Oak Shelterwood

White oak
and
Black Oak Response

Jeff Stringer – University of Kentucky
Dylan Dillaway – University of Wisconsin
David Loftis – USFS Southern Research Station

UK COOPERATIVE EXTENSION SERVICE
University of Kentucky – College of Agriculture

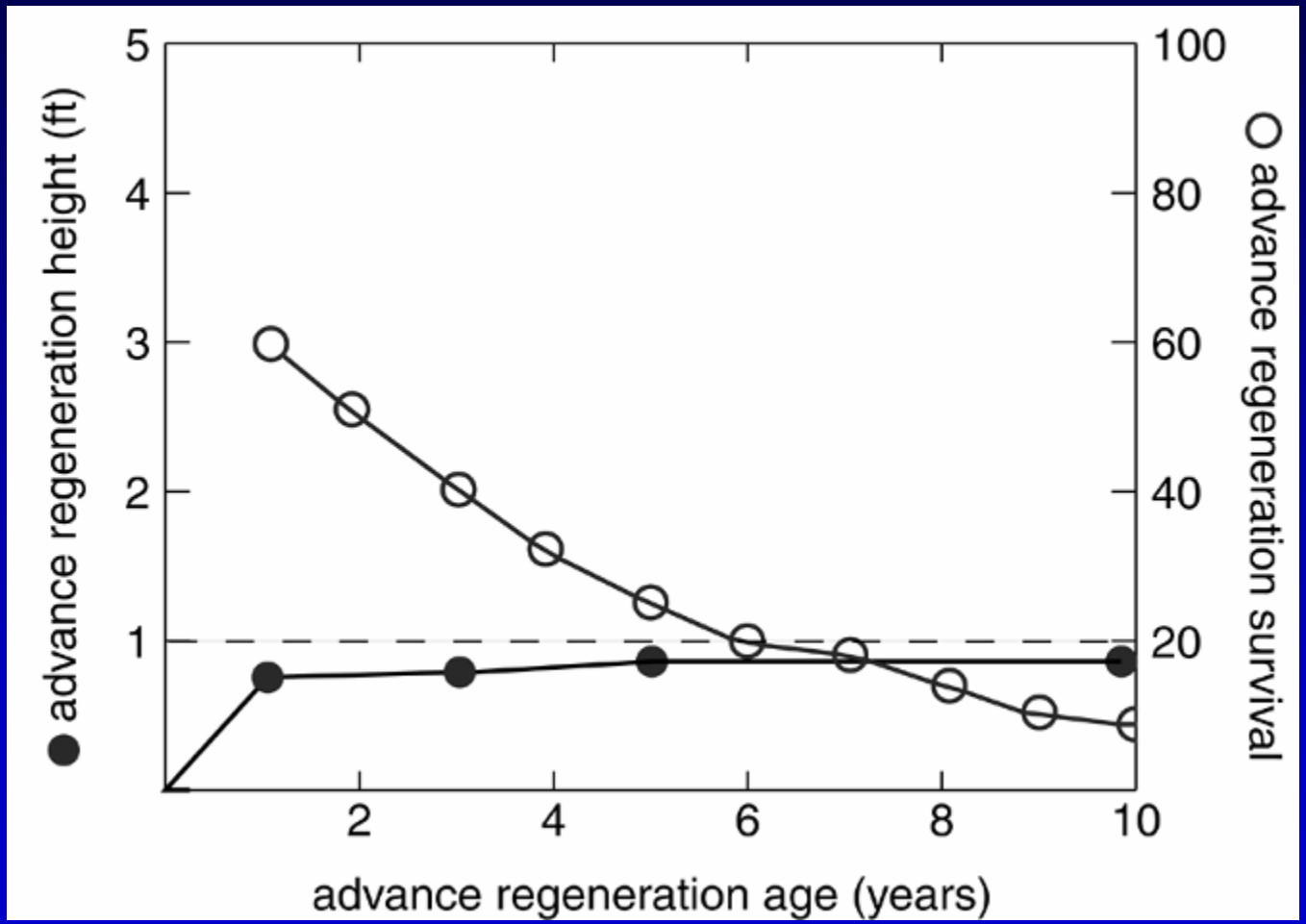
Oak Shelterwood Method

- requires presence of advance regeneration
- properly timed mid-story removal
- appropriate interval to culture advance regeneration
- final overstory removal (entire or partial)

