



U.S. Geological Survey Response to Chronic Wasting Disease

The **USGS** is focused on the development of early detection and effective response tools that promote an adaptive management approach to **Chronic Wasting Disease**.

Overview

Chronic wasting disease (CWD), a fatal contagious neurological disease, affects free-ranging and captive cervids (members of the deer family) such as elk (*Cervus elaphus*), moose (*Alces alces*), white-tailed deer (*Odocoileus virginianus*), and mule deer (*Odocoileus hemionus*). It is transmitted directly through animal-to-animal contact, and indirectly through contact with objects or an environment contaminated with infectious material (including saliva, urine, feces, and carcasses of CWD-infected animals). CWD is not known to affect humans or livestock. CWD, similar to scrapie in sheep and bovine spongiform encephalopathy (mad cow disease) in cows, is caused by prions—pathogenic agents that mostly consist of an abnormal, infectious form of a host protein primarily found in the brain and central nervous system tissues of mammals.

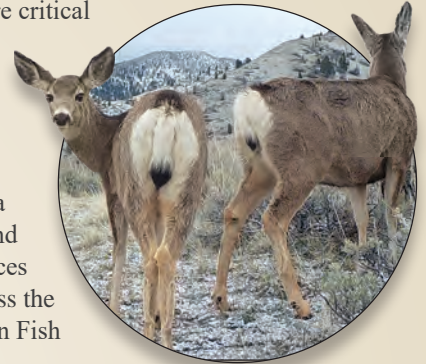
CWD was initially identified in captive animals in the late 1960s and in free-ranging animals in the 1980s. Since its initial identification in Colorado, CWD continues to spread and has affected cervids in 26 States in the United States and 3 Provinces in Canada, as well as in Finland, Norway, South Korea, and Sweden.

A white-tailed deer displaying clinical signs of chronic wasting disease including weight loss, poor body condition, and hypersalivation.



Importance of Cervids

Healthy cervid populations are critical to biodiversity—these species serve as a middle link in the food chain between the plants they consume and the predators that prey on them. Cervids are also a popular game species providing a valuable food source for many and considered Tribal cultural resources and traditional food sources across the United States (Great Lakes Indian Fish and Wildlife Commission, 2018).



Mule deer

Cervids are an integral and charismatic presence in the fabric of the U.S. landscape and an important element in the Nation's economy. Elk and deer are coveted among hunters and wildlife watchers throughout the country. According to the Outdoor Industry Association (2017), hunting and fishing contributed \$63 billion to U.S. retail spending in 2017, and sales of permits and licenses for hunting and fishing support State wildlife agency budgets.

In 2016, according to the U.S. Fish and Wildlife Service and U.S. Census Bureau (2018), 9.2 million hunters pursued big game such as deer and elk, with deer being the most popular and attracting 8.1 million hunters across the United States. Deer were also among the most popular land mammals observed or photographed by 14 million people.

In areas of Colorado, Wisconsin, and Wyoming heavily affected by CWD, more than 40 percent of free-ranging cervids are infected. Scientists at the U.S. Geological Survey (USGS) Wyoming Cooperative Fish and Wildlife Research Unit (CRU) and their collaborators have documented CWD-associated population declines in white-tailed deer and mule deer. The effects of CWD on these biologically, culturally, and economically valuable animals could be devastating if measures are not taken to prevent its spread and persistence in wildlife and the environment.



Mapping the Spread of Chronic Wasting Disease

The USGS National Wildlife Health Center (NWHC) maintains an online map (<https://go.usa.gov/xmDTH>; Richards, 2019) for North America that documents the expanding distribution of CWD. Map data originate from State wildlife agencies, the U.S. Department of Agriculture, and the Canadian Food Inspection Agency and represent best-available information. This map is used and cited by Federal, State, and academic partners to monitor the spread of the disease.

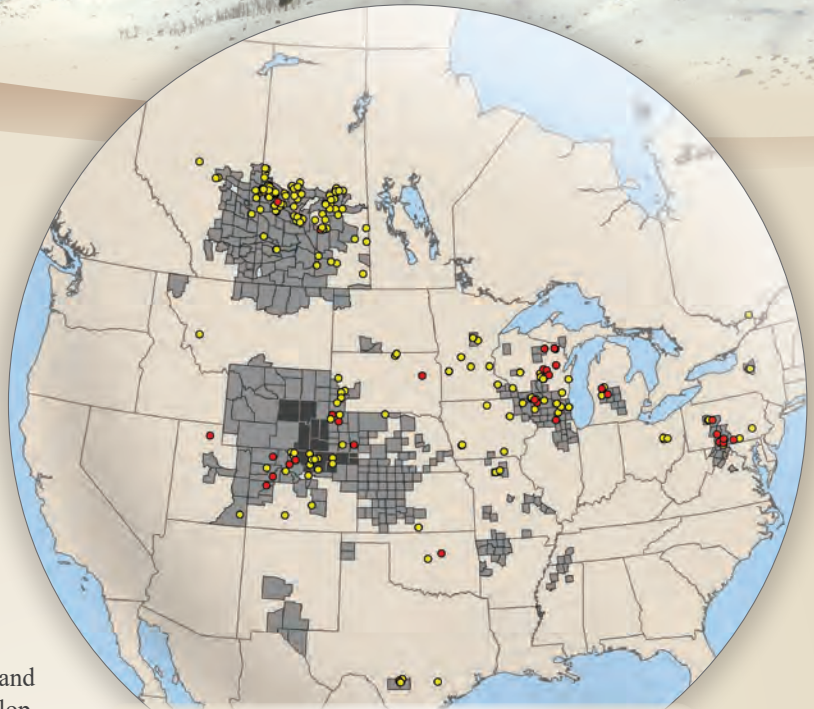
USGS Research

USGS scientists across the United States are working to understand the biology of CWD; assess and predict the spread and persistence of CWD in wildlife and the environment; and develop tools for early detection and control.

