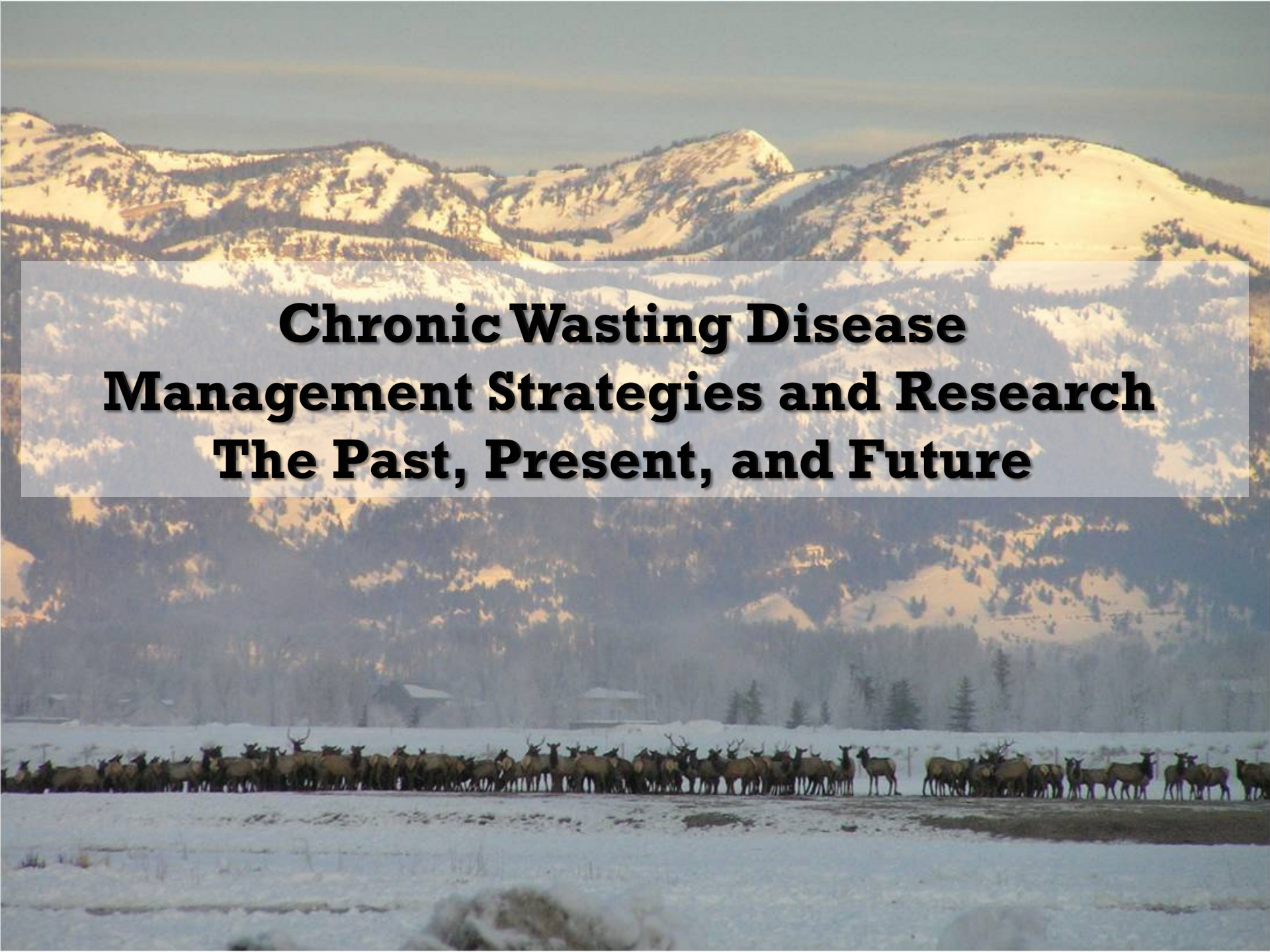


Chronic Wasting Disease Management Strategies and Research The Past, Present, and Future

