Disking and Mid- and Understory Removal Following an Above Average Acorn Crop in Three Mature Oak Forests in Southern Indiana

PURDUE UNIVERSITY

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Factors Affecting Oak Seedling Establishment

Acorn loss – predation, disease, environmental extremes

Light environment

Objective

Improve oak seedling establishment through:

1. Disking in acorns
2. Timely mid- and understory removal


Southern Indiana
Purdue Ag Center

SIPAC Disking Trial – Total Basal Area (ft^2/acre)

SPP	I	N	P	Grand Total
Overstory Basal Area				
White Oak	18	40	97	55
Red Oak	45	24	11	29
Black Oak	3	10	6	6
Oak Total	66	75	113	89
Other Hardwood	74	29	16	43
Total Overstory	141	104	129	132
Mid- and Understory	27	23	29	28
Total Basal Area	**168**	**127**	**158**	**160**

Stand Characteristics

Average across all 3 sites:

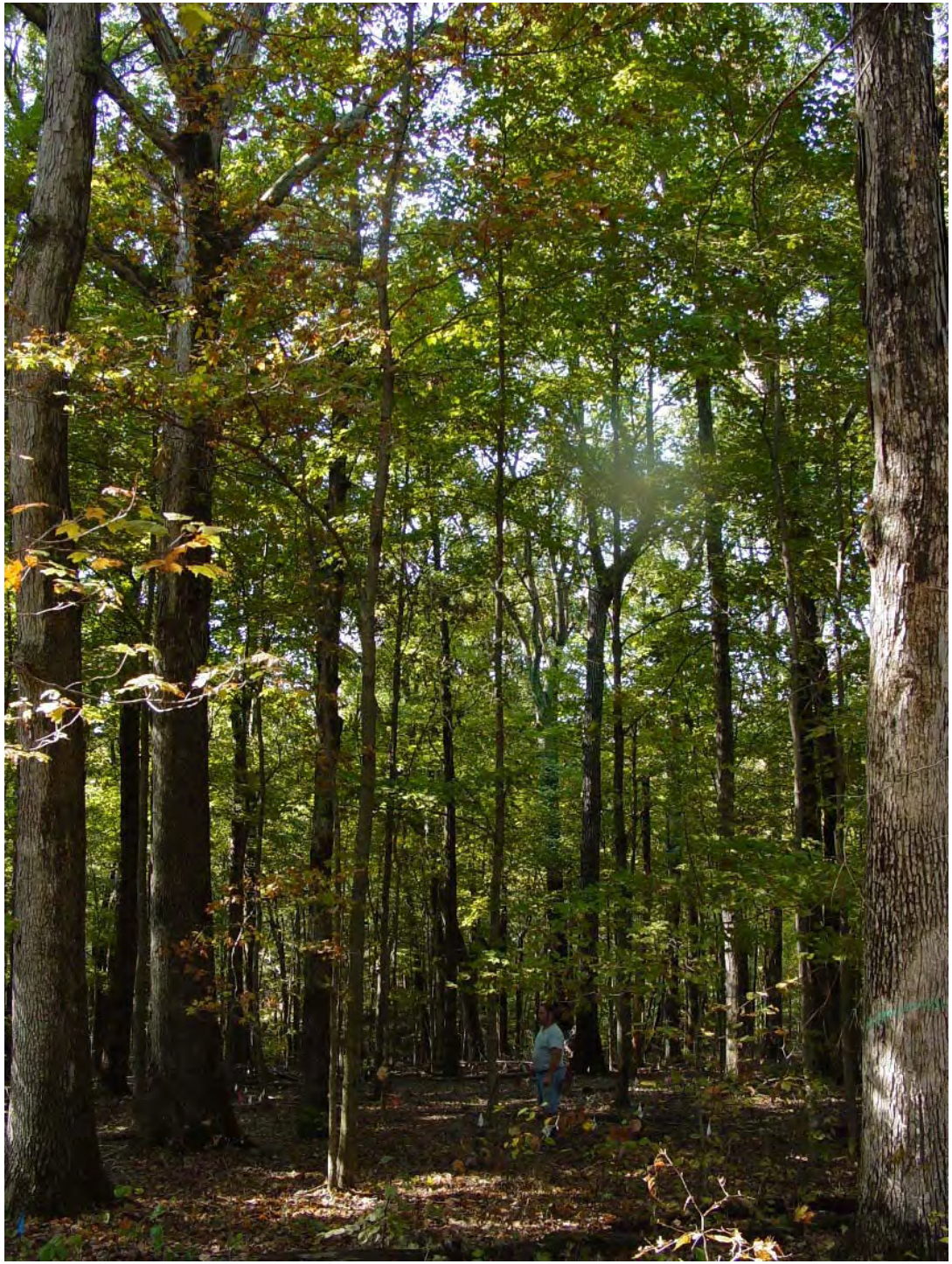
67% of overstory basal area is oak

57% of all basal area is oak

Stand Characteristics

Across all 3 sites:

15 – 19% of basal area was shade tolerant midstory trees



Disking for Oak Seedling Establishment

Indiana:

- ❑75% owned by family forest owners (NIPF)
- ❑Methods and techniques adapted to small ownerships (< 500 acres)