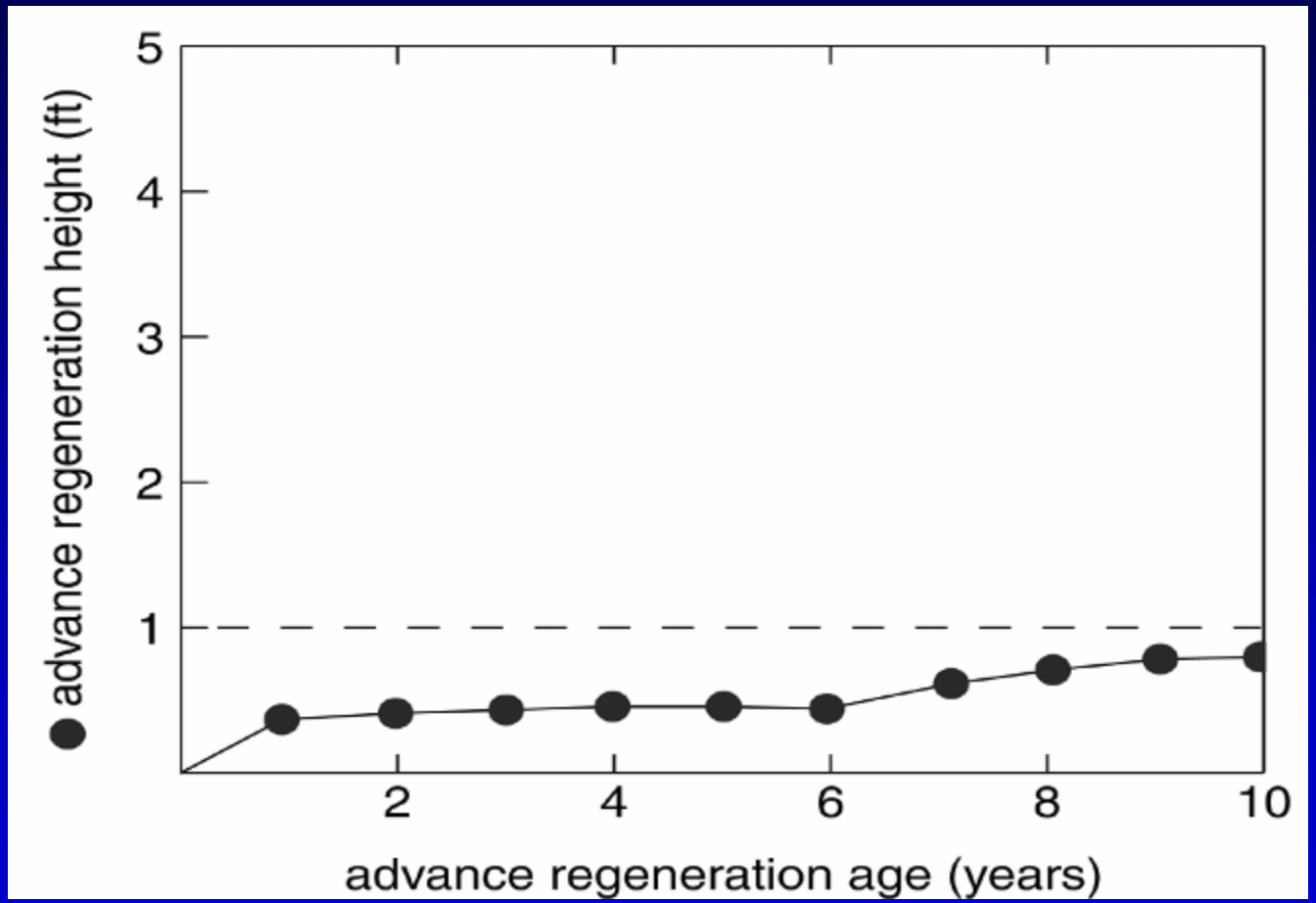
Results of Research

- Q. alba and associated species
- S.I. 65 to 80 for upland oak
- Berea Forest, Eastern/Central KY

