



Deer & Allegheny Plateau Forests

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Deer & Allegheny Plateau Forests

- Short history of PA's deer situation
- Impacts of deer on forest vegetation
- Recognizing and managing deer impacts

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- *Short history of PA's deer situation*
- Impacts of deer on forest vegetation
- Recognizing and managing deer impacts

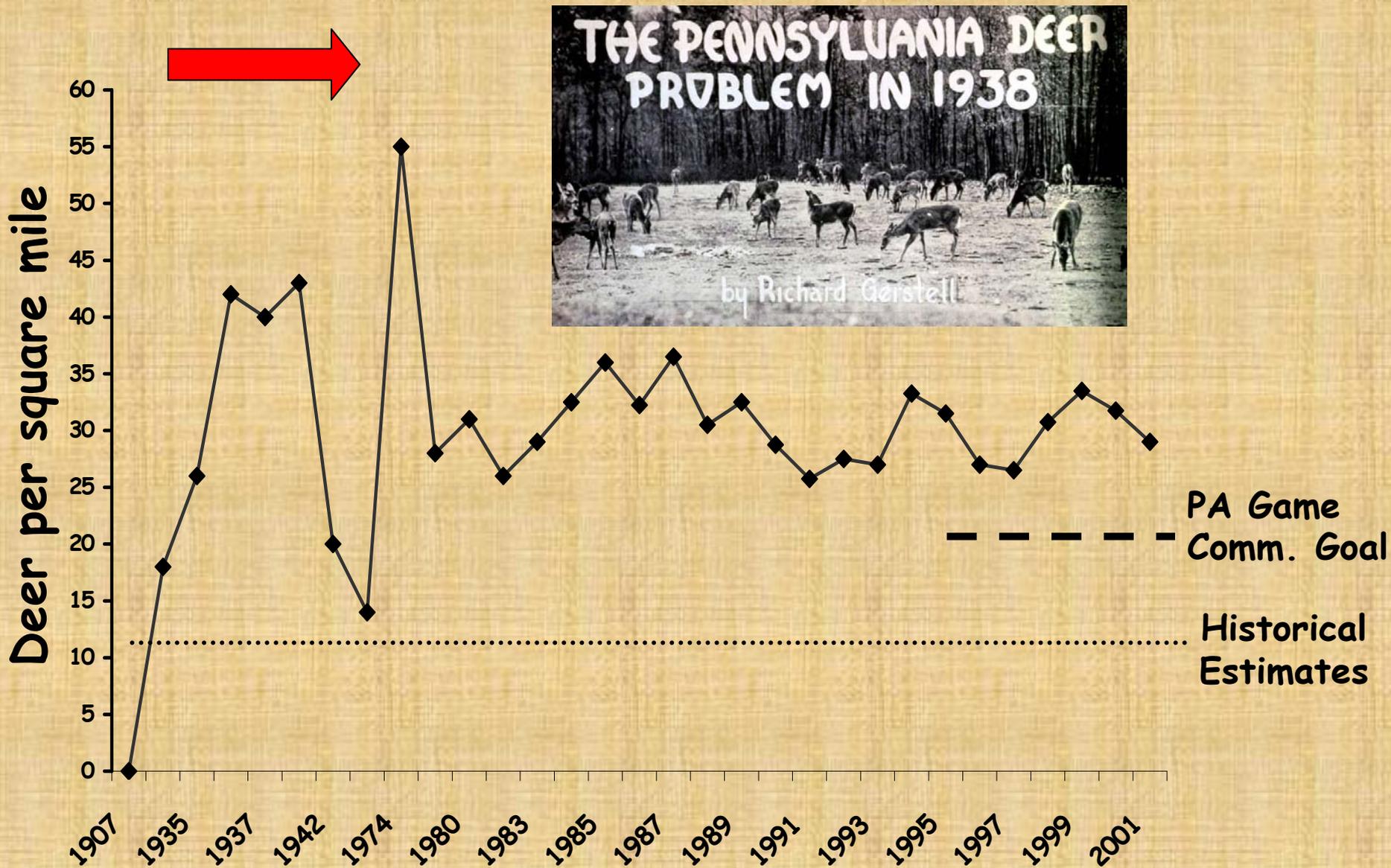
Deer Herbivory



Deer browsing - THE major factor affecting forest regeneration in PA since the 1920s

Deer have direct and indirect effects on forest regeneration

Deer Population during 20th Century

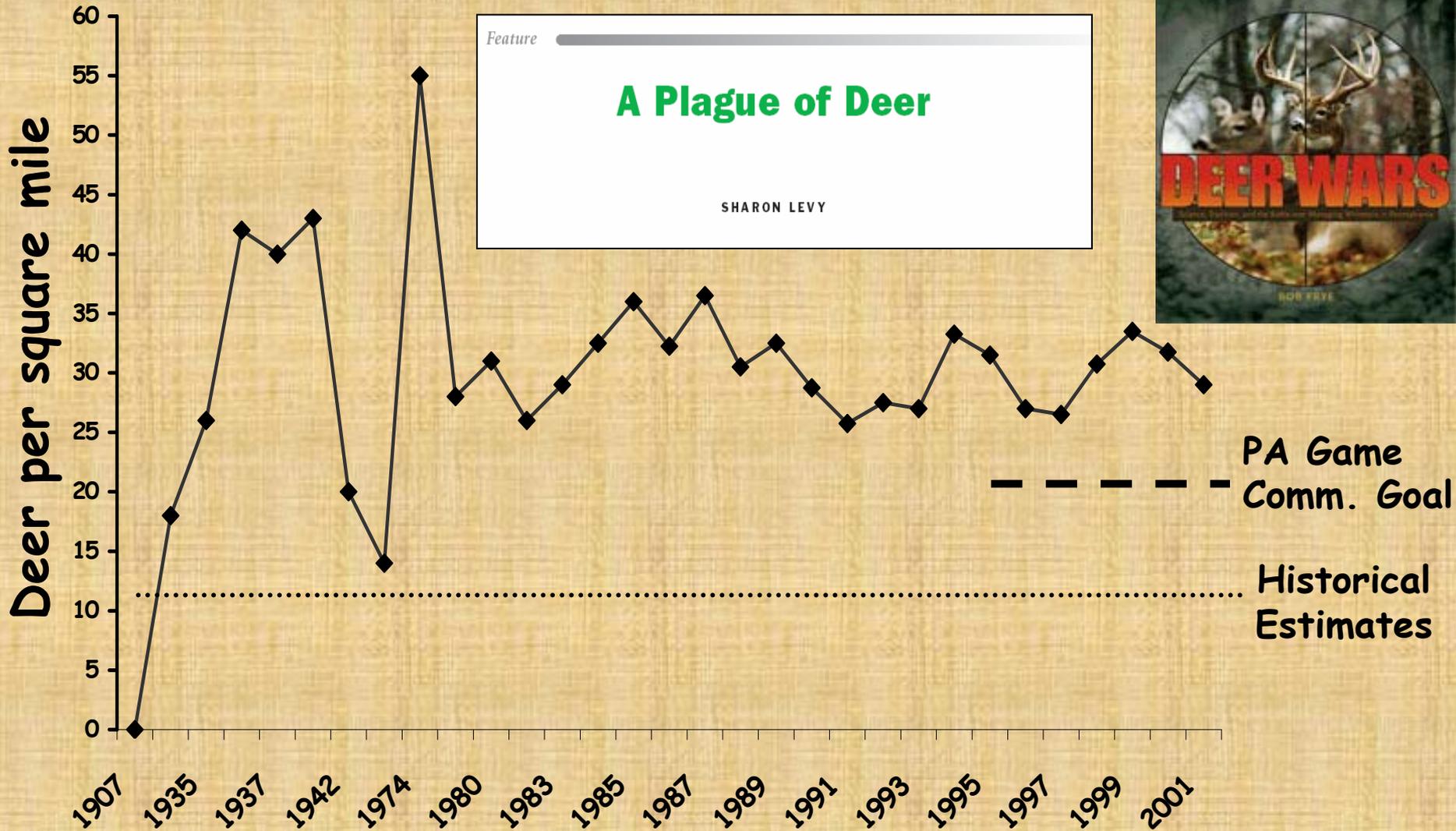


Early Impacts

- Farmers were first to complain of overabundance
- Hobblebush and shrub layer significantly altered, including in old growth
- Alters recovery after disturbance



