National Park Service
Biological Resource Management Division

A National Park Service Manager's Reference Notebook to Understanding Chronic Wasting Disease

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1.0 INTRODUCTION

Chronic wasting disease (CWD) is a slowly progressive neurological disease of mule deer, white-tailed deer, Rocky Mountain elk, and moose. Two NPS deer and elk populations are currently affected by the disease and many more are at risk. It is important for wildlife managers to have easily accessible information regarding the disease so informed management decisions can be made.

The purpose of this notebook is to serve as an informational reference which summarizes some of the most pertinent CWD literature, management options, and policy as they pertain to NPS units. It is not meant to be an all inclusive review of current literature or management options. Because CWD is an emerging disease, and knowledge of the disease continues to expand, this document will be updated regularly.

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2.0 OVERVIEW OF CWD

2.1 Disease etiology

Chronic wasting disease is an infectious, self propagating, neurological disease of captive and free-ranging mule deer (*Odocoileus hemionus*), white-tailed deer (*O. virginianus*), Rocky Mountain elk (*Cervus elaphus nelsoni*), and moose (*Alces alces*). All naturally susceptible CWD hosts belong to the taxonomic family cervidae. CWD belongs to the transmissible spongiform encephalopathy (TSE) group of diseases (Table 1). CWD is the only TSE currently found in free-ranging animals. TSEs are characterized by accumulations of abnormal prion (proteinaceous infectious particle) proteins in neural and lymphoid tissues (Prusiner 1982; 1991; 1997). Not all researchers agree that TSEs are caused solely by presence of prion proteins (Lasmezas et al. 1997, Chesebro 1998, Farquhar et al. 1998). However, there is strong evidence that protease resistant prions (PrP^{res}) are required for the development of clinical TSEs (Prusiner 1991).

Prions are proteinaceous particles and will be referred to here as PrP^{c} (normal cellular prion protein) or PrP^{res} (abnormal protease resistant protein). Both forms of the protein have the same primary structure (amino acid sequence). There is a post translational change in the tertiary conformation (folding) of the protein when it is transformed from PrP^{c} to PrP^{res} (Williams et al. 2002). As a result of this change in structure, normal proteases in the body can no longer break it down and the protein begins to accumulate principally in the brain and lymphoid tissues. These changes presumably lead to the changes in neurological function. The microscopic changes

Table 1. Other diseases belonging to transmissible spongiform encephalopathy family.

Bovine spongiform encephalopathy	Domestic cattle
Scrapie	Domestic sheep and goats
Transmissible mink encephalopathy	Mink (captive)
Feline spongiform encephalopathy[1]	Felids (captive)
Exotic cervid spongiform encephalopathy[1]	Oryx, gemsbok, eland, nyala (captive)
Creutzfeldt-Jakob disease	Humans – sporadic
Variant Creutzfeldt-Jakob disease[1]	Humans – BSE linked
Kuru	Humans – cannibalism
Fatal familial insomnia	Humans – familial
Gerstmann Straussler Scheinker syndrome	Humans – familial

seen in the central nervous system of animals affected by all of the TSEs are similar though not identical (Williams and Young 1993). Once an animal demonstrates clinical signs of CWD the disease is invariably fatal. There is no treatment or preventative vaccine for the disease.

2.2 Native vs. exotic

The origin of CWD is unknown and the time and place of emergence cannot be determined with certainty (Spraker et al. 1997, Williams et al. 2002). CWD was first observed clinically in 1967 in captive mule deer in a wildlife research facility in Colorado. It was recognized in 1978 in a similar facility in Wyoming. More than 80% of mule deer over the age of 2 years, held in the Colorado facility from 1974-1979, died or were euthanized following signs consistent with CWD. By 1979 vacuolar brain lesions had been identified and the disease had been described as a spongiform encephalopathy (Williams and Young 1980; 1992).

CWD has likely been present in the historic area since the early 1960s or earlier (Miller et al. 2000). There are several hypotheses regarding the origin of CWD. It is possible that CWD resulted from spontaneous conformational change of the PrP^{c} to PrP^{res} with subsequent transmission to susceptible cervids (Williams et al. 2002). The sporadic form of Creutzfeldt-Jakob Disease (CJD) is thought to arise in this manner. However, unlike CWD sporadic CJD does not appear infectious. Additionally, sporadic TSEs have never been reported in animals (Williams et al. 2002).

Alternatively, CWD could be a mutated form of domestic sheep scrapie that has adapted to cervids (Raymond et al. 2000, Race et al. 2002). Both CWD and scrapie are infectious contagious TSEs. Moreover, scrapie has been implicated in the bovine spongiform encephalopathy (BSE) outbreak in Great Britain (Wilesmith et al. 1988, Collinge et al. 1996, Bruce et al. 1997). While the circumstances surrounding the BSE epidemic in cattle in the U.K. are vastly different from those involved with CWD in the U.S., it does raise suspicion that ruminant TSEs can cross species barriers when permissive conditions exist. Then again, CWD may have originated from infection with another novel prion strain with adaptation and subsequent lateral transmission

[1] Appear to be linked to food products contaminated with bovine spongiform encephalopathy.

among cervids (Williams and Miller 2003). The precise origin of CWD will probably never be determined (Williams and Miller 2003), although it is strongly suspected that CWD in a non-native disease (Appendix 12.2).

Regardless of the origin of CWD, there is good epidemiological evidence that human associated movement of cervids has aided in the spread of the disease in captive, and likely free-ranging, deer and elk (Miller and Williams 2003, Salman 2003, Williams and Miller 2003). Additionally, localized artificial concentration of cervids in areas with few natural predators likely aids in the transmission of CWD (Spraker et al. 1997, Samuel et al. 2003, Farnsworth et al. 2005). There is strong evidence to suggest that anthropogenic factors, such as land use, influence prevalence of CWD in the historic area (Farnsworth et al. 2005). Therefore, human influences are a significant component of observed CWD distribution and prevalence.

2.3 Distribution

To date (November 2005) CWD has been found in 10 states and two Canadian provinces in captive/farmed cervids and 10 states and two provinces in free-ranging cervids (Appendix 12.1). For an up-to-date map of CWD distribution see http://www.cwd-info.org/index.php/fuseaction/about.map.

The historic area of CWD infection encompasses northeastern Colorado, southeastern Wyoming, and the southwest corner of the panhandle of Nebraska (Williams and Miller 2002, Williams et al. 2002). However since 2001, when surveillance increased significantly, the disease has been found with increasing frequency in other geographically distinct areas (Joly et al. 2003). It is unknown whether this detection is solely a result of increased surveillance or if the disease distribution continues to expand (Spraker et al. 1997, Miller et al. 2000). It is likely a combination of both.

CWD has been diagnosed in two National Parks, Rocky Mountain and Wind Cave National Parks, as of November 2005. Several other NPS units lie within the historic area of disease or near CWD positive cases (Appendix 12.1).

2.4 Clinical signs

The primary clinical signs of CWD in deer and elk are changes in behavior and body condition (Williams et al. 2002). Signs of CWD are progressive. Initially only someone who is quite familiar with a particular animal or group of animals would notice a change in behavior. As the clinical disease progresses over the course of several weeks to months animals demonstrate increasingly abnormal behavior and additional clinical signs (Table 2; Williams and Young 1992). Affected animals can loose their fear of humans, show repetitive movements, and/or appear depressed but quickly become alert if startled. Affected animals rapidly loose body condition despite having an appetite (Williams et al. 2002). In the end stages of the disease they become emaciated.

Table 2. Additional clinical signs consistent with chronic wasting disease.

Lowered head/ears	"Star gazing"	Increased drinking
Increased urination	Increased salivation	Incoordination
Stumbling	Wide-based stance	Regurgitation

Affected animals can loose the ability to swallow properly and as a result may aspirate rumen contents during rumination. This can lead to aspiration pneumonia. Cervids showing evidence of pneumonia on postmortem examination should be considered candidates for CWD testing. Some CWD-positive animals, particularly deer, display increased drinking and urination (Williams et al. 2002). These animals may be found remaining close to water sources for abnormally long periods of time. A combination of these clinical signs may lead to the conclusion that an animal is a suspect for chronic wasting disease; however, these clinical signs are not specific to CWD and the definitive diagnosis can be made only with laboratory testing (Williams et al. 2002).

Once signs of CWD appear the clinical course can vary from a few days to nearly a year until death. The clinical course may be more prolonged in elk than in deer (Williams et al. 2002). In captivity, most clinically affected CWD-positive animals survive a few weeks to 3-4 months; however, in the wild, animals are generally identified late in the clinical stage of disease likely with only days to live. Clinical features of the disease in mule deer and white-tailed deer are similar (Miller and Wild 2004). There is no information regarding the clinical disease in moose (T. J. Kreeger, *pers. comm.*).

2.5 Diagnosis

Clinical signs recognized in cervids affected by CWD are non-specific for the disease. Therefore, it is imperative to confirm a diagnosis of CWD with laboratory tests. In addition, laboratory testing of appropriate samples can potentially diagnose the disease before animals are clinically ill (Wild et al. 2002).

CWD was initially diagnosed in deer and elk using standard histopathology techniques (Williams and Young 1993). A specific portion of the brain, which is found in the dorsal medulla oblongata at the obex, is the most important site for diagnosing CWD. Spongiform change of the neuropil, intracytoplasmic vacuoles, and neuronal degeneration can be observed to differing degrees within the central nervous system (Williams and Young 1980; 1982). While histopathology is effective at diagnosing relatively advanced cases of CWD, it is not sensitive enough to detect early stages of the disease because PrP^{res} begins to accumulate before microscopic changes can be visualized (Spraker et al. 1997, Peters et al. 2000).

In contrast to histopathology, immunohistochemsitry (IHC), can be used to identify relatively early cases of CWD. IHC is the gold standard for CWD diagnosis. This technique uses formalin fixed tissues which are sectioned and mounted to a microscope slide similar to standard histopathology sample preparation. The slides are then treated with heat and chemicals to remove or block normal PrP^{c} proteins.

They are stained with a monoclonal anti-PrP antibody. Finally, a second antibody is used to stain the monoclonal antibody (O'Rourke et al. 1998, Spraker et al. 2002a). When the slide is examined microscopically, any tissue containing PrP^{res} is visualized as having deep red staining over the normal hematoxylin and eosin stain. These animals are diagnosed as positive for CWD. Whereas histopathology can only be used to diagnose CWD in the brain, IHC can detect CWD prions in many tissues. Brain (particularly the obex), retropharyngeal lymph nodes, and tonsils are all good tissues for diagnosing CWD. IHC is a sensitive, specific, and reliable test for diagnosing accumulations of PrP^{res} within tissues (O'Rourke et al. 1998). However, this does not mean that the test is infallible. In fact, there is no test available which is 100% sensitive for CWD, meaning that a negative test result is not a guarantee of a CWD-free animal.

In addition to IHC, which takes several days to complete, there are several new rapid tests that also employ antibody technology to diagnose the presence of PrP^{res}. They are based on the same principle of adding an anti-PrP antibody to homogenized lymphoid or brain tissue to detect the abnormal prion. These tests include the Bio-Rad TeSeE® ELISA, IDEXX HerdChek®, VRMD Dot Blot ELISA, and the PDL rapid CWD antigen test by Prion Laboratories. Each has various advantages and disadvantages. Only certified laboratories can perform IHC or the rapid CWD tests.

3. DISEASE ECOLOGY

3.1 Transmission

The natural mode(s) of CWD transmission between and among cervids is unknown. There is strong evidence that the disease is infectious and is spread by direct lateral (animal to animal) or indirect transmission (Miller et al. 2000, Miller and Williams 2003). Maternal transmission can not be ruled out, but it does not play a large role in continuing the disease cycle in either deer or elk (Miller et al. 1998, Miller et al. 2000, Miller and Williams 2003, Miller and Wild 2004). It is unknown to what extent environmental contamination contributes to disease transmission but it is likely a significant factor (Williams and Young 1992, Miller et al. 1998, Miller et al. 2000, Williams and Miller 2003, Miller et al. 2004). In a study conducted at a captive research facility, presumably CWD-free mule deer were exposed to CWD prions via three natural routes. Some of the deer that resided in paddocks that previously held CWD-infected deer, paddocks with decomposing CWD-infected deer carcasses, or paddocks that held live CWD-infected deer became CWD-positive (Miller et al. 2004). This demonstrates that environmental contamination can contribute to CWD transmission in captive mule deer (Miller et al. 2004). Environmental contamination likely also plays a role in transmission in free-ranging cervids.