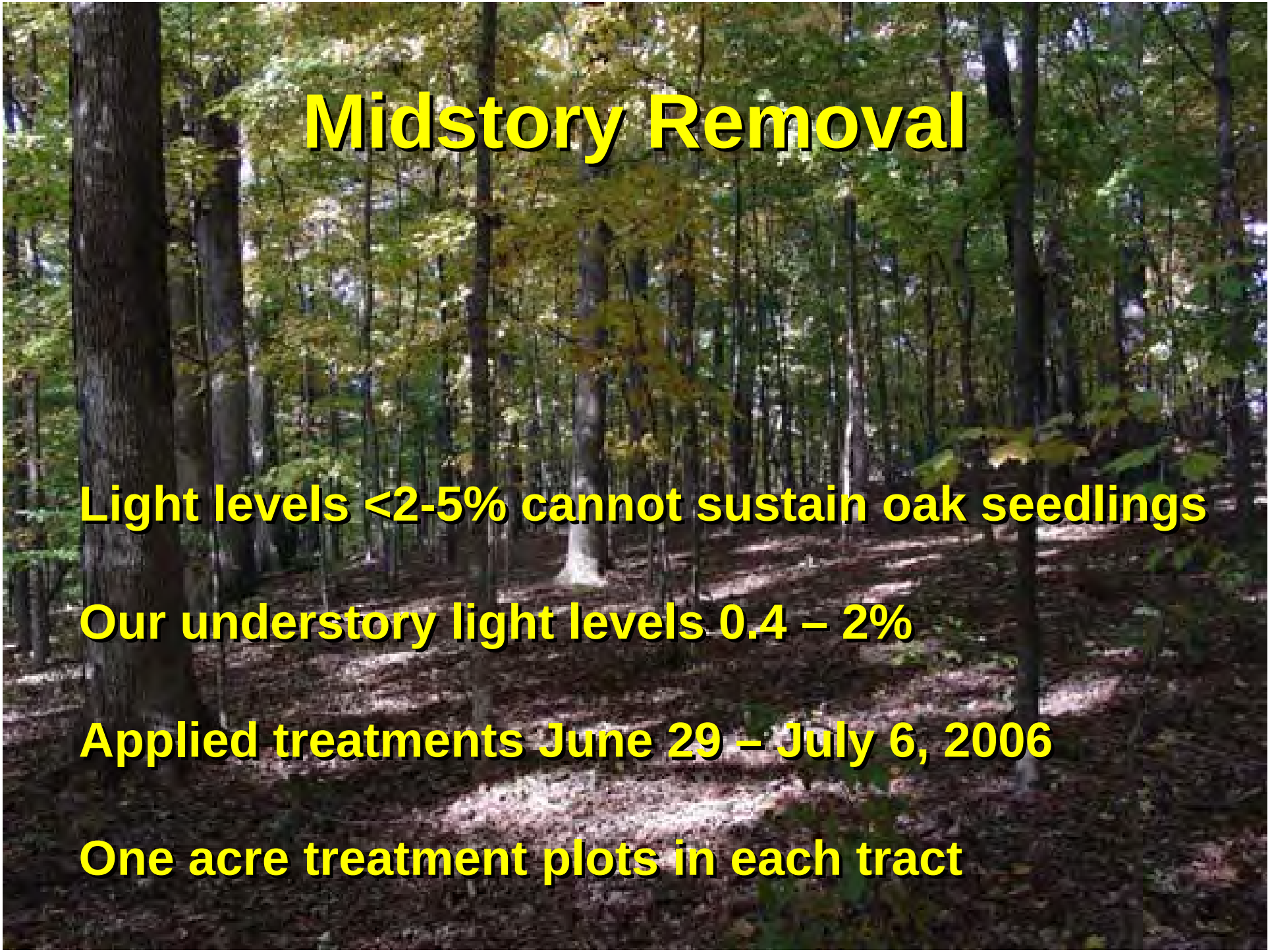

John Hodges
UGA47980


John Deere 855, 24 hp diesel, 4x4
Two row 6 ft. disk
Paired Transects
150 – 500 ft length
16 to 30 ft apart


• 2ft x 2 ft sample plots, permanently marked
• 30 ft intervals
• Sound acorns and advance reproduction


• 6 ft wide
• 3 to 6 inches deep


Disking completed Nov. 1, 2005
17% - 26% of tract area disked



Midstory Removal

Light levels <2-5% cannot sustain oak seedlings

Our understory light levels 0.4 – 2%

Applied treatments June 29 – July 6, 2006

One acre treatment plots in each tract

Midstory Removal

Injection

1 per inch dbh

Pathway

Midstory Removal

Chainsaw Girdle and Felling

Pathway

Felled ½” - 5”

Girdle >5”