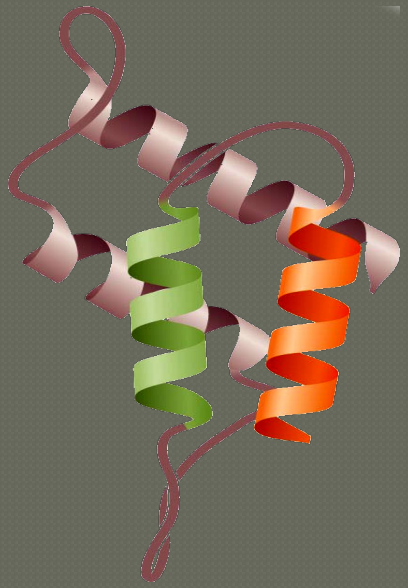
What is Chronic Wasting Disease

Prion = infectious protein

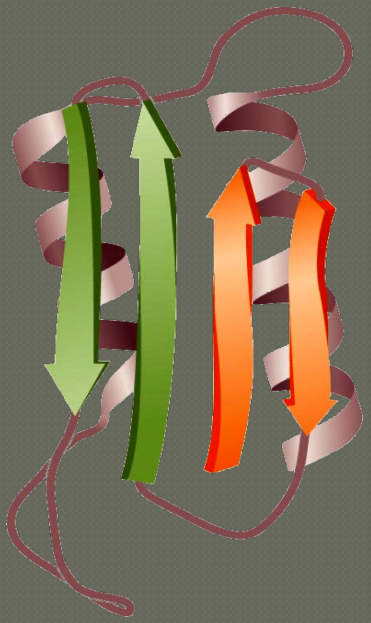
Protein = chains of amino acids

No DNA

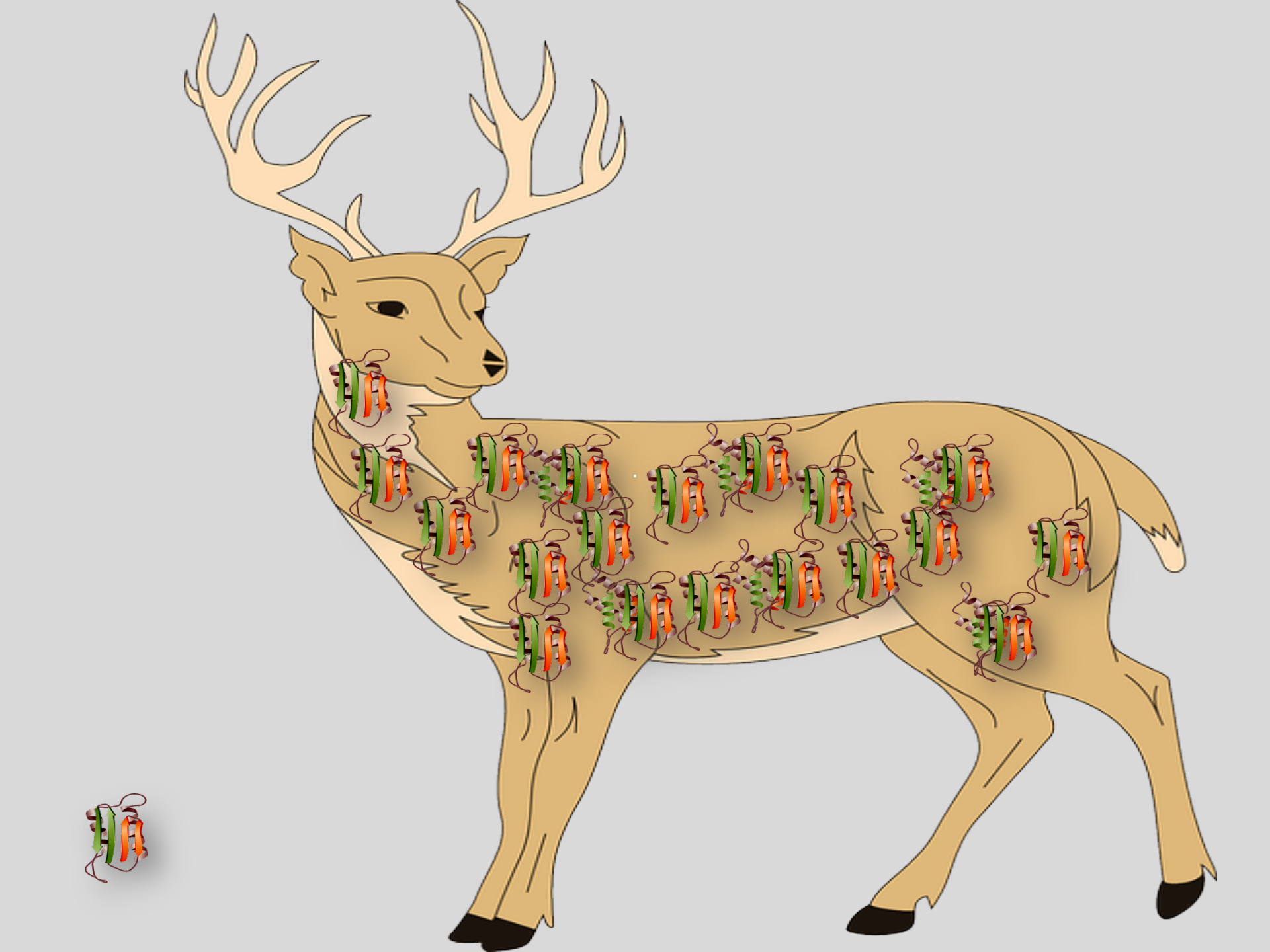
Prion Simplified



Normal Protein



Abnormal Prion Protein



CWD In Wyoming

First detected in free-ranging elk in 1986

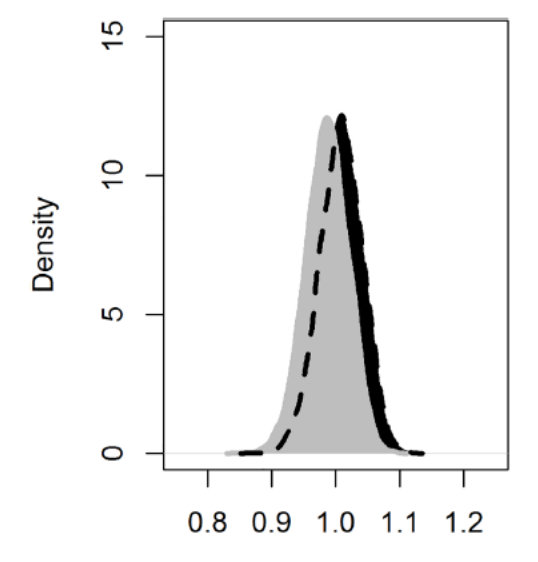
Significant collaboration with Colorado to understand CWD

Agreed to act as a "Control" to evaluate effects of CWD in absence of management

Review of Research

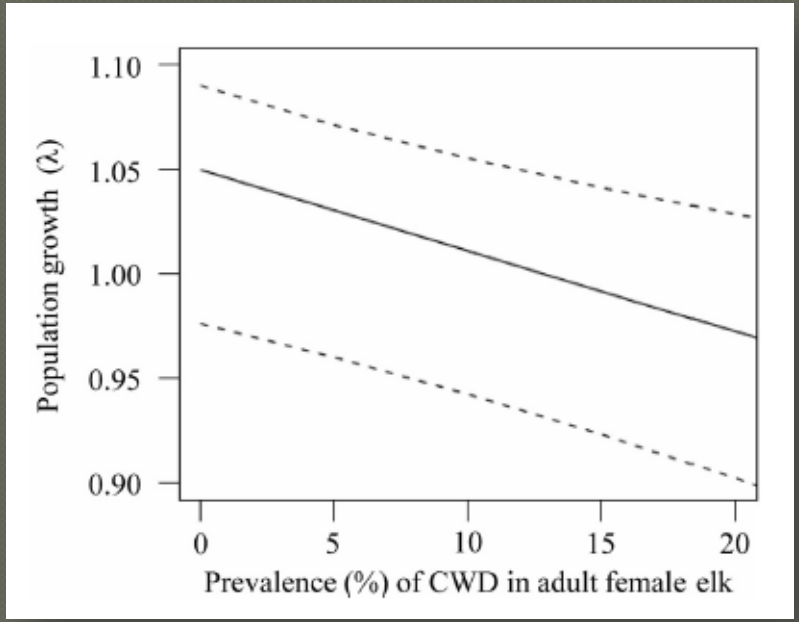
Population Effects of CWD Colorado

Northern CO: possible decrease at 4% prevalence



Geremia, Chris, et al. "Bayesian Modeling of Prion Disease Dynamics in Mule Deer Using Population Monitoring and Capture-Recapture Data." PloS one 10.10 (2015): e0140687.

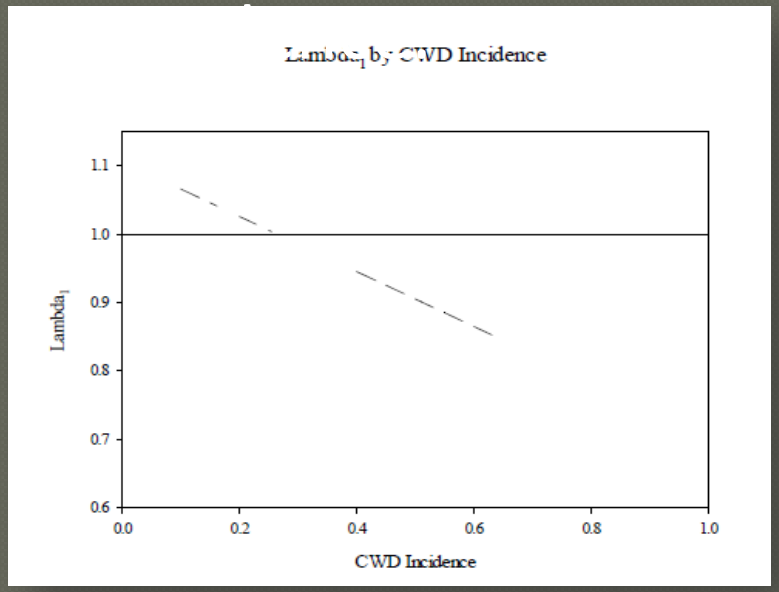
Rocky Mountain National Park: possible decrease at 13% prevalence



Monello, Ryan J., et al. "Survival and population growth of a free-ranging elk population with a long history of exposure to chronic wasting disease." The Journal of Wildlife Management 78.2 (2014): 214-223.

