

Chronic Wasting Disease (CWD)



Chronic Wasting Disease

Chronic Wasting Disease (CWD) is a fatal nervous system disease of white-tailed deer, mule deer, elk, moose, and reindeer/caribou



Causative agent: Prion (infectious protein)

Similar diseases: Animal: BSE (“mad cow”), scrapie in sheep, etc..

Human: Creutzfeldt-Jakob disease, Kuru, etc...

Distribution of CWD



Norway - 2016



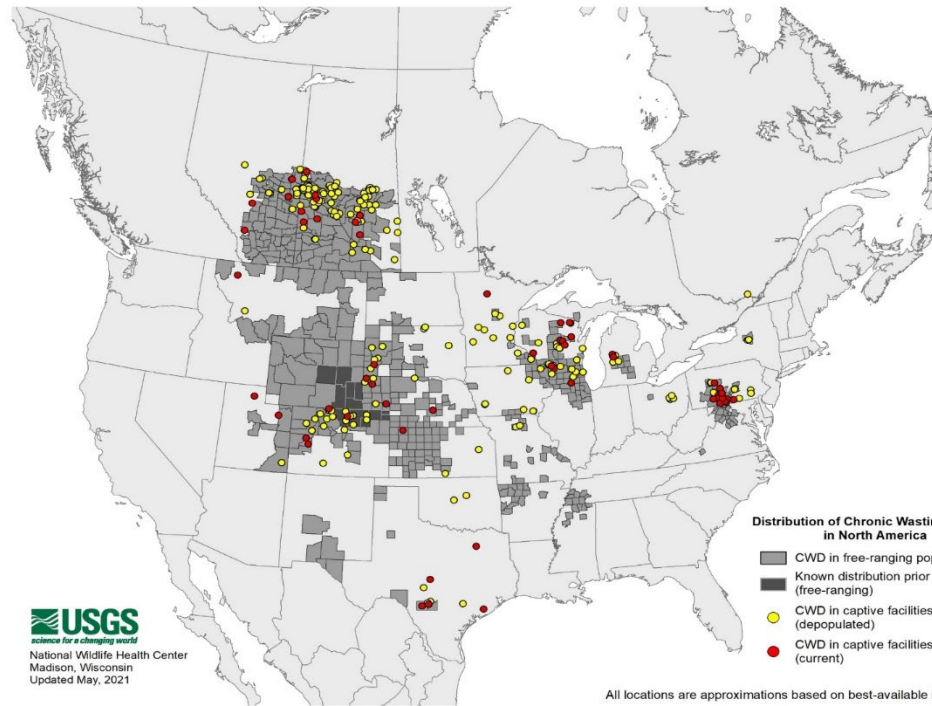
Finland - 2018



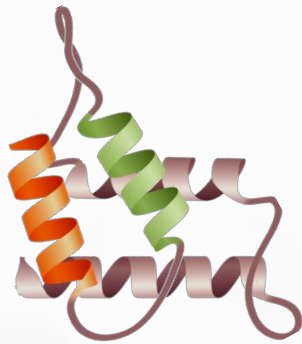
South Korea - 2000



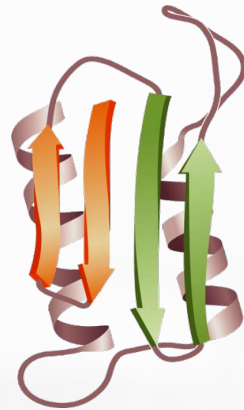
Sweden - 2019



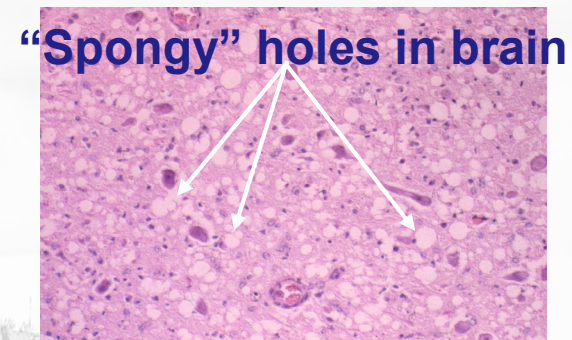
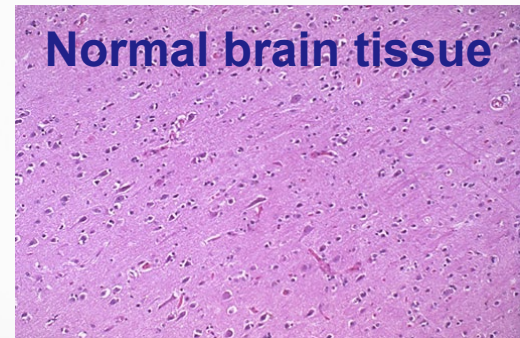
Prion Simplified



