensuing Special CWD Hunts, we detected CWD in 8 mule deer and 2 white-tailed deer in south-central Montana (HDs 502, 510, and 520) and one mule deer in north-central Montana (HD 401). Unless otherwise noted below, for south-central Montana, we report on the combined results from general surveillance and the Bridger Special Hunt.

In south-central Montana, our surveillance efforts led to the detection of CWD within priority surveillance units 5B and 5C (Figure 3). The first positives were detected among mule deer and white-tailed deer during the general hunting season within surveillance unit 5C (HDs 502 &

510). During the ensuing Bridger Special Hunt, we also identified an infected white-tailed deer on the southeastern edge of surveillance unit 5B (in HD 520). In surveillance unit 5A (HDs 500, 570 and 590), we achieved over 300 weighted surveillance points for mule deer with no detections (Figure 4), suggesting that as of 2018, we are 95% confident that CWD is absent or affects less than 1% of mule deer in this area. We detected no positives within surveillance unit 3A, however, we only achieved 44% of our 300-point goal in mule deer, leaving us only 73% confident that we would have detected at least 1 positive if prevalence were ≥1%.

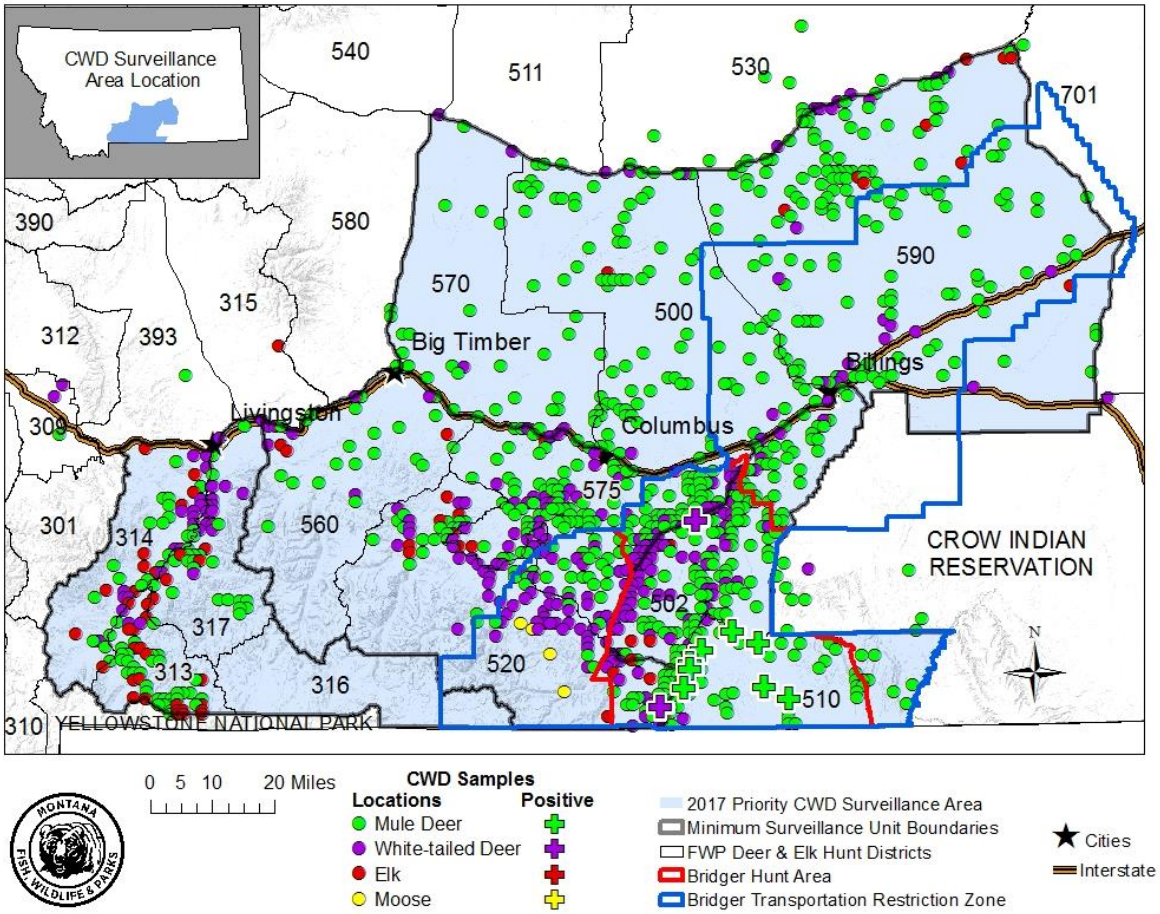


Figure 3. Map of locations where samples were collected during the general surveillance and Bridger Special Hunt in south-central Montana, 2017-2018, color-coded by species. The four minimum surveillance units are outlined in thick black lines and the boundaries of the Bridger Special Hunt Area are outlined in red. Positives are denoted by the color-coded “plus” signs.

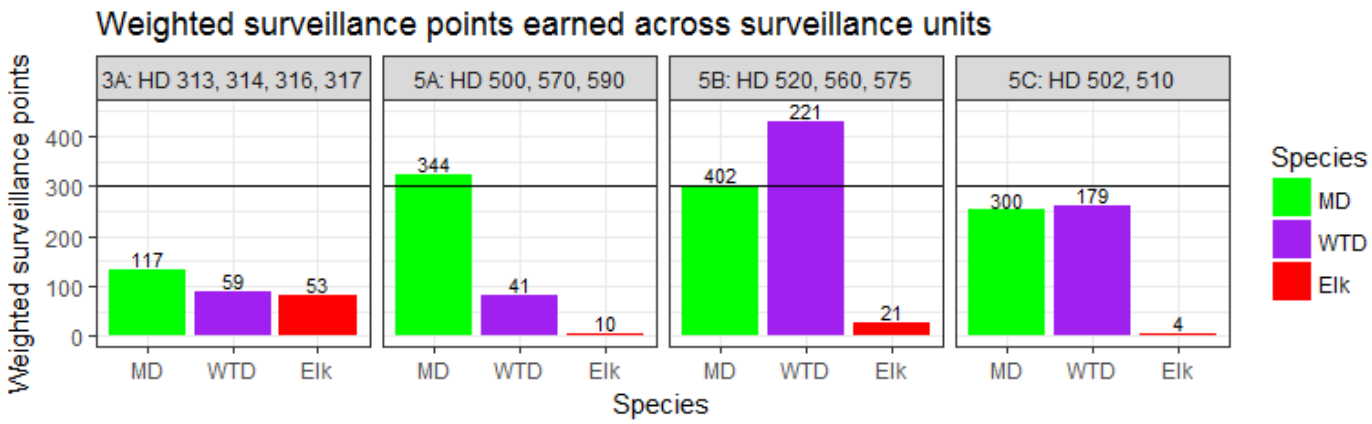


Figure 4. Weighted surveillance points earned for mule deer (MD), white-tailed deer (WTD), and elk within each of the four minimum surveillance units in south-central Montana, 2017-2018. Under the weighted surveillance framework, different demographic groups (age, sex, or cause of death categories) of a species are assigned different point-values based on their relative risk of being infected and summed to a total point value. Our goal was to reach 300 weighted surveillance points (depicted by the horizontal black line) in mule deer to detect ≥ 1% prevalence with 95% confidence. The sample size is displayed above each bar. These data include samples collected during the general surveillance effort (July 1, 2017 – March 1, 2018) and the Special Bridger Hunt (December 15, 2017 – February 15, 2018).

