

Wildlife and the Disease Landscape in Southern Iowa

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EHD + CWD

bTB + RHD

Epizootic Hemorrhagic Disease

NEWS

What you need to know about EHD, the disease that's killing hundreds of deer in Iowa

Sarah Kay LeBlanc The Des Moines Register
 Published 12:11 p.m. CT Nov. 20, 2019



Hemorrhagic Disease

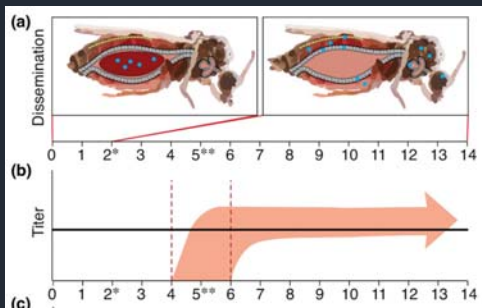
Family: Reoviridae

- Genus: *Orbivirus*
- 27+ serotypes of Bluetongue;
- 7+ serotypes of Epizootic Hemorrhagic Disease
- Also African Horse Sickness, among others



- Arbovirus= arthropod-borne virus → spans multiple families
- Transmitted to vertebrate host during blood-feeding (hematophagy) via saliva

Electron Imaging Center for Nanomachines, UCLA



(Mills et al. 2017)

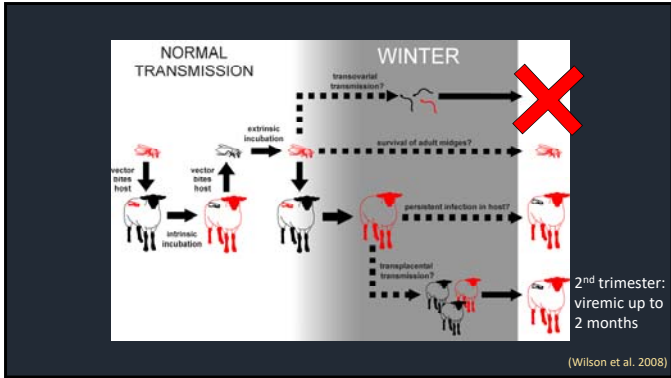
Vector-borne transmission

Transmitted by a biting midge (*Culicoides* spp.)

- Females require blood-meal for sustained egg production
- Weak evidence of vertical transmission
 - Likely overwinters in parous females
- Patchy outbreaks mediated by weather
 - Mud flats and wind
 - Ceases shortly after first frost



(<http://sntnemdept.uff.edu>, Featured Creatures; Osborne et al. 2015)



Seasonality

- Emerges late summer, persists into early fall
- 2019: received earliest reports of suspect EHD mortalities out of Warren County, ~ July 20th

Photos courtesy of Tom Litchfield, Iowa DNR

Species Susceptibilities & Clinical Presentation

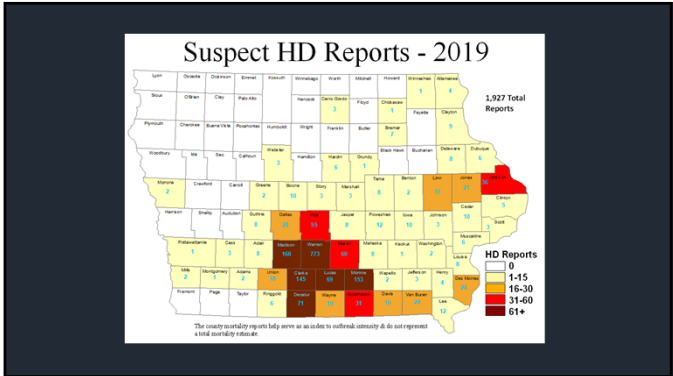
Epizootic Hemorrhagic Disease	Bluetongue
<ul style="list-style-type: none"> Primary host= WTD <ul style="list-style-type: none"> Cattle often asymptomatic Incubation= 7-10 days Signs= malaise, drooling, dyspnea, acute death (often in or near water) Subacute/chronic: oral erosions, growth interruptions or sloughing of the hoof wall, walking on knees, poor body condition 	<ul style="list-style-type: none"> Primary host= sheep <ul style="list-style-type: none"> Subclinical: goats, cattle, other ruminants Incubation= 5-10 days Signs= fever, dyspnea, oral erosions, drooling, facial edema, hyperemia, cyanosis (i.e. "bluetongue"), teat lesions, drop in milk production, reproductive failure (1st trimester), acute death