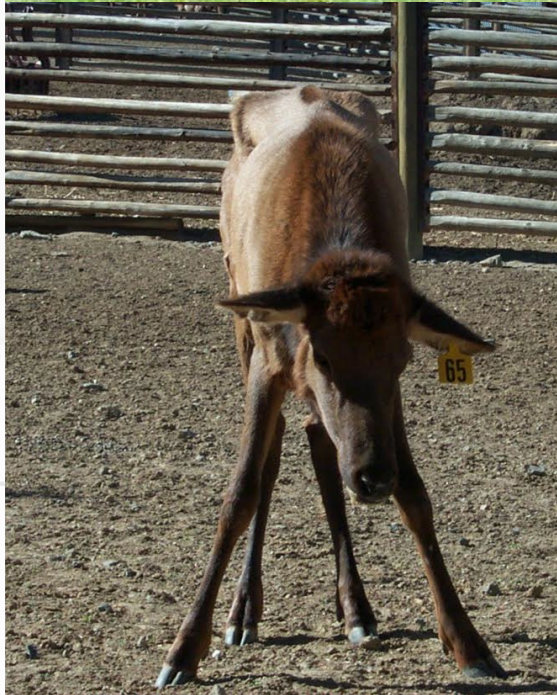
Normal Protein
(predominant in
nervous system cells)



Abnormal Prion
Protein



Clinical Signs of CWD



- Incubation period generally 18 to 48 months
- No clinical signs during incubation period
 - Vast majority of all harvested CWD positive animals appear normal
- Clinical signs during last 4-8 weeks of the disease:
 - **Weight loss**
 - **Drooling**
 - **Behavioral changes**
 - **Hair/coat changes**
 - **Droopy ears**
 - **Lack of general awareness**

Shedding Prions in the Environment

- CWD prions can be shed in feces, urine, and saliva for **months to years** during the incubation period



CWD Transmission

- Animal to animal
 - Increases with density
- Environment to animal
 - Ingestion of contaminated feed/soil (saliva, feces, urine)
 - Contact with contaminated surfaces
 - Mineral licks etc...
 - Carcasses
- Long-term persistence of prions in the environment (scrapie 16+ years)
- Plants?





CWD & Sex/Age

- CWD equally distributed in bulls and cows
- More common in prime age animals
- Mule and white-tailed deer
 - CWD more common in bucks
 - More common in prime age bucks

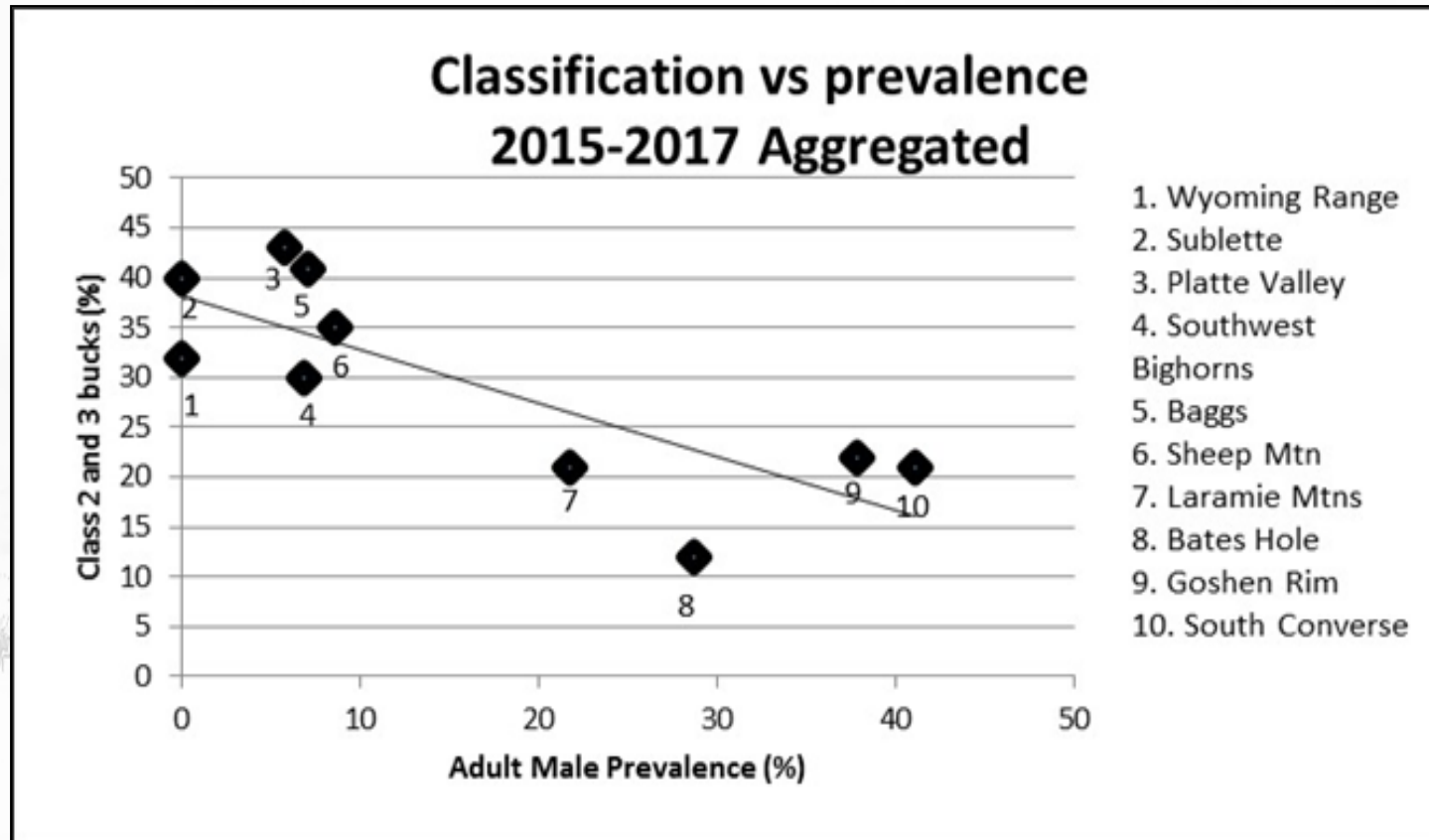


CWD and Class II & III Bucks

Buck class is determined by antler spread.