Most samples collected during the 2017-2018 surveillance season were from hunter-harvested animals, followed by road-kill, symptomatic animals, and other causes of mortality (e.g. unexplained, predation, etc.; Figure 5). Most hunter-harvested animals were sampled at check stations or regional offices (See Appendix I for a detailed breakdown of samples collected by date). We observed a substantial increase in the number of hunters actively seeking to have their animals sampled and tested following the announcement of the first CWD detection near Bridger, MT on November 7, 2017 (Figure 6). In addition to check stations, we had limited participation from several processors and taxidermists who collected cervid heads in collaboration with FWP (22 samples from 4 facilities). Montana Department of Transportation staff and the Montana Highway Patrol officers also contributed road-killed samples throughout our surveillance effort.

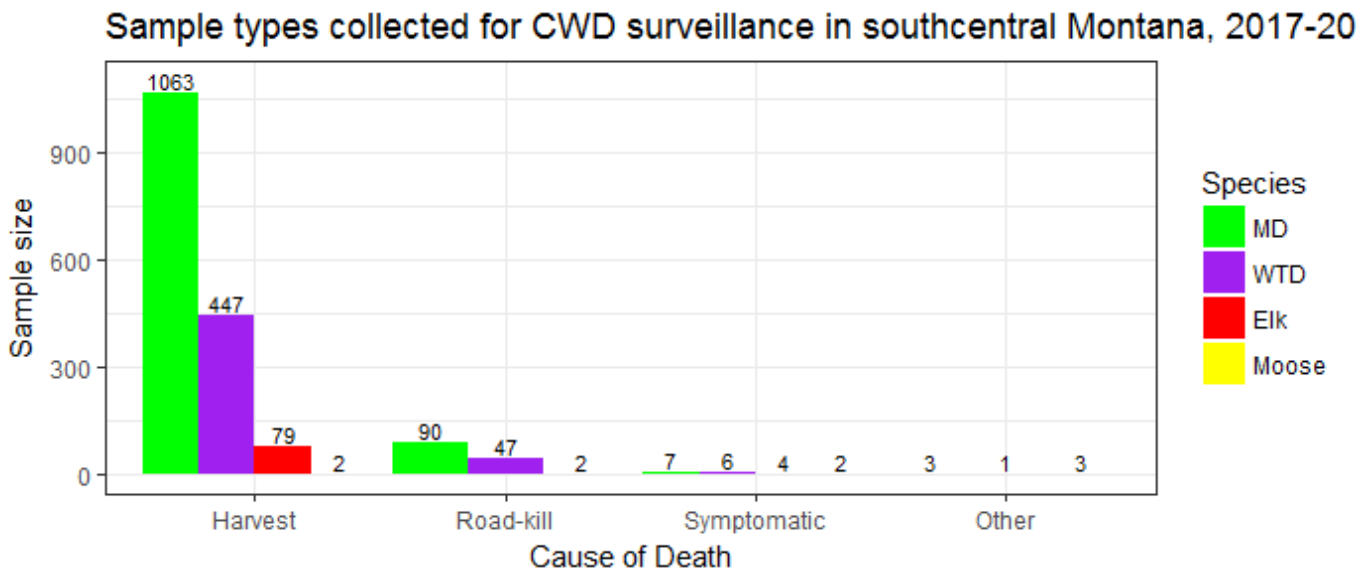


Figure 5. Samples collected by species and cause of death during the general surveillance and Bridger Special Hunt in south-central Montana, 2017-2018.

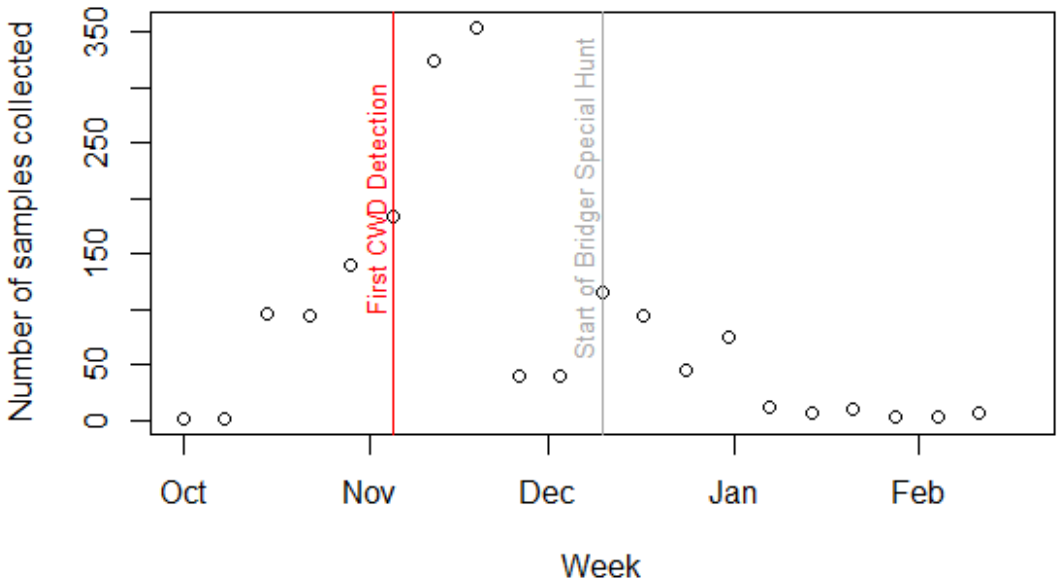


Figure 6. Number of hunter-harvested samples collected by week in south-central Montana (Oct 1-Feb 15, 2017) in the R3 & R5 priority surveillance areas. Check stations experienced a significant increase in hunter participation in sampling after the first CWD detection was

announced. Samples collected after Dec 15, 2017 were from the Bridger Special Hunt. Sage Creek Hunt data are not displayed here.

