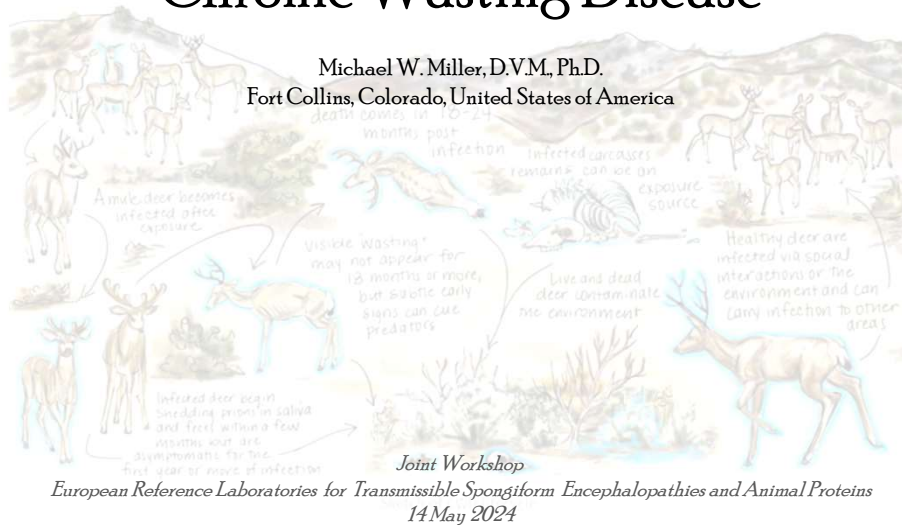


The North American Epidemic of Chronic Wasting Disease


Michael W. Miller, D.V.M., Ph.D.

Fort Collins, Colorado, United States of America



The North American Epidemic of Chronic Wasting Disease

- ❖ CWD – what it is & what it is not
- ❖ CWD patterns, trends, & lessons learned
- ❖ CWD 'in the news' (& the rest of the story...)



CHRONIC WASTING DISEASE

spongiform encephalopathy

WHAT IT IS

- transmissible \pm infectious* prion disease(s)
- progressive brain damage, eventual death
- direct & indirect infectious transmission
- affects multiple cervid (“deer”) species



CHRONIC WASTING DISEASE

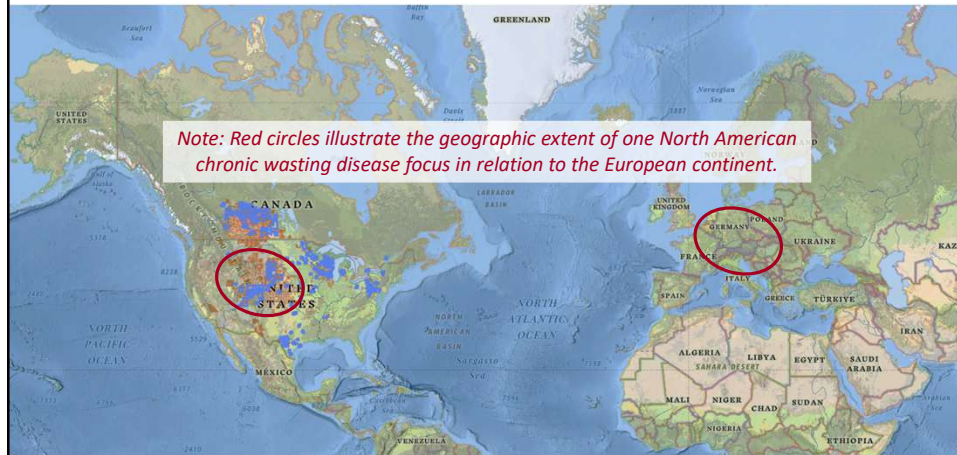
spongiform encephalopathy

WHAT IT IS NOT (REALLY)

- highly contagious
- rapidly spreading
- an imminent ecological disaster
- something to be ignored...

