Montana Fish, Wildlife & Parks' 2021 Chronic Wasting Disease Surveillance and Monitoring Report

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Executive Summary

Montana Fish, Wildlife, and Parks (FWP) has been conducting surveillance for chronic wasting disease (CWD) since 1998, and first detected CWD in wild deer in 2017. In 2021, FWP prioritized sampling in northwestern, northcentral, southwestern, southcentral, and eastcentral Montana. FWP continued to target sampling in the Libby CWD Management Zone with a 3rd annual special Libby CWD hunt and through agency trapping/removal of white-tailed deer within the town of Libby. Additionally, targeted sampling was conducted in southwest Montana through a 2nd annual special CWD hunt known as the Southwestern Montana CWD Management Hunt. FWP offered free state-wide testing available via mail-in, CWD sampling stations, and all FWP regional offices in 2021.

During the 2021 season, FWP tested 8777 samples from mule deer (n=3566), white-tailed deer (n=4152), elk (n=1007), and moose (n=52). Of these, 349 animals tested positive for CWD, including 77 mule deer, 271 white-tailed deer, and 1 moose. In 2021, we detected CWD in 5 new hunting districts, including: 317, 330, 333, 340, and 700.

Among CWD-positive hunting districts across the state, prevalence estimated from hunter-harvested animals sampled from 2019-2022 ranged from <1% - 9% in mule deer and <1% - 30% in white-tailed deer. In the town of Libby, 10% (95%CI: 8-14%) of hunter-harvested or trapped white-tailed deer were positive for CWD, whereas only 4% (95%CI: 3-5%) were positive outside the town within the Libby CWD Management Zone. In southwestern Montana, CWD prevalence among hunter-harvested white-tailed deer was highest in hunting districts 322 (30%, 95%CI: 28-32%), 326 (10%, 95%CI: 4-21%), and 324 (7%, 95%CI: 1-31%).

An analysis of all data collected from 2017-2022 from hunter-harvested deer in CWD-positive hunting districts suggests several state-wide patterns of infection across species, sex, age class, and geographic area. The Libby CWD Management Area and the Southwestern Montana CWD Management Hunt Area contain significant hotspots of CWD among white-tailed deer. Outside of these two areas, CWD prevalence did not significantly differ by deer species (relative risk of white-tailed deer: mule deer = 0.6 (95%CI: 0.4 – 1.0); white-tailed deer prevalence = 1%, mule deer prevalence = 2%). Among mule deer, adult males had 3.7 times the risk of infection as adult females across Montana's hunting districts, whereas among white-tailed deer, sex was not significantly associated with infection status. The risk of infection was greatest in adults, followed by yearlings and young of the year.

FWP continues to plan for long-term CWD management in positive areas. In 2022, FWP will continue to provide educational materials and programs and enforce proper carcass disposal requirements. FWP will continue to advertise CWD sampling station locations and hours of operation as well as distribute information for hunters who will collect and submit their own samples throughout the hunting season. Administrative rules governing the use of scents were finalized by the Fish & Wildlife Commission in August 2021. Harvest management aimed at minimizing spread preventing population effects of CWD is ongoing in various regions around the state. In 2022, FWP will attempt surveillance in all hunting districts that intersect a 40-mile buffer on known positives, where CWD has not yet been found. In addition, FWP will target districts in southwestern, southcentral, northcentral, and central Montana for surveillance and monitoring to improve our understanding of whether the prevalence and distribution of the disease is changing.

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 course of infection. The CWD-associated prion 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 29 US states, four Canadian Provinces, Norway, Sweden, Finland, and South Korea. CWD is a relatively slow-moving disease, and if left unmanaged, may take decades to reach prevalences of 20-30%. Significant herd-level declines are predicted at such high prevalences (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 early detection of CWD are essential to providing the best options for managing the spread and prevalence of the disease. While CWD is not known to infect humans, public health authorities advise against consuming meat from a CWD-positive animal and recommend hunters have their deer, elk, or moose tested if it was harvested within a CWD-endemic area.

Introduction

Surveillance programs for CWD are essential for 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, our goal is to 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 conducting surveillance for CWD since 1998, with varying levels of intensity. In 2017, FWP renewed its CWD surveillance and management plans with the help of an internal CWD Action Team and a CWD Citizen's Advisory Panel. FWP's plan outlines a strategy to maximize our ability to detect CWD in high-priority areas where it is not known to exist. This entails (1) continuing to test any symptomatic deer, elk, or moose statewide, (2) focusing surveillance on mule deer and white-tailed deer, 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 are defined as those hunting districts that intersect a 40-mile buffer on known CWD positive cases inside Montana, and outside of Montana's borders in neighboring states and provinces. In addition, once an area is determined to be positive for CWD, FWP may set up special CWD hunts, or use hunter-harvest samples from the general season to monitor the distribution and prevalence of the disease.

In the fall of 2021, FWP conducted CWD surveillance and monitoring in northwestern, northcentral, southwestern, southcentral, and eastcentral Montana (Figure 1). FWP organized a 2nd annual special CWD management hunt in southwestern Montana in 2021 in response to the high prevalence of CWD detected there. In addition, FWP conducted a 3rd annual special CWD management hunt in the Libby CWD Management Zone and continued to trap and euthanize white-tailed deer within the town of Libby as part of an effort to reduce deer densities and help control CWD within the surrounding Libby CWD Management

Zone. Lastly, FWP continued to provide free, state-wide CWD testing of hunter-harvested animals in 2021. Below, we report on the results and lessons learned from the 2021 CWD surveillance and monitoring efforts.
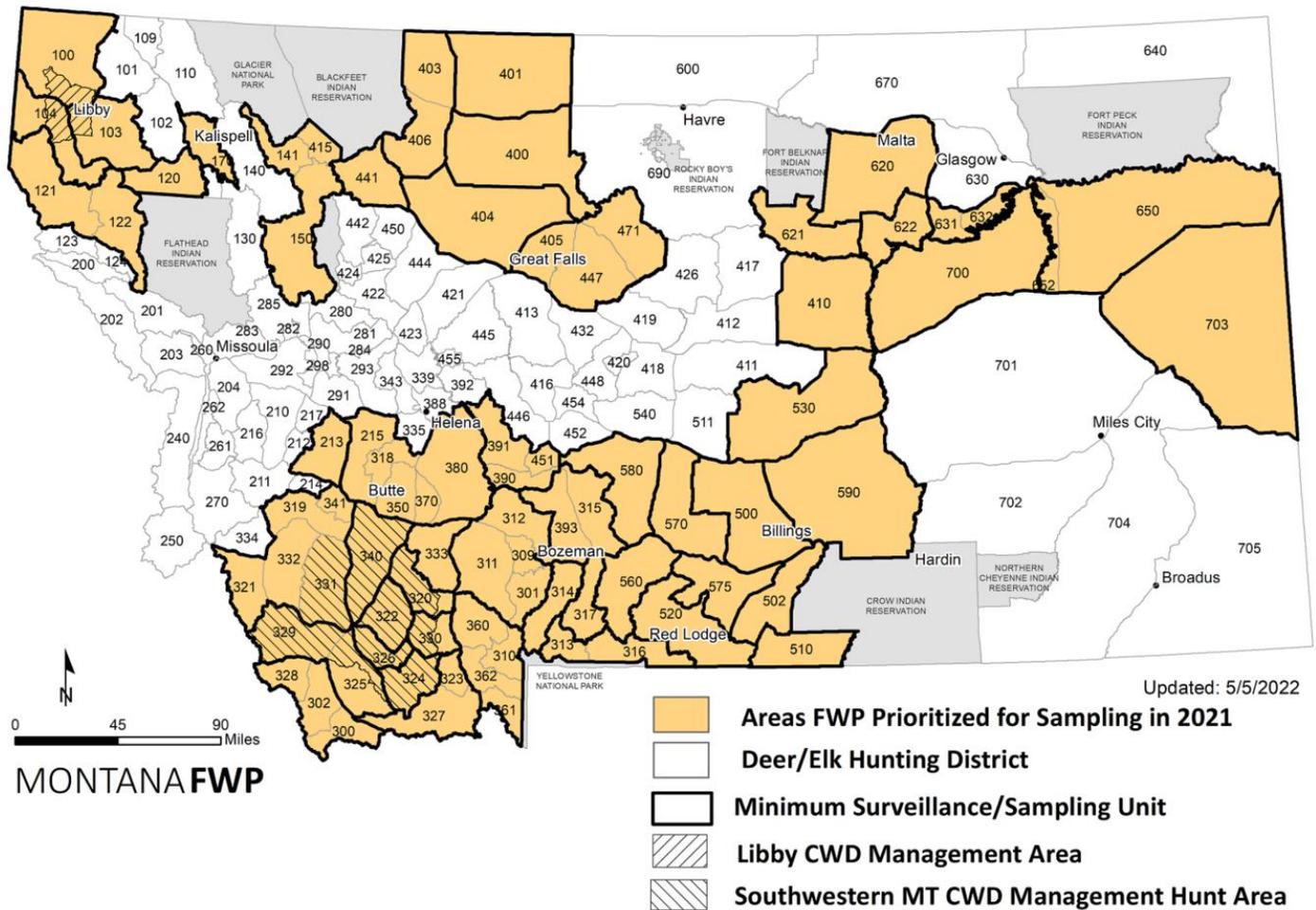

Figure 1. CWD priority sampling areas in Montana, 2021. CWD surveillance and monitoring areas included northwestern, northcentral, southwestern, southcentral, and eastcentral Montana. Boundaries of the Libby CWD Management Area and the Southwestern Montana CWD Management Hunt Area are displayed in cross-hatch.

Methods

Surveillance
In 2021, FWP focused its surveillance efforts on districts where CWD had not yet been detected in northwestern, northcentral, southwestern, southcentral, and eastcentral Montana. Priority surveillance areas were divided into minimum surveillance units (Figure 1). Each minimum surveillance unit was defined as a portion of, or an aggregation of hunting districts meant to capture discrete and well-mixed population units of ≤15,000 mule deer. 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 1). A total of 300 points, spatially distributed across the unit, were necessary to establish our detection goals within each minimum surveillance

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unit. Sample size goals were specific to a single species within a minimum surveillance unit, and our efforts prioritized the sampling of deer since they have the highest prevalences among the different cervid species where they overlap (Miller et al. 2000). Elk and moose were sampled opportunistically.

Table 1. 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	0.001	NA

FWP staff collected samples between July 1, 2021 – March 1, 2022 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 it 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 hunters at sampling stations, processors and taxidermists, outfitters, landowners, Montana Department of Transportation, and by sending letters to license holders notifying them of the surveillance effort. Field and laboratory staff collected retropharyngeal lymph nodes (Hibler et al. 2003) or an obex sample if lymph nodes were not available (both lymph nodes and obex were collected from moose), an incisor tooth for aging, and a small genetic sample (muscle tissue) from each cervid sampled as part of the CWD surveillance program. Field staff worked with hunters to gather precise location information on where the animal was harvested/found, as well as 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 Montana Veterinary Diagnostic Laboratory for ELISA testing. Samples requiring an IHC test (e.g. moose samples and confirmations of ELISA positives) were sent to Colorado State University Veterinary Diagnostic Laboratory, National Veterinary Services Laboratory, or Utah Veterinary Diagnostic Laboratory on a weekly basis. Testing costs were $14/sample for the ELISA, and $35/sample for IHC. 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 on the ELISA (labeled a "suspect"), FWP directly contacted the associated hunter via email or phone to inform them of the test results, to let them know the meat could be legally disposed of, and to discuss proper disposition of the carcass parts. IHC confirmations were typically available 1-3 weeks later, so we did not require hunters to wait that full time before legally disposing of the carcass.

In addition to the focused sampling efforts in the 2021 priority surveillance areas, FWP collected or received samples from symptomatic or hunter-harvested animals state-wide. Hunters that harvested an animal outside of the priority surveillance areas and wanted to have their animal tested either brought their animal to a CWD

sampling station, a regional headquarters/area office, or were instructed on how to collect and mail in their samples for testing that was paid for by FWP. The video instructing hunters how to collect their own CWD sample can be found at fwp.mt.gov/CWD under "Submitting Samples."

Monitoring of prevalence and distribution within CWD Positive Areas
In 2021, FWP continued to prioritize sample collection from known positive areas in northwestern, northcentral, southwestern, southcentral, and eastcentral Montana, and continued to test any hunter-submitted samples from other positive areas around the state. In 2021, FWP held a 2nd annual special CWD management hunt in southwestern Montana. Although CWD testing was not required, it was encouraged to improve our estimates of CWD prevalence and distribution in these areas (Figure 1). In addition, FWP held a 3rd annual special CWD management hunt with the Libby CWD Management Zone and continued to trap and euthanize white-tailed deer in the town of Libby to further reduce deer densities. To reflect a more recent and current estimate, prevalence estimates in this report were calculated using only data from hunter-harvested, or agency trapped and euthanized animals (in Libby), from 2019-2022.

Data summaries and analyses
Weighted surveillance points were calculated separately for mule deer, white-tailed deer, and elk (relative risk of infection data currently do not exist for moose) using data collected from 2019-2022. 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),

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

to calculate the threshold prevalence above which we would expect to detect at least one positive given our weighted surveillance points (*n*) and assuming 95% statistical confidence:

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

Following detection, we explored patterns of infection among hunter-harvested deer in CWD-positive hunting districts using logistic, generalized linear mixed models. We evaluated the odds of infection as a function of species, sex, age class, whether the animal was harvested in either the Libby or Southwestern MT CWD Management Hunt Area or outside of these areas, and relative timing of harvest within the general season (early-rut: Oct 15-Nov 14; late-rut: Nov 15-Dec 5), while using hunting district as a random effect. Models with various permutations of these covariates were evaluated using Akaike's Information Criterion (AIC; Burnham and Anderson 2002), and unless otherwise noted, we report the estimated covariate effects from the best supported models (< 2 AIC units from the top model). Odds ratios (exponentiated logistic coefficients) were converted to estimates of relative risk to facilitate interpretation (relative risk = odds ratio/(1-p_0 + (p_0*odds ratio)), where p_0 is the prevalence within the baseline group; Grant 2014). All analyses were carried out in Program R (R Core Team 2017). We report prevalence at the scale of hunting districts and within the Libby CWD Management Area. We calculated 95% binomial confidence intervals using the Wilson method.