On average, it took 12 days (sd = 6 days; median = 10 days) from the time that staff collected a sample to have it analyzed and the test results posted online. The turn-around time for test results was somewhat faster during the general season (mean = 10 days, sd = 5 days) than during the Special Hunts (mean = 15 days, sd = 7 days), which overlapped with the holidays. Samples were shipped to Colorado State University's Diagnostic Lab 1-2 times per week, depending on volume.

Special CWD Hunts

Following the detections of CWD in south-central and north-central Montana, FWP organized the Bridger Special Hunt which ran from December 15, 2017- February 15, 2017 and included a quota for 200 mule deer and 200 white-tailed deer, and the Sage Creek Hunt, which ran from January 6 – February 15, 2018 and included a quota for 157 mule deer (Figure 2). Licenses for both hunts sold out within a day, and 78% of the licenses were bought by resident hunters (Table 3). In total, 217 mule deer and 131 white-tailed deer were harvested during the Bridger Creek Hunt, for a license fill rate of 36% and 22%, respectively. During the Sage Creek Hunt, 121 mule deer were harvested, for a license fill rate of 36%.

Table 3. Licenses sold for the 2017-2018 Bridger and Sage Creek Special CWD hunts, broken out by species (MD = mule deer; WTD = white-tailed deer), license type (either-sex or antlerless) and by hunter resident status.

			Either-Sex			**Antlerless**			
Special CWD Hunt	**Dates**	**Species**	**Resident**	**Non-Resident**	**Total**	**Resident**	**Non-Resident**	**Total**	**Total Licenses Sold**
Bridger	Dec 15 2017 - Jan 7 2018	MD	67	33	100	353	147	500	600
	Dec 15 2017 - Feb 15 2018	WTD	82	18	100	399	101	500	600
Sage Creek	Jan 6 2018 - Feb 15 2018	MD	49	11	60	241	34	275	335

If we combine the results from all hunter-harvest samples collected within the boundaries of the Bridger Special Hunt Area, including those collected during the general season, the estimated prevalence of CWD within the hunt boundaries was 0.02 (95% CI: 0.01 – 0.04 , n=411) in mule deer and 0.01 (95% CI: 0 – 0.03, n=217) in white-tailed deer (Figure 7, Figure 8). The estimated prevalence in mule deer was statistically similar (x^2 = 0.06, df = 1, p = 0.81)

among males (0.02, 95%CI: 0.01 – 0.05, n=214) and females (0.02, 95%CI: 0 – 0.06, n=197). Prevalence was slightly higher among adult male mule deer (0.03, 95%CI: 0.01 – 0.07, n=168) than among adult females (0.01, 95% CI: 0 – 0.05, n=148), though these differences were not statistically significant (x^2 = 0.36, df = 1, p = 0.55). Among white-tailed deer, both positives were does, yielding a higher estimated prevalence among female white-tailed deer (0.02, 95%CI: 0 – 0.06, n=114) than among males (0, 95%CI: 0 – 0.4, n=103), though this difference was not statistically significant (x^2 = 0.42, df = 1, p = 0.52). Most of the CWD cases were clustered in HD 510 and the southern boundary of HD 502. Within the HD 510 portion of the Bridger Special Hunt boundaries, prevalence in mule deer was estimated to be 0.08 (95%CI: 0.04 – 0.16, n=83) overall, or 0.09 among females (95%CI: 0.03 – 0.22, n=35) and 0.08 among males (95%CI: 0.03 – 0.19, n=49). The difference in prevalence between males and females in the Bridger Special Hunt area was not statistically significant (x^2 = 0, df = 1, p = 1). To the north, within the HD 502 portion of the Bridger Special Hunt boundaries, mule deer prevalence was estimated to be 0.007 in both mule deer (95%CI: 0 – 0.04, n=152) and white-tailed deer (95%CI: 0 – 0.04, n=142).

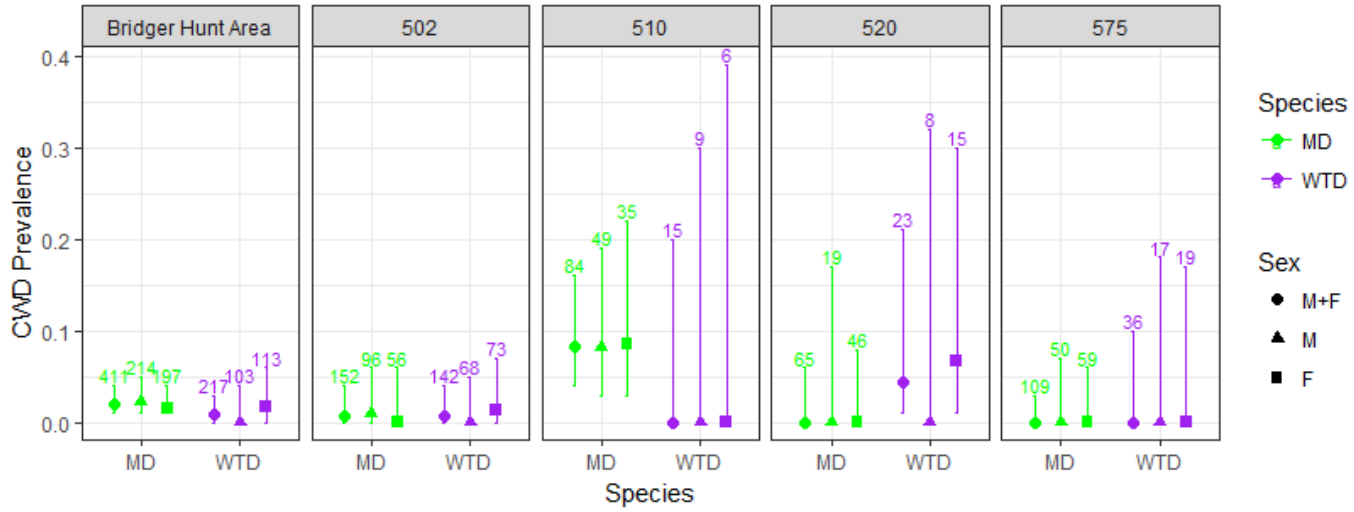


Figure 7. Estimated CWD prevalence in mule deer (MD) and white-tailed deer (WTD) across the sexes (M+F) and among the sexes (M = male, F= female) at various scales within the Bridger Special CWD Hunt Area. On the left, the "Bridger Hunt Area" plot displays estimated prevalences for the entire hunt area. Each of the panels to the right illustrate estimated prevalence for those segments of hunting districts 502, 510, 520, and 575 that fell within the special hunt boundaries. Mule deer data are plotted in green; white-tailed data are plotted in purple. Sample sizes are displayed above 95% confidence intervals.