Deer Population during 20th Century



Half of all harvests failed to regenerate



Fencing fixed 87% of failed cuts



Advanced regeneration was the key



However... 'success' was often monoculture



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Forestry Sciences Lab. Irvine, PA

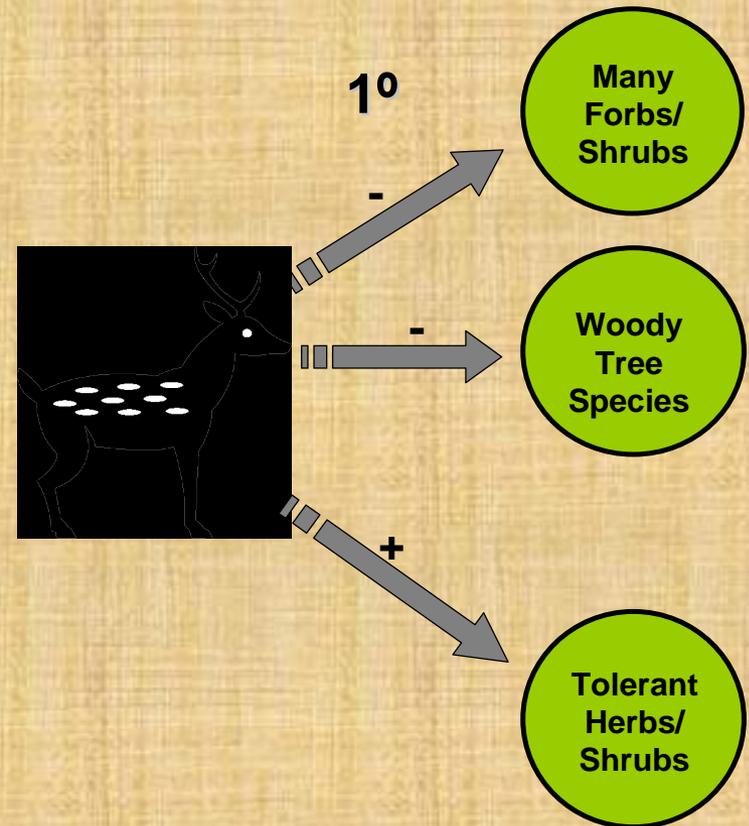


Deer Browsing

Direct Consumptive Impacts

- Impact species composition, abundance and growth

- Over time, selective browsing on preferred species reduces species richness and shifts species composition towards unpreferred & browse-resilient species



Species Food Preference / Resilience to Browsing by Deer

<u>Spp</u>	<u>Pref</u>	<u>Resil</u>	<u>Spp</u>	<u>Pref</u>	<u>Resil</u>
BC	L	L	CUC	H	L
RM	H	L	HEM	M-H	L
SM	H	L	PC	H	L
AB	M-L	H	STM	M-L	H
WA	H	L	RUB	H	M-H
Y-P	H	L	HSF	Not	H
YB	M	M	NYF	Not	H
BB	M	M	G / S	M-L	H

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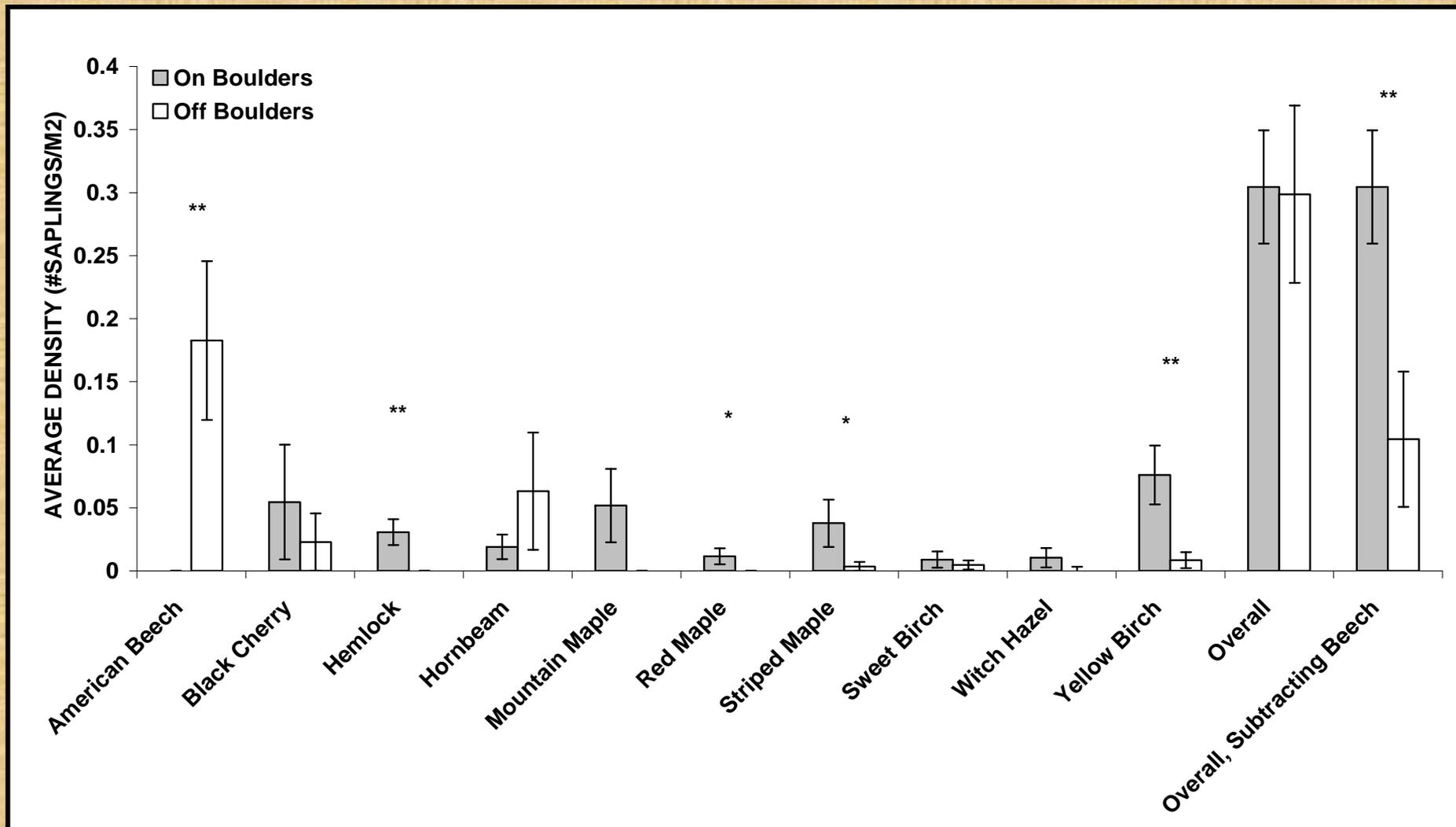
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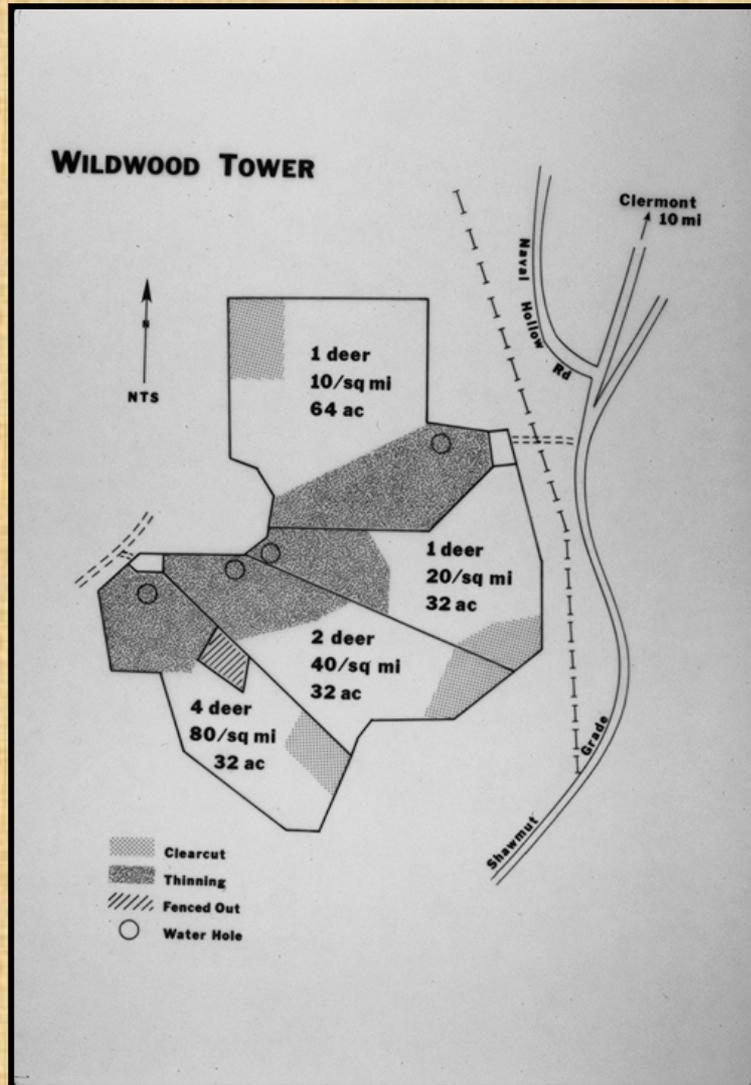
Boulders as a Bioassay and a Refugia