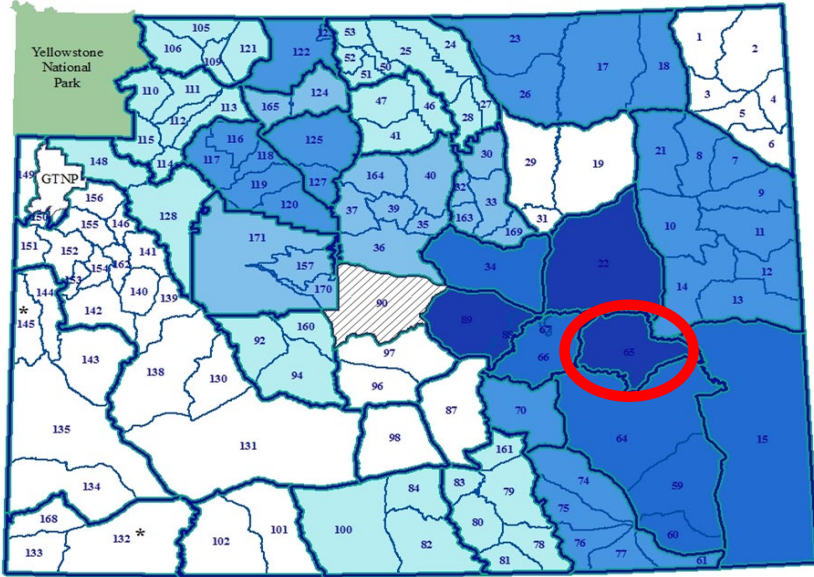
Class II bucks = 20-25" Class III bucks = >25"

Raw management data must be interpreted with caution



South Converse Mule Deer

Estimated Chronic Wasting Disease Prevalence in Wyoming Mule Deer Herd Units (2012-2016)



CWD prevalence Estimates by Herd Unit in Hunter-Harvested Animals 2012-2016 (5 yrs)



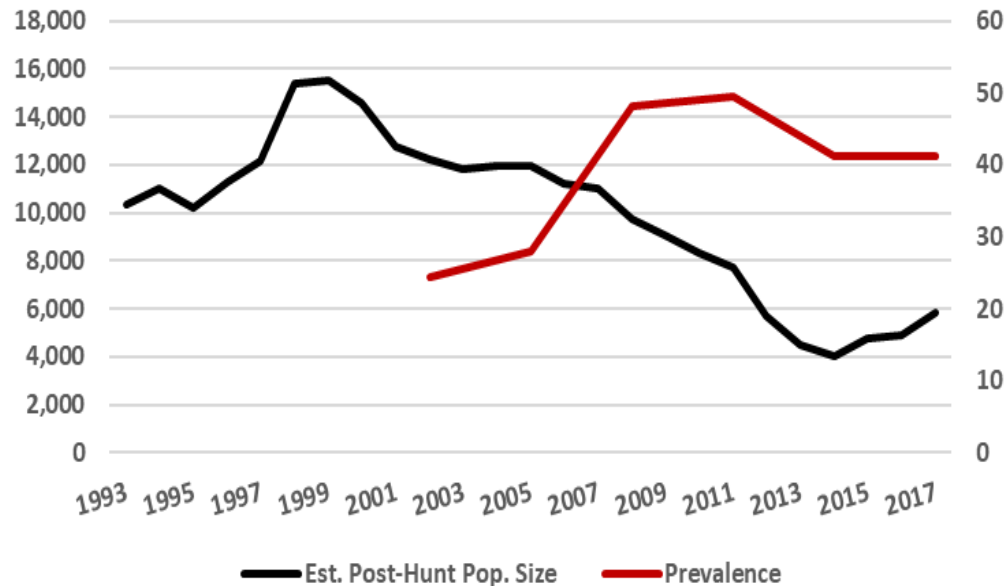
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Prevalences depicted in this map are estimates only; most herd units sample sizes are not significant.

0 10 0 20 40 Miles

Information depicted in this map is for reference only; reasonable efforts have been made to ensure the accuracy of this map. Please see regulations for written boundary descriptions. The Wyoming Game and Fish Department disclaims responsibility for damages or liability that may arise from the use of this map.

South Converse Mule Deer



2010-2014 Adult female survival:

Leading causes of mortality:
 Mountain lion predation
 and clinical CWD

- CWD Negative: 79%
- CWD Positive: 37%
- Combined: 65-73%

CWD & Genetics

- Genetics can influence the length of time animals survive once infected with CWD
 - Most deer die within 2 years
 - Most elk within 4 years
- No true resistance identified
- No documented immunity or recovery
- All cervids susceptible regardless of nutrition, vitamins, or minerals





CWD & Predators

- Mountain lions selectively prey on CWD infected animals
- Modeling suggests selective wolf predation may decrease CWD prevalence



CWD & Human Health



- Laboratory Studies
 - Substantial species barrier – not absolute
 - Ongoing study reported transmission to macaques via ingestion of game meat
- Public Health Studies
 - No demonstrated link between human prion disease and ingestion of game meat



