

## WILDLIFE DISEASE MANAGEMENT

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## Disease Management Options

- Common source epizootic
  - Animals acquire disease from common source
  - Reservoir, environmental contamination
  - Management: Remove source or keep animals away from it.
- Examples:
  - Aspergillosis (fungal disease) in waterfowl feeding on moldy grains
    - Solution: till fields to bury the grains

## Disease Management Options

- Perpetuated epizootic
  - Animals transmit disease among each other
  - Management:
    - **Reduce exposure (force of infection)**
      - Reduce population density
        - » General culling or contraception
        - » Disperse animals from concentrated areas
      - Reduce density of infectious animals
      - Control vectors or reservoirs
      - Remove or prevent access to foci of indirect transmission
        - » Feeders / bait sites, mineral licks, water holes, etc.
    - **Reduce susceptibility**
      - Immunization
    - **Treat diseased animals**
      - Rarely used
    - **Reduce impacts**
      - Minimize contact with humans, domestic animals, species of conservation concern

## Disease Management Difficulties

- Difficult to access animals in remote areas
- Difficult to access animals on private lands
- Difficult to control animal movements
- Wild animals are often cryptic, wary, difficult to capture
- Wildlife diseases are very rarely eliminated through management
  - But impacts can be reduced

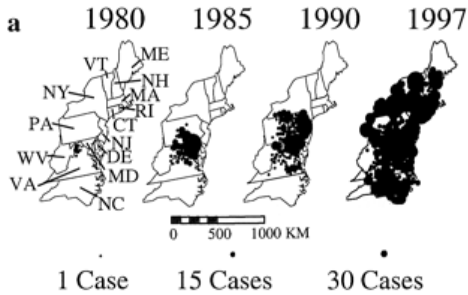
## Rabies

- 7 main strains in the U.S.
  - Skunk (northcentral states, CA, TX gray fox)
  - Skunk (southcentral states)
  - Raccoon
  - Arctic/Red fox
  - Gray fox (AZ)
  - Coyote/Domestic Dog
  - Bat
- Each strain has few species to which it is adapted
  - However, **spillover** into other species occurs
- Large majority of human cases in the U.S. have been **bat rabies**

## Distribution of Major Terrestrial Reservoirs of Rabies in the United States



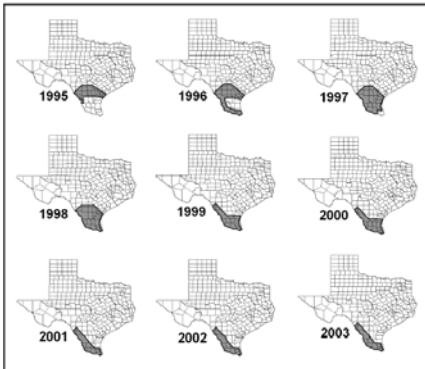
Spread of epizootic rabies among raccoons in the mid-Atlantic and northeastern United States from a focus on the Virginia/West Virginia border



Childs, James E. et al. (2000) Proc. Natl. Acad. Sci. USA 97, 13666-13671

## Vaccination Strategies

- Ring vaccination: vaccinate at perimeter or forefront of epizootic wave
  - Allow disease to “burn out” behind the front
- Need to focus on the species that maintains a particular strain
- One of the few cases where a wildlife disease has been locally eradicated
  - Fox rabies has been eradicated from most of Europe
  - Coyote rabies has been essentially eradicated from Texas



From:  
Sidwa et al.  
J. Am. Vet. Med.  
Assoc.  
227:785-792.

Figure 1—Illustration of target areas of an oral rabies vaccination program for coyotes in south Texas.

## Infectious Cancer in Tasmanian Devils

- Late 1990s, increasing reports of Tasmanian devils with facial tumors
- Death by starvation 3-6 months after tumors appear
- ~50% population decline by 2005
  - About 150,000 to 75,000
- Local extinctions in some areas
- Larger impacts in dense populations

## Infectious Cancer in Tasmanian Devils

- Tumor cells from different individuals are genetically identical
- Tumor line is independent of host line
- Tumor cells appear to be transmitted during fights and take root in host animal's tissue
- Low genetic diversity in the population may prevent immune response

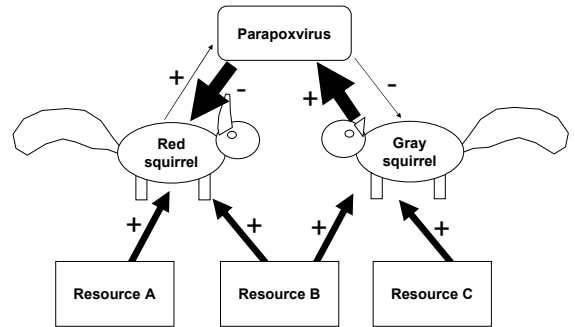
## Red Squirrel Decline In U.K.