Bouldertop Communities Had Greater Abundance of Several Woody Species

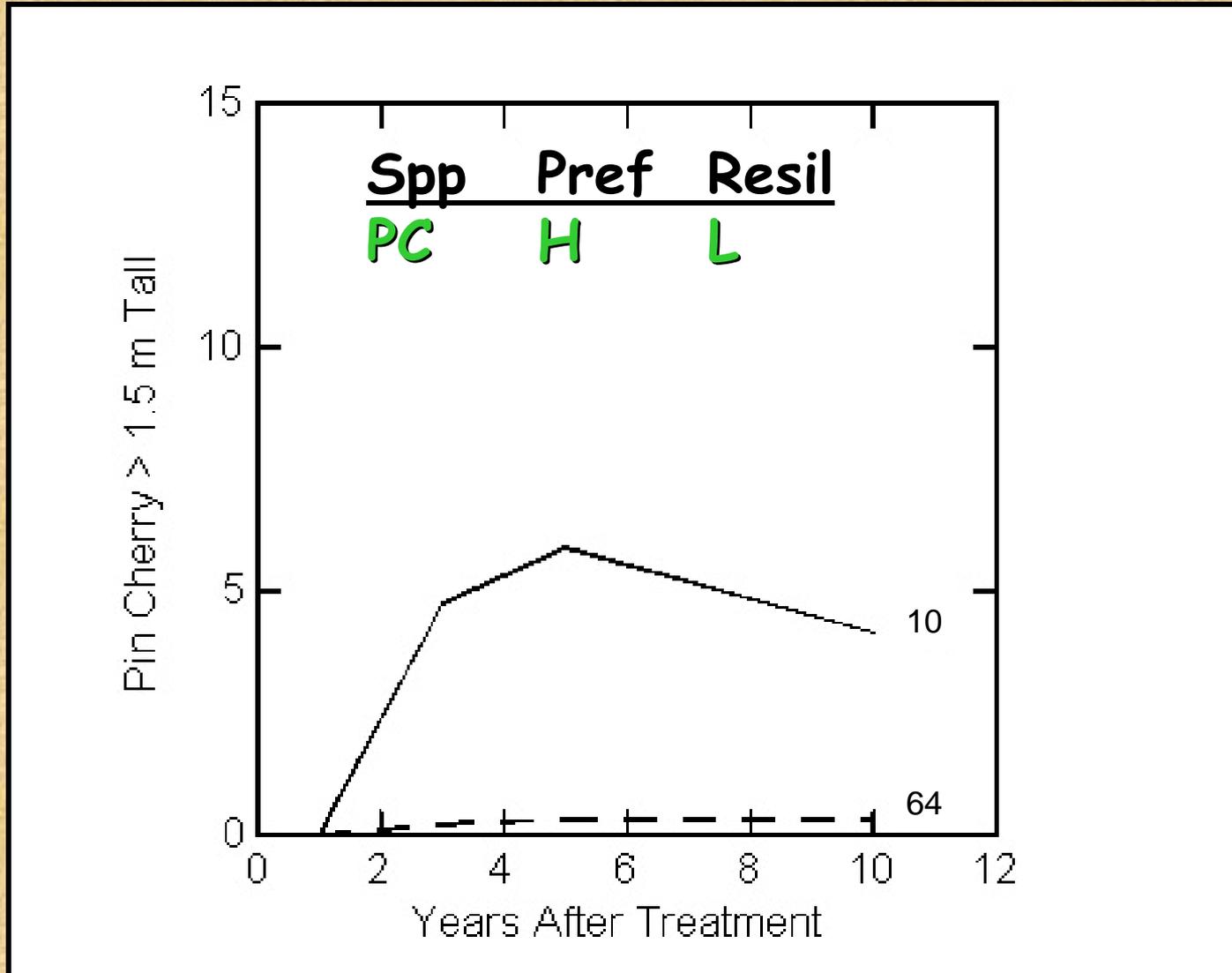


Experimental Manipulations of Deer Levels: Enclosure Study

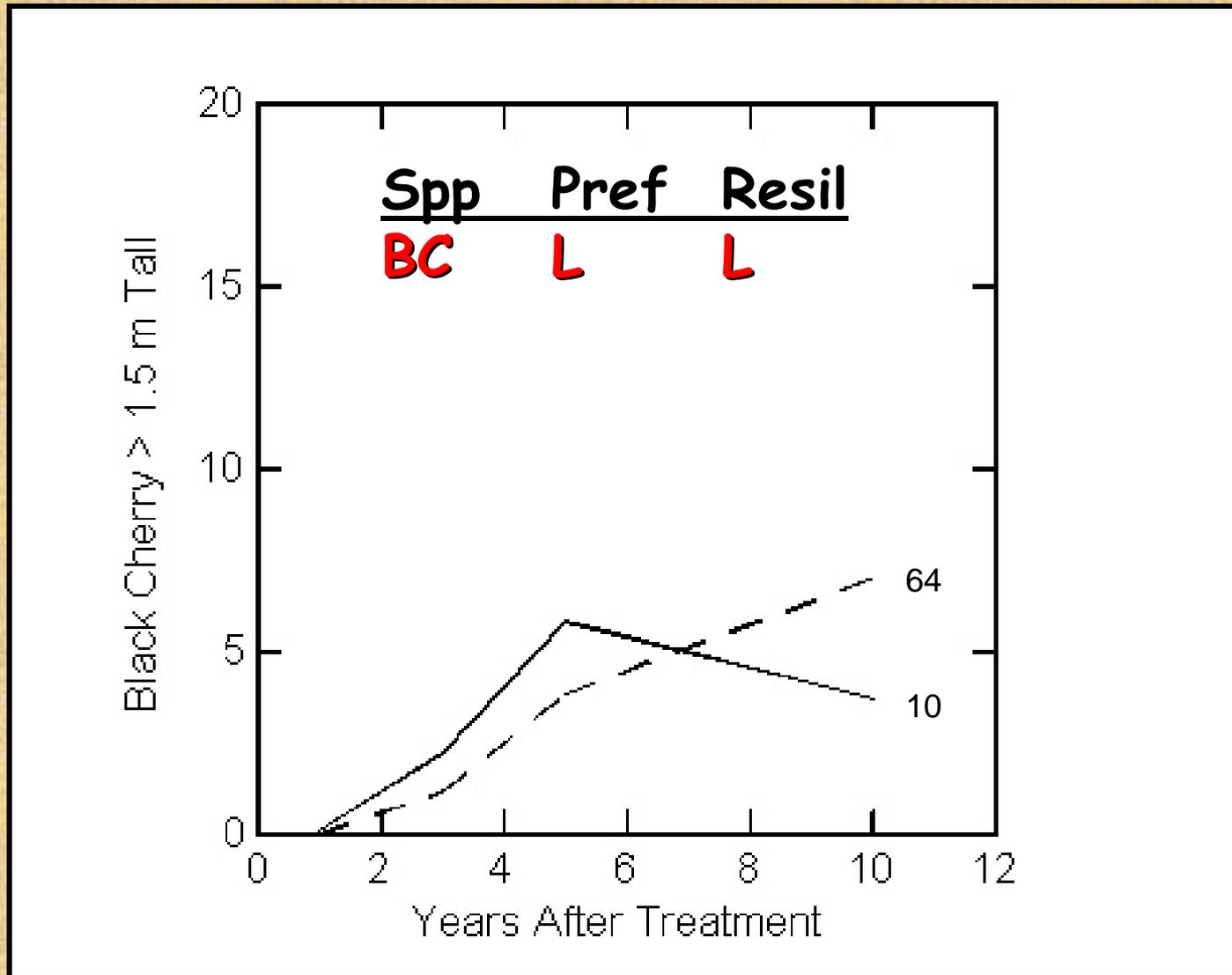


- A designed study, replicated at 4 NW PA locations
- 4 deer densities enclosed in managed forests
- Each deer enclosure was 10% clearcut, 30% thinned, and 60% uncut