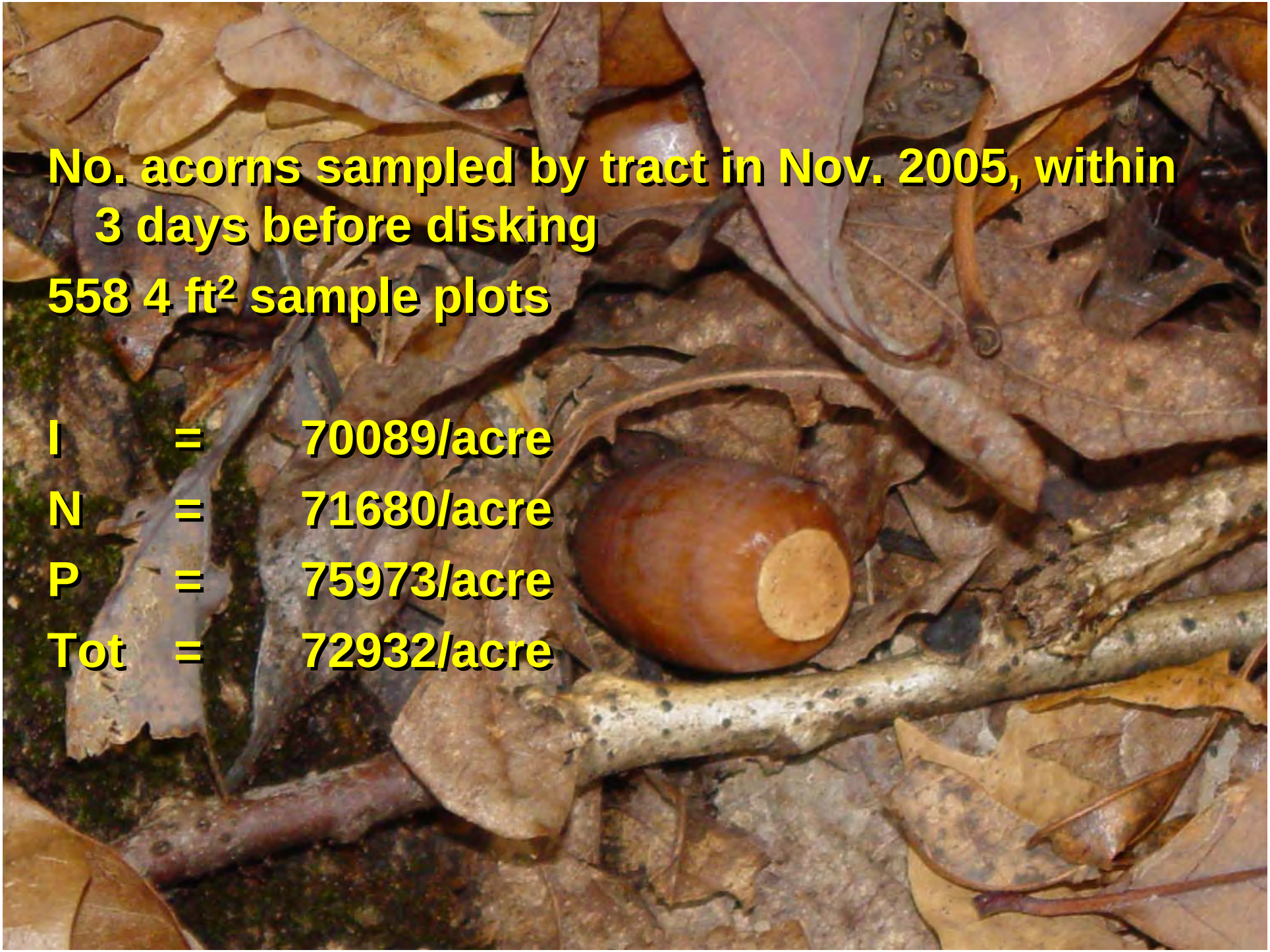

Midstory Removal
Basal Bark
20% Garlon 4 in AX-IT

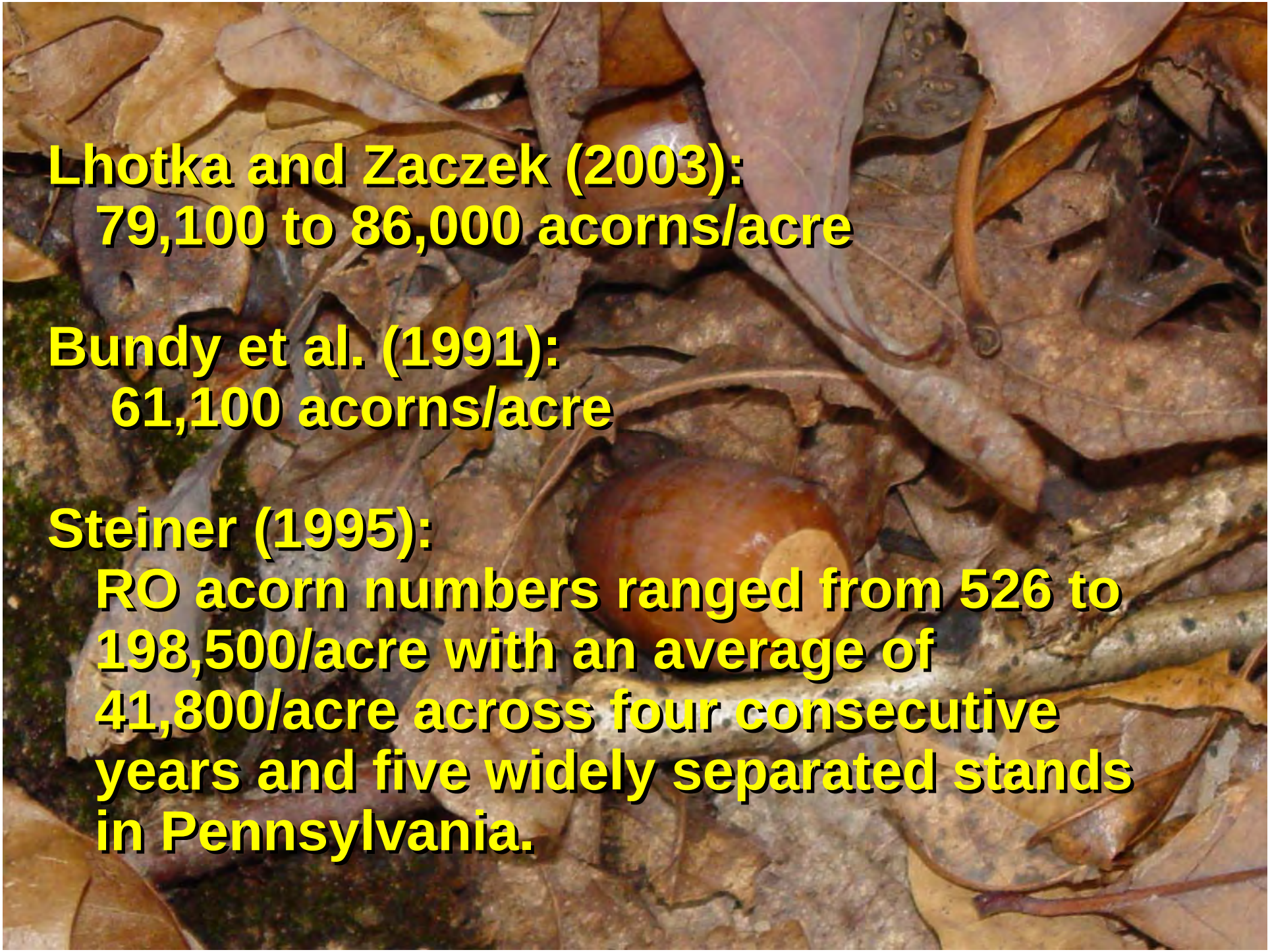
Seedlings inventoried May, July, August, and October, 2006

Paired plots

1,111 1 m^2 sample plots

Results – Oct 2006


No. acorns sampled by tract in Nov. 2005, within 3 days before disking
558 4 ft² sample plots
I = 70089/acre
N = 71680/acre
P = 75973/acre
Tot = 72932/acre


Lhotka and Zaczek (2003):
79,100 to 86,000 acorns/acre
Bundy et al. (1991):
61,100 acorns/acre
Steiner (1995):
RO acorn numbers ranged from 526 to 198,500/acre with an average of 41,800/acre across four consecutive years and five widely separated stands in Pennsylvania.

