



**CIDRAP**

Center for Infectious Disease Research and Policy  
University of Minnesota

# **A Crash Course on Chronic Wasting Disease**

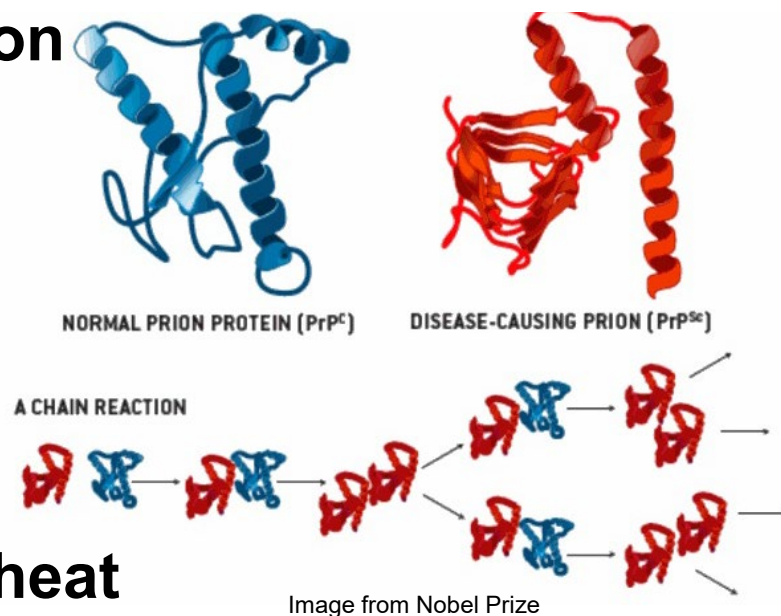
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# What are Prions?

- **Normal cellular prion proteins (PrP<sup>C</sup>)**
  - **Present in many different species**
    - **Ex. mammals, birds, amphibians, reptiles**
    - **Formed by the PRNP gene**
    - **Highly conserved among mammals**
    - **~210 amino acids in length**
  - **Expressed on cellular membranes**
  - **Soluble and easily digested**
    - **Short half-life**
  - **Exact function remains unknown**

# What are Prions?

- Disease-causing prions (PrP<sup>Sc</sup>)
  - Sporadic, genetic, or infectious
  - Misfolded form of normal prion proteins
  - Template for disease
  - Long incubation periods
    - Slow accumulation
  - Highly resistant agents
    - Ex. alcohol, formalin, UV, heat (~1550°F)



# Examples of Prion Diseases

- **Transmissible spongiform encephalopathies**
  - **Neurodegenerative disorders that are always fatal**
- **Animal prion diseases**
  - **Scrapie**
  - **Bovine spongiform encephalopathy (BSE)**
  - **Chronic wasting disease (CWD)**
- **Human prion diseases**
  - **Creutzfeldt-Jakob Disease (CJD)**
  - **Kuru**
  - **Variant Creutzfeldt-Jakob Disease (vCJD)**

# Scrapie

- Prion disease in sheep and goats
- Described for hundreds of years
- Infectious prions shed in bodily fluids and present in the afterbirth
- National efforts have largely controlled the disease
  - Ex. USDA's National Scrapie Eradication Program
- No evidence of human infection



Image from ScienceDirect

# **Bovine Spongiform Encephalopathy (BSE)**

- **First identified in cattle in 1986**
- **Majority of cases in the United Kingdom**
- **Unknown origin**
  - **Infection amplified after BSE-contaminated, bovine-sourced meat-and-bone meal was fed to calves**
  - **Cases dropped significantly after restrictions were put on feeding practices**
- **Estimated 500,000 to 1 million BSE-infected cattle entered the human food supply**

# Variant Creutzfeldt-Jakob Disease (vCJD)

- First human case identified in 1996
- 10 year average incubation period
- Linked to consumption of beef contaminated with BSE prions
- 231 cases in 12 countries
  - Studies in the UK have identified thousands of asymptomatic “carriers”
  - Unknown what the implications of carriers are at this time



Image from BBC News

# Chronic Wasting Disease

- **Prion disease in cervids**
  - **Ex. deer, elk, moose, reindeer**
- **First described in 1967 in a Colorado research facility**
- **Always fatal to cervids**
- **No complete genetic resistance known**
- **No current evidence that CWD has infected humans**





# Chronic Wasting Disease

- Horizontally transmitted
  - CWD prions are shed in bodily fluids
    - Ex. Saliva, urine, feces, blood, antler velvet
  - Environmental contamination
  - Prions can remain infectious for a long time
    - CWD: 2+ years
    - Scrapie: 16+ years
  - Direct and indirect exposures

