



Colorado Chronic Wasting Disease Response Plan



December 2018

MISSION

The mission of Colorado Parks and Wildlife (CPW) is *“to perpetuate the wildlife resources of the state, to provide a quality state parks system, and to provide enjoyable and sustainable outdoor recreation opportunities that educate and inspire current and future generations to serve as active stewards of Colorado’s natural resources.”*

STRATEGIC PLAN

CPW’s strategic plan identifies six goals that contribute to the achievement of the agency’s mission. Goal 1 of the plan sets out to *“conserve wildlife and habitat to ensure healthy sustainable populations and ecosystems,”* ensuring that fish and wildlife populations persist through use of science, habitat preservation, harvest, and other management tools.

COLORADO MULE DEER STRATEGY

CPW’s Colorado West Slope Mule Deer Strategy states that *“together with the public and stakeholders, CPW will work to stabilize, sustain and increase mule deer populations in western Colorado and, in turn, increase hunting and wildlife-related recreational opportunities.”* One of the strategic priorities set in the strategy is to *“maintain a strong ungulate population and disease monitoring program and conduct applied research to improve management of deer populations.”*

NOTE FROM THE DIRECTOR

As laid out in the agency’s mission, strategic plan, and formalized strategic approaches to deer management, CPW maintains the responsibility of ensuring the perpetuation of healthy, sustainable wildlife populations and ecosystems for the well-being and enjoyment of all. Therefore, it is the agency’s duty to conduct applied research, monitoring, and management to minimize the adverse effects chronic wasting disease has on Colorado’s deer, elk and moose populations. It is also the agency’s duty to manage CWD to provide enjoyable and sustainable outdoor recreation opportunities over the long-term. CPW recognizes that some management efforts may be difficult to endure at local scales in the short term but necessary for the holistic benefit of the state’s natural resources. This agency’s CWD management objective is to maximize control of CWD prevalence while minimizing the impact of both this disease and its management on Colorado’s deer, elk and moose herds.

Bob Broscheid, Director
Colorado Parks and Wildlife

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I. Executive Summary

To Be Completed After July 25th Meeting

DRAFT

II. Definitions

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

Attractant - any visual, audible or scented material intended to attract a species of wildlife to a given location.

Unintentional attractant - an attractant (defined above) that is not intentionally placed for the purpose of attracting a particular wildlife species but does so nonetheless. Examples could include salt blocks for livestock, ornamental water catchments, hay stacks, crop spills, etc.

Bull:cow ratio - the relative number of male elk per every 100 female elk in a population.

Buck:doe ratio - the relative number of male deer per every 100 female deer in a population.

Calf:cow ratio - the relative number of calf elk per every 100 female elk in a population.

Culling - the intentional removal of animals from a population for a purpose that improves the status of the base population. Generally, culling is accomplished via lethal removal by governmental employees or contracted agents.

Data Analysis Unit (DAU) - a defined geographic area that provides the framework to manage individual herds of big game animals. DAUs are generally discrete geographically, and attempt to identify a distinct big game population. However, individual animal movements may at times straddle or encompass more than one DAU. While DAU boundaries are administrative, they represent the best way to encompass the majority of a herd within a biological area, and allow the most practical application of management tools such as hunting to reach objectives.

Fawn:doe ratio - the relative number of fawn deer per every 100 female deer in a population.

Foci - a

Game Management Unit (GMU) - a defined geographic area that provides a practical framework where management goals can be refined and applied on a finer scale than a DAU, typically through hunting regulations.

Homeowners Association (HOA) - an organization that is designed to provide rules and regulations governing the behavior of homeowners and the allowable construction materials, landscaping, etc. within a private community.

Herd Management Plan (HMP) - a written narrative and analysis on individual populations of big game in specific geographic areas that establish herd management objectives through an open public process. Plans frame the best scientific population information in the context of

habitat availability and social carrying capacity of a herd into various population objective alternatives. Plan objectives provide the basis for annual regulation development and a reference point for the public, other agencies, and the Colorado Parks and Wildlife Commission to measure progress toward achieving management objectives.

Lure - a scent-based attractant, which usually does not provide an edible reward to an animal.

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

Prevalence - the proportion of a population that is infected by a disease such as CWD, calculated as $[\text{number infected} \div \text{total number sampled}]$ and expressed as a percentage (e.g., 10%), ratio (e.g., 1 in 10), or decimal value between 0 and 1 (e.g., 0.1).

Prion (PrP^{CWD}) - a malformed, disease-associated protein thought to be the infectious agent that causes CWD in a susceptible animal. This malformed protein serves as template to generate additional prions.

Surveillance - efforts to detect the occurrence of a disease such as CWD within a specific species and geographic area where the disease is not already known to occur.

Municipality - a city, town, or other district possessing corporate existence and usually its own local government.

Private Land Only (PLO) - a type of hunting license that permits hunting only on private lands in a defined geographic area.

R3 - shorthand for recruitment, retention, and reactivation efforts by state fish and wildlife agencies put in place to maintain or grow participation in wildlife-related activities and support (financial and social) for agency missions.

Special Hunting Season for Disease Management in Big Game - CPW

Vital rates - the

III. Introduction

History of CWD in Colorado

Colorado's history of experience with chronic wasting disease (CWD) dates to the 1960s, when the syndrome was first recognized by university scientists studying captive mule deer in facilities west of Fort Collins. Initially believed to be a nutritional malady, Dr. Beth Williams diagnosed CWD as a new form of "transmissible spongiform encephalopathy" (now prion disease) in the late 1970s, describing cases in captive deer as well as elk from multiple research facilities in Colorado and Wyoming. This new TSE appeared to be infectious. Within a few years thereafter, symptomatic CWD cases were being diagnosed in free-ranging deer and elk in northcentral Colorado and southeastern Wyoming. By the early 1990s, the growing number of documented cases compelled early attempts to estimate infection rates (prevalence) by sampling harvested and vehicle-killed deer and elk. Applying diagnostic advances that afforded more accurate detection of infected animals, surveys in the late 1990s revealed that CWD already was well-established in much of northeastern Colorado (as well as much of southeastern Wyoming). The foregoing pattern and timeline has in some accounts been portrayed as evidence of CWD's explosive geographic expansion from a single point source, but seems more correctly interpreted as reflecting the exponential increase in *understanding* about CWD distribution as new knowledge, diagnostic tools, and field surveillance methods emerged during 1980–2000, revealing a disease that likely had been present for decades before being recognized.

Many aspects of CWD that were mysteries even into the early 2000s now are well-understood. Chronic wasting disease appears to be caused by one or more strains of infectious prions. One mystery—the ultimate origin(s) of CWD in Colorado and elsewhere—likely never will be solved with certainty. Regardless of their murky origin(s), sustained outbreaks now occur as large and small free-ranging foci throughout much of Colorado and, less often today, in captive wildlife facilities. Natural cases of CWD have occurred in four native host species: mule deer, white-tailed deer, elk, and moose. No immunity, recovery, or absolute resistance to CWD has been documented in any of the susceptible species. However, natural genetic variation in host species can extend survival time and perhaps lower likelihood of infection for individuals of "relatively resistant" genotypes. The disease course typically is measured in years. Clinical signs—altered behavior initially, with body condition declining much later—become progressively apparent later in the disease course. Infection can be detected in carcasses as well as in live animals, and diagnostic tests become increasingly reliable in individual animals as the disease progresses. Chronic wasting disease is infectious. Infected individuals shed prions from several routes during most of the disease course, exposing others either directly or through contamination of shared resources or environments. Shed prions can persist for years in the environment, and their binding to soil elements (e.g., clay) enhances persistence and infectivity. The uncoupling of transmission from the immediate presence of infected animals greatly complicates CWD control. (Miller and Fischer 2016)