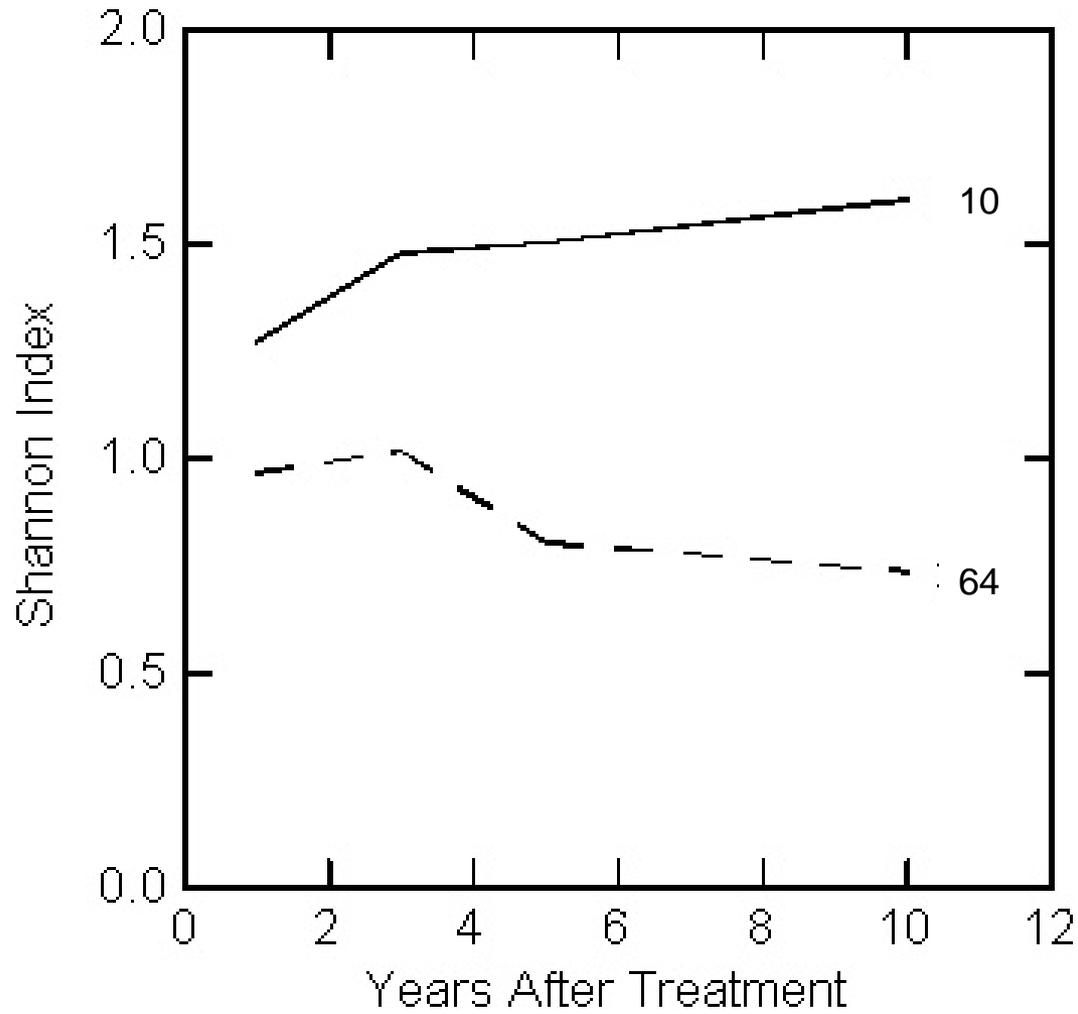
Preferred Species Decrease in Abundance



Unpreferred Species Increase in Abundance

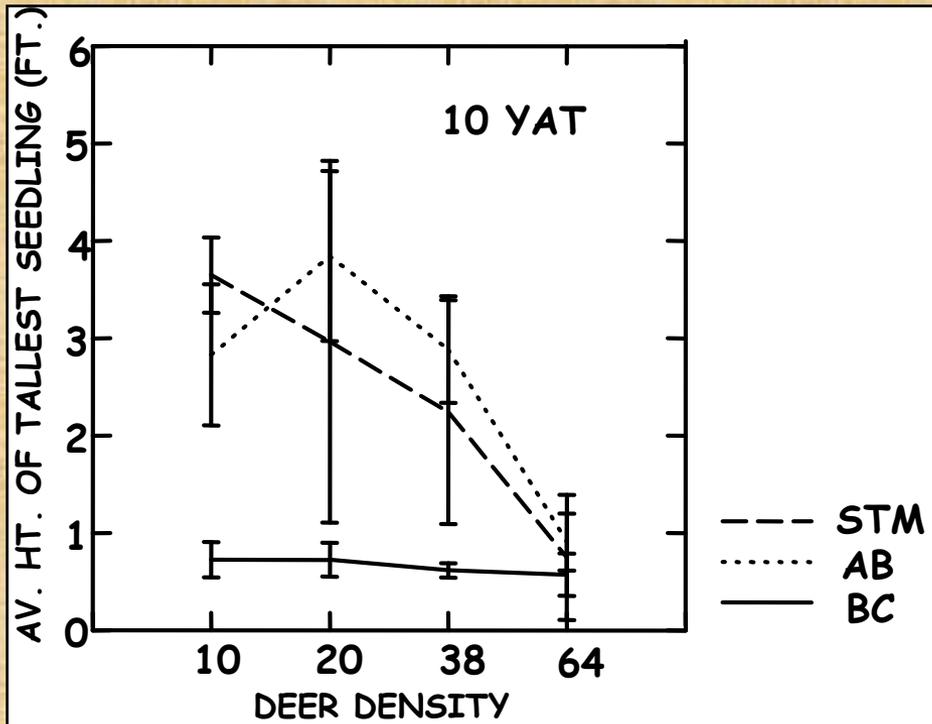


Diversity Decreases



Deer affected height growth

- Negative linear trend of decreasing height with increasing deer density for most species



Deer affected height growth

- Negative linear trend of decreasing height with increasing deer density for most species