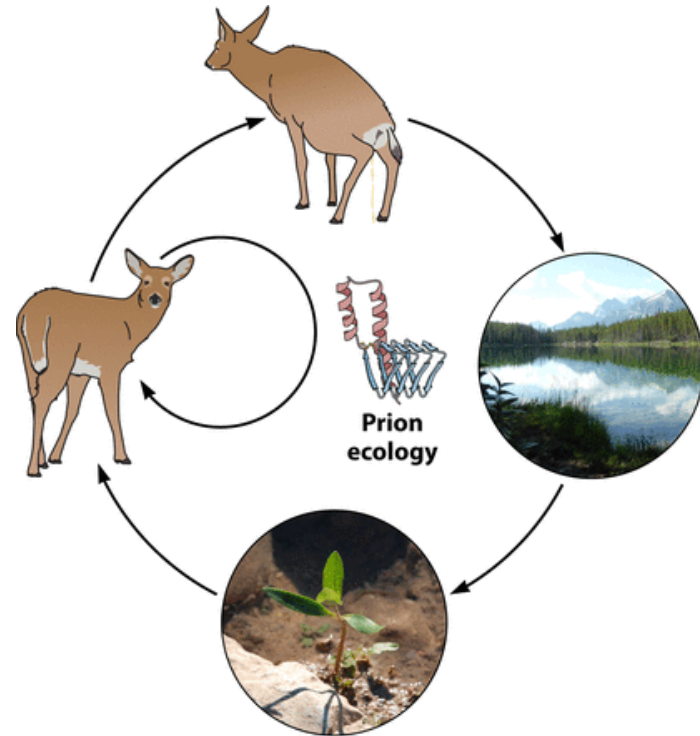
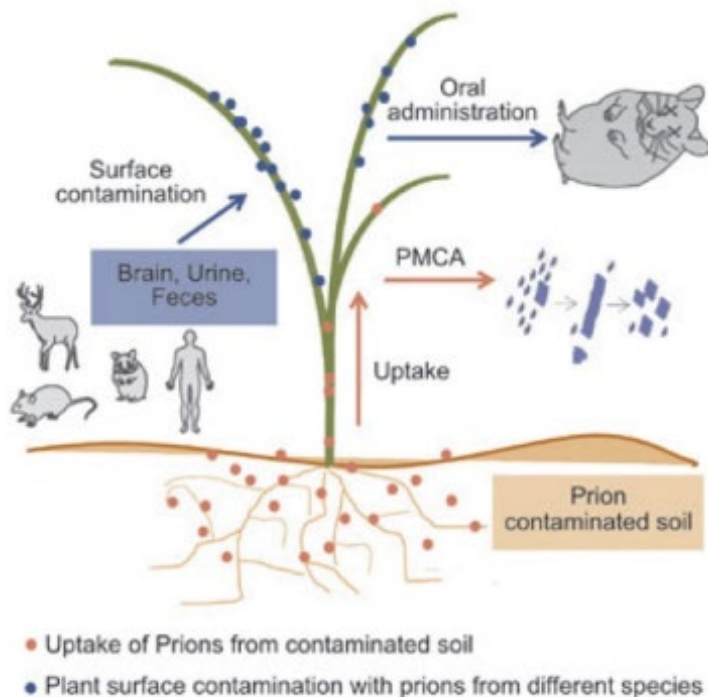


Image From Zabel & Ortega, 2017

# Other Potential Routes of Infection

- Some studies show that prions can adsorb to plants (E.g. leaves, roots, stems) and remain infectious



- Others have shown that prions can remain infectious after passing through certain predators and scavengers (E.g. crows, coyotes)
- Unknown what the true risks and implications are for these routes
- Highlight the importance of proper carcass disposal

# Chronic Wasting Disease

- **Average incubation period: 18-24 months**
- **Shed infectious prions for a majority of the incubation period**
- **Short window of time with clinical symptoms followed by death**
- **Symptoms of CWD**
  - **Weight loss (wasting)**
  - **Lack of coordination**
  - **Altered gait**
  - **Excessive salivation**
  - **Lack of fear of humans**



Image from Idaho Fish and Game

# Chronic Wasting Disease

- **Geographic range**
  - 26 US states
  - 3 Canadian provinces
  - South Korea
  - Finland
  - Norway
  - Sweden