Results

Between July 1, 2021 – March 1, 2022, FWP submitted 8777 samples for testing, which was a 10% increase over the number of samples collected in 2020 (n=7974) and a 25% increase over the number of samples collected in 2019 (n=7025). The majority of these samples were analyzed at Montana Veterinary Diagnostic Laboratory, with a much smaller number of IHC tests conducted at Colorado State University Veterinary Diagnostic Laboratory, National Veterinary Services Laboratory, and Utah Veterinary Diagnostic Laboratory. Of these samples, 3566 were collected from mule deer, 4152 from white-tailed deer, 1007 from elk, and 52 from moose. Thirty three percent (n=2918) of samples were collected from outside our priority sampling areas and hunters collected and submitted 1033 of their own samples in 2021. Since FWP's renewed surveillance efforts in 2017, we have tested 27717 samples statewide (Figure 2). FWP detected 349 CWD positive cervids during the 2021 season, including 77 mule deer, 271 white-tailed deer, 0 elk, and 1 moose. In 2021, we detected CWD in 5 new hunting districts, including: 317, 330, 333, 340, and 700 (Figure 2).
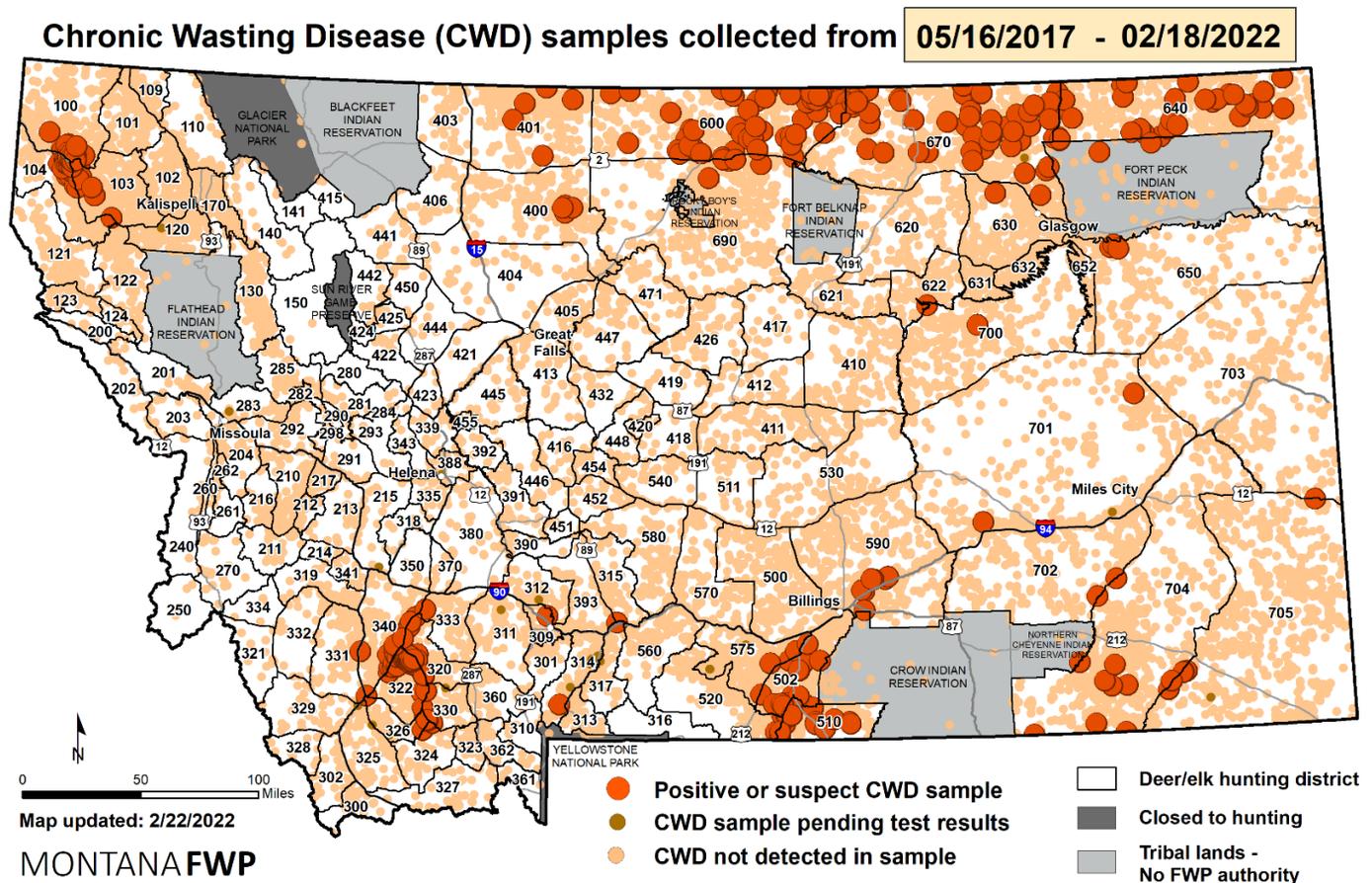
Figure 2. Map of sampling locations and CWD positives among deer, elk, and moose from 2017-2022.

We met or exceeded our numerical surveillance goals among most of the minimum surveillance units in northwestern Montana for white-tailed deer, except for in HDs 141, 150, and 415 (Appendix I, Figure A1, A4). This suggests that if CWD is present among these units, it is likely to be affecting <1% of the white-tailed

deer populations. This supports the belief that the foci of infection around the Libby area is still contained within hunting districts 100, 103, and 104. However, inspection of the sampling distribution in hunting districts 100, 103, and 104 suggests that continued sampling could improve district coverage and increase our confidence that these districts have extremely low prevalence. As of the 2021 sampling season, priority surveillance hunting districts 317, 330, 333, and 340 were all found to have CWD present (Figure 2). We did not detect CWD within any of the other minimum surveillance units in southwest Montana (Appendix I, Figure A1, A5). However, we fell short of the necessary surveillance points to rule out infection in these areas except for white-tailed deer in hunting districts 301, 311, and 312. Additionally, we did not meet our numerical surveillance goals for any of the minimum surveillance units in northcentral and southcentral Montana and, therefore, lack the necessary surveillance points to rule out infection in these areas (Appendix I, Figure A1, A6, A7). In hunting districts 620, 621, 631, 632, and 652 in eastcentral Montana, we did not find any CWD positives, but fell short of our sampling goals (Appendix I, Figure A1, A8). We did meet our numerical surveillance goal in hunting district 703 for white-tailed deer suggesting if CWD is present it is likely affecting <1% of the white-tailed population. (Appendix I, Figure A1, A9).

Among all CWD-positive hunt districts, prevalence estimated from hunter-harvested animals sampled from 2019-2022 ranged from <1% - 9% in mule deer and <1% - 30% in white-tailed deer (Figure 3 and 4; see Appendix II for prevalence estimates by hunting district), with varying levels of precision. Estimates of prevalence in eastern Montana were improved by another year of sampling and in most cases allowed us to exceed our targeted range of precision of ± 3% margin of error (Figures 3 and 4). Between 2019-2022 in the town of Libby, 10% (95%CI: 8-14%) of hunter-harvested or trapped white-tailed deer were positive for CWD, whereas only 4% (95%CI: 3-5%) were positive outside the town within the Libby CWD Management Zone. Between 2019-2022 in southwestern Montana, CWD prevalence among hunter-harvested white-tailed deer was highest in hunting districts 322 (30%, 95%CI: 28-32%), 326 (10%, 95%CI: 4-21%), and 324 (7%, 95%CI: 1-31%).

An analysis of all data collected from 2017-2021 from hunter-harvested deer in CWD-positive hunting districts suggested several state-wide patterns of infection across species, sex, and age class. Our best supported model included deer species, sex, a species by sex interaction, age class, an indicator for the Libby and Southwestern (SW) Management Area, and an interaction between the Management Area indicator and species (see Appendix III for the list of evaluated models). We included an indicator for the white-tailed deer CWD hotspots in Libby and in Southwestern Montana to account for the intensity of infection in those locations without skewing the estimated patterns for the rest of the state. Indeed, within these two areas, white-tailed deer prevalence was significantly higher than estimates from elsewhere around the state. On average, white-tailed deer from the Management Areas have 14.0 times the risk of infection as white-tailed deer elsewhere in the state (95%CI: 5.4 – 31.9), and average white-tailed deer prevalence inside the Libby and Southwestern Management Areas is 16% whereas outside of these areas it is 1%. Outside of the Libby and Southwestern CWD Management Areas, we found that CWD prevalence did not significantly differ by deer species. The relative risk of infection in white-tailed deer: mule deer was 0.6 (95%CI: 0.4 – 1.0), while prevalence in white-tailed deer was 1% and in mule deer was 2%. Among mule deer, adult males had 3.7 times the risk of infection as adult females (95%CI: 2.4 – 5.7), and adult male mule deer prevalence was 3% while adult female prevalence was 0.8%. By contrast, among white-tailed deer there was no significant difference in the relative risk of infection between the sexes (outside of the Libby and SW Management Areas: adult white-tailed deer female prevalence = 1%, adult white-tailed deer male prevalence = 1%; Relative risk of females:males = 0.4, 95%CI: 0.2 – 0.6). Across deer species in CWD-positive hunting districts, young of the year and yearlings had 0.1 times (95%CI: 0.1 – 0.2) and 0.6 times (95%CI: 0.4 – 0.7), the risk of infection as adults, respectively (outside of the management areas: young of the year prevalence = 0.0%, yearling prevalence = 0.6%, and adult prevalence = 2.0%).
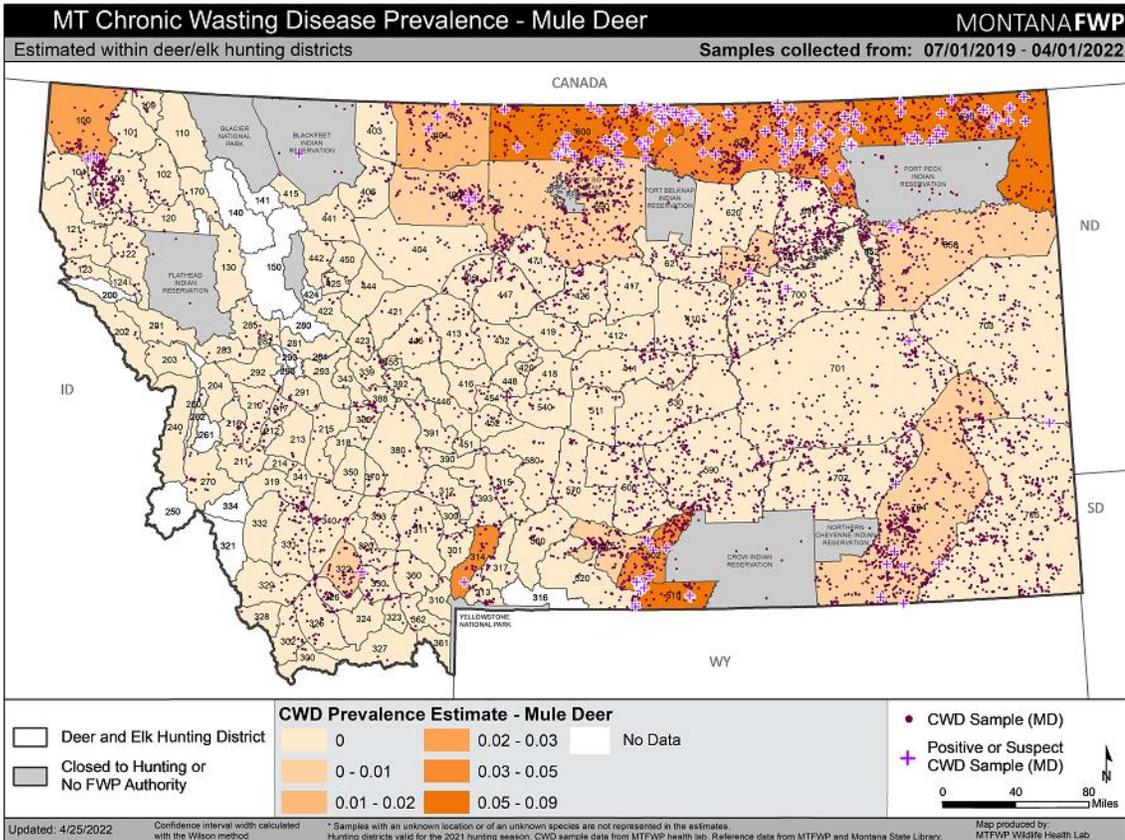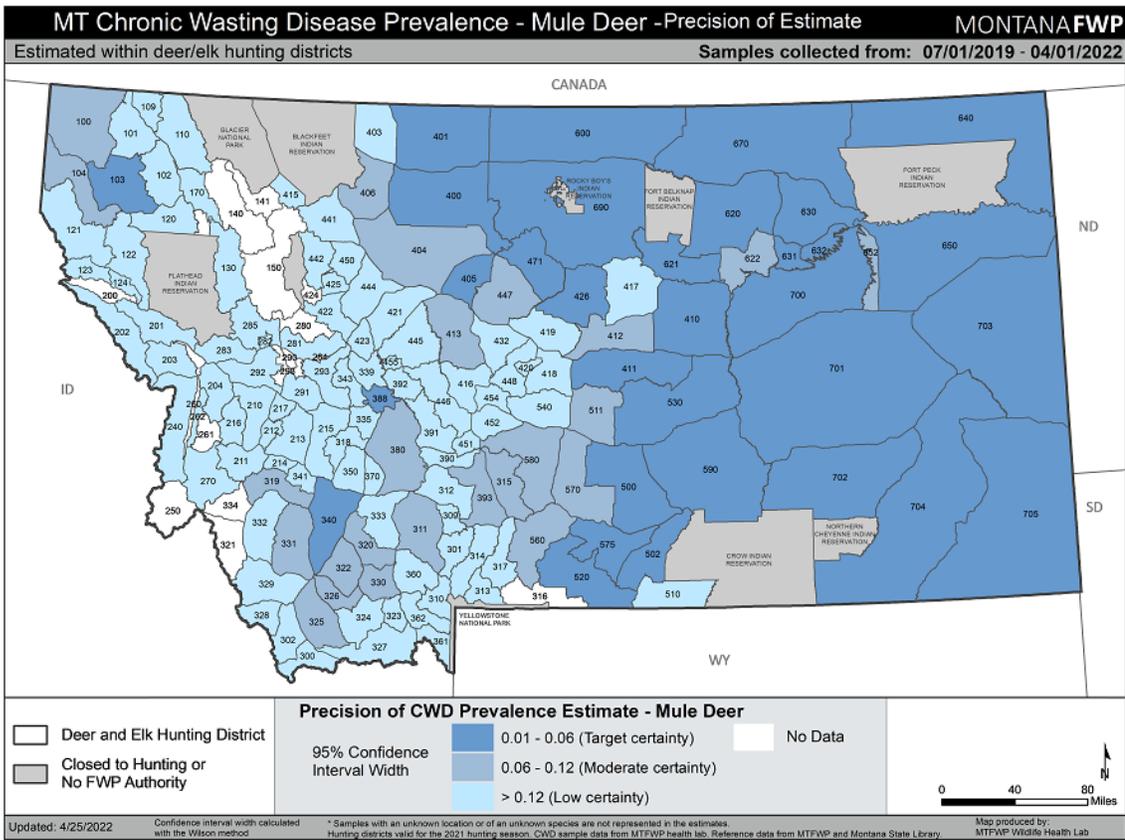
Figure 3. CWD prevalence in mule deer (top figure), estimated by hunting district across Montana, 2019-2022. Prevalence is calculated by dividing the number of test-positives by the total number of animals sampled. Only data from hunter-harvested or agency removal/trapping were used to calculate prevalence. The corresponding precision of these estimates is displayed in the bottom figure. Small 95% confidence interval widths (dark blue) indicate higher certainty in prevalence estimates; large 95% confidence interval widths (light blue) indicate low certainty in the estimates. Where CWD has not been detected (i.e. prevalence = 0 in top figure), additional sampling may still be necessary to declare the area free from disease, or below 0.01 prevalence, with 95% confidence.