Population Effects of CWD Wyoming

White-tailed deer study: 10% annual decline at ~30%



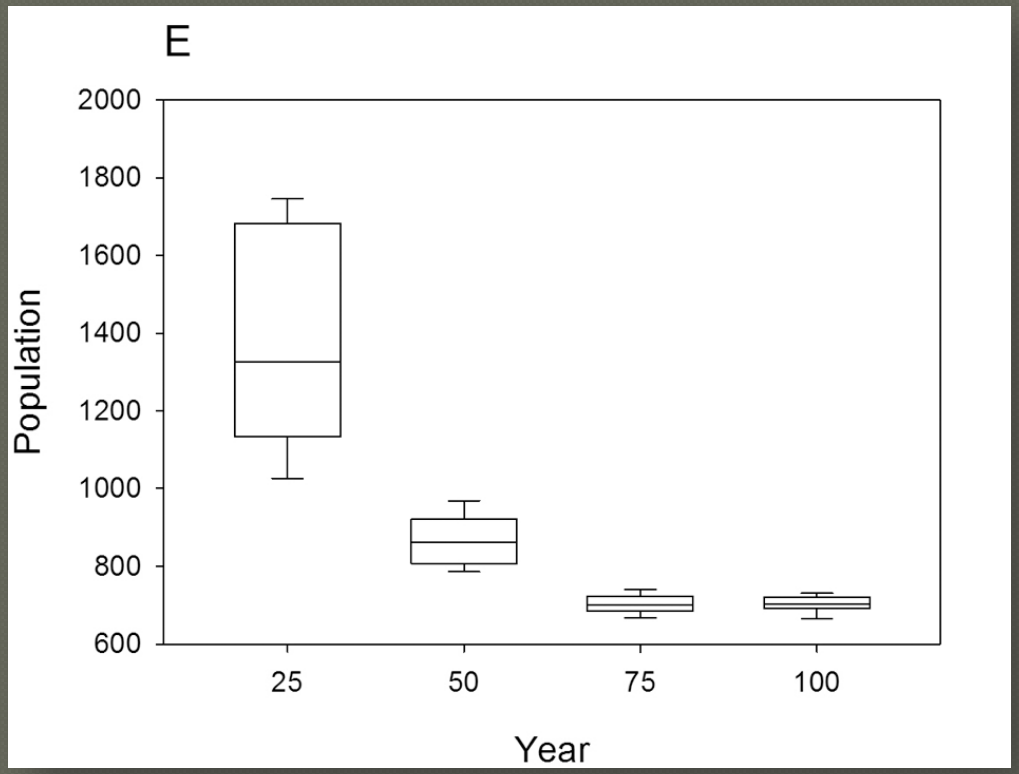
Edmunds, David R. Chronic wasting disease ecology and epidemiology of white-tailed deer in Wyoming. University of Wyoming, 2013.

Recent mule deer study: 19% annual decline at ~ 40% prevalence

DeVivo, Melia T. Chronic Wasting Disease Ecology and Epidemiology of Mule Deer in Wyoming. University of Wyoming, 2015.

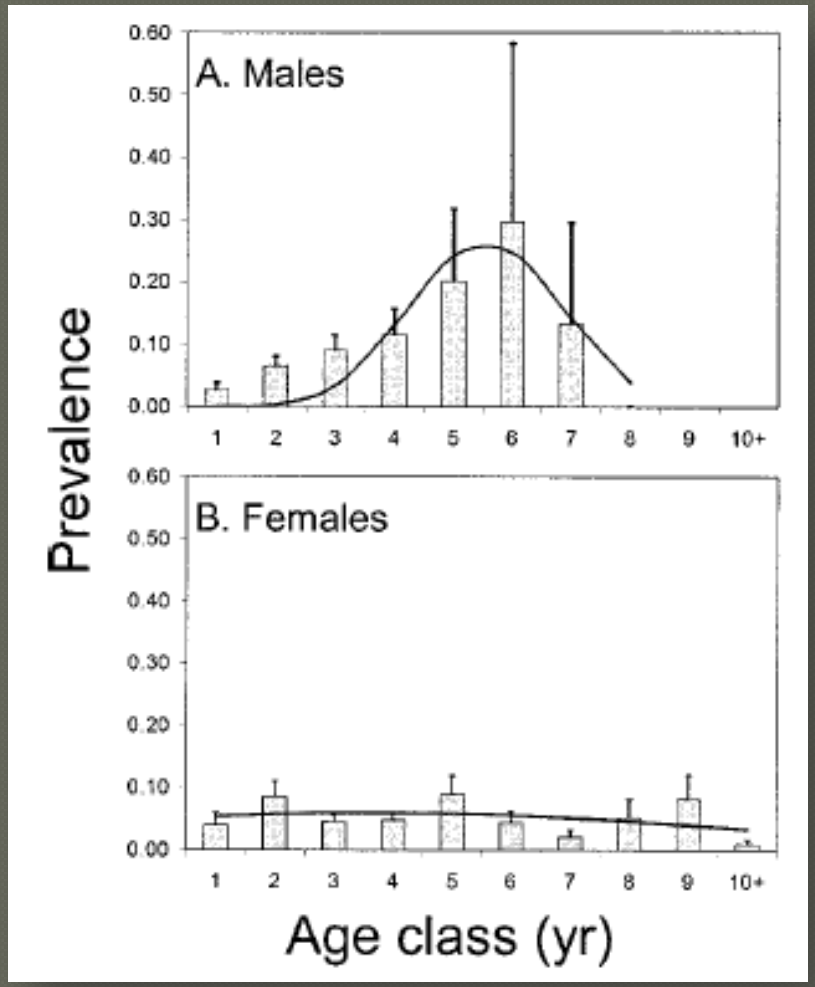
Population Effects of CWD Wyoming

Feedground elk modeling: ~ 50% population decline and genetic shift



Williams, A. L., T. J. Kreeger, and B. A. Schumaker. "Chronic wasting disease model of genetic selection favoring prolonged survival in Rocky Mountain elk (Cervus elaphus)." Ecosphere 5.5 (2014): 1-10.