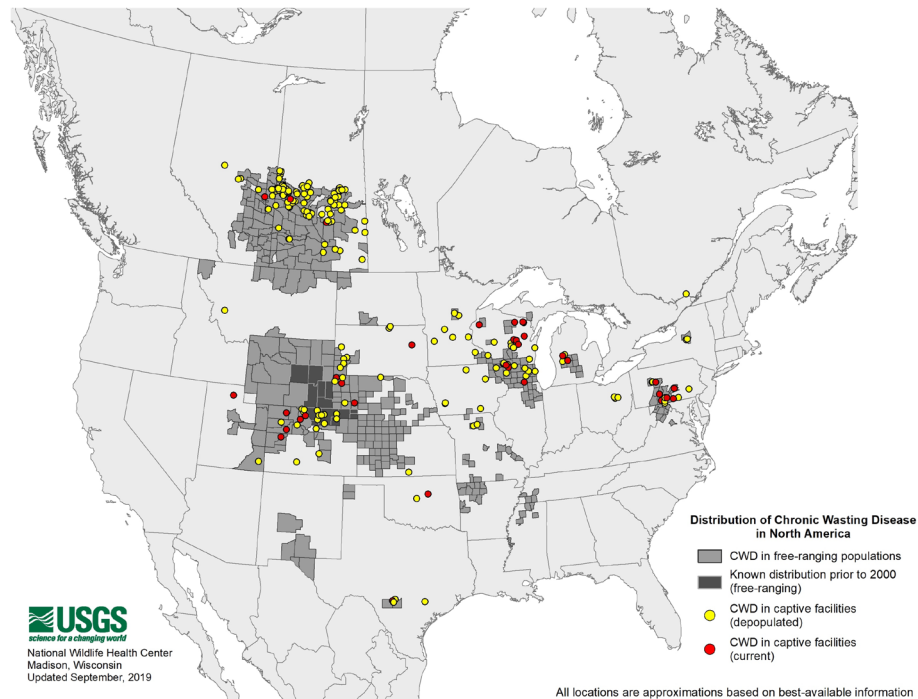


Image Courtesy of USGS

# **The Challenge of CWD**

- **Majority of infections are amongst free-ranging populations**
  - **Management**
    - **Primarily done through hunting**
    - **Ex. hunters in MN harvested just under 200,000 deer in 2018**
  - **Surveillance**
    - **Requires a lot of resources**
      - **Ex. funding, staffing**
    - **Can be difficult to implement in free-ranging populations**