Early harvest surveys in the Piceance Basin, Middle Park, the Uncompahgre Plateau, and the Gunnison Basin revealed no evidence of CWD, supporting the notion that occurrence in the

wild was confined to deer and elk herds in the northeastern part of the state. But in early 2002, a cluster of CWD cases was unexpectedly detected in wild mule deer entrapped in a captive wildlife facility near Pagoda in northwest Colorado. Two rounds of agency-sponsored culling in the surrounding area along the Williams Fork River revealed additional cases in mule deer but not elk. In autumn 2002, CPW launched a massive statewide CWD testing campaign focused on hunter-harvested animals, screening approximately 10,800 deer and 14,600 elk. This greatly expanded surveillance revealed that CWD already was far more widespread across northern Colorado than believed just a few years before. Thereafter, Colorado's CWD surveillance and monitoring efforts generally declined in intensity from 2002-2017. In 2003, approximately 7,500 deer and 8,700 elk were tested for CWD. Most of the samples tested during these years came from voluntary submissions, with submissions required only in northeastern units. In the mid to late 2000s, total CWD testing submissions from hunters remained high for some herds and waned in others as CPW relied increasingly on hunters to voluntarily submit samples for testing and the agency's attention shifted to other issues. After 2010, annual prevalence trends in many herds became difficult to track because too few hunters voluntarily submitted samples for testing. Sample sizes were generally too low to provide precise prevalence estimates, thus results were not considered to be representative for many herds. From 2014–2016, CPW's growing concern about changes in apparent prevalence, particularly evidence of sharply increasing prevalence trends in some deer herds in northwest Colorado, led to the decision in late 2016 to resume mandatory testing of hunter-harvested deer. In 2017, CPW required mandatory submissions of all males harvested during rifle seasons in six mule deer herds.

As of July 2018, at least 31 of Colorado's 55 deer herds (56%) are infected with CWD; at least 16 of 43 elk herds (37%) and 2 of 9 moose herds (22%) also are infected. Four of Colorado's five largest deer herds and two of our five largest elk herds are infected with CWD. Infection rates vary between herds. In general, deer herds tend to be more heavily infected than elk herds living in the same geographic area. By comparison, CWD is relatively rare in moose in Colorado. The rate of infection (i.e., percent of animals infected within affected herds) varies from herd to herd. A [table](#) on CPW's web page devoted to CWD reports the most recent 3-year prevalence estimates by herd unit for each species.

In light of the foregoing, the initial focus of CWD monitoring and management in Colorado has been on deer, especially mule deer. Estimated infection rates in several deer herds in the northwest part of Colorado have become sufficiently high to be concerning. The cause for concern is because without management CWD will become more and more common in an infected herd and can eventually cause population level declines over time. Fifteen-year (2003-2017) trends in prevalence were analyzed in the six deer herds included in mandatory testing (Table 1). Prevalence estimates declined or remained relatively constant in two herds where management actions were prescribed to control CWD during this time period. Prevalence in adult males increased in at least one of the remaining four herds (D-07). The largest change in prevalence trends for a single herd (D-07) was a ten-fold increase from 1.5% to 15.3% in fifteen years. The prevalence trend of just the mandatory testing results solidified

concerns about increasing prevalence rates in some herds and prompted the development of a statewide CWD Response Plan.

Table 1. Sample sizes, adult male CWD prevalence estimates, and 95% confidence intervals generated for six Colorado mule deer herds in 2003 and 2017. (Source data: Colorado Parks and Wildlife Disease Tracking System)

DAU (Herd)	2003			2017		
	Sample Size (Adult Males)	Prevalence (%)	95% CI (%)	Sample Size (Adult Males)	Prevalence (%)	95% CI (%)
D-04	409	9.5	6.9-12.8	410	5.6	3.6-8.3
D-07	601	1.5	0.7-2.8	931	15.3	13.3-17.7
D-10	290	11.0	7.7-15.2	208	12.0	7.9-17.2
D-19	55	0.0	0.0-6.5	258	3.9	1.9-7.0
D-40	25	0.0	0.0-13.7	268	1.5	0.4-3.8
D-42	28	0.0	0.0-12.3	230	10.0	6.4-14.6

By convention, for purposes of comparing statistics across North American jurisdictions, prevalence as measured in adult males has become the preferred metric. This is in part because infection is relatively rare in fawns and yearlings and rates among adult (>2 year old) males tend to be about twice that measured among adult females in the same herd, and in part because annual male harvest tends to provide larger and more consistent sample sizes for assessing trends over time and between herds than doe harvest.

All Game Management Units (GMU) in Colorado allow for male harvest every year, whereas not all units allow for female harvest or have had consistent female harvest over time. Furthermore, hunters holding either sex licenses tend to harvest predominantly male deer. For these reasons, there is much higher and more consistent male harvest statewide, which better supports the assessment of long-term trends in prevalence. Consequently, CPW tracks and reports prevalence primarily in adult males when describing CWD prevalence across deer herds.

In addition, Colorado data supports that CWD prevalence rates are generally higher in males than females so there is a greater chance to find CWD in a herd if resources are focused on testing only males. Since adult males (>2 years) are more likely to contract CWD and appear in CWD test results generated from hunter-harvest, they provide the earliest indication of a change in prevalence. Including young males in sampling for prevalence would result in lower prevalence estimates. Unless prevalence thresholds were calibrated lower, a herd would be carried farther into an epidemic and a greater number of adult males and adult females would die from CWD before an intervention was prescribed to control the disease. Consequently, CPW excludes fawns/calves and yearlings when calculating prevalence.

Statement of Purpose

This response plan provides guidance for CPW field staff to manage CWD prevalence within Colorado's deer herds. It strives to maintain CWD prevalence below a realistic management threshold statewide. It includes a suite of actions that local wildlife managers can implement at the individual herd level to control CWD prevalence while achieving population and herd composition objectives within herd management plans. Local managers, working with local constituencies, will determine which actions are best suited to managing CWD issues for each herd. This approach will provide maximum flexibility to maintain healthy big game populations while achieving publicly-derived management objectives.

This response plan addresses one of the disease issues identified within CPW's Colorado West Slope Mule Deer Strategy, published in 2014 (Add citation). The Strategy, developed following extensive public engagement, sets priorities for the agency's management actions designed to halt long-term declines in mule deer populations within Colorado. Specifically, this CWD Response Plan supports the priority to "maintain a strong ungulate population and disease monitoring program and conduct applied research to improve management of deer populations."

CWD Advisory Group

In early 2018, the Colorado Parks and Wildlife Commission established a CWD Advisory Group (CWDAG) following a request for public engagement in the development of the CWD Response Plan. The CWDAG was comprised of representatives of various stakeholder groups: big game outfitting industry, big game hunters, county governments, mule deer and elk conservation organizations, the Parks and Wildlife Commission, and leadership within CPW. The CWDAG relied on the technical expertise of several key CPW personnel who were researchers, biologists and managers with knowledge and experience dealing with CWD.

CWDAG members served as conduits of information to and from the various stakeholder interests as CPW drafted the CWD Response Plan. The CWDAG's role was fundamental to the development of a publicly-approved response plan, although it was solely advisory in nature. Ultimately, the content of the plan was determined by CPW prior to approval by the Parks and Wildlife Commission and implementation.

As a stakeholder process, all CWDAG meetings were open to the public (in person or through conference phone) and included designated public comment periods. Meeting notes, presentations and supporting information was posted online within the CPW website for public review.

The list of management actions considered within this plan was developed following extensive discussions by the CWDAG; they represent the group's assessment of acceptable approaches to controlling the disease within Colorado's ecological and social environments.

