Woodlot Regeneration:
Deer Impacts & Protection Strategies and Tactics

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December 8, 2020 – Penn State University Cooperative Extension

Forestry Webinar Series

Cornell University
College of Agriculture and Life Sciences
Department of Natural Resources

USDA United States Department of Agriculture
National Institute of Food and Agriculture

Supplemental Resources (p.1)

- B Blossey, P Curtis, J Boulanger, A Davalos, Red oak seedlings as indicators of deer browse pressure: Gauging the outcome of different white-tailed deer management approaches, Ecology and Evolution, 2019, 9. https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.5729

- Blossey B, Davalos A, Nuzzo V. 2017. An indicator approach to capture impacts of white-tailed deer and other ungulates in the presence of multiple associated stressors. *AoB PLANTS* **9**: plx034; doi: 10.1093/aobpla/plx034

- P Curtis, P Smallidge, B Blossey, K. Sullivan. 2020. Protecting the Future Health of Forests in New York State. *Scientia*, 2020, DOI: https://doi.org/10.33548/SCIENTIA501. (also, http://AVIDdeer.com)

- Rawinski, T.J. 2018 (draft). Monitoring white-tailed deer impacts: the ten tallest method. https://flnps.org/sites/default/files/newsletters/Ten-tallest%20Method%20Instructions%202018.pdf

- Ward, J., P. Smallidge, T. Worthley, K. Bennett. 2013. Northeastern forest regeneration handbook. USDA Forest Service NA-TP-03-06. 66 pp. https://www.fs.usda.gov/naspf/sites/default/files/publications/ne_forest_regeneration_handbook_revision_130829_desktop.pdf

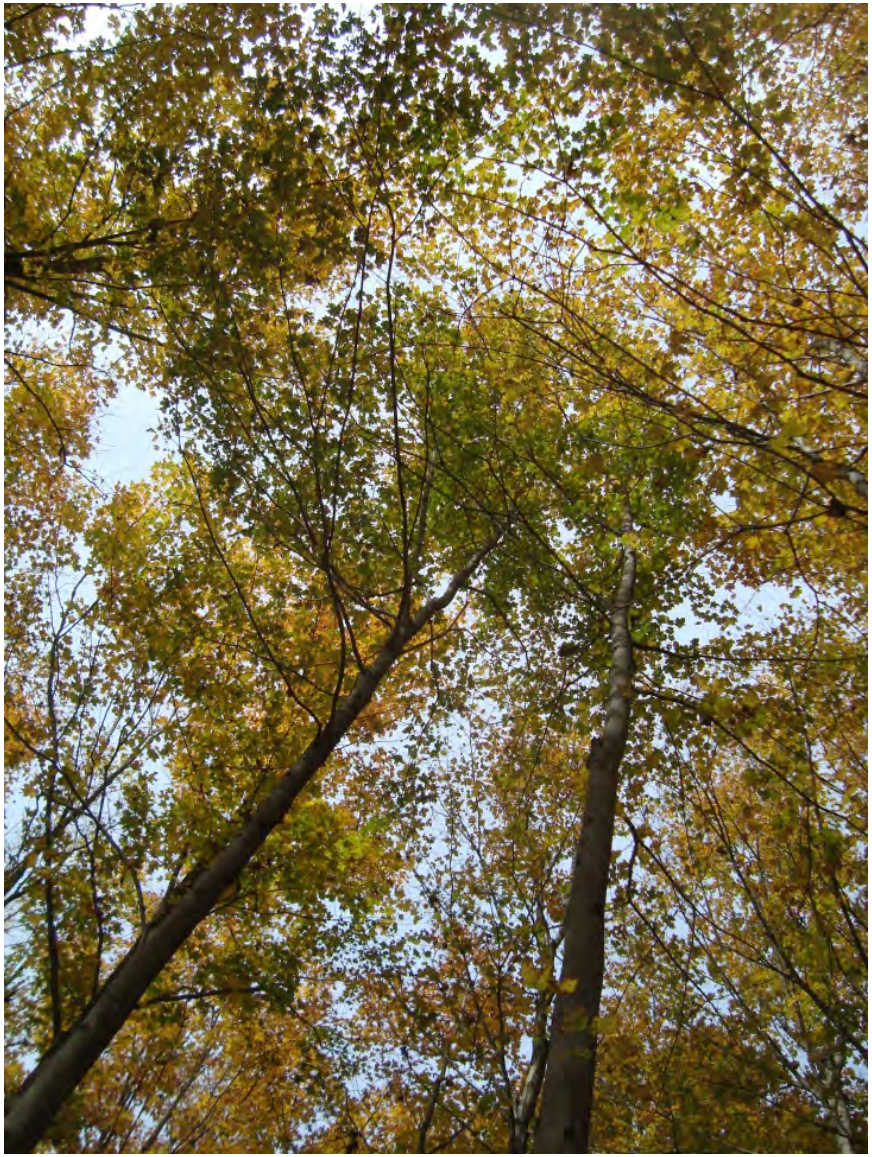
Supplemental Resources (p.2)

- Smallidge, P.J. and B.J. Chedzoy. 2020. How much is enough? – Assessing the success of hardwood regeneration. New York Forest Owner 58(1):6-7, 18-19 (also as ForestConnect Fact Sheet, Cornell University Cooperative Extension Department of Natural Resources https://blogs.cornell.edu/cceforestconnect/files/2020/06/Assessing-the-success-of-hardwood-regeneration.pdf)

- Smallidge, P.J., B.J. Chedzoy, E. Staychock. 2017. Low-cost fence designs to reduce the impacts of deer in woodlands. Cornell ForestConnect Fact Sheet. 6 p. https://goo.gl/YmBqnE

- Sugarbush fence – handout http://blogs.cornell.edu/slashwall/technical-resources/

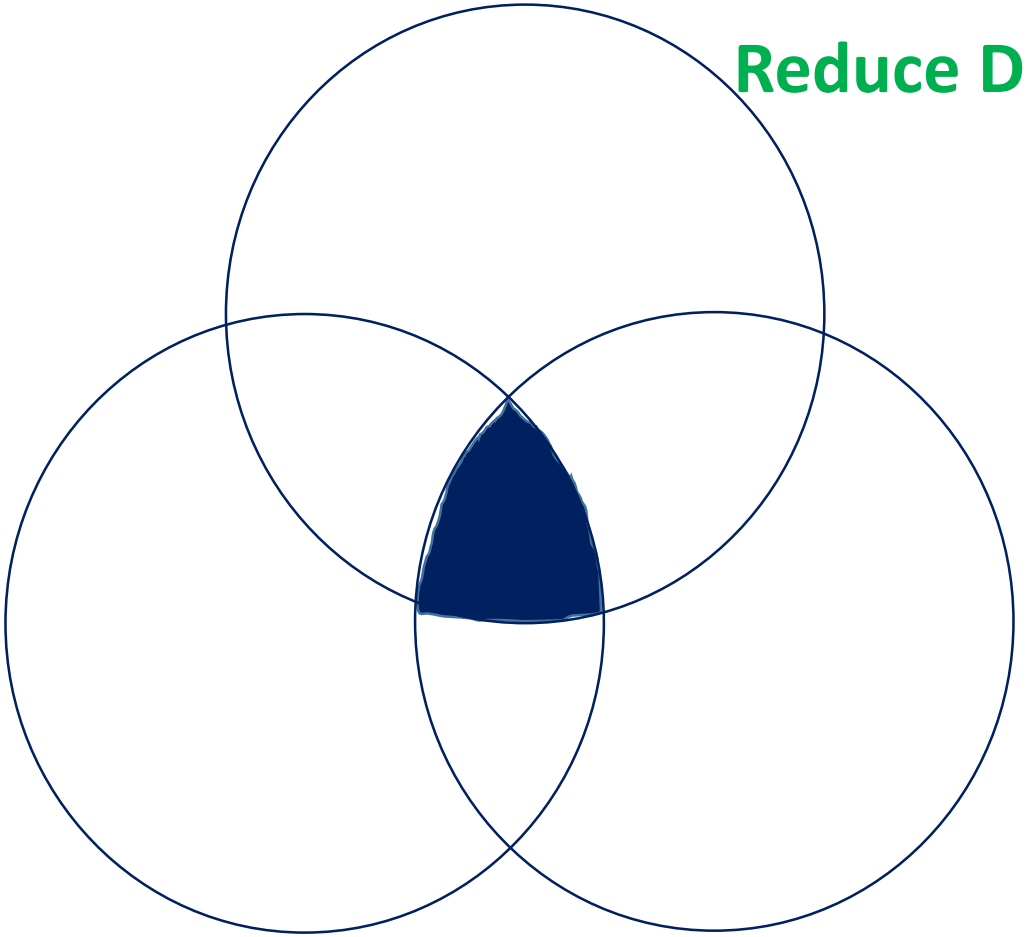
- Slash wall abstract (SAF 2020 National Convention) http://blogs.cornell.edu/slashwall/technical-resources/