CWD and Human Health



CDC and the World Health Organization recommend CWD positive animals not be consumed

- Prion not inactivated by cooking
- Minimize exposure to prions

Disinfection of hunting knives/butchering equipment: 40% bleach (2 parts bleach/3 parts water) for 5+ minutes

Chronic Wasting Disease in Wyoming

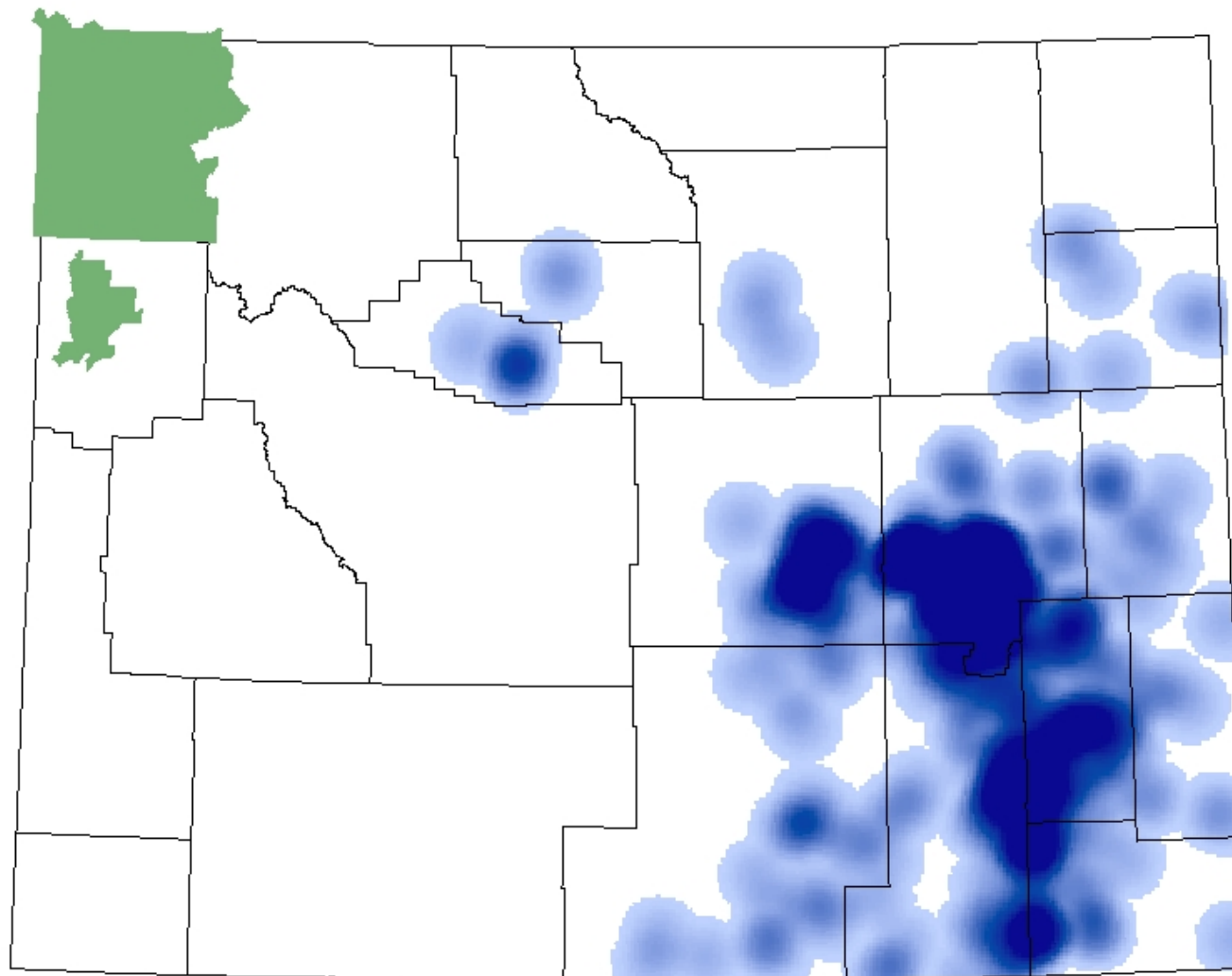


CWD in Wyoming

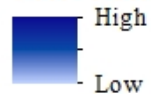
- Unknown origin or date of establishment
- Modeling suggests disease presence since 1950s
- Documented in free-ranging mule deer (1985), elk (1986), white-tailed deer (1990), and moose (2008)