Implementation

Within the past two decades, many state wildlife agencies have focused on reducing population densities through a combination of hunter harvest and agency culling, though many of these programs were prematurely terminated due to lack of early measurable success, high personnel and agency costs, and lack of public support (WAFWA 2018). Early termination of these programs and a lack of experimental design precluded proper evaluation of CWD prevalence response to management actions. Consequently, this CWD Response Plan is designed to take a long-term management approach that will test the efficacy of different management actions to control CWD prevalence. Colorado's approach to big game management and hunting license allocation provides ideal conditions to test how CWD responds to management.

Colorado sets management objectives and license numbers for individual herds of big game. Hunting licenses for deer, elk and moose are limited throughout the state and allocated according to GMUs, except for where over-the-counter elk licenses are made available. Most herds include multiple GMUs, which means CPW has the ability to issue licenses at a scale that is smaller than an entire herd. This makes it possible to implement this CWD Response Plan at the herd scale as well as the smaller GMU scale, provided that sufficient CWD prevalence data is available. As mentioned previously, herd-specific management actions prescribed to control CWD will be determined by local herd managers in concert with herd management plan objectives. Hunter harvest will continue to be a primary tool for implementation and controlled through licensing.

IV. Management Objectives

Objective 1: To reduce or maintain CWD prevalence in free-ranging deer, elk and moose herds below the management threshold set in this plan. Prescribed management actions will intend to maximize control of CWD prevalence while minimizing the impact of both this disease and its management on herds.

Objective 2: To provide the public with science-based information regarding CWD

Objective 3: To maintain Colorado's robust deer and elk herds to support public hunting and viewing opportunity

Objective 4: To provide guidance for 15 years of CWD surveillance, monitoring and management in Colorado's deer herds and a framework to test how prevalence responds to prescribed management actions.

V. Surveillance & Monitoring Programs

Surveillance

A sustained, continuous surveillance effort will be needed to detect “new” cases and disease foci in the 24 deer herds, 27 elk herds, and 7 moose herds mostly in the southern half of Colorado where CWD has not already been detected. Harvest surveys likely will not be the most effective or efficient way to detect new CWD foci. Instead, sampling focused individuals falling into higher risk source categories (e.g., symptomatic animals, vehicle-, predator-, or winter-killed adult animals of either sex) has been recommended as a preferred approach. The details of how such an approach would be undertaken in Colorado remains to be determined, but one goal and deliverable of this CWD Response Plan will be for CPW to develop an appendix plan for CWD surveillance in “undetected” herd units by June 2019.

Monitoring and Testing Efficacy of Management Actions

A sustained, continuous monitoring effort will be needed to understand prevalence trends and how prescribed CWD management actions influence prevalence. CPW will implement mandatory testing in select herds to ensure reliable prevalence estimates are obtained in addition to voluntary submissions.

CPW will include deer herds in mandatory testing when they have shown signs of CWD prevalence for several years or herds that are suspected to have high prevalence and are lacking a reliable baseline prevalence estimate. Baseline prevalence estimates are important for understanding the rate of change in prevalence over time. Herds known to have high prevalence will be the highest priority for mandatory testing. CPW will maximize the number of herds tested statewide with finite resources available; both mule deer and white-tailed deer will be tested for CWD.

Not all herds will be included in mandatory testing over time. If detections of CWD have been low or zero in a herd, that herd will not be prioritized for mandatory testing. Instead, other surveillance efforts more appropriate for detecting CWD will be used, including opportunistic testing of live or dead animals suspected to have CWD based on physical appearance or behavior. Free-ranging deer, elk and moose that are symptomatic will be dispatched by CPW personnel and tested for disease. CWD infected cervids are more likely to be killed by vehicles than non-infected animals; therefore, CPW will consider how best to sample roadkill for detecting CWD. When detections suggest prevalence is at a level of concern, that herd may be prioritized for mandatory testing.

15-Year Monitoring Plan

The 15-year monitoring plan using mandatory testing is presented in Table 2. In 2018, six deer herds that differ from those tested in 2017 will be included in mandatory testing. The same approach will be used in 2019, 2020 and 2021. From 2022-2026, mandatory testing will include herds that were previously included in mandatory testing and that are implementing some form of CWD management response, plus addition herds that have not already been

included in mandatory testing. This creates a five-year rotational approach that allows CPW to test a large number of herds statewide with the resources available. In 2027-2031, herds included in mandatory testing during the first and second five-year rotations will again be retested. This rotational approach also allows adequate time to show a meaningful change in CWD prevalence over time while ensuring that upwards of 40 different herds are included in mandatory testing. Reassessment of this 15-year rotational approach will occur throughout the testing period. If at some point elk or moose are included in mandatory testing, the rotational schedule for deer may change.

Conducting mandatory testing in a single herd for consecutive years or every other year likely would not detect a meaningful change in prevalence. CWD is a relatively slow moving disease and annual changes in prevalence would probably fall within the 95% confidence intervals of prevalence estimates generated from large sample sizes. For example, in 2017 CPW tested 931 adult males in a single herd for CWD and the 95% confidence interval generated for the prevalence estimate (15.3%, CL 13.3-17.7) was $\pm 2\%$ prevalence (Table 1). However, sample sizes for the five other herds included in mandatory testing were about one-third of this sample size and had wider confidence intervals ($\sim \pm 4\%$ prevalence). CPW is targeting sample sizes of 300 adult male submissions through mandatory testing and therefore expects 95% confidence intervals on prevalence estimates to be $\pm 2-4\%$. Since annual changes to prevalence are expected to be less than 2%, it may take multiple years to detect any change in prevalence. A 5-year rotational approach should be enough time to test how CWD prevalence responds to prescribed management actions.

Nonetheless, CPW may incentivize voluntary submissions from select herds to yield large sample sizes. Providing an incentive, such as a free CWD test to hunters, may effectively increase the number of samples submitted without requiring mandatory testing. While voluntary submissions may not yield as large of sample sizes as mandatory testing, they may be large enough to generate trustworthy prevalence estimates. CPW has provided incentives in previous years, though efforts have been limited and, in most cases, responses have not yielded a sufficient number of samples to reach targets. Additional factors that must be considered before incentives are offered include the cost of the incentive within a finite budget, personnel available to handle increased volumes of submissions, and whether a cap is created once the targeted sample size is reached.

Cost Projections for the 15-Year Monitoring Plan

Costs associated with the mandatory testing of six deer herds in 2017 and 2018 provide realistic estimates for annual costs of the 15-year monitoring plan. Temporary personnel and CWD testing (enzyme-linked immunosorbent assay, or “ELISA”) costs represent approximately 90% of the annual financial needs for mandatory testing. However, in 2018, lab testing fees increased by 20%, which was not factored into the 2018 budget projection. Furthermore, budget projections are built on an estimated submission rate, which is calculated from an anticipated compliance rate (number of successful hunters that submit a sample for CWD testing) and the anticipated harvest for each herd included in mandatory testing. Compliance

rates are expected to increase over time as more hunters become aware of high prevalence found in some herds.

The annual cost of the 15-year monitoring plan is projected to be \$175,000-\$200,000. This includes mandatory testing of 6-8 herds each year. The maximum number of herds will be included in mandatory testing as finite resources allow. CPW will annually review the budget needs for mandatory testing that are commensurate with annual testing goals.

Table 2: Fifteen-year schedule for mandatory and incentivized CWD testing of deer, including a five-year rotation for testing select herds already included in mandatory testing. Annual costs for mandatory testing would be approximately the same. The five-year rotation will allow an evaluation of how CWD prevalence responds to prescribed management actions.

