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

Chronic wasting disease has been part of Colorado's history for many decades and will remain in this state for many generations to come. Early efforts in disease management were focused on eradication, but we've learned that eradication is unachievable with available tools. A more achievable goal for Colorado is to maintain CWD prevalence at low levels.

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 the public. 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.

CPW recognizes that some management efforts may be difficult to endure in some areas over the short term, but are intended 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.

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Colorado Parks and Wildlife

Contents

I. Executive Summary

Mule deer, white-tailed deer, elk and moose are highly valued species in North America. Some of Colorado's herds of these species are increasingly becoming infected with chronic wasting disease (CWD). As of July 2018, at least 31 of Colorado's 54 deer herds (57%), 16 of 43 elk herds (37%), and 2 of 9 moose herds (22%) are known to be infected with CWD. Four of Colorado's 5 largest deer herds and 2 of the state's 5 largest elk herds are infected. Deer herds tend to be more heavily infected than elk and moose herds living in the same geographic area. Not only are the number of infected herds increasing, the past 15 years of disease trends generally show an increase in the proportion of infected animals within herds as well. Of most concern, greater than a 10-fold increase in CWD prevalence has been estimated in some mule deer herds since the early 2000s; CWD is now adversely affecting the performance of these herds.

Colorado's wildlife resources are owned by the public and entrusted in the care of the Colorado Division of Parks and Wildlife and the Parks and Wildlife Commission to be safeguarded for the public's long-term benefit. Therefore, in 2018, the Colorado Parks and Wildlife and the Parks and Wildlife Commission recognized the need to take action with managing CWD and initiated the revival and development of a statewide CWD Response Plan.

The Colorado Parks and Wildlife Commission established a CWD Advisory Group following a request for public engagement in the development of the CWD Response Plan. Advisory group members served as conduits of information to and from the various stakeholder interests for consideration. Although solely advisory in nature, the group's role was viewed as fundamental to the crafting of a publicly supportable response plan.

This CWD Response Plan includes a suite of actions and recommendations that local wildlife managers can implement and assess at the individual herd level to control CWD prevalence while achieving population and herd composition objectives within Herd Management Plans. The suite of actions is seen as tools in the toolbox available to local managers and local constituencies when determining which actions are best suited to manage CWD in a herd. This plan intends to provide maximum flexibility to maintain healthy big game populations while achieving publicly derived management objectives. Therefore, management actions presented in this plan are seen as small adjustments, not changes, from the existing framework of Herd Management Plans.

This CWD Response Plan calls for the development of a surveillance plan that will systematically search for and detect CWD where not already detected. Until now, Colorado has undertaken *ad hoc* surveillance without the benefit of formal operations or procedures. A surveillance plan will be developed in 2019 and included as an appendix to this plan.

This CWD Response Plan launches a 15-year monitoring plan that relies on mandatory testing of male deer in a 5-year testing rotation schedule. For several reasons explained in this plan, Colorado is predominantly focusing CWD monitoring efforts on male deer. A rotational approach will test and retest herds for CWD to show how the disease responds to management actions. Testing every 5 years allows adequate time to show a meaningful change in CWD

infection rate (prevalence) while ensuring that upwards of 40 different herds will be included in mandatory testing. Reassessment of this 15-year rotational approach will occur throughout the testing period, though this level of testing is recommended as the minimum investment to ensure a robust monitoring program.

A statewide prevalence threshold for compulsory intervention for deer is prescribed to guide when adaptive disease management actions should be taken. A single threshold essentially sets a maximum tolerance level for CWD prevalence at the herd level. Because monitoring efforts in deer are focused on adult males, the threshold is specific to adult males. A 5% prevalence threshold for compulsory intervention was selected as the lowest rate of adult male prevalence that is realistic to manage in herds statewide so as to minimize annual adult female CWD mortality. If prevalence approaches or exceeds the 5% threshold put in place to safeguard the resource, adaptive management actions would be taken to ensure a reduction in prevalence over time. Allowing prevalence to increase above levels that could be prevented through management would infringe upon CPW's duty of safeguarding the public's wildlife resources. In low prevalence herds, management efforts will seek to prevent prevalence from increasing to the management threshold, thereby preempting more aggressive management actions.