Bodily secretions such as feces, urine, and saliva have all been suggested as possible means of transmitting the disease between animals and disseminating infectious prions into the environment (Miller et al. 2000, Williams et al. 2002, Williams and Miller 2003). Oral inoculation of mule deer fawns with CWD-positive brain material demonstrated that PrP^{res} could be found in various gut associated lymphoid tissues in as little as 42 days post-exposure (Sigurdson et al. 1999). There are ongoing research projects designed to investigate the infectivity of urine, feces, saliva, and blood as modes of CWD transmission.

While oral exposure is a likely route of CWD transmission, there is no evidence that the CWD agent was first transmitted to deer via contaminated feedstuffs, such as is the case with BSE. Certainly, transmission among animals is now maintained in the absence of contaminated feedstuffs in both captive and free-ranging cervids (Williams and Miller 2003).

Although the mode of CWD transmission is unknown, it is clear that CWD can be transferred with high efficiency within captive herds. In one captive research herd, with a long history of CWD, 80-90% of mule deer over the age of 2 died or were euthanized as a result of CWD (Williams and Young 1980). Similarly, captive elk (Miller et al. 1998) and white-tailed deer (Miller and Wild 2004) can exhibit high CWD prevalence (17-36% in elk and up to 82% in white-tailed deer) when confined in areas with relatively high animal densities. This suggests that, like other contagious diseases, CWD transmission increases when animals are concentrated.

High animal densities and environmental contamination are important factors in CWD transmission among captive cervids. These factors may also play a role in transmission in free-ranging animals (Miller et al. 2004). Management actions that increase mortality rates in diseased populations can retard disease transmission and reduce prevalence. Increasing mortality slows transmission via two mechanisms. First, it reduces the average lifetime of infected individuals. Reduced lifespan, in turn, can compress the time interval when animals are infectious, thereby reducing the number of infections produced per infected individual. Moreover, the effect of reduced intervals of infectivity is amplified by reductions in population density that occur as mortality increases. Both of these mechanisms retard the transmission of disease. If these mechanisms cause the number of new infections produced per infected individual to fall below one, then the disease will be eliminated from the population (Tompkins et al. 2001).

Any elevation in mortality rate has the potential to cause these effects, however, reduction in transmission rates and disease prevalence can be particularly large if mortality rates are elevated in the infected portion of the population to a greater extent than in the susceptible portion. This explains why diseases that cause rapid death fail to persist. However, other non-disease agents of selective mortality can exert the same, beneficial effect. For example, if predators prey selectively on diseased individuals or test and removal is used to identify CWD-positive animals for culling, it is reasonable to expect that they might reduce disease prevalence much more rapidly than would occur if mortality were non-selective.

3.2 Epidemiology

Chronic wasting disease may have been best described by Miller et al. (2000) as an epidemic with a protracted time scale. Despite the fact that CWD was identified over two decades ago, researchers have only recently begun to describe and attempt to explain the interrelationships of factors that determine the frequency and distribution of this disease. Because the disease spreads slowly and the incubation period is relatively long under natural conditions, it is difficult to assess where we are with respect to disease chronology. Even though there are gaps in the current understanding of CWD, there are several important factors that characterize the disease in free-ranging cervids.

Demographic, spatial, and temporal factors all appear to contribute to the marked differences in CWD prevalence[2] in mule deer observed at several levels of geographic resolution within the historic CWD area of northcentral Colorado (Miller and Conner 2005). Gender and age both appear to be important factors contributing to CWD prevalence. In several studies, prevalence of CWD was found to be higher in male mule deer in every age class greater than 2 years old (Miller et al. 2000, Wolfe et al. 2002, Conner and Miller 2004, Farnsworth et al. 2005, Miller and Conner 2005). Additionally, male mule deer were 2.5 times more likely to be CWD-positive than sympatric females. Higher CWD prevalence among males than females has also been observed in white-tailed deer and elk (reviewed in Miller and Conner 2005). In addition to prevalence differences between the sexes, differences have also been observed between age classes, particularly in males. It is hypothesized that sex-specific breeding, foraging, and/or migration behaviors likely contribute to these differences (Conner and Miller 2004, Miller and Conner 2005).

In addition to demographic influences on CWD prevalence, geographic factors may also play a role. It has been observed that CWD prevalence is not homogenous across landscapes (Miller et al. 2000, Farnsworth et al. 2005). Prevalence tends to be higher on winter ranges or areas where deer congregate seasonally (Miller and Conner 2005). Moreover, there is strong evidence to suggest that anthropogenic factors, such as land use, influence prevalence of CWD in the historic area. In one study, CWD prevalence was nearly twice as high in urban developed areas than in undeveloped areas (Farnsworth et al. 2005). This work suggests that land uses which discourage normal migration, encourage congregation or sedentary behavior, and prevent hunting or other predatory pressure are more permissive to CWD.

3.3 Species susceptibility

To date the only naturally CWD-infected animals belong to the cervid family. They include mule deer, white-tailed deer, Rocky Mountain elk, and moose. There is evidence to suggest differences in susceptibility among natural hosts (Williams et al. 2002). Other members of the cervid family (e.g., other species of deer or elk, caribou, reindeer) may also be naturally susceptible although no cases have been reported.

Domestic livestock are not known to be naturally susceptible to CWD (Williams et al. 2002). Domestic cattle in two research facilities within the historic CWD area have been orally inoculated with CWD contaminated tissues and/or kept in close contact with CWD-infected deer and elk. Despite continuous contact for more than 8 years

[2] Prevalence = the number of cases of a disease present in a specified population at a given point in time.

none of the cattle have shown evidence of clinical disease (Williams et al. 2002). Additionally, a survey of cattle in northeast Colorado looked for evidence of naturally occurring transmissible spongiform encephalopathies and found no indication of these diseases within the brains of slaughtered cattle (Gould et al. 2003).

In experimental studies, CWD has been transferred to a variety of species via intracranial (IC) inoculation. Mink (*Mustela vison;* reviewed in Williams and Young 1992), domestic ferret (*Mustela putorius furo;* Bartz et al. 1998), and squirrel monkey (*Saimiri sciureus;* Marsh et al. 2005) are susceptible to CWD via this unnatural method of disease transmission. IC inoculation is commonly used in research to investigate relative susceptibility of various species and in development of experimental disease models. It does not represent evidence of natural susceptibility. Domestic cattle are moderately susceptible to IC inoculation with CWD tissue. In one study, three of 10 calves inoculated with CWD infected brain material IC, were euthanized due to clinical signs consistent with a TSE. Postmortem, all three were positive for PrP^{res} with immunohistochemistry of the brain. The remaining seven inoculated animals have not shown any clinical signs and are apparently healthy (Hamir et al. 2001). Intracranial inoculation of cattle and laboratory mice with CWD was less efficient than IC inoculation with scrapie or BSE material (Cutlip et al. 1994, Belay et al. 2004).

The inefficiency with which CWD infects alternate species is evidence of a species barrier. A species barrier refers to the likelihood that a prion strain will infect a non-adapted host and produce a TSE. Crossing the species barrier between cattle and humans, non-domestic cats, and exotic ungulates is the most likely explanation of the development of variant CJD (Bruce et al. 1997, Scott et al. 1999), feline spongiform encephalopathy, and exotic ungulate encephalopathy (Williams and Miller 2003), respectively. One factor controlling TSE transfer between species is the similarity of their normal prion proteins (amino acid sequences). In *in vitro* laboratory tests of cell free prion protein conversion it has been shown that cervid PrP^{res} efficiently converts cervid PrP^{c} to the resistant state (Raymond et al. 2000). Cervid PrP^{res} was far less efficient at converting human and domestic cattle PrP^{c} to the resistant prion. Domestic sheep PrP^{c} conversion was intermediate. This suggests there is a molecular barrier that likely limits the susceptibility of humans, cattle, and sheep to CWD (Raymond et al. 2000).

3.4 Genetics

Many transmissible spongiform encephalopathies are affected by variability in the nucleotide sequence of the PrP gene (*Prnp* or *PRNP*). *PRNP* contains genetic information which translates to the primary amino acid sequence of PrP^{c}. Heterogeneity in *PRNP* at certain locations on the gene is associated with relative susceptibility, pathological lesion patterns, incubation times, and clinical course of disease of natural TSE infections in some species (Collinge et al. 1991, O'Rourke et al. 1999). Single nucleotide substitutions with corresponding changes in amino acid sequence can affect the disease incubation period in mice (Westaway et al. 1987, Scott et al. 2004). Three specific amino acid residues control the relative susceptibility and incubation time of scrapie in sheep (Goldmann et al. 1994, Hunter et al. 1997, O'Rourke et al. 1997). Human TSEs are also highly influenced by changes in the PrP gene (Collinge et al. 1991, Palmer et al. 1991).

In elk there is evidence that a polymorphism at codon 132 on *PRNP* may influence CWD susceptibility (O'Rourke et al. 1999). Likewise, in mule deer, codon 225 may have an important effect on CWD incubation periods (Jewell et al. 2005). Evidence for genetic effects in white-tailed deer is less clear (Johnson et al. 2003, O'Rourke et al. 2004). This is an active area of CWD research and continued studies may reveal more specific genetic effects on the clinical expression of CWD in cervids, although it is unlikely that true genetic resistance will be identified.

3.5 Risk evaluation

Risk factors are attributes of the landscape, environment, or host animals associated with a greater probability of CWD occurring in a given region or cervid population. By evaluating the risk factors, wildlife managers can attempt to predict the population(s) most likely to be affected by CWD. This is important because in most areas CWD is likely to occur at a low prevalence that is difficult to detect (Samuel et al. 2003). CWD occurrence and prevalence can vary between geographic areas as well as within geographic areas (Samuel et al. 2003, Conner and Miller 2004, Miller and Conner 2005). Additionally, disease prevalence can vary with sex and age of the host (Miller et al. 2000, Wolfe et al. 2002, Miller and Conner 2005).

Risk factors can generally be divided into two categories (Table 3). The first relates to the risk of being exposed to CWD. This addresses the likelihood that CWD will be introduced into a given population. The second addresses the risk of amplifying the disease once a population of animals has been exposed. Both are important in evaluating risk. The first group of characteristics will be important for NPS units which have not identified CWD within 60 miles of their border (Appendix 12.2). The second set of factors is applicable to NPS units with CWD close to or within their borders as well as in proactive planning efforts. By evaluating the risk of CWD exposure and amplification, managers can make better decisions regarding how to use their resources to identify the disease.

Table 3. CWD risk factors for disease exposure and amplification.

Exposure risk factors	Areas adjacent to CWD-positive wildlife
	Areas with CWD-positive farmed or captive cervids
	Areas with concentrations of farmed or captive herds
	Areas that have received translocated deer or elk from CWD-affected regions
	Areas permitting transport of hunter-killed deer or elk carcasses from CWD identified areas
	Areas adjacent to land on which TSE-positive animals, farmed or wild, have lived
Amplification risk factors	Areas with a history of CWD animals or CWD contaminated environments
	Areas with high deer or elk population density
	Areas with low abundance of large predators
	Areas where free-ranging deer or elk are artificially concentrated (baiting, feeding, water development, and other human related habitat modifications)

From: *Surveillance Strategies for Detecting Chronic Wasting Disease in Free-Ranging Deer and Elk,* Samuel et al. 2003

4 DECONTAMINATION PROCEDURES

4.1 Disinfection

Abnormal prion proteins are resistant to breakdown and removal from equipment and the environment by a wide variety of inactivation procedures that are effective for conventional microorganisms (Kimberlin et al. 1983, Taylor 2000). There are relatively few options for effective prion decontamination. Although studies relating to inactivation of CWD-specific PrP^{res} are lacking, there are numerous papers addressing decontamination of other TSE prions including CJD, BSE, and scrapie (Kimberlin et al. 1983, Ernst and Race 1993, Taylor et al. 1994, Zobeley et al. 1999, Race and Raymond 2004). This information has been widely applied to CWD PrP^{res} deactivation.