Year	DAUs (Herds) Included in Mandatory Testing	Incentivized Voluntary Testing
2017	D-04, D-07, D-10, D-19, D-40, D-42	None
2018	D-02, D-05, D-08, D-09, D-12, D-44	D-07
2019	6-8 DAUs not included in 2017-2018	D-02
2020	6-8 DAUs not included in 2017-2019	TBD
2021	6-8 DAUs not included in 2017-2020	TBD
2022	Select DAUs from 2017 Mandatory Testing; New DAUs	TBD
2023	Select DAUs from 2018 Mandatory Testing; New DAUs	TBD
2024	Select DAUs from 2019 Mandatory Testing; New DAUs	TBD
2025	Select DAUs from 2020 Mandatory Testing; New DAUs	TBD
2026	Select DAUs from 2021 Mandatory Testing; New DAUs	TBD
2027	Select DAUs from 2017/2022 Mandatory Testing	TBD
2028	Select DAUs from 2018/2023 Mandatory Testing	TBD
2029	Select DAUs from 2019/2024 Mandatory Testing	TBD
2030	Select DAUs from 2020/2025 Mandatory Testing	TBD
2031	Select DAUs from 2021/2026 Mandatory Testing	TBD

VI. CWD Prevalence Threshold for Compulsory Disease Management

Deciding when to implement management actions to reduce CWD prevalence in a herd is a serious consideration as actions may change the structure of age classes, sex ratio, and population number and density. One approach is to set a prevalence threshold for compulsory intervention at or before the point when mortality from CWD causes an undesirable effect in the herd. If prevalence approaches or exceeds an established threshold put in place to safeguard a herd, adaptive management actions should be taken to ensure a reduction in prevalence over time. Once the herd's prevalence has been reduced to a low level, less aggressive management actions would be needed to prevent CWD prevalence from increasing.

An appropriate threshold for compulsory intervention could be determined based on the level of adult female mortality caused by CWD that would initiate a declining population trend. Population models can be used to predict when a declining trend would occur by entering various adult female survival rates into multiple runs of the same population model with other vital rates being held constant. The difference between the model-derived survival rate for when a population enters a declining trend and the observed adult female survival rate generated from fieldwork represents the maximum annual additive adult female mortality that could be realized before the onset of a population decline (Figure 1). This mathematical difference would be an appropriate maximum threshold for compulsory intervention to ensure a stable population. This approach to determine a threshold for CWD management is only valid when the population is increasing.

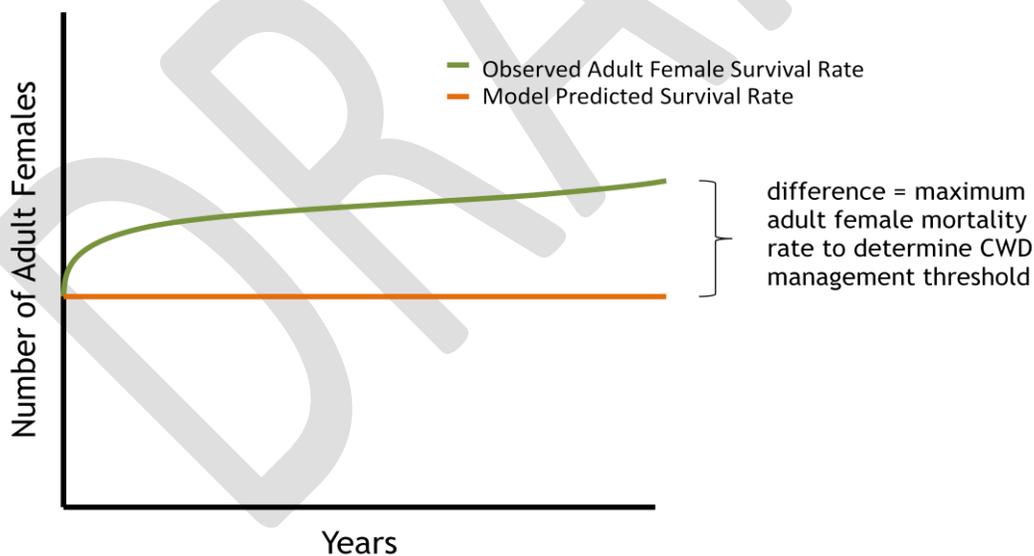


Figure 1. This conceptual exercise displays an approach to determine a prevalence threshold for CWD management. The difference between the observed adult female survival rate and the model predicted stable survival rate represents the maximum annual adult mortality that can be absorbed by the population before the onset of a population decline. This exercise assumes new mortality from CWD is additive.

In the case of a stable population, any increase in adult female mortality would cause a population decline unless other vital rates, such as survival of young, increase. Therefore, if vital rates of a stable population stay the same, an increase in CWD prevalence would initiate a population decline. Likewise, in the case of a declining population, any increase in CWD prevalence would accelerate a population decline. An appropriate CWD management objective for stable or decreasing population would be to minimize CWD prevalence to minimize the affect the disease has on the herd. An appropriate prevalence threshold for compulsory intervention could be set according to the lowest level of CWD prevalence that managers can realistically maintain and is socially acceptable.

CWD Prevalence Threshold for Deer

CPW intensively monitors annual adult female survival and winter fawn survival in five mule deer herds known as Intensive Mule Deer Monitoring Areas. Adult male survival is also monitored in two of the five herds. These herds were selected to ecologically and geographically represent mule deer west of I-25. Survival rates from these herds are used to produce a statewide average survival rate and are used in deer population models.

Colorado's statewide mule deer population has been in a long-term decline. The current statewide average adult female (>2 years) survival rate is approximately 83% and the average adult female survival rate that would cause a statewide decline generated from CPW's population models is approximately 83% (Appendix I). Therefore, any additional adult female mortality will accelerate the declining trend, which means any increase in CWD prevalence will adversely affect the population. Since eradication of CWD is unrealistic, Colorado must accept some level of additive adult female mortality caused by CWD that will contribute to the population decline until statewide average vital rates improve.

The threshold for compulsory intervention that was determined appropriate for deer was not calculated from modeled and observed estimates of adult female survival, but the lowest value of CWD prevalence that CPW believes is possible to manage to minimize adult female mortality. This threshold is 5% prevalence for adult male deer at the scale of individual herds.

For several reasons explained in the Introduction section of this plan, Colorado is predominantly focusing CWD monitoring efforts on male deer. Mandatory CWD testing of hunter harvested male deer is the most effective way to generate a large sample size and small statistical confidence interval for CWD prevalence in each Colorado deer herd. Large sample sizes, thus statistical confidence in prevalence estimates, are not possible for hunter-harvested female deer because few antlerless deer licenses are issued for many herds throughout the state. This justifies using a prevalence threshold for males instead of females.

Considering that CWD monitoring in Colorado has shown that adult female deer typically exhibit CWD infection at half the rate of adult males (>2 years), the 5% adult male prevalence threshold for compulsory intervention is approximately a 2.5% threshold in adult female deer. Recalling that CWD is 100% fatal and animals die from the disease within 2.5 years of infection, roughly half of the infected deer will die each year. Therefore, if a herd has a 5% prevalence threshold for adult males, approximately 2.5% of adult females are infected and

1.25% of adult females will die from CWD each year. This threshold represents the lowest rate of adult male prevalence that is realistic to manage statewide, and consequently the level of adult female mortality that must be tolerated despite the fact that current statewide average vital rates for deer are causing a population decline.

