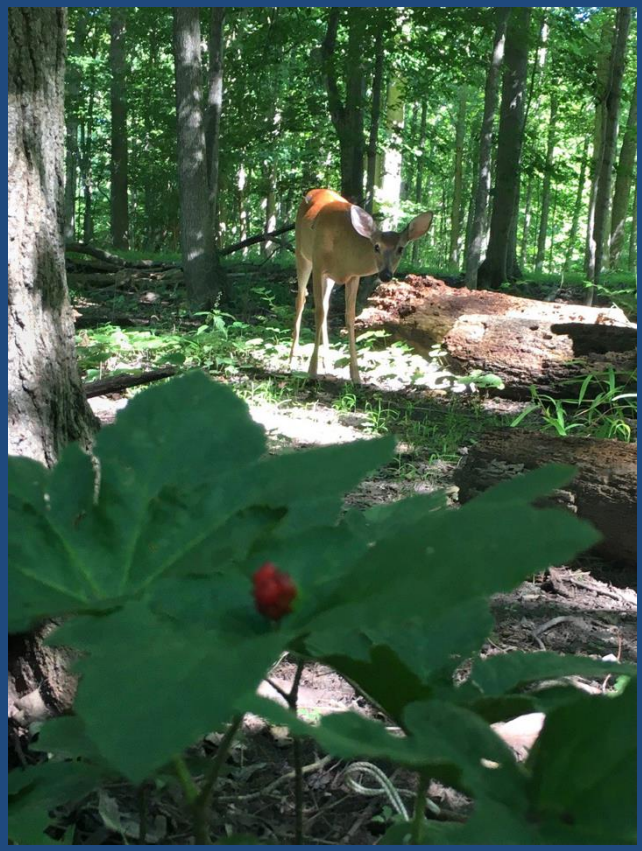
Impacts and Interactions: Deer and Southfield's Ecosystems



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· ECOLOGICAL MONITORING · CONSULTING · WRITING ·

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Overview

- Deer impacts on plant communities
  - Background
  - Research findings in Southfield
  - Implications
- Deer vs. other threats
- Options for managing deer impacts

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Direct effects: deer eat and damage plants in other ways

- Deer are generalist browsers that damage or remove plant parts, whole plants, flowers, & fruits (consumptive effects)

Antler rubs

Browsing

Trampling & bedding

Direct impacts on individual plants

- Mortality
  - Outright: plant uprooted, broken off, mostly browsed
  - Delayed: browsing reduces resources, increases susceptibility to drought, disease, pests
- Reduced growth (slow to none)
  - Prevent tree saplings from escaping “molar zone” 0.5–1.5 m (observed: 0.05–2.25 m)
  - Forest regeneration declines
- Reproduction reduced or prevented
  - Fewer flowers, fruit produced

Impacts on individuals lead to impacts on populations, species

- Reduced growth may delay reproduction
  - e.g., spring flora spp. need 7–15 years to bloom
- Reduced flowering may lead to reduced pollination, fruit set (density effects)
- Reduced fruiting, fruit predation may lead to population declines, local disappearance
- Species range may decline

By directly affecting plants, deer indirectly affect other species

- Communities or food webs including multiple interacting species
- Deer browsing can affect
  - Flowers for pollinators
  - Fruit for birds, small mammals
  - Food (leaves, fruit) for insects that birds eat
  - Web sites for spiders that birds eat
  - Nest sites for forest birds
- Ecosystems (nutrient and water cycling)

Various songbird species eat ants, bees, spiders that rely on plants that deer eat

Stock photos from internet sources

Community & ecosystem impacts harder to assess

- "Non-consumptive effects" like soil compaction, reduced vegetation affects microclimate—plants more susceptible to drought
- Disturbed soil: seed sites for weeds; erosion
- Deer disperse seeds—but often weeds, invasive species
- Nutrient addition, pH changes; alters N cycling

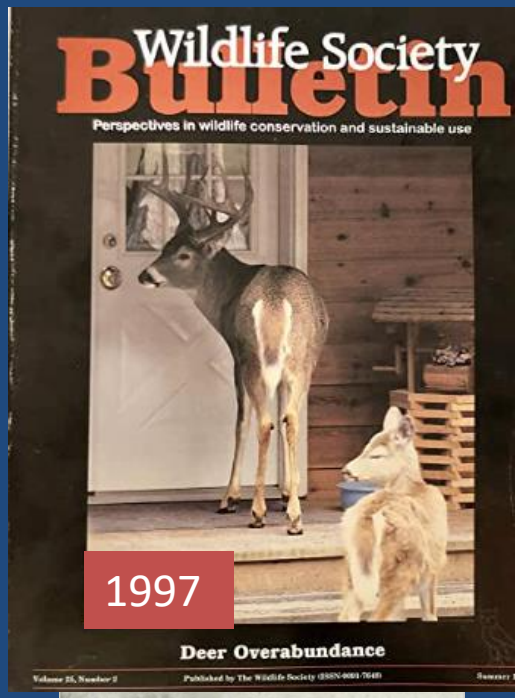
Nutrient addition

Soil disturbance

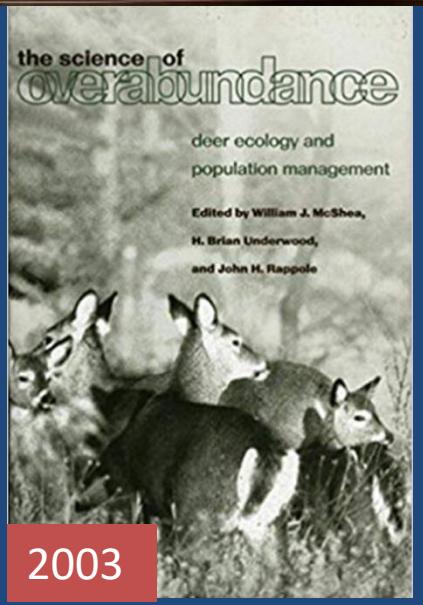
Soil compaction

Many studies have found deer impacts on forest plants

- Declining tree regeneration
- Decreased native shrub, wildflower diversity, abundance, flowering, reproduction
  - 85% of forest biodiversity is in species other than trees!
- Declines of sensitive species (orchids, trilliums, others)



1997



2003

Waller & Alverson 1997, Rooney 2001, McShea et al. 2003, Rawinski 2008, Frerker & Waller 2014, Pendergast et al. 2016, Averill et al. 2017, Waller et al. 2017

Deer affect forest food webs

- Declines in forest arthropods (affects birds)
- Altered food, habitat, nesting sites for birds; songbird declines
- Seed dispersal of invasives (including long-distance transport)
- Increase in invasives with differential herbivory or recovery can further affect habitat

DeCalesta 1994; Waller & Alverson 1997, Rooney 2001, Rawinski 2008, Frerker & Waller 2014

Overview

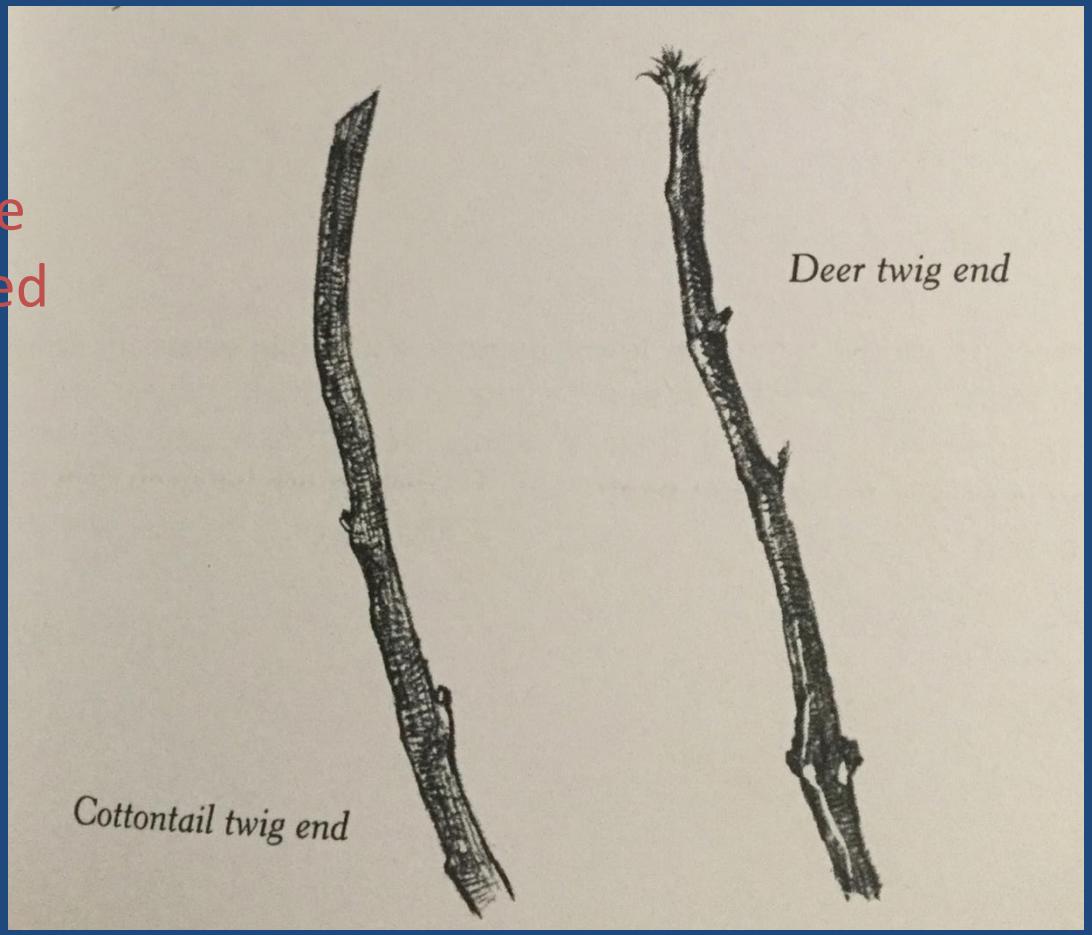
- Deer impacts on plant communities
  - Background
  - **Research findings in Southfield: How deer are affecting…**
    - **Trees**
    - **Wildflowers?**
    - **Rare species**
  - Implications
- Deer vs. other threats
- Options for managing deer impacts

How are deer affecting trees and shrubs in Southfield parks?