Chronic Wasting Disease in North America

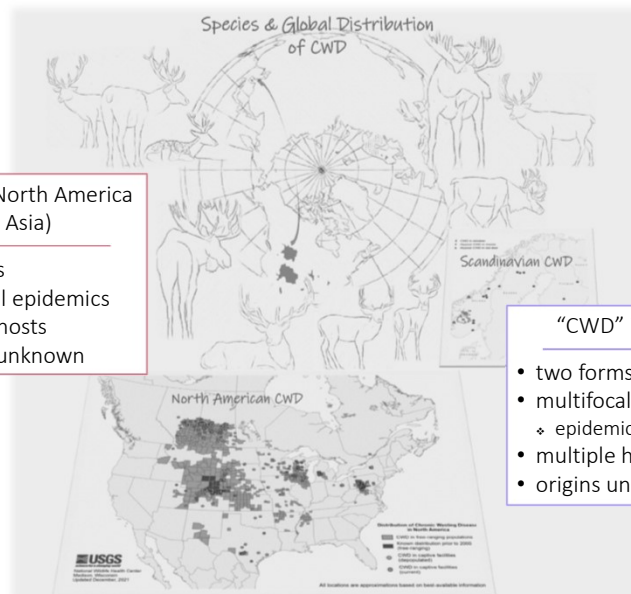
In North America, chronic wasting disease also is well-established & widespread...



“chronic wasting disease” is not a singular entity

“CWD” in North America (& Asia)

- infectious
- multifocal epidemics
- multiple hosts
- origin(s) unknown



“CWD” in Europe

- two forms (\neq NA form)
- multifocal
 - ❖ epidemic(s) & cases
- multiple hosts
- origins unknown

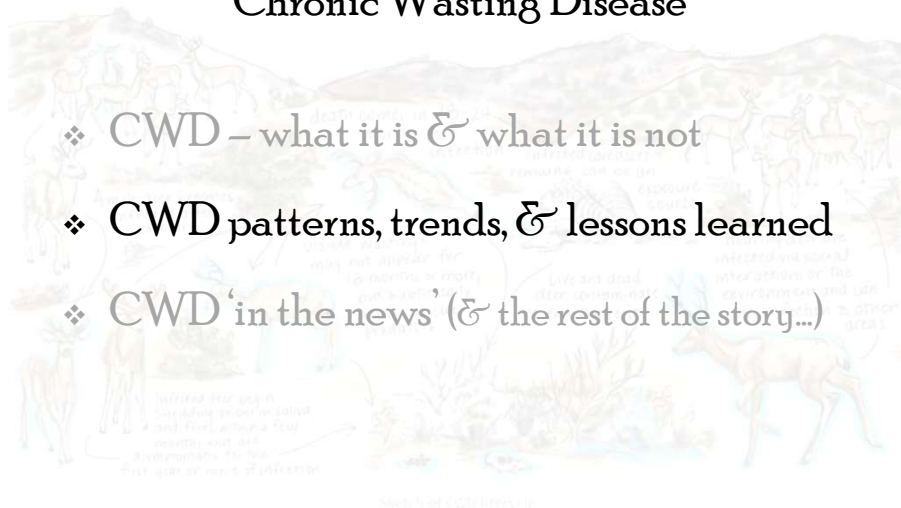
Figure from M. W. Miller & L. L. Wolfe, Chronic wasting disease, *Wildlife Health/Disease and Conservation* 2023

“CWD” in North America vs. Europe

Aspect	North America	Europe
Source(s)	unknown (multiple?)	unknown likely multiple
Distribution	wide & underestimated	limited (but likely underestimated)
Epidemiology	infectious	infectious & ?
Hosts	multiple	multiple but limited across forms
Epidemic growth	sustained & expanding in multiple locations	uncertain (potential in reindeer)
Natural buffering	limited thus far	uncertain
Ecological impacts	growing evidence (host species)	uncertain
Zoonotic potential	limited (based on data & experience to date)	uncertain

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Chronic Wasting Disease in North America

Cumulative *known* CWD distribution in North America

- ❖ captive & free-ranging
- ❖ heavy overlap in some areas
- ❖ bidirectional spillover likely
- ❖ surveillance uneven & occurrence likely underestimated (c & fr)
- ❖ order of detections may not reflect true chronology



Chronic Wasting Disease

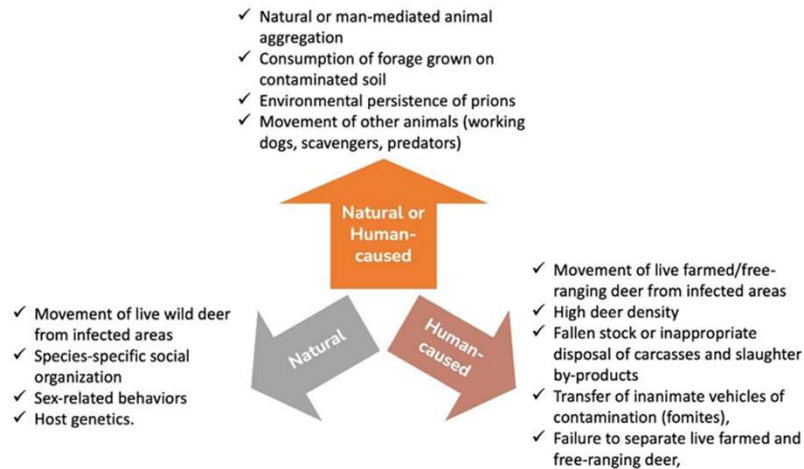


Sketch of CWD lifecycle

From M. W. Miller & L. L. Wolfe, Chronic wasting disease, *Wildlife Health/Disease and Conservation* 2023