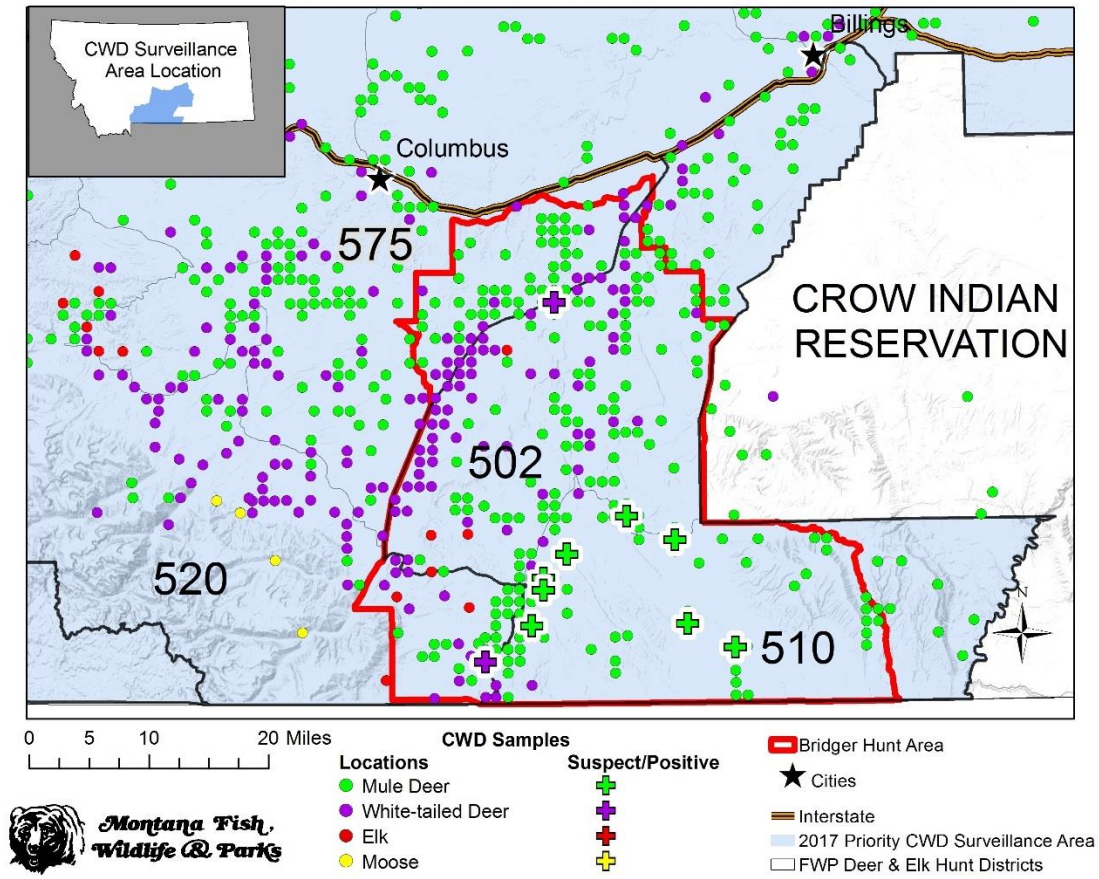


Figure 8. Close-up map of locations where samples were collected within the boundaries of the Bridger Special CWD Hunt Area (outlined in red) through general surveillance and special hunt efforts, 2017-2018, color-coded by species. Positives are denoted by the color-coded "plus" signs.

Within the Sage Creek Special Hunt area, we collected a combined 124 hunter-harvested mule deer samples during the special hunt (n=121) and the general season (n=3; Figure 9, Figure 10). We did not detect any additional positives during the special hunt. The estimated prevalence within this area is 0.008 (95%CI: 0.001 – 0.04, n=124), or 0.03 among males (95%CI: 0.01 – 0.15, n=35) and 0 among females (95%CI: 0 – 0.04, n=89). The difference between males and females

was not statistically significant (x^2 = 0.24, df = 1, p = 0.63; Figure 9).

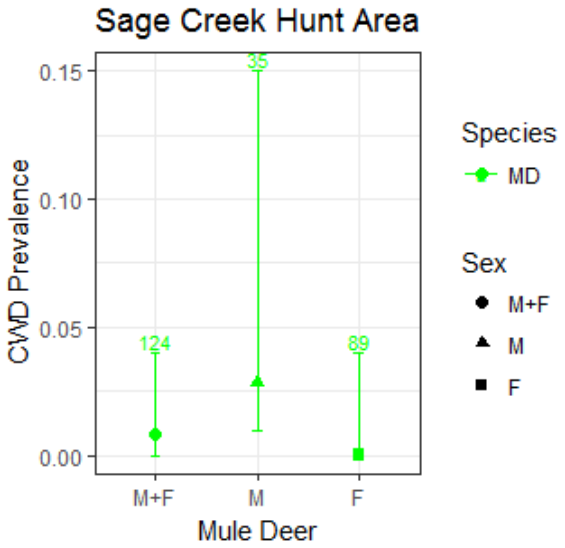


Figure 9. Estimated CWD prevalence in mule deer (MD) across the sexes (M+F) and among the sexes (M = male, F= female) within the Sage Creek Special CWD Hunt Area. Sample sizes are displayed above 95% confidence intervals.