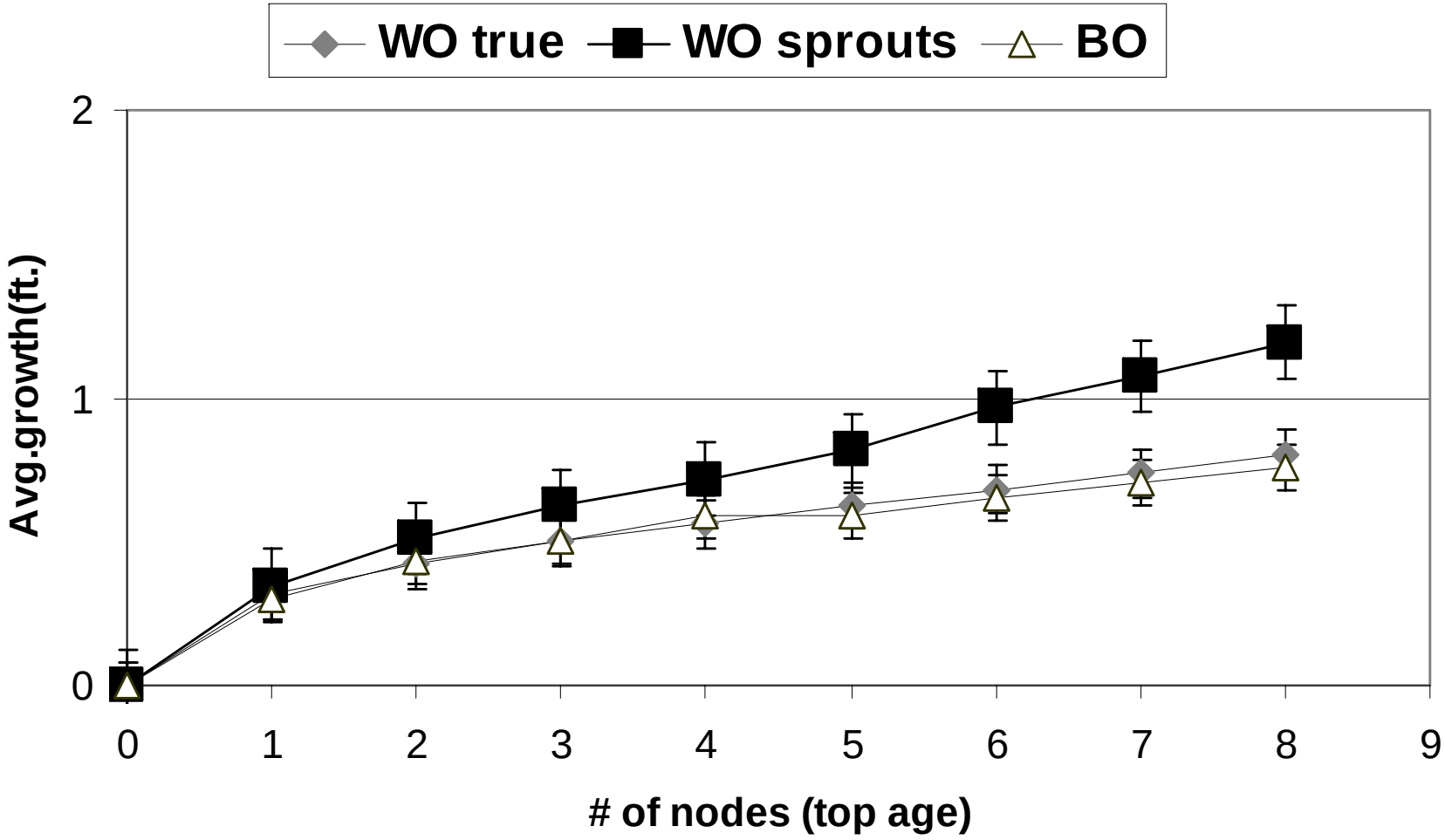
Comparison Q. rubra and Q. alba Undisturbed Stands (Q. rubra)



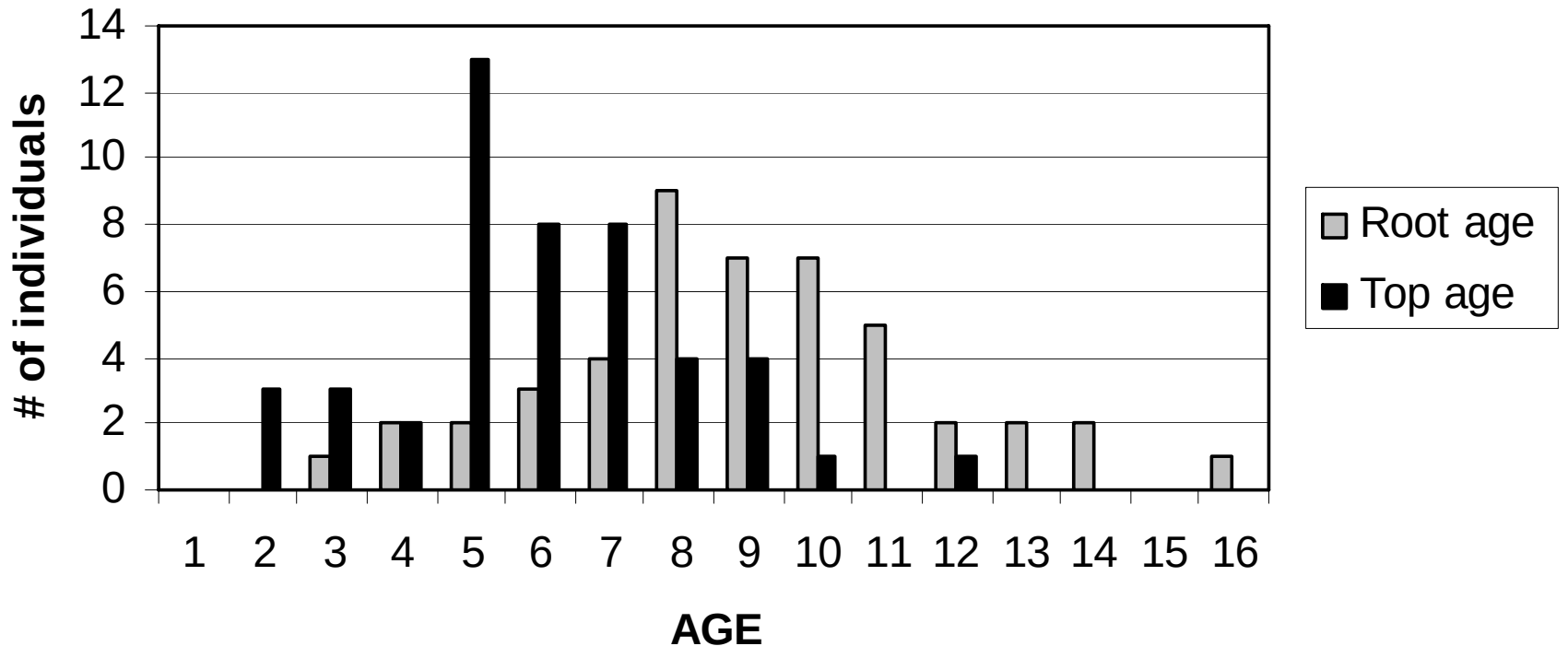
Undisturbed Stands (Q. alba)