CWD Age/Sex Distribution



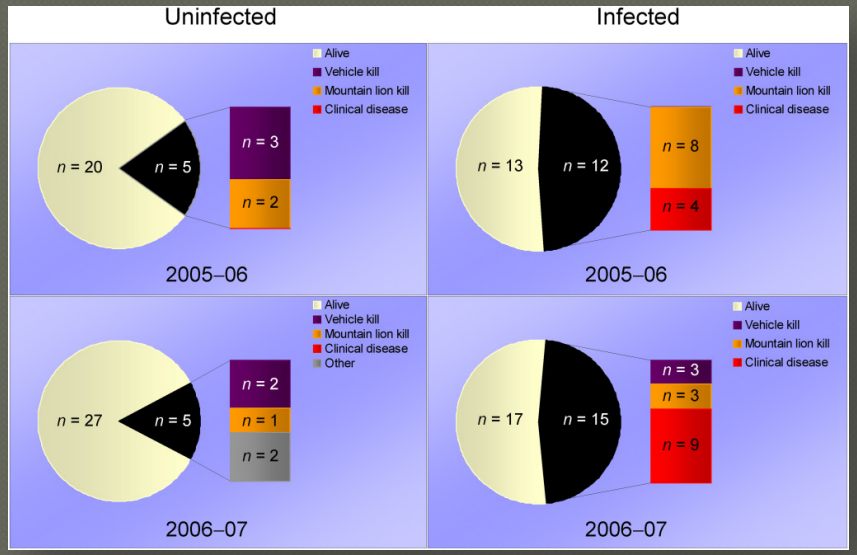
CWD prevalence in males higher than females

CWD prevalence higher in prime age males

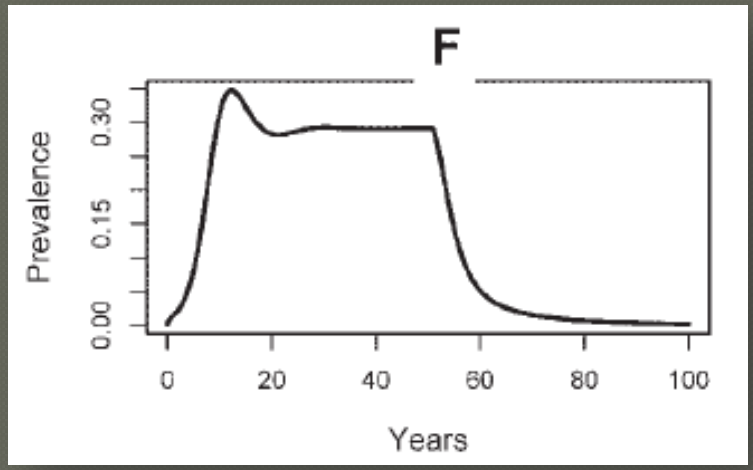
Miller, Michael W., and Mary M. Conner. "Epidemiology of chronic wasting disease in free-ranging mule deer: spatial, temporal, and demographic influences on observed prevalence patterns." Journal of Wildlife Diseases41.2 (2005): 275-290.

Role of Predation in CWD

Mountain lions selectively prey on CWD infected animals.



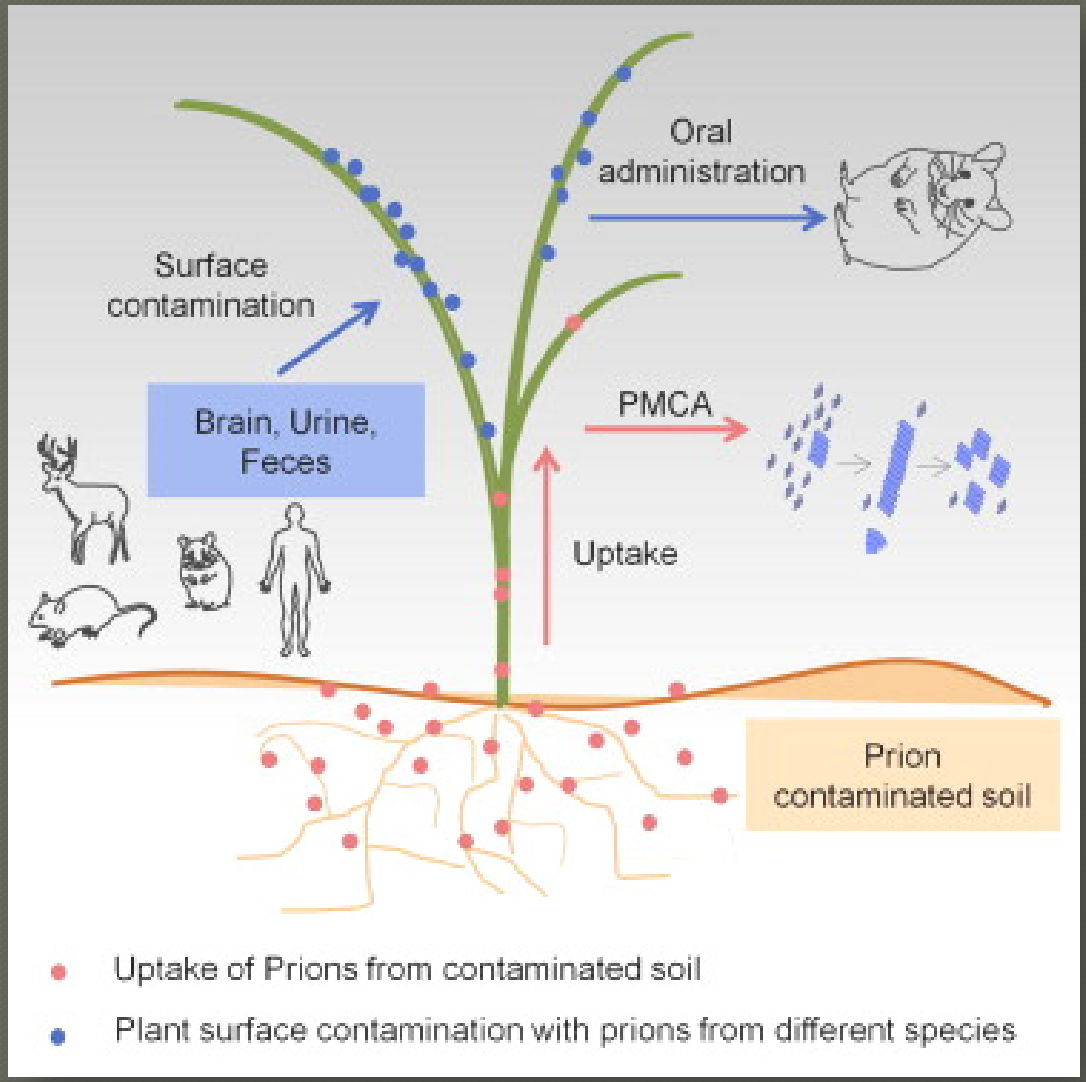
Miller, Michael W., et al. "Lions and prions and deer demise." PLoS one 3.12 (2008): e4019.