The prevalence threshold for compulsory intervention is likely the most contentious topic in this CWD Response Plan. However, concerns should be alleviated once additional understanding is gained in regards to how herd-specific management actions prescribed to curtail CWD will be determined by local herd managers in concert with existing Herd Management Plan objectives. Because Herd Management Plan objectives are developed through an open public process and are approved by the Colorado Parks and Wildlife Commission, any changes in licensing prescribed to reduce CWD prevalence would be aligned with objectives that have already been endorsed. This emphasizes the importance of public involvement in setting herd management plan objectives, ensuring plans are up to date, and that future plan revisions are aligned with this CWD Response Plan. Furthermore, management actions will not be taken until reliable prevalence estimates are generated, which is expected from mandatory testing results.

CPW's approach to assessing herd responses to CWD management will generally follow the 2018 Western Association of Fish and Wildlife Agencies (WAFWA) recommendations for adaptive management of CWD. Several of these recommendations are integrated into this response plan. One important WAFWA recommendation guides assessing the effectiveness of management actions through a "BACI" (before-after-control-impact) study design. Testing how CWD responds to varying management actions under similar herd conditions will contribute to a greater international understanding of how to curtail CWD through wildlife management.

This CWD Response Plan is intended to be adaptive in nature, with review and assessment of management performance in individual herds at 5-year intervals. 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 opportunity for necessary programmatic adjustments.

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 (>1 year) elk per every 100 female (>1 year) elk in a population.

Buck:doe ratio – the relative number of male (>1 year) deer per every 100 female (>1 year) deer in a population.

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

Cervid – any mammal of the deer family (*Cervidae)*.

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 or "herd". 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.

Float Group – a CPW term used when a group of hunt codes share a license quota. The number of licenses may vary (or float) between hunt codes, as long as the total quota is not exceeded for that group of hunt codes. This is based on hunt codes being specific to different season dates and means that CPW does not have a preference as to which seasons have which

total numbers of licenses as long as the maximum is not exceeded. A hunter must select which hunt code (season) within the float group to hunt at the time of purchasing a license.

Foci – the primary center or centers from which a disease develops or in which it localizes.

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 (or "herds") of big game in specific geographic areas that establish herd management objectives through an open public process that is approved by the Colorado Parks and Wildlife Commission. 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. Previously termed "DAU Plan".

Inflection point – a point of a curve at which a change in the direction of curvature occurs.

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 [number infected ÷ 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. The following websites provide more information about prions:

https://www.cdc.gov/prions/index.html
http://cwd-info.org/
https://www.colorado.gov/pacific/cdphe/prion-diseases
https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/

Shedding (of prions)—the release or excretion of an infectious agent from the body of an infected host.

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.

List A – A license category set in CPW regulation. Any hunter may obtain one license in this category.

List B – A license category set in CPW a regulation that allows a hunter to obtain two licenses when certain conditions are met.

List C – A license category set in CPW regulation that allows a hunter to obtain any number of licenses listed in this category.

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 Seasons for Disease Management in Big Game" - refers to a Colorado Parks and Wildlife Regulation (Chapter W-2 #272) that allows the establishment of a special hunting season for big game, when hunting harvest has not been adequate to reduce the incidence of disease, to reduce emigration of infected animals, or to otherwise control expansion of the disease.

Vital rates – a collective term used to describe the demographic parameters (rates of birth, growth, maturation, survivorship, fertility, fecundity, and mortality) averaged over groups of individuals that affect changes in the size and composition of a population.

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" (TSE; 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 foci in free-ranging animals throughout much of Colorado and, less often today, in captive wildlife facilities. Natural cases of CWD have occurred in 4 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; the disease is always fatal and animals die from the disease within about 2.5 years of infection (Miller et al. 2012, Miller et al. 2008). However, natural genetic variation in host species can extend survival time and perhaps lower the 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 (Miller and Fischer 2016).

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)

Management planning related to CWD control in Colorado dates to the late 1990s and initially focused on containing geographic distribution and suppressing prevalence (largely as a vehicle for limiting spread). Early hunter-harvest samples 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 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, largely from hunters with strong interest in whether their animal was CWD positive. Submissions were mandatory 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 both hunter's 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 6 mule deer herds.