- By year 10, some species had grown out of reach of deer.



Deer affected stocking

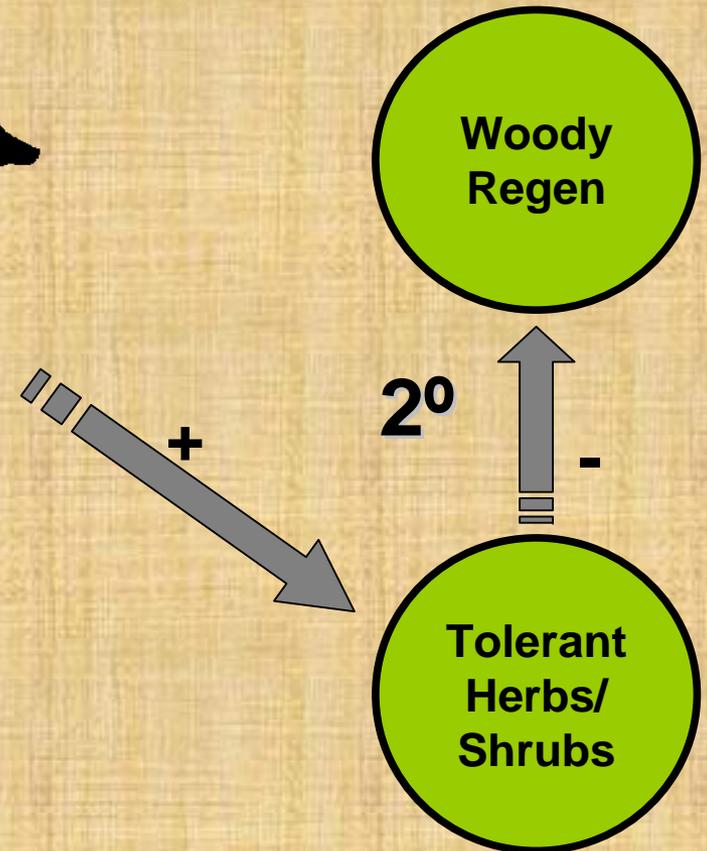
- 85% of regen was bc, pc, bi, and stmaple
- By 10 yrs in clearcuts
 - Rubus, pc, bi, rm, be, sm, wa were less abundant at high deer density sites
 - fern, grass, and bc *increased* with deer density
- Similar effects in thinnings and uncuts



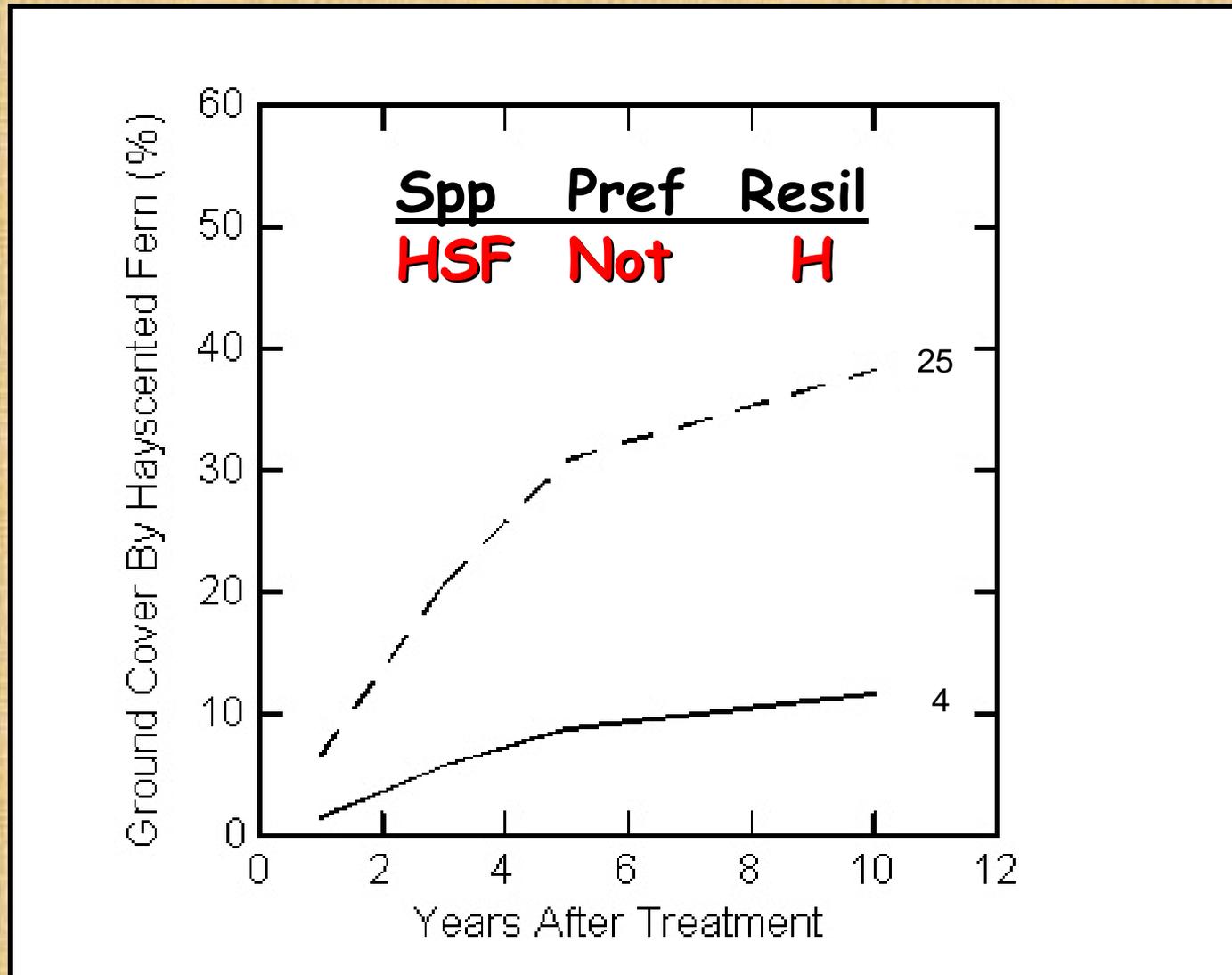
Indirect Impact - Establishment of Dense Understory Layers