Early Detection

The USGS has been instrumental in conducting risk assessments and developing CWD surveillance strategies for early detection.

Scientists at the USGS NWHC, in collaboration with those at the National Park Service, Wisconsin Department of Natural Resources, and Minnesota Department of Natural Resources, have recently developed a new statistical application (<https://popr.cfc.umt.edu/CWD/>) that allows scientists and managers to conduct surveillance of white-tailed deer populations by targeting animals at highest risk of CWD. Use of this application may improve the early detection of CWD in white-tailed deer and allow management agencies to mitigate the emerging wildlife threat, saving valuable time and resources.



EXPLANATION

Distribution of Chronic Wasting Disease (CWD) in North America as of June 2019.

- CWD in free-ranging populations
- Known distribution prior to 2000 (free-ranging)
- CWD in captive facilities (depopulated)
- CWD in captive facilities (current)

Scientists at the USGS NWHC, in collaboration with those at the State wildlife agencies in Iowa, Michigan, and Minnesota, Kansas State University, the University of Wisconsin, and the U.S. Department of Agriculture, are developing advanced mathematical models that provide robust, data-driven tools capable of forecasting CWD spread based on historical trends. The tools will provide information for managers to target surveillance and management efforts in areas of high CWD risk and fastest spread.

Elk grazing.





In collaboration with Federal and State agencies, ongoing USGS research is focused on developing rapid and sensitive diagnostic tests to detect prions in blood, feces, and the environment. These tests will potentially provide alternative methods for ante-mortem testing, help managers detect infection earlier in the disease course, and increase understanding of the risk and impacts of indirect transmission of CWD.

In the Field

The USGS Northern Prairie Wildlife Research Center is supporting National Park Service efforts to manage CWD at Wind Cave National Park in South Dakota. Past USGS work found that CWD was the leading cause of death in the park's elk population with infection rates up to 24 percent. Current efforts are focused on evaluating the effectiveness of reducing elk density on CWD-related mortality in that population. Results will guide CWD management at this and other national parks.

Scientists at the USGS Northern Rocky Mountain Science Center and the Wyoming CRU are collaborating with the Wyoming Game and Fish Department to map the risk of CWD spread from migrating mule deer to elk on feed grounds in western Wyoming. Movement data from Global Positioning System (GPS)-collared elk and mathematical models were used to develop disease risk maps for managers to focus surveillance strategies in elk.

USGS scientists at the Pennsylvania CRU are evaluating the effectiveness of targeted removal of white-tailed deer groups on CWD occurrence and distribution. Scientists are also implementing genetic research to understand the patterns of disease susceptibility and population connectivity across Maryland, Pennsylvania, and Virginia for targeted CWD mitigation strategies.

Since 2002, CWD prevalence in adult male white-tailed deer in western Wisconsin has increased to over 35 percent in 2019, from 8 to 10 percent (Wisconsin Department of

USGS lab technician prepares a DNA sample for genetic analysis.

Natural Resources, 2019). Scientists at the USGS NWHC, the Wisconsin Cooperative Wildlife Research Unit, and the Wisconsin Department of Natural Resources are developing a framework to understand relationships between CWD infection and deer demographic rates to guide management decisions. These generated, forecasted impacts of CWD on deer population dynamics will enable State natural resource managers to refine management decisions with improved accounting of the predicted effects of CWD.

In the Laboratory

Scientists at the USGS NWHC are working with experts in the medical industry to develop a process that optimizes the degradation of prions by existing or modified chemical solutions. Researchers have identified the temperature, pH, and process steps that provide the greatest reduction in prion infectivity.



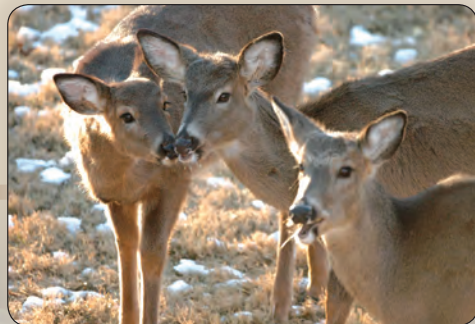
Bull elk near Red Valley, within Wind Cave National Park, at sunrise.



USGS scientists research risk of CWD with unmanned aircraft systems on the National Elk Refuge.

This work applies to prion decontamination for humans in hospitals as well as prion decontamination for animals in veterinary hospitals and at meat-processing facilities.

Prion-contaminated soil and plants, such as corn and other crops that deer feed on, may facilitate CWD transmission. Scientists at the USGS NWHC are working with those at the University of Wisconsin to study prion infectivity and prion uptake in plants to better understand what role crop plants play in transmission on the landscape.



White-tailed deer fawns.

Elk on a feeding ground in Wyoming.

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