As of July 2018, at least 31 of Colorado's 54 deer herds (57%) are known to be 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 5 largest deer herds and 2 of the state's 5 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 the CPW web page devoted to CWD reports the most recent 3-year prevalence estimates by herd unit for each species. Prevalence of CWD in captive deer and elk herds in Colorado is not monitored by CPW, as all but 3 of these herds are under the purview of Colorado Department of Agriculture, 2 of which have mule deer. Fallow Deer and elk held in captive facilities are categorized as alternative livestock and all

of the state's alternative livestock ranches are managed by the Colorado Department of Agriculture (Appendix I).

In light of the foregoing, the initial focus of CWD monitoring and management in Colorado has been on free-ranging deer, especially mule deer. Estimated infection rates in several deer herds in the northwest part of Colorado have become sufficiently high to be concerning; without changes in management, CWD will become more and more common in an infected herd and can eventually cause population level declines. Fifteen-year (2003-2017) trends in prevalence were analyzed in the 6 deer herds included in mandatory testing (Table 1). Prevalence estimates declined or remained relatively constant in 2 herds where management actions were prescribed to control CWD during this time period. Prevalence in adult males increased in the remaining 4 herds. The largest change in prevalence trends for a single herd was a 10-fold increase from 1.5% to 15.3% in 15 years. The prevalence trend of just the mandatory testing results solidified concerns about increasing prevalence in some herds and prompted the revival 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)

	2003			2017		
DAU (Herd)	**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 female 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 is 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 (Miller and Conner 2005). Because 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 to take into account low prevalence of young age classes, 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 suppress individual herd-level CWD prevalence below a realistic management threshold applied statewide. The plan includes a suite of actions that local wildlife managers can implement and assess 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 (CPW 2014). 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 and individual stakeholders including: Associated Governments of Northwest Colorado, Colorado Department of Agriculture, Colorado Parks and Wildlife Commission, Coloradans for Responsible Wildlife Management, Outfitters, Mule Deer Foundation, Rocky Mountain Elk Foundation, Wildlife Management Institute, and 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 review and approval by the Parks and Wildlife Commission and implementation.

As a stakeholder process, all 5 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 on a dedicated CWDAG web page. 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, but do not necessarily reflect complete consensus of all CWDAG members.

Implementation

Within the past 2 decades, many state wildlife agencies—including CPW—have focused on reducing population densities through a combination of hunter harvest and agency culling in efforts to control CWD, 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 assess 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 Game Management Units (GMU), 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. This integration of CPW's current management framework with the CWD Response Plan will increasingly rely on hunters to help manage CWD. Hunter harvest will continue to be a primary tool for implementation that is controlled through licensing.

IV. Management Objectives

Objective 1: *To reduce or limit CWD prevalence below the management threshold as set in this plan for free-ranging deer, elk and moose herds. 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 prevent CWD prevalence from reaching the management threshold in low prevalence herds.

Objective 3: To provide the general public and stakeholders with science-based information regarding CWD.

Objective 4: To maintain Colorado's robust deer, elk, and moose herds to support public hunting and viewing opportunity.

Objective 5: To provide guidance for 15 years of CWD surveillance, monitoring and management in Colorado's deer herds within an adaptive framework to further understand how prevalence responds to prescribed management actions.

V. Surveillance & Monitoring Programs

Surveillance

A sustained, continuous surveillance effort is 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 on 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 is needed to understand prevalence trends and how prescribed CWD management actions influence those prevalence trends. 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 those herds have insufficient numbers of voluntary submissions to reliably estimate prevalence for several years or are suspected to have high prevalence or 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 or the longest time interval since having a reliable

estimate will be prioritized 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 in an infected herd have been low or zero based on a sufficient number of voluntary test submissions or equivalent data, that herd will not be prioritized for mandatory testing. In these herds and in herds not known to be infected, 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 (Krumm et al. 2005); therefore, CPW will consider how best to sample roadkill for detecting CWD. When detections suggest prevalence is at a level of concern and increasing in a herd, it will be prioritized for mandatory testing.

15-Year Monitoring Plan

The general framework for a 15-year monitoring plan using mandatory testing is presented in Table 2. In 2018, 6 deer herds will be included in mandatory testing that differ from those tested in 2017. 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 additional herds that have not already been included in mandatory testing. This creates a 5-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 5-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, though this level of testing is recommended as the minimum investment to ensure a robust monitoring program. If elk or moose are included in mandatory testing in the future, the rotational schedule for deer may change and additional resources will be necessary to expand monitoring efforts.