Chronic Wasting Disease in North America

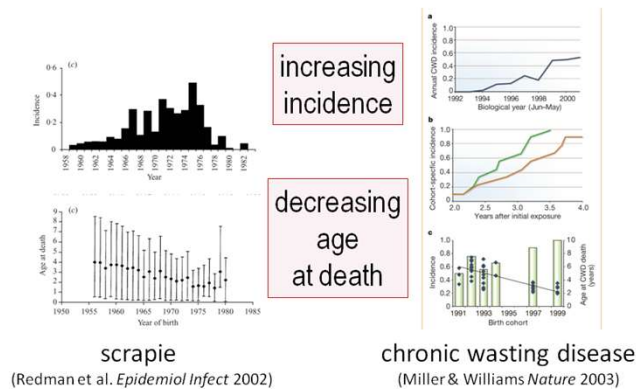
Multiple known or plausible risk factors contribute to epidemic growth & geographic spread



Summary of identified risk factors based on their biological plausibility to spread CWD (adapted from EFSA 2019 [49]).

Figure from Mori et al. 2024

Infectious prion diseases: epidemic dynamics & consequences

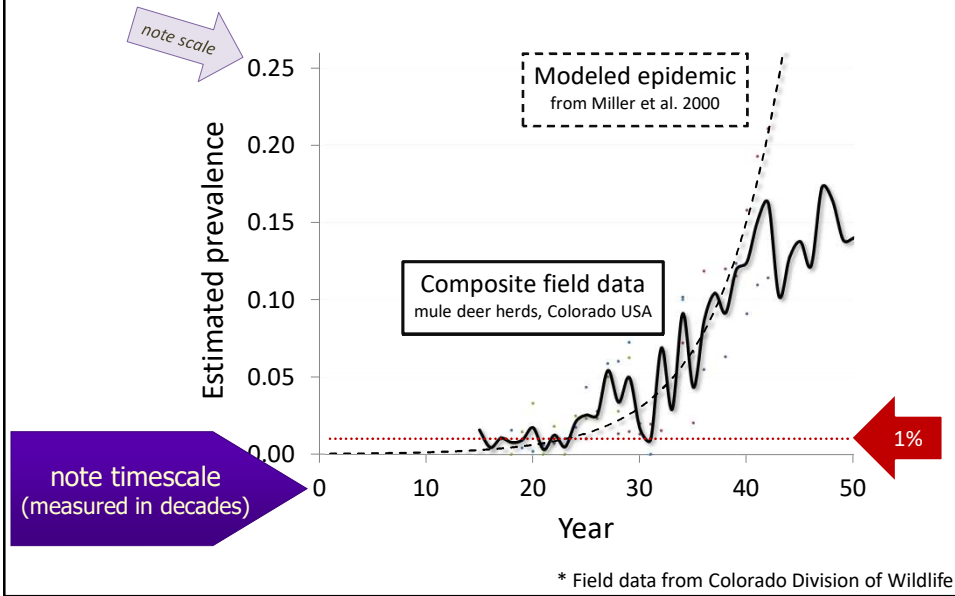


KEY PATTERN

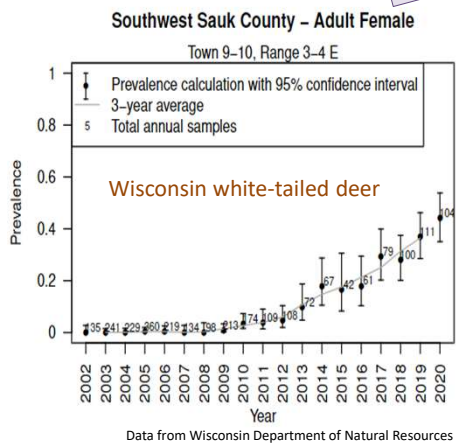
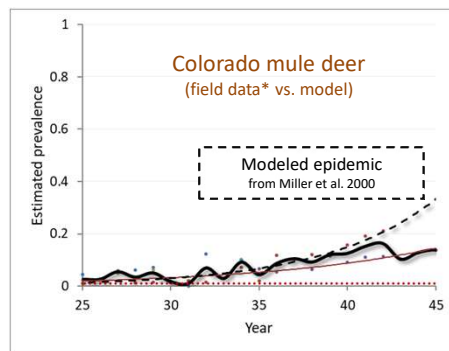
more & more infected animals dying at younger & younger ages