A 5% prevalence threshold is also justified when comparing observed Colorado prevalence data to modeled disease trends showing how CWD infection rate increases over time. Actual CWD monitoring data from Colorado were used to create a composite epidemic curve and compared to a modeled epidemic curve to learn whether actual changes in prevalence for mule deer followed the model (Figure 2). The modeled curve does reflect a similar trend in prevalence observed in the White River herd (D-07) from 2002-2017 where prevalence increased from 1.3% to 15.3%. Other Colorado deer herds also show similar fifteen-year trends to the modeled curve. From a management perspective, maintaining prevalence below the inflection point would prevent a rapid increase in the rate of infection. According to both the modeled curve and the composite field data from Colorado, the inflection point is approximately 5%. (Miller et al. 2000; Ricci et al. 2018)

Composite epidemic curve (field data vs. model)

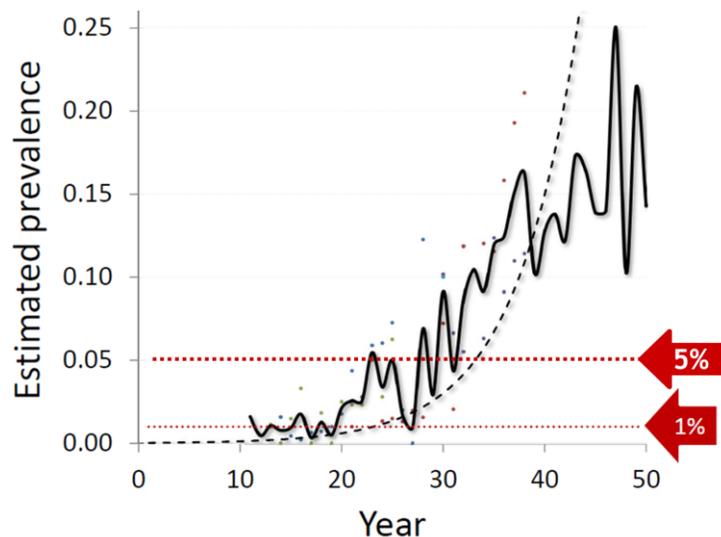


Figure 2. Actual versus modeled CWD epidemic curves show a similar trajectory over time with an inflection point of approximately 5% CWD prevalence. (Miller et al. 2000; Ricci et al. 2018)

Above and Below the 5% Prevalence Threshold

Establishment of a 5% prevalence threshold for compulsory intervention creates two management scenarios:

1. If the CWD prevalence estimate for adult male deer in a herd is greater than or equal to 5%, management actions will be taken to reduce prevalence until it falls below the 5% threshold.

2. If the CWD prevalence estimate for adult male deer in a herd is less than 5%, management actions are recommended to maintain prevalence below the 5% threshold.

How prevalence is reduced, and specifically what management actions are prescribed, will be at the discretion of CPW managers overseeing each herd. The Management Actions section of this response plan reviews the various management approaches CPW may take to reduce prevalence below the 5% threshold. Also, the *rate* at which prevalence is decreased will be decided at the local level by CPW managers, not as part of this statewide CWD response plan. Local managers will refer to the relevant existing herd management plan for both population size and herd composition objectives; actions to control CWD are envisioned to be initially applied at levels to retain the respective objective ranges. For herds that have adult male prevalence rates that exceed 10%, it may take 5-10 years of management action to bring prevalence down below 5%. CPW will make every effort to reduce prevalence to below the threshold within a ten-year period. If, after a reasonable period (10-15 years) of adaptive management, the 5% adult male prevalence threshold proves to be unrealistically low, CPW will reevaluate the statewide management threshold.

CWD Prevalence Threshold for ELK and Moose

Thus far, CWD infection rates in Colorado elk and moose herds appear lower than rates in deer. A review of Colorado prevalence rates shows that prevalence is usually much lower in elk than deer within the same geographic area. The elk herd with the highest CWD prevalence in the state overlaps the highest prevalence deer herd, but prevalence is at least three times higher in deer than elk in this same area. Because the areas of infected elk herds are similar or even the same as for deer, management efforts to reduce prevalence in deer herds are anticipated to also reduce CWD infection in elk, at least in the short term.

Moose appear to be even less likely to contract CWD than deer or elk. Only two cases were detected in from 2015-2017. Although harvest rates are considerably lower for moose than for deer and elk, thus lower hunter-harvest submissions for CWD testing, CPW does not attribute low prevalence estimates in moose to low sample sizes. CPW anticipates that management efforts to reduce prevalence in deer herds will also reduce CWD infection in moose.

A threshold for compulsory intervention has not been determined for elk or moose at this time. CPW will focus CWD management efforts on deer and concurrently monitor prevalence trends for all three species through testing of voluntary submissions. Should the prevalence rates for elk or moose sharply increase, CPW will consider setting an appropriate statewide CWD prevalence threshold for each species.

VII. Herd Management Plans and WAFWA Guidelines

Colorado's deer, elk and moose herds each have varying habitat characteristics, resource limitations, stresses on productivity, harvest strategies, land ownership, human population influences, and history of stochastic events that make each herd unique. CPW's approach to big game management is by design customized to the herd level and implemented through the use of herd management plans, which include an open public process in setting management objectives.

Herd Management Plans (HMP) are a key element of CPW ungulate management programs. HMPs establish local herd management objectives using the best scientific population information in the context of habitat availability and social carrying capacity. HMP objectives provide the basis for development of annual regulations and license setting as well as a reference point for the public, other agencies, and the Parks and Wildlife Commission to measure progress toward achieving management objectives. The components of typical HMPs are population objective ranges and post-hunt sex ratio objective ranges. Population objective ranges are important for managing herds to both biological and social capacity. Likewise, sex ratio objectives are a significant social and biological aspect of herd management planning.

HMPs are central to CWD management. The population and sex-ratio objective ranges will be used to implement management prescriptions and herd managers will incorporate CWD management objectives into HMPs. Therefore, CPW will continue to focus on maintaining current, up-to-date HMPs throughout the state, with added emphasis on deer HMPs. If a herd is scheduled for mandatory testing, revision of that herd's HMP will be scheduled, ideally, immediately following mandatory testing. HMPs are intended to be 10-year plans, which means each HMP would be revised once or twice within the 15-year Monitoring Plan.

WAFWA Recommendations for Adaptive Management of Chronic Wasting Disease in the West
In 2017, the Western Association of Fish and Wildlife Agencies (WAFWA) published recommendations to facilitate the assessment of three CWD suppression strategies using an adaptive management framework in western states ([Recommendations for Adaptive Management of Chronic Wasting Disease in the West](#)). The three main strategies identified for evaluation include: 1) the reduction of artificial points of host concentration, 2) harvest management, and 3) harvest targeting disease foci. Furthermore, WAFWA recommends using a Before-After-Control-Impact (BACI) design to determine what treatments most effectively influence CWD prevalence. CPW is already well-suited to use a BACI design with annual estimation of CWD prevalence for designated herds, a thorough understanding of similarities between herds, and a long list of management actions that can be used as treatments for "matching pairs" of herds. The list of possible management actions discussed in this CWD Response Plan incorporate the suppression strategies identified by WAFWA.

The statewide guidance included in this CWD Response Plan intends to provide herd managers with maximum flexibility to customize management actions that will reduce or maintain CWD prevalence below the 5% prevalence threshold. The management actions included in this plan

will all be considered when herd managers are determining how to respond to CWD prevalence estimates that are above or below the threshold. The management actions and recommendations do not exclude new ideas; CPW anticipates the number of actions to change over time within an adaptive approach to managing CWD.

VIII. Management Actions and Recommendations to Control CWD Prevalence

A. *Reduce Population or Density*

If the 5% prevalence threshold for adult males is met or exceeded in a herd, the CWD management response may be to reduce population or the density of animals in specific areas. If this management action is selected, herd managers will strive to reduce population to the lower end of the population objective range identified in the herd management plan. Since the population objective range has already been approved through a public process, a formal public process will not be conducted when managers implement a CWD management response. Hunter harvest will be the primary tool used to reach the bottom of the range.

The rate at which the herd is reduced will be determined by the herd managers, though managers should strive to reduce population to the lower end of the HMP population objective range and reduce prevalence to below the 5% threshold for adult males within ten years. When prevalence exceeds 10%, it is recommended that herds are aggressively reduced during the years between the first and second round of mandatory testing for that herd.