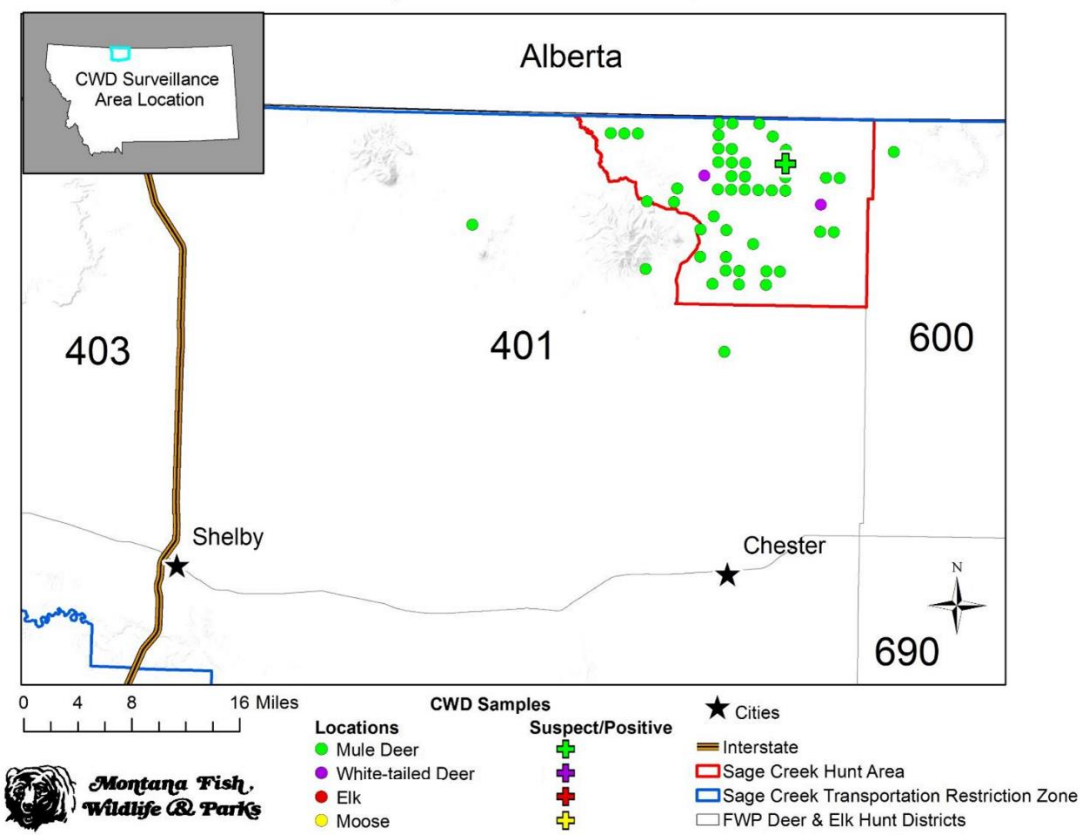


Figure 10. Map of locations where samples were collected within the boundaries of the Sage Creek Special CWD Hunt Area (outlined in red) through general surveillance and special hunt

efforts, 2017-2018, color-coded by species. The one positive case is denoted by the green "plus" sign.

Without detailed information on private land access and the underlying distribution of deer on the landscape, it is difficult to rigorously evaluate the extent to which our sampling may have been spatially biased. Both areas experienced good cooperation from landowners who granted hunter access to private land; however, access and deer distributions certainly influenced where hunters were able to harvest their animals. A visual comparison of the locations of harvests during the general season and Bridger Special Hunt suggest no major differences or shifts away from known positive areas (Figure 11).

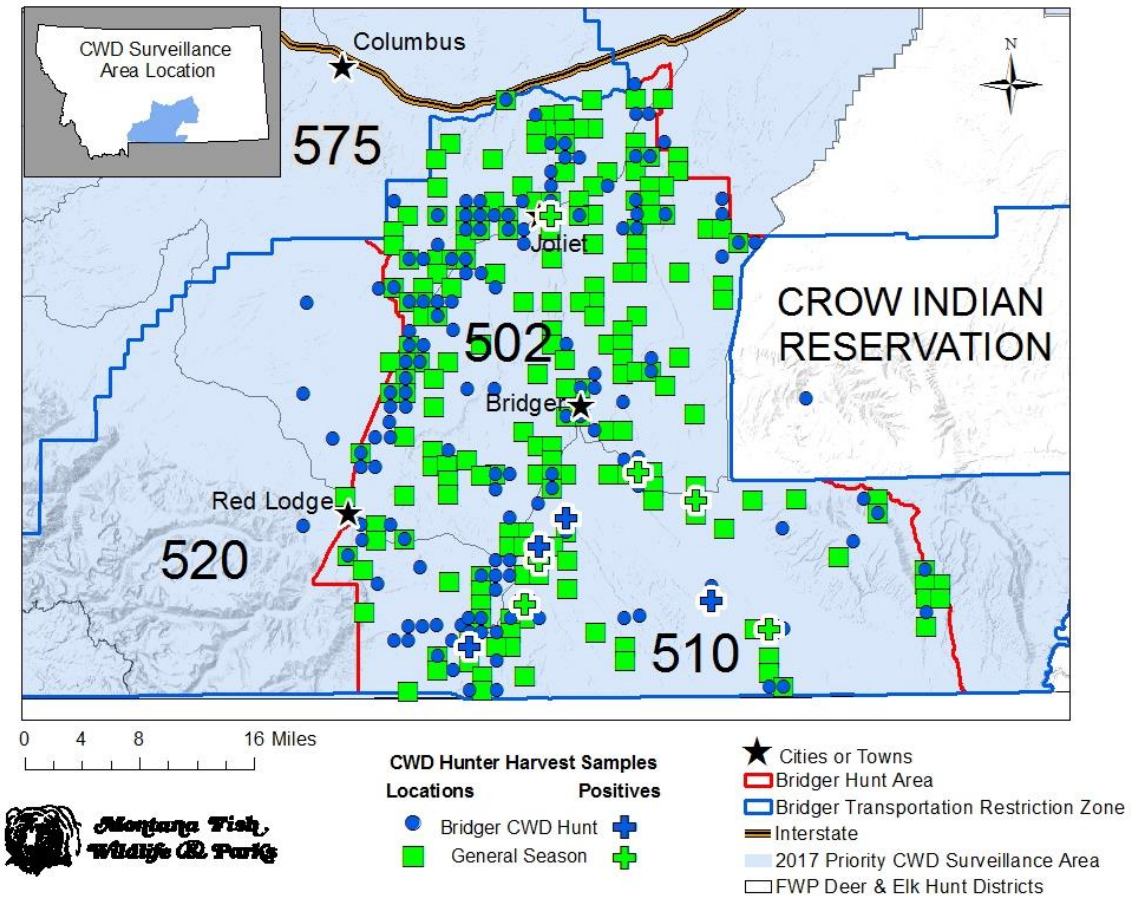


Figure 11. Map comparing the locations of where samples were collected within the boundaries of the Bridger Special CWD Hunt Area (outlined in red) during general surveillance (green squares) and the Special Hunt (blue dots). Positives are denoted by the color-coded "plus" signs.

FWP contacted all hunters whose animals tested positive for CWD to ask them to dispose of the carcass or meat in a Class II Landfill. FWP worked closely with the Montana Department of Environmental Quality to identify Class II Landfills for the public. FWP also worked closely with the Department of Public Health and Human Services and the Department of Livestock to contact processors that may have handled infected carcasses. All CWD-positive hunter-harvested animals appeared outwardly healthy. Hunters participating in the two special hunts were given information on the transport restrictions in effect for Carbon and Yellowstone Counties, as well as Liberty, Toole, and Hill Counties. While there were no documented violations of these transport restrictions, it is unknown how well the restrictions were observed.

Discussion

In the fall of 2017, Montana unfortunately joined the ranks of the now 23 states and 2 provinces that have detected CWD within their wild cervid populations in North America. Between general surveillance efforts and the ensuing Special CWD Hunts that were called to measure prevalence and distribution, we identified CWD-positive areas in south-central and north-central Montana. We found no additional positives during the Sage Creek Hunt on our northern border, suggesting that that local mule deer prevalence there is quite low (<1%). However, we did identify a larger CWD endemic area in south-central Montana with prevalences of 2% in mule deer and 1% in white-tailed deer. Within the southern-most hunt district in the Bridger Special Hunt Area, where positive CWD cases were clustered, we estimated prevalences as high as 8% in mule deer.

