Chronic Wasting Disease in Colorado: Past, Present, & Future
Chronic Wasting Disease
Agent: prion (origin unknown)
Hosts: mule deer
      white-tailed deer
      elk
      moose
Signs: behavior
       emaciation
Epi: prolonged incubation
     uniform susceptibility*
     indirect, lateral transmission
     environmental persistence

Photo by M. W. Miller
A brief history of chronic wasting disease in Colorado

“Those who cannot remember the past are condemned to repeat it.”
George Santayana  The Life of Reason: The Phases of Human Progress (1905–1906)
Chronic Wasting Disease in Colorado

- Infects >50% of deer herds* & 33% of elk herds.
  - 4 of 5 largest deer herds & 2 of 5 largest elk herds.

- Infection within herds varies (<1 – >25%); deer>elk>> moose.
  - Infection in bucks ~2× rate in does; elk sexes similar.

- ~2% of annual harvest submitted for testing.*

- Most infections unapparent; hundreds consumed each year.

- Management practices may be exacerbating CWD problem
  - e.g., high buck : doe ratios & mature buck numbers.
A brief history of chronic wasting disease in Colorado

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Chronic wasting disease prevalence trends in Colorado (harvest-based estimates)
Chronic wasting disease prevalence trends in Colorado (harvest-based estimates)
Composite epidemic curve (field data vs. model)
Sex, Age, & CWD

Infection rates higher (~2×) in bucks than in does from the same herd. (Not so for elk.)

“Prime aged” adults show higher infection rates than very young or very old deer.

As the overall rate of infection in a herd increases, mule deer are infected & succumb at younger ages. Older aged deer become rare.

Examples shown at right:
In heavily hunted Larimer County herds, 25% of does & 4% of bucks were over 6 years old.
In the unhunted Table Mesa herd where infection rates were much higher, only 6% of does & 2% of bucks were over 6 years old.
Five lessons:

- Longer than you think
- At least two good stories
- Looking hard/hardly looking
- The five phases
- Sustained & sustainable effort
Lessons in chronic wasting disease

Sustained & sustainable effort...

- surveillance
- monitoring
- control
Colorado deer & elk chronic wasting disease testing: harvest submission trends
2017 mandatory testing herds

COLORADO PARKS AND WILDLIFE - Deer DAUs
Mandatory head submission improves sample size
(submissions by hunt code for 2015–2016 vs. 2017)

= mandatory in 2017
## 2017 mandatory testing results

<table>
<thead>
<tr>
<th>DAU</th>
<th>Sample size</th>
<th>Prevalence (%) adult buck</th>
<th>95% confidence interval (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-07</td>
<td>931</td>
<td>15</td>
<td>13–18</td>
</tr>
<tr>
<td>D-42</td>
<td>230</td>
<td>10</td>
<td>6–15</td>
</tr>
<tr>
<td>D-04</td>
<td>410</td>
<td>6</td>
<td>4–8</td>
</tr>
<tr>
<td>D-10</td>
<td>208</td>
<td>12</td>
<td>8–17</td>
</tr>
<tr>
<td>D-19</td>
<td>258</td>
<td>4</td>
<td>2–7</td>
</tr>
<tr>
<td>D-40</td>
<td>268</td>
<td>2</td>
<td>0.4–4</td>
</tr>
</tbody>
</table>
2018 mandatory testing herds
Lessons in chronic wasting disease

Sustained & sustainable effort...

- surveillance
- monitoring
- control
Recommendations for Adaptive Management of Chronic Wasting Disease in the West
Potential Management Strategies

- **Reduce Artificial Points of Host Congregation**
  Identify artificial point-sources of food/minerals/water; remove/reduce density of point-sources.

- **Harvest Management**
  Increase male harvest, bias harvest toward infected males, &/or shift timing of harvest to post rut.