- Preliminary browse damage survey 2017
- Experimental study 2018–19
  - Red oak seedlings grown from MI acorns
  - 24+ seedlings transplanted into each of 5 parks
  - Seedlings tagged, monitored for deer damage 3–4 times during year
  - Offers standardized way to compare impacts
- Permanent plots to track tree growth, 2018–19

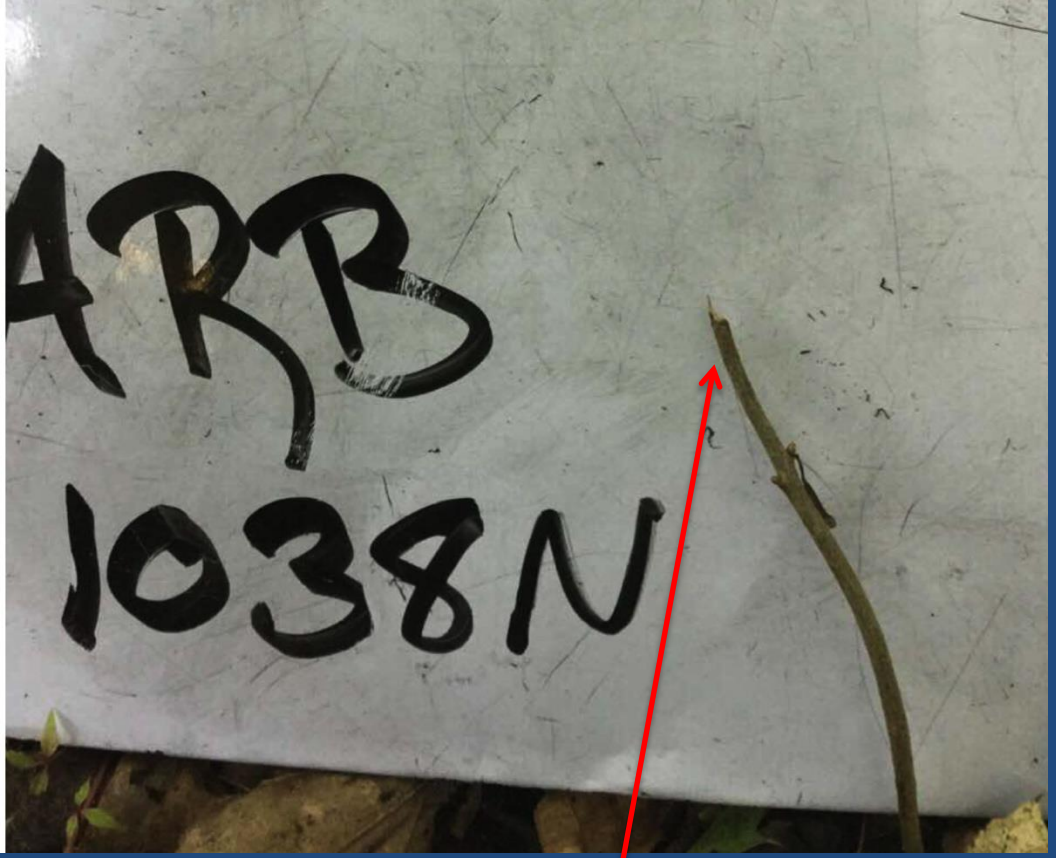
How do we know it's deer browse?