Treatments prescribed to reduce or maintain prevalence should go into effect the year following when mandatory testing was initiated. That same herd will be retested under mandatory testing within a 5-year window, according to the 15-year Monitoring Plan. If changes to prevalence have not been realized, the intensity of the prescription may be increased. If the population has reached the bottom of the objective range set in the HMP and CWD prevalence is still above the 5% threshold, CPW will consider revision of the HMP objectives.

The following list of tactics will be considered as possible treatments for reducing population or density and may be expanded over time:

- Increase female and/or either sex hunting licenses
- Increase harvest in later seasons or high prevalence areas
- Increase opportunities for harvest, such as increasing access, the availability of PLO licenses, hunting on open spaces, and new special hunts for youth, R3 and new hunter programs
- Increase harvest by creating a Special Hunting Season for Disease Management in Big Game
- Increase harvest through targeted population reductions not related to hunter harvest. In areas where hunters are not able to access herds, CPW will consider the use of focused herd reduction measures as a last resort.
- Increase hunter access of all types through specialized strategies or programs

B. Reduce Male/Female Ratio

If the 5% prevalence threshold for adult males is met or exceeded in a herd, the CWD management response may be to reduce the ratio of males to females. If this management action is selected, herd managers will strive to reduce male:female ratio to no lower than the lower end of the sex ratio objective range identified in the herd management plan. Since the sex ratio objective range has already been approved through a public process, a formal public process will not be conducted when managers implement a CWD management response. Hunter harvest will be the primary tool used to reach the lower end of the range.

This management action is expected to be commonly used for deer because adult male deer typically have twice the infection rate as adult females. Reducing the segment of the herd with the highest prevalence should effectively reduce prevalence in the short term. Additionally, of all Colorado deer herds that have classification data, 70% (35 out of 50 herds) have a 3-year average of observed sex ratios that exceeds the top of the HMP sex ratio objective range. This statistic does include several HMPs that have not been updated in many years and current management objectives do not match the outdated HMP objectives; these outdated plans are scheduled for revision.

The rate at which the sex ratio is reduced will be determined by the herd managers, though managers should strive to reduce the sex ratio to the lower end of the HMP sex ratio objective range and reduce prevalence to below the 5% threshold for adult males within ten years. When prevalence exceeds 10%, it is recommended that the sex ratio is aggressively reduced during the years between the first and second round of mandatory testing for that herd.

Treatments prescribed to reduce or maintain prevalence should go into effect the year following mandatory testing. That same herd will be retested under mandatory testing within a 5-year window according to the 15-year Monitoring Plan. If changes to prevalence have not been realized, the intensity of the prescription may be increased. If the sex ratio has reached the bottom of the objective range set in the HMP and CWD prevalence is still above the 5% threshold, CPW will consider revision of the HMP objectives.

The following list of tactics will be considered as possible treatments for reducing the sex ratio:

- Increase male hunting licenses
- Increase male harvest in later seasons or in high prevalence areas
- Shift male harvest from early seasons to later seasons in high prevalence areas
- Adjust hunt codes to focus harvest in specific areas
- Eliminate float groups to better control hunter pressure across seasons
- Increase opportunities for male harvest, such as changing male licenses from List A to List B, increasing the availability of PLO licenses, hunting on open spaces, and creating new special hunts for youth, R3 and new hunter programs

- Increase male harvest by creating a Special Hunting Season for Disease Management in Big Game

C. Change Age Structure

Colorado data has shown that at current prevalence rates, the age classes of deer most likely to be infected are 4-6-year-old males. Without changing the population or sex ratio, managers could change a herd's age structure to reduce the number of 4-6-year-old males and increase the number of 1-3-year-old males. Managers would likely implement antler point restrictions to increase harvest of adult males. However, antler point restrictions create an additional regulation to enforce, they assume harvest of adult males will increase, and they may create a surge of younger males entering the mature age classes after a few years of implementation. If deer behavior changes and males become nocturnal, reduction in population or sex ratio may still be necessary.

The following list of tactics will be considered as possible treatments to change the age structure:

- Shift male harvest from early seasons to later seasons in high prevalence areas
- Eliminate float groups to better control hunter pressure across seasons
- Increase opportunities for male harvest, such as changing male licenses from List A to List B, increasing the availability of PLO licenses, hunting on open spaces, and creating new special hunts for youth, R3 and new hunter programs
- Establish an antler point restriction

D. Maximize Ability to Remove Diseased Animals at the Smallest Scales Possible (hot spots)

CWD positive animals are not uniformly distributed in a herd or over land area. Of great value to managers is an understanding of how CWD positive animals are distributed at the smallest scale possible. This is because the most effective way to reduce CWD prevalence is to expeditiously remove concentrations of infected animals.

CPW currently requires hunters to report the location of harvest and often obtains GPS locations. Harvest locations are matched with CWD test results to map all of the positive animals harvested and determine where hot spots occur. For herds that include large geographic areas, prevalence estimates may be heavily influenced by high prevalence found in a few hot spots. Targeted management actions would help achieve the CWD management objective of maximizing the impact on CWD while minimizing the impact on herds.

The larger the number of submissions for CWD testing, the easier it is to identify hot spots at smaller scales. In general, mandatory testing should generate large enough sample sizes to assess CWD prevalence at various scales including the herd, hunt code, and GMU level. Management prescriptions made by local herd managers will be at the smallest scale possible provided sufficient surveillance data are available.

Hunter harvest will be the primary tool used within identified hot spots to remove infected deer. However, herd managers will consider a suite of management actions to maximize the effectiveness of removing infected animals. In addition, free-ranging deer, elk and moose that are symptomatic will be dispatched by CPW personnel and tested for disease.

Deer and elk that seek refuge within town limits, often at high concentrations, pose a serious management challenge. Hunting is often prohibited on city and county open spaces and deer and elk evade CPW's primary tool to manage populations, which is hunter harvest. Because deer and elk seeking refuge on open spaces are not included in hunter harvest, the CWD prevalence of these animals is not included in their herd's prevalence estimate. CPW will need to work with municipalities to cooperatively address disease issues in deer and elk with herd health being a common goal. However, it is recognized that because of the challenges of managing deer on open spaces, reducing CWD prevalence down to 5%, or maintaining it below 5%, may be unrealistic for herd managers dealing with challenges created by open space.

Recommendations:

- CPW will coordinate the involvement of multiple stakeholders to present CWD issues to municipalities and the need for new big game management programs.
- CPW will enhance cooperation with municipalities, local governments, HOAs, private landowners and Tribal leadership to establish CWD management programs to reduce CWD on open spaces.
- CPW will consider implementing focused surveillance and monitoring efforts in populations within urban areas to inform the need to conduct focused population reductions.

E. Remove Motivations that Cause Animals to Congregate

The identification and removal of point-sources that cause deer, elk and moose to congregate is the basis for this action. Per CPW regulations in W-0 Article XI #021 - Feeding or Attracting Wildlife, no person shall place, deposit, distribute or scatter grain, hay, minerals, salt, or other foods so as to intentionally constitute a lure, attraction or enticement for big game not lawfully held in captivity (Appendix II). Colorado Parks and Wildlife Commission policy further limits the conditions set on emergency winter feeding and baiting of big game ungulates (Appendix III). Remaining motivations that cause animals to congregate may include unintentional attractants, such as mineral blocks and harvested crops that are unsecured or spilled. Agricultural producers in areas of high CWD prevalence may be amenable to removing or burying crop spills and minimizing the use of mineral blocks.

Recommendations:

- CPW will work with producers, landowners, and agriculture authorities to minimize unintentional attractants.
- CPW will produce and release a targeted educational brochure for relevant groups (Colorado Cattlemen's Association, Colorado Livestock Association, Colorado Wool

Growers Association, Colorado Farm Bureau, Colorado State University Extension, relevant roundtable meetings, etc.) to deliver guidance on eliminating point sources and minimizing the use of mineral blocks in high prevalence areas to producers.