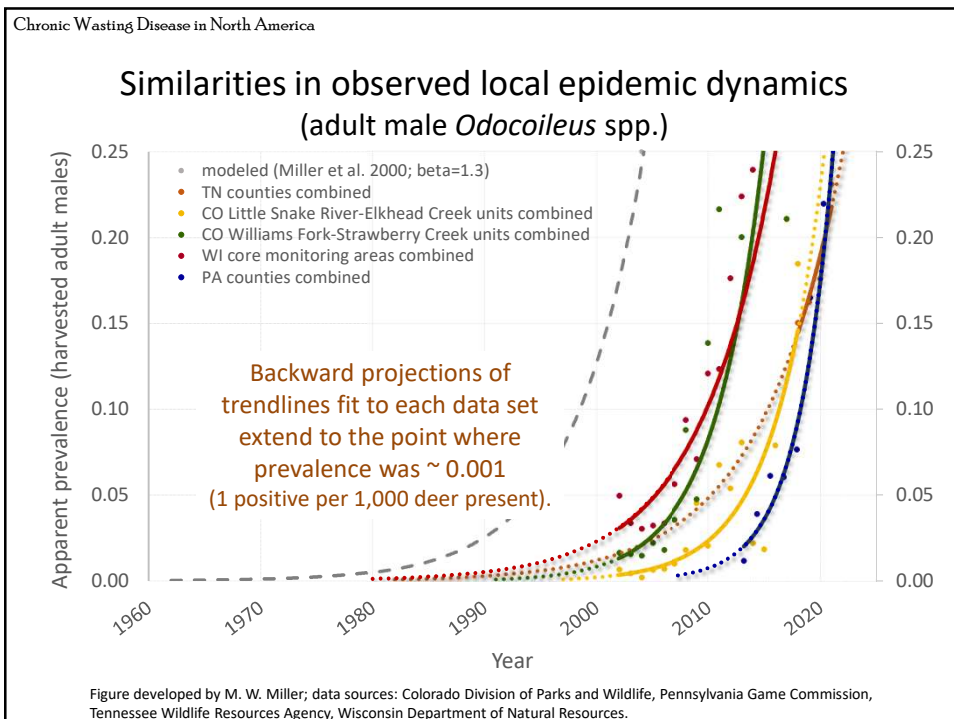
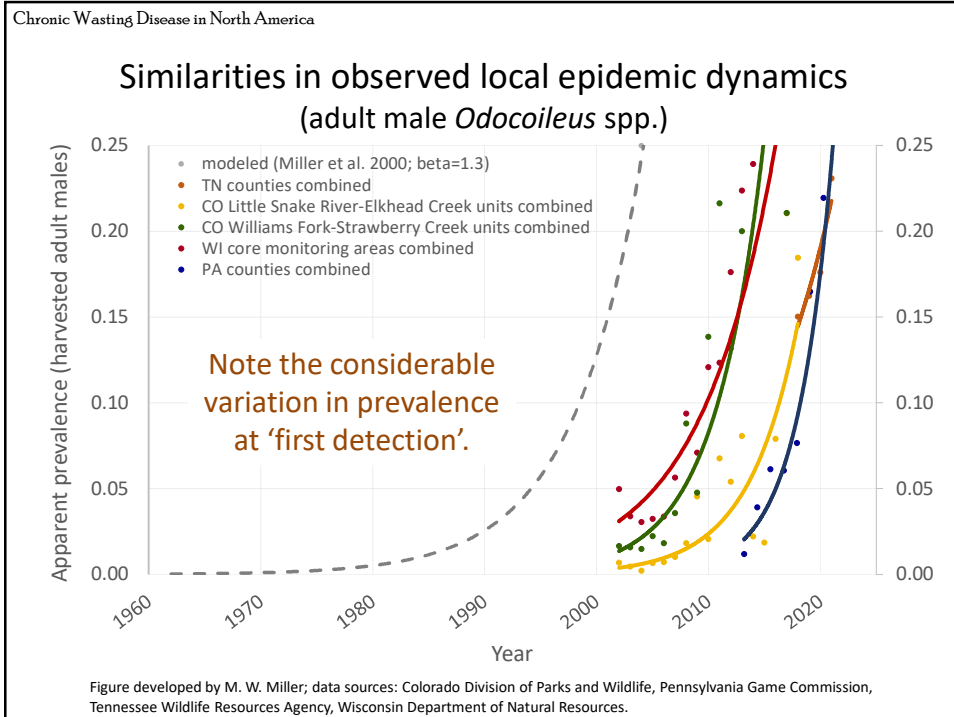
Chronic Wasting Disease in North America