Rabbit, woodchuck: Incisors leave cleanly angled mark, 45°

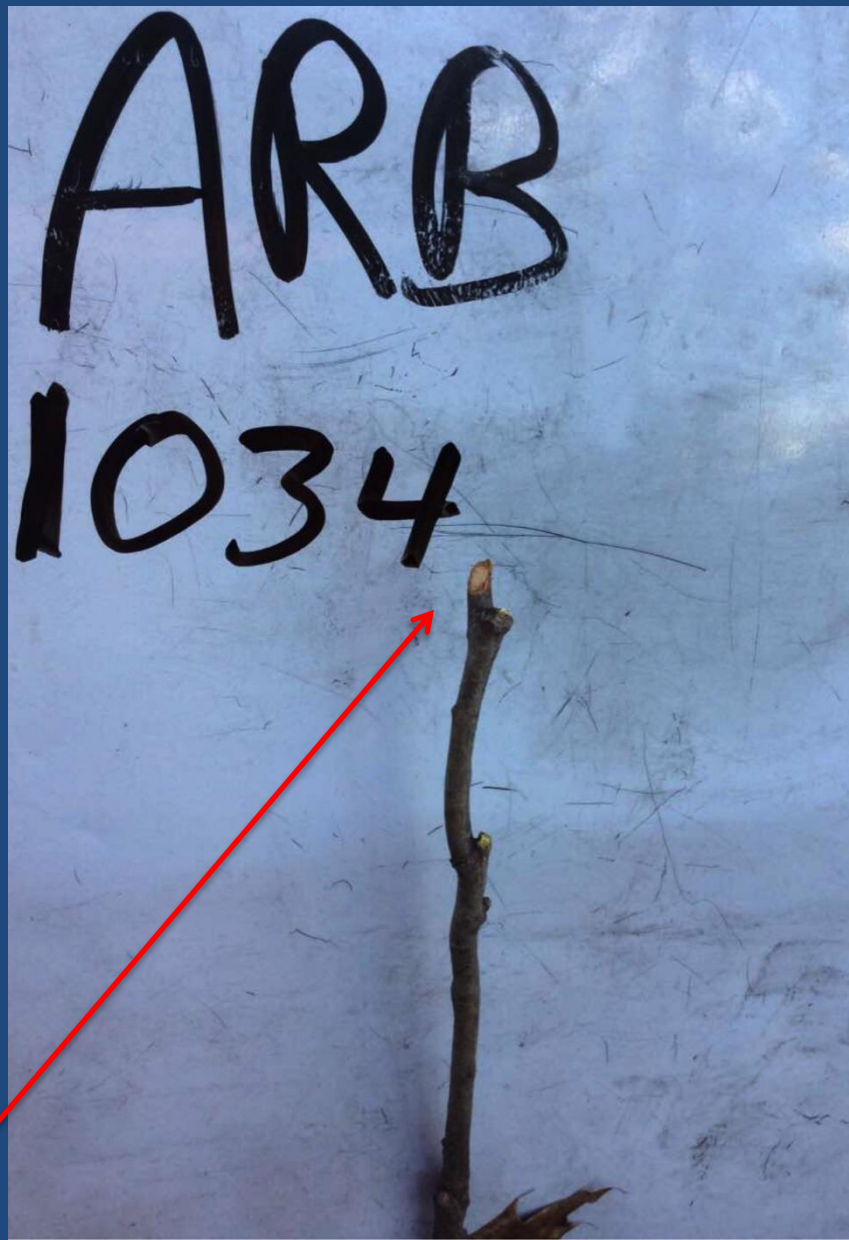


Deer: Lack incisors; edges are shredded, not cleanly angled; edge often crimped

Also squirrels, chipmunks, voles, mice

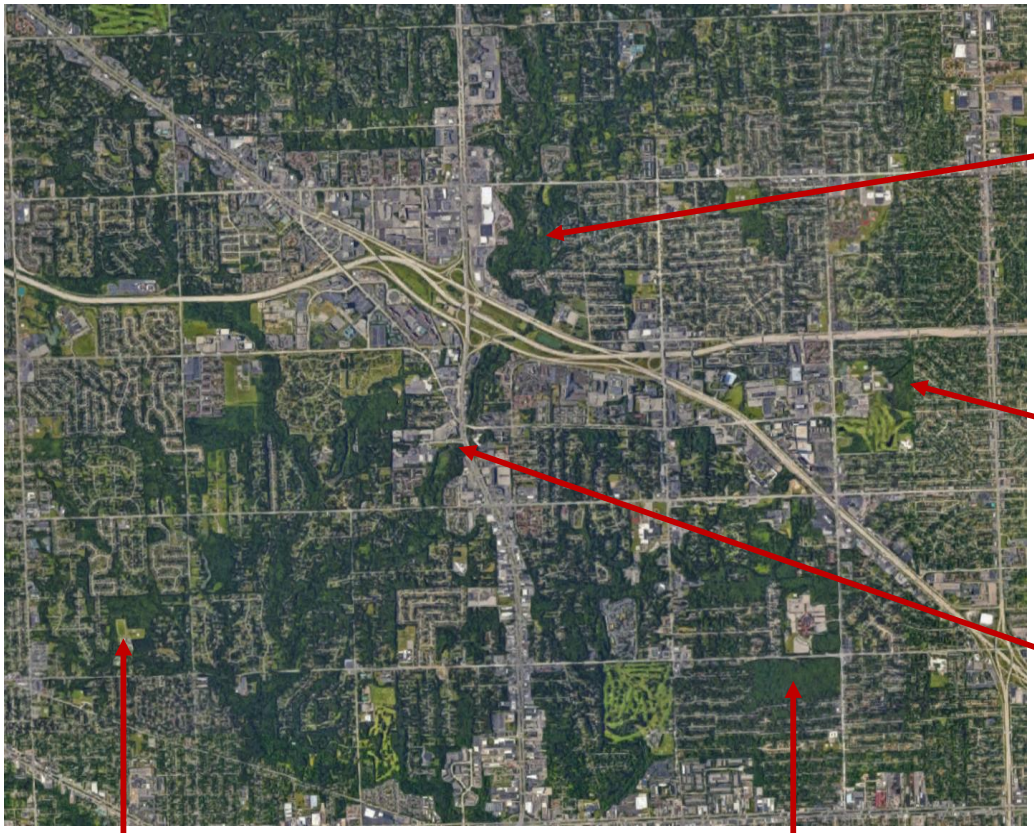


Deer browse: shreddy



Rabbit browse: angled

2017 browse damage surveys



Berberian Woods
- 88% of woody plants browsed by deer
- 72% have half or more branches damaged
- Sensitive species: Bladdernut
  - 100% of stems browsed
  - 96% have half or more branches damaged
  - 20% show signs of dieback
  - 22% dead

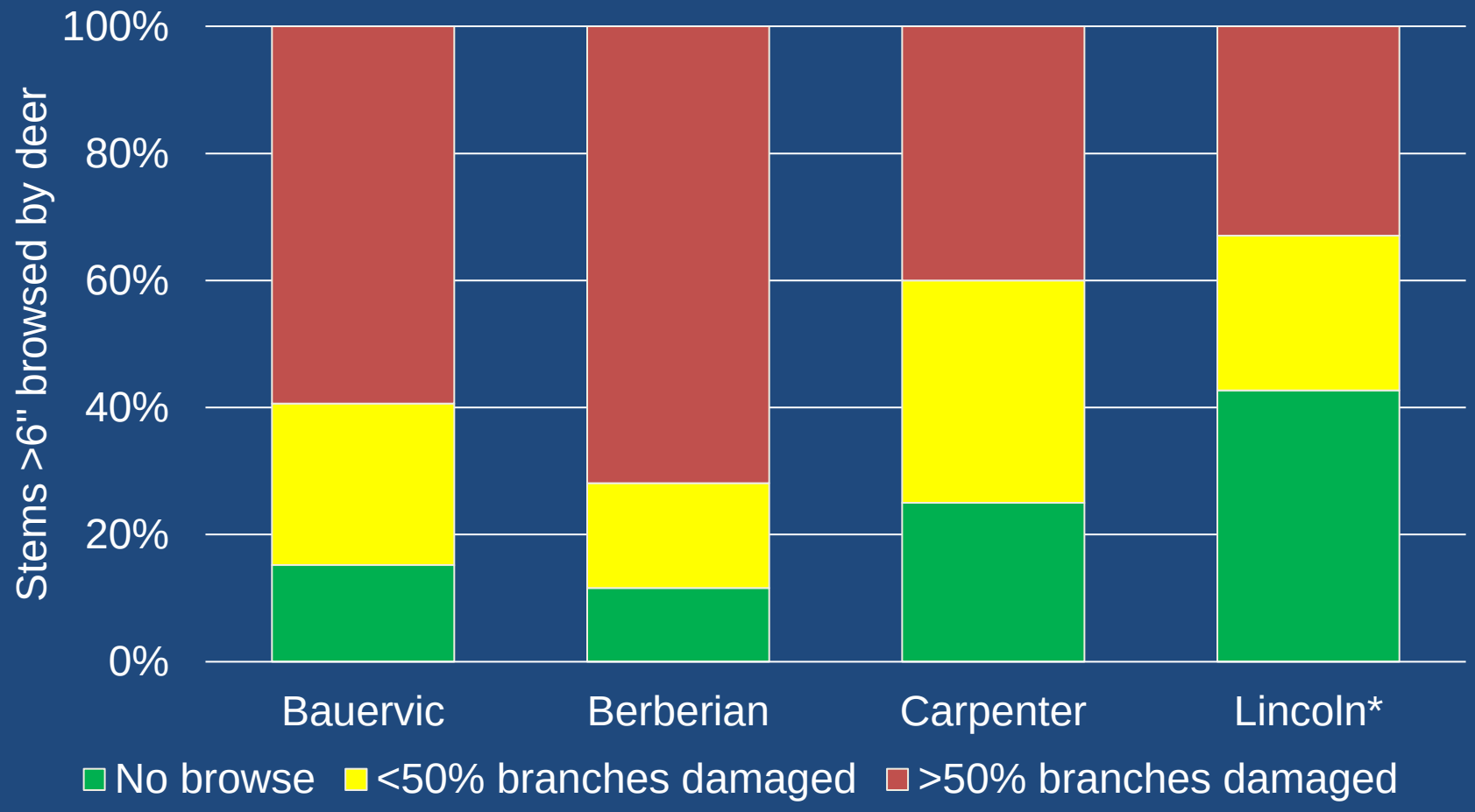
Lincoln Woods
- 57% of woody plants browsed by deer
- 33% have half or more branches damaged
- 15% show signs of dieback

Valley Woods
- 88% of shrub stems deer browsed

Carpenter Lake
- 75% of woody plants browsed by deer
- 40% have half or more branches damaged
- 23% show signs of dieback

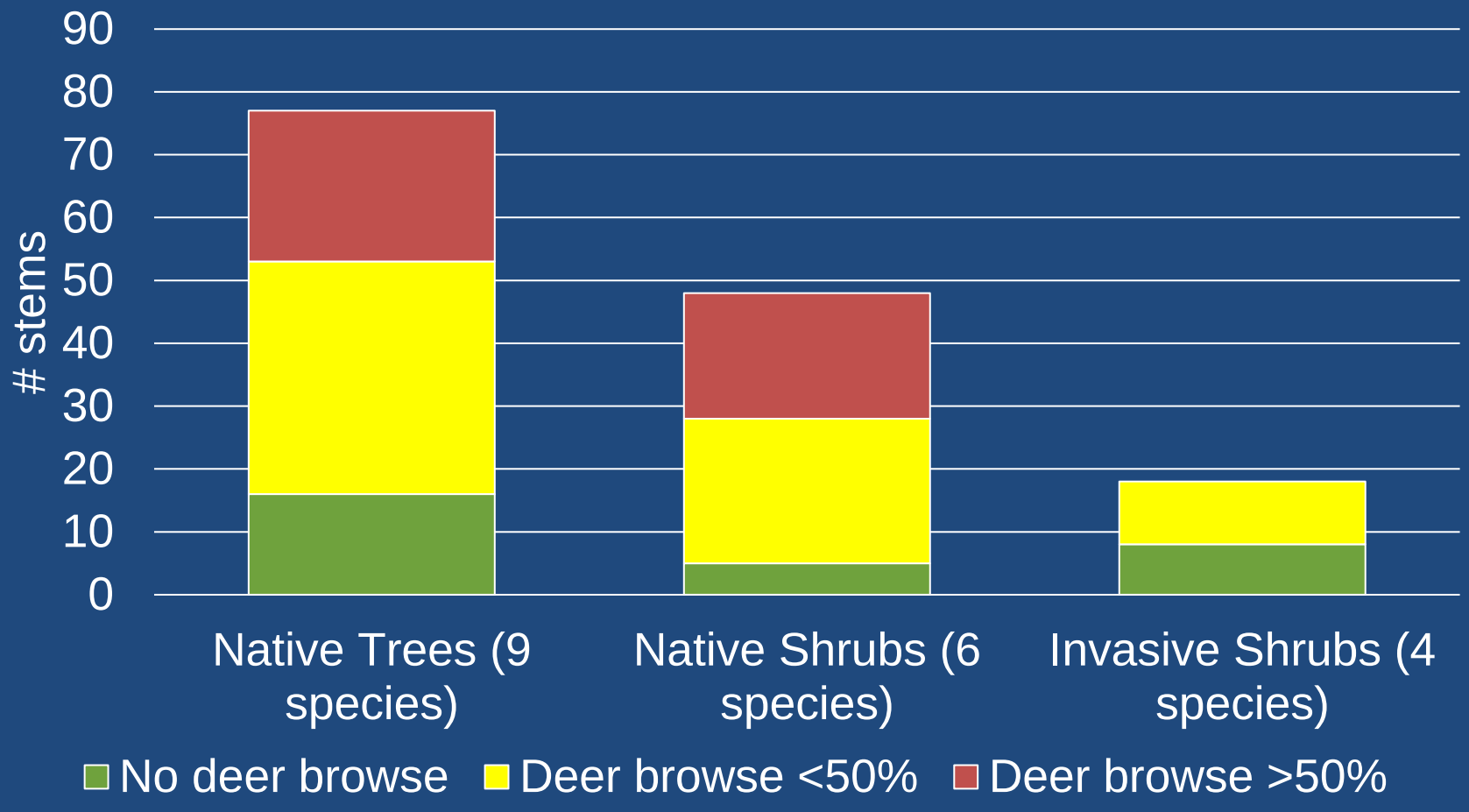
Bauervic Woods
- 85% of woody plants browsed by deer
- 59% have half or more branches damaged
- 39% show signs of dieback