- CPW will work with municipalities to eliminate feeding within the municipality.
- CPW will develop an education campaign about not feeding wildlife and the implication feeding has with spreading CWD.

F. Minimize Prion Point Sources

Transportation and disposal of carcass parts of CWD positive animals may create new point sources of CWD prions. For many years, CPW enforced regulations specific to the transportation of carcasses to minimize the movement of prions around the state. In 2008, the Colorado Parks and Wildlife Commission struck these regulations and replaced them with a Commission policy on CWD (Appendix IV). The new policy on CWD removed restrictions on carcass transportation and emphasized education efforts on the proper disposal of deer and elk carcasses as the primary strategy to minimize risks for spreading CWD via carcasses. CPW currently advises hunters that all parts of a CWD infected animal, including processed meat, should be carefully contained in two heavy duty plastic garbage bags and put out with the weekly trash or brought to the local landfill, and further recommends that each plastic garbage bag be independently tied. However, there still exist opportunities to educate various public interests of Colorado's deer, elk and moose resources to minimize risk of spreading CWD via carcasses.

Taxidermists and meat processors, for example, handle a large number of carcasses that may or may not be tested for CWD. Therefore, as a precaution to minimize the possibility of creating a prion point source, taxidermists and meat processors should dispose of carcass parts in such a way that does not leave carcasses exposed. CPW will consider outreach efforts that target taxidermists, meat processors, and other interests to minimize prion point sources.

Recommendations:

- CPW will develop and release an educational effort regarding carcass disposal targeted at taxidermists and meat processors.
- CPW will work to create carcass disposal sites at landfills in cooperation with state health organizations, Environmental Protection Agency, Colorado Department of Transportation, and landfill organizations.
- CPW will consider additional outreach efforts to inform hunters about minimizing the transportation of carcass parts that are most likely to contain CWD.

G. Incorporation of CWD Management Actions and Prevalence Threshold into Herd Management Plans

The Colorado Parks and Wildlife Commission provided direction to the agency in 2015 when it revised its CWD policy, stating that “management actions to address CWD should be included

in appropriate Data Analysis Unit (DAU) plans where CWD occurs, and these should be reviewed and revised as part of the regular DAU planning process” (Appendix IV). The term “DAU plans” is synonymous with HMPs. This CWD response plan provides a framework for incorporating CWD management actions into CPW’s regular herd management planning process. All new and revised deer HMPs will incorporate management actions identified in this response plan that will best manage CWD according to the herd’s characteristics and vital rates. Implementation of management actions will be in accordance with the statewide management threshold identified within this response plan. HMPs will not include the actual management threshold value; only this statewide response plan will contain current threshold values, which will be updated as new science becomes available.

HMPs will include a timeline for reducing prevalence below the management threshold contained in this CWD response plan if the estimated prevalence exceeds the threshold. In herds where prevalence exceeds 10%, HMPs plans will be updated within 12 months if CWD management is not already addressed in such plans. For other infected herds, measures for addressing CWD will be considered at the next scheduled plan update but within no more than 60 months. In addition, as CPW continues to conduct mandatory testing of hunter-harvested deer, HMPs for herds that are newly detected as CWD-infected will be revised to incorporate CWD management actions proactively. These actions will be designed to maintain CWD prevalence at low levels.

In 2018, (X?) of the 55 deer HMPs are either at the end of their 10-year lifespan, or are overdue for revision; therefore, CPW has prioritized herd management planning and produced a schedule for revisions to ensure all plans are no older than ten years.

IX. Monitoring Results, Reassessment and Adaptive Management Actions

CPW’s approach to assessing herd responses to CWD management will generally follow recommendations made by the Western Association of Fish and Wildlife Agencies [Recommendations for Adaptive Management of Chronic Wasting Disease in the West](#) adopted in 2018. Key elements of that approach are highlighted below and greater detail is provided in the original WAFWA report.

Based on past experience in Colorado and elsewhere, CPW expects changes in prevalence in response to management will accrue over time and therefore beneficial (or adverse) effects may not be demonstrable within the first few years. For this reason, CPW will rely mainly on an intermittent mandatory sampling strategy to assess responses to management actions taken to suppress CWD.

Available data suggest sustained management actions will be most effective in changing prevalence trends. CPW anticipates applying selected herd management treatments for at least 5 years before discontinuing or making substantive changes in the selected approach. At each change or end-point in management approach a round of mandatory sampling will be

conducted to provide data for assessing prior effort. This aligns the monitoring interval with the treatment of management actions.

Wherever feasible, management treatment assessments will be conducted using paired areas (e.g., GMUs or DAUs) within reasonable proximity. Data from mandatory sampling within the first 3 years of starting management will represent prevalence “before” undertaking management. Data from mandatory sampling generated after 5 or more years of the starting management will represent prevalence “after” (or in response to) the management undertaken. One of the two areas will be designated for “impact” (i.e., treatment) and the other as a “control” (i.e., no impact). For efficiency, two different management treatments may be compared rather than leaving an area completely unmanaged. In addition, local managers may choose to run comparisons between several herds to assess multiple approaches more efficiently.

Adaptive management: Management approaches will be reviewed and assessed on a statewide basis at intervals of no more than 10 years, and a 5-year statewide review may be considered initially to afford an opportunity for programmatic adjustments should the need arise. Local managers also may choose to make interim or continuous assessments to meet information needs.

CPW will continue to rely on hunters to submit samples from harvested deer to monitor and document the relative success of efforts to manage CWD prevalence. Every year, the agency will identify a set of deer herds as the focus of annual sampling efforts, and will then designate specific hunts targeting these herds for mandatory reporting requirements. Each successful hunter participating in the selected hunts will be expected to submit the head of their deer for CWD testing. The number of herds selected for mandatory testing will be determined annually, with consideration for program capacity and availability of funding. If 6-8 herds are included in the mandatory sampling effort each year as proposed in the aforementioned 15-year monitoring plan, CPW can provide a 5-year rotation of mandatory sampling/herd, where each herd in the state is part of the mandatory sampling every fifth year.

X. Reporting Timeline and Future Plan Expansions

CPW will provide an annual report on the status of CWD management efforts to the Colorado Parks and Wildlife Commission, and will conduct an extensive review of the program’s progress at approximately 5-year intervals, beginning in January 2024. As staffing and funding capacity permits, CPW will continue surveillance on elk and moose populations, and incorporate intensive, targeted sampling and perhaps adaptive disease management in these species when management concerns arise.

XI. Education and Communications Strategy

Independent communications strategy, describe the main components of that strategy. 2 paragraphs?

XII. Acknowledgements - Individual members?, support of the Commission, support of the Director and leadership team.

XIII. Appendices

APPENDIX I

When determining an appropriate CWD management threshold, CPW used incorporated its statewide mule deer data generated from five intensive mule deer monitoring areas into population models to predict the effects of varying rates of CWD infection.

December fawn:doe ratios of 55.8 fawns:100 does were determined from a three year average of all mule deer units in Colorado. Six-month fawn survival from December through June of 68.1% was calculated from the five intensive study areas using data from 1997-present. A sex ratio of 50% males:females at birth was assumed. A 'CWD-free' rate of 84% annual survival rate for adult and yearling females was used as a baseline. A survival rate of 84% is higher than four of the five monitoring areas including two that are CWD-free. Only Middle Park (D-9) has a higher average survival rate than 84%.

