THE HUMANE SOCIETY OF THE UNITED STATES

Solving the Deer Problem: What's Practical and Possible?

Outline of presentation to Bethlehem Deer Task Force on Nov 5, 2014

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Context:

- The suburban landscape is very attractive to deer and creates ideal "edge" habitat
- Deer are drawn in and can exist at high numbers where their impacts are keenly felt

GOALS: Take critical look at:

- Some management assumptions
- Effective non-lethal deer problem mitigation methods and applications

Management Assumptions - Hunting will:

- Control the deer population
- Restore biodiversity
- Reduce the human risk of Lyme Disease
- Significantly lower deer-car accidents

#1: Can Hunting Control Deer?

- When hunted, about 20-30% of the deer are removed
- Confounding effect: Well-fed deer exhibit adaptive, physiological response to their nutritional condition:
  - Breed earlier, conceive at a younger age, have more young , lower neonatal mortality, higher fawn survival (Verme, 1969, Woolf & Harder, 1979, Miller & Ozoga, 1997)
    Result: "Rebound" effect due to compensatory reproduction mechanism

Ex; Univ. of FL study : Incidence of twinning was **14%** on unhunted site vs. **38%** on hunted site *(Labisky et al, 1985)* .

Hunting can lead to "irruptive" pattern –"bounce-back" effect:

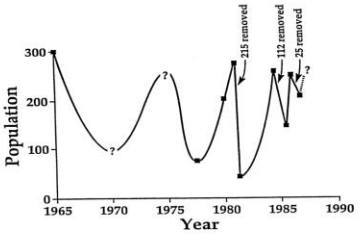

FIGURE 6.6. Population size of black-tailed deer on Angel Island. Shown is the repeated irruptive behavior and no apparent lessening of peak population sizes. Question marks represent qualitative estimates not based on data. See text for further explanation.

- in W. McShea et al, eds. The Science of Overabundance

Will hunting control deer? Particularly in suburban areas?

Answer: *The conditions in cities and suburbs are not conducive for controlling deer populations by hunting:*

- Extremely high densities of deer and people
- Rich deer habitat
- Safety-mandated hunting restrictions

- Unattractiveness of hunting conditions *for hunters*
- Negative PR potential

The Challenge: How to sustain low deer numbers?

Deer density reduction is difficult enough, but keeping population at low level even harder!

- Up against high reproductive potential and higher survival rate
- Reduction in hunter success over time - so more hunting effort is required *to take out same number of deer*
- Immigration of deer from the surrounding area – thereby replacing some of the deer removed. All the green space surrounding Bethlehem means other deer will fill any empty niches

#2: Can Hunting Reduce Human Risk of Lyme Disease?

Less Ticks Don't Necessarily Mean Less Disease!

- 2,500 yards in Connecticut, Maryland and New York sprayed with either bifenthrin or a placebo.
- Participants asked to detail tick bites and encounters through 4 monthly surveys.
- Result: Ticks decreased 60% in sprayed yards
- Finding: *Those whose yards received pesticide and those who got placebo had virtually same number of*
  - 1) Ticks found crawling on them
  - 2) Ticks found biting them
  - 3) Incidences of tick-borne disease

CONCLUSION:

- 1) Reduced tick density does not necessarily mean less human disease!
- 2) People don't necessarily pick up Lyme disease in their own backyards

Larger Issue:

- The point is NOT if killing deer will reduce tick numbers ….
- But will hunting reduce tick density and infectivity *enough* to lower transmission of disease in people?

Tick Life Cycle: Refresher:

- Tick (*Ixodes scapularis*) has a 3-stage life cycle (*larvae, nymph, adult*)which takes 2 years to complete
  - 1 blood meal at each stage
  - Prefers a progressively larger host
  - The problem: Hunting doesn't kill off enough ticks!

Problem of tackling one host in a multi-host cycle

- The black-legged tick is carried by many species of birds, lizards and mammals – i.e. is a multi-host disease
- Deer are preferred host for *adult* ticks, but not only or most important host
- *Birds* transport the tick (and Lyme disease) to new areas

- Battaly and Fish, 1993, Keirans et al, 1996

Can you control Lyme Disease by host reduction?