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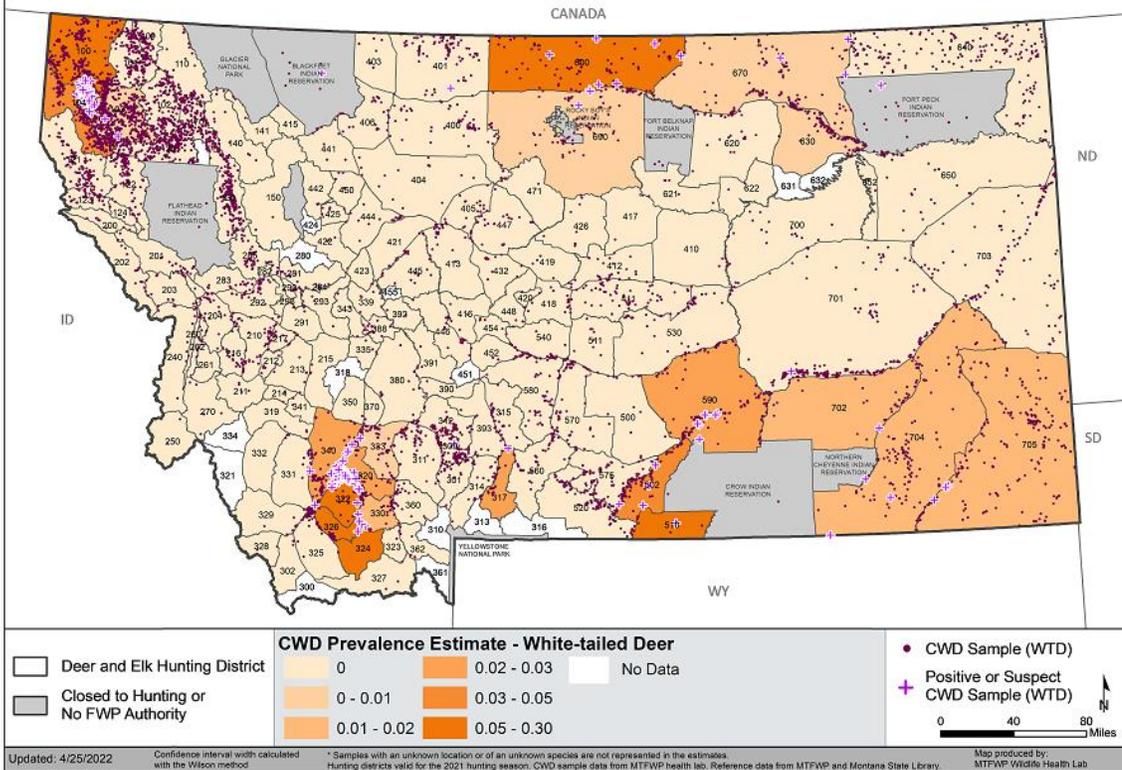
Figure 4. CWD prevalence in white-tailed deer (top figure), estimated by hunting district across Montana, from hunter-harvested or agency removed/trapped deer from 2019-2022. Prevalence is calculated by dividing the number of test-positives by the total number of animals sampled. The corresponding precision of these estimates is displayed in the figure below. Small 95% confidence interval widths (dark blue) indicate higher certainty in prevalence estimates; large 95% confidence interval widths (light blue) indicate low certainty in the estimates. Where CWD has not been detected (i.e. prevalence = 0 in top figure), additional sampling may still be necessary to declare the area free from disease, or below 0.01 prevalence, with 95% confidence.
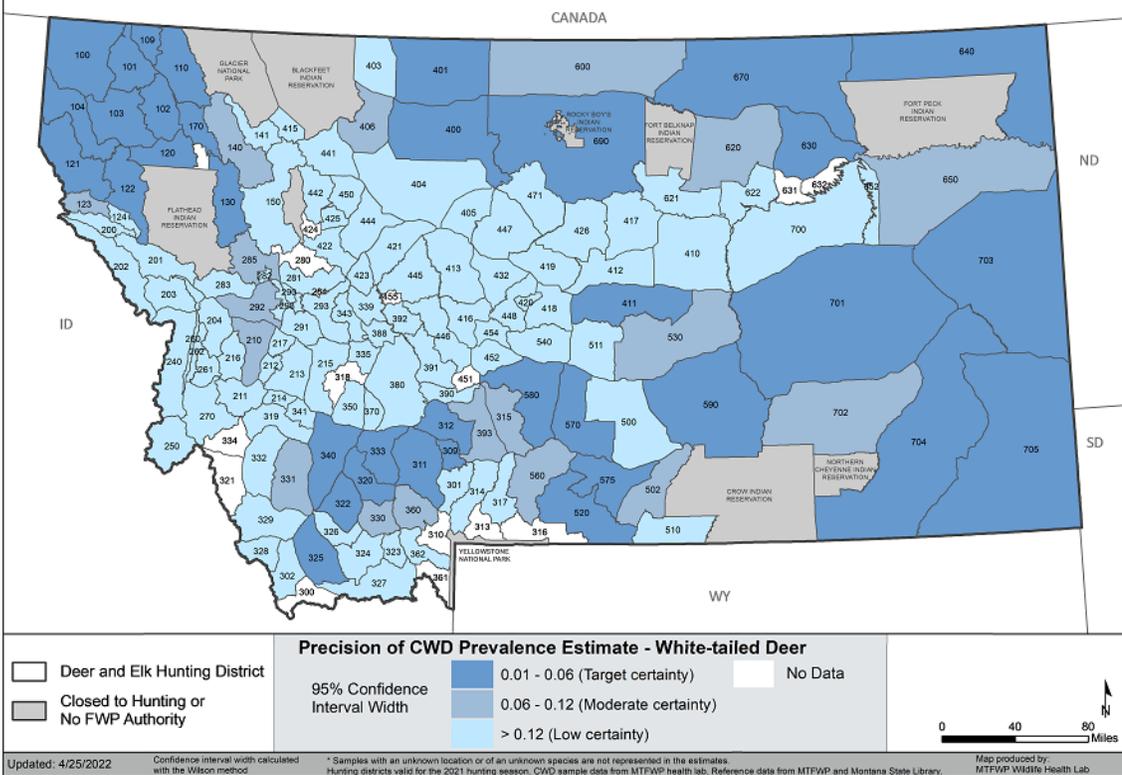
During the general rifle season (October 23rd – November 28th), deer harvested during the "late rut" (November 15th – November 28th) were 1.3 times more likely to be infected than those deer harvested during the "early rut" (October 23rd – November 14th) (prevalence during early rut: 3%; prevalence during late rut: 4%; relative risk late:early = 1.3, 95%CI: 1.1 – 1.5; Appendix III, Table A2). However, when we repeated this analysis within each species' datasets, we found no significant association between infection and timing of harvest.

<u>CWD Management Hunts:</u>

Southwestern Montana CWD Management Hunt

FWP ran the Southwestern Montana CWD Management Hunt from December 11, 2021 – February 15, 2022 that included hunting districts (or portions of) 320, 322, 324, 325, 326, 329, 330, 331, and 340. Hunters were allowed to apply any unused 2021 general deer licenses for either-sex white-tailed deer harvest and/or existing unused 2021 003-00 B-licenses, 399-00 B-licenses, or any 2021 B-licenses from any other hunting district for white-tailed deer. There were no testing or reporting requirements associated with the hunt, however, 246 white-tailed deer harvested during the hunt were submitted for testing. Of these, 90 were CWD positive. These samples, combined with general season samples, improved the precision of our prevalence estimates in some of the districts, although some districts remain below our targets for sampling intensity (Appendix I, Figure A2).

Libby

FWP continued to offer antlerless white-tailed deer licenses during the 2021 season as part of the ongoing effort to increase harvest within the Libby CWD Management Area. During the general hunting season, hunters submitted 413 white-tailed deer from this area for testing, of which 21 were positive for CWD. From January 3, 2022 through February 28, 2022, FWP trapped, euthanized, and tested an additional 99 white-tailed deer within the Libby CWD Management Area, of which 5 were positive. Using only data from hunter-harvested or trapped and euthanized white-tailed deer during the 2021-2022 season, the estimated prevalence was 5% (95%CI: 3-7%) in the entire Libby CWD Management Zone, a figure slightly lower than estimates from previous years' data. Within this zone, the core "Libby Surveillance Area" (the town of Libby) had a prevalence of 8% (95%CI: 5-14%), whereas the remaining outer ring of the Management Zone had a prevalence of 4% (95%CI: 2-6%). Within the entire Libby CWD Management Zone, only 39 mule deer were harvested, of which 1 was positive (prevalence = 3%, 95%CI: 1-13%). There were 6 elk and 2 moose tested within the Libby CWD Management Zone during the 2021-2022 season, none of which were positive.

<u>Testing and reporting turn-around time</u>

On average, it took 11 calendar days (sd = 5 days) from the day a sample was collected to the day the ELISA test results were posted online. This was a significant improvement in turnaround time from 2019, when our average was 19 days, but was an increase from the 8-day turnaround average from 2020. Of this time, it took on average 2 days (sd = 3 days) from the time the sample was collected until shipment to Montana Veterinary Diagnostic Laboratory, and an average of 9 days (sd = 4 days) from the day of shipment until results were received, which includes 1-2 days of transit time. Using three diagnostic laboratories (Colorado State University Veterinary Diagnostic Laboratory, National Veterinary Services Laboratory, and Utah Veterinary Diagnostic Laboratory), the IHC testing confirmations of ELISA positives and the IHC testing of moose samples also took 11 days.

When a suspect CWD test result was received, FWP staff emailed and/or called hunters to notify them and to inquire about the disposal of the meat/carcass. If meat had gone to a processor, the Department of Public Health and Human Services contacted the processor and followed up with any hunters who may have received meat that was batch-processed with the positive animal. The majority of hunters with positive animals had either waited for their test result prior to processing or processed their animal at home.

Discussion

To date, targeted CWD surveillance has confirmed our predictions of CWD presence within the northcentral, northeastern, southcentral, and southeastern borders of our state. However, we have also detected CWD in places where we did not expect to find it, including Libby, Sheridan, Bozeman, and Livingston. These detections indicate the disease is more widely distributed than we initially expected, consistent with Montana's mostly intact landscape and widely connected state-wide deer populations. State-wide testing that is offered free-of-charge to hunters, while requiring a significant amount of time and resources, continues to be successful at detecting positives in new areas outside of those targeted for annual surveillance. We plan to continue offering free state-wide testing to meet hunter interest and to improve our sampling coverage across the state.

In 2021-2022, we largely met our surveillance and monitoring goals for northwestern Montana and one hunting district in eastcentral Montana but fell short of the target sample sizes and distribution of sampling in most of the other priority surveillance areas. Districts where we still need additional samples will continue to be prioritized in coming years.

Our state-wide analysis suggests that outside of the CWD hotspots among white-tailed deer in the Libby and SW Management Areas, there is little difference in risk of infection or prevalence between white-tailed deer and mule deer elsewhere in the state. Based on data collected from 2019 – 2022, the Sheridan and Libby areas that are dominated by white-tailed deer, have the highest measured local CWD prevalences in the state (30% in HD 322 and 10% within the town of Libby). In other areas where both mule deer and white-tailed deer are abundant, prevalences tend to be relatively similar between the species (Figures 3 & 4). Other western states and provinces have reported that mule deer have higher prevalences than white-tailed deer where they overlap (Miller et al. 2000, DeVivo 2017, Nobert et al. 2016), and indeed Montana's previous CWD surveillance plan prioritized mule deer for CWD detection. However, white-tailed deer populations should remain a priority for surveillance and monitoring in Montana, particularly when they are abundant or the dominant species in an area. The fact that the patterns in Montana diverge from those reported elsewhere may relate to differences in the way the two species are managed among states and provinces, the relative timing of disease introduction across the two species, or local differences in the ecology, movement, and population dynamics of the two species in Montana, all of which may result in differences in transmission dynamics within or between the species.

We also found that while adult male mule deer are much more likely to be infected than adult females, there are no significant differences in infection risk among the sexes in white-tailed deer in Montana. Male mule deer have been found to have higher prevalences than females in other western states and provinces (Miller et al. 2000, DeVivo 2017, Nobert et al. 2016). However, reported patterns among the sexes in white-tailed deer have been more variable, including evidence for a female bias (Edmunds et al. 2016), a male bias (Grear et al. 2006, Nobert et al. 2016), and no detectable differences in prevalence between the sexes (Miller et al. 2000). Our data suggests that we should continue to emphasize the sampling of adult male mule deer over

females for surveillance, but that adult male and female white-tailed deer may be equally valuable for surveillance in Montana. As the CWD sampling dataset for Montana becomes larger and more robust for each species and demographic group, we plan to evaluate and develop estimates of our own weighted surveillance point values (Table 1) based on patterns observed within our state.

Conner et al. (2000) found that the risk of harvesting CWD positive mule deer, particularly mule deer bucks, increased over the harvest season. One hypothesis is that older-aged animals, which are more likely to be positive, are more susceptible to harvest during the rut, which could bias the estimate of prevalence upwards in late vs. early season. Another hypothesis is that CWD-infected deer may be less aware or responsive to hunters, particularly when they are already distracted by the rut. We found marginal support for a general pattern where hunters were more likely to harvest a CWD-positive mule deer and white-tailed deer later in the rut (after November 15th) than earlier. Further investigation is needed to identify and connect possible explanatory factors or sampling biases to the marginal pattern we see in Montana. However, when we repeated the analysis within each species' datasets, there was no clear pattern. Differences observed between the Montana dataset and the Conner et al. (2000) study may be related to differences in deer management among states. The Conner et al. (2000) pattern is based on Colorado data, where they have statewide limited-entry hunting, producing higher buck ratios and older age structures. By contrast, Montana has much more liberal buck harvest, producing younger buck age structures. This may result in a higher likelihood that hunters harvest an older (and more likely positive) buck as the rut progresses in Colorado than in Montana.

In 2022, we will attempt surveillance in all hunting districts that intersect a 40-mile buffer on known positives where CWD has not yet been found (Figure 5). In addition, FWP will target districts in southwestern, southcentral, northcentral, and central Montana for monitoring to improve our understanding of whether the prevalence and distribution of the disease is changing.
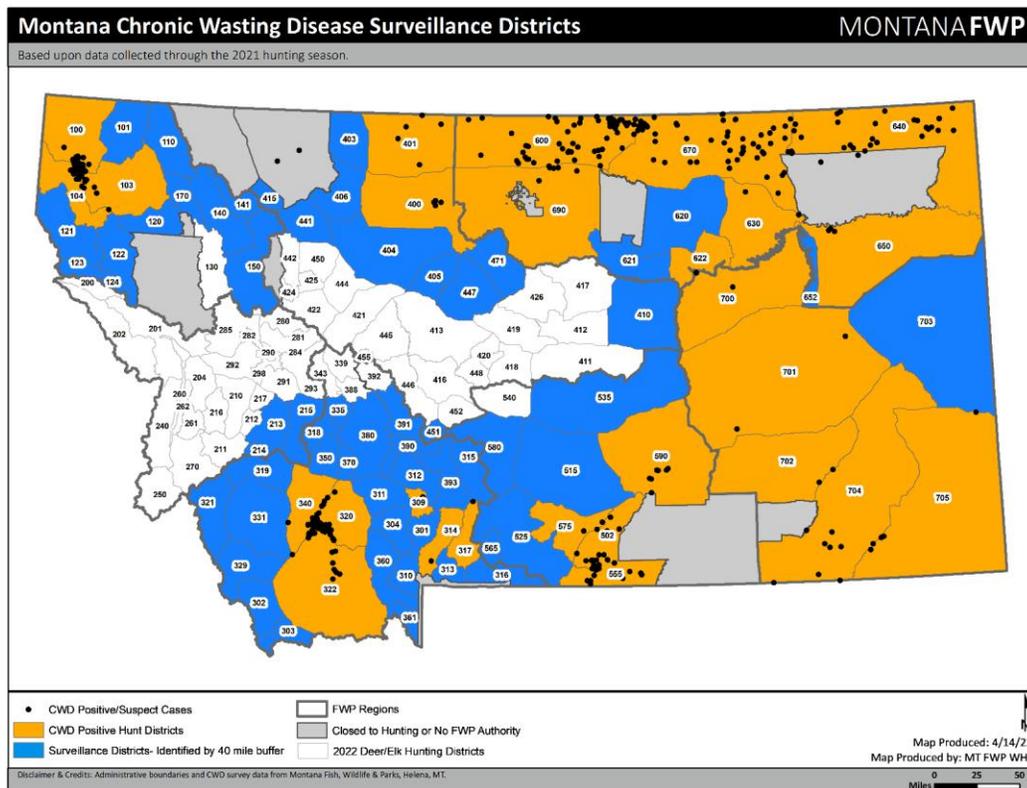

Figure 5. Map of future priority CWD surveillance districts (blue) that are within 40 miles of known CWD positives. CWD-positive hunting districts are in orange.