Montana Fish, Wildlife, and Parks' CWD surveillance efforts in south-central Montana were largely successful. We detected CWD in two of our minimum surveillance units and achieved enough sample points to be 95% confident that CWD affects <1% of mule deer in our northern most surveillance unit (Unit 5A). FWP will continue to opportunistically collect samples from Paradise Valley (Region 3 minimum surveillance unit), where we fell short of our sampling goals, and will formally revisit this area during the next 3-year rotation (year 2020).

FWP's CWD surveillance is guided by a risk model that defines high priority surveillance areas as those that have both high mule deer densities and are within the lowest quartile of distances to the nearest known cases of CWD (Russell et. al 2015). This strategy for prioritizing our efforts appears to have been helpful. We found CWD where model predictions indicated that we were most likely to. Unfortunately, this same risk model suggests we are likely to find CWD along the northern border of the state and in south-eastern Montana. High or increasing prevalence estimates and spatial spread of CWD detected in northern Wyoming and in southern districts

within Saskatchewan and Alberta suggest that it is only a matter of time before we detect more widespread infections within Montana's borders.

Within the boundaries of the Bridger Special Hunt Area in south-central Montana, we detected a distinct cluster of infections concentrated in the southernmost hunt districts adjacent to Wyoming. Given an estimated prevalence of 8% within HD510, it is likely that CWD has been present within this area for some time. The growth rates of CWD are typically quite low, and it often takes decades to reach prevalences >20% (Gross and Miller 2001, Wasserberg et al. 2009, Almberg et al. 2011). CWD prevalence among mule deer and white-tailed deer in neighboring Wyoming hunting districts is estimated to be between 10-20% (wgfd.wyo.gov), also suggesting a long-term problem. Without attempted management of the disease, we would expect continued transmission and spatial spread as has been observed in Wyoming and elsewhere.

The CWD detection in north-central Montana was somewhat unexpected given that we were not actively pursuing surveillance there this year. It was also surprising that we detected no additional positives during the ensuing Sage Creek Special Hunt. The positive hunter-harvested mule deer buck had been GPS-collared and was part of a mule deer movement study on the Montana-Alberta border. The buck had tested negative for CWD on a rectal biopsy at the time of capture (January 2016) and his GPS collar locations showed that he never ventured north of the Montana-Alberta border during the time he was collared. The fact that he was asymptomatic at the time of harvest suggests that he contracted the infection in Montana from another infected individual. Broad surveillance of this area in 2018 will hopefully provide additional information on the possible distribution of CWD along our northern border.

FWP learned numerous lessons over the course of the general surveillance season and Special CWD Hunts. Perhaps most notable was the dramatic increase in hunter participation in having their animals sampled and tested once CWD was discovered in an area. This suggests that we may be able to accomplish future sampling goals to estimate prevalence and distribution by relying on hunter sample collection during the subsequent general season as opposed to a late-season special hunt. Special CWD Hunts called after the general season come with some challenges, including additional staffing needs, logistics associated with monitoring quotas, overlap with holidays which slows shipping and testing timelines, and additional strain on landowners allowing extended access. If we can obtain sufficient samples the following general season, it would be preferable to hold special hunts at that time.

Future management

FWP anticipates making several long-term changes to management within CWD-positive areas. The agency has begun discussing harvest management changes for hunt districts 510, 502, 520,

and 575 in south-central Montana. These changes will likely take the form of liberalizing both mule deer and white-tailed deer harvest, particularly of bucks. Any proposed changes to season structure will be presented to the Commission between November 2018 – January 2019, for a target implementation of fall 2019.

Transport Restriction Zones (TRZ), which encompass counties surrounding Special Hunt or Endemic Area boundaries, will remain in effect permanently. Montana currently has two TRZs: one for Carbon and Yellowstone Counties surrounding the Bridger CWD Hunt Area, and one for Toole, Liberty, and Hill Counties surrounding the Sage Creek Special Hunt Area (Liberty County, north of Hwy 2). Hunters that harvest cervids within the Special Hunt or Endemic Area boundaries cannot transport whole carcasses, spinal columns, or whole heads outside of the TRZ. Carcass parts that may be removed from the TRZ 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 meat or tissue attached, and skulls that have been boiled and cleaned to remove flesh and tissue. These restrictions will require outreach and education on the part of FWP and some additional planning on the part of hunters wishing to remove processed deer from the affected areas. It is in the interest of our wild cervid species and future hunters that these TRZs are adhered to; we hope they minimize the inadvertent spread of CWD by hunters who might otherwise move infectious carcasses around the state.

In the fall of 2018, FWP plans to conduct surveillance along the northern boundary of the state (HDs 401, 403, 600, 611, 670, 640, 620, and 630) and around Philipsburg, MT (HDs 210, 212, and 217; Figure 2), where CWD was detected on a depopulated captive elk farm in 1999. In addition, FWP will return to conduct additional sampling in the Bridger Special Hunt Area to improve our estimates of prevalence among the different age and sex classes of mule deer and white-tailed deer. In 2019, FWP will conduct CWD surveillance in southeastern Montana (HDs 702, 704, 705).

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Appendix I: Number of samples collected at check stations or regional offices by date and species.

Date	Collection Site	Mule Deer	White-tailed Deer	Elk	Moose	Total
10/21/2017	Big Timber Check Station	4	0	0	0	4
10/22/2017	Big Timber Check Station	3	0	0	0	3
10/28/2017	Big Timber Check Station	4	0	0	0	4
11/4/2017	Big Timber Check Station	1	0	0	0	1
11/5/2017	Big Timber Check Station	1	0	0	0	1
11/11/2017	Big Timber Check Station	4	1	0	0	5
11/12/2017	Big Timber Check Station	1	0	0	0	1
11/18/2017	Big Timber Check Station	4	0	0	0	4
11/19/2017	Big Timber Check Station	2	0	0	0	2
11/25/2017	Big Timber Check Station	3	1	0	0	4
11/26/2017	Big Timber Check Station	4	0	0	0	4
10/21/2017	Billings Check Station	15	0	0	0	15
10/22/2017	Billings Check Station	7	0	0	0	7
10/28/2017	Billings Check Station	3	1	0	0	4
10/29/2017	Billings Check Station	6	0	3	0	9
11/4/2017	Billings Check Station	12	3	1	0	16
11/5/2017	Billings Check Station	12	6	3	0	21
11/11/2017	Billings Check Station	10	1	0	0	11
11/12/2017	Billings Check Station	15	0	1	0	16
11/18/2017	Billings Check Station	22	14	1	0	37
11/19/2017	Billings Check Station	18	2	0	0	20
11/25/2017	Billings Check Station	16	4	2	0	22
11/26/2017	Billings Check Station	20	1	0	0	21
1/15/2018	Chester Check Station	10	0	0	0	10
1/22/2018	Chester Check Station	1	0	0	0	1
10/21/2017	Columbus Check Station	16	0	0	0	16
10/22/2017	Columbus Check Station	10	0	0	0	10
10/28/2017	Columbus Check Station	7	6	0	0	13
10/29/2017	Columbus Check Station	10	4	0	0	14
11/2/2017	Columbus Check Station	0	1	0	0	1
11/4/2017	Columbus Check Station	14	0	0	0	14
11/5/2017	Columbus Check Station	10	4	0	0	14
11/9/2017	Columbus Check Station	1	0	0	0	1
11/11/2017	Columbus Check Station	8	5	0	0	13
11/12/2017	Columbus Check Station	7	7	0	0	14
11/16/2017	Columbus Check Station	1	0	0	0	1