Wild, Margaret A., et al. "The role of predation in disease control: a comparison of selective and nonselective removal on prion disease dynamics in deer." Journal of Wildlife Diseases 47.1 (2011): 78-93.

Modeling suggests selective wolf predation may decrease CWD prevalence.

Prions in Plants



Pritzkow, Sandra, et al. "Grass Plants Bind, Retain, Uptake, and Transport Infectious Prions." Cell reports 11.8 (2015): 1168-1175.

CWD Transmission to Humans

Laboratory Studies: Substantial species barrier – not absolute.

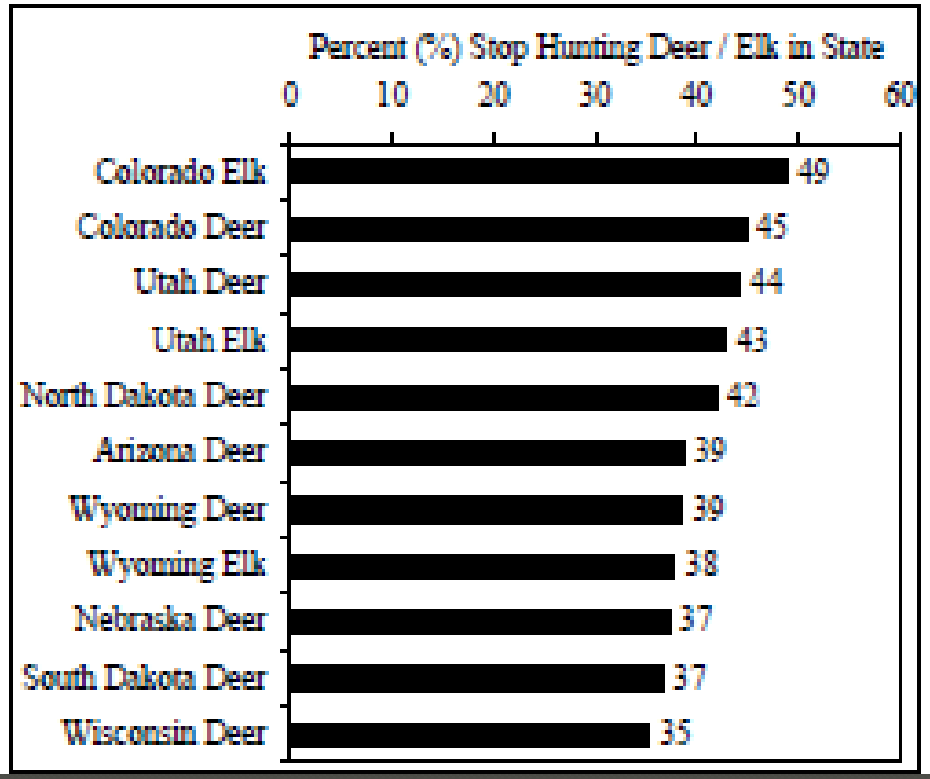
Public Health Studies: No demonstrated link between human prion disease and ingestion of game meat.

Prion Strains: Human transmission may be strain dependent.

Resident Hunter Attitudes

Human dimensions committee of the Western Association of Fish and Wildlife Agencies. (2005). *Hunter's Responses to Chronic Wasting Disease.* HDNRU Report no. 56.

Figure 4.1.1d. Percent of hunters that would stop hunting deer / elk in the state for Situation 4 (50% across the entire state)



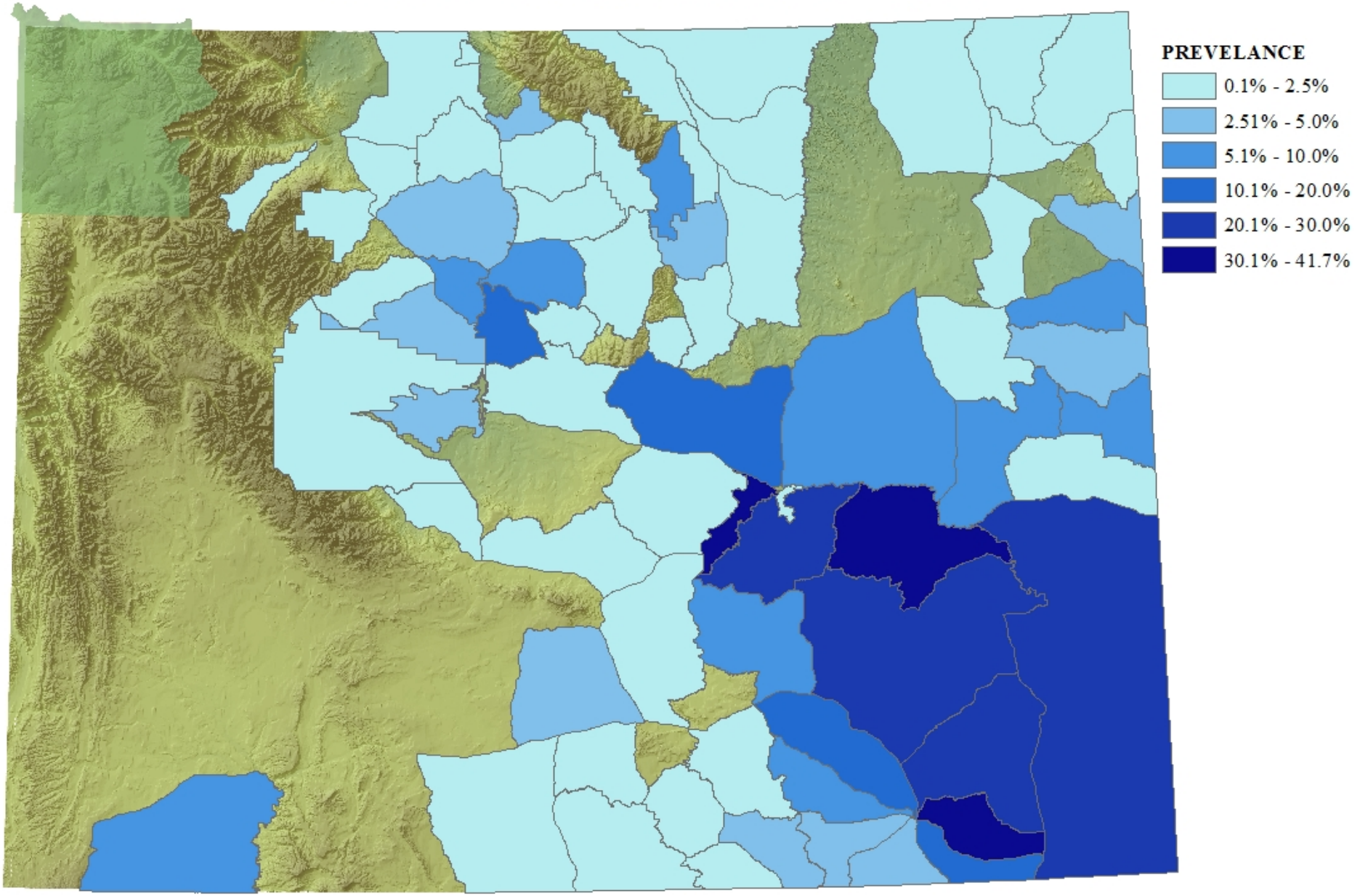
Nonresident Hunter Attitudes

TABLE 4
Behavioral Intentions of Nonresident Hunter Specialization Cluster Groups In Response to CWD[1]