Too Often, Forests Don’t Regenerate

Restore New York WOODLANDS
A NYFOA Initiative

Reduce Deer Impact

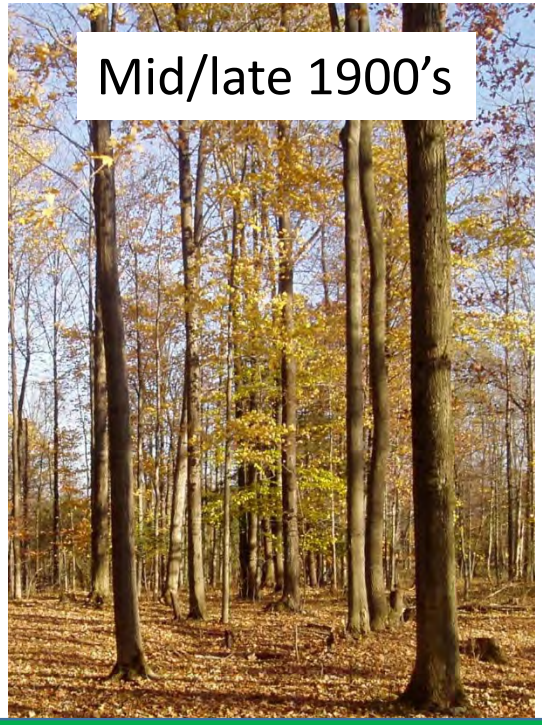


Control Interfering Vegetation

Sustainable Harvesting

[plus other factors]

Why Do We Need Desirable Regeneration?



The last 150 years, or so

?

Today's Objectives

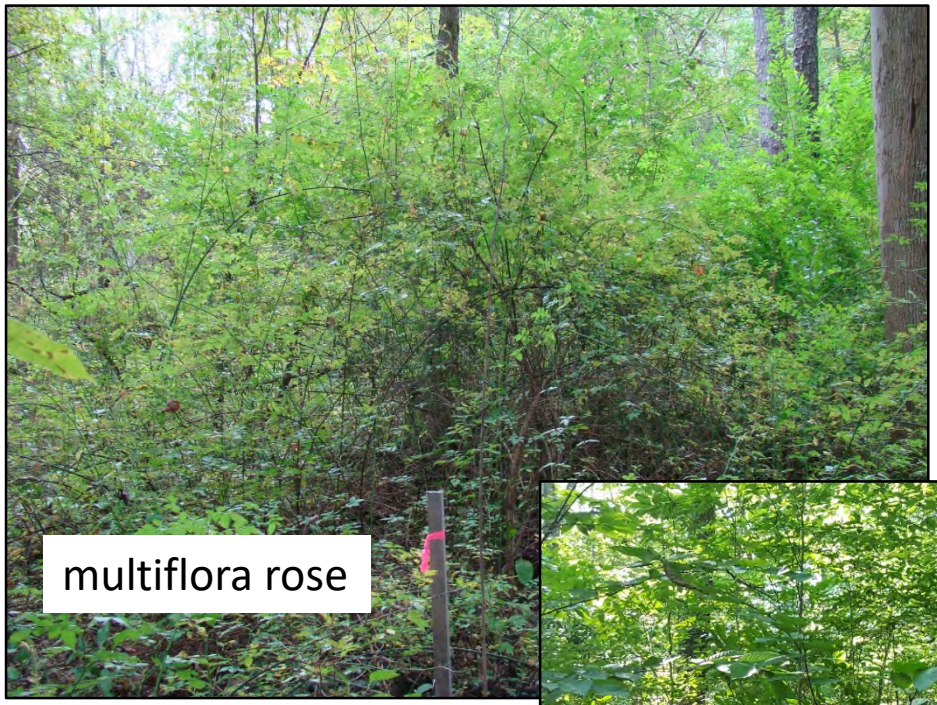
- A terse review of the ecology of regeneration
- A terse review of the impacts of deer on forests
- Assessing deer impacts
- Limiting deer impacts on forest plants
  - Lethal
  - Tree tubes
  - Small-scale fences
  - Moderate/large scale fences
  - Slash walls

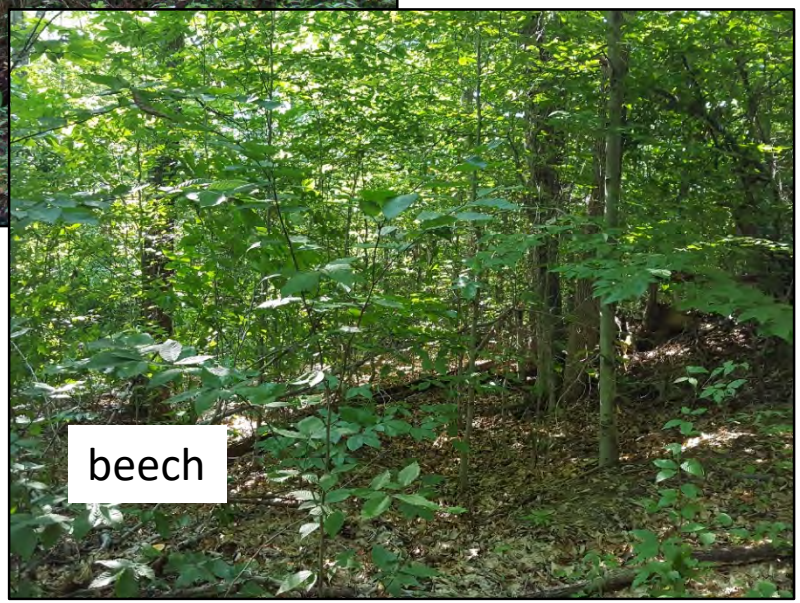
Manage Sunlight & Manage Regeneration

- Regulate the mixtures of species (composition)
- Regulate the number of stems/acre by stem size (structure)

(More details at Ward et al. 2013. Northeastern forest regeneration handbook)

However, some plants don’t need much sunlight





- rose
- buckthorn (x2)
- honeysuckle (x3)
- privet
- barberry
- beech
- hophornbeam
- striped maple
- fern
- *etc.*

Foresters Suggest a Problem Looms

	Statewide	Adirondacks	Southern Highlands	Other
Highly Successful	13	12	16	8
Moderately Successful	17	31	13	16
Marginally Successful	45	50	47	38
Complete Failure	25	7	24	38

Connelly, NA, PJ Smallidge, GR Goff and PD Curtis. 2010. Foresters perception of forest regeneration and possible barriers to regeneration in New York State. Cornell University Department of Natural Resources Human Dimensions Research Unit HDRU 10-2. 37 pp.
http://www2.dnr.cornell.edu/hdru/pubs/HDRUReport10-2.pdf