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%, CI 13.3%-17.7%) was ±2% of the prevalence estimate (Table 1). However, sample sizes for the 5 other herds included in mandatory testing were about one-third of this sample size and had wider confidence intervals (~±4% of the prevalence estimate). CPW is targeting sample sizes of 300 adult male submissions through mandatory testing and therefore expects 95% confidence intervals on prevalence estimates to be ±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 provide sufficient periods of time to test how CWD prevalence responds to prescribed management actions.

Nonetheless, CPW may opt to incentivize voluntary submissions from select herds to yield large sample sizes or improve the geographic resolution of CWD distribution as a basis for management planning. 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 6 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; permanent staff time is not included. 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 (proportion 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 in some herds and the mandatory testing efforts.

The cost of the 15-year monitoring plan for deer alone is projected to be $175,000-$200,000 per year. 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. In addition, CPW may offer incentives to increase voluntary submissions in select herds, which is not factored into the projected annual cost. CPW will annually review the budget needs for mandatory testing that are commensurate with annual testing goals. If elk or moose are included in mandatory testing in the future, the projected annual monitoring costs will increase.

TABLE 2: Tentative 15-year schedule for mandatory and incentivized CWD testing of deer, including a 5-year rotation for testing select herds already included in mandatory testing. Annual costs for mandatory testing would be approximately the same. The 5-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 temporarily 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 will be needed to prevent CWD prevalence from increasing.

In low prevalence herds, management efforts should be implemented to keep prevalence from increasing to the management threshold thereby preventing more aggressive management actions.

An appropriate threshold for compulsory intervention can be determined from the level of CWD-caused adult female mortality that will initiate a declining population trend. Population models can be used to predict when a declining trend will 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 zero population growth ($\lambda=1$) and the average observed adult female survival rate generated from fieldwork represents the average additive adult female mortality that could be realized annually before the onset of a population decline. This mathematical difference can be used to set an appropriate management 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.

In the case of a stable population or already declining population, any increase in adult female mortality will cause a population decline unless other vital rates, such as survival of young, increase. Therefore, if vital rates of a stable population remain constant, an increase in CWD prevalence would initiate a population decline. Likewise, in the case of a declining population, any increase in CWD prevalence will accelerate a population decline. An appropriate CWD management objective for a stable or decreasing population would be to minimize CWD prevalence to minimize the effect the disease has on the herd. Therefore, 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 5 mule deer herds known as Intensive Mule Deer Monitoring Areas. Adult male survival is also monitored in 2 of the 5 herds. These herds were selected to ecologically and geographically represent mule deer west of Interstate-25. Survival rates from these herds are used to produce a statewide average survival rate and for deer population modeling purposes.

Colorado's statewide mule deer population has been in a long-term decline. The statewide average adult female (>2 years) survival rate is approximately 83%. Using statewide averages for fawn:doe ratios and over-winter fawn survival this 83% average adult female survival rate causes a decline when used in CPW's population models (Appendix II). 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 statewide population decline until statewide average vital rates improve. Each individual deer population performs differently because fawn:doe ratios, fawn survival, and biological and environmental factors differ in each herd.

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 95% confidence intervals on prevalence estimates generated from large sample sizes of adult males are expected to be ±2-4%, a 5% prevalence threshold for compulsory intervention is the lowest rate of adult male prevalence that allows for detection of a change in CWD prevalence.

The threshold for compulsory intervention that was determined appropriate for deer was not calculated from modeled and observed estimates of adult female survival. Rather, It was calculated as the lowest value of CWD prevalence that CPW can manage to minimize adult female mortality. This threshold is 5% prevalence for adult male deer (>2 years) at the scale of individual herds (DAUs).

Monitoring in Colorado has shown adult female deer typically exhibit CWD infection at half the rate of adult male deer (Miller and Conner 2005); therefore, a 5% adult male prevalence threshold is approximately a 2.5% threshold in adult female deer. Recalling that CWD is invariably fatal and animals die from the disease within about 2.5 years of infection, roughly half of the infected deer will die each year. 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. Selecting the lowest prevalence threshold for adult males that is realistic to manage (5%) limits annual adult female CWD mortality to about 1.25%.