Oak seedling growth/node



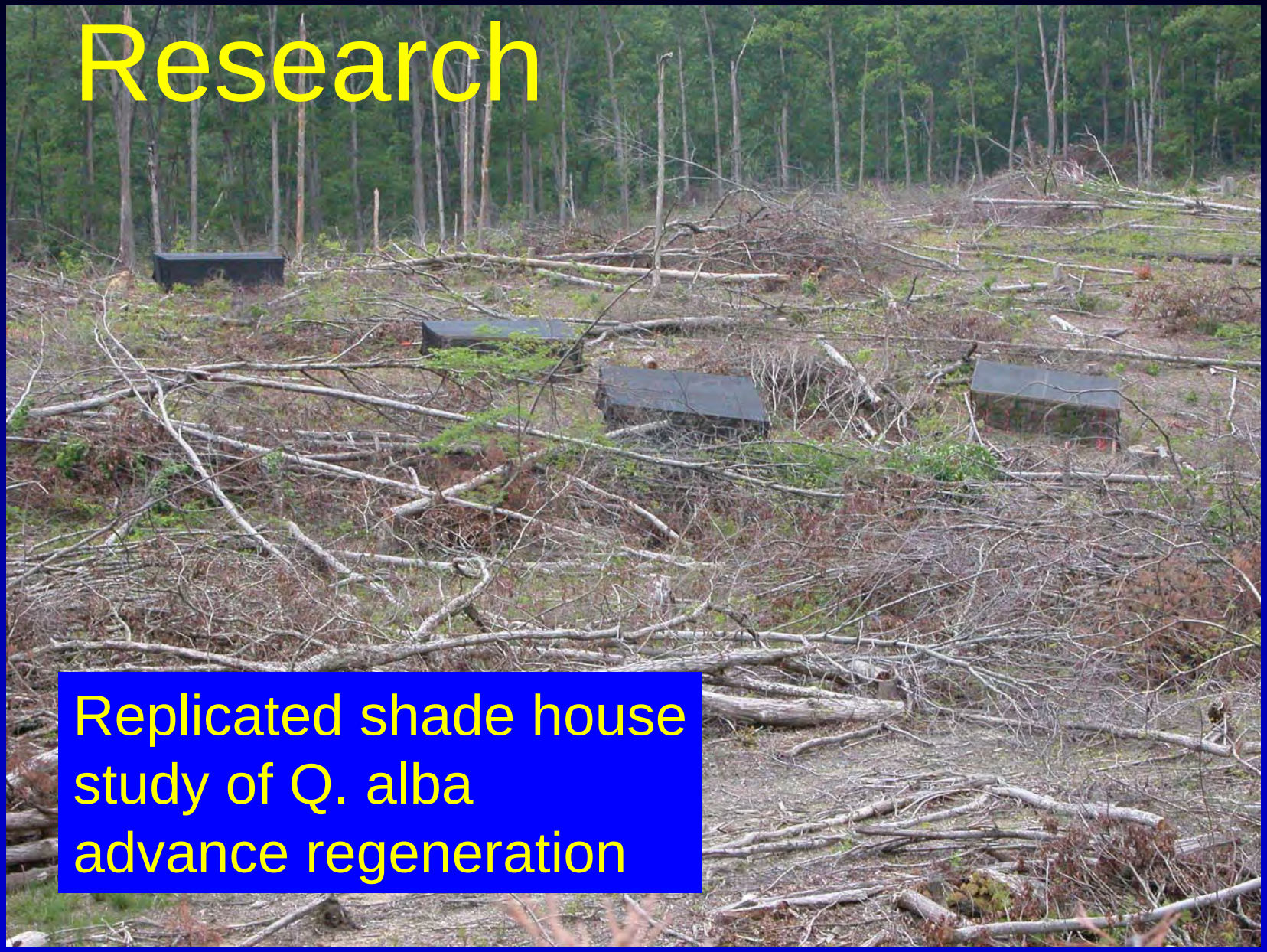
Age distribution of seedling sprouts




14 year-old
suppressed Q. alba
seedling

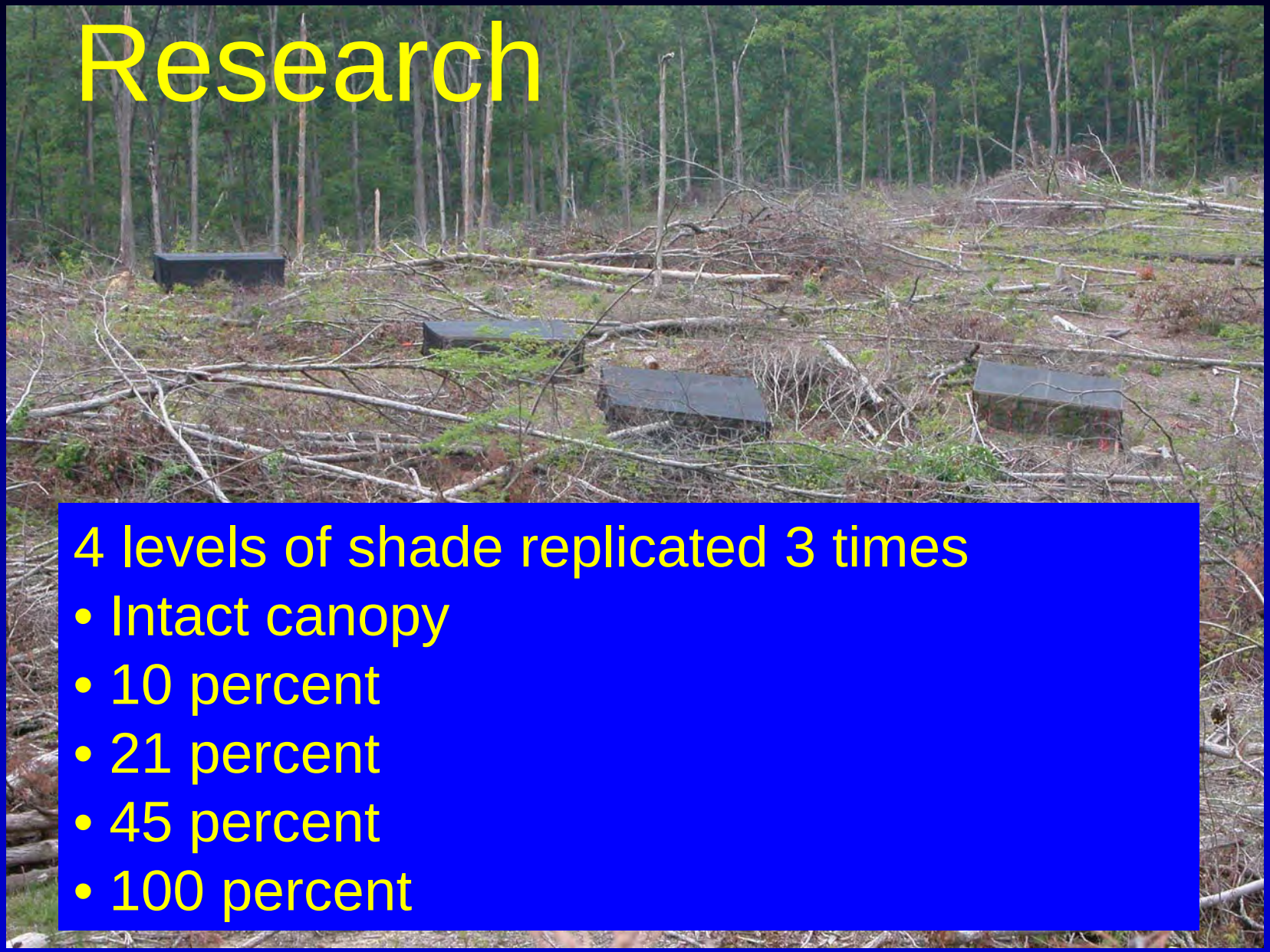