Permanent Plots Suggest A Potential Problem

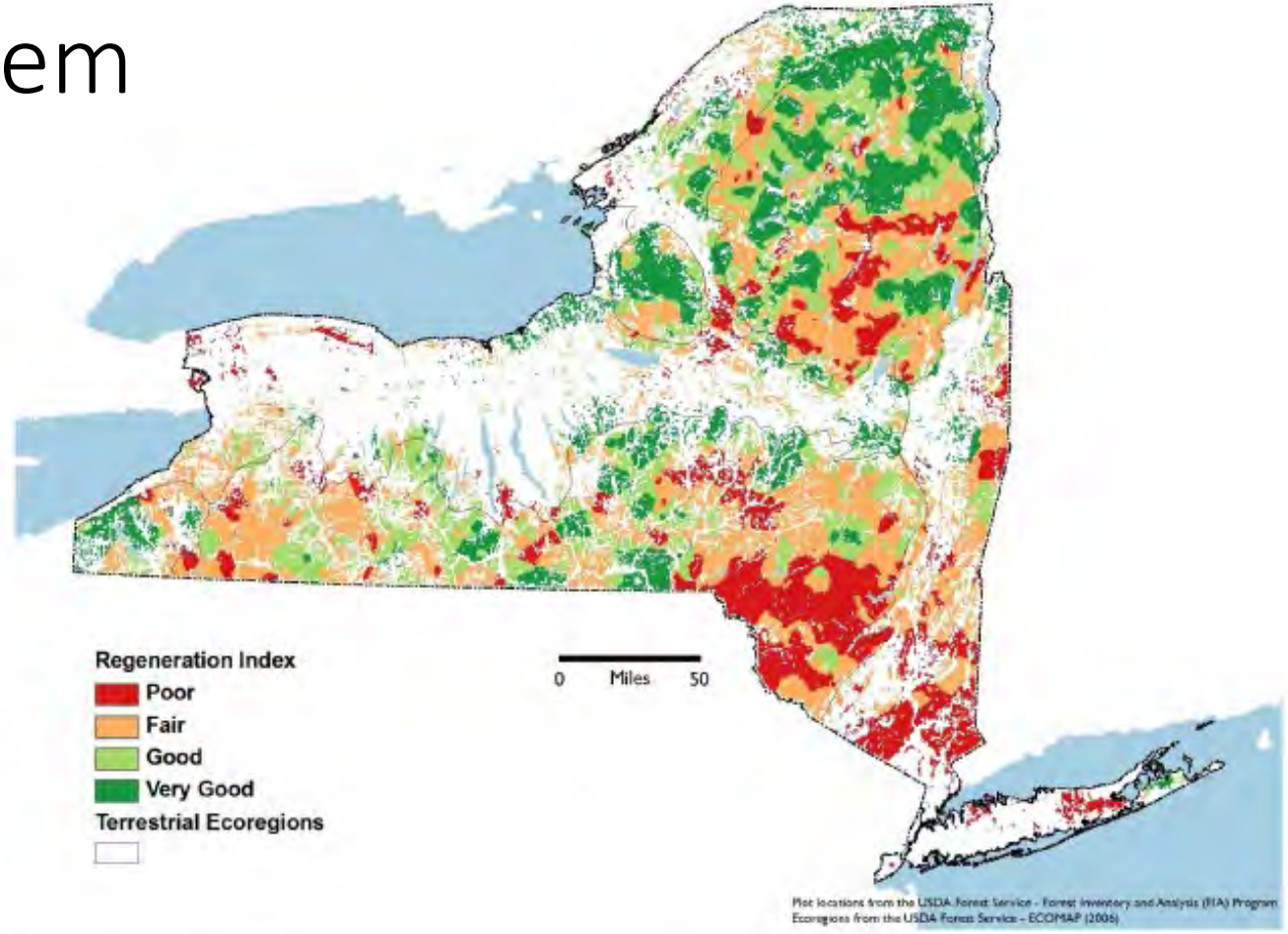


Figure 6. Predicted values for Regeneration Index of desirable timber species in New York State.

Shirer, R and C Zimmerman. 2010. Forest regeneration in New York State. The Nature Conservancy. 25 pp. http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/newyork/placesweprotect/easternnewyork/final_nys_regen_091410_2.pdf

Factors Present (%) in Stands with Marginal or Failed Regeneration

	Statewide	Adirondacks	So. Highlands	Other
Deer	65	38	59	91
Interfering Vegetation	47	47	46	49
Owner Attitude	25	16	25	32
Owner Finances	21	18	29	12
Soil/Site	14	18	9	17
Forest Health	10	12	8	11

Connelly, NA, PJ Smallidge, GR Goff and PD Curtis. 2010. Foresters perception of forest regeneration and possible barriers to regeneration in New York State. Cornell University Department of Natural Resources Human Dimensions Research Unit HDRU 10-2. 37 pp. http://www2.dnr.cornell.edu/hdru/pubs/HDRUReport10-2.pdf

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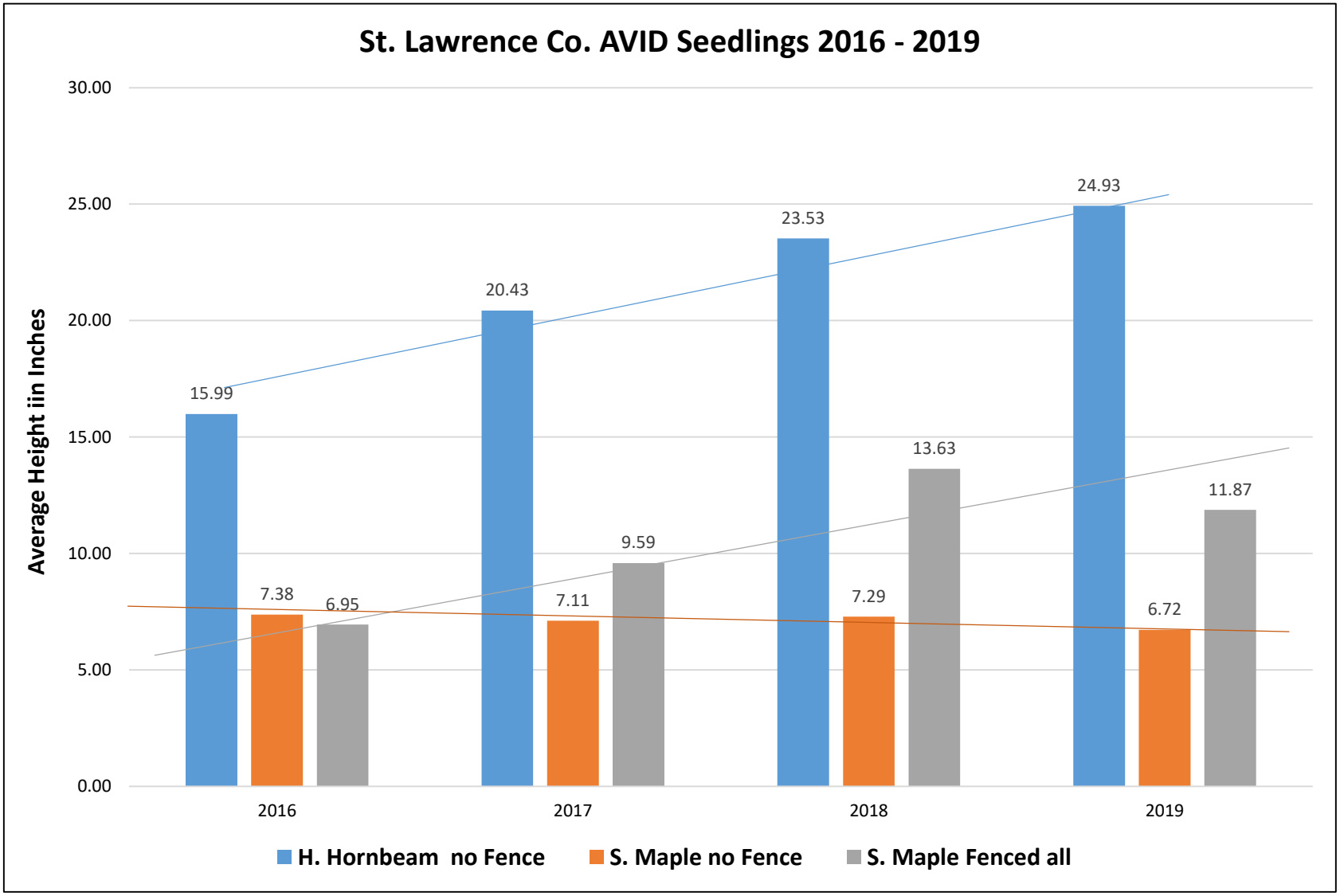
Deer browsing impacts

- ~7 lbs fresh weight per day
- Favor some species over other species
- 600 seedling tips per pound
- Up to 4200 seedlings per deer per day

