Wildlife Services

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National Wildlife Research Center

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Evaluation and Management of Chronic Wasting Disease Transmission

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Major Cooperators

- USDA/APHIS/Wildlife Services
- USDA/APHIS/Veterinary Services
- University of Nebraska
- Colorado State University
- State Departments of Public Health
- Wisconsin Department of Natural Resources
- Colorado Division of Wildlife
- Michigan Department of Natural Resources
- University of Wisconsin
- Private elk and deer farmers

Groups Affected By These Problems

- Wildlife and natural resource managers
- U.S. citizens
- Livestock producers and farmers
- Captive cervid industry
- Sporting organizations
- Consumers
- Meat processors
- Rural communities
- State and federal agriculture and wildlife agencies

NWRC Scientists Assess the Potential for Chronic Wasting Disease (CWD) Transmission Between Wild and Domestic Cervids and Develop Methods to Reduce/Manage the Disease

Wildlife Services' (WS) National Wildlife Research Center (NWRC) is the only Federal research organization devoted exclusively to resolving conflicts between people and wildlife through the development of effective, selective, and acceptable methods, tools, and techniques.

As increased urbanization leads to a loss of traditional wildlife habitat, the potential for conflicts between people and wildlife increases. Such conflicts can take many forms, but recently the potential for the transmission of diseases among wildlife, livestock, and humans has received greater attention.

Chronic wasting disease (CWD) is a fatal neurological disease that infects captive and wild native white-tailed deer (Odocoileus virginianus), mule deer (Odocoileus hemionus), elk (Cervus elaphus), and moose (Alces alces). Red deer (also Cervus elaphus), imported to North America from Europe for the production of venison, are also susceptible.
CWD is thought to be caused by abnormal proteins called prions. Over time, these abnormal proteins can accumulate in the central nervous and lymphatic systems causing a degenerative lack of control and a "wasting-away" death.

There is no known cure or vaccine for CWD. The origin of CWD is unknown. The disease may have existed in the wild or begun in captivity under abnormally high deer densities. CWD was first observed in 1967 by the Colorado Division of Wildlife where it was initially diagnosed as malnutrition. In 1977, CWD was determined to be a transmissible spongiform encephalopathy, and the first infected wild animal, an elk from Rocky Mountain National Park, was diagnosed in 1981. Since that time, the disease has been found in fifteen other states in the west and mid-west. NWRC scientists are working aggressively to develop methods to reduce the transmission and spread of CWD.

Applying Science & Expertise to Wildlife Challenges

Ability of White-tailed Deer to Jump Game-Farm Fences—Deer can breach fences by going over, through or under the structure. One concern is that wild deer will jump the fences into captive deer farms, thus exposing those deer to disease. Agencies and landowners need information on the ability of deer to breach fence systems. NWRC scientists determined the capacity of deer to breach fences. The results from these studies have been critical in setting standards for fence height for security and containment of captive deer herds.

Resource Selection and Dispersal Direction of Sympatric Deer—Sympatric species are those that occur in the same or overlapping geographical areas, white-tailed deer and mule deer are examples. Determining how these species interact and move across landscapes is important, especially in areas where CWD is endemic and cross-species transmission for the disease is a possibility. In 2004, NWRC researchers initiated a 3-year study in Morrill County, Nebraska (MC) to determine behavior, habitat and movement conditions conducive to transmission of CWD between mule deer and white-tailed deer. The degree of spatial overlap and habitat use will assist the development of models for predicting the spread of CWD.

Sanitation and Decontamination of CWD-infected Surfaces and Sites—The captive cervid industry, meat processors, hunters, farmers, and other constituents need effective methods and techniques for eliminating the spread of CWD and other transmissible spongiform encephalopathies (i.e., Bovine Spongiform Encephalopathy, scrapie, Crutzveld-Jacob Disease). NWRC scientists are developing an enzymatic product that breaks down prion proteins and renders them harmless. This product potentially could be used to

sanitize and decontaminate tools, surfaces, facilities, mineral licks, and other areas infected with transmissible spongiform encephalopathies.