4 year old
top
WP-WHO-23
11 year old
root

Research



Replicated shade house study of Q. alba advance regeneration

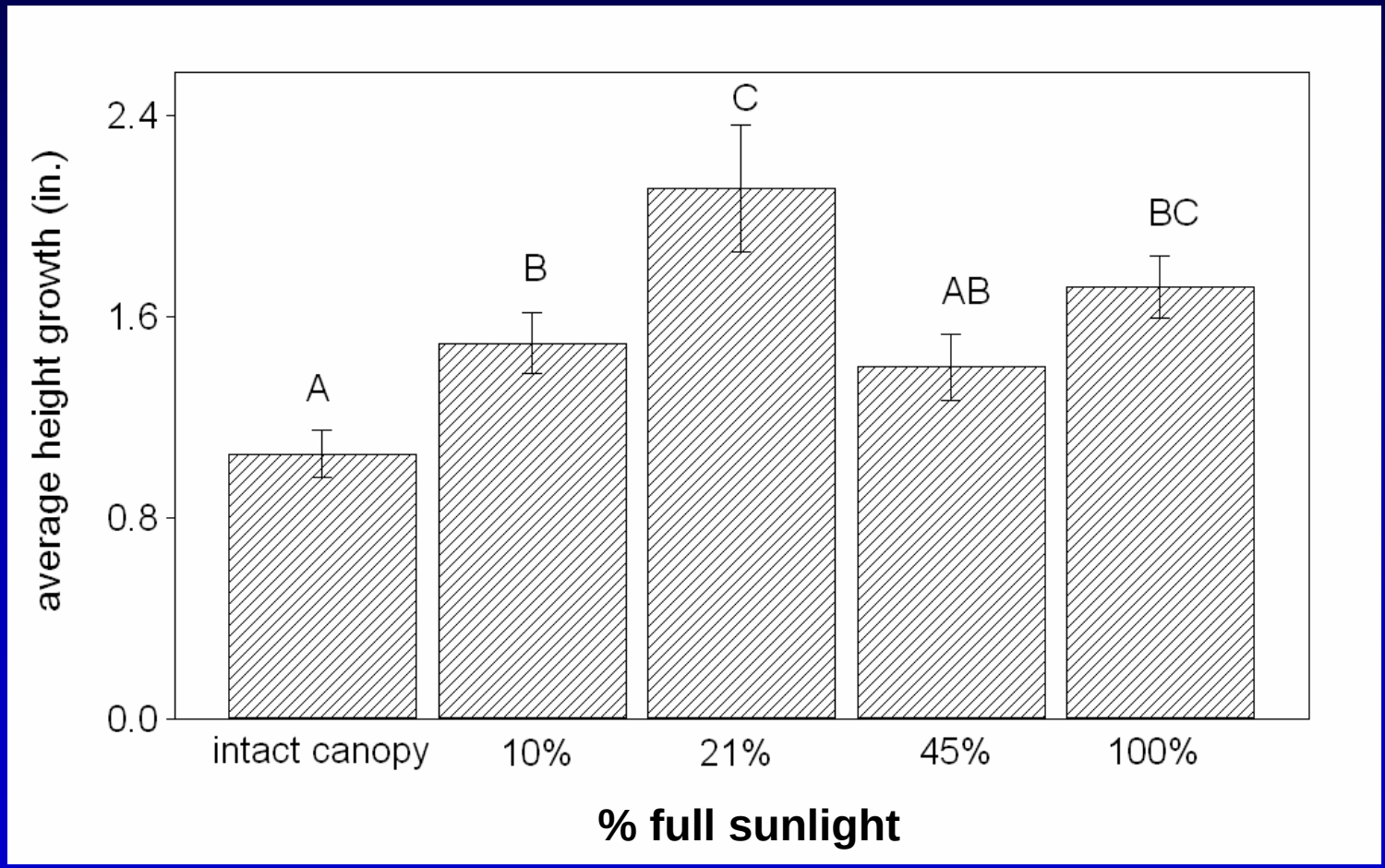
Research