Palatable, Non-palatable, and Fenced Seedlings

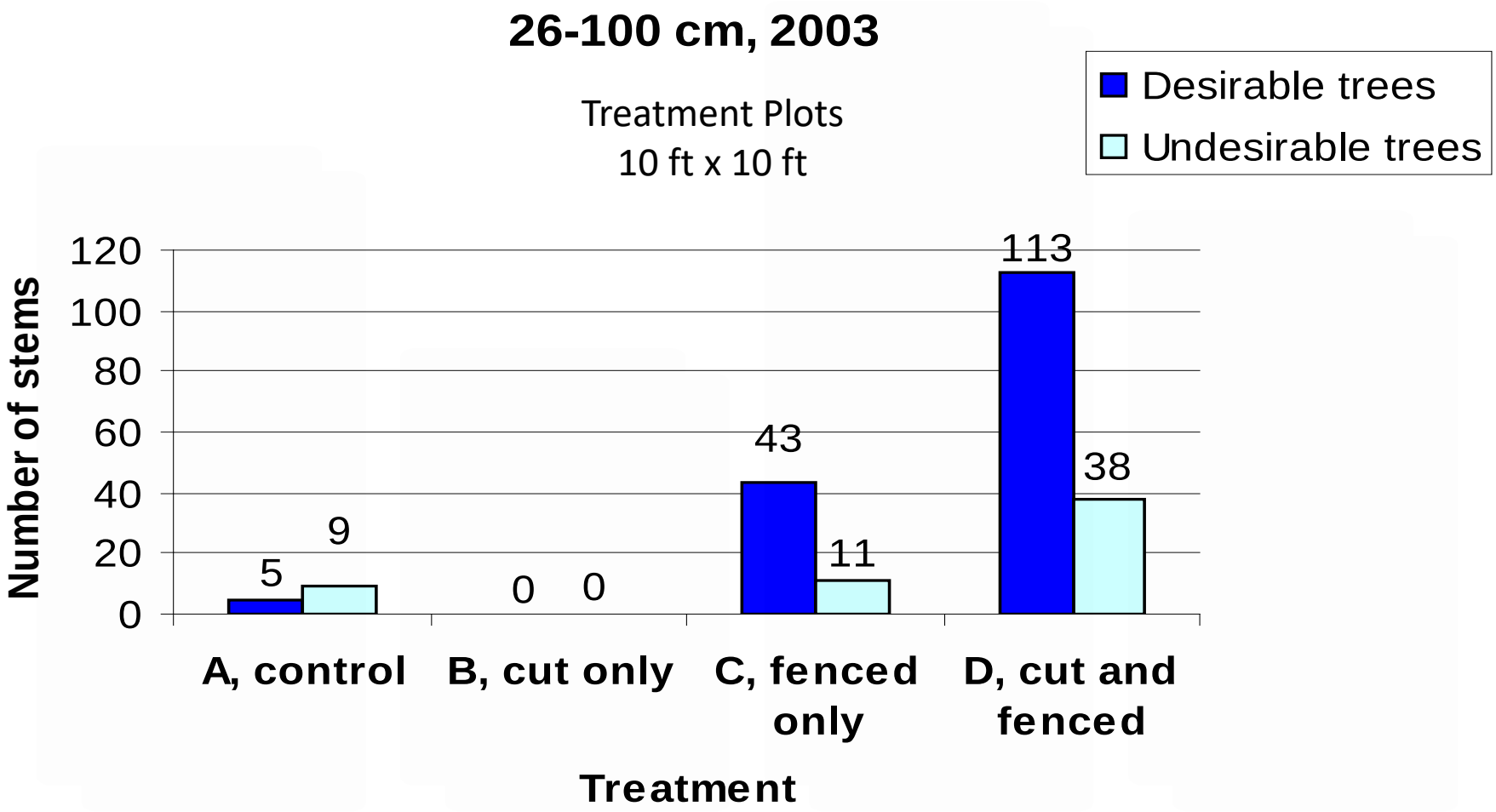


www.AVIDdeer.com A protocol to assess the impact of deer in forests (Cornell & NYSDEC)

Deer Exclosure (8 deer / sq. mi)

Paul Curtis, 9/2014. ALC

Effects of Deer + Shade



Kamprath, K., Curtis, P., and Goff, G. 2003. Summer Intern project. Unpublished data.

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Goals for Assessing Impact

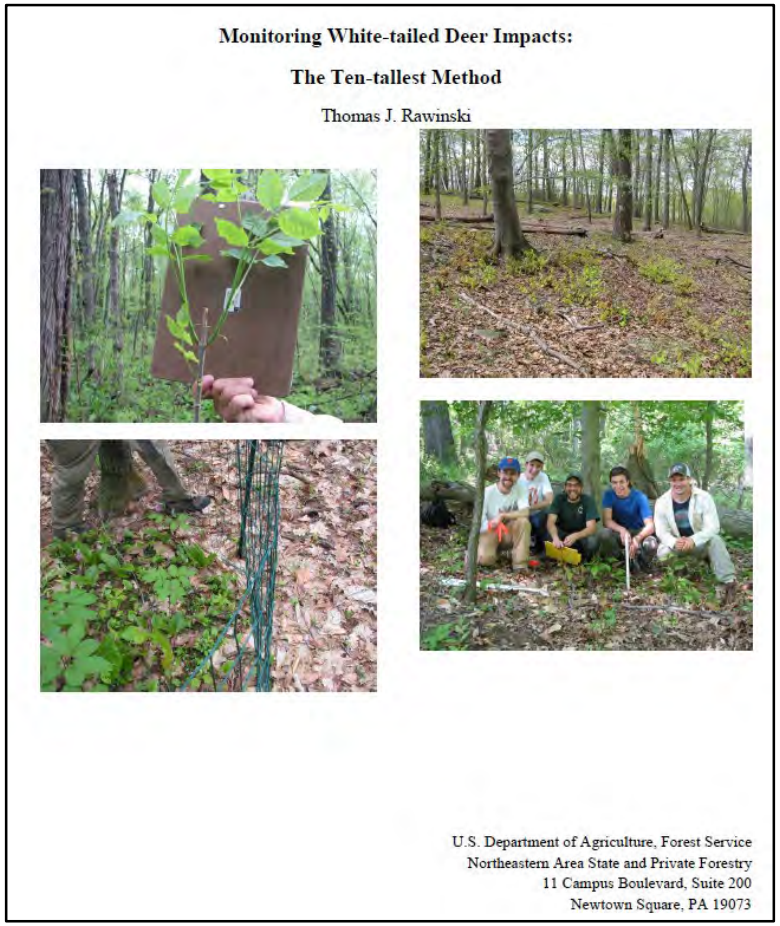
- Who's asking the question?
  - Seen the impact?
  - Perspective on deer?
- At a minimum:
  - Is there a meaningful impact?
  - Has some intervention resulted in change?

Goals for Assessing Impact

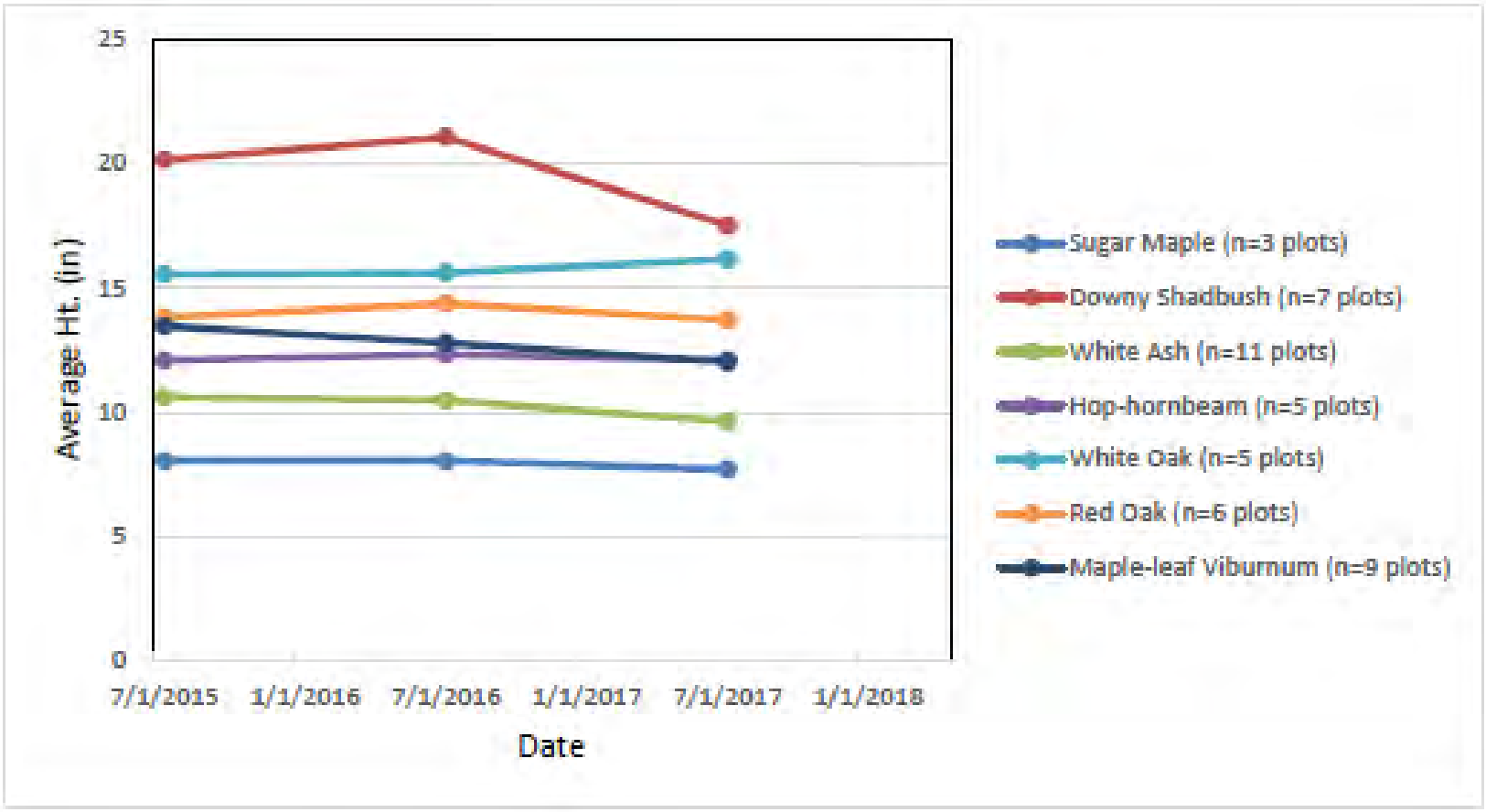
- Are deer impacts at a threshold (binary)?
- Is the assessment method calibrated to deer abundance?
- Effort and preparation to assess impact?
- Skills of those monitoring?
- Quantify the abundance of deer (relative to threshold or over time)

Ten-Tallest
(T. Rawinski)

- Use existing plants
- Annual measurements of the ten-tallest species per plot on multiple plots
- Plotless option
- Multiple species possible