Management updates

FWP is committed to managing CWD to minimize its spread and to keep prevalences below 5%. Management has been changed in response to CWD in the following areas:

- Region 1: Following the detection of CWD in Libby, the region focused on increasing the accuracy and precision of prevalence estimates. Efforts were made to increase signage and/or public messaging throughout the Libby CWD Management Zone about 1) not feeding/aggregating deer, 2) discouraging carcass dumping, and 3) informing hunters of proper carcass disposal. FWP has worked with the Libby City Council to assist with drafting an Urban Deer Management Plan, which was completed in 2021. Lastly, the Commission approved another either-sex B-license valid within the Libby CWD Management Zone. For the 2021 hunting season, there were no limits on the number of B-licenses that could be sold, but there was a limit of one license per person.

- Region 2: Using a US Department of Agriculture Animal and Plant Health Inspection Service grant, we offered 6 strategically placed carcass disposal dumpsters during the hunting season to facilitate FWP's carcass disposal policy aimed at reducing the human-assisted spread of CWD to new areas of the state. Of the 6 funded dumpsters, 5 dumpsters were located in R2 for the 2021 season.

- Region 3: FWP ran the Southwestern Montana CWD Management Hunt from December 11, 2021 – February 15, 2022 that included hunting districts (or portions of) 320, 322, 324, 325, 326, 329, 330, 331, and 340. Hunters were allowed to apply any unused 2021 general deer licenses for either-sex white-tailed deer harvest and/or existing unused 2021 003-00 B-licenses, 399-00 B-licenses, or any 2021 B-licenses from any other hunting district for white-tailed deer. The goals of the hunt were to continue ongoing priority CWD surveillance; to reduce the number of CWD positive animals, prevalence, and slow the spread of CWD among white-tailed deer populations; to measurably reduce white-tailed deer populations where CWD currently occurs and where CWD is likely to occur in the future; reduce white-tailed deer populations and CWD prevalence to levels that can be more effectively managed through general hunting season harvest; and to reduce probability of CWD spreading to overlapping mule deer, elk, and moose.

- Region 4: Based on CWD surveillance findings in 2019, FWP Region 4 managers proposed a change from a 3-week general deer season to a 5-week general deer season in HD's 400, 401, 403, and 406. Due to significant public resistance and direction from the Fish & Wildlife Commission, the Department proposed an alternative of limited species-specific antlered buck permits valid for 2 weeks after the 3-week general season in these 4 hunting districts. This change was approved by the Commission on February 13, 2020 and is still in effect.

- Region 5: 2019 was the first year of CWD-related season changes in south-central Montana (hunting districts 510, 502, 520, and 575) designed to liberalize both mule deer and white-tailed deer harvest, particularly of bucks. HD 502 went from a buck-only mule deer to an either-sex harvest, and additional antlerless mule deer B licenses were made available. HD 510 went from an unlimited mule deer buck permit to an either-sex general season hunt. HD 520 went to an either-sex mule deer season in that portion of HD 520 lying east of Highway 212. HD 575 maintained the antlered buck mule deer season type but doubled the number of antlerless B-licenses issued compared to 2018.

  Harvest estimates for 2020 suggest:
  - In HD 502, white-tailed and mule deer buck and doe harvest was similar to the 5-year averages.

- In HD 510, mule deer buck harvest was at a second consecutive year low since 1998, and doe harvest was low but slightly above average for the previous 5 years. Harvest of both sexes of white-tailed deer remained stable with the previous 5-year average.
- In HD 520, mule deer buck harvest was the lowest recorded since 1986, and doe harvest was above the 5-year average, but still low. Among white-tailed deer, buck harvest was at its lowest since 1998, and doe harvest was 30% lower than the 5-year average.
- In HD 575, mule deer buck harvest was at its lowest since 1996, and doe harvest had a second consecutive year of high harvest nearly 4 times the 5-year average seen between 2013-2018. Among white-tailed deer, buck harvest was at its lowest since 1992, and doe harvest was slightly below the 5-year average.
- These harvest numbers reflect that deer numbers of both species are at or near lowest levels in 40 years.

- Region 6: Managers have actively increased antlerless B-licenses in recent years for both mule deer and white-tailed deer in response to the presence of CWD and increasing deer populations. In 2021, 10,100 mule deer B-licenses were issued region-wide, which was a 206% increase since 2017 (3,300). In 2021, 2,000 limited draw, region-wide white-tailed deer B-licenses were available, compared to 1,000 in 2018. Permits in the regions sole permitted mule deer buck hunting district (HD 652) were increased to 200, as compared to 100 in 2017. This was also in response to an increasing deer population, high buck ratios, and detection of CWD in neighboring HD 650. Using a US Department of Agriculture Animal and Plant Health Inspection Service grant, we offered 6 strategically placed carcass disposal dumpsters during the hunting season to facilitate FWP's carcass disposal policy aimed at reducing the human-assisted spread of CWD to new areas of the state. Of the 6 funded dumpsters, 1 dumpster was located in R6 for the 2021 season.

- Region 7: Management continues to be fairly liberal as it has been for the last few decades. The general deer license is valid for either-sex, either-species across the entire region. Region-wide mule deer B licenses have been set at the maximum quota (11,000) within the quota range from 2017-2020. Region-wide white-tailed deer B licenses are available over-the-counter, 1 per hunter. An additional 2,000 licenses are available for residents to purchase as a 2nd white-tailed deer B license, valid region-wide.

In addition, in 2021, FWP's Fish & Wildlife Commission adopted regulations regarding carcass disposal in Montana, along with the development of administrative rules of Montana (ARMs) to address the use of cervid-derived scents. The Commission Rule (CR) adopted regarding carcass disposal reads "To prevent the spread of Chronic Wasting Disease, all parts of the head or skull containing brain material and/or the spinal columns of deer, elk, and moose harvested in Montana must be left in the field at the kill site or, if transported for further processing including taxidermy or meat processing, must be disposed of in a class II landfill once that processing is complete." This rule was designed to replace former within-state carcass transport restrictions.

Three separate ARMs are effective as of August 2021 to regulate the use of scents. Statute (MCA 87-6-221) restricts the use of cervid urine to sources from states that do not have CWD unless the Commission designates a urine production facility within a CWD positive state to comply with the standards set for in MCA 87-6-221. Consequently, the first approved ARM designates the states and provinces where CWD is currently found; this ARM may need to be updated annually or as frequently as additional states detect CWD within their administrative boundaries. The second approved ARM identifies that products displaying approval by

the Archery Trade Association (ATA) or the Responsible Hunting Scent Association (RHSA) are in compliance with the standards set forth in MCA 87-6-221. The final approved ARM establishes that glandular scents that comply with the ATA or RHSA approval or artificial scents not using natural glandular scent sources may be used as attractants for deer, elk, or moose in Montana. The Commission provided initial approval of these rules on April 1, 2021, and final Commission adoption was received June 24, 2021.

Acknowledgements

Figure A1. Weighted surveillance points earned for mule deer (MD), white-tailed deer (WTD), and elk within the 2021 minimum surveillance units in Montana, using data collected from 2019-2022. 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 in mule deer and/or white-tailed deer to detect ≥ 1% prevalence with 95% confidence. Above each bar, we have displayed the threshold prevalence, above which we would expect to detect at least 1 positive if the disease were present, given the number of surveillance points earned.
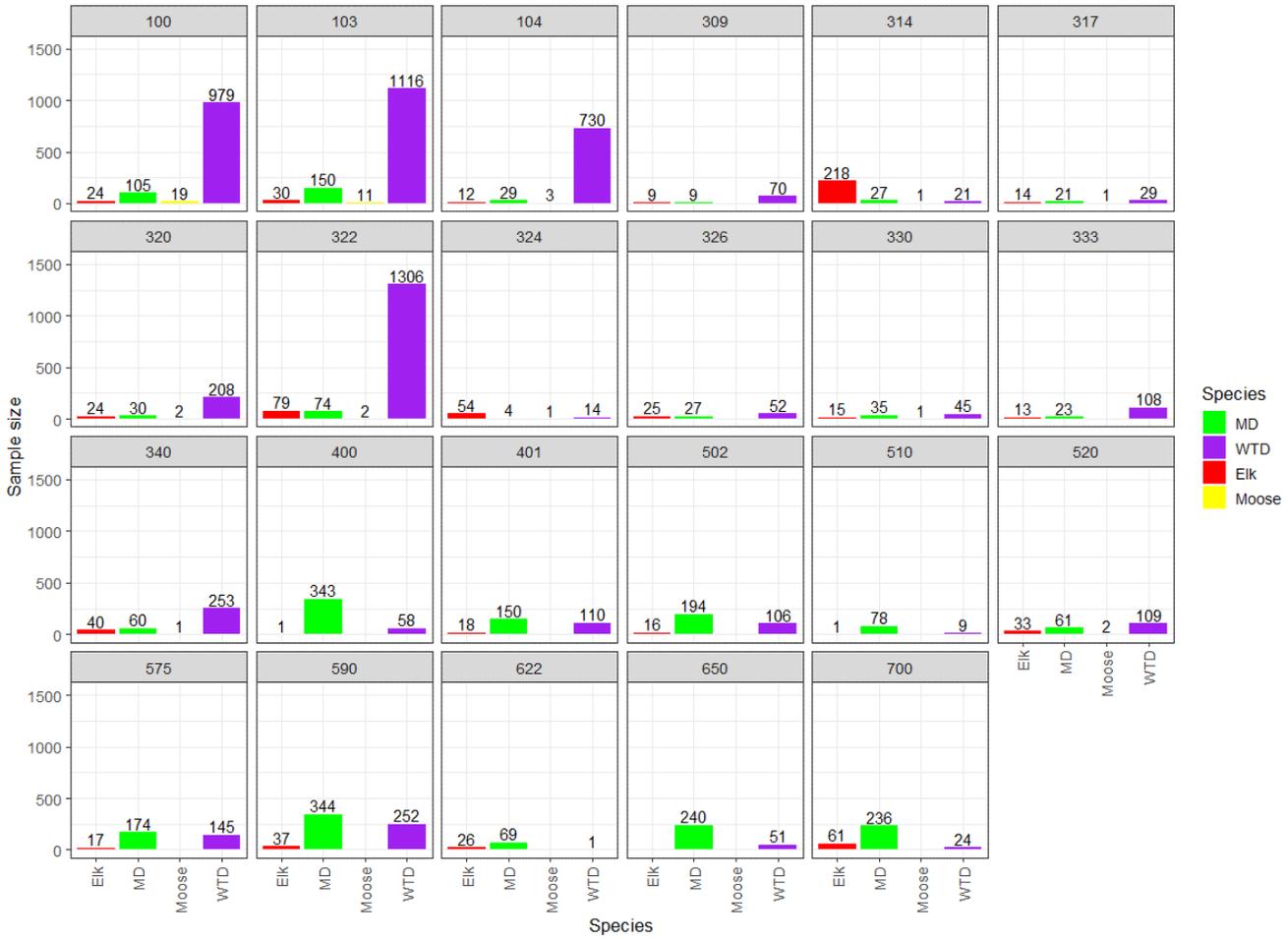
Figure A2. Samples collected from mule deer (MD), white-tailed deer (WTD), elk, and moose within the 2021 priority monitoring areas in Montana, using data collected from 2019-2022. We are typically aiming for at least 200 samples distributed across the population, to achieve a prevalence estimate with a margin of error ≤3%. Above each bar, we have displayed the total number of individuals sampled.

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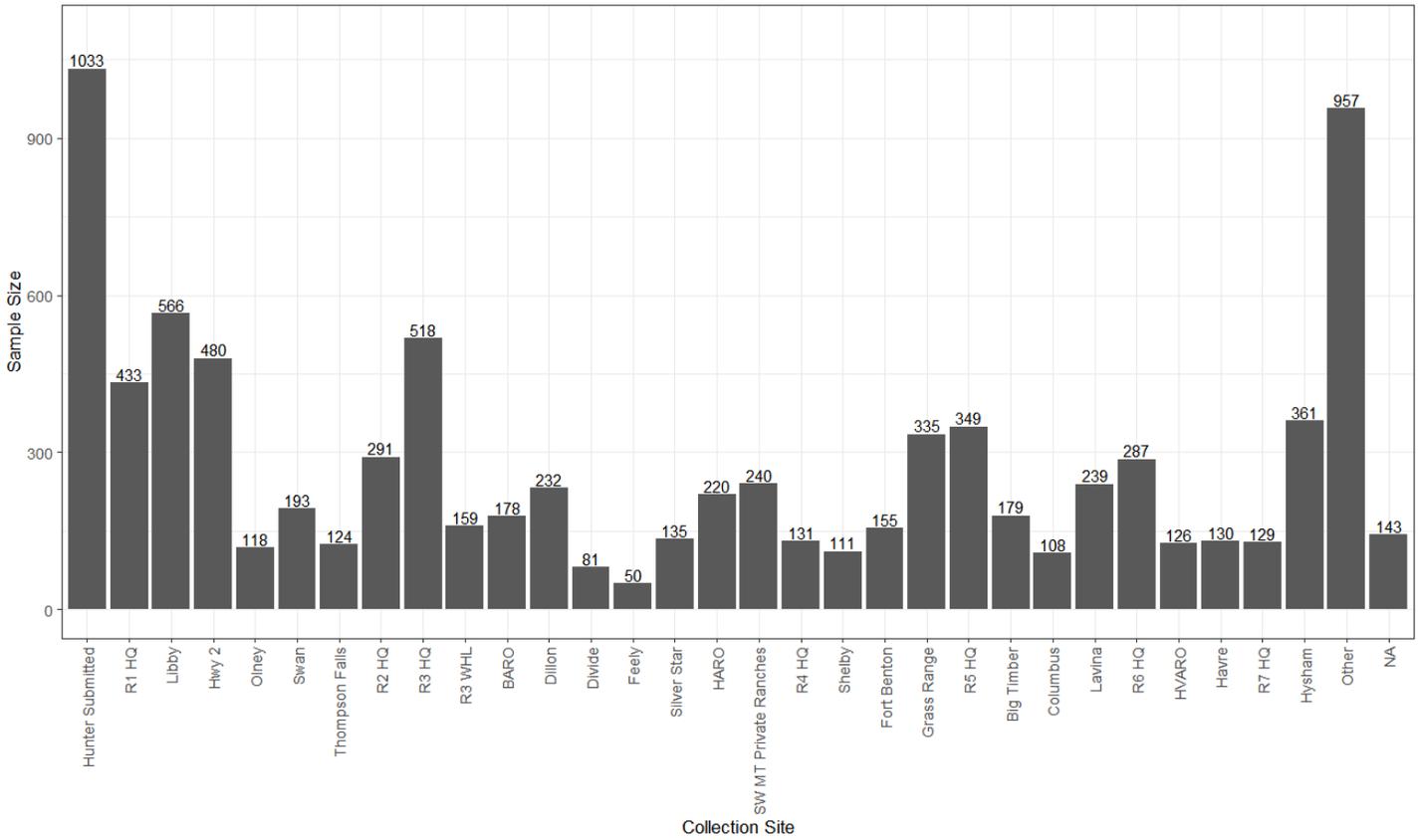**Number of Samples Collected by Collection Site**