Composite epidemic curve (field data* vs. model)

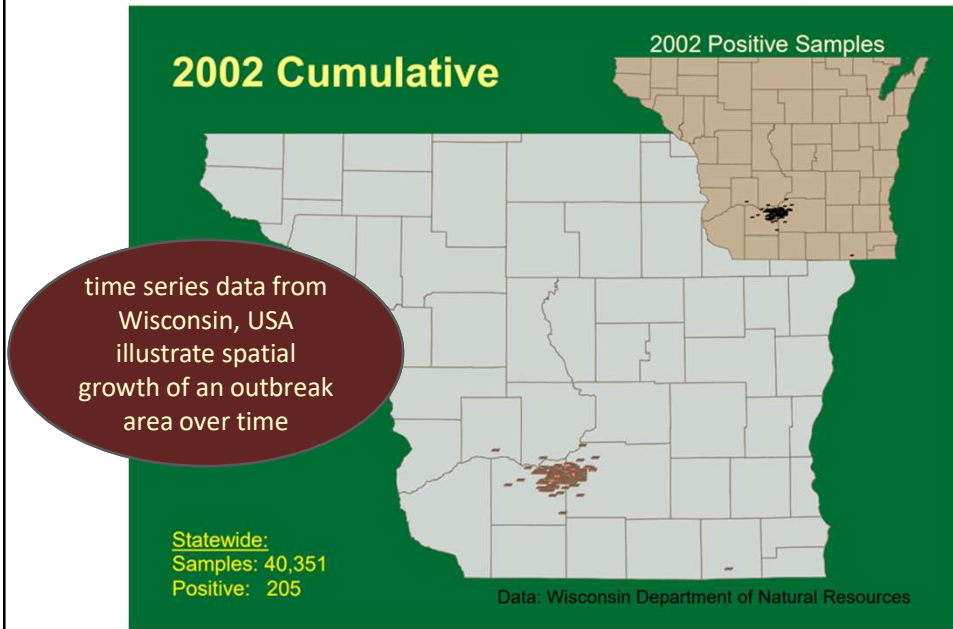


Chronic Wasting Disease in North America

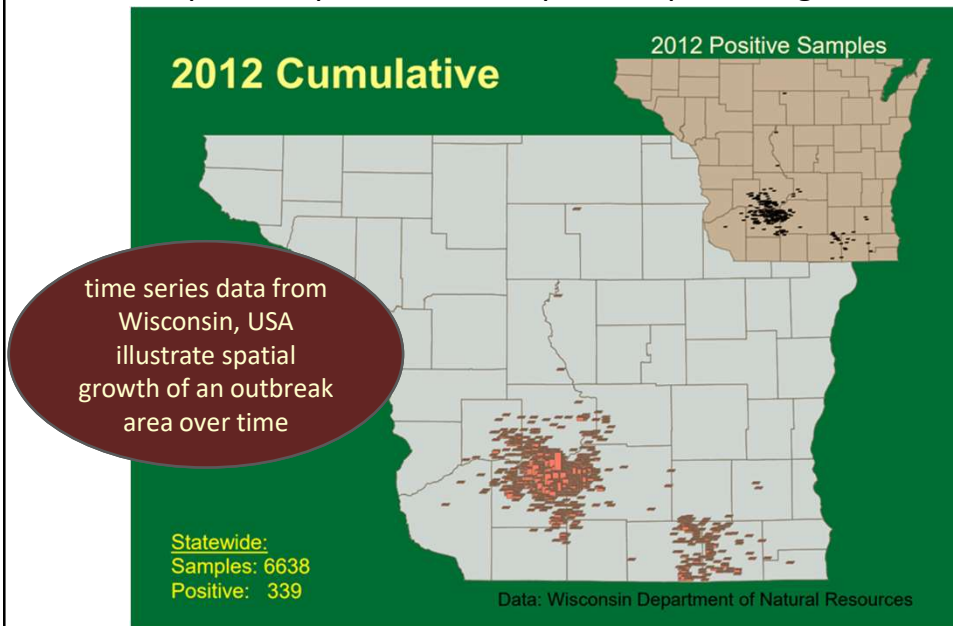
Similarities in observed local epidemic dynamics
(*Odocoileus* spp.)