- Gray squirrels (*Sciurus carolinensis*) were introduced to UK in 1800's
- Have spread over much of the country, with matching declines in the native red squirrels (*S. vulgaris*)
- Weak direct competition
  - Grays do better in deciduous woods, reds do better in coniferous

## Parapoxvirus in Squirrels

- Parapoxvirus is common in North American squirrels
- Gray squirrels are essentially unaffected
- Red squirrels highly susceptible
  - severe lesions and >30% weight loss after 2-3 weeks
  - Antibodies to parapoxvirus never been found in living wild red squirrels, only in red squirrels **already dead** from disease
    - Implies they cannot defeat the disease

## Disease-mediated Competition



## Roundworms, Raccoons, and Rats

- Allegheny woodrat (*Neotoma magister*)
  - Once widely distributed in northeast
  - Have declined greatly in some areas
- Raccoon roundworm (*Baylisascaris procyonis*)
  - Definitive host = raccoons
  - Lives in intestine
  - Eggs excreted with feces

## Roundworms, Raccoons, and Rats

- Woodrats (“pack rats”) like to collect & store raccoon feces in food caches
  - Highly susceptible to *Baylisascaris procyonis*
  - Worm eggs can persist long time in cached feces
  - Woodrats tend to take over vacant dens
    - Dens with cached feces act as “traps”

## Roundworms, Raccoons, and Rats

- LoGiudice 2003
- Reintroduced Allegheny woodrats to 4 locations in New York and New Jersey
- Survival was negatively related to abundance of infected raccoon latrines
- All reintroduced populations failed within 2 yrs.

## Brucellosis

- Affects mainly wild (deer, bison) and domestic ungulates (cows)
  - Can affect humans
- Mainly Affects Reproduction
  - Spontaneous abortion or premature birth
  - Infertility
  - Reduced lactation
- Transmission
  - Vertical
    - Transplacental
    - Lactation
  - Horizontal
    - Consumption of birth products & aborted fetuses
  - Humans can be infected by:
    - Physical contact with infected animals
    - Consuming unpasteurized milk products & soft cheeses
- Treatment is ineffective in ungulates

## Brucellosis

- Brucellosis is an **economic** disease
  - Billions of \$\$ in reduced trade, reimbursing farmers, and eradication efforts
  - Vaccine is available for cattle
  - Cattle herds with positive animals are quarantined or depopulated
  - U.S. states with no positive cases in cattle for 1 yr earn **Class-free status**
    - easier interstate transport & trade
- All states currently class free except TX & WY
- Wyoming lost class free status in 2004
  - 2 cases in cattle from near Yellowstone National Park

## Brucellosis in Yellowstone-Area Elk & Bison

- Last focus of brucellosis in wild
- Bison: herd behavior promotes high horizontal transmission
  - Jackson WY bison herd: 50-80% prevalence
  - Vaccine is ineffective

## Brucellosis in Yellowstone-Area Elk & Bison

- Elk: much lower transmission
  - isolate themselves to give birth
  - females eat own birth products
  - herds off feedgrounds have prevalence  $\leq 3\%$
  - herds using feedgrounds have prevalence  $\sim 30\%$
  - vaccine is marginally effective

## Brucellosis in Yellowstone-Area Elk & Bison

- Management:
  - Attempt to drive bison leaving parks back in
  - Culling & increased public hunting of elk and bison outside parks
  - Capture & vaccinate elk at feedgrounds

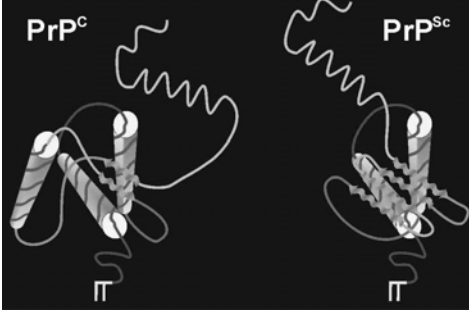
## Chronic Wasting Disease

- Affects deer, elk, and moose (wild and captive)
- Similar to “mad cow disease”
- Fatal degeneration of central nervous system
  - >16 months between infection and clinical signs
- Signs/Lesions
  - Emaciation, incoordination, lethargy, excessive salivation
  - “Spongy” brain tissue