Example of Ten-Tallest Summary Data

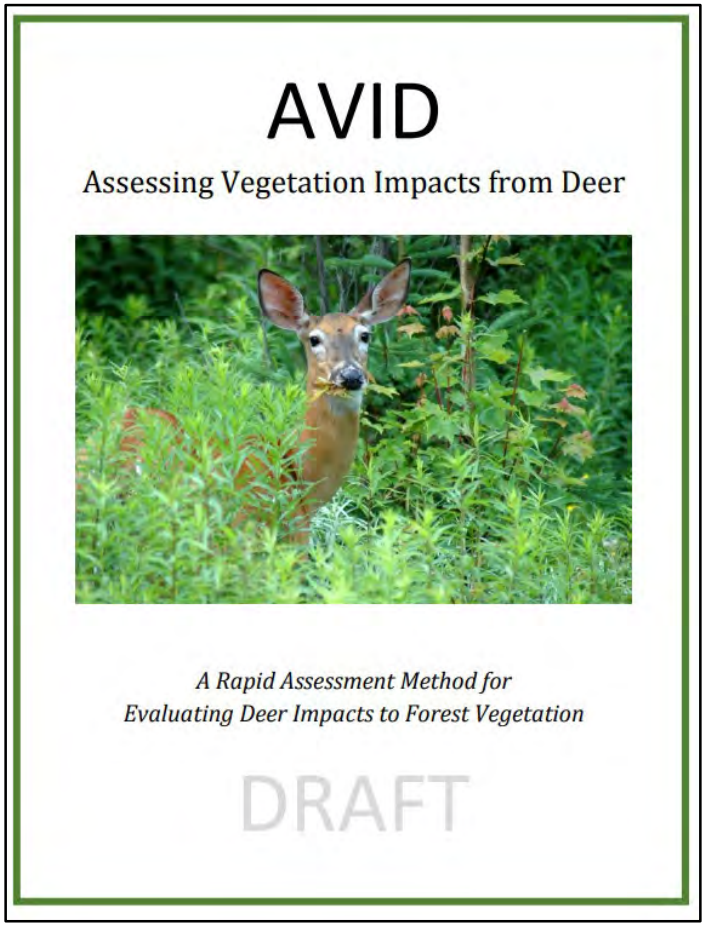


Adapted from Figure 9 from Rawinski, T.J. 2018 (draft).

http://AVIDdeer.com

(Curtis, Smallidge, Sullivan)

- Use existing plants
- Annual measurement of tagged seedlings or select herbs
- ~ 25 stems/species over an array of 6 plots
- Multiple species possible
- Population changes possible



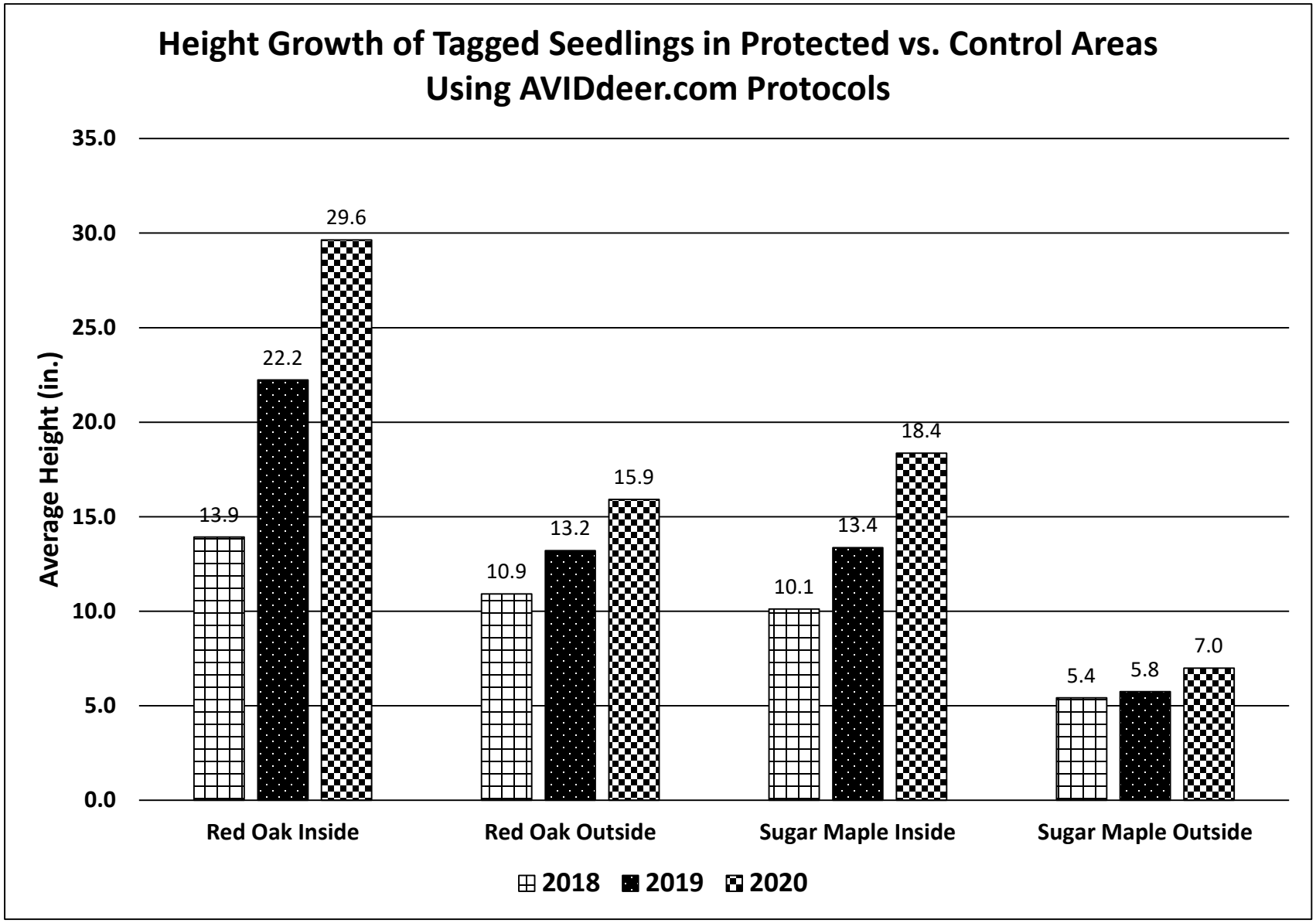
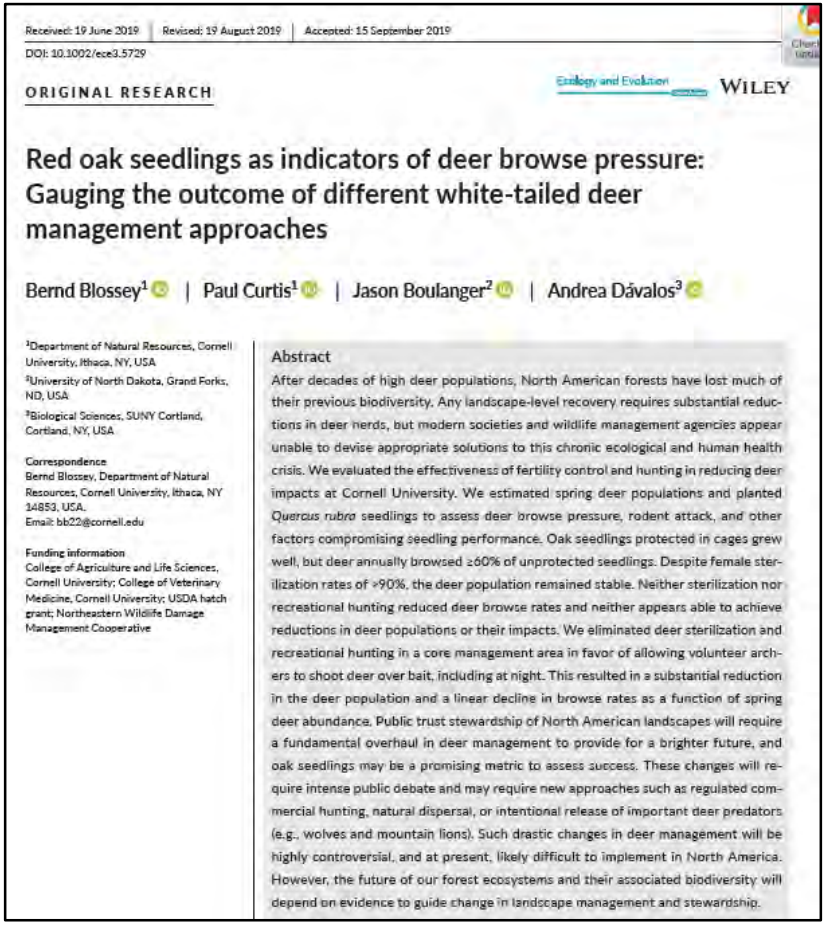


Figure x. Data from AVID plots in the "gas line" slash wall illustrate that seedling height growth rate inside the slash wall is greater than outside the slash wall. Seedling height growth inside fences inside the slash wall (data not shown) was similar to unfenced seedlings inside the slash wall. (Smallidge, Curtis, Chedzoy, Ashdown, unpublished data 2020)

Sentinel Oak

(Blossey, Curtis, Boulanger, and Davalos)

- Plant 40 containerized red oak (*Q. rubra*) seedlings. Half caged. Meander through 1 ha (2.5 acres)
- Annual height measurement and assessment of browsing
- Ensures a species of known browse preference.
- High labor and costs.
- Calibrated for deer abundance at study location.