Indirect effect:

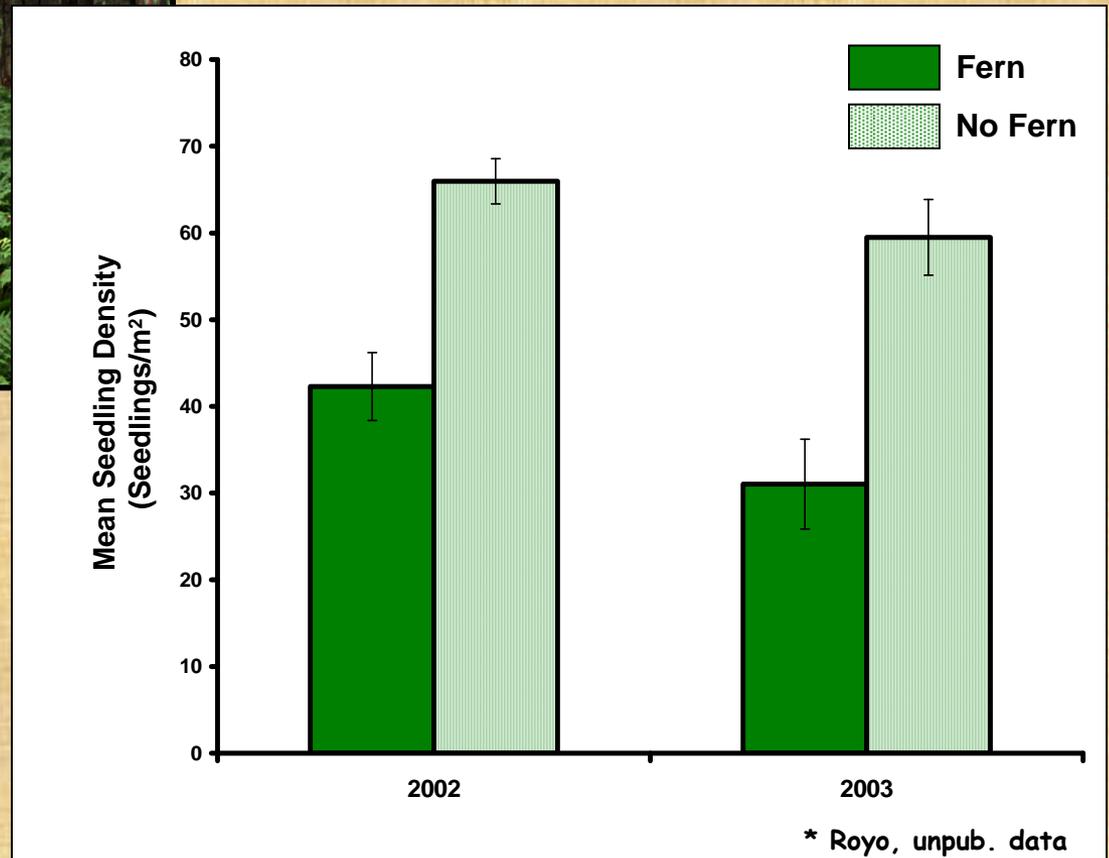
Increase in browse-tolerant
understory species leading to
plant-plant competition (e.g.
fern-tree seedling).



Hay-scented Fern Abundance Increased at High Deer Levels



Deer affected herbaceous cover & low shade



** Similar results Horsley 1993, Lyon and Sharpe 1995, Hill 1996, George and Bazzaz 1999, de la Cretaz and Kelty 2002, and others

Hay-scented fern dominance across Allegheny Plateau



- Historically - < 1% of understory.
- Present day:
 - 33% of 499 sample plots across all of Pennsylvania.¹
 - Estimated 130,000 - 180,000 acres in ANF alone.^{2,3}

1. McWilliams et al. 1995
2. Allegheny National Forest Management Area 3.0 6,000 Plot Survey Report, 1995.
3. Royo, unpub. data.



Interfering Plants on the Allegheny National Forest

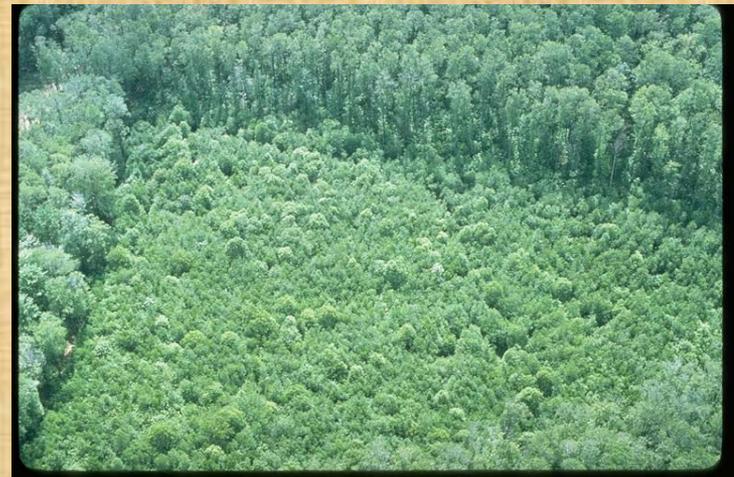
Interference	Acres	% all Acres
Fern	130,173 - 180,000	46%
Grass	61,176	21%
Woody Interference	63,107	21%
Fern and/or Grass	162,138	57%

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Deer Enclosure Study

- Is this the worst case scenario we expected?
- Why weren't there complete regeneration failures at 64 dpsm?



Reality check

Treatment	Allegheny NF, early 80s avg.	Deer study
Final harvest	4%	10%
Thinnings	13%	30%