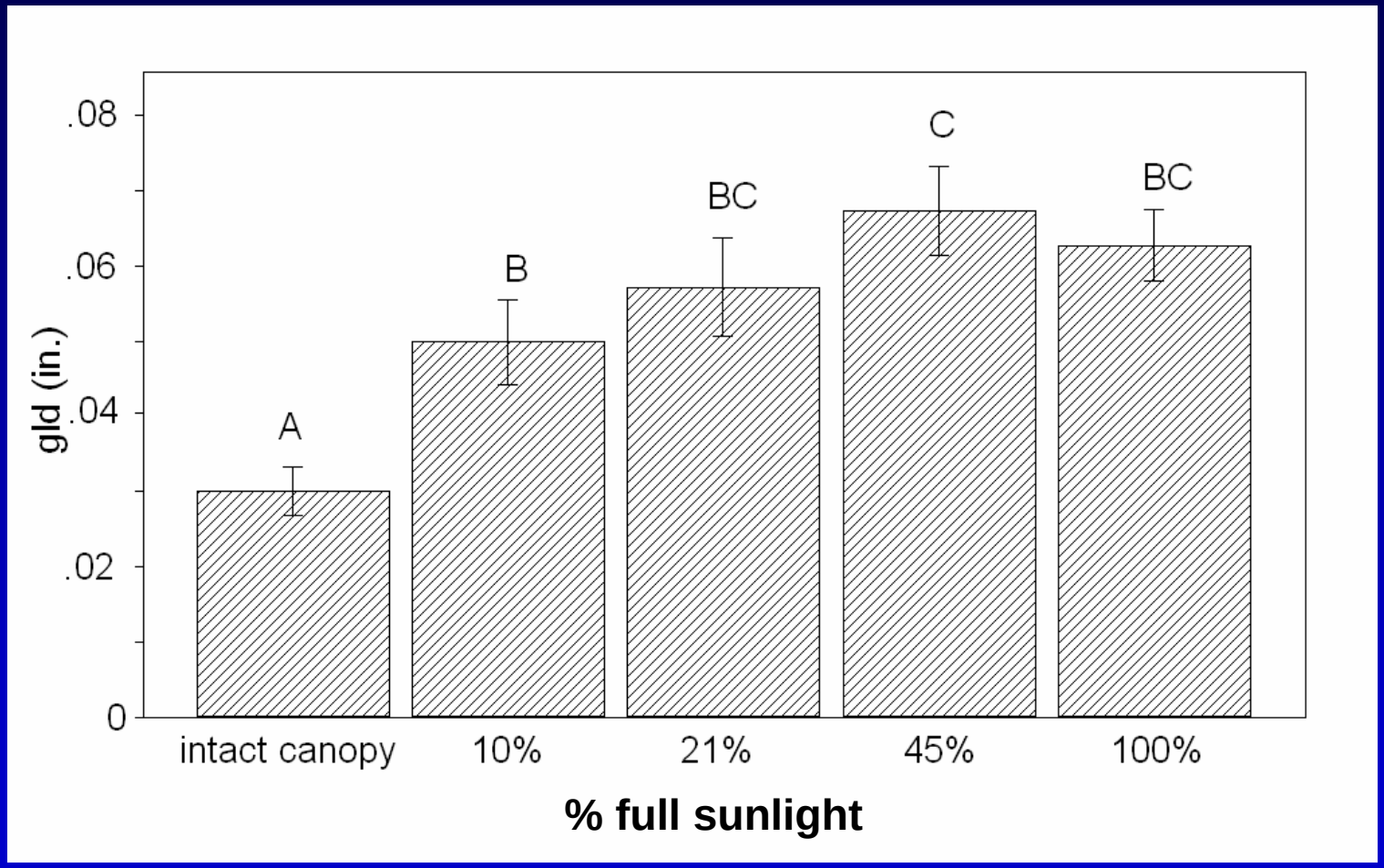
4 levels of shade replicated 3 times

- Intact canopy
- 10 percent
- 21 percent
- 45 percent
- 100 percent

Effect of light on first year