- Impractical
- Would have to target mice, squirrels, chipmunks, deer, songbirds, shrews, lizards, etc…

Confounding variables:

- Regular hunting season occurs too late to affect tick reproduction or numbers
- Sept-Nov: Female engorgement / egg-laying
  Nov-Jan: Regular deer hunting season. By then, a good portion of ticks have already mated/ dropped off to lay eggs :
  "*Deer reduction efforts carried out at the end of fall will have minimal impact on the tick population*" (Falco and Daniels, 1993)
- When deer numbers are reduced, ticks may congregate in higher densities on the remaining deer or switch to other hosts.
- Localized deer removals can lead to tick amplification and disease *hotspots* (S. Perkins et al, 2006 in *Ecology*)
- Questing ticks looking for a large host can be more likely to end up *on people* - (Ginsberg and Zhioua, 1999) *The public is advised to be extra vigilant after deer numbers reduced*

Most frequently cited deer hunt "success" cases are small islands and involved near elimination of deer

- Great Island, MA:
  - After 70% of the deer removed :
  - No marked reduction in tick abundance (Wilson et al, 1984)
  - After near elimination: Sub-adults did decline *but adult tick numbers increased in subsequent years* *-Wilson et al, 1988*

- Mohegan Island, ME
  - Ticks did decline but deer were virtually **eliminated!**
  - Completely different host ecology:
  - No mice on island, Norway rats are substitute host for mice
  - No mid-size/lg mammal hosts – just dogs, cats, people
    - P. Rand et al, 2004
  - Crane's Beach, Ipswitch, MA:
    - After 83% deer reduction (to 27 deer/ sq ml) over 7 year period:
      - Slow decline in immature ticks –took 5-7 years
      - Adult tick density *increased* throughout study
      - In final 2 years, nymph tick numbers rose to same level as when sampling began
      - *Tick abundance on deer less but … infected ticks remained abundant.*
        - Wilson and Deblinger, 1983

How low do deer numbers need to go?

- Some assert that deer density <8 deer/square mile results in less disease in humans and disruption of tick reproductive cycle

- Studies which support this claim are geographically isolated tiny "islands" – different scale of magnitude than Bethlehem, and enclosed areas

Is 8 deer / square mile even low enough to control human disease?

- What about Cape Cod? Very low deer densities yet high rates of LD

Studies which looked at effect of deer reduction on Lyme disease

- Bernard Township – NJ - Deer reduced from 17 to 9 deer/ square miles
    - Tick abundance and LD incidence monitored for 3 seasons after incremental deer removal
    - Active and passive surveillance for disease incidence
    - Result: Cull didn't effect questing sub-adult numbers, host-seeking ticks increased by 2nd year
- *Lyme disease incidence in humans did not vary with deer decline*
  - R. Jordan, T. Schulze, M. Jahn, 2007- J. Medical Entomol 44(5)

Recent Mumford Cove, CT Study*:*

- Concluded that major deer reduction *did* result in less human cases of LD (based on resident surveys)
- Based on self –reporting , no validation of LD cases
    - No medical records or health dept reports used
- Assumed ticks picked up in yards but not necessarily so (per CDC study)
- No control group—a control is necessary for a proper scientific study so you can compare differences between treated and untreated sites
- Sharp downward trend noted in Lyme Disease and nymph ticks *prior to hunt*

Deer reduction is not synonymous with disease reduction

- Research indicates approximately 50% ticks infected with LD bacterium
    - If average resident bitten by 12 ticks annually, then probability of being bitten by infected tick is almost 100%
    - Intervention which cuts tick bites 90% won't lower probability of transmission by same factor
    - If resident bitten by only 1 tick, good probability of becoming infected with LD
- Main point: Not just tick numbers but infectivity rate + probability of being bitten that = transmission risk

"*Reducing deer populations has been an inefficient means of preventing Lyme disease…."… "Unless deer are completely eradicated, reduction in deer densities has little effect on tick densities."*
-Wilson et al, 1985, 1988, Duffy et al, 1994, Conover, 1997

BOTTOM LINE:

- Culling doesn't remove *enough* ticks to interrupt the tick's reproductive cycle or to reduce human disease.
- There's good reason that the CDC and national health authorities DON'T recommend deer hunting to control Lyme disease!

Personal Protection Measures

- BEST STRATEGY: Doing self-body check w/in 24 hours of being outdoors
- Tucking pants in socks when outdoors, and other prevention measures prescribed by State and local Health Depts, CDC

What does control the tick?

"4-Poster" Deer Treatment Station:

- Is a device that attracts deer to corn bait, while feeding, an acaricide is applied with rollers to their neck and shoulders – will kill ticks

- USDA tested (7-yr, 5 state study)
- *Perethrim*-based, kills 95-98% of all ticks on 90%+ of the deer in a 50 acre area
  - Elimination of adults in 2nd year, all stages reduced 91-100% by 3rd year (*Solberg et al, 2003*)

Products which target mice, for individual property use:

- *Damminix* – tubes with perethrim-treated cotton balls – mice use cotton for nesting which kill ticks
- *Maxforce Bait Boxes* – targets small rodents (yet limited if any availability)

#3: Will Hunting Reduce Deer Car Collisions?