## Chronic Wasting Disease

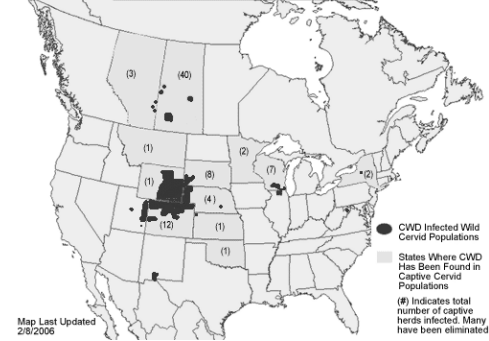
- Caused by a **prion** = misshapen protein
  - causes similar protein molecules to become misshapen
- Transmission: saliva & possibly feces
  - can persist in environment for months to years
- First found in captive deer in Colorado, 1960's
- First found in wild Illinois deer: Nov. 1, 2002

## Structural Changes Occur in PrP



[http://w3.ag.uiuc.edu/AnSci/BSE/Prion\\_3D\\_Structure.htm](http://w3.ag.uiuc.edu/AnSci/BSE/Prion_3D_Structure.htm)

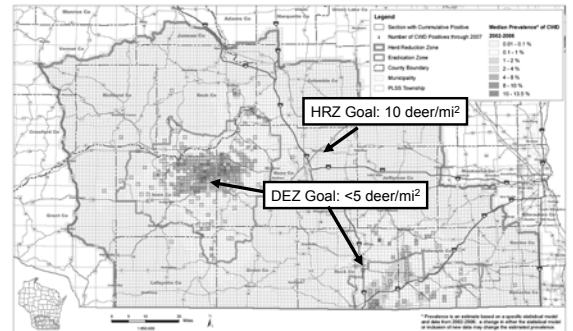
## Chronic Wasting Disease In North America



## Wisconsin

- CWD discovered in wild deer Feb., 2002
- All positive cases in south central area
- Management plan:
  - Disease Eradication Zone (DEZ)
    - virtually eliminate deer (<5/mi<sup>2</sup>) in known infected area
  - Herd Reduction Zone (HRZ)
    - reduce deer densities in buffer area to ~10/mi<sup>2</sup>
    - Current densities ~ 40-50 / mi<sup>2</sup>
  - prohibit baiting & feeding of wild deer
  - test & restrict transport of captive deer & elk

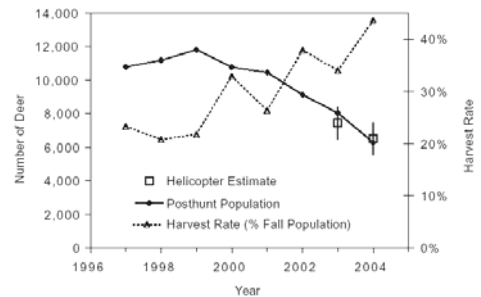
## Prevalence of CWD in the CWD Zones



## Chronic Wasting Disease Harvest Management

- Sharpshooting
- Extend hunting season
- Increase available permits
- “Earn a Buck” – each hunter must kill antlerless deer before allowed to take an antlered deer
  - Extremely unpopular among hunters
- 2006-- \$\$
  - Checking in any deer enters into lottery for cash prize
  - Checking in a CWD-infected deer earns \$400 prize

## Antlerless Harvest Rates and Posthunt Population Estimates DMU 70A



## Putting Wildlife Diseases to Work

- Myxomatosis: used to control exotic rabbits in Australia (start 1950)
  - Caused immediate crash in rabbit population
  - But rabbit populations recovered somewhat
    - Rabbits evolved resistance
    - Virus evolved toward less-virulent form
- Current research: genetically engineer herpes viruses that express zona pellucida proteins
  - Brushtail possums in New Zealand
  - Red foxes in Australia

## Things To Remember

- Strategies & tactics for managing wildlife diseases
- Case studies: rabies, Tasmanian devil cancer, parapoxvirus, raccoon roundworm, brucellosis, CWD
  - etiology
  - mode of transmission
  - impacts & importance