height growth of *Q. alba* advance regeneration



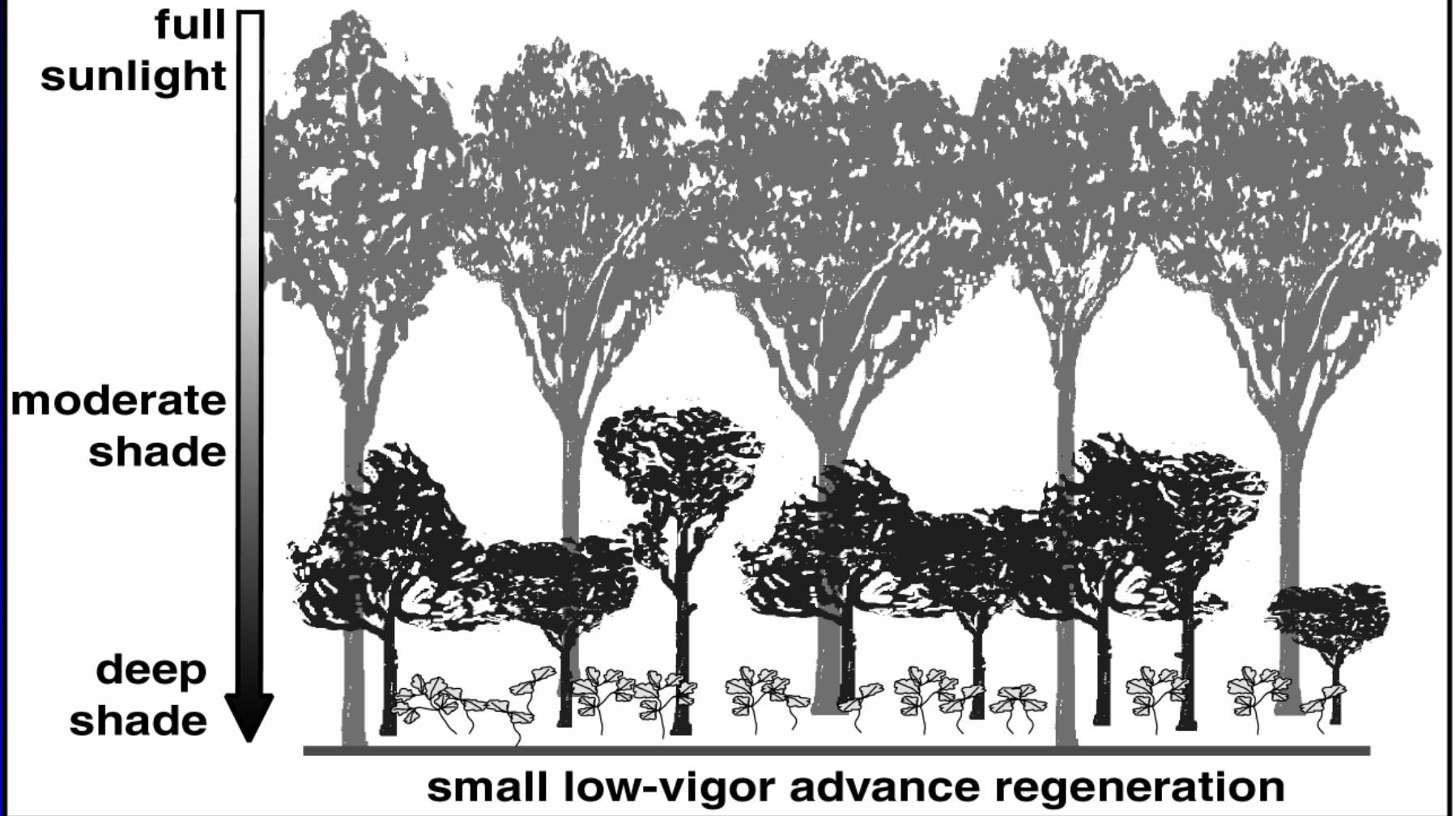
Effect of light on first year groundline diameter (gld) of *Q. alba* advance regeneration