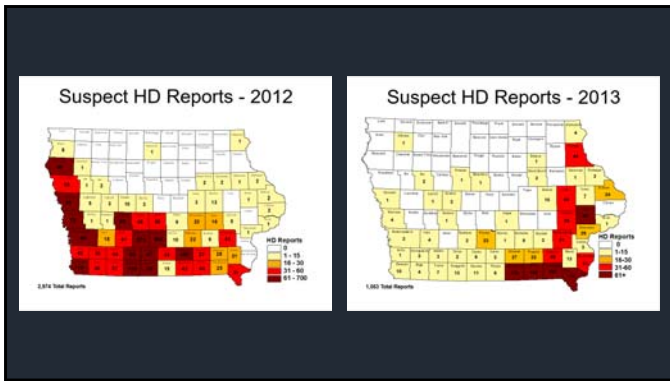
+ dermatitis, skin breaks in cattle

(cfsph.iastate.edu)

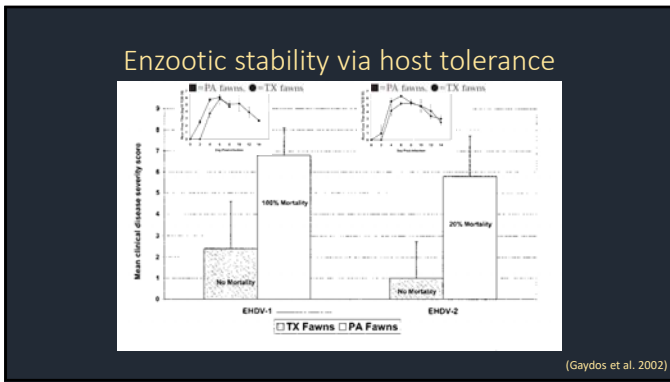
Diagnostics

- RT-PCR on spleen or whole blood (4 mL in EDTA) via NVSL
 - Confirm presence of viral RNA, also allows for serotyping
- cELISA or AGID (BT/EHD cross-react) on serum via NVSL or ISU Vet Diagnostic Lab
 - Seroconversion indicates previous exposure





(Schirtzinger et al. 2019)



(Gaydos et al. 2002)

Chronic Wasting Disease

“Zombie Deer Disease”

Chronic Wasting Disease (CWD)

- CWD is a transmissible spongiform encephalopathy (TSE) of cervids (deer, elk, moose, caribou)
- Other TSEs include scrapie (sheep and goats), bovine spongiform encephalopathy (“Mad Cow Disease”), and Creutzfeldt-Jakob Disease (CJD, humans)
- Transmitted by proteinaceous infectious particles, or “prions” (misfolded host protein)

$PrP^C \rightarrow PrP^{CWD}$

CWD Pathogenesis

- Once a deer becomes infected, this is a uniformly fatal neurodegenerative disease
- Prions accumulate in all tissues (including muscle)
 - Excreted in saliva, urine, and feces
 - Form plaques in the brain that lead to abnormal mentation and inadequate provisioning (i.e. wasting)
- May die of disease sequela like pneumonia or vehicular collisions

(Angers et al. 2006)

CWD Clinical Signs

Though individuals experience long incubation periods, they can still be infectious!



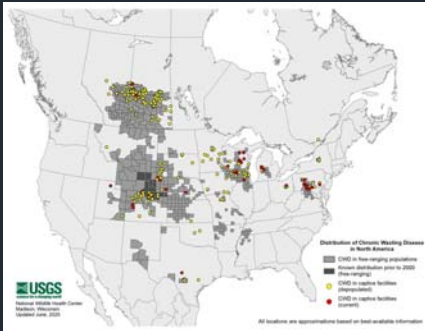
- Asymptomatic 16 mo to 3 yrs
- May shed prions in saliva by 3 mo, urine by 6 mo

(CWD Alliance, Henderson et al. 2015)

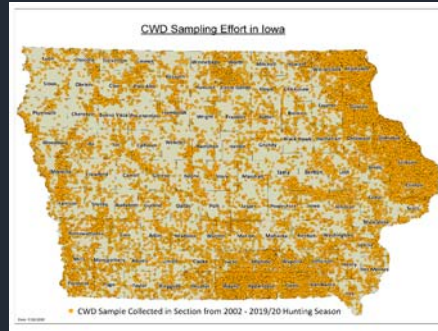
CWD History

- 1967: First detected in captive mule deer at CO research facility
- 1981: First detected in free-ranging cervid (elk from CO)
- 2002: Detected in free-ranging WTD in WI and IL
- 2002-2003: IA begins CWD surveillance on hunter-harvest
- 2013: First free-ranging WTD confirmed (+) in Allamakee Co.