- **Harvest Targeting Disease Foci**
  Targeted harvest strategy built upon ongoing fall harvest to maximize removal of infected individuals.
Potential Management Strategies

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- Harvest Targeting Disease Foci
  Targeted harvest strategy built upon ongoing fall harvest to maximize removal of infected individuals.
Proportionally more infected deer may be removed via harvest in later seasons.
# A tale of two deer herds

<table>
<thead>
<tr>
<th>White River herd (D-07)</th>
<th>Red Feather herd (D-04)</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Goal: eradication!</td>
<td>✓ Goal: suppression</td>
</tr>
<tr>
<td>✓ Tactic: intensive but focal</td>
<td>✓ Tactic: extensive with focal</td>
</tr>
<tr>
<td>✓ Duration: one shot</td>
<td>✓ Duration: ongoing (2000–05)</td>
</tr>
<tr>
<td>✓ Licensing trend: conservative</td>
<td>✓ Licensing trend: liberal(ish)</td>
</tr>
<tr>
<td>✓ Timing: increasingly early</td>
<td>✓ Timing: proportional late</td>
</tr>
</tbody>
</table>

"Every man has a right to his own opinion, but no man has a right to be wrong in his facts."

**Bernard M. Baruch, financier, ca. 1940s**
Third season license numbers strongly affect prevalence in subsequent years.
Licensing trends & prevalence
(Colorado 2002–2017†)
Change in prevalence (difference: 2017 - 2002)

Change in license numbers* (proportional: 2017/2002)

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increasing license #s
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Increasing prevalence
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Change in prevalence (difference: 2017−2002)

Change in license numbers* (proportional: 2017/2002)

Increasing prevalence

Increasing license #s
OK, a tale of two three deer herds

**Middle Park herd (D-09)**
- Goal: suppression
- Tactic: extensive (via harvest)
- Duration: ongoing
- Licensing trend: liberal(ish)
- Timing: proportional late

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*Bernard M. Baruch, financier, ca. 1940s*
How are they doing?

**Middle Park (2017)**
- Bucks: 100 does (obs) – 40
- Fawns: 100 does (obs) – 68 (!)
- Herd size trend: stable (> obj)

**Red Feather (2017)**
- Bucks: 100 does (obs) – 39
- Fawns: 100 does (obs) – 48
- Herd size trend: stable (> obj)
Licensing trends & prevalence
(Colorado 2002–2017†)

Change in prevalence (difference: 2017−2002)

Change in license numbers* (proportional: 2017/2002)

increasing license #s

increasing prevalence
Licensing trends & prevalence
(Colorado 2002–2017†)

Change in prevalence (difference: 2017–2002)

Change in license numbers* (proportional: 2017/2002)

increasing license #s

increasing prevalence
KEY FEATURES

➢ Monitoring plan
➢ Prevalence threshold for compulsory management
➢ Management actions & recommendations
Estimating CWD impacts on doe survival

- simple calculation (back of envelope – literally)*
- based on Colorado field data
  - doe infection rate ~ ½ buck rate
  - ~ ½ infected individuals die each year (either sex)

*(originally calculated on a bar napkin...)*
Estimating CWD population impacts

- driven by impaired doe survival
- “healthy” doe survival ~85% (range-wide avg)
- CWD losses further reduce doe survival
  - ~85% – (annual disease loss)
- sufficiently low doe survival will depress herd trends
Thresholds for chronic wasting disease management

Estimating CWD population impacts

Effects of CWD on overall female survival

\[
\text{doe survival} = 85\% - (\text{annual disease loss})
\]
So why use a prevalence threshold?

- Here’s the math:
  - $\text{prev}_{\text{buck}} \div 2 \div 2 = \text{added loss}_{\text{doe}}$
  - $10\% \div 2 \div 2 = 2.5\%$
  - $85\% - 2.5\% = 82.5\%$
So why use a prevalence threshold?

At the 10% prevalence (in bucks) threshold, affected herds would begin to decline.
Three Substantive Findings

- Hunters are concerned about CWD & strongly support taking action to combat it.

- Hunters prefer we balance hunting opportunity & disease control... but want us to err on side of control.

- We stand to lose hunters in affected areas if prevalence increases.
Hunter Perspectives About Chronic Wasting Disease & Management: Preliminary Survey Results

Three Substantive Findings

“Acceptable” actions

- Use special "disease management" hunts: 82%
- Use hunters to reduce total population: 70%
- Increase buck hunting licenses in later seasons: 68%
- Increase buck hunting licenses: 52%
- Use trained CPW staff to reduce herds/infection rates: 38%
- Take no action: 21%
Hunter Perspectives About Chronic Wasting Disease & Management: Preliminary Survey Results

Three Substantive Findings

“Effort should be taken to reduce the rate of CWD in deer populations.”

- **Agree**: 79%
- **Neither disagree nor agree**: 15%
- **Disagree**: 6%
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

Read more at: https://www.brainyquote.com/quotes/franklin_d_roosevelt_122780