Figure A3. Number of samples collected at various CWD sampling locations around the state during the 2021 hunting season. "Hunter submitted" is the number of samples collected and submitted by hunters. "HQ" and "CS" stand for headquarters and sampling station, respectively. "R3 WHL" stands for the Region 3 Wildlife Health Lab. "HVARO" stands for Havre Area Resource Office. "BARO" stands for Butte Area Resource Office. "Other" includes all the additional locations that samples were collected (e.g. private property, trailheads, BMA, etc.,) or other forms of spellings/abbreviations of the listed collection sites (e.g. highway 2 = Hwy 2, TF check station = Thompson Falls.
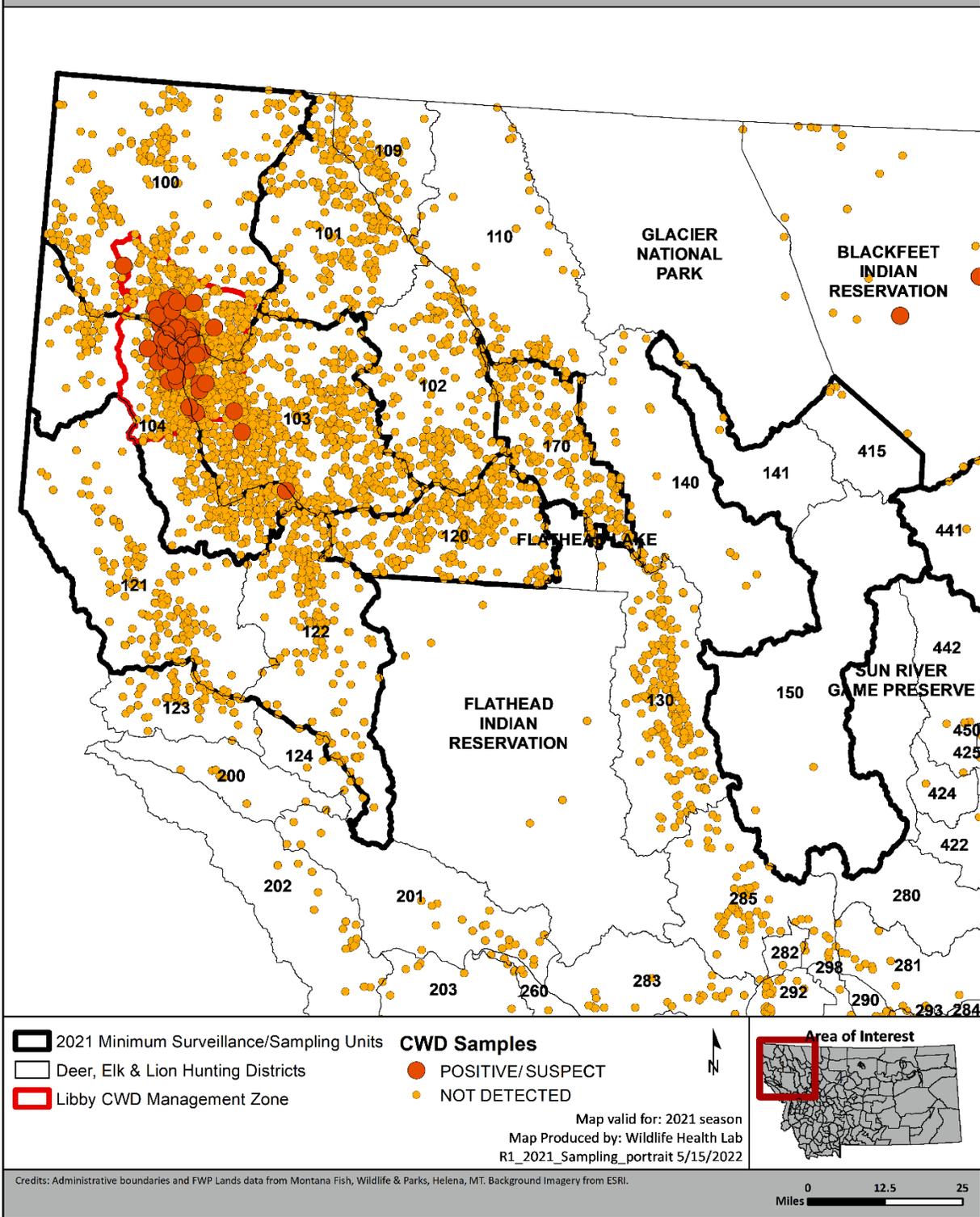
Figure A4. Map of sampling locations and positive/suspect white-tailed deer, mule deer, elk, and moose in northwestern Montana from 2017-2022.
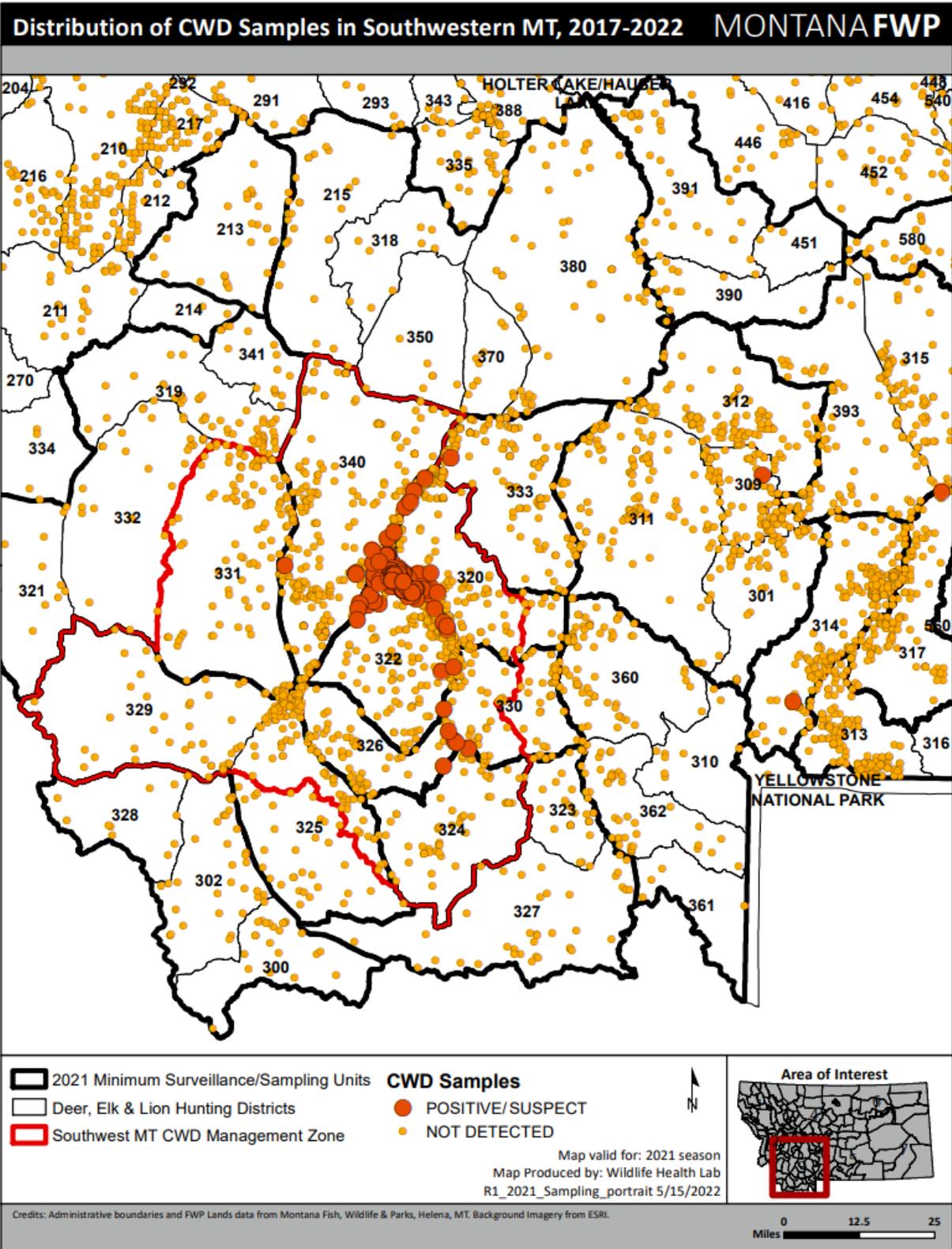
Figure A5. Map of sampling locations and positive/suspect white-tailed deer, mule deer, elk, and moose in southwestern Montana from 2017-2022.
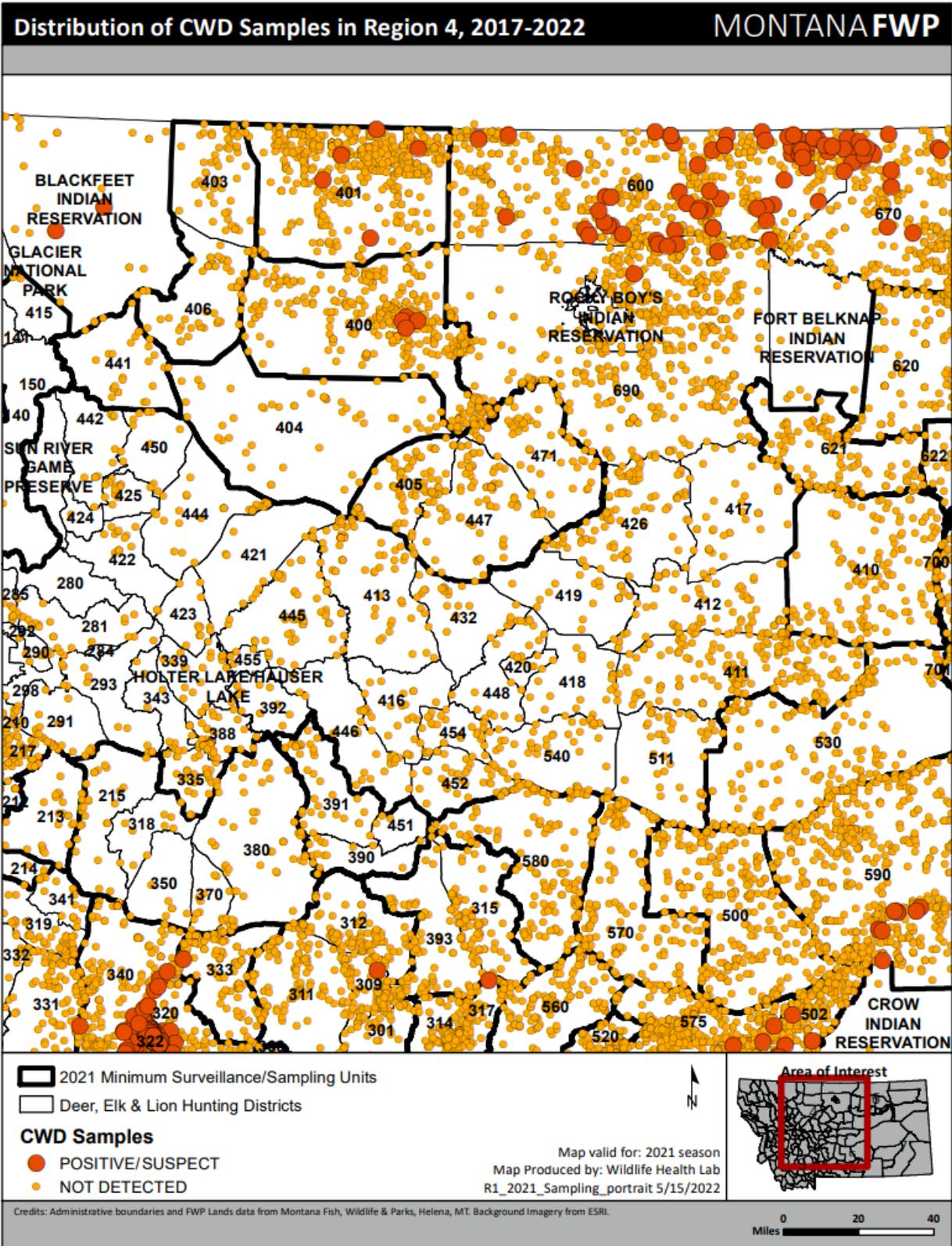
Figure A6. Map of sampling locations and positive/suspect white-tailed deer, mule deer, elk, and moose in FWP Administrative Region 4 from 2017-2022.
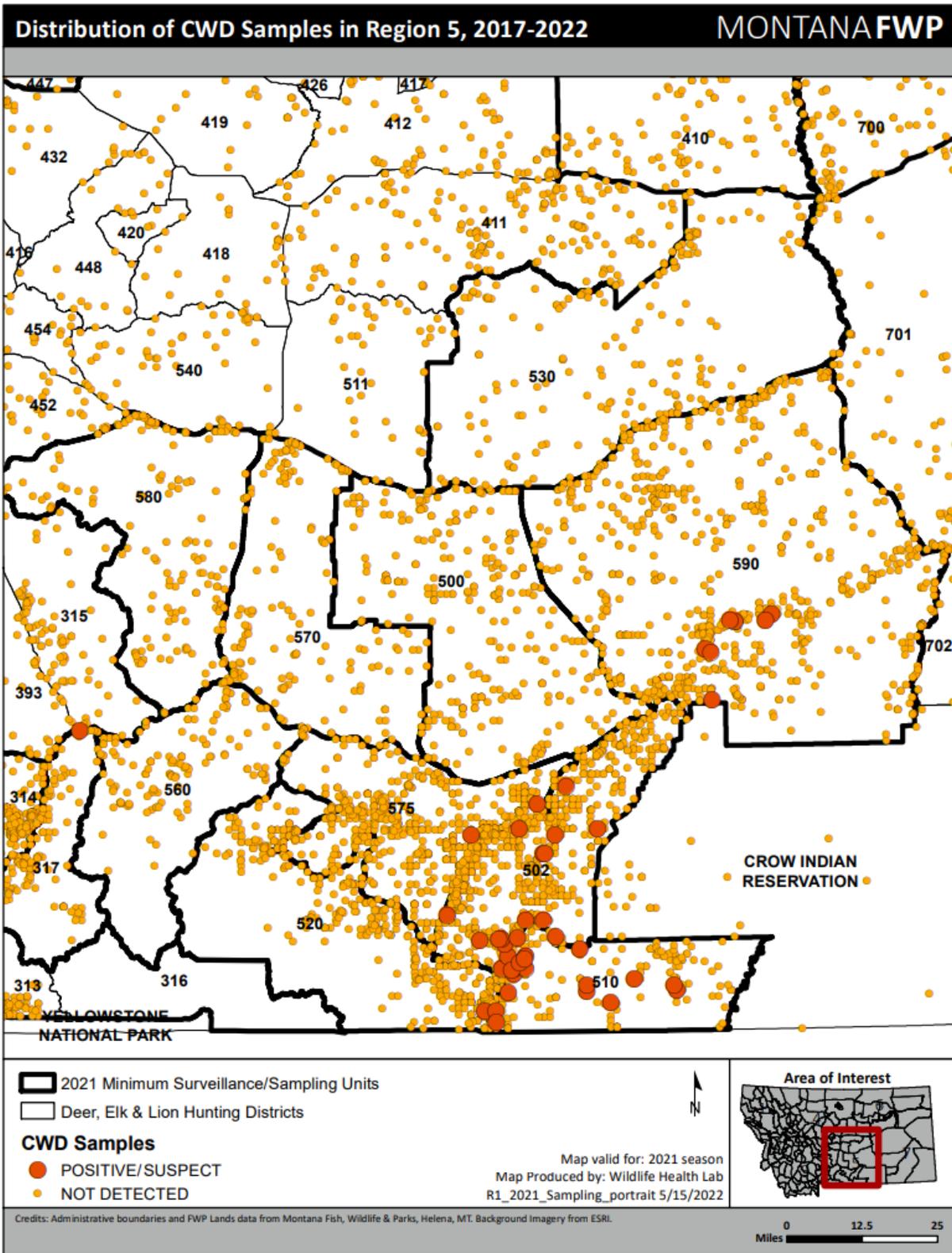
Figure A7. Map of sampling locations and positive/suspect white-tailed deer, mule deer, elk, and moose in FWP Administrative Region 5 from 2017-2022.
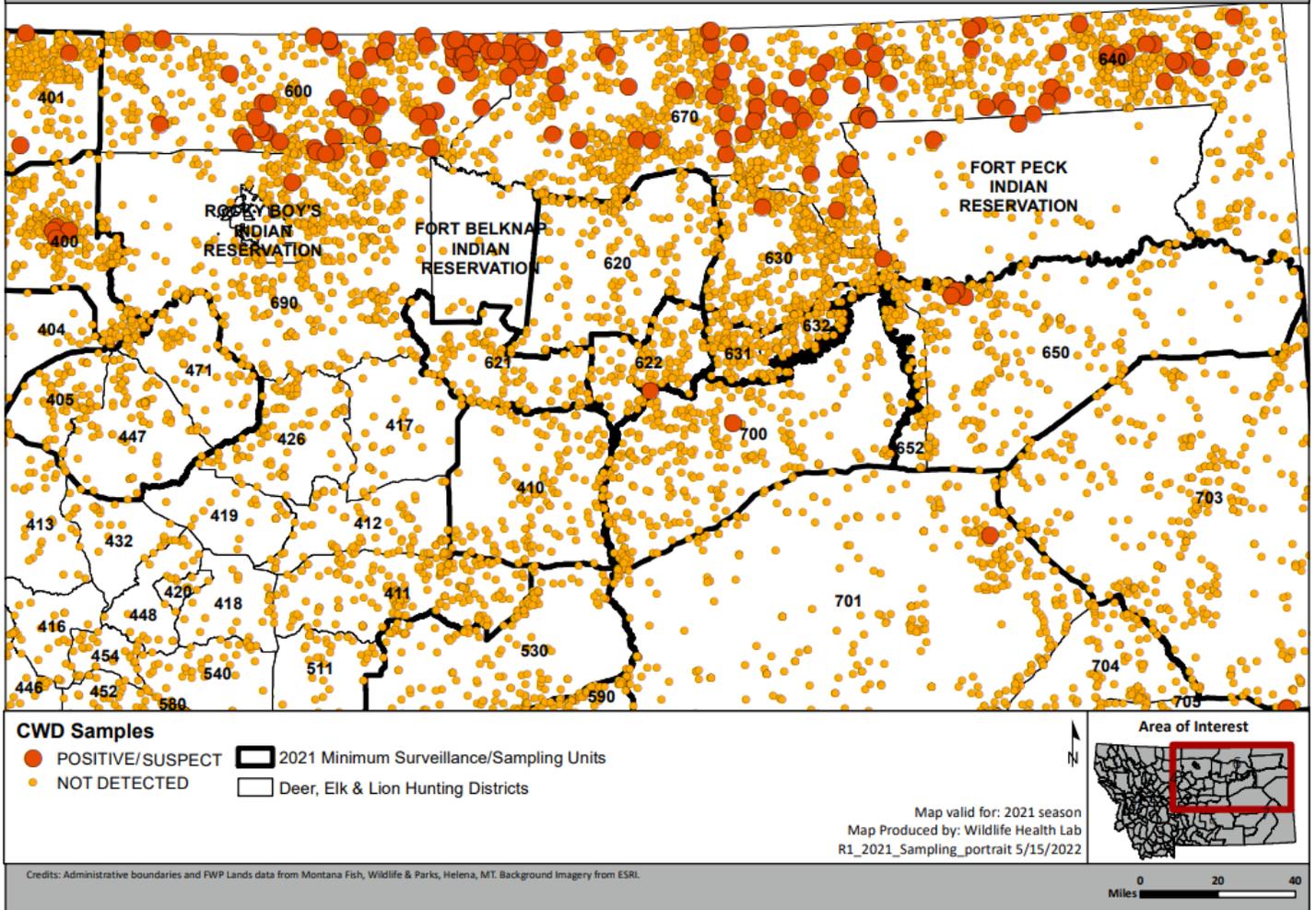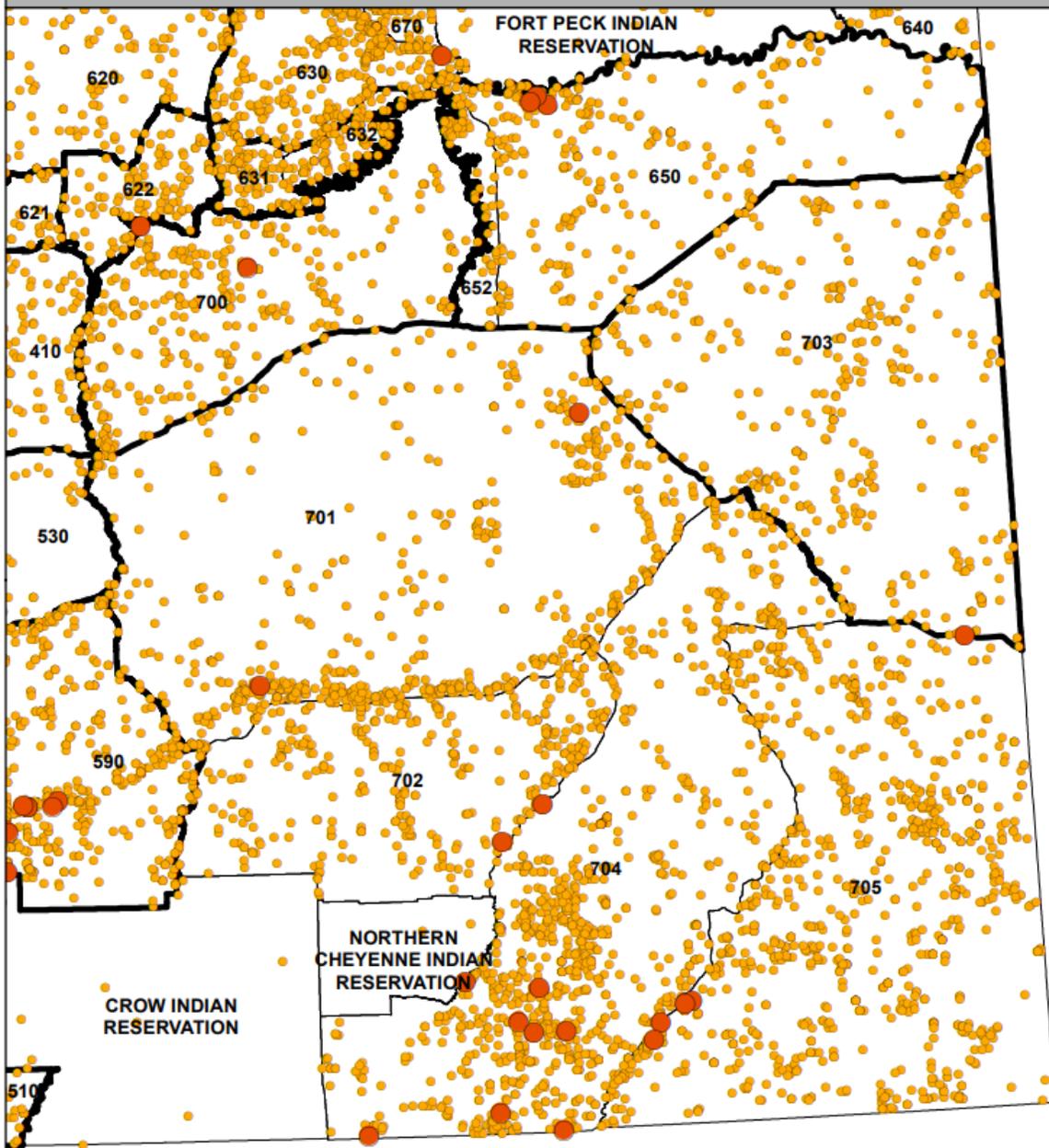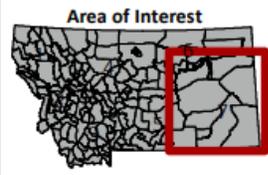
Figure A8. Map of sampling locations and positive/suspect white-tailed deer, mule deer, elk, and moose in FWP Administrative Region 6 from 2017-2022.