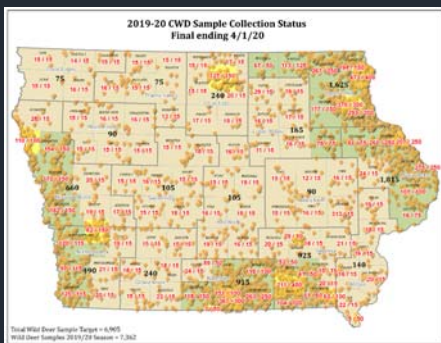
At present: 90 free-ranging WTD from 8 counties have tested (+) in IA



- 24 states, 2 provinces in NA
 - Free-ranging WTD, mule deer, elk, moose
- Captive elk imported to S. Korea
- Norway, Finland, Sweden
 - Free-ranging reindeer, moose, red deer



- >83,000 wild WTD
- >4,800 preserve deer/elk

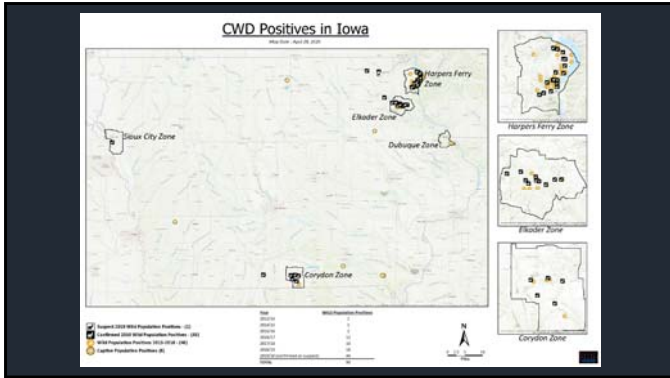


- Hunter-harvest
- Roadkill
- Target/sick

Total positive wild deer

- 2013-2018 = 46
- 2019/20 = 44
- 90

- Allamakee = 56
- Clayton = 15
- Decatur = 1
- Dubuque = 1
- Fayette = 2
- Wayne = 10
- Winneshiek = 4
- Woodbury = 1
- 90



Diagnosics

- Free-ranging deer: RPLN
- Captive deer: RPLN + obex
- Elk: RPLN + obex
- Screening test= ELISA
- Confirmatory test= IHC
- RT-QuIC + PMCA in pipeline
- Measure seeding activity

(Spraker et al. 2004, Gough and Maddison 2010; Henderson et al. 2015)

Species Barrier?

- Prion strains are classified by protein conformation, host range, and clinical outcome
- Host passage can modify species susceptibilities
 - Can infect cattle via intracranial route
 - Infection rate: WTD (11/12) > mule deer (5/13) > elk (2/14)
 - Incubation period: mule deer (2-5 yrs.) > WTD (18-26 mo.) > elk (17 mo.)
 - 2nd passage improves infection rate, shortens incubation time

(Bartz et al. 1998, Hamir et al. 2005, Hamir et al. 2006, Hamir et al. 2007, Morales et al. 2007, Greenlee et al. 2012, Osterholm et al. 2019)

Species Barrier?

- Can infect domestic swine via IC inoculation OR per oral
 - Detected in brainstem and lymphoid tissue by 6 mo.
- Exposure to CWD+ carcasses
 - Feral pigs
 - Swill feeding
 - Role as shedders/spreaders?

(Moore et al. 2017)

Testing the Species Barrier

- Lack of evidence for zoonotic risk today does not preclude risk in the future
- CDC recommendation: keep CWD prions out of the human food chain
- CWD testing NOT designed for food safety—but presently our only tool
- Mineral licks in endemic areas