Alternate Reality Check



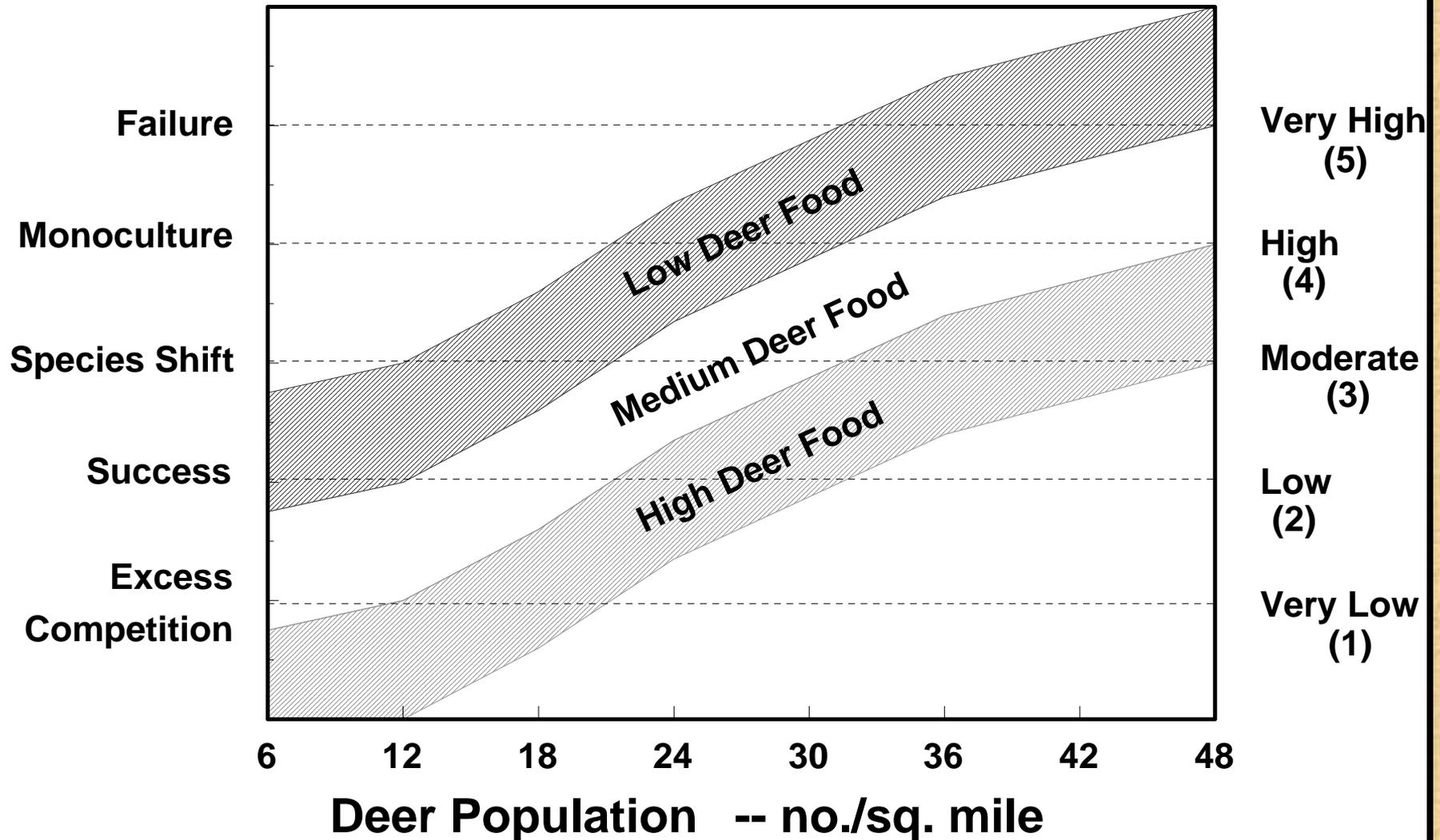
- Home gardens and landscape plants provide ample deer food



Deer Impact Index

**Effect on
Regeneration**

**Deer
Impact**



Deer Impact Level 1:

Inside a well maintained,
woven-wire deer fence.

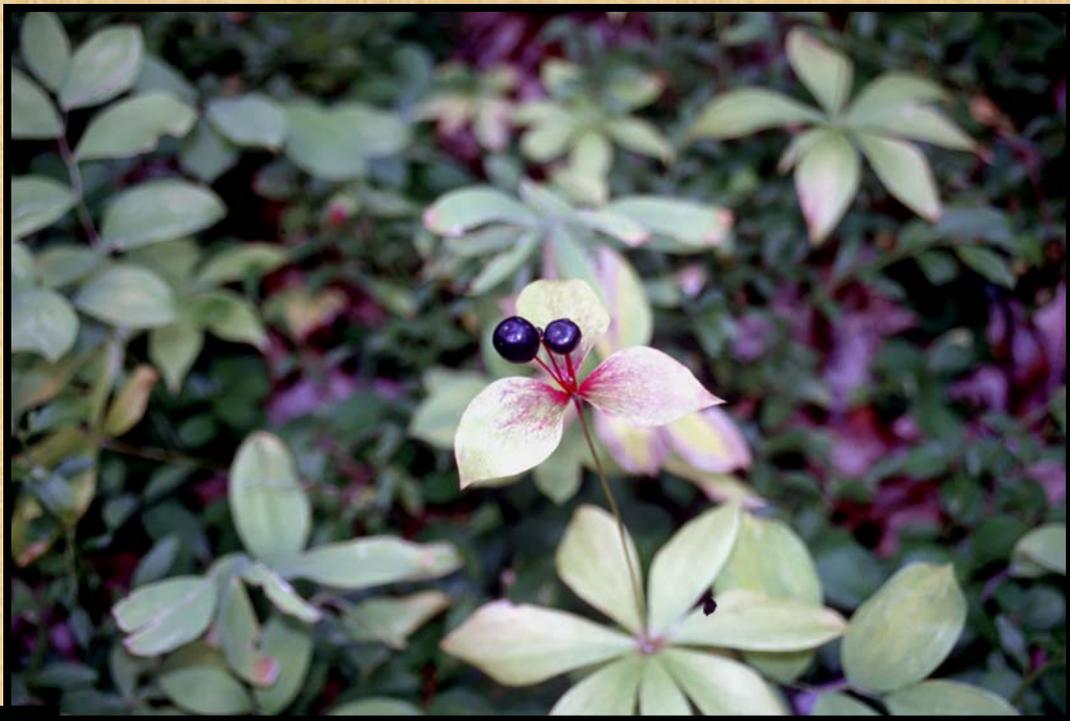


Deer Impact Level 2:

Desirable regeneration
common, widespread, of
varying heights, and ...



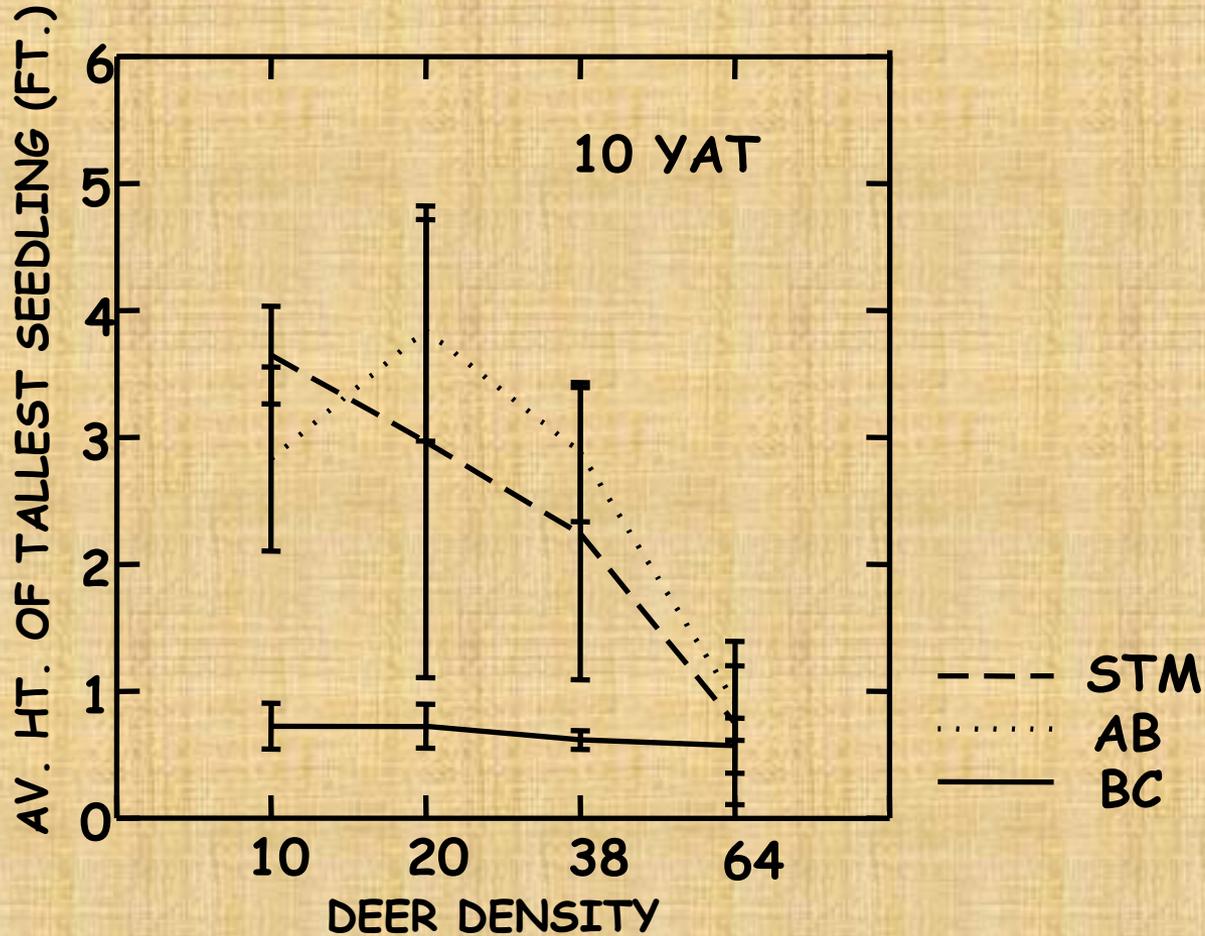
accompanied by a diverse herbaceous plant community.