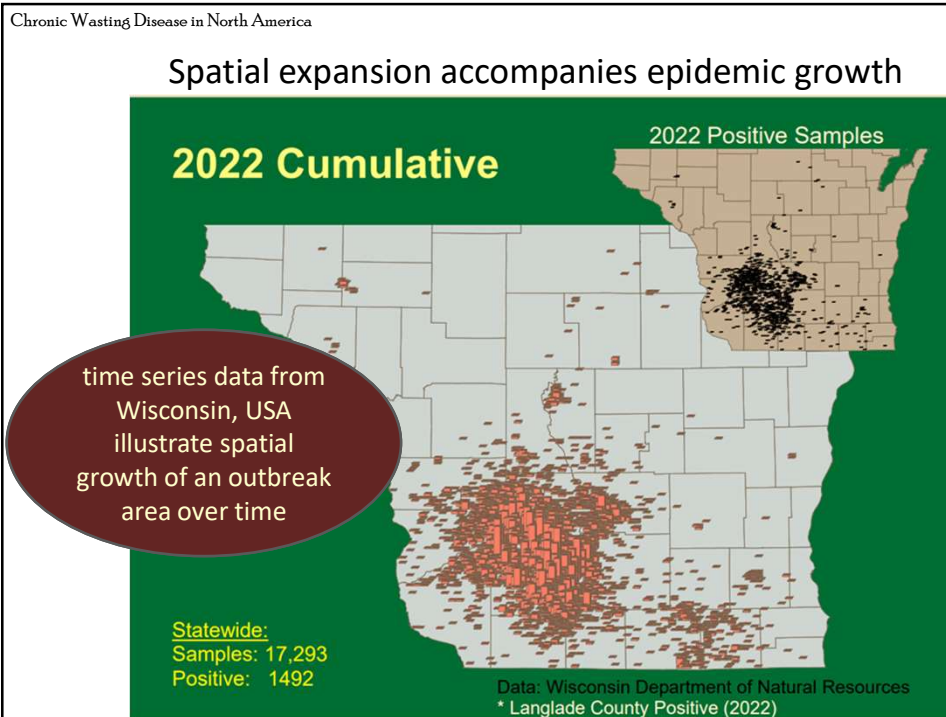


Spatial expansion accompanies epidemic growth



Spatial expansion accompanies epidemic growth






Chronic Wasting Disease in North America

Drivers of spatial “spread” in North America

- live, infected animals moved by humans
- live, infected animals moving naturally
- & maybe by humans (& other species?) moving
 - infected carcass materials
 - byproducts of infected animals
 - other contaminated materials

Reminder: The ultimate origins of CWD in North America remain unknown & that source also could be contributing to observed patterns.

Chronic Wasting Disease in North America



CONTROLLING CHRONIC WASTING DISEASE

- ❖ focused on known/suspected drivers of transmission & spread
- ❖ uneven effort within & among jurisdictions, & over time
- ❖ assessments complicated by delayed responses
- ❖ evidence of benefits, but 'effectiveness' likely situational
- ❖ some evidence of natural buffering
- ❖ adaptive & sustainable approaches seem most viable

*The First Five (or More) Decades of Chronic Wasting Disease:
Lessons for the Five Decades to Come*

Five lessons from North America:

- ❖ Longer than you think
- ❖ At least two good stories
- ❖ Looking hard/hardly looking
- ❖ The five phases
- ❖ Sustained & sustainable effort

For further reading, see: Miller, M. W., and J. R. Fischer. 2016. The first five (or more) decades of chronic wasting disease: lessons for the five decades to come. Transactions of the North American Wildlife and Natural Resources Conference 81:110–120. [81st-NAWNRC-Transactions_FINAL-CWD-Excerpt.pdf \(cwg-info.org\)](#)

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Chronic Wasting Disease in North America

CWD ‘in the news’ (& the rest of the story...)

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INFECTIOUS DISEASE: NEUROINFECTIOUS DISEASES, COMMON ETIOLOGIES, AND RARE DISEASES 2 | April 9, 2024 |

Check for updates

Two Hunters from the Same Lodge Afflicted with Sporadic CJD: Is Chronic Wasting Disease to Blame? (P7-13.002)

Jonathan Trout, Matthew Roberts, Michel Tabet, Ethan Kotkowski, and Sarah Horn | [AUTHORS INFO & AFFILIATIONS](#)

April 9, 2024 Issue • 102 (17, supplement_1) • <https://doi.org/10.1212/WNL.0000000000004407>

Abstract

Objective:

This study presents a cluster of Creutzfeldt-Jakob disease (CJD) cases after exposure to chronic wasting disease (CWD)-infected deer, suggestive of potential prion transmission from CWD-infected deer to humans.