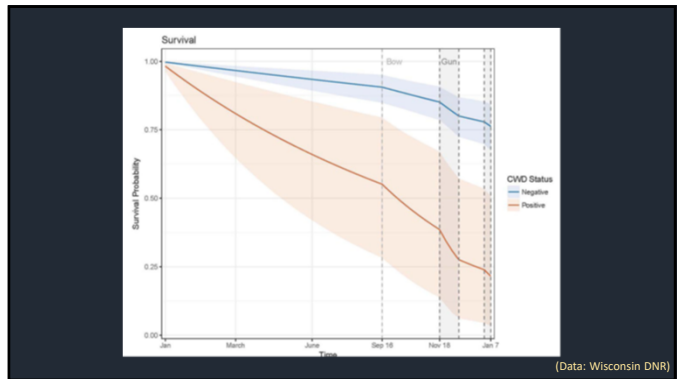
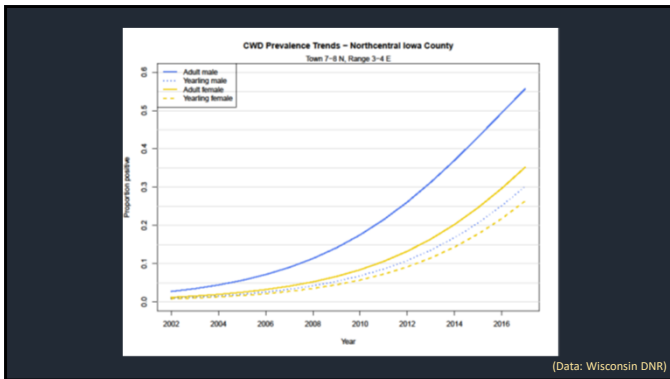
(Plummer et al. 2018)

Iowa County WI 2015 CWD Samples (males only)

Age Category	Negative	Positive	Total Samples	% Positive
Fawn	21	1	22	4.5
1.5	86	15	101	14.9
2.5	74	20	94	21.3
3.5	80	44	124	35.5
4 to 5	28	26	54	48.1
6 to 8	2	2	4	50.0
9 to 11	1	0	1	0
Grand Total	292	108*	400	27.0

*Non-hunting samples not included

(Data: Wisconsin DNR)



Questions?

*To ask questions, type into the Q&A or Chat.
 To find these options, hover your mouse over the screen and click on the chat or question icon. If not visible, click bubble with three dots and select Q&A*

IOWA STATE UNIVERSITY
 Extension and Outreach
Iowa Beef Center

Bovine Tuberculosis

NEWS

A Michigan man was infected with tuberculosis while hunting deer. Should Iowa hunters worry?

Donnelle Eller The Des Moines Register
Published 3:00 p.m. CT Oct. 1, 2019

Tests have shown a Michigan man was infected with pulmonary tuberculosis while hunting deer, but an Iowa wildlife expert says hunters here face no increased risk.

Rachel Ruden, the Iowa Department of Natural Resources' wildlife veterinarian, said the outbreak of deer-transmitted bovine tuberculosis has been contained to four counties in Michigan's Lower Peninsula.

"Bovine tuberculosis has not been detected in Iowa" deer herds, Ruden said. "This is a wildlife health issue specific to Michigan."

bTB Pathogenesis

- Mycobacterial infection with *M. bovis* characterized by granulomatous inflammation (i.e. tubercles)
- Disease location depends on route of exposure
 - Pulmonary tuberculosis: targets the lungs
 - Nonpulmonary tuberculosis: targets the LNs
 - Cutaneous tuberculosis: local infection

(Wilkins et al. 2008)

Host Predilections

- Primary host= cattle
- Wildlife reservoirs= WTD (U.S.), European badger (U.K.)
 - Michigan, functionally eradicated from Minnesota, isolated case in Indiana
- Any mammal susceptible




(Carstensen and DonCarlos 2011, purdue.edu, Mossy Oak)

Spillover → Reservoir

- Spillover events happen frequently
 - Most become dead-end hosts
- Confluence of factors necessary to establish new disease reservoirs
 - Repeated point introductions from primary host
 - Clinical signs that promote transmission
 - Contact with conspecifics



(ghostbear.org, Donna Sabattus)

History of bTB in Michigan

- 1920s: Highest reactor rates localized to the northeastern lower peninsula (20–32%)
- 1975: Tuberculous doe harvested in Alpena County
- 1979: USDA conferred bTB-free status
- 1994: Tuberculous buck harvested in Alpena County
 - ^ index case for bTB endemic in WTD

(O'Brien et al. 2006)

bTB in WTD

- Expanded sampling of WTD in 1995
 - Apparent prevalence 4.8%
- Researchers estimate initial host jump to 1955
- Multiple point-source introductions likely



(McCarty and Miller 1998, O'Brien et al. 2002, michigan.gov)