Ferns, grasses, and other unpalatable/browse-resistant plant species are present but not common.

Photographer: Kenneth J. Sytsma

Height varies both within and between species



Preferred landscape plants survive



G.F. Russell - USDA Plants Database



JS Peterson - USDA Plants Database



J.S. Peterson - USDA Plants Database

Deer Impact Level 3:

Desirable regeneration present but heights are uniformly low. Browse evidence is widespread.



Ferns, grasses, and other unpreferred/browse resistant plant species common.

Deer Impact Level 4: Desirable regeneration lacking, small. No stump sprouts. Few herbaceous plants. Widespread unpreferred/browse resistant plants, often browsed. Indistinct browse line.



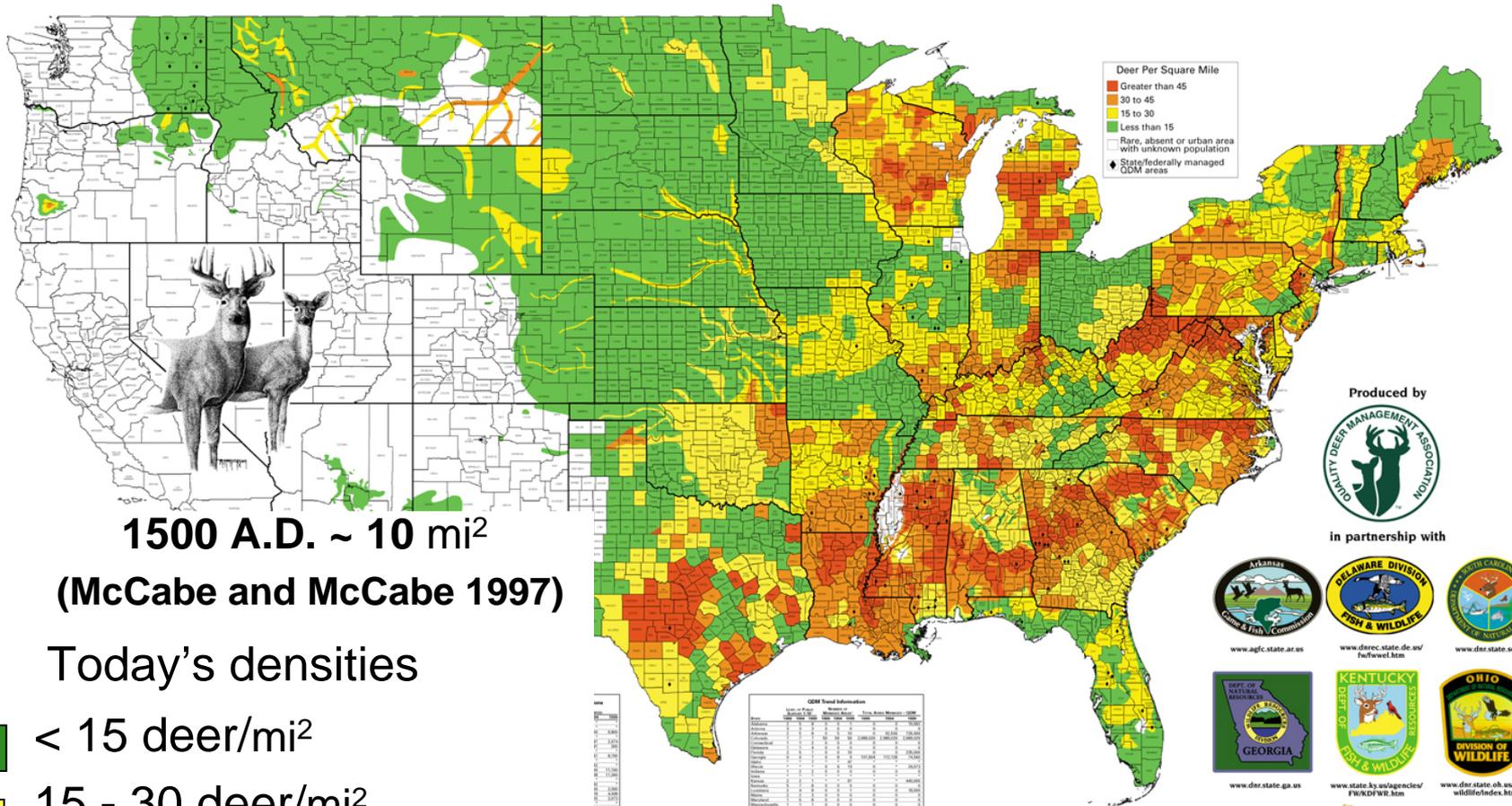
Deer Impact Level 5: Desirable regeneration absent or nearly so. No stump sprouts. Only the hardiest browse-resistant and unpalatable plant species present. Distinct browse line.



Deer & Allegheny Plateau Forests

- Past and present deer herbivory has often left its mark on the distribution and abundance of plant species.
- This has left a legacy direct and indirect impacts that make regenerating diverse stands challenging.
 - Species poor overstories/restricted seed supply.
 - Direct effect of overbrowsing.
 - Indirect effect of invasive understory plants species.
 - Indirect effect of increased seed predation.
- This legacy has profoundly altered understory dynamics often leading to regeneration failures or monocultures.

White-tailed Deer Density Map - 1999



1500 A.D. ~ 10 mi²
(McCabe and McCabe 1997)

Today's densities

- < 15 deer/mi²
- 15 - 30 deer/mi²
- 30 - 45 deer/mi²
- >45 deer/mi²

County	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
Alabama																						
Alaska																						
Arizona																						
Arkansas																						
California																						
Colorado																						
Connecticut																						
Delaware																						
Florida																						
Georgia																						
Idaho																						
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North Carolina																						
North Dakota																						
Ohio																						
Oklahoma																						
Oregon																						
Pennsylvania																						
Rhode Island																						
South Carolina																						
South Dakota																						
Tennessee																						
Texas																						
Utah																						
Vermont																						
Virginia																						
Washington																						
West Virginia																						
Wisconsin																						
Wyoming																						

County	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
Alabama																						
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Florida																						
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Questions???