Using all of the vital rates listed above, a population trajectory at 0% CWD rate (84% annual survival as stated above) was run. Population trajectories were then run for 2% CWD rate (83.5% annual female survival), 4% CWD (83% annual female survival), 5% CWD (82.75% annual female survival), 6% CWD (82.5% annual female survival), 8% CWD (82% annual female survival), and 10% CWD (81.5% annual female survival). Note that annual yearling survival was assumed to be 84% for all of these simulations.

These trajectories show a statewide average without annual fluctuations. When annual variance is included in population models, average population trajectories tend to show a more downward trend than a deterministic trajectory.

Several assumptions were made when calculating the appropriate threshold for compulsory intervention for each species. First, CPW is taking a conservative approach by assuming all female mortality anticipated from CWD infection rates is additive mortality, even though some infected individuals will succumb to various causes of mortality before dying from CWD. Second, with the exception of adult female survival, all other population vital rate estimates reflect statewide averages and were held constant in the modeling exercise. These rates are assumed to be representative of each herd over multiple years. Actual population vital rates for individual herds vary from the statewide average, which will be taken into account when prescribing management responses to CWD at the herd level.

APPENDIX II

CHAPTER W-0 - GENERAL PROVISIONS

ARTICLE XI - SPECIAL RESTRICTIONS

#021 - FEEDING OR ATTRACTING WILDLIFE

A. Except as provided in subsections (A)(1-4) of this regulation no person shall place, deposit, distribute or scatter grain, hay, minerals, salt, or other foods so as to intentionally constitute a lure, attraction or enticement for big game not lawfully held in captivity.

1. Crops and crop aftermath, including hay, alfalfa and grains, produced, harvested, stored or fed to domestic livestock in accordance with normal agricultural practices shall not be subject to this regulation.

2. When the Director determines it necessary to authorize feeding to prevent damage to private property.

3. When the Director determines it necessary to authorize feeding to mitigate the population loss anticipated by a predicted winter mortality that will exceed 30 percent of the adult female segment of a big game ungulate population in any one Game Management Unit.

4. When the Director determines it appropriate to feed big game as a part of a research or management program.

B. It shall be unlawful to place or deposit minerals or salt in an area so as to constitute a lure or attractant for wildlife. Nothing in this regulation shall restrict the use of salt or mineral blocks in normal agricultural practices.

APPENDIX III

COLORADO PARKS AND WILDLIFE COMMISSION POLICY TITLE: EMERGENCY WINTER FEEDING AND BAITING OF BIG GAME UNGULATES

Effective Date: November 20, 2015

I. PURPOSE

The purpose of this policy is to provide guidance in statewide approaches for emergency winter feeding and baiting of big game ungulates.

II. AUTHORITY

C.R.S. § 33-1-104 (1) “The commission is responsible for all wildlife management, for licensing requirements, and for the promulgation of rules, regulations, and orders concerning wildlife programs.”

III. POLICY STATEMENT

Emergency feeding of big game ungulates may be used as a last resort to reduce unusually severe winter-related mortality in cases where the anticipated winter-related mortality exceeds thirty percent (30%) of the adult female segment of a major big game population. Where available, managers should make use of existing on-the-ground ungulate monitoring activities and data to guide decisions on emergency feeding. Compared to small game, big game populations recover more slowly from significant winter mortality. Therefore, consideration should also be given to the effects of mortality on population recovery and associated impacts to local economies, license numbers, etc. The decision to feed in a severe winter is complex and will be made considering both biological and social factors. Based on the experience from previous feeding actions, significant mortality of deer, particularly fawns, should be expected regardless of effort. In addition, at least one year of suppressed recruitment likely will occur.

The decision of where and when to feed will be made by the Director after considering site-specific information (quantified to the extent possible) about the anticipated costs of feeding versus the consequences of not feeding. If feeding occurs, it is recommended to use weed-free hay (for elk) or commercial pellet products formulated for use in wild ungulates.

The Colorado Parks and Wildlife Commission recognizes the additional and unique threat created by congregating animals into feeding areas where chronic wasting disease (CWD) exposed animals may be present. Therefore, notwithstanding any other provision in this policy, emergency winter *feeding* shall not occur in any Game Management Unit (GMU) where CWD has been found in wild ungulate populations without prior approval of the Commission. In addition, managers should carefully consider whether winter feeding in a particular area might increase the risk of establishing CWD in an area where it is not known to occur.

Baiting is defined as the use of feed to move or redistribute animals with no intent to support or maintain animal condition. Baiting of big game ungulates may be used to prevent or reduce damage to private property when other preventative measures have been ruled impracticable, inappropriate or ineffective. Furthermore, when considering whether or not to bait, the cost of baiting relative to the estimated cost of damage to private property should be evaluated. Baiting may also be used to address the loss of animals unusually congregating near highways and railroad tracks (often as a result of severe winter weather). These

situations create a public hazard and can cause significant localized big game mortality. If baiting occurs, it is recommended to use weed-free hay or commercial pellet products specifically formulated for use in wild ungulates. The decision of where and when to bait will be made by the Director (or the Director's designee).

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APPENDIX IV

COLORADO PARKS AND WILDLIFE COMMISSION POLICY TITLE: CHRONIC WASTING DISEASE

Effective Date: November 20, 2015

I. PURPOSE

The purpose of this policy is to provide guidance in statewide approaches for chronic wasting disease monitoring and control.

II. AUTHORITY

C.R.S. § 33-1-104 (1) “The commission is responsible for all wildlife management, for licensing requirements, and for the promulgation of rules, regulations, and orders concerning wildlife programs.”

III. POLICY STATEMENT

Chronic wasting disease (CWD) is a naturally-occurring prion disease of deer, elk and moose. CWD has been endemic in free-ranging cervid populations in north central Colorado and elsewhere since at least the early 1980s.

Chronic wasting disease is likely an additive source of mortality in affected deer populations, but the extent of harm depends on the extent of infection. Therefore, monitoring and controlling CWD in deer and elk populations are worthwhile objectives even though eradication of CWD in Colorado is not a realistic goal. The Commission encourages the Division to develop a system for tracking CWD trends in priority affected deer and elk populations and incorporating these data into population models so long-term impacts can be better understood. The Division should also consider pursuing adaptive management experiments to develop and evaluate management actions intended to reduce prevalence or prevent increases in distribution or prevalence. Where applicable, management actions to address CWD should be included in appropriate Data Analysis Unit (DAU) plans where CWD occurs, and these should be reviewed and revised as part of the regular DAU planning process. Wherever feasible, the Division should use hunting to achieve CWD management goals and deemphasize agency culling.

The risk of CWD spread via transport of carcasses appears small, especially when compared to the risk of introduction via the natural or human-assisted movement of living, infected animals. Thus, carcass transport and disposal safeguards should not be so onerous that they impede hunter participation in affected units. Education on proper disposal of deer and elk carcasses should be the primary strategy to minimize risks for spreading CWD via carcasses.

At this time there is no evidence that CWD poses a risk to human health. However, the Division should continue to ensure that current information relative to CWD is available to all prospective Colorado hunters. As currently operated, the Division’s carcass testing service primarily serves to allow individual hunters to minimize the risk of consuming an infected animal. Although data from voluntary testing submissions may have some information and management value, more rigorous surveillance should be undertaken when monitoring trends or estimating prevalence is the primary goal. When the Division requires that hunter-killed animals be submitted for testing, the Division should pay for these tests. In situations where CWD testing serves primarily as a customer service, strategies for reducing or recovering full costs and/or privatizing this program should be pursued.

The Commission recognizes the Division's ability to impact CWD is primarily limited by statutory authority to wild ungulate populations and specific commercial facilities. Because the Division shares statutory and regulatory responsibility for managing captive cervids with the Colorado Department of Agriculture (CDA), continued cooperation between the two agencies is required to comprehensively manage CWD in Colorado. In particular, the Division should maintain regulations governing the movement and management of captive cervids in order to minimize further spread of CWD.

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