Confluence of Factors

- Low hunting pressure
- Supplemental feeding
 - Increasing population densities
 - Changing spatial distribution
- Sustained transmission ($R_0 > 1$)
 - Opportunity for reverse point-source introductions



bTB Persistence

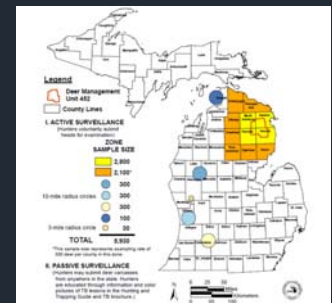
- MOA granting split-state status in 2016:
 - 4 county MAZ, rest of MI Accredited Free
- 78 cattle herds have tested bTB-positive since 1998
 - Some infected following repopulation
- 6 additional feedlots
- 3 premises identified via trace-out in 2020 alone
 - 2 outside MAZ- deer could be sentinels in IA



(michfb.com)

2019 WTD Results (as of 3/16/20)

County Name	Total Tested	Number Positive
Alcona	878	14
Alpena	1147	9
Cheboygan	154	0
Crawford	202	0
Iscos	307	0
Montmorency	618	5
Ogemaw	364	0
Oscoda	465	3
Otsego	167	0
Presque Isle	538	0
Roscommon	391	0
Total to date	5231	31



(michigan.gov)

Emerging Disease Notice:

Rabbit Hemorrhagic Disease in the southwestern U.S.

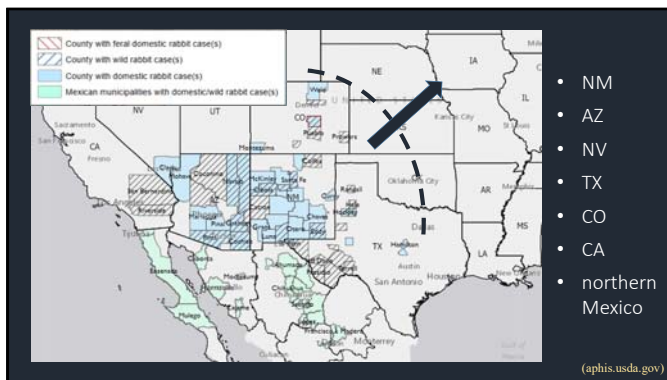


(cfsph.iastate.edu)

Rabbit Hemorrhagic Disease

- Caused by a calicivirus: rabbit hemorrhagic disease virus serotype 2 (RHDV2)
- Emerged in France in 2010
- Wild North American lagomorphs are susceptible
 - Unlike classical RHDV/RHDVa
 - 2020 emerging outbreak

(cfsph.iastate.edu)



RHDV2 Disease Ecology

- Incubation period < 5 days
- Virus shed in respiratory secretions, urine, and feces
- Mechanically vectored by insects, predators/scavengers (scat), and fomites
- Carcasses can remain infectious for months
- Resistant to extreme heat and cold, and certain chemical disinfectants

(cfsph.iastate.edu, oie.int)

RHDV2 Clinical Signs and Diagnostics

- Acute mortality
- +/- Blood or blood-tinged foam at nose
- In captivity: malaise, fever
- Rt-PCR @ NVSL, Plum Island → liver (highest viral load)
- NO field necropsy- double bag and submit to ISU VDL

(aphis.usda.gov)

Vaccination

- No vaccine currently licensed in the U.S.
- USDA allowing import via special permit to states with (+) detections
 - Eravac or Filavac = killed vaccines
 - Increasing demand in affected states to protect pet/show/foster rabbits

(aphis.usda.gov)

Biosecurity

- Transition rabbits indoors
- Exclude insects
- Use dedicated footwear
- C + D: 10% bleach, 1% Virkon-S
- Enforce 10 day quarantines, handle last



(Nebraska Wildlife Rehab)

Report Dead Lagos!

Wild Rabbits/Hares:
• DNR: (515) 823-8544

Domestic Rabbits:
• IDALS: (515) 281-5305
• USDA: (515) 284-4140



(Roger Hill, WeAreIowa.com)

SARS-CoV-2 and Wildlife

- Betacoronavirus that targets respiratory epithelium
 - Origin= Asian horseshoe bat (*Rhinolophus* spp.) + intermediate host
 - Asymptomatic disease with fecal shedding
- Felids: domestic cats, lions and tigers from zoological collection
- Mustelids: ferrets (exp.), mink farms in the Netherlands
- Canids: domestic dogs
- North American bats?
 - NWHC assessing risk for reverse zoonosis (*Eptesicus fuscus*)

(Dominguez et al. 2007, Oreshkova et al. 2020, Shi et al. 2020)

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Literature Cited

- | | |
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