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ORIGINAL RESEARCH

Ecology and Evolution WILEY

Red oak seedlings as indicators of deer browse pressure: Gauging the outcome of different white-tailed deer management approaches

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Abstract

After decades of high deer populations, North American forests have lost much of their previous biodiversity. Any landscape-level recovery requires substantial reductions in deer herds, but modern societies and wildlife management agencies appear unable to devise appropriate solutions to this chronic ecological and human health crisis. We evaluated the effectiveness of fertility control and hunting in reducing deer impacts at Cornell University. We estimated spring deer populations and planted *Quercus rubra* seedlings to assess deer browse pressure, rodent attack, and other factors compromising seedling performance. Oak seedlings protected in cages grew well, but deer annually browsed ≥60% of unprotected seedlings. Despite female sterilization rates of >90%, the deer population remained stable. Neither sterilization nor recreational hunting reduced deer browse rates and neither appears able to achieve reductions in deer populations or their impacts. We eliminated deer sterilization and recreational hunting in a core management area in favor of allowing volunteer archers to shoot deer over bait, including at night. This resulted in a substantial reduction in the deer population and a linear decline in browse rates as a function of spring deer abundance. Public trust stewardship of North American landscapes will require a fundamental overhaul in deer management to provide for a brighter future, and oak seedlings may be a promising metric to assess success. These changes will require intense public debate and may require new approaches such as regulated commercial hunting, natural dispersal, or intentional release of important deer predators (e.g., wolves and mountain lions). Such drastic changes in deer management will be highly controversial, and at present, likely difficult to implement in North America. However, the future of our forest ecosystems and their associated biodiversity will depend on evidence to guide change in landscape management and stewardship.

Oak Sentinel Method

- Proportion of browsed, planted red oak seedlings predictive of total number of deer (camera counts)
- Replication in other areas would presumably require new population estimates for browse intensity to predict deer abundance, but the pattern might be similar.

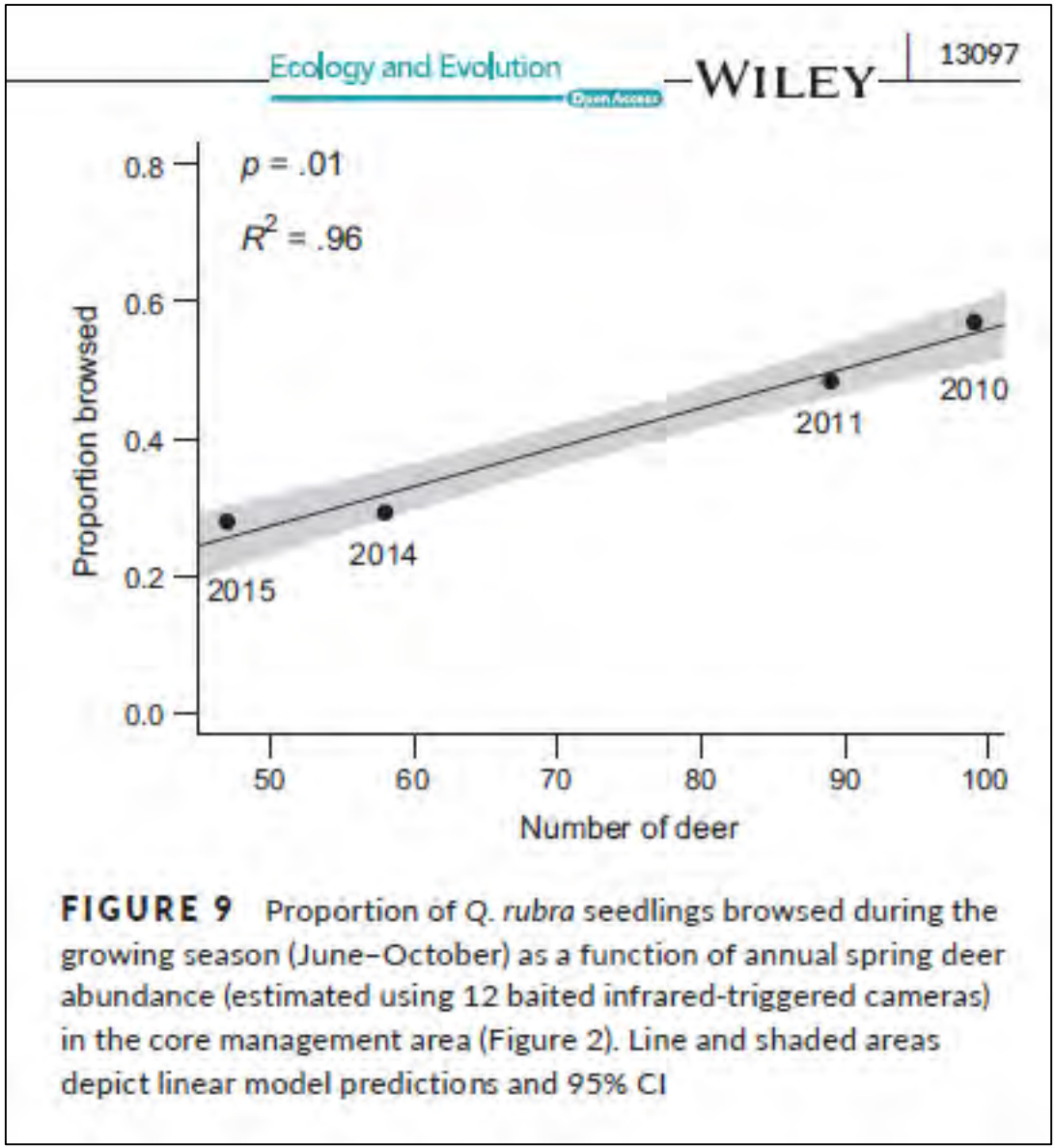

FIGURE 9 Proportion of *Q. rubra* seedlings browsed during the growing season (June–October) as a function of annual spring deer abundance (estimated using 12 baited infrared-triggered cameras) in the core management area (Figure 2). Line and shaded areas depict linear model predictions and 95% CI

Blossey et al. 2019. Ecology and Evolution vol 9
(~ 27 / mi in 2010, ~12/mi in 2015)

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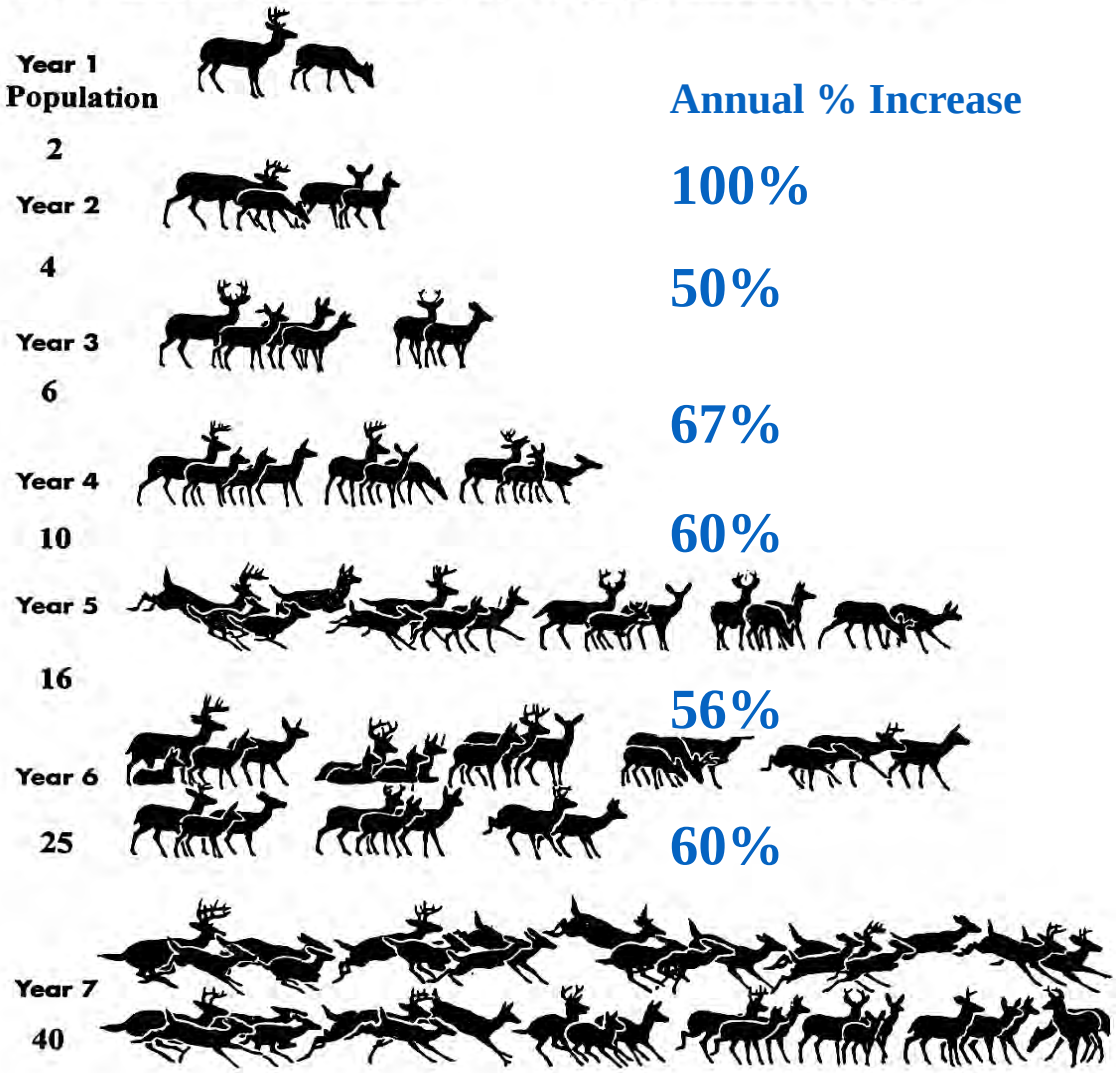
GUIDE TO URBAN BOWHUNTING