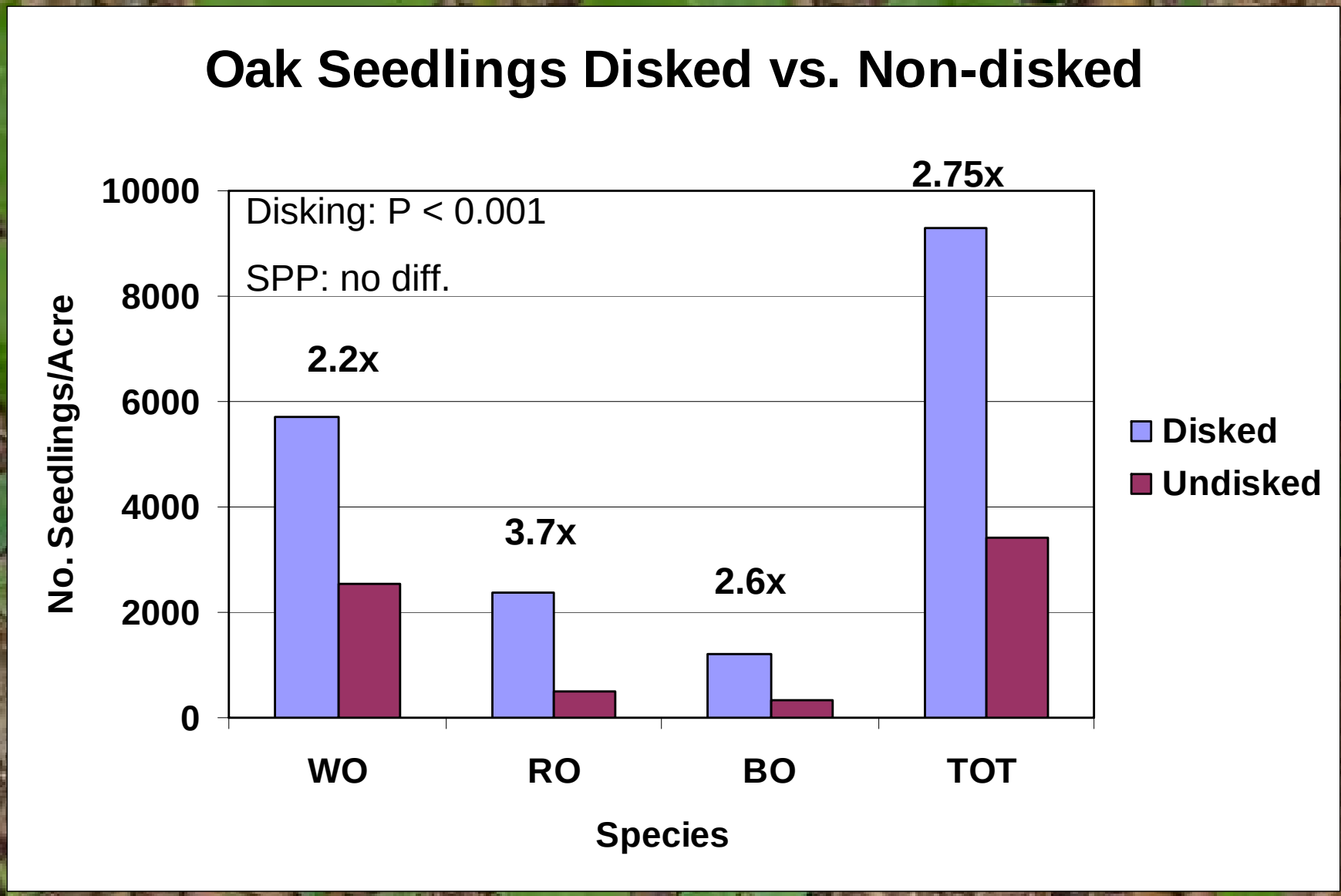
Patchy Distribution

20% sample plots had 0 acorns

>50% sample plots had 3 or less

>20% sample plots had 10 or more

Disking Results – Oct 2006