Figure A9. Map of sampling locations and positive/suspect white-tailed deer, mule deer, elk, and moose in Southeastern Montana from 2017-2022.

Appendix II.

Table A1. Estimated CWD prevalence by hunting district (HD) and species, using data from All-time Sampling (2017-2022) and 2019-2022 Sampling from hunter-harvested or agency removed (i.e. in Libby) animals. The lower (LB) and upper (UB) 95% confidence intervals are provided along with sample size (N) and total number of positives by species in each HD.

HD	Species	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
			All-time Sampling					**2019-2022 Sampling**			
100	Elk	24	0	0	0	0.14	24	0	0	0	0.14
100	MD	105	3	0.03	0.01	0.08	105	3	0.03	0.01	0.08
100	Moose	19	1	0.05	0.01	0.25	19	1	0.05	0.01	0.25
100	WTD	979	58	0.06	0.05	0.08	979	58	0.06	0.05	0.08
101	Elk	6	0	0	0	0.39	6	0	0	0	0.39
101	MD	17	0	0	0	0.18	17	0	0	0	0.18
101	Moose	2	0	0	0	0.66	2	0	0	0	0.66
101	WTD	202	0	0	0	0.02	202	0	0	0	0.02
102	Elk	5	0	0	0	0.43	5	0	0	0	0.43
102	MD	18	0	0	0	0.18	18	0	0	0	0.18
102	Moose	6	0	0	0	0.39	6	0	0	0	0.39
102	WTD	197	0	0	0	0.02	197	0	0	0	0.02
103	Elk	30	0	0	0	0.11	30	0	0	0	0.11
103	MD	150	0	0	0	0.02	150	0	0	0	0.02
103	Moose	11	1	0.09	0.02	0.38	11	1	0.09	0.02	0.38
103	WTD	1116	15	0.01	0.01	0.02	1116	15	0.01	0.01	0.02
104	Elk	12	0	0	0	0.24	12	0	0	0	0.24
104	MD	29	0	0	0	0.12	29	0	0	0	0.12
104	Moose	3	0	0	0	0.56	3	0	0	0	0.56
104	WTD	730	36	0.05	0.04	0.07	730	36	0.05	0.04	0.07
109	Elk	4	0	0	0	0.49	4	0	0	0	0.49
109	MD	15	0	0	0	0.2	15	0	0	0	0.2
109	Moose	1	0	0	0	0.79	1	0	0	0	0.79
109	WTD	89	0	0	0	0.04	89	0	0	0	0.04
110	Elk	4	0	0	0	0.49	4	0	0	0	0.49

HD	Species	All-time Sampling					2019-2022 Sampling				
		N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
110	MD	2	0	0	0	0.66	2	0	0	0	0.66
110	Moose	3	0	0	0	0.56	3	0	0	0	0.56
110	WTD	57	0	0	0	0.06	57	0	0	0	0.06
120	Elk	11	0	0	0	0.26	11	0	0	0	0.26
120	MD	15	0	0	0	0.2	15	0	0	0	0.2
120	Moose	1	0	0	0	0.79	1	0	0	0	0.79
120	WTD	252	0	0	0	0.02	252	0	0	0	0.02
121	Elk	24	0	0	0	0.14	24	0	0	0	0.14
121	MD	15	0	0	0	0.2	15	0	0	0	0.2
121	Moose	1	0	0	0	0.79	1	0	0	0	0.79
121	WTD	128	0	0	0	0.03	128	0	0	0	0.03
122	Elk	14	0	0	0	0.22	13	0	0	0	0.23
122	MD	23	0	0	0	0.14	23	0	0	0	0.14
122	Moose	2	0	0	0	0.66	2	0	0	0	0.66
122	WTD	159	0	0	0	0.02	159	0	0	0	0.02
123	Elk	13	0	0	0	0.23	13	0	0	0	0.23
123	MD	6	0	0	0	0.39	6	0	0	0	0.39
123	WTD	29	0	0	0	0.12	29	0	0	0	0.12
124	Elk	6	0	0	0	0.39	6	0	0	0	0.39
124	MD	1	0	0	0	0.79	1	0	0	0	0.79
124	WTD	2	0	0	0	0.66	2	0	0	0	0.66
130	Elk	5	0	0	0	0.43	5	0	0	0	0.43
130	MD	2	0	0	0	0.66	2	0	0	0	0.66
130	WTD	206	0	0	0	0.02	206	0	0	0	0.02
140	Elk	4	0	0	0	0.49	4	0	0	0	0.49
140	Moose	1	0	0	0	0.79	1	0	0	0	0.79
140	WTD	29	0	0	0	0.12	28	0	0	0	0.12
141	WTD	2	0	0	0	0.66	2	0	0	0	0.66
150	WTD	2	0	0	0	0.66	2	0	0	0	0.66
170	Elk	16	0	0	0	0.19	16	0	0	0	0.19
170	MD	15	0	0	0	0.2	15	0	0	0	0.2
170	WTD	184	0	0	0	0.02	183	0	0	0	0.02

| HD | Species | All-time Sampling | | | | | 2019-2022 Sampling | | | | |
		N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
200	WTD	9	0	0	0	0.3	9	0	0	0	0.3
201	Elk	5	0	0	0	0.43	5	0	0	0	0.43
201	MD	4	0	0	0	0.49	4	0	0	0	0.49
201	WTD	22	0	0	0	0.15	22	0	0	0	0.15
202	Elk	1	0	0	0	0.79	1	0	0	0	0.79
202	MD	4	0	0	0	0.49	4	0	0	0	0.49
202	WTD	13	0	0	0	0.23	13	0	0	0	0.23
203	Elk	2	0	0	0	0.66	2	0	0	0	0.66
203	MD	4	0	0	0	0.49	4	0	0	0	0.49
203	WTD	12	0	0	0	0.24	12	0	0	0	0.24
204	Elk	24	0	0	0	0.14	24	0	0	0	0.14
204	MD	1	0	0	0	0.79	1	0	0	0	0.79
204	Moose	1	0	0	0	0.79	1	0	0	0	0.79
204	WTD	26	0	0	0	0.13	26	0	0	0	0.13
210	Elk	38	0	0	0	0.09	14	0	0	0	0.22
210	MD	30	0	0	0	0.11	22	0	0	0	0.15
210	WTD	78	0	0	0	0.05	53	0	0	0	0.07
211	Elk	11	0	0	0	0.26	10	0	0	0	0.28
211	MD	7	0	0	0	0.35	7	0	0	0	0.35
211	WTD	6	0	0	0	0.39	6	0	0	0	0.39
212	Elk	9	0	0	0	0.3	2	0	0	0	0.66
212	MD	18	0	0	0	0.18	11	0	0	0	0.26
212	WTD	11	0	0	0	0.26	7	0	0	0	0.35
213	Elk	16	0	0	0	0.19	14	0	0	0	0.22
213	MD	6	0	0	0	0.39	6	0	0	0	0.39
213	WTD	9	0	0	0	0.3	9	0	0	0	0.3
214	MD	1	0	0	0	0.79	1	0	0	0	0.79
214	WTD	1	0	0	0	0.79	1	0	0	0	0.79
215	Elk	10	0	0	0	0.28	10	0	0	0	0.28
215	MD	7	0	0	0	0.35	7	0	0	0	0.35
215	WTD	3	0	0	0	0.56	3	0	0	0	0.56
216	Elk	4	0	0	0	0.49	3	0	0	0	0.56