Population Dynamics of White-tailed Deer



Under conditions of NO immigration, emigration, mortality, or population growth limitation: 2 deer to 40 deer = 1900% increase in 7 yrs.

That's a 19-fold increase in 7 years, with a 1:1 sex ratio.

Bottom line:

Over ~50% of the herd must die or go elsewhere annually to stabilize herd

Slide courtesy P. Curtis & G. Goff, 2013, Farm Show

Don’t Hunters Control Deer?

- Fewer hunters
- Aging hunters
- Less aggressive
- Less time in the woods

Detroit Free Press. 21% decline in numbers of Michigan hunters 1998 - 2018. https://www.freep.com/story/news/local/michigan/2018/11/09/michigan-hunting-big-decline-deer-fishing/1924497002/

Non-lethal exclusion methods need to pay attention to:

1. Seed Source
2. Illumination
3. Protection

Deer Impact

Interfering Vegetation

Selecting a Protection Tactic

- Cost (and cost-share)
- Extent of regeneration area (acres)
- Density of stems
- Deer pressure (deer aggression; palatability)
- Maintenance
- Removal
- Visual
- Access

Cages and Tubes

$3.32 each, plus

2 yr old coppiced cherry

$4.50 each, plus

Maintenance

- Plastic tubes in full contact with soil.
- Rot resistance stakes
- Damage by deer or bear.
- Bird mesh

Brush Piles

- Slash piles restrict access of deer
- Most effective for established seedlings
- Doesn’t ensure full stocking
- “Chop and Drop”

Low Cost/Height Fence: Small Patch Openings

- Openings 0.25 – 0.33 acres
- Maple producers and woodlot owner DIY
- Two designs tested, one worked better

July 2015 – July 2020
(5 growing seasons)

- $0.52 / foot installed (T&M)
- 12” wooden batten, fender washer, 4” galvanized nail
- 12 ga wire at top
- 5’ mesh (4.5’ fence)
- Hog ring fence to wire
- Debris to weight apron

Enhancement and Maintenance

- Offset strands
  - Baling twine
  - 12 ga wire
- Monthly to quarterly check

“Inexpensive” Fence Options

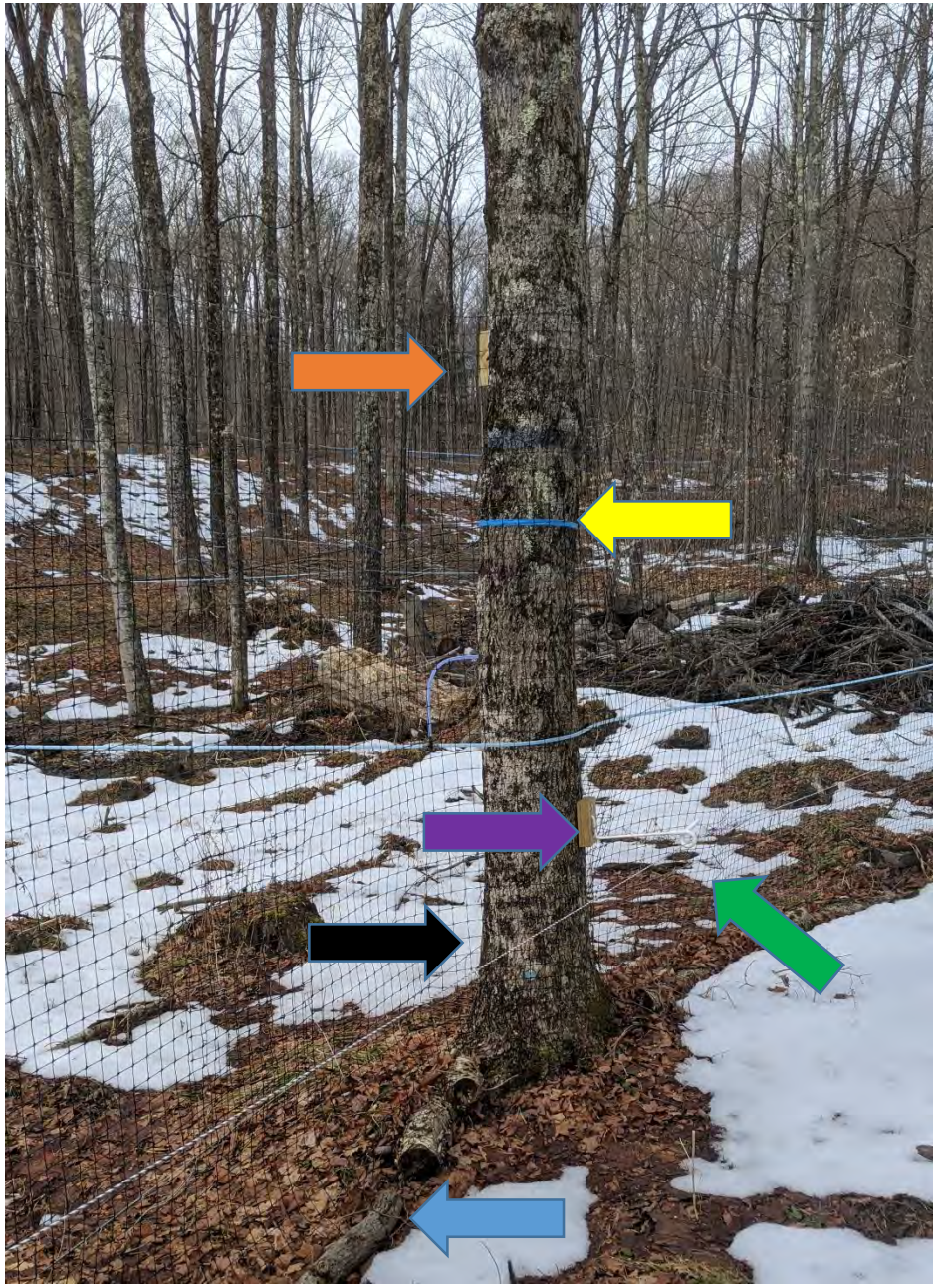
Simple Supplies

- Simple tools
- Maintenance is essential
- About $0.52 per linear foot

Moderate/Large acreage = High Fence

Fence BMPs

- Mark post trees before harvest
- Two wires (high and low)
- Apron + anchors
- External hot wire
- High fence installed
  > $3.75/ft
- Requires regular maintenance




Pennsylvania:
Fences work
Fences require:
• Install @ $4 - $6 per foot
• Regular maintenance (4 hrs/week)
• Removal @ $0.95/ ft
Photo credit: Gary Alt