Physical decontamination with ionizing, ultraviolet, or microwave irradiation or dry heat does little to inactivate PrP^{res} (Taylor 2000). Acids, organic solvents (acetone, ether, ethanol, petroleum derivatives), detergents, and alkylating agents such as formalin or glutaraldehyde have little to no effect on denaturing PrP^{res} (Taylor 2000). Even proteolytic enzymes such as trypsin, proteinase K, and pronase have little effect unless there are prolonged digestion times (Taylor 2000). The most effective methods of disinfecting TSE contaminated materials is through the use of chemicals followed by specialized autoclaving (Ernst and Race 1993, WHO 1999, Rutala and Weber 2001, Race and Raymond 2004).

Sodium hydroxide (soda lye, NaOH) is a strong base used in some disinfectants and detergents. Because NaOH can be caustic to skin and mucous membranes, it should be used with care. If NaOH is used for disinfecting TSE-contaminated equipment, the World Health Organization (WHO) recommends treatment with 1-2 normal (N) solution for 1 hour on instruments and surfaces (WHO 1999). However, alternate disinfectants provide equal or greater efficacy of disinfection, less human health risk, and are more easily applied (Lemmer et al. 2004).

Sodium hypochlorite (chlorine bleach, NaOCl) is effective at denaturing PrP^{res} when high levels of available chlorine are present. Exposure to NaOCl solutions containing at least 8250 ppm of available chlorine for 30 minutes inactivated two strains of BSE (Taylor et al. 1994). In another study exposing scrapie prion to NaOCl with 1000 ppm of available chlorine for 4 hours or 10,000 ppm for 0.5 hours was effective in substantially decreasing the infectivity titer (Kimberlin et al. 1983). In light of these and other studies the WHO has adopted a recommendation of using 20,000 ppm available chlorine with a contact time of 1 hour (WHO 1999). To achieve this concentration of available chlorine, household chlorine bleach (5-6% NaOCl, 23,800 ppm – 28,500 ppm) can be diluted appropriately with water. While effective, this combination is highly corrosive to equipment and metal surfaces. Rinsing equipment thoroughly with clean water after disinfecting with a bleach solution will help to decrease corrosion. Chlorine bleach solutions loose their effectiveness if left exposed to heat, light, or carbon dioxide in the air. Therefore, a fresh NaOCl solution should be made before each use.

Environ® LpH® is a proprietary[3] disinfectant which contains a variety of phenols as well as glycolic acid and isopropanolol. It is unknown which ingredient or combination of ingredients is responsible for its TSE inactivation properties. A solution of 9% Environ® LpH® removed all measurable detectable scrapie infectivity after a 30 minute incubation time. An overnight incubation with a 0.9% solution also removed all infectivity (Ernst and Race 1993, Race and Raymond 2004). There are several formulations of LpH on the market. LpH-AG, LpH-SE and LpH-st all represent a common combination of ingredients which are different from the Environ® LpH®. None of these products have the same level of prion deactivation seen with Environ® LpH® (Race and Raymond 2004). Environ® LpH® is not corrosive to instruments and surfaces and does not pose the same human health hazards as chlorine bleach. See Appendix 12.4 for disinfection products material safety and data sheet information.

Specialized autoclaving can be an effective method of disinfecting TSE contaminated instruments. There are conflicting data regarding autoclaves and recommendations for time and temperature parameters (Kimberlin et al. 1983, Ernst and Race 1993, Taylor et al. 1994). The only study that found complete inactivation of one strain of scrapie used a gravity displacement autoclave at 132 degrees centigrade for 90 minutes. Autoclaving used in conjunction with either sodium hydroxide or Environ® LpH® increases the disinfection capabilities of both procedures (Ernst and Race 1993). The important point to remember concerning autoclaves is that standard temperatures, pressures, and times used for sterilizing instruments contaminated with normal pathogens (bacteria and viruses) are not sufficient for inactivating prions.

[3] Steris Corporation, 7501 Page Avenue, St. Louis, MO 63133, USA, 1-800-548-4873, www.steris.com

Prion disinfection methods are changing rapidly and new products are becoming available (Fichet et al. 2004). At this time, however, these products and procedures are not feasible for use in NPS units.

4.2 Recommendations

Before disinfecting TSE contaminated equipment or surfaces all organic material must be removed using a standard detergent or soap. This allows the disinfectant to contact the surface to be decontaminated. The current recommendations for NPS resource managers looking to mitigate the risks of CWD on potentially contaminated equipment (biopsy instruments, scissors, other stainless steel instruments) include the use of a 10% Environ® LpH® solution (diluted with water) for 1 hour. Additionally, if possible, after LpH treatment, rinsing, and drying, the equipment should be autoclaved at 121-132 degrees centigrade for 1 hour. Universities and veterinary diagnostic laboratories often have autoclaves that can be used. Environ® LpH® solution can also be used to disinfect countertops, sinks, boots, and other equipment. If large areas or non-metal surfaces (concrete floors, tarps, truck beds) require disinfection, household bleach appropriately diluted with water can be used. Again, allow a 1 hour contact time. The key to disinfection is removal of all visible tissue from the surface or instrument to be cleaned before soaking it in an appropriate solution of Environ® LpH® or bleach.

4.3 Disposal of CWD infected organic material

Discarding known or suspect CWD contaminated organic material such as whole or partial carcasses is likely to become an important issue for NPS units in the future. Each state, Environmental Protection Agency Region, and refuse disposal area is likely to have different regulations and restrictions for disposal of potentially infected tissues. There is currently no national standard for disposal. Because infected carcasses serve as a source of environmental contamination (Miller et al. 2004) it is recommended that known and suspect CWD-positive animals be removed from the environment. Alkaline digestion and incineration are two of the most effective ways of destroying contaminated organic material. These are usually only available at veterinary diagnostic laboratories or universities. Arrangements can often be made with laboratories to test and then dispose of animals. Another option, depending on the region, is landfill disposal; however, local landfills should be contacted for more information regarding carcass disposal.

5 IMPLICATIONS OF CWD ON CERVID MANAGEMENT

5.1 Cervid resources

The effect that CWD will have on native deer and elk populations is unknown. However, two mathematical models based on mule deer and general cervid demographics within the historic area of disease (northeastern Colorado and southeastern Wyoming) predict that CWD epidemics will limit cervid populations and may drive mule deer populations to extinction (Miller et al. 2000, Gross and Miller 2001). However, the assumptions and outcomes of the current models have been challenged (Schauber and Woolf 2003). Clearly more research is needed to more accurately construct and parameterize models of CWD. Regardless of whether CWD has dramatic impacts on localized populations of cervids by causing large scale declines or the disease eventually comes to an equilibrium state and stabilizes at an endemic level, it will certainly have an effect on native deer and elk populations and their management in NPS units.

5.2 Equipment contamination

Managers should be aware that there may be real or perceived risks of using potentially CWD-contaminated equipment on CWD susceptible cervids. Current diagnostic tests are not sensitive enough to detect CWD PrP^{res} from environmental samples (Miller et al. 2004). Although undemonstrated, it may be possible for equipment or materials to harbor a sufficient prion load to infect a susceptible host. Therefore, it is important to minimize the transfer of organic material, particularly substances which originated from a CWD-infected animal, from one geographic location to another. Managers and wildlife biologists should have dedicated equipment for use in CWD areas (e.g., biopsy equipment) or ensure that items such as mouth gags, thermometers, blindfolds, animal slings, ear-tagging equipment, and other supplies used in animal handling procedures are properly and adequately decontaminated prior to leaving CWD areas. The NPS has developed guidelines for re-use of radio-telemetry collars as well as capture nets from known CWD areas (Appendix 12.5)

5.3 Movement restrictions

Human-assisted movement of cervids has been implicated in several CWD outbreaks which have occurred outside of the historic area of disease (Williams and Miller 2003). Therefore, many state and federal land management agencies have put movement restrictions in place for transportation of cervids and cervid products. NPS also restricts movement of deer and elk (Appendix 12.2). The United States Department of Agriculture (USDA) has a proposed rule which may affect the transportation of wild cervids in addition to captive cervids. The rule is due to be enacted during fiscal year 2006. It will be important for parks considering cervid translocation as part of a management action to be aware of this ruling. Upon enactment of the final rule it will be added to this CWD reference notebook.

6 CWD MANAGEMENT OPTIONS

6.1 General considerations

A thorough understanding of site-specific CWD goals and objectives is necessary before choosing a management strategy. This will help determine if it is most appropriate to attempt prevention of disease introduction, work at detecting the disease if risk factors are high, mitigate the effects of the disease if it has become established, or attempt to eliminate the disease. Further, goals will focus planning, communication, implementation, and evaluation of strategies. Appendix 12.6 lists 10 questions to consider when establishing a CWD surveillance program. If management is the goal, options to control CWD are limited to actions that reduce the number of infected animals in the population or otherwise alter the transmission rate. Current approaches to managing CWD are intensive, costly (often both economically and environmentally), and will require a long-term commitment to reduce prevalence or eliminate the disease in free-ranging populations. It is important to recognize that these approaches have been applied for a limited amount of time and the outcome of these management options is unknown. Application of an adaptive management approach will be critical to evaluation and refinement of these approaches.

6.2 No action

This is the most conservative approach. It has the least immediate impact on the native host species. However, it does not allow for disease surveillance or detection. This may only be an appropriate action if the threat of CWD is remote and there are no available resources to dedicate to disease recognition. The consequences of no action include failing to detect the disease if it is present and the inability to work with neighboring land management agencies in assessing, understanding, or controlling the disease.

6.3 Opportunistic surveillance

Opportunistic surveillance involves taking diagnostic samples for CWD testing from cervids found dead or harvested within an NPS unit. Cause of death may be hunting, culling, predators, disease, trauma (hit by car), or undetermined. Opportunistic surveillance has little, if any, negative impact on current populations. Unless deer or elk are harvested or culled, relatively small sample sizes may be available for opportunistic testing. Animals killed in collisions with vehicles may be a biased sample that could help detect CWD because CWD-infected mule deer may be more likely to be hit by cars than non-CWD infected deer (Krumm et al. 2005). Opportunistic surveillance is an excellent way to begin surveying for presence of CWD without changing management of the host resource. This is a good first step option for NPS units where CWD is a moderate risk but where it has not yet been encountered.

6.4 Targeted surveillance

Targeted surveillance entails lethal removal of deer or elk which exhibit clinical signs consistent with CWD. Lethal removal of sick individuals from a population can be covered by a categorical exclusion (NPS DO-12 3.4 E(3)). See Appendix 12.7 for an example of an environmental screening form which resulted in a categorical exclusion for targeted surveillance. Targeted surveillance has negligible negative effects on the current population, removes a potential source of CWD infection, and is an efficient means of detecting new foci of infection (Miller et al. 2000). One limitation to targeted surveillance is that clinically affected animals presumably shed infectious PrP^{res} before they are visibly ill. Thus, environmental contamination and direct transmission may occur prior to removal. Additionally, there is no available method to extrapolate CWD prevalence data collected from targeted surveillance animals in order to estimate population prevalence. Targeted surveillance is moderately labor intensive and requires educating park staff in recognition of clinical signs, training for identification and removal of appropriate samples for testing, as well as vigilance for continued observation and identification of potential CWD suspect animals. Targeted surveillance is prudent in any area and is highly advised in areas with moderate to high CWD risk or in NPS units where CWD has already been identified.

6.5 Test and cull

A live test is available for diagnosis of CWD in mule deer and white-tailed deer (Wild et al. 2002, Wolfe et al. 2002). Tonsillar biopsy has been used in limited situations to test deer and cull CWD-positive members of the population (Wolfe et al. 2004). This method of selective removal allows for relatively early disease detection and may reduce transmission of CWD by minimizing infectious contacts and minimizing shedding of the prion into the environment. The technique requires capture and general anesthesia of the animal, specialized training in biopsy techniques, and the ability to test large proportions of the population. These logistics make it an expensive and intensive method of managing CWD. Studies are ongoing to evaluate the feasibility of this technique for decreasing the incidence of CWD in a moderately to heavily infected population (L. Wolfe and M. K. Watry, unpub. data). This technique is not suitable for confirming that an individual is CWD-free. It is a good option for testing relatively small, accessible populations of deer, especially where the risk of CWD is moderate to high. Because the progression of CWD in elk differs from progression in deer, sampling lymphoid tissue in elk using current techniques does not appear to be sensitive enough to use as a reliable antemortem diagnostic test (Williams et al. 2002).