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. 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 1). 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 15-year trends to

the modeled curve. From a management perspective, maintaining prevalence below the inflection point would prevent a rapid increase in CWD prevalence. According to both the modeled curve and the composite field data from Colorado, the inflection point is approximately 5%. (Miller et al. 2000; EFSA Panel on Biological Hazards 2018). In summary, CWD prevalence increases slowly until this inflection, or threshold is crossed, and then prevalence accelerates exponentially.

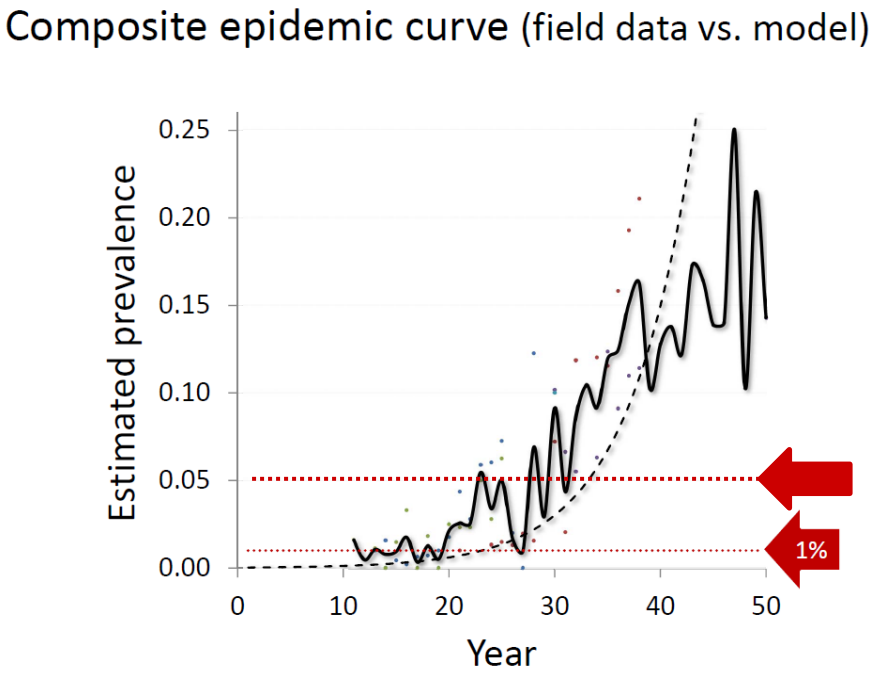

Figure 1. Actual versus modeled CWD epidemic curves show a similar trajectory over time with an inflection point of approximately 5% CWD prevalence. (Miller et al. 2000; EFSA Panel on Biological Hazards 2018)

The final consideration of an appropriate prevalence threshold for disease management in deer was in regards to CPW's mission and strategic plan goals to ensure healthy, sustainable wildlife populations and ecosystems and to provide enjoyable and sustainable outdoor recreation opportunities. Selection of the lowest rate of CWD prevalence that is realistic to manage in deer herds statewide minimizes the adverse effects CWD has on Colorado's wildlife resources and upholds CPW's mission. Allowing prevalence to increase above levels that could be prevented through management would infringe upon CPW's duty of safeguarding the public's wildlife resources. Thus, a 5% prevalence threshold for compulsory intervention was selected as the lowest rate of adult male prevalence that is realistic to manage in herds statewide.

Above and Below the 5% Prevalence Threshold

Establishment of a 5% prevalence threshold for compulsory intervention creates 2 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 targeted *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 objective ranges; actions to control CWD are envisioned to be initially applied at levels that maintain the respective objective ranges. For herds that have adult male prevalence that exceeds 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 10-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 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 3 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. Reducing prevalence in deer should reduce the number of CWD prions that are shed into the environment that could infect elk and moose.

Moose appear to be even less likely to contract CWD than deer or elk. Only 2 individual cases in moose were detected from 2015-2017, and in total only 6 moose cases have been recorded in Colorado. For over 10 years, all Colorado moose hunters were required to participate in mandatory CWD testing, which generated hundreds of samples. Between 2004 and 2015, annual sample sizes ranged from 101-228 (males and females) statewide and annual prevalence estimates were zero to 1.5%. Although harvest rates are considerably lower for moose than for deer and elk, and 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 prevalence in moose.