Slash Walls

Progress to Date www.slashwall.info

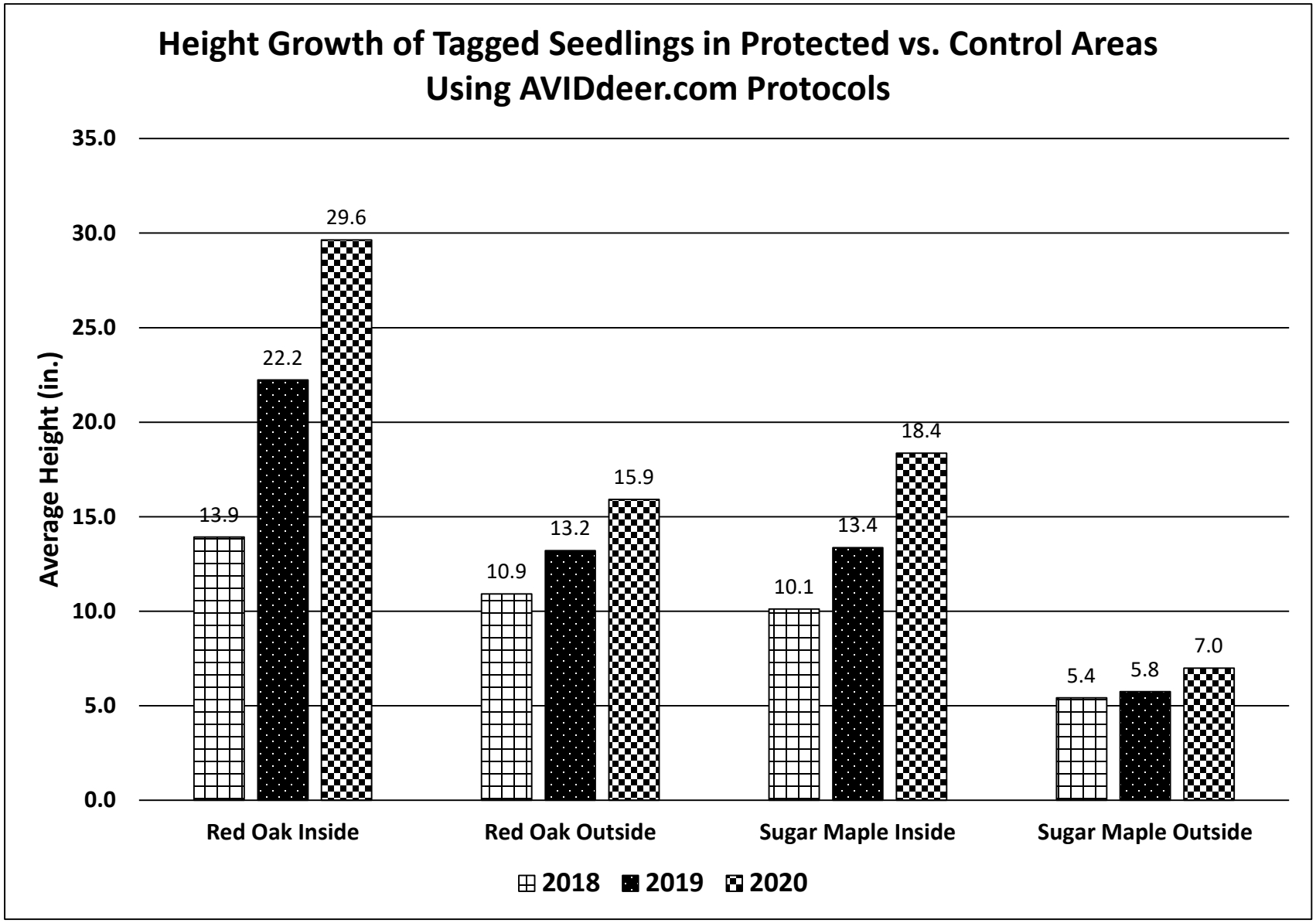
- Nine harvests of 6 – 160 acres and 51,000 linear feet completed in 2017-2019.
- *Deer impacts?*
- *Slash wall durability?*
- *Beech development?*

Slash Wall Regeneration Harvests

- Mechanized felling and windrowing
- Built from low-value stems and slash (tops) near perimeter
- Integrated cutting of all understory vegetation (“brushing”)

Contracts

- Minimum 10’ high to 3” diameter and 20’ wide, plus “sufficiently dense to exclude deer” as determined by Forest Manager
- Negotiated percentage sales
- Loggers compensated for slash wall construction and cutting the “interfering” understory vegetation



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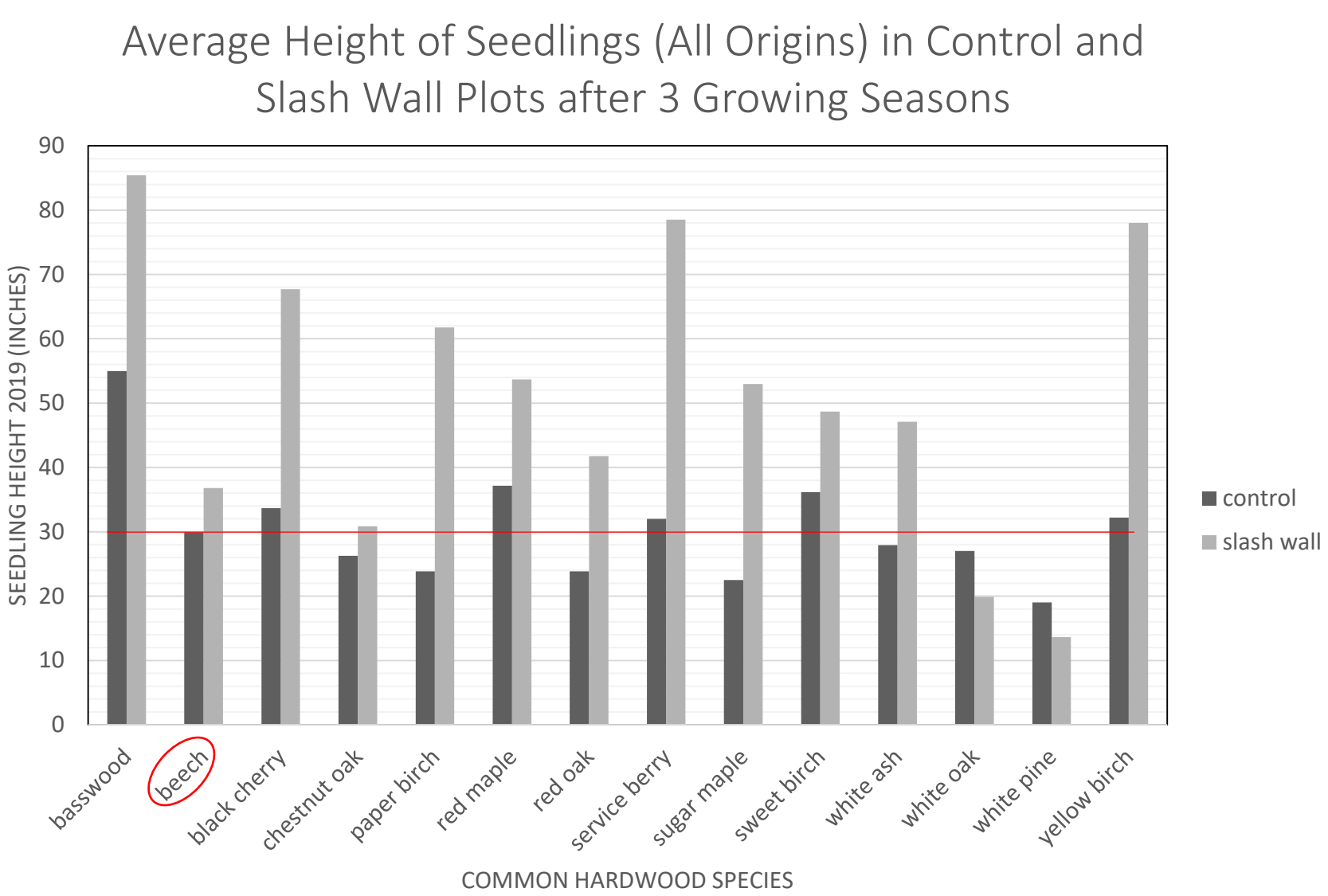

Figure 2. The total height of seedlings in the 2017 slash walls varied with controls for some species. Most species had greater height inside than outside the slash wall. Several species had better growth than beech inside the slash wall, but poorer growth than beech outside the slash wall. (Smallidge, Curtis, Chedzoy, Ashdown, unpublished data 2020)

Stocking with commercial species after 3 growing seasons in slash wall harvests. Threshold follows SILVAH (> 5775 stems/ac if less than 1 ft)

Plot Type	# plots	% stocked: < 1 ft tall	% stocked: 1 – 4.5 ft, free to grow	% stocked: 4.5 ft – 9 ft, free to grow
Control	79	41	48	0
Perimeter	39 (74)	85	36	5
Interior	48 (94)	98	36	7

Wall Construction

- Construction costs $0.80 to $1.88/foot (average $1.47/foot)
- 30 tons per 100 feet
- 15 – 20 tons >6” dia per 100 feet ($0.75/ft)
- $1.50/ft (time and machine)
- < $0.75/ ft (wood)
- Little to no maintenance

Wall Slumping

- Design specs:
  - 10 ft wide (now 20 ft)
  - 10 ft (now to 3” diam stem)
- Constructed
  - 22’ – 26’ wide
  - 8’ tall
- 25% - 30% slump after 3 seasons

Lessons Learned

- Crew needs to “buy in”
- Mechanized, not “hand” felling
- Negotiated, not bid sales (might change)
- Logger learning curve
- Prioritize low-grade into wall
- Avoid acute corners
- Anticipate future wall and harvest locations

What's Next?

- Seedling stocking, height growth, and stand development
- Forecasting wall supply zone
- Sequence of silvicultural operations
- Wall functional longevity
- Economic metrics
- New locations and crews (RI, NY, CT, MA)
- www.slashwall.info

… and Extension!

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Photo by RJ Andersen, CCE Media