6.6 "Hot-spot" culling

Hot-spot culling is a technique where animals potentially in contact with a confirmed CWD-positive animal are lethally removed. It has been shown that, in infected areas, there are localized regions of higher CWD prevalence within the greater metapopulation (Conner and Miller 2004). CWD is not distributed uniformly across the landscape (Miller et al. 2000, Miller and Conner 2005). It is hypothesized that removing animals which have been in contact with CWD positive animals will decrease local prevalence of CWD. A drawback to this method is that it inevitably removes healthy animals in addition to those that are diseased.

6.7 Population reduction

Population reduction involves culling animals randomly within a population in an attempt to reduce animal density, and thus decrease transmission rates. In captive situations, where animal density is high, the prevalence of CWD can be substantially elevated compared to that seen in free-ranging situations. Thus, it is hypothesized that increased animal density and increased animal to animal contact, as well as increased environmental contamination, enhances the spread of CWD. Therefore, decreasing animal densities may decrease the transmission and incidence of the disease.

However, migration patterns and social behaviors may make this an ineffective strategy if instead of spreading out across the landscape at lower densities, deer and elk stay in high density herds in tight home ranges throughout much of the year (Williams et al. 2002). Population reduction is an aggressive and invasive approach to mitigating the threat of CWD. It has immediate and potentially long term effects on local and regional populations of cervids and the associated ecosystem. This may be an appropriate response if animals are above population objectives and/or the need to know CWD prevalence with a high degree of accuracy is vital.

6.8 Wolf predation as a stewardship tool

Recent theoretical studies have suggested that alterations to predator abundance can strongly influence disease prevalence for diseases similar to CWD. Modeling indicates that predators reduce the force of infection on wildlife hosts. With fewer predators, longevity of an infection is expected to increase and more secondary infections are expected to be produced per primary infection. Indirectly, predators reduce the potential for spillover to alternate species (Packer et al. 2003). Further, modeling disease scenarios that are similar to CWD also indicate that disturbance to predator-prey interactions result in multiple alterations to disease emergence and dynamics. These include facilitation of establishment of novel pathogens and higher disease prevalence. Thus, one broad effect of predator reduction is the unleashing of host-parasite interactions within prey populations (R. D. Holt, in press).

Although increase in mortality rates from any type of predation could theoretically reduce transmission rates, the selective removal of vulnerable CWD-positive cervids by a coursing predator such as wolves would have the most significant impact. Wolves could influence CWD prevalence through several mechanisms including: increasing mortality rates, particularly selective removal of CWD-positive deer and elk, redistributing deer and elk from areas of high concentration, and removing infected carcasses from the environment. No field test of this hypothesis is currently in place (i.e., the range of CWD and wolves do not overlap), however, results from mathematical modeling are intriguing. Results of preliminary modeling revealed that although uncertainties in estimates of model parameters resulted in uncertainty in estimates of time required to eliminate the disease, the fundamental conclusion of disease elimination was robust and consistent for closed elk populations (N. T. Hobbs, unpub. data).

6.9 Depopulation

Depopulation of deer and elk from an area is the most aggressive approach to CWD management. In addition to potentially significant environmental impacts and human dimensions issues, the feasibility of removal of all infected animals may be limited. Additionally, prions persist in the environment and may serve as a source of contamination following removal of animals (Miller et al. 2004). It is unknown how long CWD remains infective in the environment. One research facility attempted to eliminate CWD from its captive herd by depopulating and cleaning the facility. When repopulated with elk 1 year later and deer 5 years later, the presumably CWD-free animals developed CWD in as little as 3 and 4 years, respectively (Miller et al. 1998, Miller and Wild 2004). The source of infection was speculated to be environmental contamination. Depopulation is likely only feasible if it can be applied on a limited geographic area delimited by barriers to deer and elk movement (e.g., lakes, geographic features). Depopulation may also be a consideration if deer or elk are an exotic species in an NPS unit.

7 COOPERATION / COORDINATION WITH OTHER AGENCIES

7.1 Need for cooperation

Wildlife diseases in general, and CWD specifically, do not respect political borders. This makes it difficult when trying to manage cervid health. Rarely if ever does a cervid metapopulation reside completely within an NPS unit with no overlap onto other jurisdictions. Therefore, close partnerships with other agencies are necessary to achieve management goals. Goals must be compatible with both agency's missions and mandates. Thus, goals and management actions may not be mirrored among all agencies. While challenging, it may not be impossible to reach common ground with other agencies, considering there is a nearly universal goal of containing and controlling the spread of CWD as well as increasing the body of knowledge pertaining to the disease.

7.2 Potential cooperating agencies

Interested parties to keep in mind when considering and developing cervid management plans include: state wildlife agencies, state veterinarians, private land owners, U.S. Geological Survey - Biological Resource Discipline, Tribes, and other federal land management agencies. See Appendix 12.8 for an example of a memorandum of understanding for elk management between the NPS and a state wildlife agency.

8 DATA MANAGEMENT

8.1 Within the NPS

It is essential to maintain complete records of animals tested for CWD within an NPS unit. Basic animal identification information should include: date, species, sex, estimated or exact age, location animal was found (preferably with UTM coordinates), clinical signs of disease or a visual description of the carcass, status of any other cervids seen in the vicinity, samples taken, submitted and banked, results of the CWD test(s), and results of the complete necropsy if performed (see Appendix 12.9 for an example of a sample submission form). One efficient way to accomplish this is with a computer spreadsheet with a column dedicated to each category. Additionally, CWD test results can be compiled in a separate hard copy notebook. Finally, in order to have a centralized database within the NPS, it is requested that all CWD testing results be forwarded to the BRMD chronic wasting disease coordinator. Much of the time CWD testing will be coordinated through the BRMD office, however, if alternative laboratories are utilized, please forward these results to the coordinator (see Appendix 12.10 for contact information).

8.2 Outside of the NPS

A national database for CWD information in free-ranging cervids is being developed. The National Biological Information Infrastructure (NBII) Wildlife Disease Information Node (WDIN) is a large network of databases tasked with biological information dispersal. It is serviced and overseen by the National Wildlife Health Center. This database is used to map to the county level where positive animals have been found. Additionally, it will provide a CWD data factsheet and current news, sampling information, and links to Federal, State, and regional CWD websites. NPS data will likely be integrated with the WDIN in the future. States, tribes and other federal agencies have been encouraged to disseminate data in this manner. It can be accessed at http://wildlifedisease.nbii.gov.

In addition to the national level information, each state which currently has free-ranging cervids affected by CWD has their own website for CWD statistics and information. A convenient way to access these websites is through the CWD Alliance at www.cwd-info.org. The CWD Alliance also has current CWD information on a variety of topics.

9 SAMPLE COLLECTION, HANDLING, AND STORAGE

9.1 Collection

PrP^{res} consistently accumulates in specific areas of the brain stem and various lymphoid tissues (Guiroy et al. 1991, Sigurdson et al. 2001, Sigurdson et al. 2002, Spraker et al. 2002b, O'Rourke et al. 2003, Spraker et al. 2004). Minimum tissues to remove from cervids for diagnosis of CWD are brain stem at the level of the obex and retropharyngeal lymph nodes. Tonsil and whole brain may also be useful. Additional tissues may be collected routinely for research purposes or to rule out other causes of disease. Training in proper sample collection is required to ensure good quality specimens. If expertise in sample collection is not locally available, the entire cervid head should be submitted for testing.

9.2 Handling

In order to perform diagnostic tests for CWD the samples must be preserved properly or submitted promptly for testing. To perform histopathology or IHC the tissues must be fixed in 10% neutral buffered formalin. When placed in formalin, obex and retropharyngeal lymph nodes can be used for CWD diagnosis several weeks to months after collection. However, the sooner samples arrive at the diagnostic laboratory the higher the sample quality. If possible, tissues should not be frozen before placing them in formalin. Freezing distorts the cellular architecture of the sample. For the rapid ELISA based tests fresh or fresh frozen samples are required.

If samples can be delivered promptly to the laboratory, then fresh tissues should be submitted. If submission is delayed, one retropharyngeal lymph node should be sent frozen and one sent formalin fixed. The entire brainstem can be formalin fixed.

Fresh samples should be shipped overnight on blue or dry ice. Samples preserved in 10% neutral buffered formalin (at a ratio of formalin:tissue of 10:1) should be held for at least 72 hours, then removed and placed in double ziplock bags with a damp formalin soaked piece of paper towel. Formalin is a carcinogen and should only be handled with latex or rubber gloves (see Appendix 12.4 for information regarding material safety and data sheets). All diagnostic samples must be shipped in a firm-sided cardboard box with enough absorbent material to contain any moisture that might escape. Samples should be double bagged and then placed inside a third bag with appropriate absorbent material. The box should be padded with appropriate fillers to keep the samples from moving during shipment. Additionally, the box should be appropriately labeled to identify contents as "Diagnostic Samples—Wildlife". See Appendix 12.11 for further shipping recommendations and contacts.

9.3 Storage

Samples for genetic analysis, immunologic studies, and diagnostics (e.g., whole blood, blood cells, serum, tissues, feces) are best stored in an ultra-cold freezer (-80º C). Tissues for transmission studies can be stored in a standard freezer or in an ultra-cold freezer. Pathology samples should be stored in 10% neutral buffered formalin. Alternate storage may be necessary for unique purposes. Samples collected will depend on individual circumstances and needs. In addition to various options available to NPS units for sample storage, BRMD has the capability to store appropriate NPS CWD related samples in an ultra-cold freezer, standard freezer, or in formalin. BRMD can also assist/advise in sample collection and transport, cataloging samples, and facilitating research agreements for use of the samples.

Biological specimens from CWD-positive animals are valuable for future research involving disease transmission, diagnostic modalities, immunity, genetics, pathology, and other disease characteristics. The NPS can be a partner to this research by being able to provide samples to qualified researchers. A research permit and material transfer agreement must be obtained prior to distributing research samples.

10 NATIONAL PARK SERVICE CWD POLICY

10.1 NPS Management Policies 2001

A CWD Policy Assessment workshop was held on August 27-28, 2003 to review NPS policy pertinent to addressing CWD in NPS units (Appendix 12.3). A significant outcome of that meeting was that participants confirmed that existing management policies provide sufficient flexibility regarding the surveillance and management of CWD, given required environmental compliance is achieved. Lethal removal of individual animals can be an acceptable alternative for management actions even if an NPS unit's enabling legislation prohibits take of wildlife. Although policy allows for consideration of a range of alternatives, many other factors, including site-specific information, best available science, and public input will determine the preferred alternative. Therefore, NEPA should be used as a decision-making tool to determine the appropriate action.

Excerpts from NPS Management Policies 2001 that may be pertinent to management of cervids or PrP^{res} to address CWD include:

4.2.2 Management of Native Plants and Animals

- Management is necessary
  - because a population occurs in an unnaturally high or low concentration as a result of human influences…
- Or, removal of individuals or parts thereof
  - is part of an NPS research project described in an approved management plan, or is part of research being conducted by others who have been issued a scientific research and collection permit;…
  - meets specific park management objectives.

4.4.4.2 Removal of Exotic Species Already Present

All exotic plant and animal species that are not maintained to meet an identified park purpose will be managed—up to and including eradication—if (1) control is prudent and feasible, and (2) the exotic species:

- Interferes with natural processes and the perpetuation of natural features, native species or natural habitats; or…
- Significantly hampers the management of park or adjacent lands

10.2 Director's CWD Guidance Memorandum (July 26, 2002)

The Director has provided guidance to regions and parks on the NPS response to CWD through a memo dated July 26, 2002 (Appendix 12.2). Although that memo is out-of-date with regard to the description of CWD distribution, the guidance remains pertinent and stands. In addition to guidance on surveillance, management, and communication regarding CWD, the memo strictly limits the translocation of deer and elk into or out of NPS units. Translocation can be interpreted as human-assisted movements outside the natural range of a cervid population. Restrictions on translocation are intended to prevent the mixing of metapopulations of deer and/or elk which would not naturally come into contact with one another. Like any policy, deviation from the guidance memo would require approval by the Director via a waiver process.