Deer browse on trees and shrubs in the “molar zone” (6” to 6’)

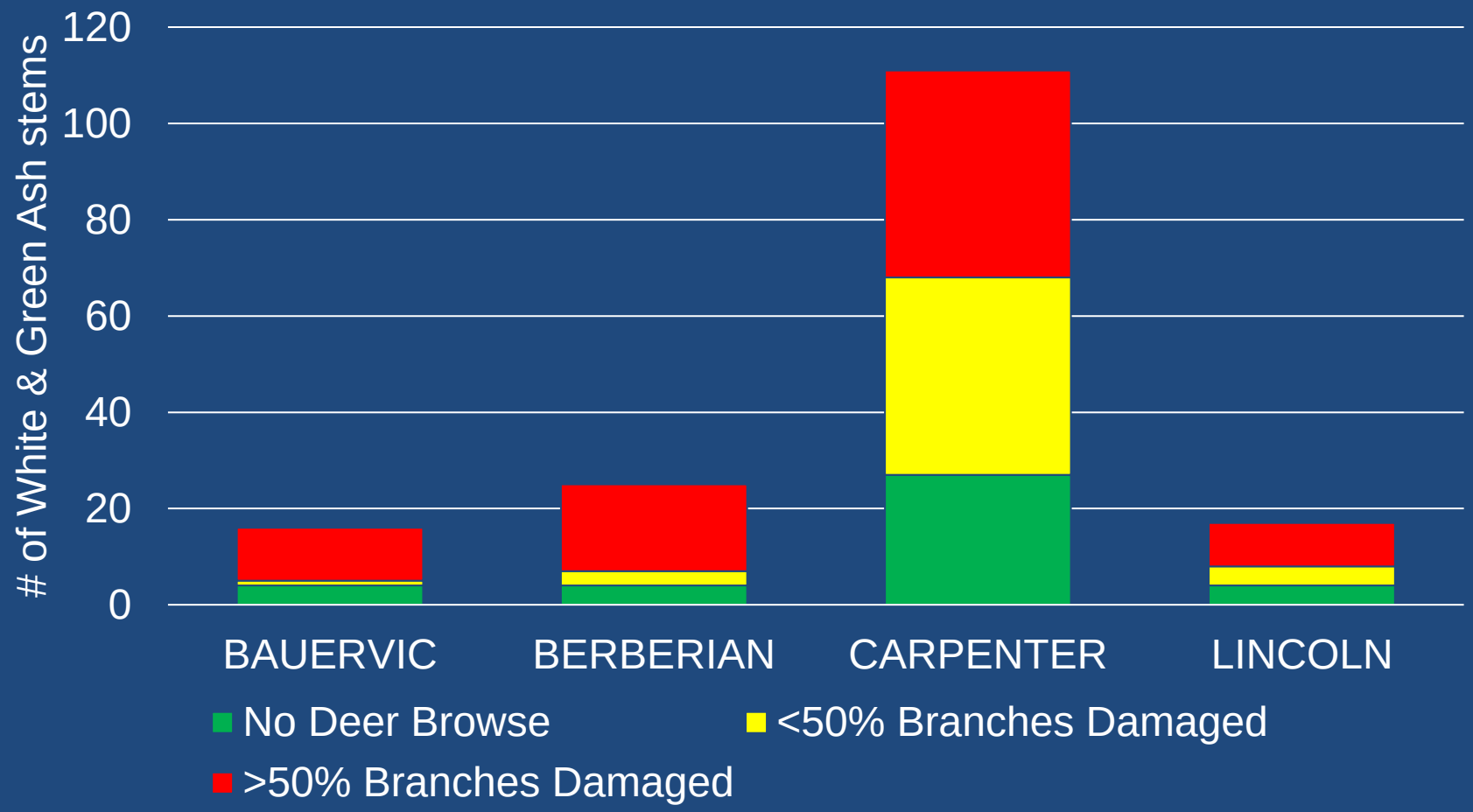


Damage to >50% of branches significantly increases mortality risk

Bauervic (175 stems)

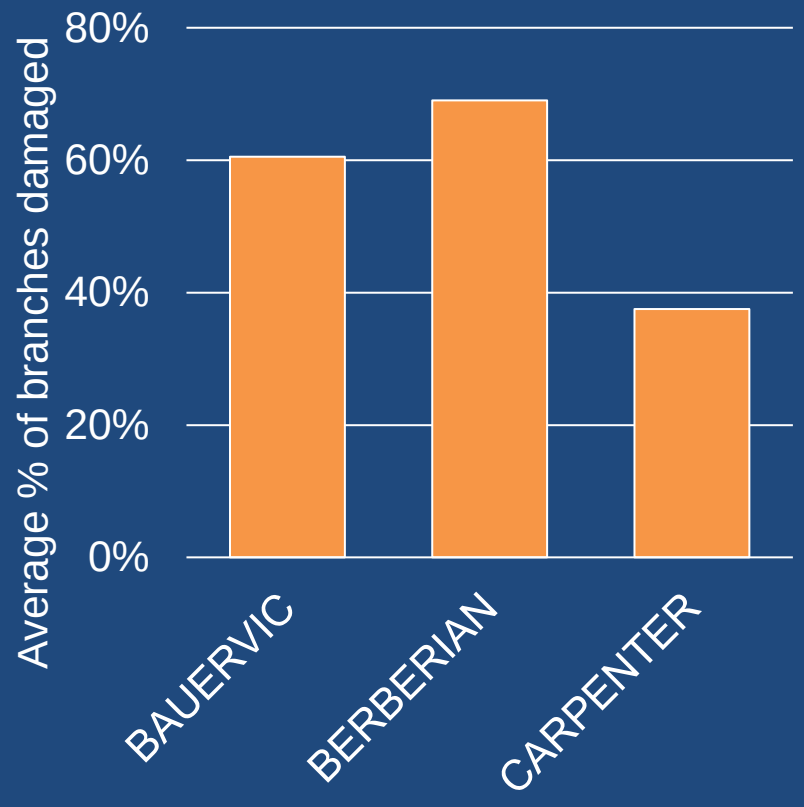


White and Green Ash (found in all parks)

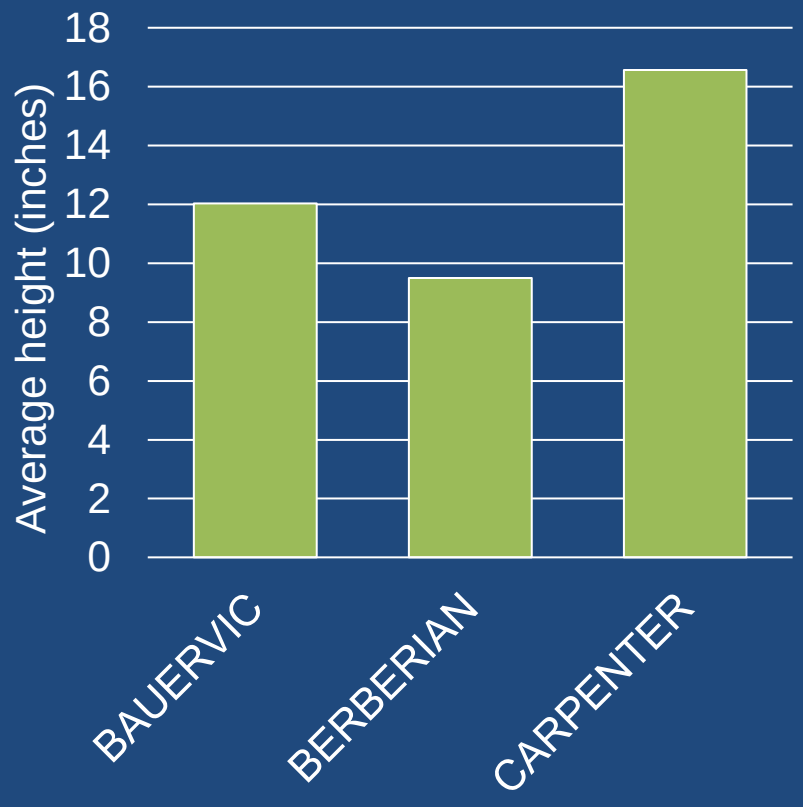


Intense browsing reduces ash seedling/sapling size

Browse intensity (% damaged)