Chronic Wasting Disease Density in Wyoming: All Species 1998-2005



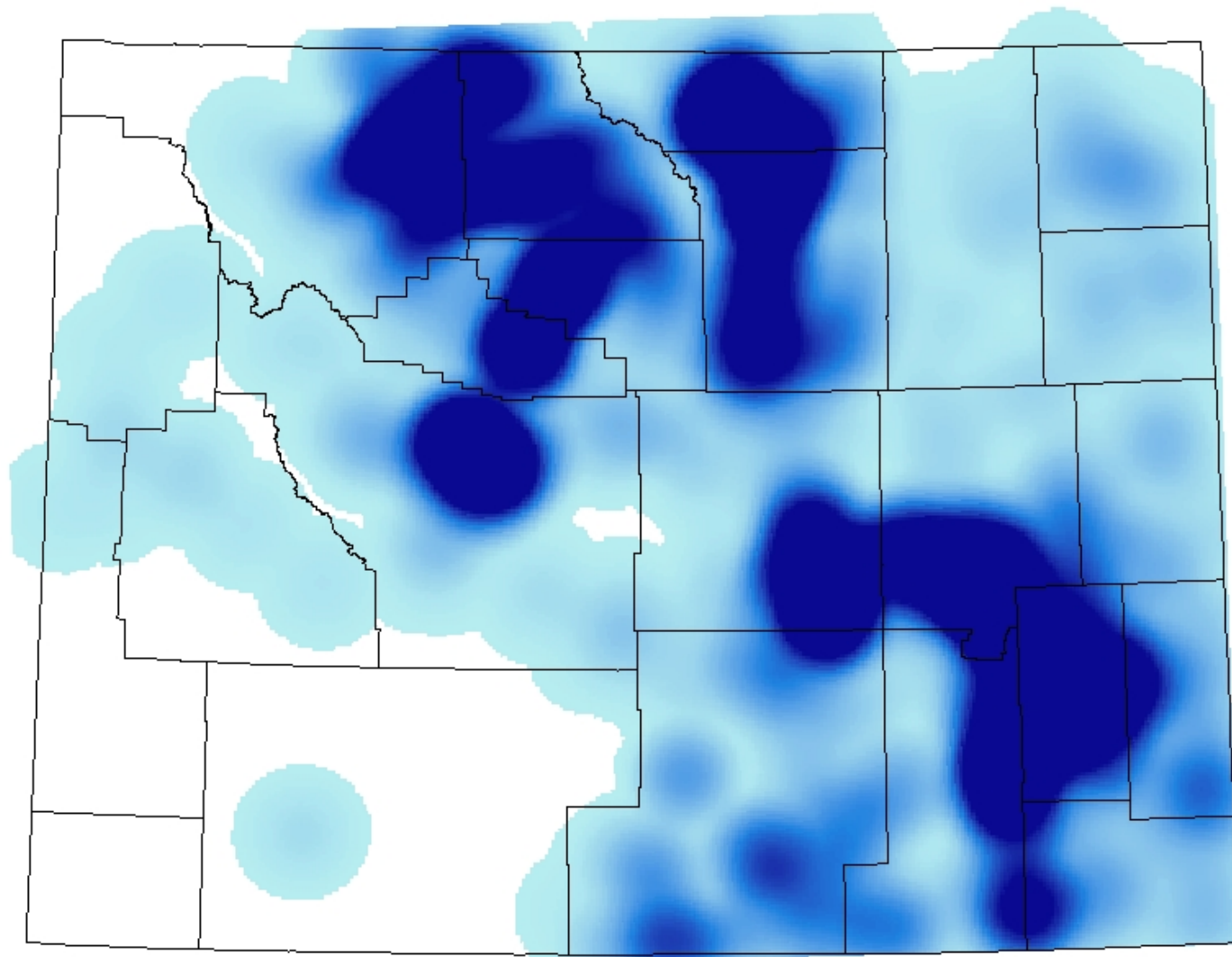
CWD Density



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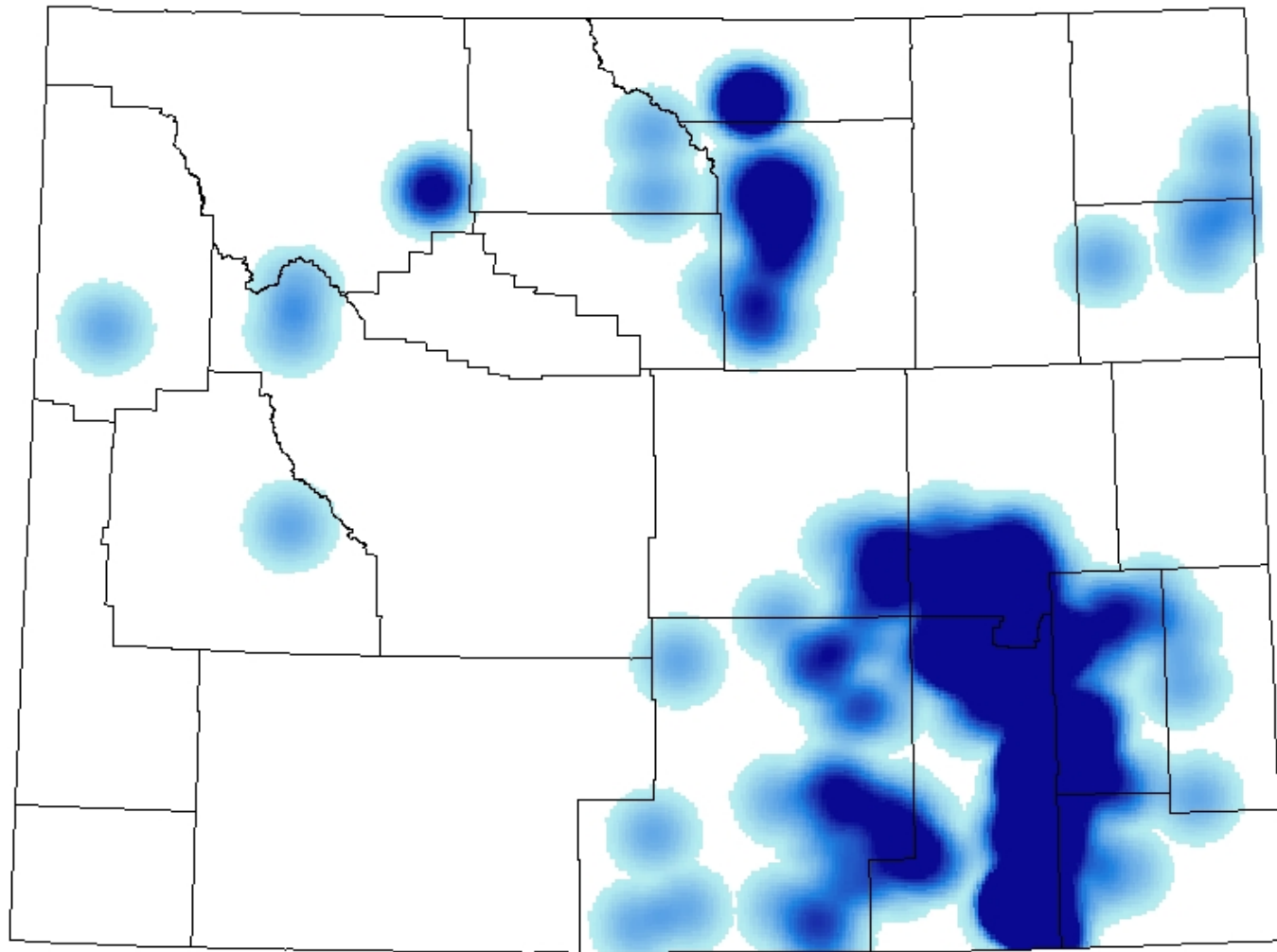
Chronic Wasting Disease Density in Wyoming Deer: 2006 - 10/25/21