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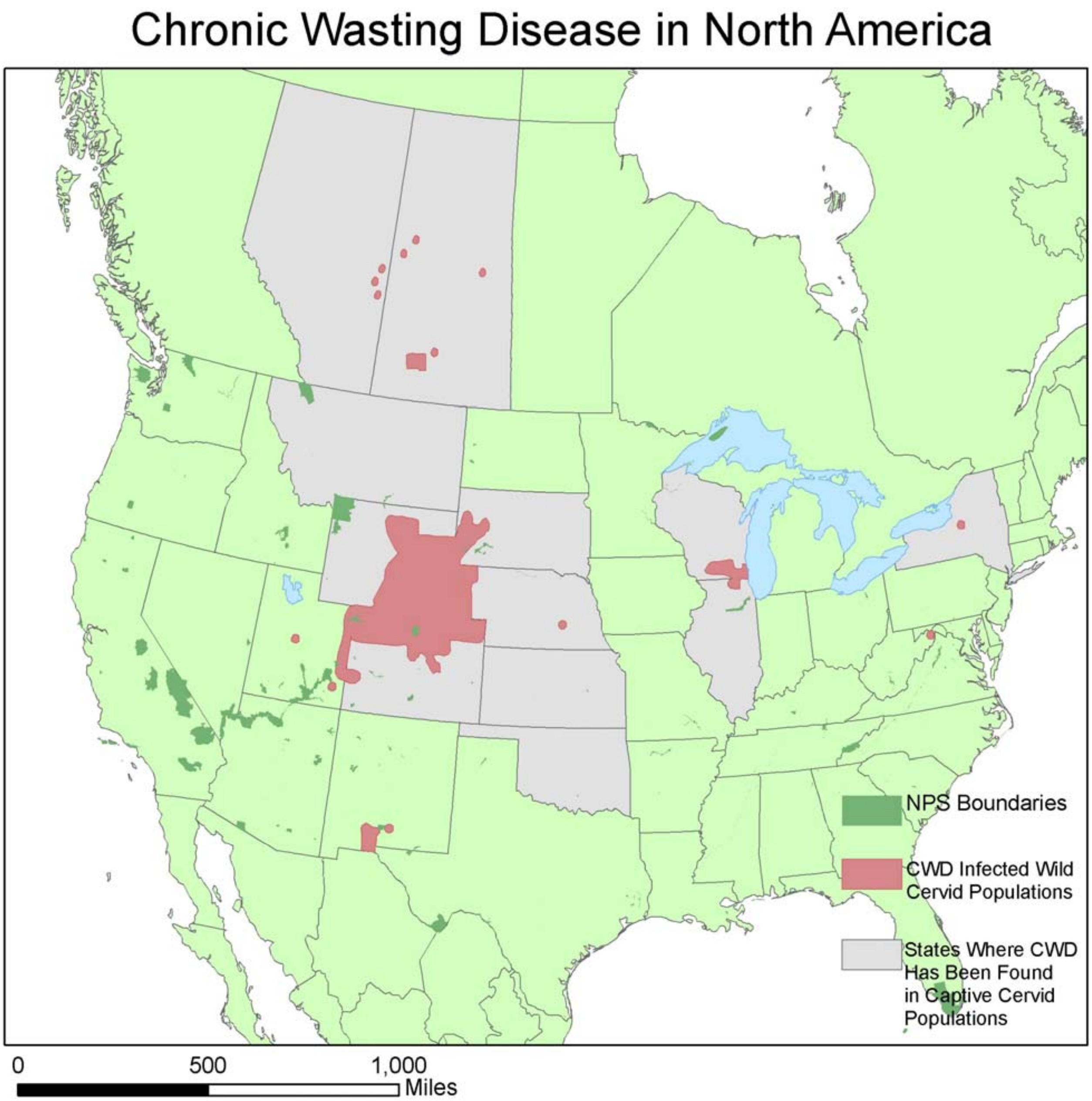
12 APPENDICIES

12.1 National Park Service units in geographic relation to areas where CWD has been identified.



12.2 Director's CWD Guidance Memorandum (July 26, 2002)

July 26, 2002

N16 (2300)

Memorandum

To: Regional Directors

From: Director /s/ Randy Jones (for)

Subject: National Park Service response to chronic wasting disease of deer and elk

The purpose of this memo is to provide regions and parks with guidance on the National Park Service (NPS) response to chronic wasting disease (CWD), which is a fatal neurologic disease of deer and elk. The disease has occurred in a limited geographic area of northeastern Colorado and southeastern Wyoming for over 20 years. Recently, CWD has been detected in captive and free-ranging deer and elk in several new locations in the United States, including western Nebraska, southwestern South Dakota, western Colorado, southern New Mexico, and for the first time east of the Mississippi River in Wisconsin.

Although Rocky Mountain National Park is the only NPS unit where CWD is known to occur, several NPS units are at high risk due to their close proximity to the newly identified areas of disease occurrence. In addition, there is a definite likelihood that CWD will be detected in other areas of the country following increases in surveillance for the disease. Therefore, CWD has become an issue of national importance to wildlife managers and other interested publics, including the NPS.

CWD is in the family of diseases known as the transmissible spongiform encephalopathies (TSEs) or prion diseases. Other TSEs include scrapie in sheep, bovine spongiform encephalopathy (BSE or mad cow disease), and Creutzfeldt-Jacob disease (CJD) in humans. CWD causes brain lesions that result in progressive weight loss, behavioral changes, and eventually death in affected deer and elk. There is currently no evidence that CWD is transmissible to humans or domestic livestock; however, the disease could limit populations of deer and elk and could result in profound impacts on the recreational value of these species. In an attempt to control chronic wasting disease, the states of Colorado and Wisconsin are drastically reducing free-ranging deer and elk numbers in affected areas.

The NPS, working within our mission and management policies, should cooperate with states in preventing and controlling CWD in park units. Although the origin of CWD is unknown, it is strongly suspected that CWD is a non-native disease of deer and elk in parks. Therefore, I am asking each region and park to:

- o Cooperate and coordinate with state wildlife and agriculture agencies regarding proposed prevention, surveillance, research, and control actions for CWD.
- o Parks in close proximity (60 miles) to areas where CWD has been detected should initiate a targeted surveillance program to monitor for deer and elk with clinical signs of the disease and submit samples for diagnostic testing from all deer and elk found dead.
- o Immediate action should be taken, on a limited scale, to address imminent threats such as a deer or elk exhibiting clinical signs of CWD. Euthanasia of CWD suspect deer or elk with samples submitted for diagnostic evaluation is a reasonable response.
- o Prior to undertaking larger scale or multiple animal actions within a park (e.g., population reduction of deer and elk) environmental planning documents, including NEPA and, if applicable, Section 7 consultation with the US Fish and Wildlife Service, will need to be prepared.
- o Proposed translocations of live deer or elk into or out of NPS units must receive critical review and CWD risk assessment. Deer or elk will not be translocated from areas where CWD is known to occur or where there is inadequate documentation to confirm absence of the disease (i.e., prevalence <1 percent with a 99 percent confidence interval).
- o Use of park or regional public affairs staff to assist in outreach to surrounding communities and communications to park visitors regarding CWD and CWD management is encouraged.
- o Remain alert to potential threats from CWD and contact the NPS Biological Resource Management Division (BRMD) or state wildlife agencies if further information or animal testing is needed.

Chronic wasting disease is currently in the spotlight with the public, States, Department of the Interior (DOI), United States Department of Agriculture (USDA), and Congress. A Congressional hearing on CWD has been held and a joint DOI-USDA-State Working Group Task Force has been established to address the CWD issue. The NPS has been an active participant in these processes. This broad level of participation increases our need to remain internally connected and coordinated at the park, regional, and national level, and to assure that our actions are consistent with agency policy.

The BRMD will provide assistance to regions and parks in prevention, surveillance, and control of CWD. The BRMD has also partnered with the USGS National Wildlife Health Center to provide additional assistance. General information and links to other websites on CWD are available through the BRMD section of InsideNPS. If you have technical questions, need more information or animal testing, please contact Dr. Margaret Wild, NPS Wildlife Veterinarian, BRMD, at (970) 225-3593. If you have policy questions regarding NPS response to CWD, please contact Michael Soukup at (202) 208-3884.

cc: Max Peterson, IAFWA
Steve Williams, USFWS
Kathleen Clarke, BLM
Denny Fenn, USGS
Jake Hoogland, NPS EQD

12.3 Meeting Notes from the National Park Service CWD Policy Assessment: August 27-28, 2003

Problems and Proposed Solutions Associated with Managing CWD in National Park Units

Working Group Meeting
Fort Collins, August 27-28, 2003

1. Problem: It is unclear whether all alternative actions for CWD surveillance and management, including lethal take of healthy animals, are acceptable under NPS policy.

1. Solution: Discussion by meeting participants confirmed that all possible alternatives for CWD surveillance and management are acceptable under NPS policy, given required environmental compliance is achieved. Lethal take can be an acceptable alternative for management actions even if an NPS unit's enabling legislation prohibits take of wildlife. NEPA should be used as a decision-making tool to determine the appropriate action to take. Although policy allows for any alternative, many other factors, including best available science and public input, will determine the preferred alternative. An Environmental Assessment (EA) or Environmental Impact Statement (EIS) also needs to be used as a decision-making tool for lethal take for CWD research actions because there is no blanket exception for research in NPS Director's Order 12 that would cover the extent of take necessary for a CWD surveillance program in deer or elk. This information on policy interpretation will be made available to parks in the reference document (see below).

2. Problem: The science of CWD is largely unknown. For instance, researchers don't know the source of CWD, whether it is an exotic or native "species", how it is transmitted between deer or elk, its impacts on cervid populations, and definitively whether it is transmissible to humans or livestock. Because the answers to these basic questions are unknown, management of the disease is difficult. For example, it is unknown whether changes in density of deer or elk populations will affect disease prevalence. Although CWD is fatal, it is unknown how quickly it will spread in a population if left unmanaged, or to what degree population-level effects will occur over time.

2. Solution: This problem exists for all cervid managers, including the NPS. Research is underway on a number of fronts, but answers to the questions will take several years at best. USGS collected the NPS group's top five research priorities, and will take them back to its managers to see if money anticipated for this next fiscal year might support some or all of them. These five top efforts are:

- Determine whether CWD is a native or exotic disease. This has considerable ramifications within NPS about how the disease is managed.

- Determine the validity of hunter survey data in extrapolating CWD prevalence to the population level and investigate alternative methods for population prevalence estimates. Because hunters don't typically randomly select all animals, because some areas are not accessible (e.g., park units, private lands), and because prevalence seems to vary among age/sex classes there is a need to determine the true population prevalence for CWD. Further, it would be useful to understand if and how data from different cervids species could be pooled for analysis.

- Improve surveillance methods to incorporate clinical surveillance. How to use clinical surveillance (sick animals) in determining probabilities of detecting CWD and estimating CWD prevalence is not well established. This is a particular need for NPS because of the difficulty in collecting healthy animals from parks.

- Determine the ecologic impacts and potential for impairment from herd reduction related to CWD management and possible mitigation strategies. NPS needs to determine the potential ecological impacts of reducing cervid populations when it is done as part of a management action. Depending on the potential ecological impacts mitigation efforts may be necessary.

- Understand the role of environmental contamination in the transmission of CWD. This need is related to longer term management of CWD and whether there is benefit of removing animals early to reduce potential environmental contamination and related transmission.

Other research efforts with information that will be useful to park managers are already under way. These include the following:

- The degree to which density affects spread of the disease
- How prevalence increases or decreases over time, and how number of elk or deer in a population change with changing prevalence
- How the disease is transmitted from animal to animal, or environment to animal in the wild
- A non-lethal test for elk
- Genetic resistance to CWD in deer or elk
- Transmissibility to cattle, scavengers and primates

The group also suggested the following research efforts, but these were not in the top 5 or are already under way:

- Any environmental correlates with CWD? Copper, toxins, military activity, etc.
- Means to eliminate the prion from the environment.
- Why are males more susceptible?
- Baseline information on elk and deer population numbers and movement patterns
- Distribution of the disease, particularly on private elk or deer ranches, trace backs, etc.
- Large predator influence on limiting CWD prevalence and distribution

In addition to supporting or encouraging the completion of research, the NPS can offer to host research, function as outdoor labs, can widely share results of different survey or management techniques or interagency cooperative efforts, etc. Parks may also want to have on hand information about where they have sent or received cervids historically.