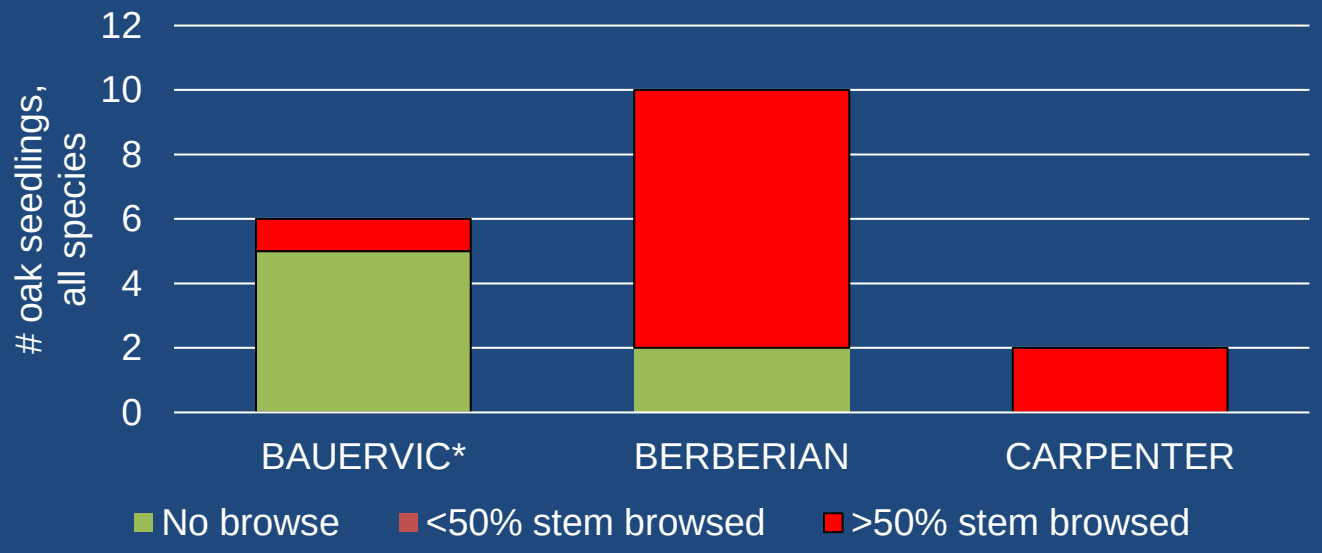


Plant height



What about oaks?
Seedlings rare, mostly deer browsed

742 square meters assessed; 1041 woody plant stems examined: just 19 oak seedlings

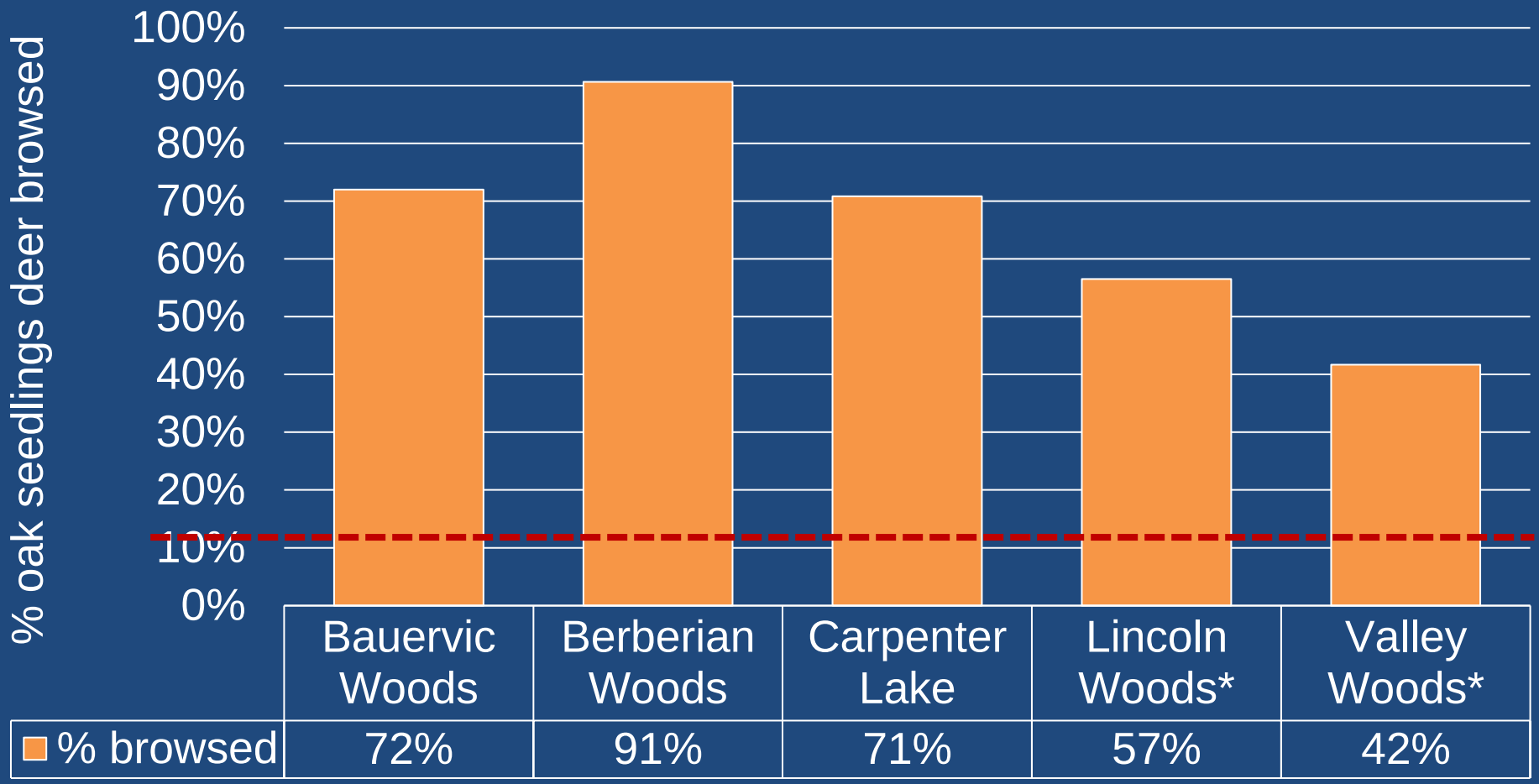


* Unbrowsed seedlings all <8”

Different oak species common to dominant in these forests, providing food for over 400 species of insects—which in turn feed birds.

Red oak experimental seedlings 2018–2019

Deer browse at all sites was >15%...



…the level over which oak regeneration is likely to fail (Blossey 2017)

How are deer affecting wildflowers?

- Trillium
- False Solomon's seal
  (False spikenard)
- Doll's-eyes
- Bladdernut

Why study deer impacts on trillium?

- Previous local studies, A2 observations of impacts
- Useful browse indicator
  - Decreased height (Anderson 1994)
  - Flowering rates <30% suggested as indicator that deer impacts are too high (Pavlovic 2014)
  - Observational & demographic modeling studies: browse rates >10–15% lead to decline

    (Knight et al. 2003, 2004, 2009; Rooney & Gross 2003)