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Chronic Wasting Disease Density in Wyoming Elk: 2006 - 10/25/21

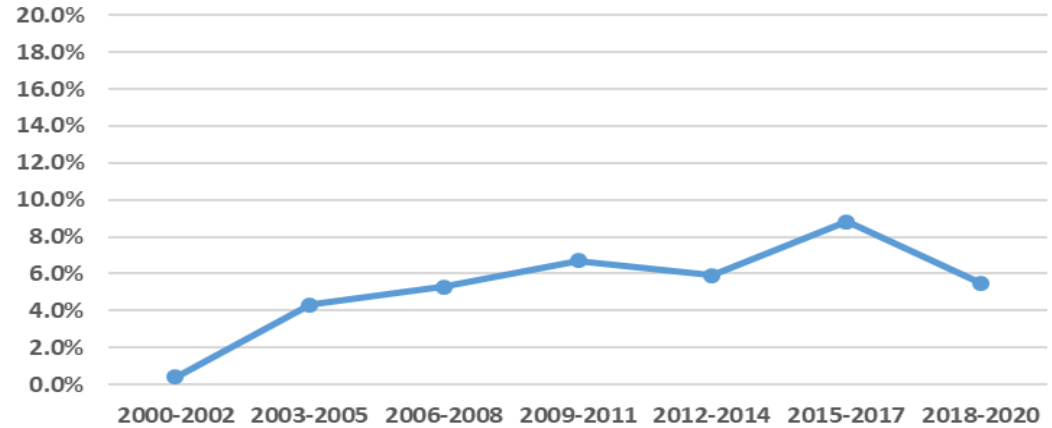


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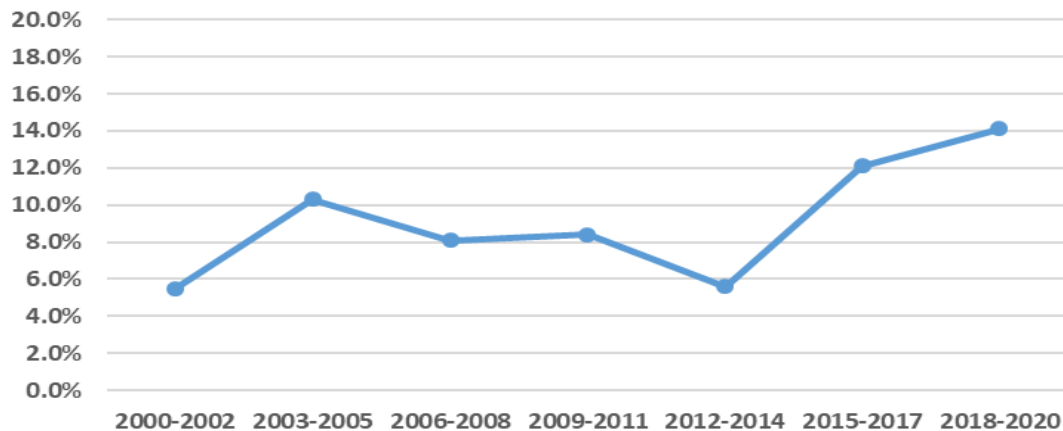


Trends in Southeastern WY Elk Herds

CWD Prevalence in the Laramie Peak Elk Herd
2000 - 2020



CWD Prevalence in the Iron Mountain Elk Herd
2000 - 2020



CWD in Elk Herds in Surrounding States

- Wind Cave National Park (SD)
 - 13.9% (2002)
- Custer State Park (SD)
 - 28% (2005)
- Rocky Mountain National Park (CO)
 - 6.5% in 2011-2016 (1981)
- Colorado Elk Herd 23
 - 8% (most HU <5%)