HD	Species	\multicolumn{5}{c	}{All-time Sampling}	\multicolumn{5}{c}{2019-2022 Sampling}
		N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
216	MD	14	0	0	0	0.22	14	0	0	0	0.22
216	Moose	1	0	0	0	0.79	1	0	0	0	0.79
216	WTD	17	0	0	0	0.18	17	0	0	0	0.18
217	Elk	14	0	0	0	0.22	10	0	0	0	0.28
217	MD	18	0	0	0	0.18	9	0	0	0	0.3
217	WTD	31	0	0	0	0.11	19	0	0	0	0.17
240	Elk	4	0	0	0	0.49	4	0	0	0	0.49
240	MD	1	0	0	0	0.79	1	0	0	0	0.79
240	WTD	12	0	0	0	0.24	12	0	0	0	0.24
250	Elk	1	0	0	0	0.79	1	0	0	0	0.79
250	WTD	1	0	0	0	0.79	1	0	0	0	0.79
260	Elk	2	0	0	0	0.66	2	0	0	0	0.66
260	WTD	7	0	0	0	0.35	7	0	0	0	0.35
261	Elk	1	0	0	0	0.79	1	0	0	0	0.79
261	WTD	2	0	0	0	0.66	2	0	0	0	0.66
262	Elk	1	0	0	0	0.79	1	0	0	0	0.79
262	MD	4	0	0	0	0.49	4	0	0	0	0.49
262	WTD	10	0	0	0	0.28	10	0	0	0	0.28
270	Elk	7	0	0	0	0.35	7	0	0	0	0.35
270	MD	15	0	0	0	0.2	15	0	0	0	0.2
270	WTD	5	0	0	0	0.43	5	0	0	0	0.43
281	Elk	3	0	0	0	0.56	3	0	0	0	0.56
281	MD	3	0	0	0	0.56	3	0	0	0	0.56
281	WTD	12	0	0	0	0.24	12	0	0	0	0.24
282	MD	1	0	0	0	0.79	1	0	0	0	0.79
282	WTD	1	0	0	0	0.79	1	0	0	0	0.79
283	Elk	1	0	0	0	0.79	1	0	0	0	0.79
283	MD	7	0	0	0	0.35	7	0	0	0	0.35
283	WTD	18	0	0	0	0.18	18	0	0	0	0.18
285	Elk	5	0	0	0	0.43	5	0	0	0	0.43
285	MD	11	0	0	0	0.26	11	0	0	0	0.26
285	WTD	49	0	0	0	0.07	49	0	0	0	0.07

| HD | Species | All-time Sampling | | | | | 2019-2022 Sampling | | | | |
		N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
290	Elk	1	0	0	0	0.79	1	0	0	0	0.79
290	WTD	5	0	0	0	0.43	5	0	0	0	0.43
291	Elk	4	0	0	0	0.49	4	0	0	0	0.49
291	MD	9	0	0	0	0.3	9	0	0	0	0.3
291	WTD	2	0	0	0	0.66	2	0	0	0	0.66
292	Elk	7	0	0	0	0.35	7	0	0	0	0.35
292	MD	6	0	0	0	0.39	6	0	0	0	0.39
292	WTD	37	0	0	0	0.09	37	0	0	0	0.09
293	Elk	3	0	0	0	0.56	3	0	0	0	0.56
293	MD	7	0	0	0	0.35	6	0	0	0	0.39
293	WTD	4	0	0	0	0.49	4	0	0	0	0.49
298	Elk	2	0	0	0	0.66	2	0	0	0	0.66
298	WTD	6	0	0	0	0.39	6	0	0	0	0.39
300	Elk	18	0	0	0	0.18	18	0	0	0	0.18
300	MD	4	0	0	0	0.49	4	0	0	0	0.49
301	Elk	6	0	0	0	0.39	6	0	0	0	0.39
301	MD	13	0	0	0	0.23	13	0	0	0	0.23
301	Moose	1	0	0	0	0.79	1	0	0	0	0.79
301	WTD	25	0	0	0	0.13	25	0	0	0	0.13
302	Elk	14	0	0	0	0.22	14	0	0	0	0.22
302	MD	15	0	0	0	0.2	15	0	0	0	0.2
302	Moose	1	0	0	0	0.79	1	0	0	0	0.79
302	WTD	5	0	0	0	0.43	5	0	0	0	0.43
309	Elk	9	0	0	0	0.3	9	0	0	0	0.3
309	MD	9	0	0	0	0.3	9	0	0	0	0.3
309	WTD	70	0	0	0	0.05	70	0	0	0	0.05
310	Elk	5	0	0	0	0.43	5	0	0	0	0.43
310	MD	2	0	0	0	0.66	2	0	0	0	0.66
310	Moose	1	0	0	0	0.79	1	0	0	0	0.79
311	Elk	20	0	0	0	0.16	19	0	0	0	0.17
311	MD	36	0	0	0	0.1	36	0	0	0	0.1
311	WTD	70	0	0	0	0.05	70	0	0	0	0.05

HD	Species	All-time Sampling					2019-2022 Sampling				
		N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
312	Elk	16	0	0	0	0.19	15	0	0	0	0.2
312	MD	14	0	0	0	0.22	14	0	0	0	0.22
312	Moose	3	0	0	0	0.56	3	0	0	0	0.56
312	WTD	78	0	0	0	0.05	78	0	0	0	0.05
313	Elk	66	0	0	0	0.06	37	0	0	0	0.09
313	MD	75	0	0	0	0.05	26	0	0	0	0.13
313	WTD	3	0	0	0	0.56	NA	NA	NA	NA	NA
314	Elk	231	0	0	0	0.02	218	0	0	0	0.02
314	MD	45	1	0.02	0	0.12	27	1	0.04	0.01	0.18
314	Moose	1	0	0	0	0.79	1	0	0	0	0.79
314	WTD	39	0	0	0	0.09	21	0	0	0	0.15
315	Elk	9	0	0	0	0.3	8	0	0	0	0.32
315	MD	41	0	0	0	0.09	41	0	0	0	0.09
315	WTD	38	0	0	0	0.09	37	0	0	0	0.09
317	Elk	19	0	0	0	0.17	14	0	0	0	0.22
317	MD	47	0	0	0	0.08	21	0	0	0	0.15
317	Moose	1	0	0	0	0.79	1	0	0	0	0.79
317	WTD	48	1	0.02	0	0.11	29	1	0.03	0.01	0.17
318	Elk	8	0	0	0	0.32	8	0	0	0	0.32
318	MD	1	0	0	0	0.79	1	0	0	0	0.79
319	Elk	32	0	0	0	0.11	32	0	0	0	0.11
319	MD	28	0	0	0	0.12	28	0	0	0	0.12
319	Moose	1	0	0	0	0.79	1	0	0	0	0.79
319	WTD	5	0	0	0	0.43	5	0	0	0	0.43
320	Elk	24	0	0	0	0.14	24	0	0	0	0.14
320	MD	30	0	0	0	0.11	30	0	0	0	0.11
320	Moose	2	0	0	0	0.66	2	0	0	0	0.66
320	WTD	208	7	0.03	0.02	0.07	208	7	0.03	0.02	0.07
321	Elk	5	0	0	0	0.43	5	0	0	0	0.43
321	Moose	4	0	0	0	0.49	4	0	0	0	0.49
322	Elk	79	0	0	0	0.05	79	0	0	0	0.05
322	MD	74	1	0.01	0	0.07	74	1	0.01	0	0.07

HD	Species	All-time Sampling					2019-2022 Sampling				
		N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
322	Moose	2	1	0.5	0.09	0.91	2	1	0.5	0.09	0.91
322	WTD	1306	391	0.3	0.28	0.32	1306	391	0.3	0.28	0.32
323	Elk	20	0	0	0	0.16	20	0	0	0	0.16
323	MD	9	0	0	0	0.3	9	0	0	0	0.3
323	WTD	3	0	0	0	0.56	3	0	0	0	0.56
324	Elk	54	0	0	0	0.07	54	0	0	0	0.07
324	MD	4	0	0	0	0.49	4	0	0	0	0.49
324	Moose	1	0	0	0	0.79	1	0	0	0	0.79
324	WTD	14	1	0.07	0.01	0.31	14	1	0.07	0.01	0.31
325	Elk	32	0	0	0	0.11	32	0	0	0	0.11
325	MD	38	0	0	0	0.09	38	0	0	0	0.09
325	Moose	1	0	0	0	0.79	1	0	0	0	0.79
325	WTD	72	0	0	0	0.05	72	0	0	0	0.05
326	Elk	25	0	0	0	0.13	25	0	0	0	0.13
326	MD	27	0	0	0	0.12	27	0	0	0	0.12
326	WTD	52	5	0.1	0.04	0.21	52	5	0.1	0.04	0.21
327	Elk	26	0	0	0	0.13	26	0	0	0	0.13
327	MD	4	0	0	0	0.49	4	0	0	0	0.49
327	Moose	6	0	0	0	0.39	6	0	0	0	0.39
327	WTD	2	0	0	0	0.66	2	0	0	0	0.66
328	Elk	5	0	0	0	0.43	5	0	0	0	0.43
328	MD	4	0	0	0	0.49	4	0	0	0	0.49
328	WTD	2	0	0	0	0.66	2	0	0	0	0.66
329	Elk	15	0	0	0	0.2	15	0	0	0	0.2
329	MD	17	0	0	0	0.18	17	0	0	0	0.18
329	WTD	9	0	0	0	0.3	9	0	0	0	0.3
330	Elk	15	0	0	0	0.2	15	0	0	0	0.2
330	MD	35	0	0	0	0.1	35	0	0	0	0.1
330	Moose	1	0	0	0	0.79	1	0	0	0	0.79
330	WTD	45	1	0.02	0	0.12	45	1	0.02	0	0.12
331	Elk	26	0	0	0	0.13	26	0	0	0	0.13
331	MD	54	0	0	0	0.07	54	0	0	0	0.07

HD	Species	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
				All-time Sampling					**2019-2022 Sampling**		
331	WTD	44	0	0	0	0.08	44	0	0	0	0.08
332	Elk	23	0	0	0	0.14	23	0	0	0	0.14
332	MD	7	0	0	0	0.35	7	0	0	0	0.35
332	Moose	1	0	0	0	0.79	1	0	0	0	0.79
332	WTD	1	0	0	0	0.79	1	0	0	0	0.79
333	Elk	13	0	0	0	0.23	13	0	0	0	0.23
333	MD	23	0	0	0	0.14	23	0	0	0	0.14
333	WTD	108	1	0.01	0	0.05	108	1	0.01	0	0.05
334	Elk	4	0	0	0	0.49	4	0	0	0	0.49
334	Moose	1	0	0	0	0.79	1	0	0	0	0.79
335	Elk	6	0	0	0	0.39	6	0	0	0	0.39
335	MD	20	0	0	0	0.16	20	0	0	0	0.16
335	Moose	2	0	0	0	0.66	2	0	0	0	0.66
335	WTD	3	0	0	0	0.56	3	0	0	0	0.56
339	Elk	4	0	0	0	0.49	4	0	0	0	0.49
339	MD	15	0	0	0	0.2	15	0	0	0	0.2
339	WTD	5	0	0	0	0.43	5	0	0	0	0.43
340	Elk	40	0	0	0	0.09	40	0	0	0	0.09
340	MD	60	0	0	0	0.06	60	0	0	0	0.06
340	Moose	1	0	0	0	0.79	1	0	0	0	0.79
340	WTD	254	8	0.03	0.02	0.06	253	8	0.03	0.02	0.06
341	Elk	5	0	0	0	0.43	5	0	0	0	0.43
341	MD	8	0	0	0	0.32	8	0	0	0	0.32
341	Moose	1	0	0	0	0.79	1	0	0	0	0.79
341	WTD	2	0	0	0	0.66	2	0	0	0	0.66
343	Elk	1	0	0	0	0.79	1	0	0	0	0.79
343	MD	7	0	0	0	0.35	7	0	0	0	0.35
343	WTD	4	0	0	0	0.49	4	0	0	0	0.49
350	Elk	1	0	0	0	0.79	1	0	0	0	0.79
350	MD	5	0	0	0	0.43	5	0	0	0	0.43
350	WTD	1	0	0	0	0.79	1	0	0	0	0.79
360	Elk	32	0	0	0	0.11	32	0	0	0	0.11

HD	Species	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
				All-time Sampling					**2019-2022 Sampling**		
360	MD	20	0	0	0	0.16	20	0	0	0	0.16
360	WTD	29	0	0	0	0.12	28	0	0	0	0.12
361	Elk	2	0	0	0	0.66	2	0	0	0	0.66
361	MD	1	0	0	0	0.79	1	0	0	0	0.79
361	Moose	1	0	0	0	0.79	1	0	0	0	0.79
362	Elk	30	0	0	0	0.11	30	0	0	0	0.11
362	MD	8	0	0	0	0.32	8	0	0	0	0.32
362	WTD	5	0	0	0	0.43	5	0	0	0	0.43
370	Elk	3	0	0	0	0.56	3	0	0	0	0.56
370	MD	7	0	0	0	0.35	7	0	0	0	0.35
370	WTD	2	0	0	0	0.66	2	0	0	0	0.66
380	Elk	24	0	0	0	0.14	24	0	0	0	0.14
380	MD	32	0	0	0	0.11	32	0	0	0	0.11
380	WTD	22	0	0	0	0.15	22	0	0	0	0.15
388	Elk	8	0	0	0	0.32	8	0	0	0	0.32
388	MD	60	0	0	0	0.06	60	0	0	0	0.06
388	WTD	25	0	0	0	0.13	25	0	0	0	0.13
390	Elk	5	0	0	0	0.43	5	0	0	0	0.43
390	MD	5	0	0	0	0.43	5	0	0	0	0.43
390	WTD	2	0	0	0	0.66	2	0	0	0	0.66
391	Elk	14	0	0	0	0.22	14	0	0	0	0.22
391	MD	15	0	0	0	0.2	15	0	0	0	0.2
391	Moose	1	0	0	0	0.79	1	0	0	0	0.79
391	WTD	4	0	0	0	0.49	4	0	0	0	0.49
392	Elk	1	0	0	0	0.79	1	0	0	0	0.79
392	MD	9	0	0	0	0.3	9	0	0	0	0.3
392	WTD	2	0	0	0	0.66	2	0	0	0	0.66
393	Elk	14	0	0	0	0.22	13	0	0	0	0.23
393	MD	35	0	0	0	0.1	33	0	0	0	0.1
393	Moose	1	0	0	0	0.79	1	0	0	0	0.79
393	WTD	29	0	0	0	0.12	29	0	0	0	0.12
400	Elk	1	0	0	0	0.79	1	0	0	0	0.79

HD	Species	All-time Sampling					2019-2022 Sampling				
		N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
400	MD	441	3	0.01	0	0.02	343	3	0.01	0	0.03
400	WTD	76	1	0.01	0	0.07	58	0	0	0	0.06
401	Elk	59	0	0	0	0.06	18	0	0	0	0.18
401	MD	442	4	0.01	0	0.02	150	3	0.02	0.01	0.06
401	Moose	1	0	0	0	0.79	NA	NA	NA	NA	NA
401	WTD	217	0	0	0	0.02	110	0	0	0	0.03
403	MD	48	0	0	0	0.07	24	0	0	0	0.14
403	WTD	10	0	0	0	0.28	6	0	0	0	0.39
404	MD	34	0	0	0	0.1	31	0	0	0	0.11
404	WTD	17	0	0	0	0.18	17	0	0	0	0.18
405	MD	57	0	0	0	0.06	57	0	0	0	0.06
405	WTD	19	0	0	0	0.17	19	0	0	0	0.17
406	Elk	2	0	0	0	0.66	2	0	0	0	0.66
406	MD	35	0	0	0	0.1	32	0	0	0	0.11
406	WTD	27	0	0	0	0.12	27	0	0	0	0.12
410	Elk	45	0	0	0	0.08	45	0	0	0	0.08
410	MD	98	0	0	0	0.04	98	0	0	0	0.04
410	WTD	6	0	0	0	0.39	6	0	0	0	0.39
411	Elk	32	0	0	0	0.11	32	0	0	0	0.11
411	MD	81	0	0	0	0.05	78	0	0	0	0.05
411	WTD	69	0	0	0	0.05	69	0	0	0	0.05
412	Elk	12	0	0	0	0.24	11	0	0	0	0.26
412	MD	47	0	0	0	0.08	46	0	0	0	0.08
412	WTD	24	0	0	0	0.14	24	0	0	0	0.14
413	Elk	3	0	0	0	0.56	3	0	0	0	0.56
413	MD	29	0	0	0	0.12	29	0	0	0	0.12
413	WTD	19	0	0	0	0.17	19	0	0	0	0.17
415	Elk	2	0	0	0	0.66	2	0	0	0	0.66
415	MD	1	0	0	0	0.79	1	0	0	0	0.79
415	WTD	1	0	0	0	0.79	1	0	0	0	0.79
416	Elk	9	0	0	0	0.3	8	0	0	0	0.32
416	MD	9	0	0	0	0.3	9	0	0	0	0.3