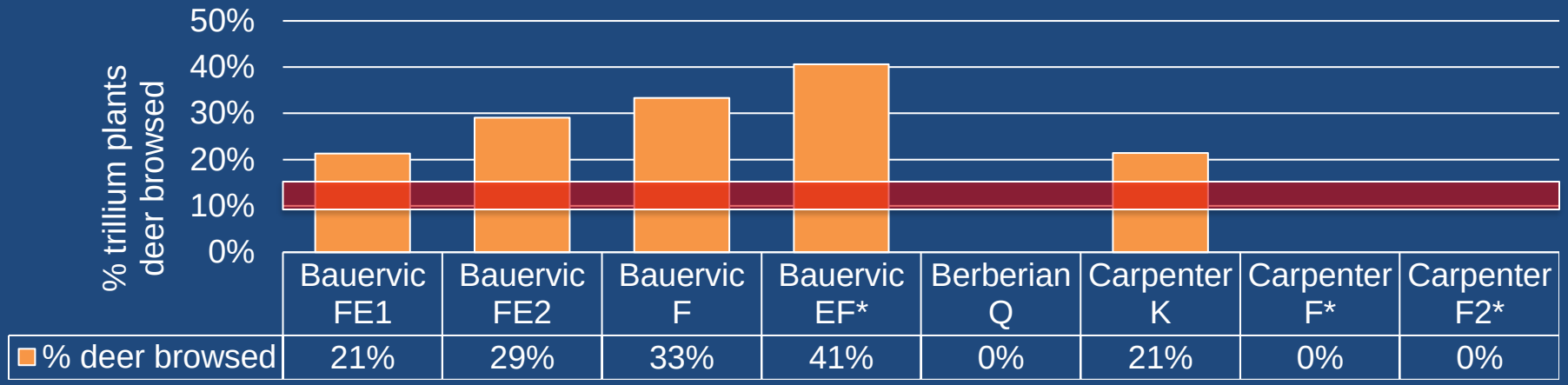
Hard to see absence

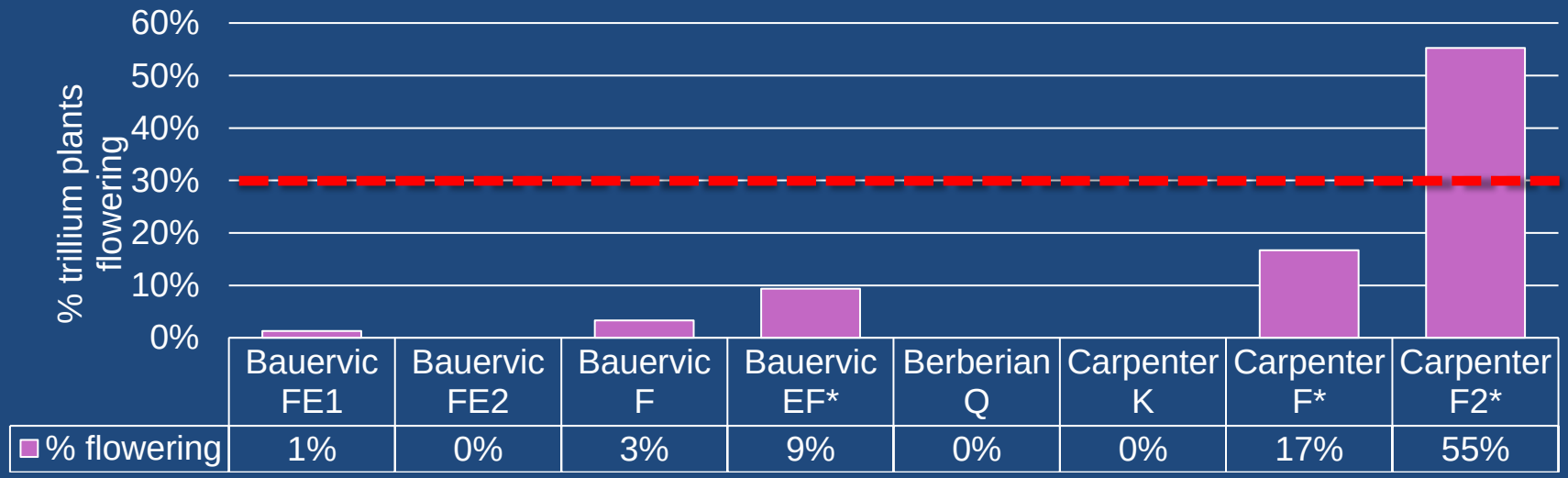
Unbrowsed: 12

Browsed: 27 stems + 1 leaf

According to other studies…

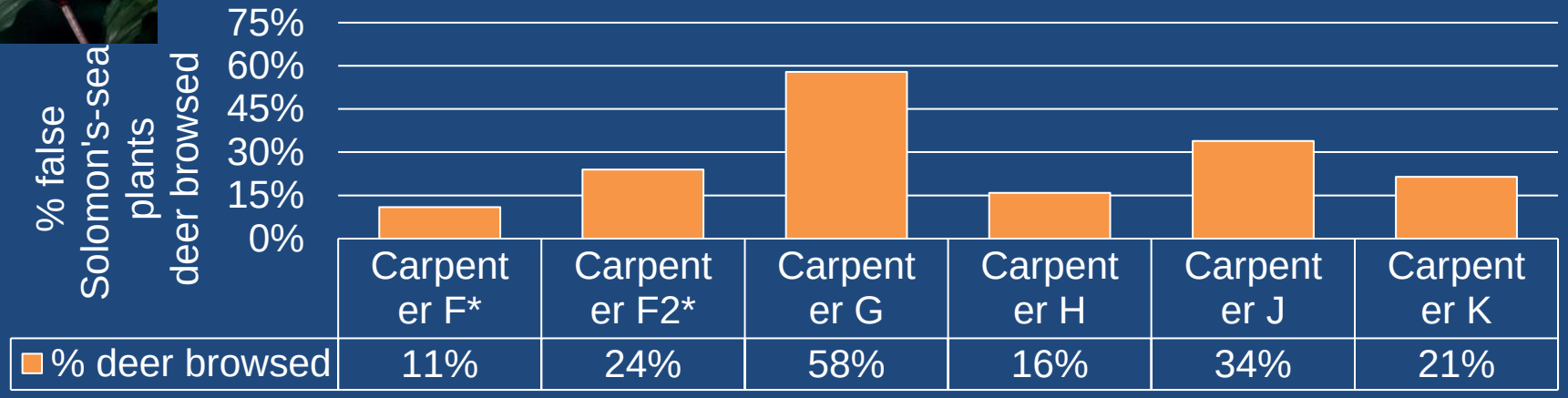
Deer browse rates >10-15% likely to lead to population declines

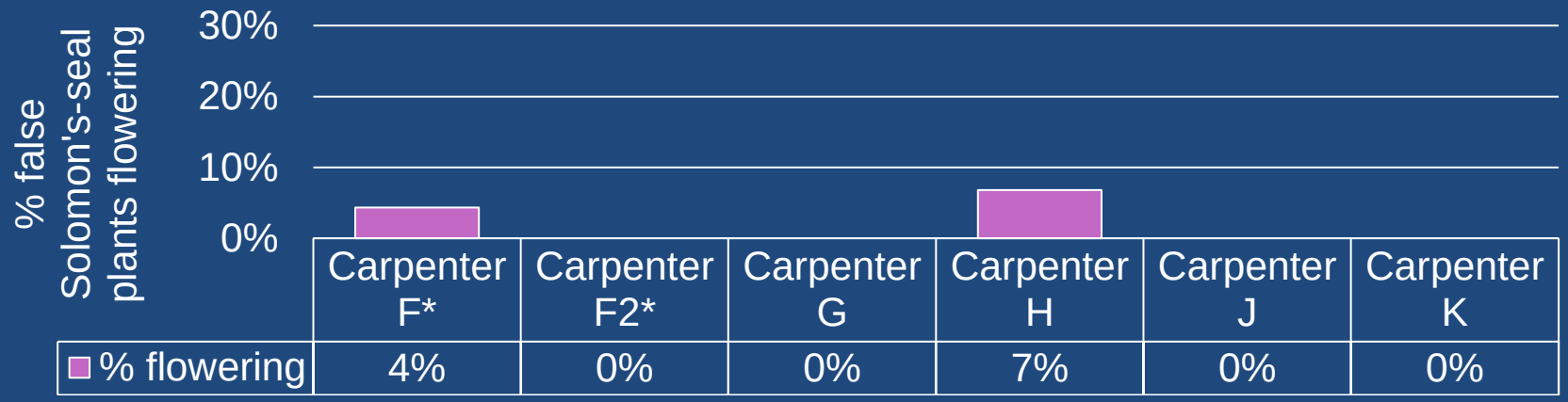




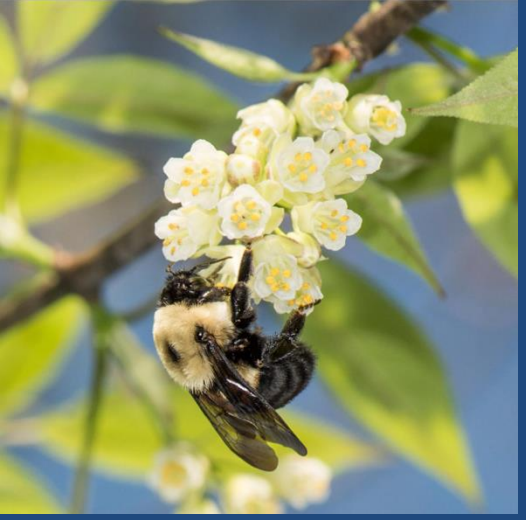
Flowering rates <30% suggest the need for deer management