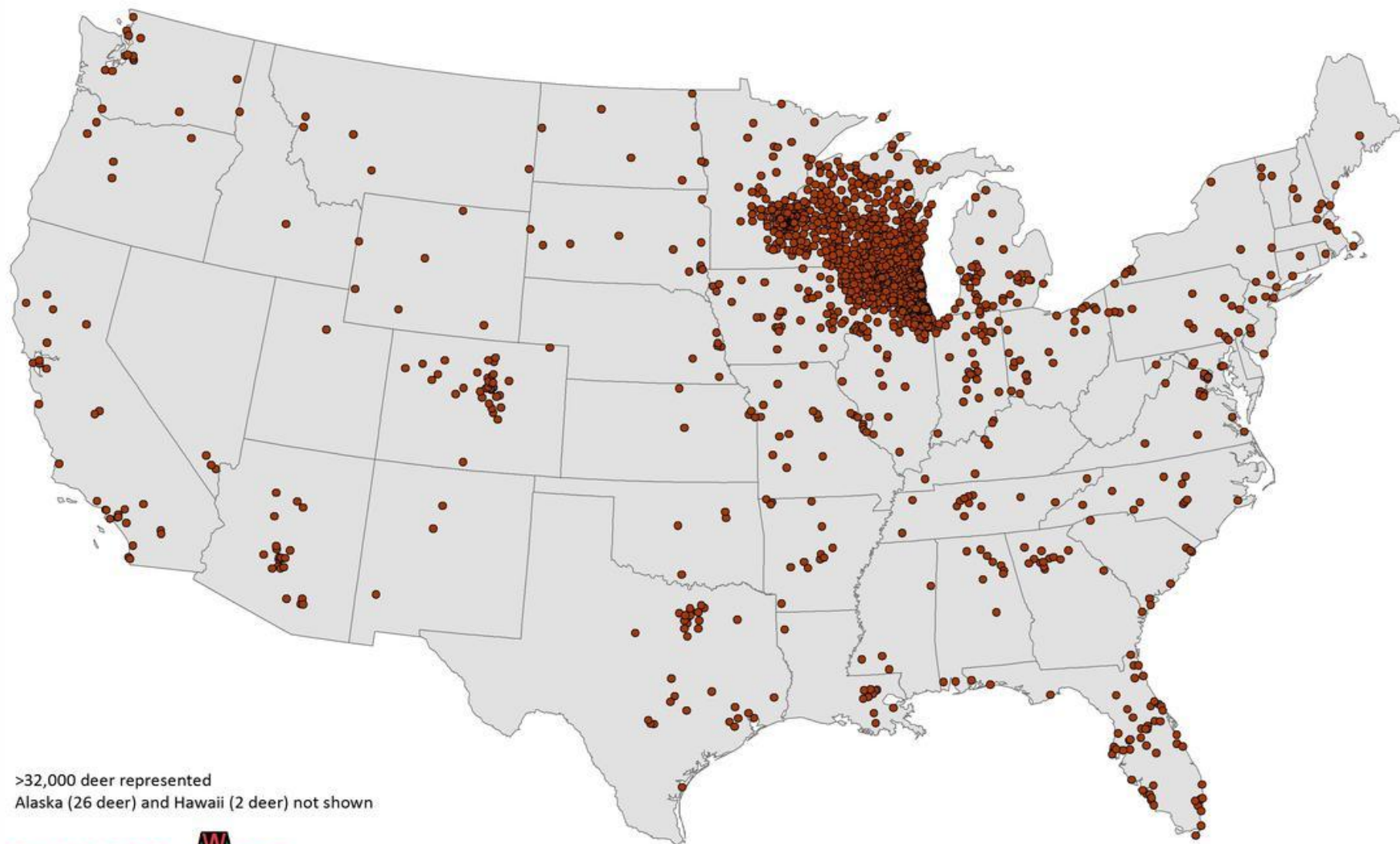


## AFWA Best Management Practices for Prevention, Surveillance, and Management of Chronic Wasting Disease

- **Association of Fish & Wildlife Agencies (AFWA) recently published a report on best CWD management practices**
- **Highlights the known risks of CWD transmission and offers regulatory suggestions/best practices to reduce risks**
  - *“Movement of infected cervid carcasses is one of the known risks for introducing CWD prions to new areas”*
- **Infected carcasses can be a reservoir for CWD when left on the landscape**
- **Many states have restrictions on carcass imports including Minnesota**



# Home Zip Codes of hunters harvesting deer in Dane, Iowa, Richland and Sauk Counties, Wisconsin, 2016-2017



>32,000 deer represented  
Alaska (26 deer) and Hawaii (2 deer) not shown



## AFWA Best Management Practices for Prevention, Surveillance, and Management of Chronic Wasting Disease

- **Chapter 14 of AFWA's CWD Best Management Practices report covers carcass disposal**

**Approved Landfill.** Properly licensed and operated landfills offer one of the most economically feasible options for disposal of carcasses and parts, particularly in high volumes. While disposal via landfill may not eliminate infectious prion, carcass parts disposed of in a landfill would be inaccessible to cervids and may functionally contain the CWD prion (Jacobson et al., 2009). It is important that carcasses are properly covered after disposal in a landfill to prevent scavenging.

***Adequate and accessible carcass disposal is a critical tool for limiting CWD transmission***



# Why should people care about CWD?

- **Localized population-level impacts over time when disease prevalence reaches certain thresholds**
  - **Ex. Altered age and sex ratios, overall decline**
- **Human exposure to CWD is increasing over time**
  - **Estimated 7,000 to 15,000 CWD-positive animals are consumed annually**
  - **Potential public health problem**
- **Could stifle hunter participation**
  - **Complicates disease management**
  - **Economic impacts**
    - **Hunters and wildlife watchers contribute more than \$1.3 billion annually to MN's economy**

# CIDRAP's CWD Resource Center

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## Chronic Wasting Disease Resource Center

### CWD Response, Research, and Policy Program

The Chronic Wasting Disease (CWD) Response, Research, and Policy Program addresses the transmission of CWD in cervids and its potential for spread to humans and other animal species. The program supports current and reliable information on CWD for the public, including hunters; the medical, veterinary and public health communities; wildlife scientists and managers; and public policymakers.

[About CIDRAP's CWD program](#)

### Expert Advisory Group

The program includes 40 national and international world-renowned and distinguished leaders in public health, medicine, science, wildlife, and agriculture.

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Link: [www.cidrap.umn.edu/cwd](http://www.cidrap.umn.edu/cwd)

# Questions?

Thank you!

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