- To what extent are car collisions a function of deer density? Threshold?
- What about other factors?
  - Deer continually attracted to mowed, succulent roadside grasses and salted roads in winter
  - Continual development of habitat shifts deer movement
  - Increasing car volume / speeds
  - Even if collision numbers have increased, may be multiple reasons! Need 7-10+ years of data to assess trends.
  - BETHLEHEM: Deer-collision graphs (past 5 years) show accident rate fairly consistent, almost all were no injuries

Varied research findings…

VA DOT study:

- Geo-located all deer /vehicle collisions in Clarke County VA between Aug-Dec 2005-2006
- 228 road segments – each 250 m in length
- Assessed what factors correlate with collisions: hunting pressure, deer density, amount forest and housing, presence of crops/corridors, speed limit/ car volume

Findings:

- "Little evidence that increased deer harvest reduced deer/vehicle collisions"

- William McShea et al, Smithsonian National Zoological Park – from a paper given at the SE Deer Cooperative Annual Meeting in MD, 2007

VERSUS:

Sharpshooting of deer -- reductions of 54%-76% of the deer population in 3 communities did lead to linear reductions in deer-vehicle collisions

- *Denicola and Williams, 2008 . Human-Wildlife Conflicts 2*(1)

Model Program in Rochester Hills, Michigan

- Initiated "Don't Veer for Deer" Campaign
  - Coordinated by City Administration & Council
- *Program Components:*
  - *Moveable changeable message boards put at hotspots*
  - *Reduction of roadway sightline barriers*

- *Big public education component : Deer –resistant gardening and defensive driving information on city website – also educational workshops and public outreach done on regular basis*

Collision Data Collected
- Type accident
- Month, day of week
- Time period
- Road conditions
- If traffic device involved
- Light conditions
- Weather
- Injury severity, etc

Aerial Survey done each year (to assess deer density)

Results – Rochester Hills Program:
- Deer-car collisions declined 25% after program began – *despite 34% increase in deer herd size*
- Accidents remain at very low level
- Task force meets regularly to monitor program and do regular aerial deer counts
- Ongoing cost of program: @ $2000+ a year

Other Mitigation Measures:
- Slower speed limits (< 45 mph)
- More bumps, turns, fencing
- Driver awareness: need for driver education!!
- Also: warning and reflector systems:
  - *Streiter Lites*, *Deer Deter* systems – can work but need to be maintained

#4: <u>Will Hunting Bring Back Biodiversity</u>?

Social context:
- We tend to equate a "healthy" environment with one that is biodiverse and in *early-successional stage*
- A human value judgment, not biologically-based

Yet Plant communities are impacted by a number of factors:
- Vegetative growth affected by: acid rain, insect damage, disease, forest fragmentation, pollutants, loss of soil fertility, herbivory, invasive and other competing plant species, parasitic organisms, climatic and weather extremes, and over-development, etc

Yale Study (Rutherford and Schmitz, 2010)
- Research question: Are deer largely responsible for biodiversity and forest regeneration loss?
  - 120 study plots in 6 western CT towns
    - Plant ID, diversity, extent browsing, etc
    - Correlated with deer density
- Results:
  - Deer density is **not** a leading factor in tree regeneration decline or loss of plant diversity across western CT

- Conclusion: *Managers may want to decrease deer populations for other reasons, but the rationale that decreasing deer populations will, in it of itself, decrease damage to vegetation needs to be re-evaluated……*"
  - Rutherford and Schmitz, 2010. J. of Wildlife Mgmt 74 (6)

Beware of simple cause-and-effect assumptions!

- Ex: Yale-Myers Forest: oaks not regenerating outside deer exclosures –*or inside them*
- *Deer do impact ecosystems BUT the environmental problems deer are blamed for are much broader, complex, and multi-faceted*

<u>Reducing Backyard Deer Problems</u>:

- Deer numbers are a function of their food source …. reduce their numbers/ presence *by limiting food availability*

We have a good toolbox for property owners!