3. Problem: Because little is known about CWD, perception plays a large role. The public may be nearly or completely unaware of CWD, its effects, research results, policies of the NPS and how they differ from state wildlife management agencies, etc. Also, although all research indicates it is not transmissible from cervids to humans or to cattle, it is extremely difficult to prove the negative that transmissions cannot and will not occur. Until long term studies bear out the assumption that it is not a health threat to humans or livestock, the public needs to be kept accurately informed.

3. Solution: A reference document (see below) prepared by BRMD should stress prevention and methods managers might use to keep a disease from entering a population or preventing its spread if it does enter. The NPS can also provide clear, honest information to the public and park managers about known risks, research results, management options, potential impacts of the disease and of management activities aimed at controlling the disease, the potential for APHIS to invoke authority for management under the Animal Health Protection Act, NPS management policies relevant to managing CWD, etc. Parks can use information on the InsideNPS wildlife health website, USGS web site, can prepare briefing statements and bulletins for their congressional representatives, NGOs and other interested public, can include CWD in interpretive talks or park brochures, etc.

4. Problem: Parks are unprepared to determine whether CWD surveillance is required in their cervid populations, how to implement a surveillance program, or how to manage to prevent or control CWD if it is found. This is due to a combination of factors, including a lack of knowledge of how to construct a statistically valid surveillance effort; lack of money; little understanding about conducting the effort itself, including tissue testing and disposal; uncertainty in the field about whether NPS management policies or specific park implementing legislation in some cases allow killing of healthy animals; uncertainty about the specifics of current NPS direction (memo) on management, including requirements for translocation; inexperience working with state or other federal agencies to manage resources regionally; the lack of management objectives regarding CWD prevention and management in most park GMPs or other broad-based plans; the requirement that killing healthy cervids for CWD research or management actions will likely be controversial and require at least an environmental assessment (several months), and a collection of sufficient numbers for a statistically valid sampling effort would probably trigger an EIS (18-24 months) under NEPA; and uncertainty about the desirability or need to conduct surveillance, given the extreme number of animals that may need to be tested and the lack of information about factors that govern management success. Problems with park management of CWD are compounded by the pressure applied by some state wildlife agencies to act quickly, by variations in state policies and management goals, and by the lack of consistent and specific, but flexible where needed, NPS CWD management guidance.

4. Solution: The group proposed two documents be created. One would be a 20-ish page NEPA-esque summary of the need for NPS management action, purpose in taking action, background and history of CWD in parks, NPS management policies and how they are interpreted regarding management of the disease and a discussion of surveillance programs and their implications. Management options and a short discussion of the ramifications of each may also be presented. This summary would be available for park managers, and would also be noticed in the Federal Register and open to public review and comment. This approach would provide quick and concise reference material and guidance to parks, and notice to park managers and the public that the NPS is facing this particular disease issue and intends to make decisions in the near future regarding its management. It would also give the public an opportunity to comment on the broad policy issues, rather than asking that they confine their comments to park specific management as NEPA documents are prepared on a park by park basis. Depending on funding, staff availability and NPS internal review, this document may be published in the Federal Register before the end of the year or in winter 03/04.

The second document would be a more detail reference notebook for park managers modeled after a 3-ring binder BRMD prepared to address foot-and-mouth disease. It would include technical, cost, contact and policy information. The following items were suggested by the group to be included:

- A discussion of the native vs. exotic status of CWD
- A compilation of different viewpoints as to the appropriate response to different CWD threats so parks can decide their own management objectives
- Examples of management options, given certain situations and given variables in guidance documents
- Interpretation of existing research, both knowns and unknowns
- Encouragement to reduce unnatural densities as this may help to reduce the threat from and to manage CWD
- A summary of disease prevention measures and why they are important
- Definition of translocation (doesn't involve natural movement by cervids)
- Waiver process for parks to move elk without 99-1 study if state allows intrastate movement and NPS believes such movement would not endanger park cervids
- Give examples of how parks can help state wildlife agencies without killing elk or deer; for example conducting non-lethal tests on deer, providing USGS scientific help to design surveillance effort; making the existing USGS Surveillance Strategies document widely available
- Encourage parks to work with other agencies or private game reserves/farms to manage the disease regionally, including using regional populations to obtain statistically valid surveillance information, rather than depending only on park populations
- Information and direction on eliminating any human sources of impact (transporting elk and deer in or out of the park primarily) before trying other management options
- A flow chart of management thresholds and decisions including policies to consider and management tips
- Statements clarifying WASO interpretation of NPS Management policies to allow killing of healthy animals in surveillance efforts following environmental compliance; that 99-1 applies only to translocation and not to management generally; that due to the difficulty in attaining 99-1, realistically cervid translocation in the NPS could be considered to be under a moratorium; to include the option of a translocation waiver;

that if necessary it is allowable to kill healthy elk or deer following environmental compliance even if the enabling legislation of the park prohibits killing of wildlife.

- NEPA compliance and options
- A schedule of what's coming in programmatic NEPA for NPS
- The current state of science on CWD, summary of research results
- The possible consequences of not taking action in a range of circumstances (e.g. CWD is present in populations 50 miles away; present in your population; farther than 150 miles away, etc.)
- Contacts, cost estimates for surveillance, factors to consider in surveillance program summarized, e.g., detail on the 10-step process for surveillance

Depending on funding, staff availability and NPS review, the reference notebook may be finished by spring 2004.

5. Problem: Depopulation or wide scale surveillance could result in significant impacts on a number of resources, including the elk and deer populations themselves, ecological systems, visitor experience, ethnographic values, social values, recreational resources, socioeconomics and subsistence or food. Impairment of the population or one of these other resources or park values is even possible.

5. Solution: EQD will investigate the possibility of a programmatic look at some of these impacts in a regional EIS that may be used as a template, or that may examine cumulative or broad based effects. Parks would be saved this part of the analysis in their own EISs or EAs when they want to add or implement management objectives or surveillance programs.

6. Problem: The list of parks currently being watched by BRMD may not be inclusive enough. Since it is better to prevent the disease and than manage it after it arrives, this list may need to be longer.

6. Solution: BRMD will work with regions to see if parks should be added, and will continue to offer training where requested.

Addition to the 2003 meeting notes:

Memorandum:

Date: November 7, 2005

To: Margaret Wild, Biological Resources Management Division

From: Sarah Bransom, Environmental Quality Division

Subject: Review of 2003 Chronic Wasting Disease Policy Workshop Meeting Summary

The Environmental Quality Division (EQD) has reviewed the document "Problems and Proposed Solutions Associated with Managing CWD in National Park Units". This document is the summary of the 2003 NPS chronic wasting disease policy workshop held in Fort Collins, CO. EQD provides the following comments:

The narrative on page 4 suggests that NPS publish a federal register notice soliciting suggestions and comments on approaches to managing CWD. This approach will not satisfy the requirements of the National Environmental Policy Act (NEPA) on any future or current park planning efforts dealing with CWD. Although striking these references from the notes may not faithfully reflect the open discussions that took place, it may be helpful to include a statement that this suggested approach would not meet NPS regulatory requirements under DO-12 or NEPA.

We do note that there may be some benefit in exploring the possibility of developing a programmatic CWD plan on a regional or park group basis, similar to what we are doing with several of the exotic plant management plan environmental assessments or environmental impact statements. In some cases, however, a park-by-park approach might be more appropriate. EQD would like to discuss this possibility further.

Additionally, the term "impairment" is used throughout the meeting report. "Impairment" has been specifically defined in section 1.4.5 of the current NPS Management Policies (2001) and generally constitutes a violation of the NPS Organic Act. Except for those discussions where actual "impairment" of resources was being discussed, we strongly suggest replacing the term "impairment" with more meaningful terms such as "adverse effects" or "resource damage."

These suggestions will help clarify the 2003 meeting notes and make them consistent with the requirements for NEPA.

12.4 Material Safety and Data Sheets (MSDS) information:

1. Environ® LpH® information can be found at:
http://www.steris.com/resources/lit/literaturesearch.cfm?app=General%20Environmental%20Decontamination#

2. 5% NaOCl solution (bleach) (Many MSDS are available please investigate the product you plan to use.)

3. 10% Neutral buffered formalin: Many MSDS documents are available, please investigate the specific product you intend to use. An example of a formalin MSDS document can be found at:
http://chemdat.merck.de/documents/sds/emd/int/en/1039/103999.pdf

12.5 Equipment re-use recommendations for CWD areas:

National Park Service – Biological Resources Management Division Recommendations for nets (nets from net guns, drop nets, rocket nets, etc.) in CWD areas

Chronic wasting disease of deer and elk is an infectious contagious transmissible spongiform encephalopathy found in localized areas of the United States and Canada. The route of transmission for the abnormal prion protein (PrP^{res} or PrP^{cwd}) is unknown (Williams et al. 2002). However, scientists suspect that bodily secretions such as feces, urine, saliva and blood are a potential means of prion transfer from one animal to another. It has been shown that environmental contamination can be a method of CWD transmission in a captive-animal setting (Miller et al. 2004). It is unknown what pathogen load is needed for CWD transmission or what level of risk low levels of contamination pose to free-ranging elk or deer.

Net guns and drop nets are often used in wildlife management to capture large ungulates such as deer, elk, bighorn sheep, pronghorn, mountain goats and moose. During use nets can become soiled with feces, saliva, urine, blood and dirt. The level of contamination with organic material varies but nets are rarely heavily soiled. The likelihood of spreading CWD by using nets in CWD areas and subsequently using them in non-CWD areas is likely minimal. However, the consequences of moving infectious prions to new areas could be substantial. Therefore we recommend the following procedures to minimize the risk of, or perception of risk of, CWD spread:

1. If nets are used on deer or elk in areas where CWD has been detected, it is ideal not to use these nets outside of areas where CWD is found.
2. If the use of CWD-area dedicated nets is not feasible, or if nets have been used in CWD areas on species other than deer or elk, then nets should be adequately cleaned. Following use in a CWD area, nets should be cleaned of organic matter and soaked in a 10% solution of Environ® LpH® (Steris Corporation, St. Louis, MO) for at least 1 hour at room temperature (Ernst and Race 1993, Fichet et al. 2004, Race and Raymond 2004). After soaking the nets should be rinsed thoroughly and air dried. Anecdotal evidence suggests Environ LpH® does not adversely affect nylon nets. However, long term effects of Environ LpH® use on nets are unknown.

Because there is a potential for transmission of other diseases via contaminated nets, disinfection of nets should be considered whenever nets are used on animals suspected of having infectious diseases. If viral or bacterial diseases are suspected, remove all organic material and consider soaking in a standard disinfectant, such as dilute bleach, followed by thorough rinsing.

SUGGESTIONS FOR REFURBISHING GPS WILDLIFE COLLARS
From chronic wasting disease affected areas

Prepared by: Dan Roddy, Wind Cave National Park
Assisted by: Chris Kohanny, Advanced Telemetry Systems
Jenny Powers, NPS – Bioligical Resources Management Division

1) Remove housing unit from collar as described below.

2) Make sure all organic matter is removed before disinfecting the housing unit (the only part to be returned for refurbishing)

3) Preference for a treatment method is for total submersion of the housing unit for at least 30 minutes in a 10% solution of Environ LpH (Steris Corp., St. Louis, MO). Rinse with clean water and air dry.

4) If submersion is impossible due to the water tightness of the housing unit, a second alternative would be to wrap housing unit in rag/paper towel that had been soaked in LpH. Keep the rag/paper towel damp and in contact with all parts of the housing unit for at least 30 minutes. Spray hard to reach places with the solution. With many hard to reach areas on the housing unit this may be difficult to get a rag or paper towel to all of those small areas and feel comfortable with the disinfection effort. Therefore, use alternative #1 if possible. Wipe excess off with a damp (water) rag and air dry.

5) Disposable gloves should be used regardless of the treatment method chosen!