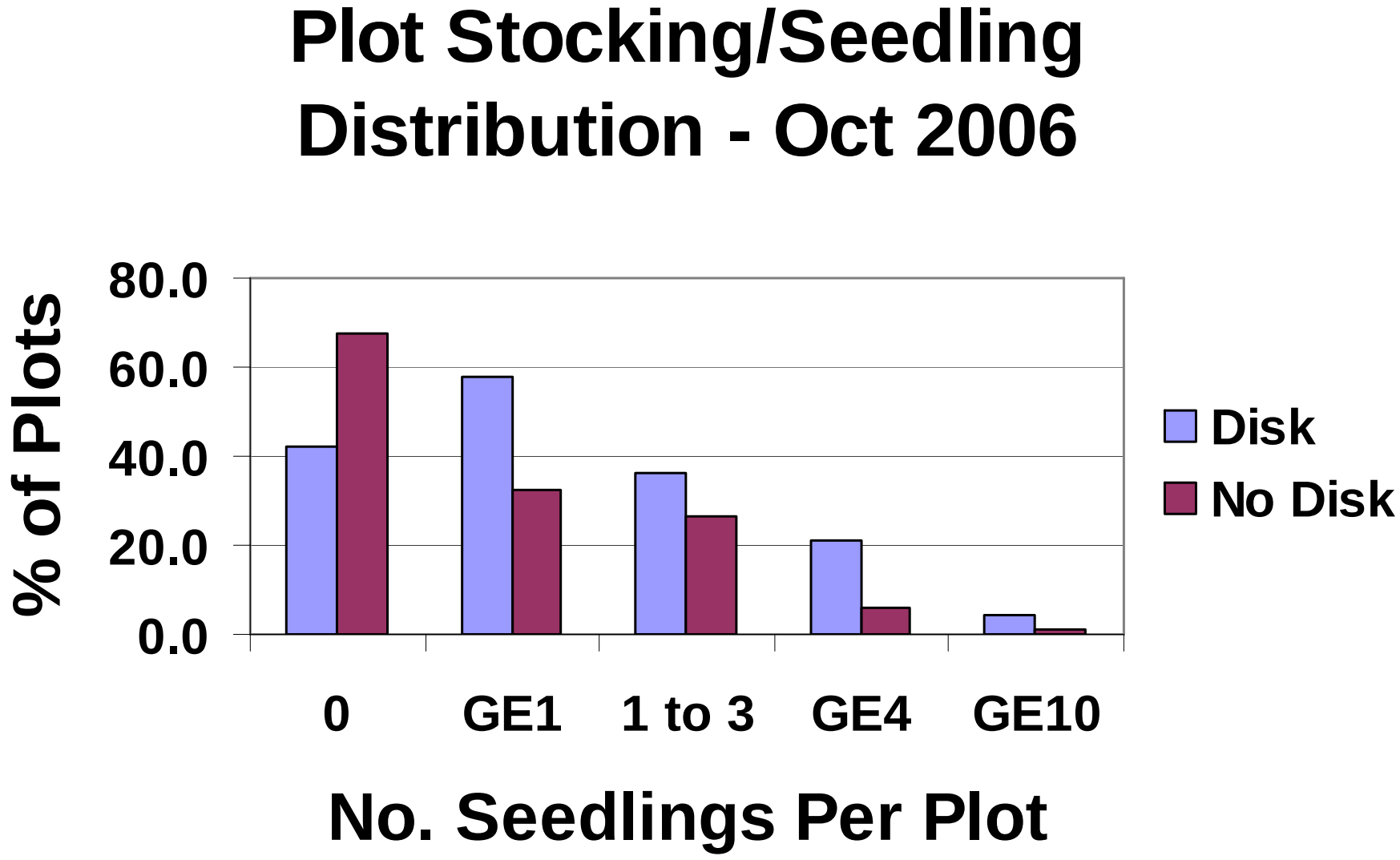


%Acorns to Seedlings

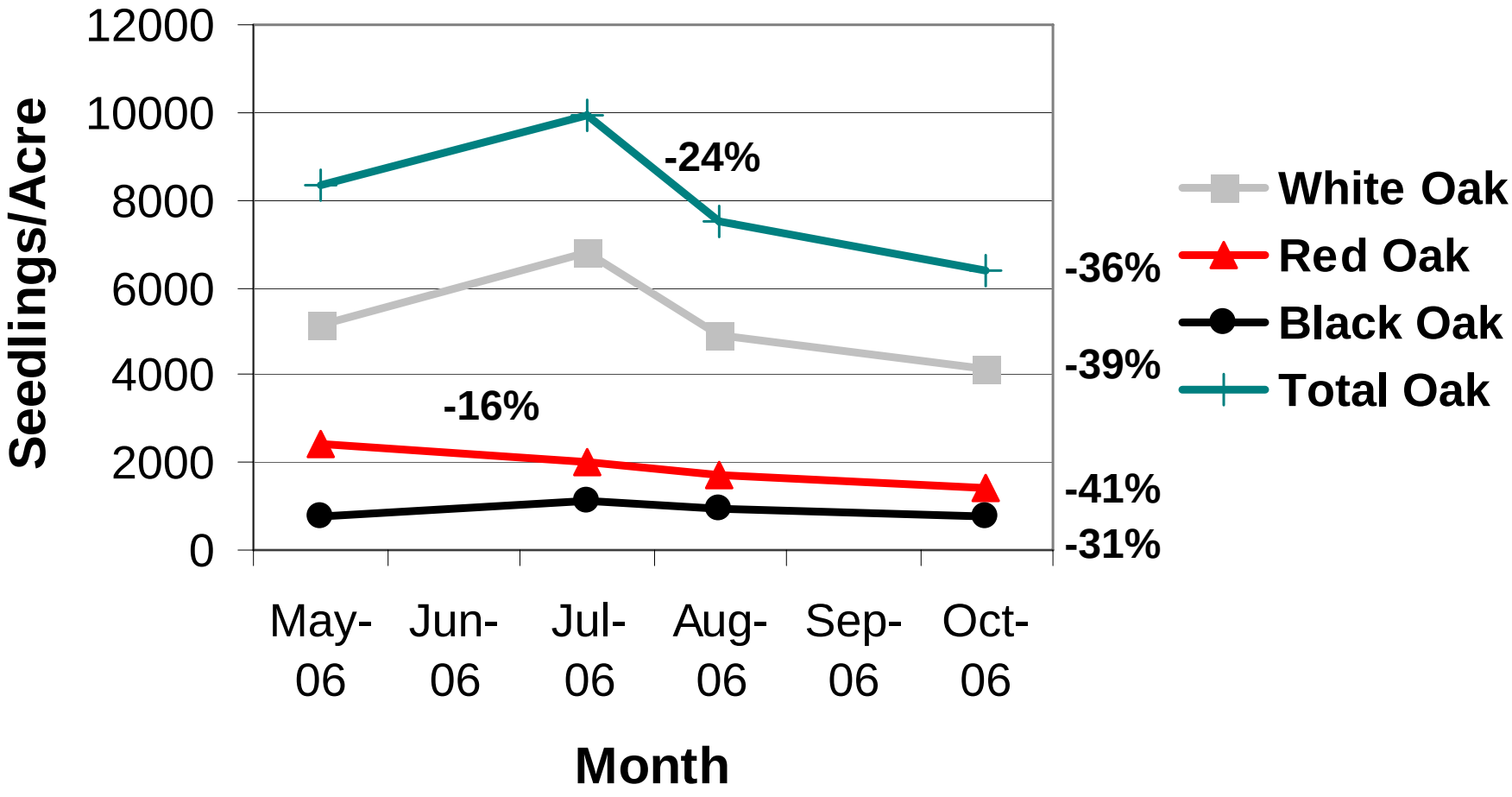
13% disked

5% non-disked

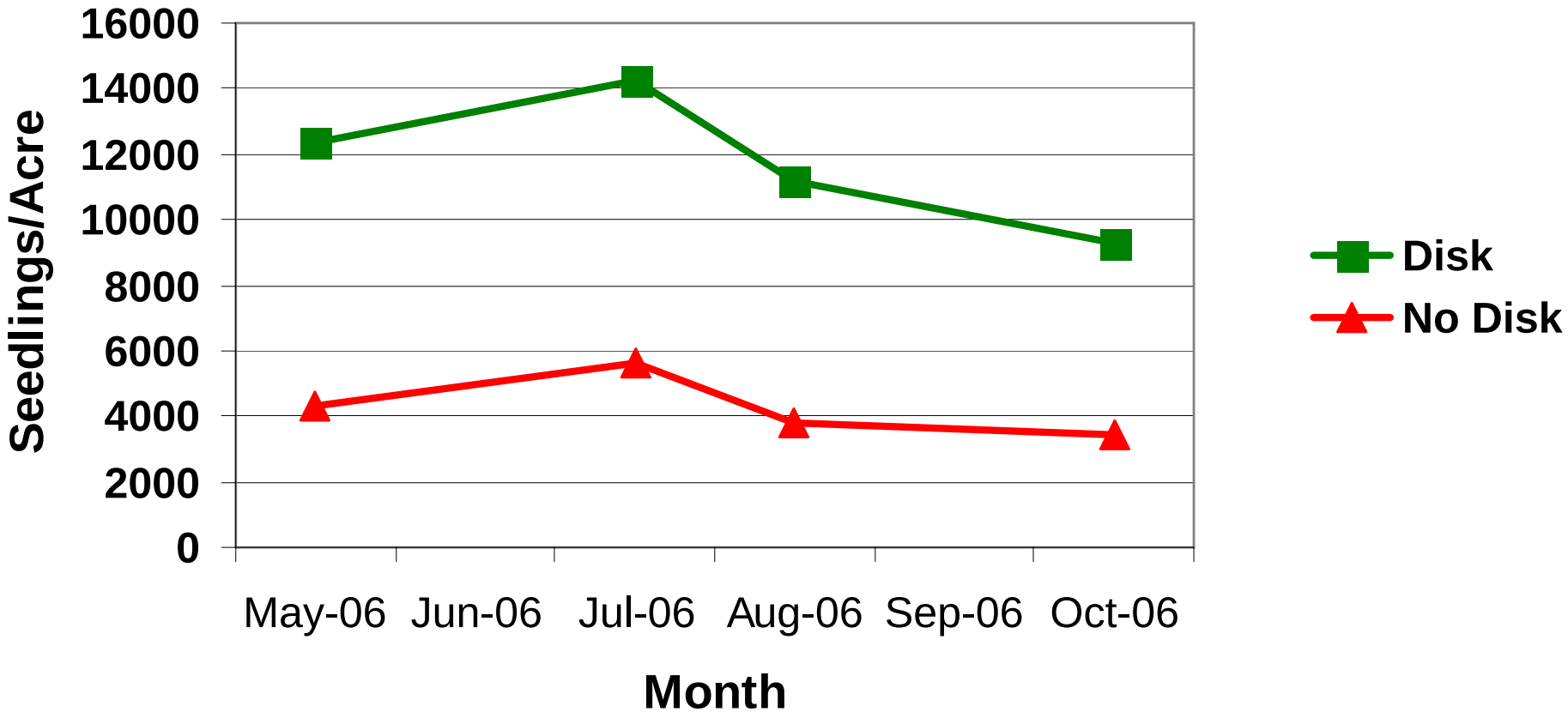
Patchy Distribution