CWD Questions from Phase 1



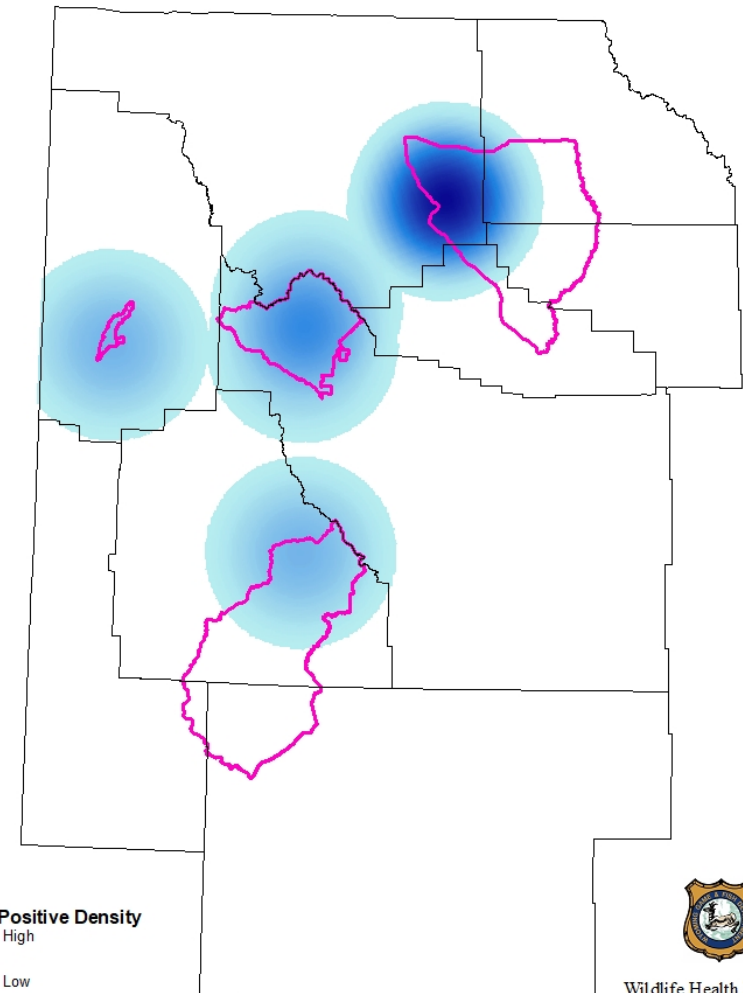
Questions on CWD

- **Q: “When CWD becomes established on feedgrounds what steps will WGFD take to slow it’s spread?” & “What exactly does WGFD plan to do when CWD arrives on each feedground?”**
- **A:** Management actions when CWD arrives on a feedground, as well as any disease management strategies to slow the spread of CWD will be detailed in the Feedground Management Plan


Questions on CWD

- **Q: “Have there been documented cases of CWD in elk in Western Wyoming?”**

**Chronic Wasting Disease Density in Western Wyoming Elk:
2006 - 10/25/21**



CWD Positive Density
High
Low

 CWD Positive Elk Hunt Areas



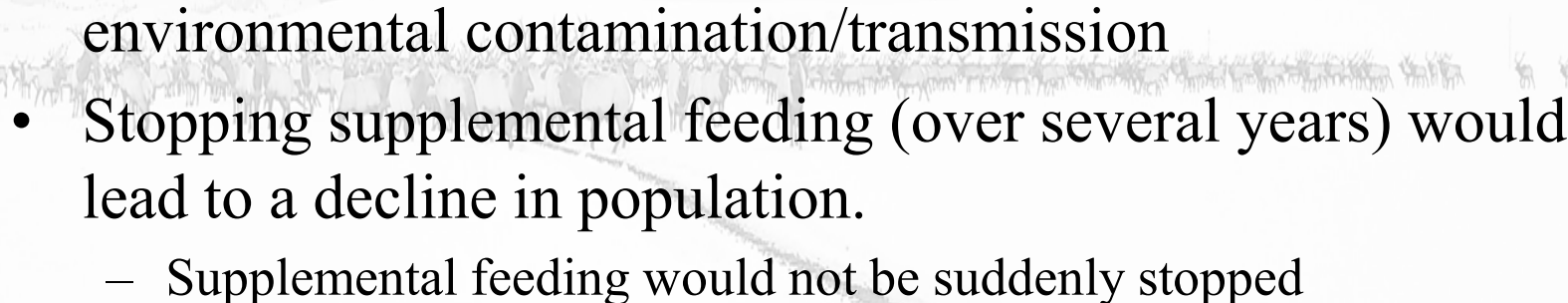
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Questions on CWD

- **Q: “What is the mortality rate of CWD vs starvation of if animals are not fed?”**
 - **A:** Difficult comparison....
 - In the absence of feeding, mortality rate from CWD will likely be low initially and increase slowly (or stabilize)
 - Mortality rates could be high with supplemental feeding and CWD – this could be irreversible with sufficient environmental contamination/transmission
 - Stopping supplemental feeding (over several years) would lead to a decline in population.
 - Supplemental feeding would not be suddenly stopped
- 

Questions on CWD

- **Q: “What do the world's CWD experts think will happen when CWD arrives on elk feedgrounds?”**
- **A: Disease experts fear CWD will significantly decrease elk populations. Feedgrounds will become year round “hotspots” of transmission to all cervids; greatly expanding the distribution and prevalence of CWD across the landscape.**