Prevalence in moose and elk herds has not yet reached a level of concern that calls for a threshold for compulsory intervention. CPW will focus CWD management efforts on deer and concurrently monitor prevalence trends for all three species. Should the prevalence in 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 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 (HMPs) 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 guiding documents, which means each HMP would be revised once or twice within the 15-year CWD Surveillance 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 3 CWD suppression strategies using an adaptive management framework in western states (*Recommendations for Adaptive Management of Chronic Wasting Disease in the West*). The 3 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 the population or 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 will 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 10 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 mandatory testing. That same herd will be retested under mandatory testing within a 5-year window according to the 15-year CWD Monitoring Plan. If changes to prevalence have not occurred then 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 through a CPW Commission-approved HMP revision.

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 harvest through enhanced cooperation with municipalities, local governments, HOAs, private landowners and Tribal leadership and the establishment of CWD management programs to reduce CWD on open spaces and landscapes where hunting is currently not utilized as a tool.
- 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.

Based on an evaluation in 2018 of all Colorado deer herds that have classification data for at least 2 of the last 3 years, 73% (32 out of 44) have observed sex ratios that exceed the top of their respective HMP sex ratio objective range. This statistic does include several HMPs that have not been updated in many years and current management approaches do not match the outdated HMP objectives; these outdated plans are scheduled for revision.

Another consideration with reducing the male:female ratio is that positive CWD infections in harvested males generally increase in later seasons closer to, and during, the rut. This is because mature males have higher prevalence than younger males and mature males make up a larger proportion of the harvest in later seasons. Focusing hunter harvest of adult male deer during the rut and late seasons may increase the efficiency in removing infected animals from the herd.

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 10 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 occurred then 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 to lower the sex ratio objective range.

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 through enhanced cooperation with municipalities, local governments, HOAs, private landowners and Tribal leadership and the establishment of CWD management programs to reduce CWD on open spaces and landscapes where hunting is currently not utilized as a tool.
- 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.

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.
- Revise the HMP to lower the sex ratio objective to lower the age structure of the herd.
- 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 where hunting is not

currently utilized as a tool, and creating new special hunts for youth, R3 and new hunter programs.

- Increase licenses and establish an antler point restriction. 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 more nocturnal, reduction in population or sex ratio may still be necessary.

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 when collecting CWD samples from hunters. 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 (DAU), hunt code, and Game Management Unit (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 use areas where hunting is prohibited pose a serious management challenge. Hunting is often prohibited on exurban development areas and city and county open space. Deer and elk evade CPW's primary tool to manage populations, which is hunter harvest, when using these areas. Because deer and elk seeking refuge on open spaces are not harvested by hunters, the CWD prevalence of those 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 space, reducing CWD prevalence down to 5%, or maintaining it below 5%, may be difficult for herd managers dealing with challenges created by open space.

Recommendations:

- Create male and female hunt codes that provide the capability to establish focused hunts at small scales.
- 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 and landscapes where hunting is currently not utilized as a tool.
- 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 III). Colorado Parks and Wildlife Commission policy further limits the conditions set on emergency winter feeding and baiting of big game ungulates (Appendix IV). 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 had 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 revised

Commission policy statement on CWD (Appendix V). 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 2 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, County governments, 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 V). 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 prevalence threshold for compulsory management identified within the CWD Response Plan. HMPs will reference the prevalence threshold set in the response plan. The CWD Response Plan will always contain the current statewide threshold as a numeric value that should be used for implementation. If the numeric value of the prevalence threshold differs between a

HMP and the CWD Response Plan, the value set in the CWD Response Plan will supersede any values written in the HMP. This guidance intends to avoid confusion in regards to the management threshold that should be implemented, should it be changed in the CWD Response Plan 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 will be updated within 12-18 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. If prevalence is low, actions taken in these herds will be designed to maintain CWD prevalence at low levels.

In 2018, 22 of the 54 (40%) deer HMPs are past the end of their 10-year lifespan and 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 (5-year interval) 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, assessments of management treatment 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 will represent prevalence "before" undertaking management and data from mandatory sampling after five or more years of management will

represent prevalence “after” (or in response to) the management undertaken. One of the 2 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 opt to run 3- or 4-way comparisons to assess multiple approaches more efficiently.

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 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 select 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 required 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 specified in the aforementioned 15-year monitoring plan, CPW can provide a 5-year rotation of mandatory sampling per herd, where each herd in the state is part of the mandatory sampling every fifth year.