Live Test for CWD—NWRC scientists and collaborators are developing more efficient methods for detecting CWD in both dead and live cervids. Current tests on dead animals are expensive and time-consuming, which limits the number of animals tested. Live tests are invasive, require anesthesia, and are effective only for deer. NWRC scientists, in collaboration with other scientists, developed the first rectal biopsy test for CWD that works on both living and dead cervids. The test is easy to perform, does not require anesthesia, and can be repeated on individuals over time. NWRC scientists are working with State and Federal agencies to further test and validate this new tool.

CWD Vaccine Development—NWRC scientists are evaluating an experimental CWD vaccine for deer. In a preliminary study with a mouse model, the vaccine lengthened the longevity of infected individuals. We are now evaluating the vaccine in mule deer, though promising the results are not yet in. At the same time, NWRC scientists are attempting to further optimize the candidate vaccines and improve their performance.

Determination of Focal Points for CWD Transmission in the Wild—Through research with animal-activated cameras, NWRC scientists quantified cervid visits to key resource sites, such as mineral licks and wallowing areas, and documented behaviors that could increase transmission of the disease. The investigators concluded that the common breeding activity of male white-tailed deer of establishing scrapes as signposts for communication are likely a means of disseminating and contracting the disease. Mineral licks are also likely focal sites for transmission of the disease among deer, elk, and moose. As modes for disease transmission become better understood and decontamination methods are developed, this information will help pinpoint specific areas for management activities.

Potential for Avian Scavengers to Transmit CWD—Mechanisms for the spread of CWD are still being discovered. Birds have been identified as potential vectors for a number of diseases, where infected material is ingested and the disease agent is later shed in new areas after flying substantial distances. NWRC scientists are investigating whether avian scavengers can disseminate prions associated with transmissible spongiform encephalopathies (TSEs), like CWD, by a similar process. As prions are resistant to destruction, it is reasonable that infectious material could pass through the digestive tract of scavenging birds. The investigators showed that TSE-positive brain material from mice (i.e., mouse-adapted scrapie) that passes through the digestive tract of American crows is still infectious to mice. Our results demonstrate that a common, migratory North American scavenger, the American crow, can pass infective prions in feces and, therefore, could play a role in the spatial dissemination of prion disease.

Emergency Response to Disease Outbreaks in Deer—In the event of catastrophic disease outbreak involving wildlife from a point source, first responders and wildlife managers need new tools for containing potentially infected animals. NWRC scientists evaluated the efficacy of a 2.1 meter tall polypropylene mesh fence for containing free-ranging white-tailed deer in eastern Nebraska. The fence provided nearly complete confinement. Pre-confinement breaches by deer totaled 259 compared to one documented breach following the completion of the experimental enclosure. Given that time is of the essence when responding to a disease outbreak, this simple, quick and inexpensive fencing technique may prove useful during such emergencies. Future studies will continue to evaluate this potential new tool for use in wildlife disease management.

Electric Fencing to Prevent Contact between Captive and Wild Elk—Interaction between wild and farmed cervids often occurs along perimeter fence-lines. Direct and indirect contact at farms with only a single perimeter fence may play a role in transmission of diseases like CWD and bovine tuberculosis. NWRC researchers tested the effectiveness of a baited electric fence, used in conjunction with a single woven-wire high fence, at reducing fence-line contact by elk. Video-surveillance camera systems were used to monitor the test fence at a captive elk ranch. Researchers varied motivation levels, between elk on either side of the test fence area. Motivation levels or animal groupings included separating rutting bulls from estrous cows, separating cows from calves, and spreading sweet feed along the woven-wire fence. Prior to the installation of the electric fence, researchers documented 700 contacts between elk and the fence. Following installation of the electric fence contacts dropped to zero. The simple, inexpensive, baited-electric fence strategy provides a practical tool for reducing the potential for disease transmission between captive and wild cervids.