11/18/2017	Columbus Check Station	17	13	0	0	30
11/19/2017	Columbus Check Station	27	11	1	0	39
11/25/2017	Columbus Check Station	18	28	2	1	49
11/26/2017	Columbus Check Station	16	10	2	0	28
11/27/2017	Columbus Check Station	1	0	0	0	1
10/21/2017	Gardiner Check Station	2	0	0	0	2
10/22/2017	Gardiner Check Station	3	0	0	0	3
10/23/2017	Gardiner Check Station	0	1	0	0	1
10/26/2017	Gardiner Check Station	1	0	0	0	1
10/27/2017	Gardiner Check Station	1	2	0	0	3
10/28/2017	Gardiner Check Station	5	1	0	0	6
10/29/2017	Gardiner Check Station	3	0	1	0	4
11/4/2017	Gardiner Check Station	1	0	1	0	2
11/5/2017	Gardiner Check Station	8	0	3	0	11
11/10/2017	Gardiner Check Station	1	1	0	0	2
11/11/2017	Gardiner Check Station	8	0	4	0	12
11/12/2017	Gardiner Check Station	7	1	4	0	12
1/9/2018	Havre Area Office	1	0	0	0	1
1/16/2018	Havre Area Office	2	0	0	0	2
1/9/2018	Havre Check Station	1	0	0	0	1
1/10/2018	Havre Check Station	4	0	0	0	4
1/11/2018	Havre Check Station	5	0	0	0	5
1/12/2018	Havre Check Station	4	0	0	0	4
1/13/2018	Havre Check Station	13	1	0	0	14
1/14/2018	Havre Check Station	6	0	0	0	6
12/15/2017	Joliet Check Station	16	7	0	0	23
12/16/2017	Joliet Check Station	33	8	0	0	41
12/17/2017	Joliet Check Station	23	19	0	0	42
12/18/2017	Joliet Check Station	17	7	0	0	24
12/19/2017	Joliet Check Station	7	4	0	0	11
12/20/2017	Joliet Check Station	8	2	0	0	10
12/21/2017	Joliet Check Station	6	3	0	0	9
12/22/2017	Joliet Check Station	3	2	0	0	5
12/23/2017	Joliet Check Station	10	8	0	0	18
12/24/2017	Joliet Check Station	6	0	1	0	7
12/26/2017	Joliet Check Station	5	0	0	0	5
12/27/2017	Joliet Check Station	10	2	0	0	12
12/28/2017	Joliet Check Station	8	10	0	0	18
12/31/2017	Joliet Check Station	7	0	0	0	7
1/1/2018	Joliet Check Station	3	0	0	0	3
1/2/2018	Joliet Check Station	1	9	0	0	10
1/3/2018	Joliet Check Station	5	2	0	0	7
1/4/2018	Joliet Check Station	3	2	0	0	5

1/5/2018	Joliet Check Station	6	5	0	0	11
1/6/2018	Joliet Check Station	8	3	0	0	11
1/7/2018	Joliet Check Station	1	2	0	0	3
1/8/2018	Joliet Check Station	0	3	0	0	3
1/9/2018	Joliet Check Station	2	0	0	0	2
1/11/2018	Joliet Check Station	0	2	0	0	2
1/13/2018	Joliet Check Station	1	2	0	0	3
1/19/2018	Joliet Check Station	0	3	0	0	3
1/20/2018	Joliet Check Station	0	2	0	0	2
1/21/2018	Joliet Check Station	0	2	0	0	2
1/22/2018	Joliet Check Station	0	1	0	0	1
1/23/2018	Joliet Check Station	0	2	0	0	2
1/28/2018	Joliet Check Station	0	7	0	0	7
1/29/2018	Joliet Check Station	0	2	0	0	2
2/2/2018	Joliet Check Station	0	1	0	0	1
2/3/2018	Joliet Check Station	0	1	0	0	1
2/11/2018	Joliet Check Station	0	2	0	0	2
2/13/2018	Joliet Check Station	0	1	0	0	1
2/14/2018	Joliet Check Station	0	1	0	0	1
10/21/2017	Laurel Check Station	12	2	0	0	14
10/22/2017	Laurel Check Station	3	0	0	0	3
10/28/2017	Laurel Check Station	6	2	0	0	8
10/29/2017	Laurel Check Station	4	2	1	0	7
11/4/2017	Laurel Check Station	11	1	0	0	12
11/5/2017	Laurel Check Station	16	0	1	0	17
11/11/2017	Laurel Check Station	28	1	0	0	29
11/12/2017	Laurel Check Station	10	0	0	0	10
11/18/2017	Laurel Check Station	25	32	2	0	59
11/19/2017	Laurel Check Station	20	8	0	1	29
11/25/2017	Laurel Check Station	20	16	0	0	36
11/26/2017	Laurel Check Station	21	23	0	0	44
10/21/2017	Lavi0 Check Station	2	0	0	0	2
10/22/2017	Lavi0 Check Station	2	0	0	0	2
10/29/2017	Lavi0 Check Station	1	0	0	0	1
11/11/2017	Lavi0 Check Station	4	0	0	0	4
11/12/2017	Lavi0 Check Station	11	0	0	0	11
11/18/2017	Lavi0 Check Station	3	2	0	0	5
11/19/2017	Lavi0 Check Station	9	2	0	0	11
11/25/2017	Lavi0 Check Station	10	0	0	0	10
11/26/2017	Lavi0 Check Station	2	0	0	0	2
10/21/2017	Livingston Check Station	3	0	0	0	3
10/28/2017	Livingston Check Station	2	0	0	0	2
10/29/2017	Livingston Check Station	2	0	0	0	2