Hypothetical scenarios and hunter specialization cluster groups	Behavioral intention			$\chi^2(6)$	Effect size (V)
	Still hunt in state	Switch to another state	Give up altogether		
Scenario 1 (10% A, 0% B, 0% C; no death)				53.68	.08
Casual	95	2	3		
Intermediate	95	4	1		
Focused	97	3	0		
Veteran	97	3	0		
Total	96	3	1		
Scenario 2 (30% A, 10% B, 0% C; no death)				50.20	.07
Casual	88	9	3		
Intermediate	89	9	2		
Focused	90	9	1		
Veteran	92	8	0		
Total	90	9	1		
Scenario 3 (50% A, 30% B, 10% C; no death)				164.05	.13
Casual	60	29	11		
Intermediate	70	23	7		
Focused	70	26	4		
Veteran	75	24	1		
Total	70	26	4		
Scenario 4 (50% A, 50% B, 50% C; no death)				195.28	.15
Casual	36	46	18		
Intermediate	45	45	10		
Focused	48	45	7		
Veteran	54	43	3		
Total	48	44	8		

Needham, Mark D., et al. "Hunting specialization and its relationship to participation in response to chronic wasting disease." *Journal of Leisure Research* 39.3 (2007): 413.

Wyoming Chronic Wasting Disease (CWD) Prevelance in Deer: 2006 - 2015



What Has Been Tried?

Minnesota and New York

Strategy:

Early and aggressive intervention of point source introductions. Population reduction through hunting and/or culling.

Outcome:

Apparently successful in eliminating CWD.

Wisconsin

Strategy:

Large-scale increased hunting combined with culling to eradicate.

Outcome:

Unable to eradicate

- Discovered disease was far more established than expected

Ultimately not sustainable and intolerable by public

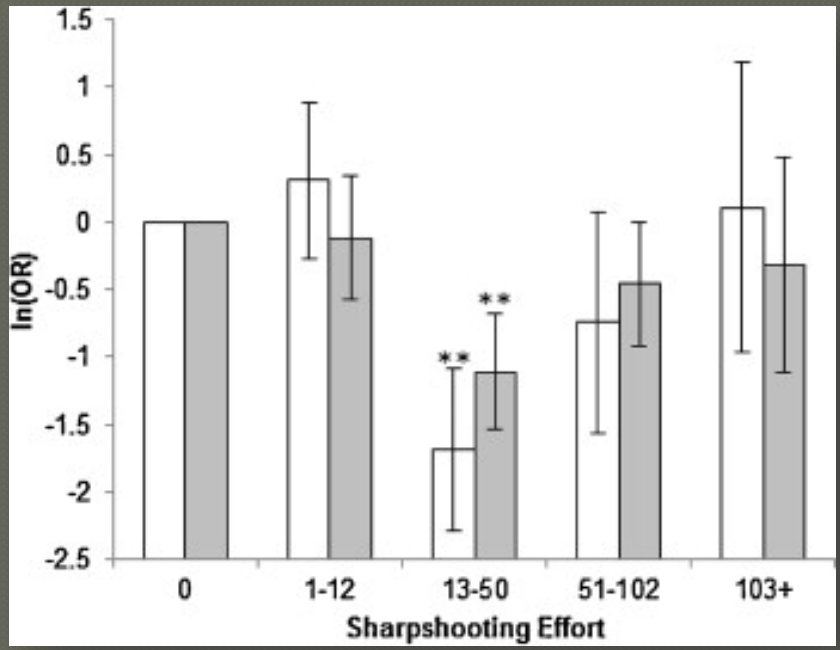
Illinois

Strategy:

Early aggressive reduction followed by prolonged selective culling and moderate hunting changes to minimize spread and maintain low prevalence

Outcome:

Able to maintain low (1-3%) prevalence and minimize spread.



Mateus-Pinilla, Nohra, et al. "Evaluation of a wild white-tailed deer population management program for controlling chronic wasting disease in Illinois, 2003–2008." Preventive veterinary medicine 110.3 (2013): 541-548.

Colorado

Strategy:

Test and Cull

- Tested 50% of select population and removed positives

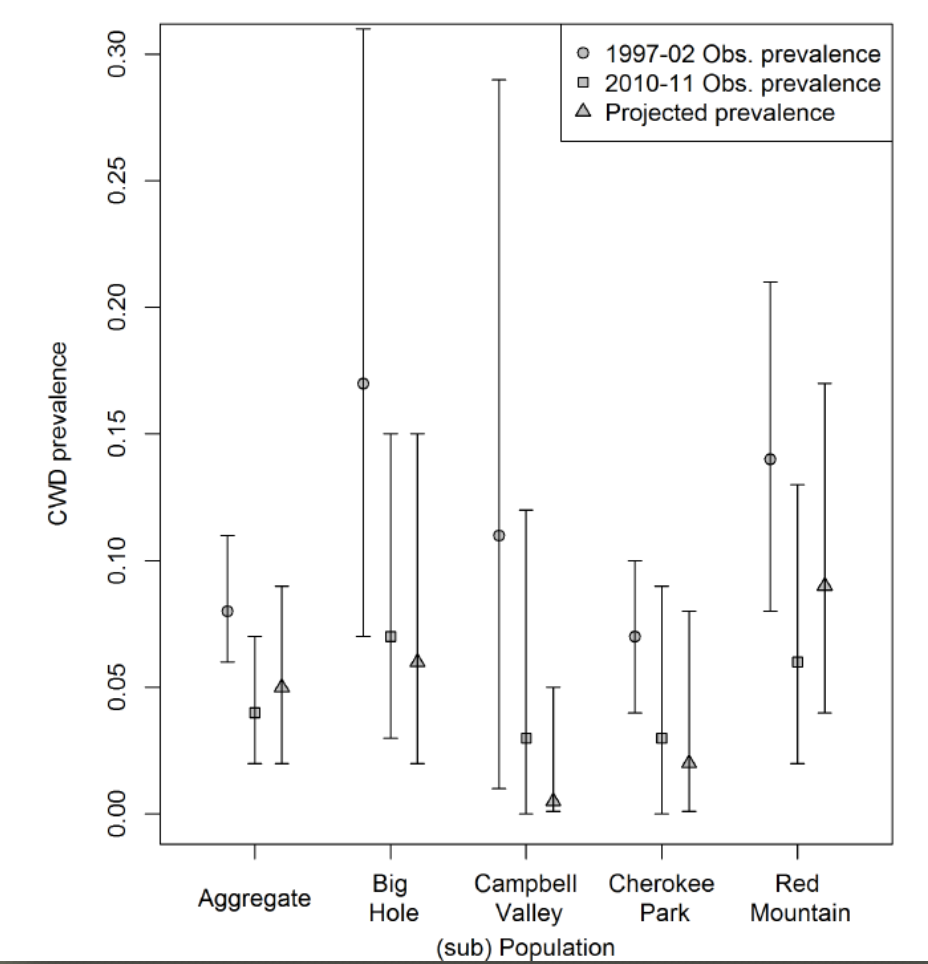
Outcome:

Dropped prevalence in bucks

- Prevalence later increased

Ultimately not sustainable – time and cost prohibitive

Colorado



Geremia, Chris, et al. "Bayesian Modeling of Prion Disease Dynamics in Mule Deer Using Population Monitoring and Capture-Recapture Data." PloS one 10.10 (2015): e0140687.