Submersion of the housing unit: once everything is disconnected or cut from the housing unit it is acceptable to submerge for 30 minutes. The 10% Environ LpH solution can be disposed of in the sewer system with addition of copious amounts of water.

The reason for cutting the antenna cables (Step 2 in the attached photos) rather than removing the connectors from the housing unit is that the connectors are sealed so they should be left in place to keep the disinfecting solution from entering the housing unit. The units are sealed and soaking them in Environ® LpH® should not be a problem.

If there is severe damage to the collar e.g. major dents, cracks which may allow for the disinfecting solution to enter the housing unit during submersion then please contact the company. It would be most helpful if you could send digital photos for discussion purposes. This will be a case by case basis but when in doubt contact the company.

It is important to stress the product is Environ® LpH® made by Steris Corporation (there are several types of LpH and only the Environ 'brand' will work for prion disinfection). The majority of research that exists on prion disinfection has been conducted using scrapie prions rather than CWD prions. Therefore, we are making an assumption that what works for disinfecting scrapie will work for CWD. This involves assuming a small amount of risk by interpreting the available information. Finally, the research available has shown a 9% solution of Environ® LpH® to be effective for disinfecting scrapie prions[4]. However, for ease of measurement we have increased the concentration to a 10% solution for CWD disinfection at parks. A 10% solution can be made by taking 1 part Environ® LpH® and adding that to 9 parts water. So if you want to make 10 gallons of the diluted solution, take 1 gallon of Environ® LpH® and add it to 9 gallons of water. Or you could use 1 cup of Environ® LpH® to 9 cups of water.

[4] Ernst, D. R. and R. E. Race. 1993. Comparative analysis of scrapie agent inactivation methods. Journal of Virological Methods 41:193-202

GPS Collar Transmitter Disassembly Procedure for Customers

To Our GPS Transmitter Customers:

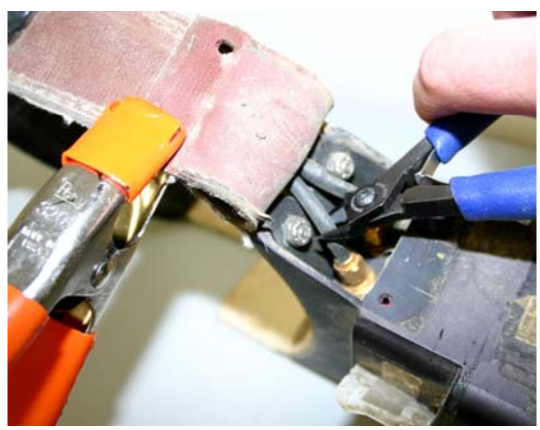
If you are planning to return transmitters to Advanced Telemetry Systems (ATS) after field use on potentially diseased animals, please follow our disassembly procedure. This procedure applies to all GPS transmitters recovered from the field in a ‘hot spot’ for chronic wasting disease (CWD), or any disease of unknown transmission. ATS will accept only the housing in which the electronic components are enclosed. The following procedure gives the specific steps to remove all unacceptable components. Thank you for your cooperation.

GPS Collar Transmitter Disassembly Procedure:

Tools: Flat tip screwdriver, 5/16” Nut driver, and wire cutter

.

Step 1



Step 2

Step 1 With screwdriver, remove the two lower screws from the flap on VHF antenna side.
Step 2 Raise the flap and cut two antenna cables with wire cutter as shown.

Step 3

Step 3 If the collar is not released; use nut driver to remove collar from the release mechanism.

Step 4

Step 4 Remove all 4 nuts with nut Driver. Remove the collar from the housing.

Step 5

Step 5 Wash the housing thoroughly with LPH. The housing may now be returned to ATS in a sealed bag or other container. Finally, properly dispose of the collar and antenna.

If you have additional questions, please contact ATS at 763-444-9267.

ATS 03/07/05

12.6 10 Steps to CWD Surveillance
(adapted from a presentation by M. Samuel given at the NPS CWD Policy Assessment Workshop, August 2003)

1. Determine whether surveillance is needed
   a) How close is the nearest case of CWD?
   b) What is the level of CWD risk?
   c) What will the implications of detecting/not detecting CWD be?
   d) What is the benefit of beginning surveillance?
   e) What is the cost of beginning surveillance?

2. Identify potential partners and affected agencies
   a) State wildlife agency
   b) State veterinarian
   c) State agricultural agency
   d) USDA
   e) DOI

3. Develop management goals
   a) Prevention
   b) Detection
   c) Elimination
   d) Meeting translocation standards
   e) Combination of more than one

4. Determine how internal and external communication will be handled
   a) Contact BRMD and affected agencies
   b) Identify someone to be point of contact
   c) Monthly NPS CWD call participation
   d) Stress open communication with all parties but the park needs to have first access to results and their interpretation.

5. Develop surveillance goals
   a) Depends on detection level goals.

6. Design surveillance program, sample size and sample distribution
   a) Involve a biometrician (e.g., NWHC, USGS)

7. Decide how carcass and tissue disposal will be conducted
   a) Depends on which state the NPS unit resides in.
   b) Work with BRMD and/or local laboratory for best plan
   c) Be aware of local EPA and federal FDA regulations

8. Determine which diagnostic tests will be used
    a) Histopathology – good for late stage diagnosis poor for early diagnosis.
    b) Immunohistochemistry
    c) Bio-Rad
    d) Other ELISA based assays

9. Determine logistics and procedures for sample collection, handling, preservation, and shipping
    a) Training for parks on detection, sample collection, submission, interpretation, etc. – BRMD
    b) Determine how excess biological samples will be stored and used in the future.

10. Decide how data will be managed
    a) How it will be disseminated to other agencies and the public
    b) Is it part of a research project?
    c) Is it to be published?
    d) Is there a database? (NBII?)
    e) Be prepared for the volume of data that may be produced

12.7 Example environmental screening form and categorical exclusion for performing targeted surveillance (WICA)

ENVIRONMENTAL SCREENING FORM FOR WIND CAVE NP

A. PROJECT INFORMATION

Park Name Wind Cave National Park

Project Number ____________________ PMIS # ________

Project Type (*Check*): ☐ Cyclic ☐ Cultural Cyclic ☐ Repair/Rehab ☐ ONPS
☐ NRPP ☐ CRPP ☐ FLHP
☐ Line Item ☐ Fee Demo ☐ Concession Reimbursable
☒ Other (specify): Wildlife Disease Research and Prevention

Project Location Parkwide

Project Originator/Coordinator Dan Foster

Project Title: CERVID MONITORING AND TAKE

Contract # ____________________

Contractor Name ____________________

Administrative Record Location Wind Cave N.P. Central Files

Administrative Record Contact ____________________

B. PROJECT DESCRIPTION/LOCATION

Chronic wasting disease was diagnosed in 1997 in captive elk at a game ranch adjacent to WICA. Subsequently, CWD has been diagnosed in 2 free-ranging deer and an additional game ranch in southwestern South Dakota. Although a perimeter fence keeps bison within WICA, elk and deer come and go from the park, particularly in one area where the fence is just 5 feet high. Due to the high risk that deer and elk at WICA may have been exposed to CWD, targeted surveillance was initiated by park staff in 2001. From May of 1998 to the present, the park has had tested ten (10) deer (5 mule deer and 1 white-tailed deer) and elk (4) for CWD. Additionally, an NRPP project has been approved to begin in FY2003 to study the potential for CWD in deer at WICA. 2002 population estimates for elk and deer at WICA are 600 and 200, respectively. CWD is considered an exotic disease by the NPS. Although a live animal test is available for deer, it has not been successfully applied to elk.

On 4 November 2002, WICA staff euthanized a 5-6 year old female elk exhibiting clinical signs consistent with CWD. A positive diagnosis for CWD was made by Colorado State University Veterinary Diagnostic Laboratory on 14 November 2002. This is the first reported case of CWD in WICA and the first reported case of CWD in a free-ranging elk in South Dakota. Previously, the only NPS unit where CWD had been diagnosed was Rocky Mountain National Park. It is unknown how the elk contracted the disease (CWD is likely transmitted from contact with infected animals or contaminated environments).

This project will be to increase surveillance of elk to identify those animals displaying clinical signs of CWD and remove (kill) and test suspected animals. This approach may remove clinically ill elk before they further spread the disease, recognizing that animals would have already had the disease a minimum of 12 months before they could be detected. The CWD deer study will be provide the same level of surveillance in deer as the study design is to capture, test, and monitor animals over time with radio collars and subsequent field tonsillar biopsy.

Increased surveillance will consist of those means where elk and deer can be observed in their natural conditions. This is to ensure that the animals are not excited, which may cause them to exhibit signs that would mask the clinical signs of CWD. Elk taken will not be shot in the head, but either the neck or chest, whichever provides the least distressful and most painless death. This is done because a post-mortem examination of the brain is required. Animals taken will be removed from the field and disposed of in an approved landfill.

As there is no current field test for CWD in elk, the entire head will be taken and sent for analysis.

Preliminary drawings attached? ☐ Yes ☒ No

Background info attached? ☐ Yes ☒ No

Date form initiated November 19, 2002

Anticipated compliance completion date November 2002

Projected advertisement/Day labor start ____________________

Construction start ____________________

C. RESOURCE EFFECTS TO CONSIDER *(Tailor the following to meet individual park/unit project needs.)*

Are any measurable[1] impacts possible on the following physical, natural or cultural resources?	**Yes**	**No**	**Data Needed to Determine**
1. Geological resources – soils, bedrock, streambeds, etc.		X	
2. From geohazards		X	
3. Air quality		X	
4. Soundscapes		X	
5. Water quality or quantity		X	
6. Streamflow characteristics		X	
7. Floodplains or wetlands		X	
8. Land use, including occupancy, income, values, ownership, type of use		X	
9. Plant species or habitats of special concern: state-listed, proposed for state or federal listing		X	
10. Species of special concern (plant or animal; state or federal listed or proposed for listing) or their habitat		X	
11. Unique ecosystems, biosphere reserves, World Heritage Sites		X	
12. Unique or important wildlife or wildlife habitat		X	
13. Unique or important fish or fish habitat		X	
14. Introduce or promote non-native species (plant or animal)		X	
15. Recreation resources, including supply, demand, visitation, activities, etc.		X	
16. Visitor experience, aesthetic resources, including impacts to interpretive operations and interpretive facilities		X	
17. Cultural resources including cultural landscapes, ethnographic resources		X	
18. Socioeconomics, including employment, occupation, income changes, tax base, infrastructure		X	
19. Minority and low income populations, ethnography, size, migration patterns, etc.		X	
20. Energy resources		X	
21. Other agency or tribal land use plans or policies		X	
22. Resource, including energy, conservation potential		X	
23. Urban quality, gateway communities, etc.		X	
24. Long-term management of resources or land/resource productivity		X	
25. Other important environment resources (e.g. geothermal, paleontological resources)?		X	

[1] Measurable impacts are those that the interdisciplinary team determines to be greater than negligible by the analysis process described in DO-12 §2.9 and §4.5(G)(4) to (G)(5).