X. Reporting Timeline, Future Plan Expansions, and Future Needs

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 5-year intervals, beginning in January 2024. As staffing and funding capacity permits, CPW will continue systematic surveillance on elk and moose populations, and incorporate intensive, targeted sampling and perhaps adaptive disease management in these species when management concerns arise.

Sustaining and increasing healthy deer, elk and moose populations when conditions allow, and increasing hunting and wildlife-related recreational opportunities, are of great importance to Colorado sportsmen and sportswomen, wildlife conservation organizations, to CPW, to the Colorado Parks and Wildlife Commission, to the CWDAG members, and to many other segments of the public. A sustained, long-term commitment to CWD management will play a pivotal role in the future success of deer, elk and moose herds, as will the continued process of informing the public on this disease to establish a basis of understanding about where we are, where we are headed, and how we will try to get there, together.

Already available science and understanding about CWD are sufficient to move forward with the implementation of this CWD Response Plan. As described, further advances in understanding can be incorporated into ongoing disease management efforts as they become available.

A list of future needs extending beyond this CWD Response Plan that will continually be considered includes, but is not limited to:

- Increasing CPW's capacity for CWD monitoring and surveillance as necessary;
- Increasing CPW's technical support of data management related to disease and wildlife health research;
- Increasing the number and locations of incinerators or digesters or other facilities or capacities to denature CWD prions as necessary;
- Increasing cooperation with municipalities and private landowners to address CWD among animals living in town herds;
- Development of innovative ways to notify and motivate hunters when they are selected for mandatory testing;
- Decreasing the time to process CWD samples for testing, ultimately decreasing the time a hunter must wait to learn of test results;
- Development of innovative ways to notify hunters of CWD test results;
- Documentation and reporting of national and international CWD management successes, to which Colorado will be a contributor; and
- Support of research investigations that involve carefully controlled comparisons of alternative harvest management strategies to identify the most effective and sustainable approaches for long-term disease suppression.

XI. Education and Communications Strategy

Public education and communication may be the single most important step in the formation and implementation of a statewide disease management plan. When key stakeholders and the general public have been informed about why management actions are necessary, the short-term and long-term objectives of planned management decisions, and how these actions affect them, they will be more likely to support the initiative. CPW has developed an education and communications strategy that complements this CWD Response Plan to ensure the public is informed about disease management in deer, elk, and moose and the projected outcomes of these management decisions. This CWD Response Plan emphasizes annual decisions that will be made for local herd disease management, which may require specialized communications from the agency. Having a communications strategy for this plan allows for rapid adaptation to local herd management decisions and the public's information needs.

The "CWD Communication and Implementation Plan" will utilize many platforms and outreach opportunities to educate and connect with the general public with management proposals and actions including, but not limited to, community workshops, public meetings, press releases, the agency website, social media, blogs, interviews, radio, and the Parks and Wildlife Commission meetings. The Communication and Implementation Plan will also inform the agency on key audiences, other government agencies, messaging strategies, communication

techniques and staff responsible for relaying information. This plan will guide the communication timelines and stakeholder involvement process.

Additionally, in August 2018, CPW conducted a study about hunters' perspectives regarding CWD in deer in Colorado. The purpose of this survey is to learn what resident and non-resident hunters' interests are, potential concerns about CWD, and the ways CPW might effectively manage affected deer herds in the state. Results from the study will be considered during the development of disease management strategies that are aligned with this CWD Response Plan. Hunters' perspectives help inform how CPW communicates information and provide valuable insight into what information is most important to our hunting public.

CPW recognizes the importance of ongoing communication to allow the general public to understand what actions are being proposed in what areas of the state and how we will monitor and evaluate progress. CPW will focus on 2 primary areas of communication: 1) educational outreach on CWD and its effects on herds in Colorado, and 2) information on monitoring and surveillance and ongoing management strategies. At the conclusion of each mandatory sampling year, agency staff will provide public updates on the previous season's testing results. CPW will be conducting a 15-year monitoring plan in coordination with the herds selected for mandatory sampling. This rotational approach allows adequate time to show a meaningful change in CWD prevalence over time while ensuring that upwards of 40 different herds across the state are included in mandatory testing. At the conclusion of each five-year monitoring period, an analysis will be provided to the public on results found in the various herds that were included in mandatory testing.