Strategy:

Density Reduction: dropped population by 25% and maintained

Outcome

Abandoned due to lack of measurable results

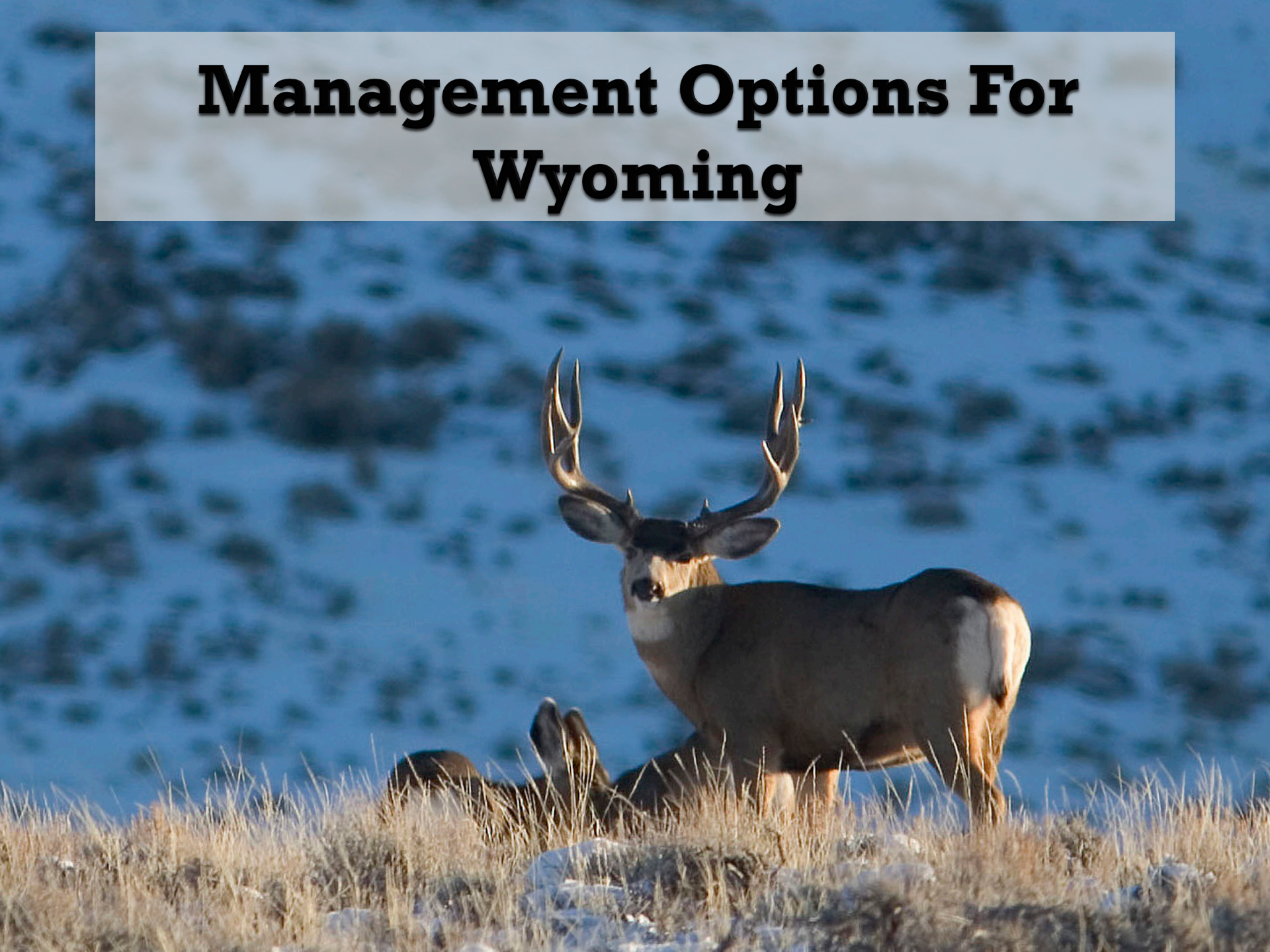
10 years later – CWD prevalence reduced

Why All The Culling?

Density dependent disease transmission
↑ Density = ↑ contact = ↑ transmission

Frequency dependent disease transmission
↑ Number of infected animals = ↑ transmission

Management Options For Wyoming



What is the Goal of CWD Management?

Ultimate goal = eradication

Current goal = slow spread and reduce/maintain prevalence

Feedgrounds

Pro-active:

Identify ways to reduce reliance on feedgrounds

Pro-active/Reactive:

Reduce densities

Reduce days fed

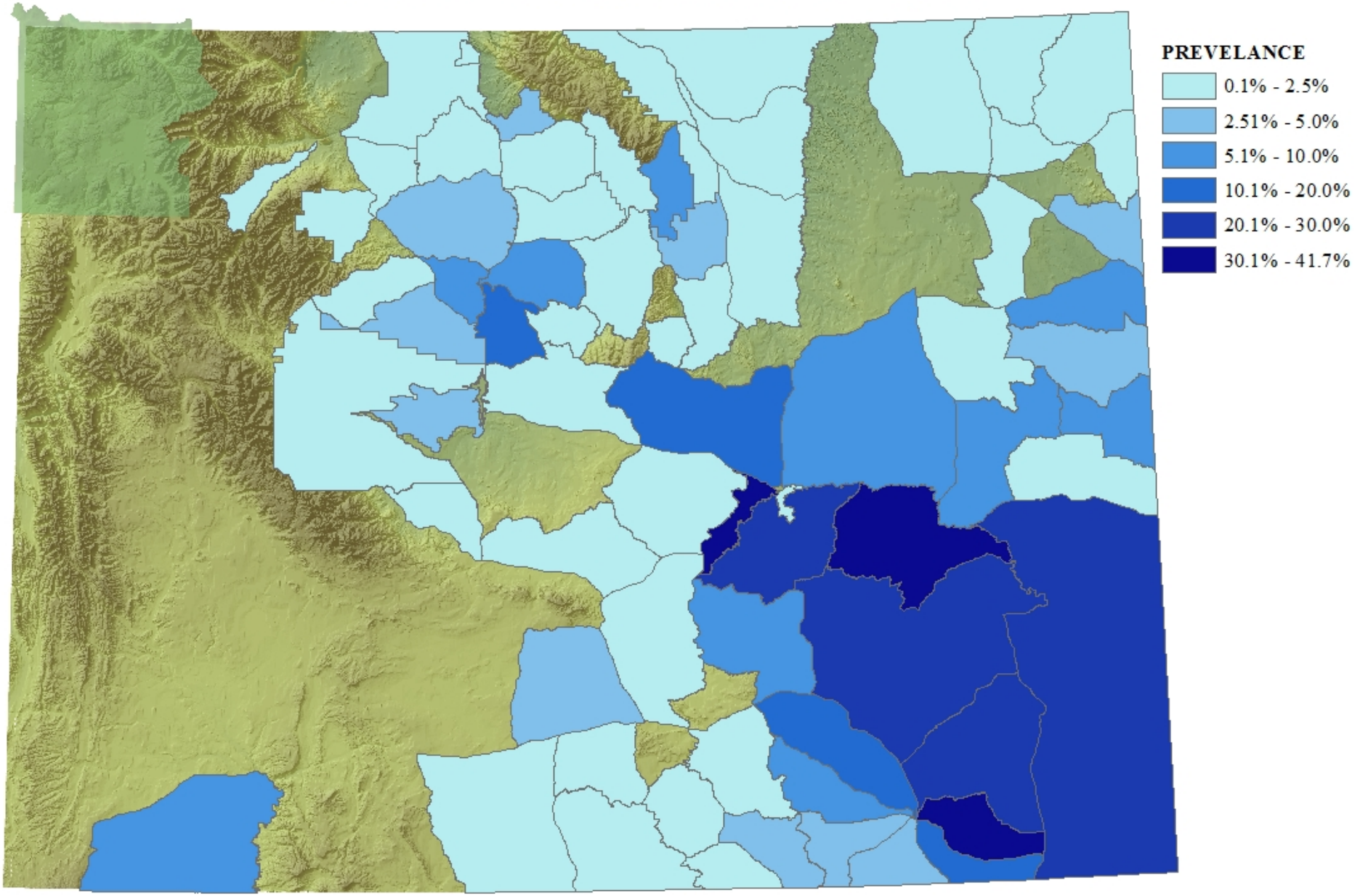
Change to pelleted feed

Surrounding Feedgrounds

Identify CWD positive populations at risk of spreading CWD north and westward

Small scale localized culling of populations combined with modified harvest strategies to reduce/maintain lower population densities

Wyoming Chronic Wasting Disease (CWD) Prevelance in Deer: 2006 - 2015



High Prevalence Areas

Identify localized “hot spots”

Population reductions in select areas

Projects to improve habitat

Eliminate points of concentration

High Prevalence Areas

Modify hunting seasons to harvest bucks late

Increase buck harvest

Information, Education, Targeted Removal

Improve public education

Emphasize targeted removal

Research

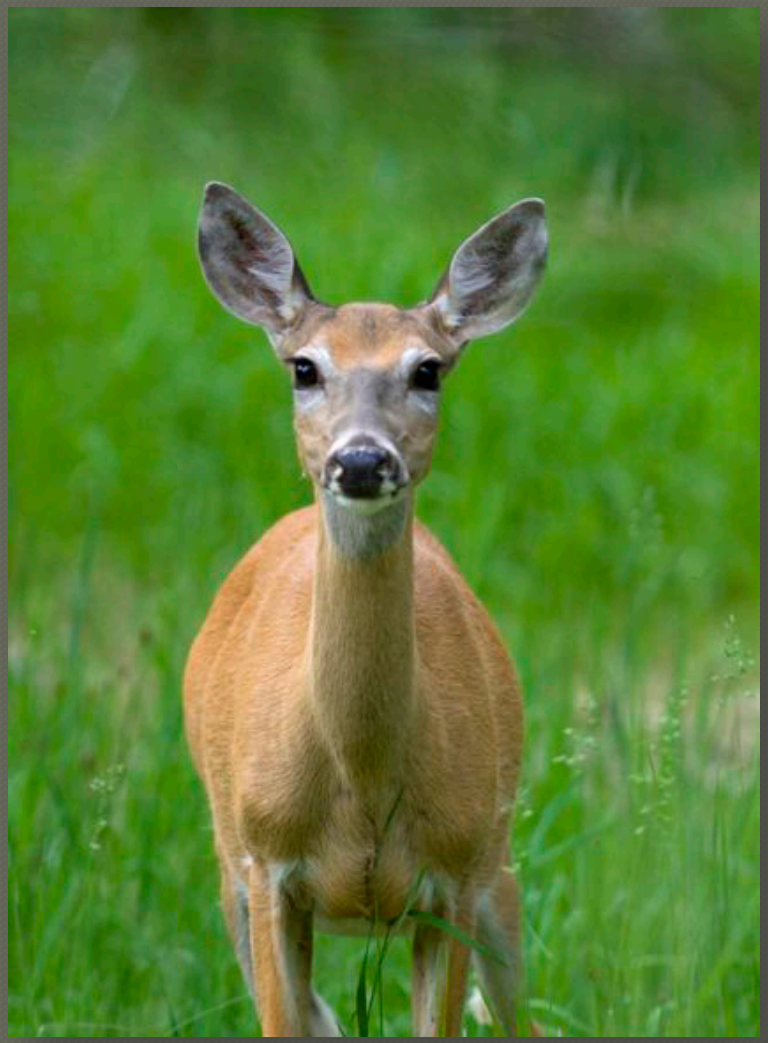
Research

Theoretical Research

- Modeling population impacts
- Understanding transmission mechanisms
- Role of genetics
- Role of predation
- Search for the “magic elixir”
- Live animal tests

Applied Research

- Evaluating tools
- On the ground management strategies



Current Collaborative Research

Theoretical Research
- Role of genetics
- Modeling population impacts
- Prion strains
- Live animal tests
- Environmental tests

Applied Research
- Vaccine evaluation

Applied Research

Identifying/Evaluating Solutions

Identify multiple sustainable management techniques

Implement management strategies long-term (5-10 years minimum)

Multi-state collaboration

If Unlimited Resources Available

Develop a wildlife research section
- Biologists, statistician, GIS specialist
- Seasonal field support
- Annual operating budget

Update facilities at TWRC
- Perimeter fencing
- Neonate building
- Large animal handling facilities

Increase seasonal field support

Long Term Investment and Commitment

CWD is a slow moving disease, measurable results from management will not be immediate

Questions?

"It is common sense to take a method and try it. If it fails, admit it frankly and try another. But above all, try something."

- Franklin D. Roosevelt