High rates of deer browse are correlated with low rates of flowering

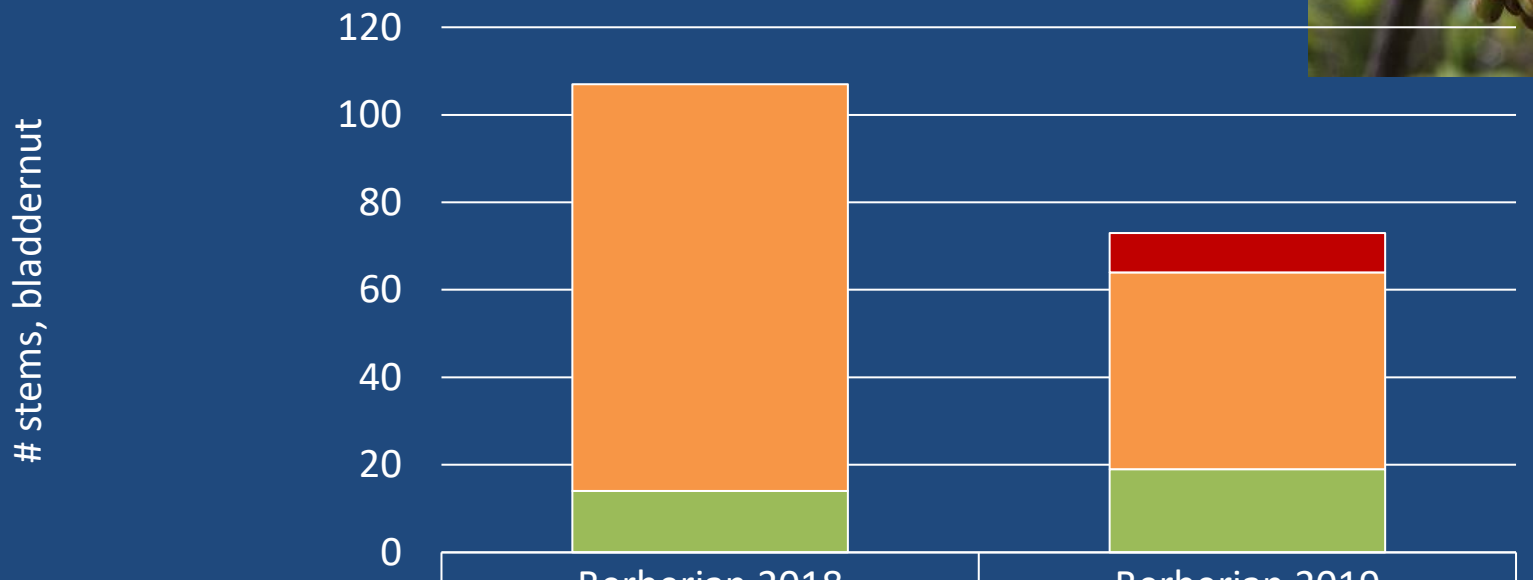




- 31 of 37 deer browsed (2018); only 11 fruits remaining (compared to 66 on 3 sheltered plants)
- 7 of 7 plants deer browsed (2019), but late in season so others might have died back



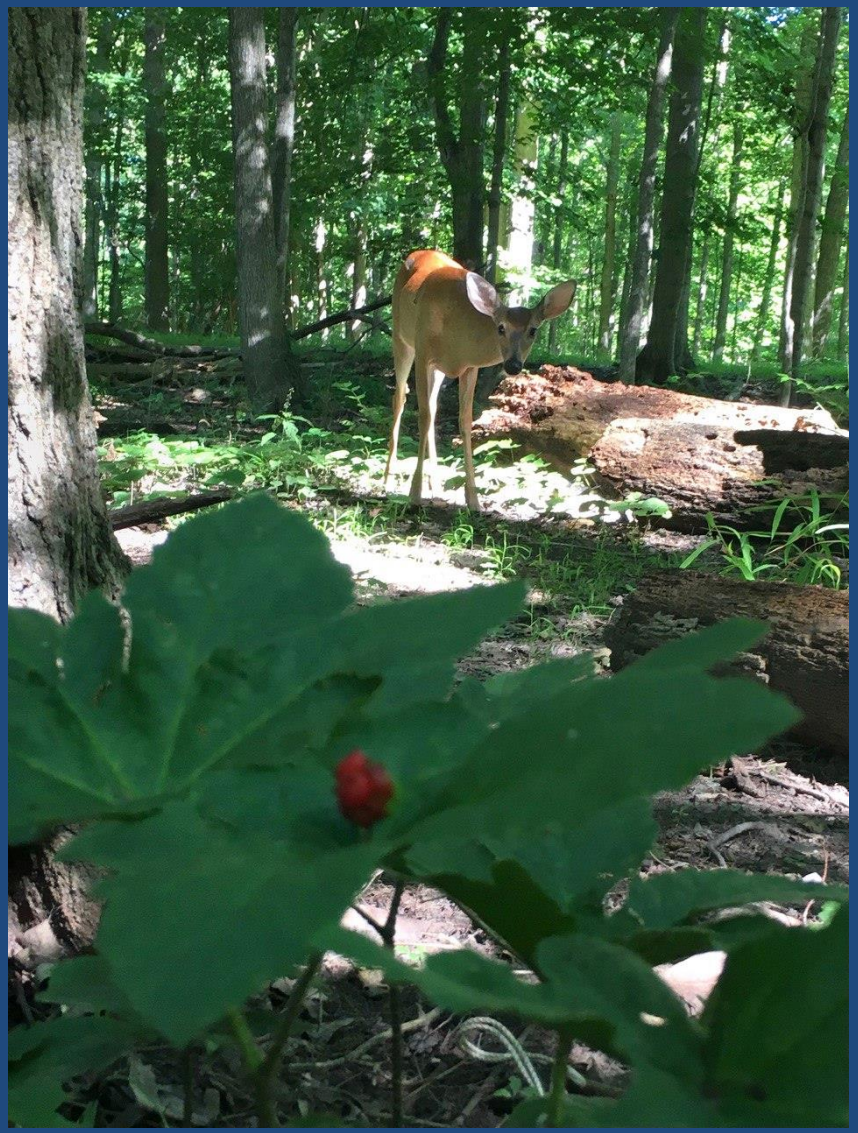
Bladdernut
(A bee-loved shrub)



	Berberian 2018	Berberian 2019
# dead (after browse)		9
# deer browsed	93	45
# unbrowsed	14	19

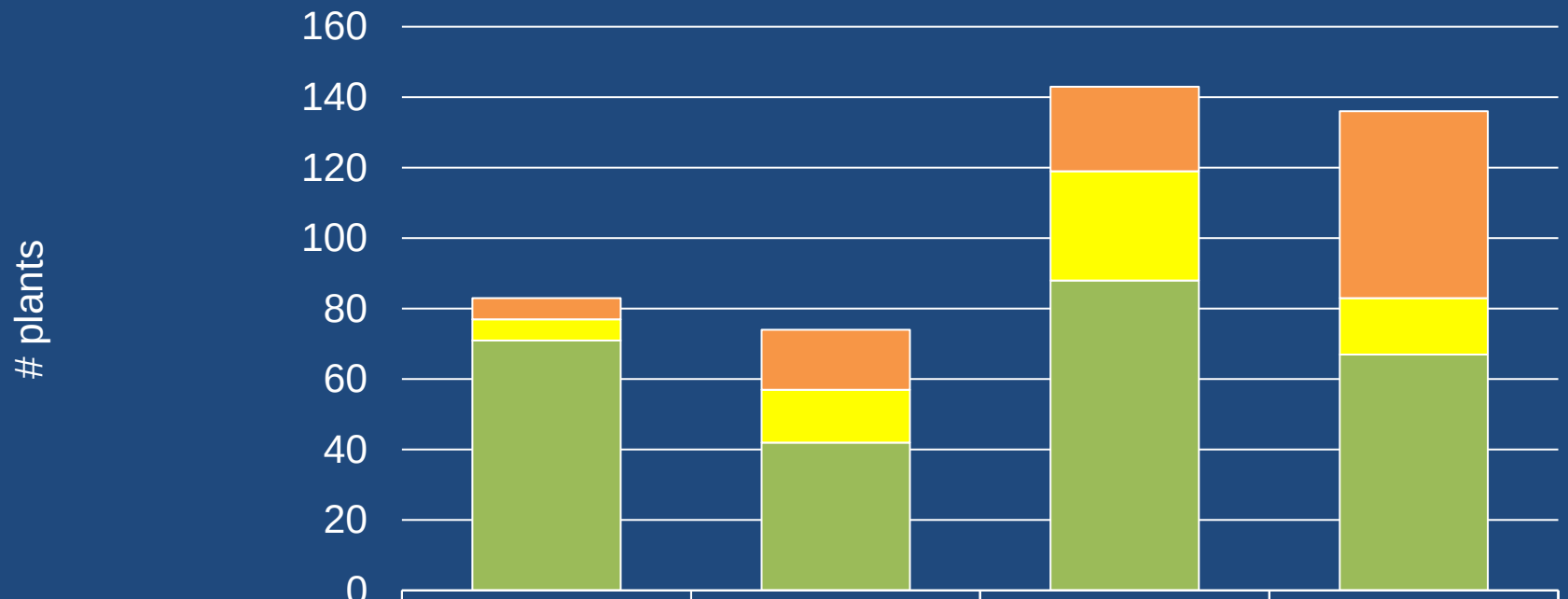
dead after browsing not recorded 2018

State threatened (protected) species: Goldenseal



Deer browse ↑ Abundance ↓

2018–2019



	July 2018 Plot 1	August 2019 Plot 1	July 2018 Plot 2	August 2019 Plot 2
# deer browsed	6	17	24	53
# with flowers/fruits	6	15	31	16
# plants (lvs only)	71	42	88	67