XII. Acknowledgements

The 2017 mandatory CWD testing results were presented to the public for the first time at the March, 2018, Colorado Parks and Wildlife Commission meeting. At this meeting, Commissioners realized the problem and the need to develop a management approach to curb CWD and supported the development of a statewide CWD Response Plan. At the subsequent Commission meeting, Commissioners demonstrated further leadership by establishing the CWDAG, ensuring stakeholders were involved with the development of the CWD Response Plan. When calls were made to secure individual members of the CWDAG, every single participant made no hesitation to serve on the advisory group. This level of commitment to safeguard Colorado's wildlife resources is hereby formally recognized by CPW.

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XIV. Appendices

APPENDIX I

ALTERNATIVE LIVESTOCK ACT: ELK AND FALLOW DEER RANCHING

Alternative Livestock are governed under 35-41.5-101 - 117 C.R.S., known as the Alternative Livestock Act.

Per 35-41.5-102 C.R.S., "Alternative livestock" means any domesticated elk or fallow deer as such are classified as alternative livestock pursuant to this article. Alternative livestock shall not be considered wildlife for purposes of this article.

With the exception of three ranches that are managed by CPW, two of which have mule deer, all of the state's alternative livestock ranches are managed by the Colorado Department of Agriculture.

Alternative Livestock ranches are further governed under 8 CCR 1201-17, Concerning the Prevention of Disease in Alternative Livestock, and 8 CCR 1205-2 Administration and Enforcement of the Alternative Livestock Act, which state:

- Brain tissue, retropharyngeal lymph nodes, and any other tissue or other appropriate sample must be submitted for examination, as directed by the State Veterinarian, of alternative livestock 12 months of age or older that die for any reason, within 15 working days of any mortality…

- Movement of all alternative livestock imported into the State of Colorado must be from a herd that has CWD Surveillance Status of at least 60 months.

APPENDIX II

POPULATION MODELING EXERCISE TO DETERMINE APPROPRIATE CWD THRESHOLD FOR COMPULSORY INTERVENTION

When determining an appropriate CWD management threshold, CPW 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.

Initial Parameterization of Modeling Efforts

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 Colorado's five mule deer intensive monitoring areas using data from 1997-present. A sex ratio of 50% males:females at birth was assumed. An 84% 'CWD-free' (0% prevalence) annual survival rate for adult and yearling females was used as a baseline. Given the values used for deer fecundity and fawn survival, 84% adult survival resulted in a population that neither grew nor shrank. This is an optimistic value because a survival rate of 84% is higher than four of the five monitoring areas, including two that are CWD-free. Only the Middle Park (D-9) intensive monitoring area had a higher average survival rate than 84%.

Using all of the vital rates listed above, a population trajectory at 0% CWD prevalence (84% annual survival as stated above) was run. Recalling that 2% adult male prevalence results in ~0.5% annual adult female mortality from CWD, population trajectories were then run for 2% CWD prevalence (83.5% annual female survival), 4% CWD prevalence (83% annual female survival), 5% CWD (82.75% annual female survival), 6% CWD prevalence (82.5% annual female survival), 8% CWD prevalence (82% annual female survival), and 10% CWD prevalence (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, i.e. stochasticity, is included in population models, average population trajectories tend to show a more downward trend than a straight line, i.e. deterministic, trajectory.

Assumptions

Several assumptions were made when calculating the appropriate threshold for compulsory intervention for each species. First, a conservative approach was taken 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. Additionally, as population size and stocking rates decline we would expect survival of the remaining individuals to increase because more forage is available at the reduced stocking rate. 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.

A prevalence threshold was determined after taking into consideration the aforementioned assumptions, the high sensitivity of modeled population trajectories with slight changes to doe survival rates, and that Colorado's statewide mule deer population is already in a long-term decline. CPW determined that both 8% and 10% CWD prevalence thresholds in adult males result in unacceptably high declining trajectories over time, and that 0%, 2% and 4% prevalence thresholds in adult males are unrealistic management objectives because of low statistical precision in monitoring (CI of ±2-4%). The 5% CWD prevalence in adult males is the lowest management threshold considered to be a realistic objective, albeit still has an associated declining trajectory. In future management efforts, CPW will strive to increase vital rates to overcome the declining trajectory.

APPENDIX III

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 IV

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).

APPENDIX V

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.