- Deer-resistant plant species
- Repellents
- Fencing, netting, other deterrent/ exclusion options

Electric fencing:

- Polytape or polywire
- 3-D scented anti-deer fence
- Electric fence kits
  - Maintenance is Everything!
  - Don't forget to bait, leave on, mow around wires

Non-electric fences

- Woven-wire fence (8-10 feet) – *the best!*
- Plastic mesh netting
- Tree shelters, etc

Repellents:

- *Beware: deer are very adaptable!*
- Effectiveness based on:
  - Alternate food availability
  - Type of repellent
  - Concentration of active ingredient*
  - Re-application schedule, repellent durability
  - Deer density, hunger, habits
  - Weather

- **Don't let feeding patterns get established!**
  - Apply *before* bud-break
  - Reapply frequently, after heavy rains

- **Most effective are repellents that emit sulphurous (rotten egg) odors**
  - Predator association? Spoiled food?
  - Ex: *Liquid Fence*

Scare Devices:

- Can provide temporary relief
- Motion-activated "scarecrow" – attaches to hose, has motion sensor, blasts deer with water pulse (solar powered versions available)
- *Electronic Deer Repe*ller (stakes for garden, baited, give deer a mild zap)
- *Deer Shield* –uses deer distress vocalizations

Some Good Resources

- *Limiting Deer Browse Damage to Landscape Plants* by Jeff Ward, CT Agricultural Station (Bulletin 968)
- Cooperative Extension Service - http://ccetompkins.org/garden/help-gardeners/deer-resistant-plants
- http://www.deerresistantplants.com
- http://wildlifehotline.org/deer.html
- www.humanesociety.org/deer

What about Immuno-Contraception?

- Immuno-contraceptive vaccines induce an immune response to reproduction
- PZP (porcine zona pellucida) vaccination causes a female mammal to produce antibodies that bind to her egg coating (ZP) and block sperm attachment.
- PZP is available under an experimental-use permit, not yet EPA-registered – GonaCon is registered.
- HSUS done 3 pilot studies (Fire Island, NY, Fripp Island (SC), National Institute of Standards in Technology (MD)
- All demonstrated a population lowering effect
- On Fripp Island (SC) there was a 50% decline in the population over 6 years time (2005-2011)
  -Rutberg et al, Wildlife Research, 40: 281-288
- Hastings on Hudson – new project testing use of PZP in "open" environment
  (More information about fertility control options attached)

What's Next: technical:

- Remote delivery of one-shot PZP vaccine
- Vaccine cost reduction
  - Testing a $100 version (vs. $230 version) of 2-3 yr vaccine

Surgical Sterilization - Ovariectomies:

- Surgical sterilization: removes the ovaries
- Less invasive than typical spay surgeries for domestic dogs and cats.
- Does captured via dart tranquilizers
- Transported to a surgical bay. Preparation and surgery take y 20 minutes
- Deer transported back to capture site, reversal agent administered. Deer monitored.
- Surgical sterilization 100 % effective -- mortality rates extremely low
  - Cayuga Heights, NY: researchers sterilized 95% of the female deer population (i.e. 149 does) in two years and observed a 30% decline after year one.
  - San Jose, CA: over 90% of the female deer (i.e.115 does) were sterilized in two years and researchers observed a 20% decline after year one.
  - Other projects onjoing in Town & Country, MS, Baltimore County, MD and Fairfax City, VA.
- Surgical sterilization expensive but long-term, prevents "bounce-back" in numbers

Urge Bethlehem to:

- Focus on reducing deer *conflicts*, NOT try to manage overall deer *numbers*
- Create deer CONFLICT management plan

Designing a Deer Problem Mitigation Plan

- Collect site-specific data to indicate scope of problem
- Set clear, achievable and measurable goals
- Create ongoing monitoring program to assess program's level of goal achievement
- Clearly spell out the long term-costs and time-line

What We See in Most Communities:

- Hunting is often proposed as the best way to manage deer problems, yet:
- Valid baseline data are not collected – so you have no starting point
- Overly-broad, non-measurable goals are set
- A solid monitoring system is not put in place
- RESULT: No idea what cull/hunt has achieved, success measured by anecdote and "eyeballing" the landscape – insufficient and misleading!

My Recommendation for Bethlehem:

- Develop comprehensive deer problem mitigation plan:
  - Use residents survey and deer collision data to design plan
  - Educate residents about ways to mitigate garden conflicts, prevent collisions and Lyme disease– put information on city website
  - Use Rochester Hills model– go to website for program details on how garden & collision issues handled
  - Focus outreach efforts on how to reduce Lyme disease risks
    - Consider use of 4 posters at strategic locations
  - Set up solid complaint and monitoring system – to better define problems and assess success of mitigation
  - Consider range of non-lethal options for site-specific application