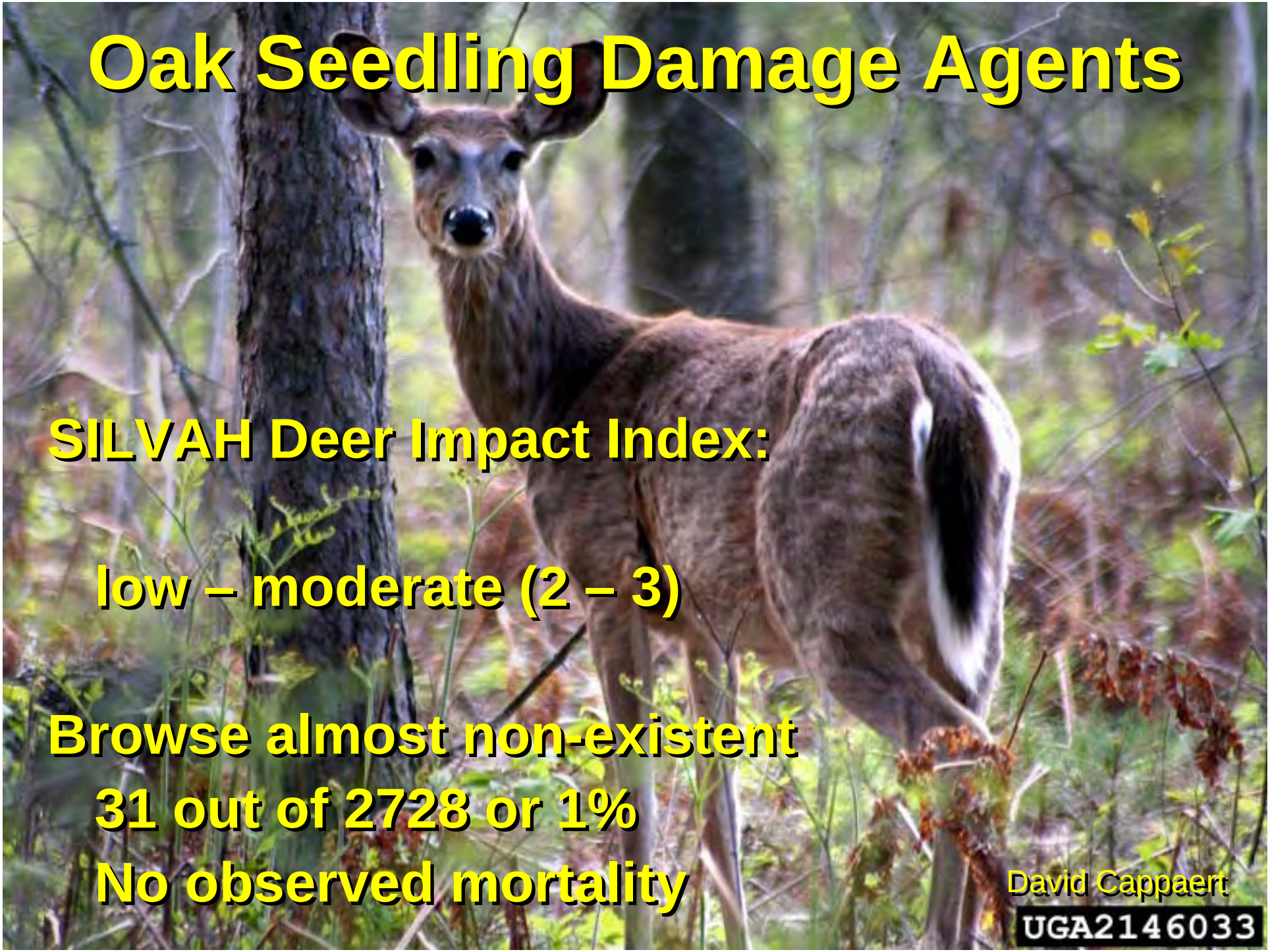
Oak Seedling Attrition by Species - Year 1



Attrition by Disking Treatment - Year 1



Oak Seedling Damage Agents



SILVAH Deer Impact Index:

low – moderate (2 – 3)