Background:

CWD 'in the news' (& the rest of the story...)

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INFECTIOUS DISEASE: NEUROINFECTION, COMMON ETIOLOGIES, AND RARE DISEASES 2 | April 5, 2024 |

Two Hunters from the Same Lodge Afflicted with
Sporadic CJD: Is Chronic Wasting Disease to
Blame? (P7-13.002)Jonathan Trout, Matthew
April 9, 2024 Issue • 10

Excerpt from poster presented at conference

- Autopsy was performed. Case Western University's NPDPSC provided diagnosis of **sporadic CJD with homozygous methionine at codon 129 (sCJDMM1)**.

CONCLUSIONS

- Biochemical studies suggest how difficult it can be to distinguish sCJDMM1 from CWD.²
- CWD is a potential, though unlikely, etiology in these cases.
- This cluster emphasizes the need for further investigation into the potential risks of consuming CWD-infected deer.

Abstract

Objective:

This study pres
chronic wasting
transmission fr

Background:

CWD 'in the news' (& the rest of the story...)



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With 2 CWD-positive deer, California
becomes 34th state to report fatal disease

Mary Van Beusekom, MS, May 8, 2024

Topics: [Chronic Wasting Disease](#)

SHARE

California has become the 34th state to detect **chronic wasting disease** (CWD), the California Department of Fish and Wildlife (CDFW) announced yesterday.

On May 6, officials received confirmation of the fatal prion disease after submitting samples collected from two deer, one in Madera County near Yosemite Lakes in central California and the other in Inyo County near Bishop, southeast of Madera County. The Madera County deer was found dead of unknown causes, and the Inyo County deer had died after being hit by a vehicle.

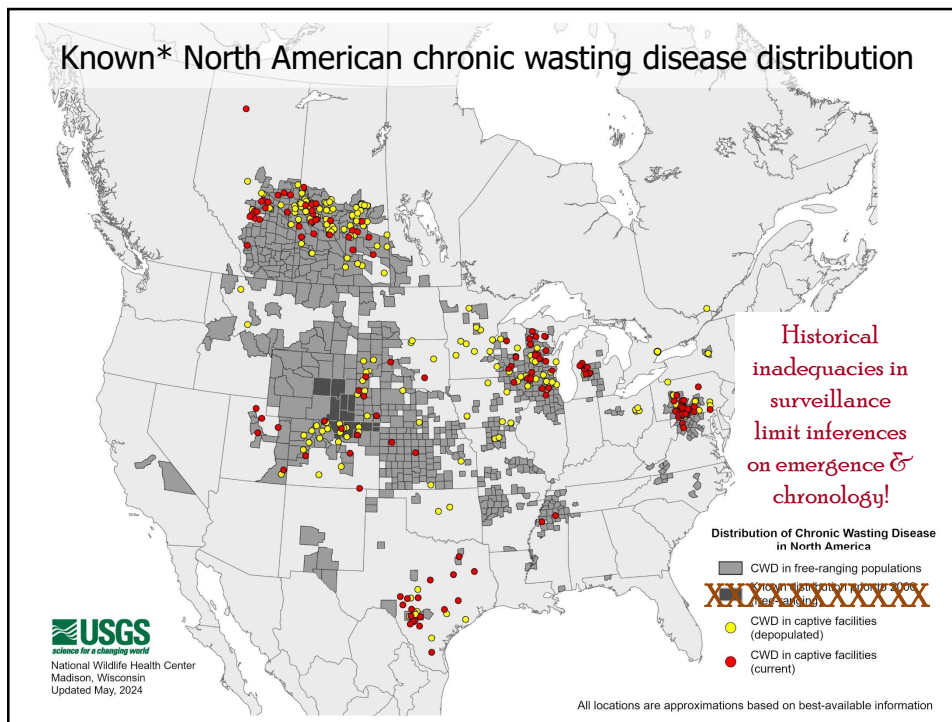
CWD likely undetected for some time

The CDFW has been monitoring elk and deer for CWD using lymph node testing of more than 6,500 cervids since 2000 and has been working with hunters, taxidermists, and meat processors to boost disease surveillance since 2018. But given that the affected counties don't share a border and the CWD incubation period can be months to years, officials said CWD has probably been in the state for some time.



doe-oakridge, Lynn Freemy / Flickr cc

6,500 samples/23 yr
<300 samples/yr



Further reading...

CHRONIC WASTING DISEASE DETECTION AND MANAGEMENT: WHAT HAS WORKED AND WHAT HAS NOT?