Selected Publications:

VerCauteren, K. C., T. C. Atwood, T. J. DeLiberto, H. J. Smith, J. S. Stevenson, B. V. Thomsen, and T. Gidlewski. 2008. Sentinel-based surveillance of coyotes to detect bovine tuberculosis in Michigan. Emerging Infectious Diseases. 14:1862-1869.

VerCauteren, K. C., M. J. Lavelle, and G. E. Phillips. 2008. Livestock protection dogs for deterring deer from cattle and feed. Journal of Wildlife Management 72:1443-1448.

Pilon, J., C. Loiacono, D. Okeson, S. Lund, K. C. VerCauteren, J. Rhyan L. M. Miller. 2007. Anti-prion activity generated by a novel vaccine formulation. Neuroscience Letters 429:161-164.

VerCauteren, K. C., P. W. Burke, G. E. Phillips, J. W. Fischer, N. W. Seward, B. A. Wunder, and M. J. Lavelle. 2007. Elk use of wallows: Implications for disease transmission. Journal of Wildlife Disease 43:784-788.

Atwood, T. C., K. C. VerCauteren, T. J. DeLiberto, H. J. Smith, and J. S. Stevenson. 2007. Coyotes as sentinels for monitoring bovine tuberculosis prevalence in white-tailed deer. Journal of Wildlife Management 71:1545-1554.

VerCauteren, K. C., N. W. Seward, M. J. Lavelle, J. W. Fischer, and G. E. Phillips. 2007. A fence design for excluding elk without impeding other wildlife. Journal of Rangeland Ecology and Management 60:529-532.

VerCauteren, K. C., M. J. Lavelle, N. W. Seward, J. W. Fischer, and G. E. Phillips. 2007. Fence-line contact between wild and farmed cervids in Colorado: potential for disease transmission. Journal of Wildlife Management. 71:1594-1602

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Seward, N. W., G. E. Phillips, J. F. Duquette, and K. C. VerCauteren. 2007. A frightening device for deterring deer from cattle feed. Journal of Wildlife Management 71:271-276.

Beringer, J., J. J. Millspaugh, T. Meyer, and K. C. VerCauteren. 2006. Use of parotid lymph node tissues for chronic wasting disease surveillance in hunter-killed and live white-tailed deer. Transactions of the Missouri Academy of Sciences 40:12-21.

Spraker T. R., T. L. Gidlewski, A. Balachandran, K. C. VerCauteren, L. Creekmore and R. D. Munger. 2006. Detection of PrPCWD in postmortem rectal lymphoid follicles of Rocky Mountain elk (Cervus elaphus nelsoni) infected with chronic wasting disease. Journal of Veterinary Diagnostic Investigations 18:553-557.

VerCauteren, K. C., M. J. Lavelle, and S. E. Hygnstrom. 2006. Fences and deer-damage management: a review of designs and efficacy. Wildlife Society Bulletin 34:191-200.

VerCauteren, K. C., M. J. Lavelle, and S. E. Hygnstrom. 2006. A simulation model for determining cost-effectiveness of fences for reducing deer damage. Wildlife Society Bulletin 34:16-22.

Seamans, T. W., and K. C. VerCauteren. 2006. Evaluation of ElectroBraid™ fencing as a white-tailed deer barrier. Wildlife Society Bulletin 34:8-15.

Major Research Accomplishmnets:

- WS determined the risk associated with direct and indirect contact between farmed and wild cervids at fencelines relative to the potential for CWD transmission.
- WS evaluated white-tailed deer and mule deer ecology along riparian areas relative to the transmission and spread of CWD.
- WS developed new methods to test for the presence of CWD in live and dead animals.
- WS determined the minimum fence height that deer cannot breach.
- WS identified focal sites where CWD is likely spread in the wild.
- WS is working to develop a CWD vaccine.
- WS is developing products to disinfect surfaces and areas contaminated with CWD.
- WS is helping to determine the origin and transmission routes of CWD.
- WS developed a fencing strategy to eliminate contact between captive and wild cervids.