Browse almost non-existent
31 out of 2728 or 1%
No observed mortality

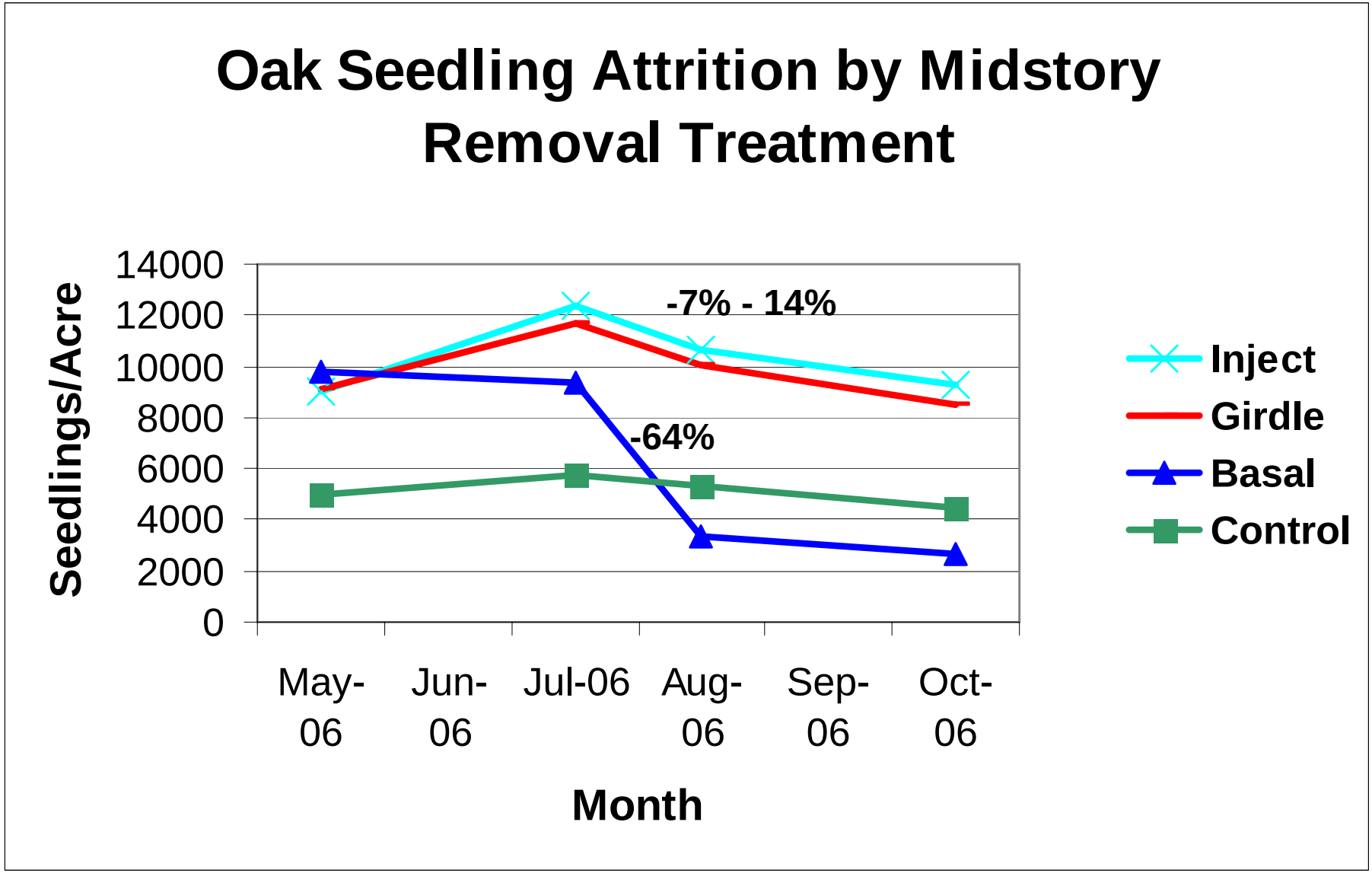
David Cappaert
UGA2146033

Oak Seedling Damage Agents

Herbicide Damage

Of 700 dead seedlings tallied, 411 or 59% killed by herbicide exposure

Oak Seedling Damage Agents



Oak Seedling Damage Agents

Herbicide Damage

Volitalization of triclopyr at temp. exceeding 85°F – 90°F

Oak Seedling Damage Agents

Herbicide Damage

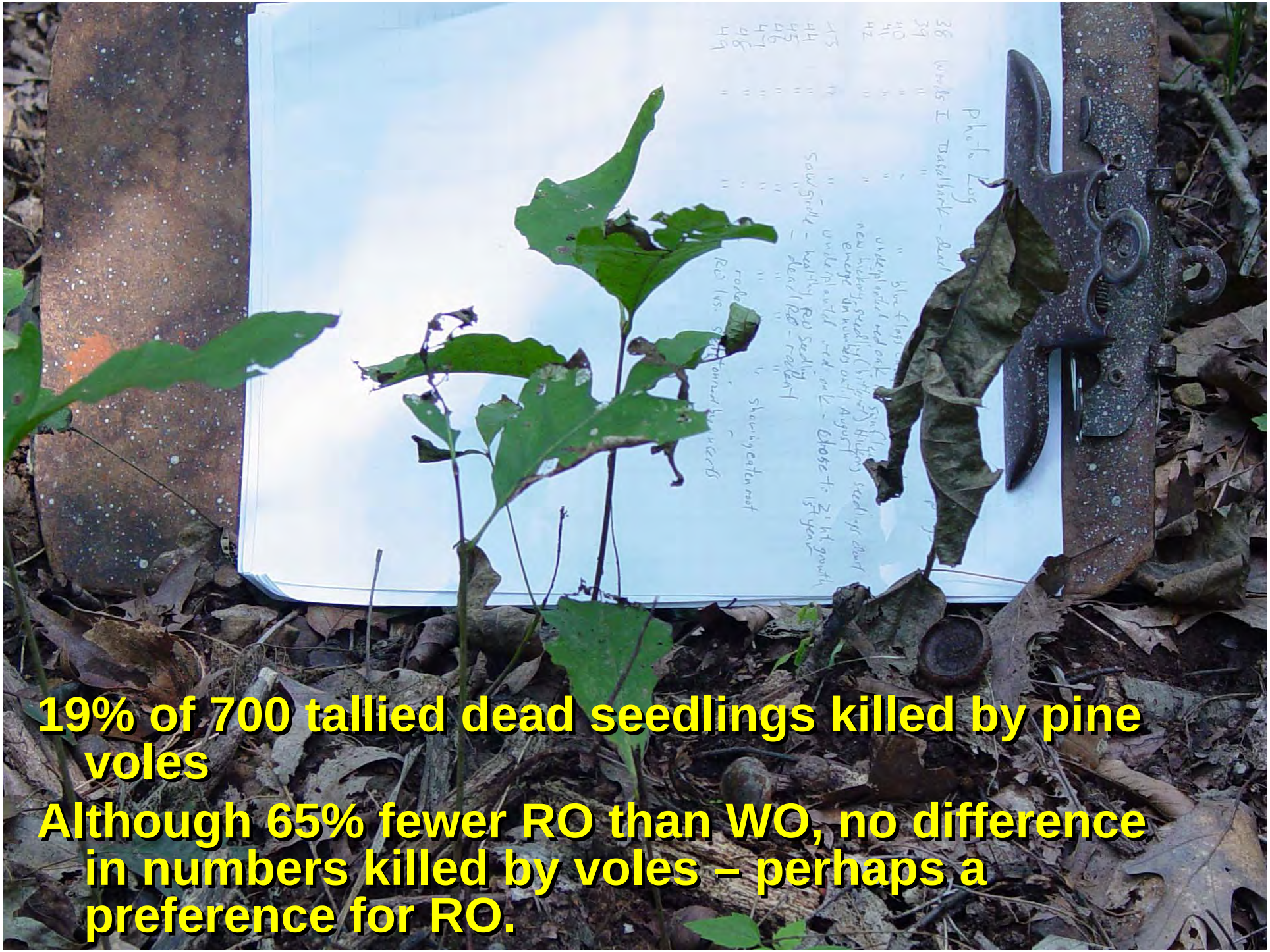
Many resprouted 2nd growing season

Oak Seedling Damage Agents

Pine Vole (*Microtus pinetorum*)
Damage

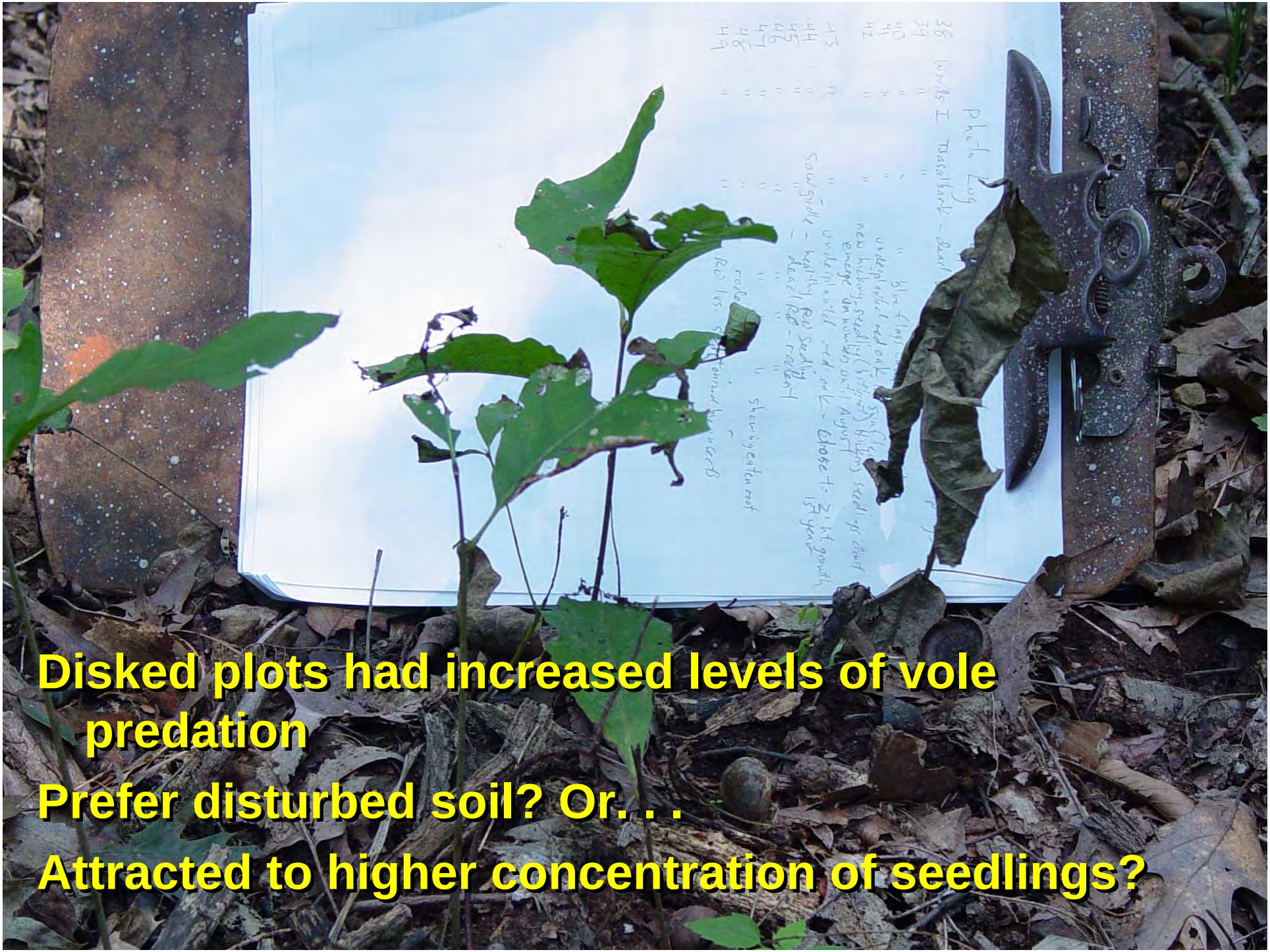
Oak Seedling Damage Agents

Pine Vole (*Microtus pinetorum*) Damage



19% of 700 tallied dead seedlings killed by pine voles

Although 65% fewer RO than WO, no difference in numbers killed by voles – perhaps a preference for RO.



Disked plots had increased levels of vole predation

Prefer disturbed soil? Or. . .

Attracted to higher concentration of seedlings?


57% of estimated mortality unaccounted for.
Pine voles implicated


57% of estimated mortality unaccounted for.
Pine voles implicated


Cost

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For treating ¼ of tract area:

Prep time 0.4 – 0.8 hr/acre

Disk time 0.4 – 0.6 hr/acre

Total Time 0.8 – 1.4 hr/acre

Labor @$25/hr: $20.00 – $35.00/acre

Fuel @$4.25/gal diesel: $0.81 – $1.23/acre

Total: $20.81 – $36.23/acre

Disking Preparation

- I.d. stands
  - Ready to regenerate
  - Adequate # seed trees, well distributed
  - Less disturbed, well-developed shade-tolerant midstory and ope understory
  - Minimal ground level obstacles
  - Favorable topography
- Scout acorn crop
- In-house equip and labor ready to respond
- Prep. equip by mid-October
- Flag disk lanes
  - Avoid obstacles & adverse terrain
  - Include acorn bearing trees
- Clear disk lanes
- Scout to determine when acorn dispersal complete

Management Implications

- Will long term survival justify effort?
- Will survival rates match or exceed prior experience (Loftis, Beck, Crow)?
- How long will voles be an important predator?
- What is spatial and temporal extent of pine vole impact on oak regeneration dynamics?
- Can pine voles be managed during significant oak seedling establishment events?

Management Implications

- Disking greatly increases oak seedling establishment
- Important to provide adequate light through timely midstory removal
- Basal bark, provided quicker kill of midstory, but volitalization precludes its use in summer.
- Pine voles may be important, but uncontrollable factor in 1st year.