11/5/2017	Livingston Check Station	3	5	8	0	16
11/10/2017	Livingston Check Station	2	0	0	0	2
11/11/2017	Livingston Check Station	8	1	1	0	10
11/12/2017	Livingston Check Station	3	2	3	0	8
11/18/2017	Livingston Check Station	5	3	2	0	10
11/19/2017	Livingston Check Station	9	4	5	0	18
11/25/2017	Livingston Check Station	12	10	8	0	30
11/26/2017	Livingston Check Station	8	11	5	0	24
10/22/2017	R3 Bozeman HQ	0	0	1	0	1
11/3/2017	R3 Bozeman HQ	1	0	0	0	1
11/10/2017	R3 Bozeman HQ	1	0	0	0	1
11/13/2017	R3 Bozeman HQ	5	1	0	0	6
11/14/2017	R3 Bozeman HQ	4	0	0	0	4
11/15/2017	R3 Bozeman HQ	1	0	0	0	1
11/17/2017	R3 Bozeman HQ	0	0	1	0	1
11/18/2017	R3 Bozeman HQ	1	0	0	0	1
11/20/2017	R3 Bozeman HQ	1	0	0	0	1
11/21/2017	R3 Bozeman HQ	2	0	0	0	2
11/24/2017	R3 Bozeman HQ	1	0	0	0	1
11/27/2017	R3 Bozeman HQ	7	0	1	0	8
11/29/2017	R3 Bozeman HQ	1	0	0	0	1
12/4/2017	R3 Bozeman HQ	1	0	0	0	1
12/6/2017	R3 Bozeman HQ	0	0	1	0	1
12/11/2017	R3 Bozeman HQ	1	0	1	0	2
12/12/2017	R3 Bozeman HQ	1	0	0	0	1
12/18/2017	R3 Bozeman HQ	1	0	0	0	1
1/3/2018	R3 Bozeman HQ	0	0	1	0	1
1/11/2018	R3 Bozeman HQ	1	0	0	0	1
1/23/2018	R3 Bozeman HQ	1	0	0	0	1
2/8/2018	R3 Bozeman HQ	1	0	0	0	1
2/14/2018	R3 Bozeman HQ	0	3	0	0	3
10/4/2017	R5 Billings HQ	1	0	0	0	1
10/11/2017	R5 Billings HQ	1	0	0	0	1
10/20/2017	R5 Billings HQ	2	0	0	0	2
10/23/2017	R5 Billings HQ	3	1	0	0	4
10/24/2017	R5 Billings HQ	2	0	0	0	2
10/25/2017	R5 Billings HQ	2	0	0	1	3
10/27/2017	R5 Billings HQ	1	0	0	0	1
10/30/2017	R5 Billings HQ	2	0	0	0	2
10/31/2017	R5 Billings HQ	1	0	0	0	1
11/1/2017	R5 Billings HQ	1	0	0	0	1
11/2/2017	R5 Billings HQ	2	0	0	0	2
11/3/2017	R5 Billings HQ	0	1	0	0	1

11/6/2017	R5 Billings HQ	3	1	0	0	4
11/9/2017	R5 Billings HQ	1	1	0	0	2
11/10/2017	R5 Billings HQ	0	0	1	0	1
11/11/2017	R5 Billings HQ	1	0	0	0	1
11/13/2017	R5 Billings HQ	6	1	1	0	8
11/14/2017	R5 Billings HQ	3	2	0	0	5
11/15/2017	R5 Billings HQ	0	1	0	0	1
11/16/2017	R5 Billings HQ	1	0	0	0	1
11/17/2017	R5 Billings HQ	3	0	0	0	3
11/20/2017	R5 Billings HQ	25	3	1	0	29
11/21/2017	R5 Billings HQ	8	2	0	0	10
11/22/2017	R5 Billings HQ	7	1	1	0	9
11/24/2017	R5 Billings HQ	2	0	0	0	2
11/26/2017	R5 Billings HQ	1	0	0	0	1
11/27/2017	R5 Billings HQ	8	3	0	0	11
11/28/2017	R5 Billings HQ	4	1	0	0	5
11/29/2017	R5 Billings HQ	5	1	0	0	6
11/30/2017	R5 Billings HQ	4	1	0	0	5
12/1/2017	R5 Billings HQ	1	1	0	0	2
12/4/2017	R5 Billings HQ	5	11	2	0	18
12/5/2017	R5 Billings HQ	2	3	0	0	5
12/7/2017	R5 Billings HQ	0	3	0	0	3
12/8/2017	R5 Billings HQ	0	0	1	0	1
12/11/2017	R5 Billings HQ	0	1	1	0	2
12/12/2017	R5 Billings HQ	0	1	0	0	1
12/13/2017	R5 Billings HQ	5	4	0	0	9
12/15/2017	R5 Billings HQ	2	0	0	0	2
12/18/2017	R5 Billings HQ	0	0	1	0	1
12/19/2017	R5 Billings HQ	1	0	0	0	1
12/20/2017	R5 Billings HQ	3	1	0	0	4
12/21/2017	R5 Billings HQ	1	1	0	0	2
12/22/2017	R5 Billings HQ	0	1	0	0	1
12/26/2017	R5 Billings HQ	2	0	0	0	2
12/27/2017	R5 Billings HQ	1	0	0	0	1
1/2/2018	R5 Billings HQ	11	1	0	0	12
1/3/2018	R5 Billings HQ	6	2	0	0	8
1/5/2018	R5 Billings HQ	6	0	0	0	6
1/8/2018	R5 Billings HQ	0	1	0	0	1
2/8/2018	R5 Billings HQ	0	1	0	0	1
1/6/2018	Region 4 Check Station CWD Special Hunt	23	1	0	0	24
1/7/2018	Region 4 Check Station CWD Special Hunt	26	0	0	0	26
1/25/2018	Region 4 Check Station CWD Special Hunt	1	0	0	0	1
1/27/2018	Region 4 Check Station CWD Special Hunt	1	0	0	0	1

2/2/2018	Region 4 Check Station CWD Special Hunt	2	0	0	0	2
2/8/2018	Region 4 Check Station CWD Special Hunt	4	0	0	0	4
2/10/2018	Region 4 Check Station CWD Special Hunt	2	0	0	0	2
2/14/2018	Region 4 Check Station CWD Special Hunt	2	0	0	0	2
1/6/2018	Sage Creek Check Station	2	0	0	0	2
1/8/2018	Sage Creek Check Station	3	0	0	0	3
1/16/2018	Sage Creek Check Station	1	0	0	0	1
1/19/2018	Sage Creek Check Station	1	0	0	0	1
1/20/2018	Sage Creek Check Station	3	0	0	0	3
1/21/2018	Sage Creek Check Station	3	0	0	0	3