D. MANDATORY CRITERIA

Mandatory Criteria: If implemented, would the proposal:	**Yes**	**No**	**Data Needed to Determine**
A. Have material adverse effects on public health or safety?		X	
B. Have adverse effects on such unique characteristics as historic or cultural resources; park, recreation, or refuge lands; wilderness areas; wild or scenic rivers; national natural landmarks; sole or principal drinking water aquifers; prime farmlands; wetlands; floodplains; or ecologically significant or critical areas, including those listed on the National Register of Natural Landmarks?		X	
C. Have highly controversial environmental effects?		X	
D. Have highly uncertain and potentially significant environmental effects or involve unique or unknown environmental risks?		X	
E. Establish a precedent for future action or represent a decision in principle about future actions with potentially significant environmental effects?		X	
F. Be directly related to other actions with individually insignificant, but cumulatively significant, environmental effects?		X	
G. Have adverse effects on properties listed or eligible for listing on the National Register of Historic Places?		X	
H. Have adverse effects on species listed or proposed to be listed on the List of Endangered or Threatened Species or have adverse effects on designated Critical Habitat for these species?		X	
I. Require compliance with Executive Order 11988 (Floodplain Management), Executive Order 11990 (Protection of Wetlands), or the Fish and Wildlife Coordination Act?		X	
J. Threaten to violate a federal, state, local, or tribal law or requirement imposed for the protection of the environment?		X	
K. Involve unresolved conflicts concerning alternative uses of available resources (NEPA sec. 102(2)(E)?		X	
L. Have a disproportionate, significant adverse effect on low-income or minority populations (EO 12898)?		X	
M. Restrict access to and ceremonial use of Indian sacred sites by Indian religious practitioners or adversely affect the physical integrity of such sacred sites (EO 130007)?		X	
N. Contribute to the introduction, continued existence, or spread of federally listed noxious weeds (Federal Noxious Weed Control Act)?		X	
O. Contribute to the introduction, continued existence, or spread of non-native invasive species or actions that may promote the introduction, growth or expansion of the range of non-native invasive species (EO 13112)?		X	
P. Require a permit from a federal, state, or local agency to proceed, unless the agency from which the permit is required agrees that a CE is appropriate?		X	
Q. Have the potential for significant impact as indicated by a federal, state, or local agency or Indian tribe?		X	
R. Have the potential to be controversial because of disagreement over possible environmental effects?	X		
S. Have the potential to violate the NPS Organic Act by impairing park resources or values?		X	

R. Taking of wildlife has the potential for controversy, but the issue of wildlife disease is understood and the need to remove animals exhibiting clinical signs has been agreed upon through the coordinating process.

E. OTHER INFORMATION (Please answer the following questions/provide requested information.)

Are personnel preparing this form familiar with the site? ☒ Yes ☐ No

Did personnel conduct a site visit? ☐ Yes ☒ No *(If yes, attach meeting notes or additional pages noting when site visit took place, who attended, etc.)* Park staff are very familiar with all the areas where elk are found within the park.

Is the project in an approved plan such as a General Management Plan or an Implementation Plan with an accompanying environmental document? ☐ Yes ☒ No

If so, plan name ____

Is the project still consistent with the approved plan? ☐ Yes ☐ No *(If no, prepare plan/EA or EIS.)*

Is the environmental document accurate and up-to-date? ☐ Yes ☐ No *(If no, prepare plan/EA or EIS.)* FONSI☐ ROD ☐ *(Check)* Date approved ______________________________________

Are there any interested or affected agencies or parties? ☒ Yes ☐ No

Did you make a diligent effort to contact them? ☒ Yes ☐No

Has consultation with all affected agencies or tribes been completed? ☒ Yes ☐ No
Please see attached sheet.

Are there any connected, cumulative, or similar actions as part of the proposed action? ☐ Yes ☒ No
(If so, attach additional pages detailing the other actions.)

F. LEGAL REVIEW

National Environmental Policy Act

Data entered by: Dan A. Foster
(*Choose one and fill in blanks*)

☐ undocumented CE; CE Citation: Sec 3.3_______________________

☒ documented CE; CE Citation: Sec 3.4 E(3) Removal of individual members of a non-threatened/endangered species or populations of pest and exotic plants that pose an imminent danger to visitors or an immediate threat to park resources.

		Excepted actions apply? *(Attach signed CE form)*	___ Yes	☒ No	(*If yes, do EA or EIS*)
___	EA	EA release to public	________________		
		FONSI date	________________		
___	EIS	ROD date	________________		

National Historic Preservation Act

Data entered by: Tom Farrell

Ground disturbance involved?	☐ Yes	☒ No
Historic structures involved?	☐ Yes	☒ No
Cultural landscapes involved?	☐ Yes	☒ No
Ethnographic concerns involved?	☐ Yes	☐ No
If yes, interested parties contacted?	☐ Yes	☐ No

(*Choose one and fill in blanks*)

☒ No historic properties affected

☐ Programmatic exclusion Citation _________Date AEF to SHPO/THPO __________

Determination of effect ☐ No effect ☐ No adverse effect ☐ Adverse Effect

Date to SHPO/THPO _______ Date to ACHP _______________

Date consultation completed ________________

Endangered Species Act

Data entered by: Dan A. Foster

Any threatened/endangered species in area? ☐ Yes ☒ No

If species in area ☐ No effect ☐ Not Likely to Adversely Affect ☐ Likely to Adversely Affect

Date Section 7 to FWS ________________ Date FWS response _______________

Floodplains/Wetlands/§404 Permits

Data entered by: Dan A. Foster

Is project in 100- or 500-year floodplain? ☐ Yes ☒ No; (If yes, *attach SOF)*

Is project in wetlands? ☐ Yes ☒ No; (If yes, attach SOF)

404 permit needed? ☐ Yes ☒ No; Date _______________

State 401 certification? ☐ Yes ☒ No; Date _______________

State DENR permit? ☐ Yes ☒ No; Date _______________

Wilderness

Data entered by: Dan A. Foster

Project located inside Wilderness? ☐ Yes ☒ No

Project has potential to affect Wilderness values or experience? ☐ Yes ☐ No

If yes, complete Wilderness minimum tool analysis form and include in the administrative record for this project.

G. MITIGATING MEASURES TO BE INCLUDED IN PROJECT:

(Specify here or attach appropriate pages from EA, EIS, FONSI, or ROD)

H. INSTRUCTIONS FOR DETERMINING APPROPRIATE NEPA PATHWAY

Complete the following tasks: conduct a site visit or ensure that staff is familiar with the site's specifics; consult with affected agencies, and/or tribes; and interested public and complete this environmental screening form.

> If your action is not described in DO-12 § 3.4 or if you checked yes or identified "data needed to determine" impacts in any block in Section D (Mandatory Criteria), you must prepare an environmental assessment or environmental impact statement.
>
> If you checked no in all blocks in Section C (resource effects to consider) and checked no in all blocks in Section D (Mandatory Criteria) and if the action is described in DO-12 § 3.4, you may proceed to the categorical exclusion form. (Appendix 2 of DO-12 Handbook)

I. INTERDISIPLINARY TEAM SIGNATORY (All interdisciplinary team members must sign.)

By signing this form, you affirm the following: you have either completed a site visit or are familiar with the specifics of the site; you have consulted with affected agencies and tribes; and you, to the best of your knowledge, have answered the questions posed in the checklist correctly

Req'd	Technical field or expertise	Signature	Date
☒	Compliance Coordinator Dan Foster		
☒	Cultural Resource Coordinator Tom Farrell		
☒	Resource Man. Spec. (surface) Dan Roddy		
☐	Cave Management Specialist Rod Horrocks		
☐	Chief of Administration Phil Heckman		
☒	Chief Park Ranger Denny Ziemann		
☒	Chief of Maintenance Steve Schrempp		
☐			

J. SUPERVISORY SIGNATORY

Based on the environmental impact information contained in the statutory compliance file and in this environmental screening form, environmental documentation for the subject project is complete.

Recommended:

Compliance Specialist	Telephone Number	Date
Dan A. Foster	605-745-1190	

Approved:

Superintendent	Telephone Number	Date
Linda L. Stoll	605-745-1129	

12.8 Example NPS/State Memorandum of Understanding (WICA)

…to be added soon.

12.9 Diagnostic sample submission form

(A PDF file can be found at:
http://inside.nps.gov/documents/NECROPSYsubmissionform.pdf)

Diagnostic Sample Submission Form
NPS – Biological Resource Management Division

PARK ASSIGNED ID____________ BRMD ASSIGNED ID ___________

SPECIES ____________________ DATE COLLECTED _____________

SEX ________________________ EST. DATE OF DEATH _________

EST. AGE ___________________ SUBMISSION DATE ____________

__ DIED __ EUTHANATIZED

LOCATION:

____

____

____

CLINICAL HISTORY:

____

____

____

____

____

SAMPLES SUBMITTED:

____

____

____

CONTACT INFORMATION:

Park:____

Contact Name: ____

Address:____

Phone: ___________________ FAX:________________________

BRMD Revised 9/27/02

12.10 NPS CWD contact information:

NPS – Wildlife Health Team
Biological Resources Management Division (BRMD)
1201 Oakridge Drive Suite 200
Fort Collins, Colorado 80525

Primary contact:	Jenny Powers, DVM NPS – Chronic Wasting Disease Coordinator (970) 267-2122 Jenny_Powers@nps.gov
Secondary contact:	Margaret Wild, DVM, PhD NPS – Wildlife Health Veterinarian (970) 225-3593 Margaret_Wild@nps.gov
Admin Assistant:	Debi Reep NPS – BRMD Administrative Assistant (970) 225-3592 Debi_Reep@nps.gov

Also see:
http://www1.nrintra.nps.gov/BRMD/nativespecies/wildlifehealth/index.htm

12.11 Shipping and handling requirements:

(Additional copies can be found at:
http://inside.nps.gov/documents/carcass%20submission%20rev.pdf

INSTRUCTIONS FOR COLLECTION AND SUBMISSION OF ANIMAL CARCASSES AND TISSUES FOR POSTMORTEM EXAMINATION

NPS BIOLOGICAL RESOURCE MANAGEMENT DIVISION

Sample Collection

1. Determine if the sample is suitable for submission (carcasses with a very strong odor or with maggots are generally too old and decomposed for diagnostic testing).

2. Determine if forensic investigation is required (e.g., was the animal poached) or if additional assistance is needed.

3. Collect carcass/samples while minimizing your exposure to potential pathogens.

   a. Performing a field necropsy
      i. See attached information
      ii. Perform necropsy in a safe location

   b. Collecting carcasses
      i. Wear gloves (and coveralls if handling a large animal)
      ii. Alternatively, place a plastic bag over your hand, pick-up the carcass, and invert the plastic bag to cover the carcass
      iii. Avoid exposure to external parasites (fleas, ticks)

   c. Transporting carcasses
      i. Large carcasses – transport covered in a pick-up truck
      ii. Small carcasses – place each carcass in a plastic bag and fasten shut. Place bagged carcasses into a second plastic bag and fasten shut. Double bagging helps avoid leakage.
      iii. If immediate delivery to the diagnostic laboratory is not possible, keep the carcass/tissue cool but do not freeze unless instructed to do so. Keep the carcass away from scavengers or from areas where human exposure may occur.
      iv. Disinfect hands and equipment.

Laboratory Selection

Always call first to get permission for submission and receive any special instructions. Several options are available for sample submission:

1. Work with a local veterinary diagnostic laboratory or laboratory with whom you have an established relationship. In this case, the park works directly with the lab and is responsible for any applicable charges. Consultation with the NPS wildlife veterinarian is available.

2. Submit samples to the NPS-BRMD for evaluation by the Colorado State University Veterinary Diagnostic Laboratory (CSUVDL) under a CESU agreement funded by BRMD. The case will be managed by the NPS veterinarian who will forward results and provide interpretation and consultation to parks as needed. See instructions for submission below.

3. Submit samples to the National Wildlife Health Center (NWHC), Madison, WI. The BRMD works closely with NWHC. Follow directions from the NWHC on submitting samples.

Submitting samples to NPS-BRMD

1. Contact Dr. Margaret Wild (970-225-3593) or admin assistant Debi Reep (970-225-3592) Most samples will be accepted, however, samples for West Nile virus surveillance should be submitted to local laboratories or the NWHC.

2. Complete BRMD Sample Submission form

3. Sample delivery options:

    a. Deliver whole carcass directly to CSUVDL

    b. Submit whole carcasses from small animals via overnight delivery to BRMD

    c. Perform field necropsy and sample collection (fresh and formalin fixed tissues). Submit samples to BRMD via overnight shipment.

4. Shipping instructions

    a. Appropriate packaging is critical, both to assure sample quality and to avoid leakage and environmental contamination. Double or triple bag all carcasses and tissues. Ship in a cooler, or Styrofoam box placed inside a cardboard box (e.g., Polyfoam Packers). Use enough blue ice to keep the carcass cool during shipment. Dry ice is preferred for tissue samples, but check with shipping company first to be sure that it is accepted.

    b. Place the BRMD Sample Submission form (and Necropsy form if necropsy was performed) in an envelope on the outside of the box. Write "Diagnostic Specimen – Wildlife" on the outside of the box.

    c. Ship Monday - Thursday via overnight delivery to:

    Dr. Margaret Wild
    NPS – Biological Resource Management Division
    1201 OakRidge Dr., Suite 200
    Fort Collins, CO 80525
    (970) 225-3593

BRMD Revised 9/27/02