HD	Species	All-time Sampling					2019-2022 Sampling				
		N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
416	WTD	7	0	0	0	0.35	7	0	0	0	0.35
417	Elk	15	0	0	0	0.2	15	0	0	0	0.2
417	MD	25	0	0	0	0.13	24	0	0	0	0.14
417	WTD	2	0	0	0	0.66	2	0	0	0	0.66
418	Elk	1	0	0	0	0.79	1	0	0	0	0.79
418	MD	10	0	0	0	0.28	10	0	0	0	0.28
418	WTD	16	0	0	0	0.19	16	0	0	0	0.19
419	MD	17	0	0	0	0.18	16	0	0	0	0.19
419	WTD	5	0	0	0	0.43	5	0	0	0	0.43
420	Elk	2	0	0	0	0.66	2	0	0	0	0.66
420	MD	1	0	0	0	0.79	1	0	0	0	0.79
420	WTD	1	0	0	0	0.79	1	0	0	0	0.79
421	MD	4	0	0	0	0.49	4	0	0	0	0.49
421	WTD	4	0	0	0	0.49	4	0	0	0	0.49
422	Elk	2	0	0	0	0.66	2	0	0	0	0.66
422	MD	4	0	0	0	0.49	4	0	0	0	0.49
422	WTD	5	0	0	0	0.43	5	0	0	0	0.43
423	MD	13	0	0	0	0.23	13	0	0	0	0.23
423	WTD	1	0	0	0	0.79	1	0	0	0	0.79
425	MD	5	0	0	0	0.43	5	0	0	0	0.43
425	WTD	6	0	0	0	0.39	6	0	0	0	0.39
426	Elk	1	0	0	0	0.79	1	0	0	0	0.79
426	MD	90	0	0	0	0.04	90	0	0	0	0.04
426	WTD	9	0	0	0	0.3	9	0	0	0	0.3
432	Elk	1	0	0	0	0.79	1	0	0	0	0.79
432	MD	15	0	0	0	0.2	15	0	0	0	0.2
432	WTD	10	0	0	0	0.28	10	0	0	0	0.28
441	Elk	4	0	0	0	0.49	3	0	0	0	0.56
441	MD	13	0	0	0	0.23	11	0	0	0	0.26
441	Moose	1	0	0	0	0.79	1	0	0	0	0.79
441	WTD	8	0	0	0	0.32	8	0	0	0	0.32
442	Elk	2	0	0	0	0.66	2	0	0	0	0.66

HD	Species	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
			All-time Sampling					**2019-2022 Sampling**			
442	MD	4	0	0	0	0.49	4	0	0	0	0.49
442	WTD	4	0	0	0	0.49	4	0	0	0	0.49
444	MD	5	0	0	0	0.43	4	0	0	0	0.49
444	WTD	20	0	0	0	0.16	20	0	0	0	0.16
445	Elk	7	0	0	0	0.35	7	0	0	0	0.35
445	MD	25	0	0	0	0.13	25	0	0	0	0.13
445	WTD	24	0	0	0	0.14	24	0	0	0	0.14
446	Elk	2	0	0	0	0.66	2	0	0	0	0.66
446	MD	6	0	0	0	0.39	6	0	0	0	0.39
446	Moose	1	0	0	0	0.79	1	0	0	0	0.79
446	WTD	18	0	0	0	0.18	18	0	0	0	0.18
447	Elk	3	0	0	0	0.56	3	0	0	0	0.56
447	MD	51	0	0	0	0.07	51	0	0	0	0.07
447	WTD	27	0	0	0	0.12	26	0	0	0	0.13
448	Elk	7	0	0	0	0.35	7	0	0	0	0.35
448	MD	12	0	0	0	0.24	12	0	0	0	0.24
448	WTD	6	0	0	0	0.39	6	0	0	0	0.39
450	Elk	3	0	0	0	0.56	3	0	0	0	0.56
450	MD	4	0	0	0	0.49	4	0	0	0	0.49
450	WTD	5	0	0	0	0.43	5	0	0	0	0.43
451	MD	3	0	0	0	0.56	3	0	0	0	0.56
452	Elk	12	0	0	0	0.24	12	0	0	0	0.24
452	MD	16	0	0	0	0.19	15	0	0	0	0.2
452	WTD	15	0	0	0	0.2	15	0	0	0	0.2
454	Elk	11	0	0	0	0.26	11	0	0	0	0.26
454	MD	9	0	0	0	0.3	9	0	0	0	0.3
454	WTD	5	0	0	0	0.43	5	0	0	0	0.43
455	Elk	1	0	0	0	0.79	1	0	0	0	0.79
455	MD	3	0	0	0	0.56	3	0	0	0	0.56
471	Elk	1	0	0	0	0.79	1	0	0	0	0.79
471	MD	61	0	0	0	0.06	60	0	0	0	0.06
471	WTD	3	0	0	0	0.56	3	0	0	0	0.56

HD	Species	All-time Sampling					2019-2022 Sampling				
		N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
500	Elk	12	0	0	0	0.24	11	0	0	0	0.26
500	MD	253	0	0	0	0.01	165	0	0	0	0.02
500	WTD	18	0	0	0	0.18	13	0	0	0	0.23
502	Elk	20	1	0.05	0.01	0.24	16	1	0.06	0.01	0.28
502	MD	459	10	0.02	0.01	0.04	194	8	0.04	0.02	0.08
502	WTD	285	6	0.02	0.01	0.05	106	4	0.04	0.01	0.09
510	Elk	1	0	0	0	0.79	1	0	0	0	0.79
510	MD	219	16	0.07	0.05	0.12	78	7	0.09	0.04	0.17
510	WTD	29	1	0.03	0.01	0.17	9	1	0.11	0.02	0.43
511	Elk	6	0	0	0	0.39	6	0	0	0	0.39
511	MD	27	0	0	0	0.12	27	0	0	0	0.12
511	WTD	10	0	0	0	0.28	10	0	0	0	0.28
520	Elk	51	0	0	0	0.07	33	0	0	0	0.1
520	MD	178	0	0	0	0.02	61	0	0	0	0.06
520	Moose	4	0	0	0	0.49	2	0	0	0	0.66
520	WTD	216	1	0	0	0.03	109	0	0	0	0.03
525	Elk	1	0	0	0	0.79	1	0	0	0	0.79
530	Elk	12	0	0	0	0.24	12	0	0	0	0.24
530	MD	121	0	0	0	0.03	106	0	0	0	0.03
530	WTD	47	0	0	0	0.08	43	0	0	0	0.08
540	Elk	13	0	0	0	0.23	13	0	0	0	0.23
540	MD	21	0	0	0	0.15	21	0	0	0	0.15
540	WTD	20	0	0	0	0.16	17	0	0	0	0.18
555	Elk	1	0	0	0	0.79	1	0	0	0	0.79
560	Elk	19	0	0	0	0.17	15	0	0	0	0.2
560	MD	59	0	0	0	0.06	30	0	0	0	0.11
560	WTD	59	0	0	0	0.06	54	0	0	0	0.07
570	Elk	7	0	0	0	0.35	7	0	0	0	0.35
570	MD	80	0	0	0	0.05	49	0	0	0	0.07
570	WTD	69	0	0	0	0.05	66	0	0	0	0.06
575	Elk	20	0	0	0	0.16	17	0	0	0	0.18
575	MD	462	2	0	0	0.02	174	1	0.01	0	0.03

HD	Species	All-time Sampling					2019-2022 Sampling				
		N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
575	WTD	264	0	0	0	0.01	145	0	0	0	0.03
580	Elk	44	0	0	0	0.08	44	0	0	0	0.08
580	MD	35	0	0	0	0.1	35	0	0	0	0.1
580	WTD	72	0	0	0	0.05	72	0	0	0	0.05
590	Elk	47	0	0	0	0.08	37	0	0	0	0.09
590	MD	520	0	0	0	0.01	344	0	0	0	0.01
590	WTD	271	7	0.03	0.01	0.05	252	7	0.03	0.01	0.06
600	Elk	7	0	0	0	0.35	7	0	0	0	0.35
600	MD	742	56	0.08	0.06	0.1	509	46	0.09	0.07	0.12
600	Moose	1	0	0	0	0.79	1	0	0	0	0.79
600	WTD	175	8	0.05	0.02	0.09	123	8	0.07	0.03	0.12
620	Elk	4	0	0	0	0.49	2	0	0	0	0.66
620	MD	162	0	0	0	0.02	111	0	0	0	0.03
620	WTD	39	0	0	0	0.09	30	0	0	0	0.11
621	Elk	17	0	0	0	0.18	16	0	0	0	0.19
621	MD	83	0	0	0	0.04	69	0	0	0	0.05
621	WTD	6	0	0	0	0.39	6	0	0	0	0.39
622	Elk	27	0	0	0	0.12	26	0	0	0	0.13
622	MD	79	1	0.01	0	0.07	69	1	0.01	0	0.08
622	WTD	2	0	0	0	0.66	1	0	0	0	0.79
630	Elk	1	0	0	0	0.79	1	0	0	0	0.79
630	MD	331	1	0	0	0.02	269	1	0	0	0.02
630	Moose	2	0	0	0	0.66	2	0	0	0	0.66
630	WTD	163	1	0.01	0	0.03	140	1	0.01	0	0.04
631	Elk	9	0	0	0	0.3	8	0	0	0	0.32
631	MD	83	0	0	0	0.04	72	0	0	0	0.05
631	WTD	1	0	0	0	0.79	NA	NA	NA	NA	NA
632	Elk	4	0	0	0	0.49	4	0	0	0	0.49
632	MD	90	0	0	0	0.04	78	0	0	0	0.05
640	Elk	1	0	0	0	0.79	NA	NA	NA	NA	NA
640	MD	634	33	0.05	0.04	0.07	526	30	0.06	0.04	0.08
640	WTD	242	1	0	0	0.02	209	1	0	0	0.03

HD	Species	All-time Sampling					2019-2022 Sampling				
		N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
650	MD	245	3	0.01	0	0.04	240	3	0.01	0	0.04
650	WTD	51	0	0	0	0.07	51	0	0	0	0.07
652	MD	55	0	0	0	0.07	55	0	0	0	0.07
652	WTD	4	0	0	0	0.49	4	0	0	0	0.49
670	Elk	2	0	0	0	0.66	2	0	0	0	0.66
670	MD	1206	49	0.04	0.03	0.05	940	44	0.05	0.04	0.06
670	WTD	211	3	0.01	0	0.04	156	2	0.01	0	0.05
690	Elk	17	0	0	0	0.18	17	0	0	0	0.18
690	MD	594	3	0.01	0	0.01	577	3	0.01	0	0.02
690	WTD	132	1	0.01	0	0.04	126	1	0.01	0	0.04
700	Elk	62	0	0	0	0.06	61	0	0	0	0.06
700	MD	237	1	0	0	0.02	236	1	0	0	0.02
700	WTD	24	0	0	0	0.14	24	0	0	0	0.14
701	Elk	16	0	0	0	0.19	16	0	0	0	0.19
701	MD	395	1	0	0	0.01	393	1	0	0	0.01
701	WTD	242	1	0	0	0.02	240	1	0	0	0.02
702	Elk	15	0	0	0	0.2	15	0	0	0	0.2
702	MD	270	0	0	0	0.01	268	0	0	0	0.01
702	WTD	49	1	0.02	0	0.11	49	1	0.02	0	0.11
703	Elk	6	0	0	0	0.39	6	0	0	0	0.39
703	MD	281	0	0	0	0.01	280	0	0	0	0.01
703	WTD	130	0	0	0	0.03	130	0	0	0	0.03
704	Elk	90	0	0	0	0.04	89	0	0	0	0.04
704	MD	775	7	0.01	0	0.02	767	7	0.01	0	0.02
704	WTD	153	3	0.02	0.01	0.06	153	3	0.02	0.01	0.06
705	Elk	27	0	0	0	0.12	27	0	0	0	0.12
705	MD	684	0	0	0	0.01	683	0	0	0	0.01
705	WTD	248	4	0.02	0.01	0.04	248	4	0.02	0.01	0.04

Appendix III.

Table A1. Logistic generalized linear mixed models used to evaluate the odds of infection as a function of species (mule deer vs. white-tailed deer), sex, age class (young of the year, yearlings, adults), and whether the animal was from the Libby or Southwestern MT CWD Management Area (ManagementArea=1) or from outside these areas (ManagementArea =0). Models are ranked from best supported to least supported. All complete deer records were included in this analysis (n=17308).

Model	AIC	Delta AIC	Relative model likelihood	AIC weight
Infected~ 1+ Species + Sex + Species*Sex + AgeClass + ManagementArea + ManagementArea*Species + (1|HD)	4614.42	0.00	1	1
Infected~ 1+ Species + Sex + Species*Sex + AgeClass + ManagementArea + (1|HD)	4670.60	56.19	0.06	0
Infected~ 1+ Species + Sex + Species*Sex + AgeClass + (1|HD)	4745.76	131.34	0	0
Infected~ 1+ Species + Sex + AgeClass + (1|HD)	4771.03	156.62	0	0
Infected~ 1+ Species + Sex + Species*Sex + (1|HD)	4836.99	222.58	0	0
Infected~ 1+ Species + Sex + (1|HD)	4864.33	249.91	0	0
Infected~ 1+ Species + (1|HD)	4883.79	269.37	0	0

Table A2. Logistic Generalized Linear Mixed Models used to evaluate the odds of infection for deer as a function of species, sex, age class, and timing of harvest (pre-rut vs. rut/post-rut), whether the animal was from the Libby or Southwestern MT CWD Management Area (ManagementArea=1) or from outside these areas (ManagementArea =0). Models are ranked from best supported to least supported. All complete deer records from the general rifle season were included in this analysis (October 27-November 27; n=13320).

Model	AIC	Delta AIC	Relative model likelihood	AIC weight
Infected~ 1+ Species + Sex + Species*Sex + AgeClass + ManagementArea + ManagementArea*Species + HarvestTiming + (1|HD)	3545.16	0	1	0.92
Infected~ 1+ Species + Sex + Species*Sex + AgeClass + ManagementArea + ManagementArea*Species + (1|HD)	3550.18	5.01	0.78	0.08
Infected~ 1+ Species + Sex + Species*Sex + AgeClass + HarvestTiming + (1|HD)	3641.56	96.40	0.01	0
Infected~ 1+ Species + Sex + Species*Sex + AgeClass + (1|HD)	3644.56	99.40	0.01	0
Infected~ 1+ Species + Sex + Species*Sex + HarvestTiming + Sex* HarvestTiming + (1|HD)	3712.29	167.13	0	0
Infected~ 1+ Species + Sex + Species*Sex + HarvestTiming + (1|HD)	3712.31	167.15	0	0
Infected~ 1+ Species + Sex + Species*Sex + HarvestTiming + Species* HarvestTiming + (1|HD)	3714.30	169.14	0	0
Infected~ 1+ Species + Sex + Species*Sex + (1|HD)	3714.87	169.71	0	0
Infected~ 1+ Species + Sex + (1|HD)	3737.61	192.44	0	0
Infected~ 1+ Species + (1|HD)	3761.22	216.06	0	0

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