Report Completed by:
Dr. John Fischer
Matt Dunfee, CWD Alliance
2022

Thank you to project contributors:
Dr. Michael Miller, Colorado Parks and Wildlife
Dr. Dale Garner, Iowa Department of Natural Resources
Dr. Eric Hildebrand, Minnesota Department of Natural Resources
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Dr. Kelly Straka, Minnesota Department of Natural Resources
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<https://cwg-info.org>

SCIENTIFIC OPINION

ADOPTED: 15 March 2023
doi: 10.2903/j.efsa.2023.7936



Monitoring of chronic wasting disease (CWD) (IV)

EFSA Panel on Biological Hazards (BIOHAZ),
Konstantinos Koutsouranis, Ana Allende, Avelino Alvarez-Ordóñez, Declan Bolton,
Sara Bover-O'd, Marianne Chemaly, Robert Davies, Alessandra De Cesare, Lieve Herman,
Friederike Hilbert, Roland Lindqvist, Maarten Nauta, Luisa Peixe, Panagiotis Skandamis,
Elisabetta Suffredini, Michael W Miller, Atle Mysterud, Maria Noremark, Marion Simmons,
Michael A Tranulis, Gabriele Vaccari, Hildegunn Viljugrein, Angel Ortiz-Pelaez and
Giuseppe Ru

Abstract

The European Commission requested an analysis of the Chronic Wasting Disease (CWD) monitoring programme in Norway, Sweden, Finland, Iceland, Estonia, Latvia, Lithuania and Poland (9 January 2017–28 February 2022). Thirteen cases were detected in reindeer, 15 in moose and 3 in red deer. They showed two phenotypes, distinguished by the presence or absence of detectable disease-associated normal cellular prion protein (PrP^{Sc}) in lymphoreticular tissues. CWD was detected for the first time in Finland, Sweden and in other areas of Norway. In countries where the disease was not detected, the evidence was insufficient to rule out its presence altogether. Where cases were detected, the prevalence was below 1%. The data also suggest that the high-risk target groups for surveillance should be revised, and road kill removed. Data show that, in addition to differences in age and sex, there are differences in the prion protein gene (PRNP) genotypes between positive and negative wild reindeer. A stepwise framework has been proposed with expanded minimum background surveillance to be implemented in European countries with relevant cervid species. Additional surveillance may include ad hoc surveys for four different objectives, specific to countries with/without cases, focusing on parallel testing of obex and lymph nodes from adult cervids in high-risk target groups, sustained over time, using sampling units and a data-driven design prevalence. Criteria for assessing the probability of CWD presence have been outlined, based on the definition of the geographical area, an annual assessment of risk of introduction, sustained minimum background surveillance, training and engagement of stakeholders and a surveillance programme based on data-driven parameters. All positive cases should be genotyped. Sample sizes for negative samples have been proposed to detect and estimate the frequency of PRNP polymorphisms. Double-strand sequencing of the entire PRNP open reading frame should be undertaken for all selected samples, with data collated in a centralised collection system at EU level.

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Keywords: chronic, wasting, CWD, surveillance, Europe, genotype

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SEARCH Q

Review of Transmission and Geographic Spread of Chronic Wasting Disease in U.S. Cervid Populations

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<https://www.nationalacademies.org>



Description

An ad hoc committee of experts appointed by the National Academies of Sciences, Engineering, and Medicine will review the state of knowledge about modes of transmission and means of geographic spread of chronic wasting disease (CWD) among free-ranging¹ and captive² populations of cervids in the United States. Specifically, the committee will draw conclusions about the state of knowledge regarding:

- The infectious dose of CWD and different modes of disease transmission among cervids;
- The means of geographic spread through cervid dispersal, scavenger activity, and human actions³;
- The effectiveness of interventions to reduce transmission and/or geographic spread of the disease; and
- The population-level and economic impacts of CWD and the effectiveness of different interventions to reduce those impacts.

The committee will write a report that addresses these points based on its review of published and in-progress research on CWD.

• About
 Description
 Committee
 Sponsors
 Past Events
 Contact

Chronic wasting disease (CWD) is such as deer, elk, reindeer, sika deer, and moose. It is a prion disease that forms clumps of protein that spread among cervids. It is thought to spread among cervids in 26 states and two Canadian provinces. Knowledge about modes of transmission is limited.

Chronic Wasting Disease in North America

~~Three~~ **Four** pieces of advice

- Don't panic, but don't ignore.
- Establish realistic goals & sustainable means of pursuing them.
- Persist, but be patient.
- Embrace the available science, then learn more as you go.