“Modeling CWD in Feedgrounds”

- **Three models** (Williams et al. 2014, Galloway et al. 2017, 2021, Maloney et al 2020):
 - CWD prevalence will increase rapidly on feedgrounds with highest elk density
 - Elk populations will decrease as prevalence increases
 - Decrease in hunting opportunity as prevalence increases and populations decline
 - Recommend limiting supplemental feeding once CWD is detected

Questions on CWD

- **Q: “WGF should make much more of an effort to educate the general public about the nuances of CWD. For example: most people are unaware of the knowledge that twenty plus years of research has produced including that there is a very significant difference in the impact of CWD on deer vs elk and what that means for populations and over what time frame.”**

CWD in Elk vs Deer

	Elk	Deer
Distribution in WY	15/36 Herd units	34/37 Herd units
Average prevalence in WY	3.5% Ad ♂♀ (2020)	16.5% Ad MD ♂ (2020)
Prevalence threshold of population impacts	7% (Galloway et al., 2017, 2021) 13% (Monello et al., 2014)	MD 10% - 13% (Miller 2008, Dulberger 2010) WTD 26% (Edmunds 2016)
Clinical signs	Same	
Incubation period / Genotypic variation	23 to 85 months	MD 19 to 36 months WTD 29 to 59 months
Prion shedding	As early as 14 days, but generally by 3 months	

Low prevalence in elk prevents evaluation of population effects

Questions on CWD

- **Q: “What are the differences and similarities between elk on feedgrounds and elk off of feedgrounds in CWD infected areas and what factors might influence disease transmission?”**



Feedgrounds vs Native Winter Range

	Feedground	Laramie Peak
Group Size	200 to 2,800 (state only) Majority 400 -800	400 to 600 common, up to 2,000
Animal contacts	2.0 to 2.6 times greater than non-fed*	NA
CWD Transmission	Animal to animal and environment to animal	Animal to animal likely most important
Winter movement	Stationary	Mobile
Migration	Yes	No



*Female elk contacts are neither frequency or density dependent. Cross et al., 2013, Human activities and weather drive contact rates of wintering elk. Jonousek et al., 2021

Elk Density on Native Winter Range (Laramie Peak HU)



Elk Density on Feedgrounds



Feedgrounds vs Native Winter Range

Study Type	Density (elk / km²)	Author / Year
Wyoming Free Range	0.21 - 0.42	Cross et al., 2013, Williams et al 2014
Laramie Peak (focused)	2.9	Binfet, 2018
Wind Cave NP	2.7 - 7.1	Sargeant et al., 2011
WY State Feedgrounds	1,977	Average of 600 elk/75 acres
Low density feeding (feedline)	12,995	BHF report of 828 ft ² /elk
High density feeding (feedline)	300,000+	BHF report of 34 ft ² /elk

Questions on CWD

- **Q: “Do wolves select for CWD positive animals? Since animals are concentrated on feedgrounds, is it concentrating predators? Do you kill predators that enter feedgrounds?”**
- **A:** In those areas where wolves exist, the prevalence of CWD is not high enough to definitively answer this question. Most experts think there is a good chance that wolves will be able to select for, and remove CWD positive animals from the population. Wolves are rarely found on feedgrounds, but may be found in areas surrounding the feedground. WGFD does not kill predators on feedgrounds, but WGFC-Chap 21 allows wolf removals in set circumstances.

Questions on CWD

- **Q: “Have any studies been done on what happens to CWD infected meat when fed to captive wolves?”**
- **A: No, but research has been done on the fate of prions when fed to crows and coyotes.**



CWD - Crows and Coyotes

- Coyotes (4) Fed CWD + elk brain
 - Infectious prions detected in feces for up to 3 days
 - Infectivity decreased through digestive tract
- Crows (20) Fed scrapie + mouse brain
 - Infectious prions detected 4 hours post infection
 - Prion infectivity not assessed
- Susceptibility to CWD prions not assessed

CWD prions remain infectious after passage through the digestive system of coyotes (*Canis latrans*). Nichols et al., 2015. Prion remains infectious after passage through digestive system of American crows (*Corvus brachyrhynchos*). VerCauteren et al., 2012

Questions on CWD

- **Q: “CWD has been found in water supplies and is currently not recommended that individuals eat CWD positive animals – if feedgrounds help contribute to the spread of the disease, what does that mean for surrounding human communities?”**



Prions in Water Supplies

- CWD prions detected in runoff water and in a freshwater treatment facility
- 90% decrease in infectivity in tap water in one week
 - Small residual detected at 8 weeks
- Lower reduction in infectivity in wastewater


Questions on CWD

- **Q: “What is the potential for CWD to become zoonotic?”**
- **A:** No clear answers
- Epidemiological studies and ongoing surveillance have found no solid evidence of the possibility of transmission to humans
- Laboratory experiments found no evidence of transmission to humans
- Susceptible species restricted to cervids (natural exposure experiments)



Zoonotic Potential of CWD

But...

- Laboratory studies demonstrated that CWD prions can convert human prion protein
 - Variation in susceptibility to different prion strain types
 - Intra-species and inter-species passage of prions has been shown to lower the species barrier
 - Researchers hypothesize transmissible CWD prions could emerge over-time given sufficient human exposure
 - Prudent to limit human exposure whenever possible (aka. don't consume CWD positive critters)
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Questions?



Mark Gocke