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    - How are deer affecting wildflowers?
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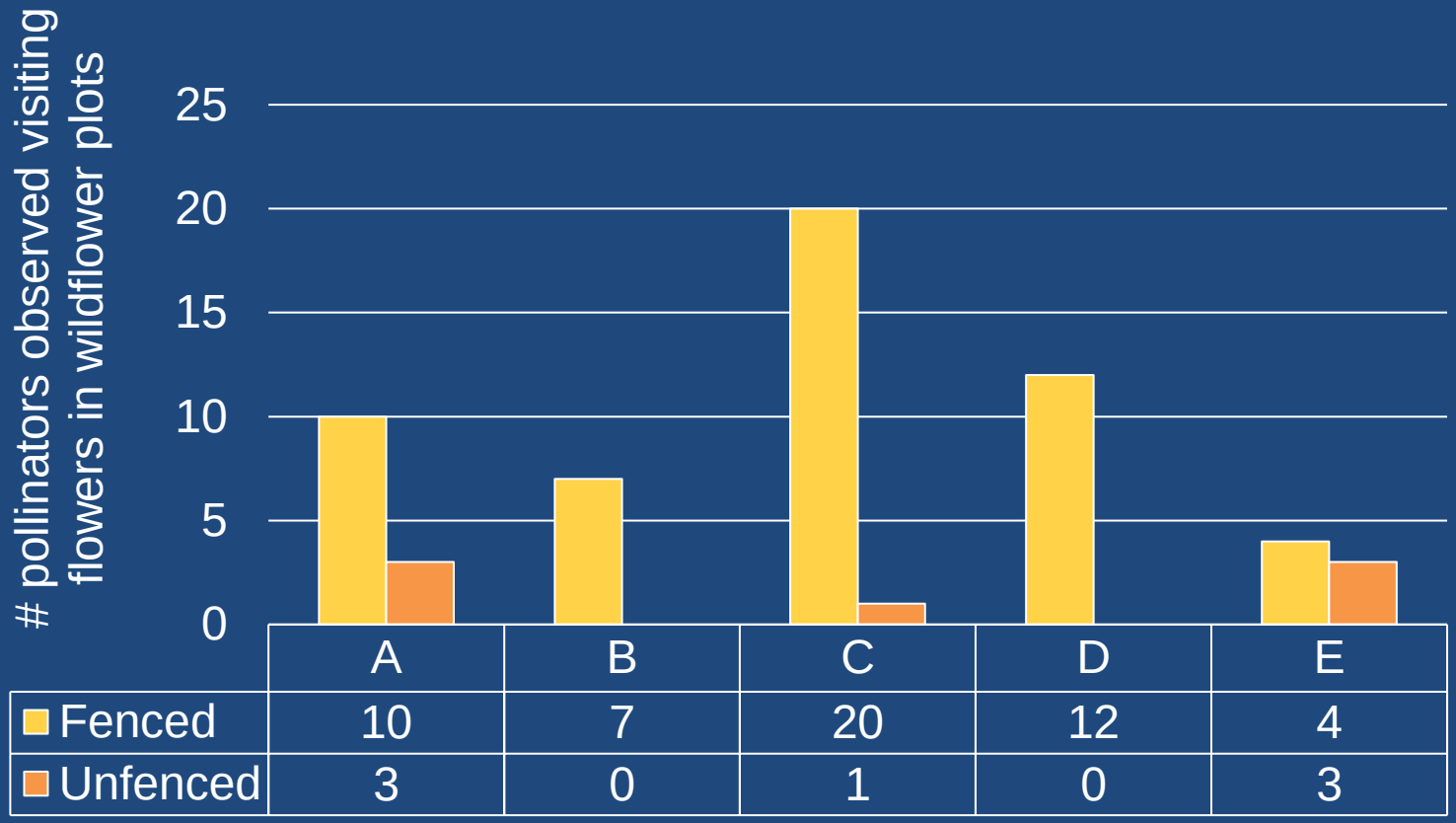
Why does deer browse on tree seedlings matter?

- ↓ tree seedling survival, growth
- ↓ forest regeneration
  - oak regeneration a particular concern in NE U.S.
- "Forest disintegration"
  - Conversion to grasslands, ferns, sedges
  - Affects many species
- ↓ ecosystem services (water quality, flood & erosion control)
- Carbon sequestration

Why does deer browse on wildflowers matter?

- Reduced flowering, fruiting leads to reduced reproduction; over time, population declines
- Fewer resources for other species
  - Pollinators
  - Songbirds
  - Small mammals

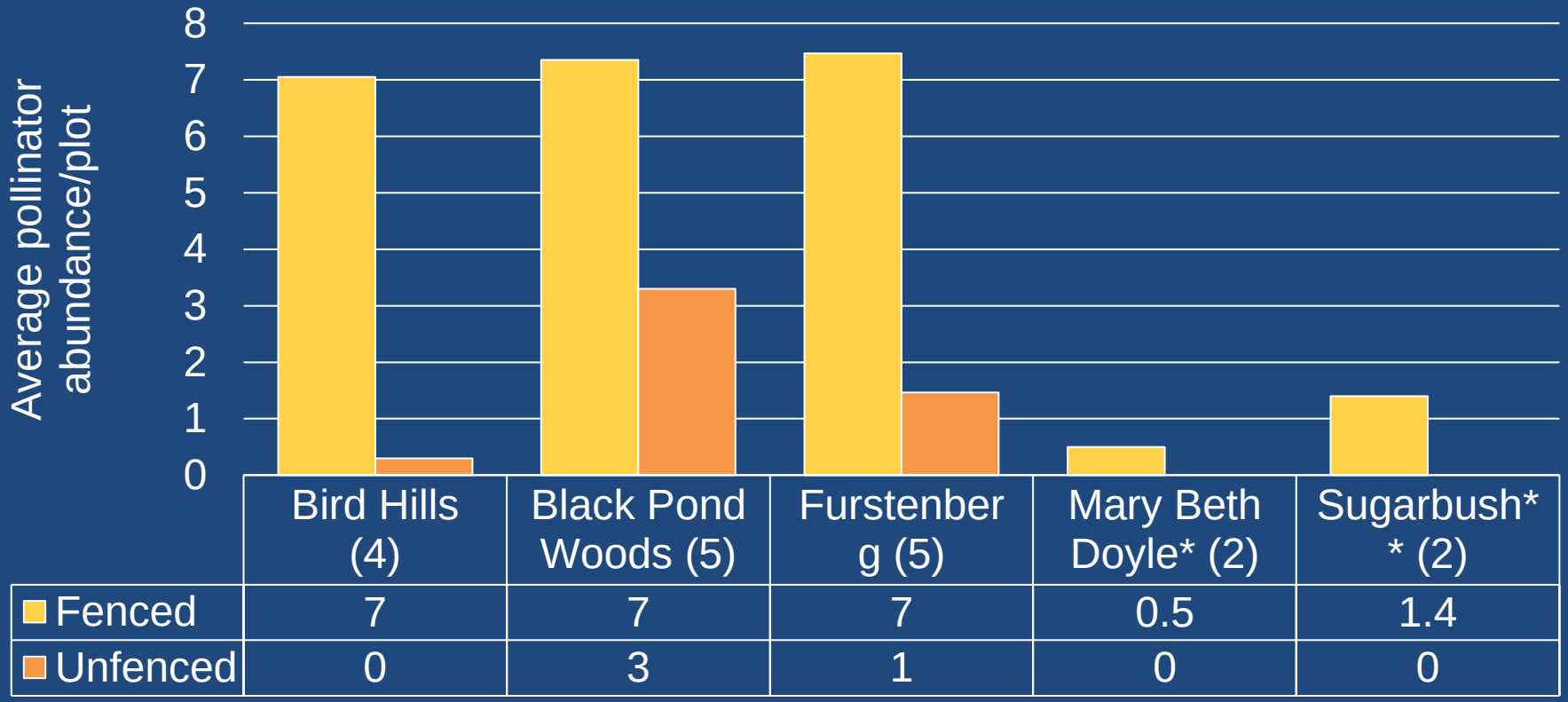
Pilot study: where there are fewer flowers, fewer pollinators



	A	B	C	D	E
Fenced	10	7	20	12	4
Unfenced	3	0	1	0	3

Pilot study of pollinator visitors in 1 site, 5 plot pairs, 15-minute time intervals. Ann Arbor park, 10/5/2018

Fewer pollinators in deer-accessible unfenced plots, 2019



	Bird Hills (4)	Black Pond Woods (5)	Furstenberg (5)	Mary Beth Doyle* (2)	Sugarbush** (2)
Fenced	7	7	7	0.5	1.4
Unfenced	0	3	1	0	0

Pollinator abundance assessed 5 Ann Arbor parks in repeated 3-5 minute counts, 2-5 plot pairs per site (# in parentheses). * Few pollinators out during 2 visits. ** Just 2 unfenced plots had flowers.

Typical forest asters and goldenrods hard to find in Southfield parks

Bluestem goldenrod

(Big-leaved aster)

Heart-leaved aster

Zigzag goldenrod

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Multiple stressors: Not either/or, but both/and

- Deer are one of many stressors
  - Habitat destruction & fragmentation
  - Invasive species (including insects, disease)
  - Global warming/climate change
  - Acid rain, etc.
- Deer amplify the stresses
- Plants less able to recover, reproduce
- Fewer resources for other species

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Options for managing deer impacts

Option	Home landcapes	Natural areas	Possible outcomes
Do nothing	X		Population controlled by vehicle crashes, starvation, disease
		X	Lose plants, species, communities over time; convert to grasslands, novel ecosystems?
Plant deer-resistant species	X		Varies over time, place--deer preferences not all the same
		X	Grasses, sedges, ferns less damaged than wildflowers
Deer repellents	X		Varying effectiveness; may need repeat application
		X	Costly, impractical for large areas; need for repeat treatments
Fencing	X	Limited	Costly, impractical for large areas; needs continued maintenance; indirect effects (more small mammal damage?)
Deer management	?	X	Can protect natural areas with continued effort

Questions?

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Acknowledgments

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- **Field technicians:** Sam Holtzman; Manuel Anderson; Kyle Lough; Calvin Floyd; Jack Floyd; Ethan Hiltner; Irene Hochgraf-Cameron.

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