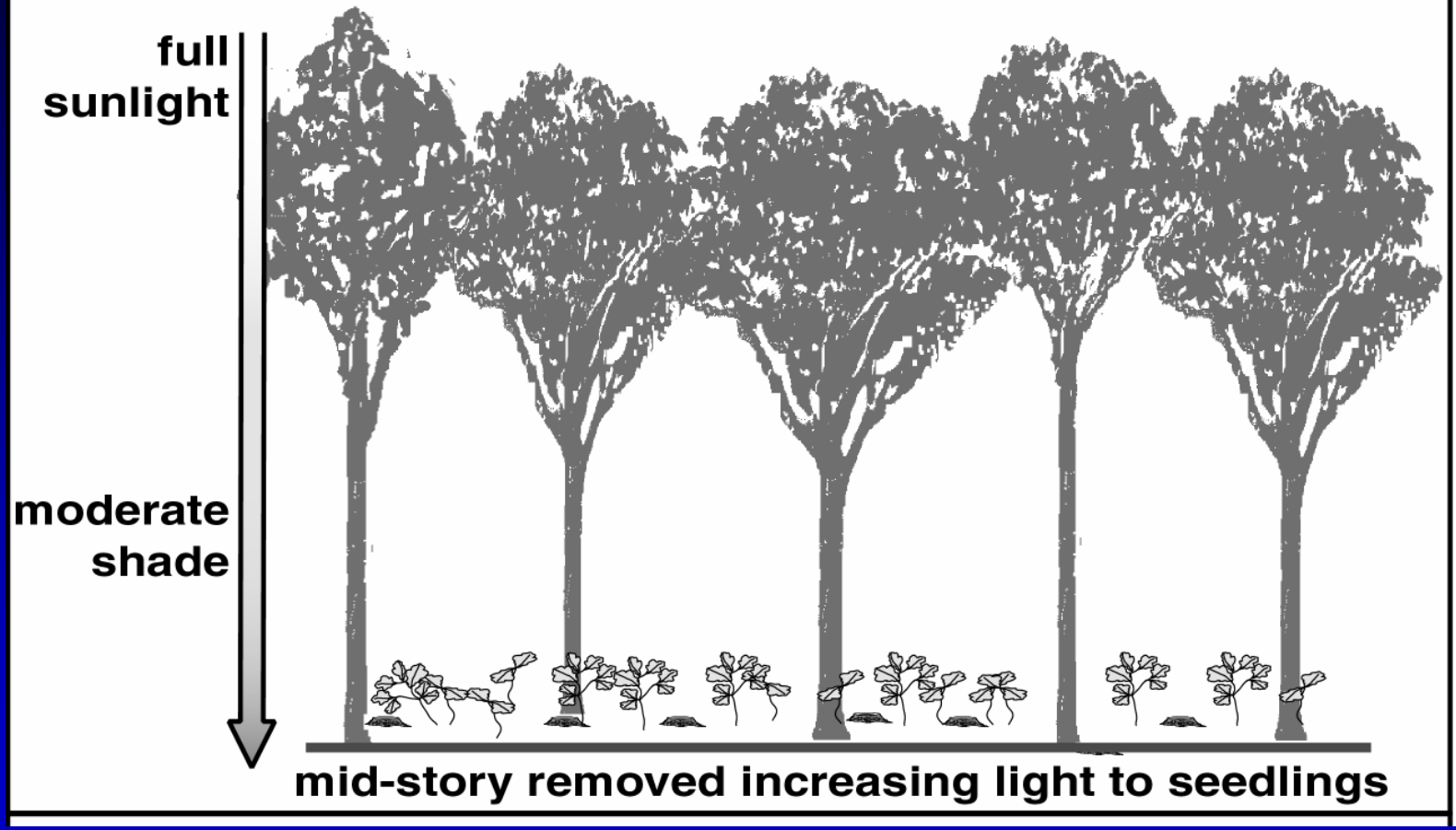
Research

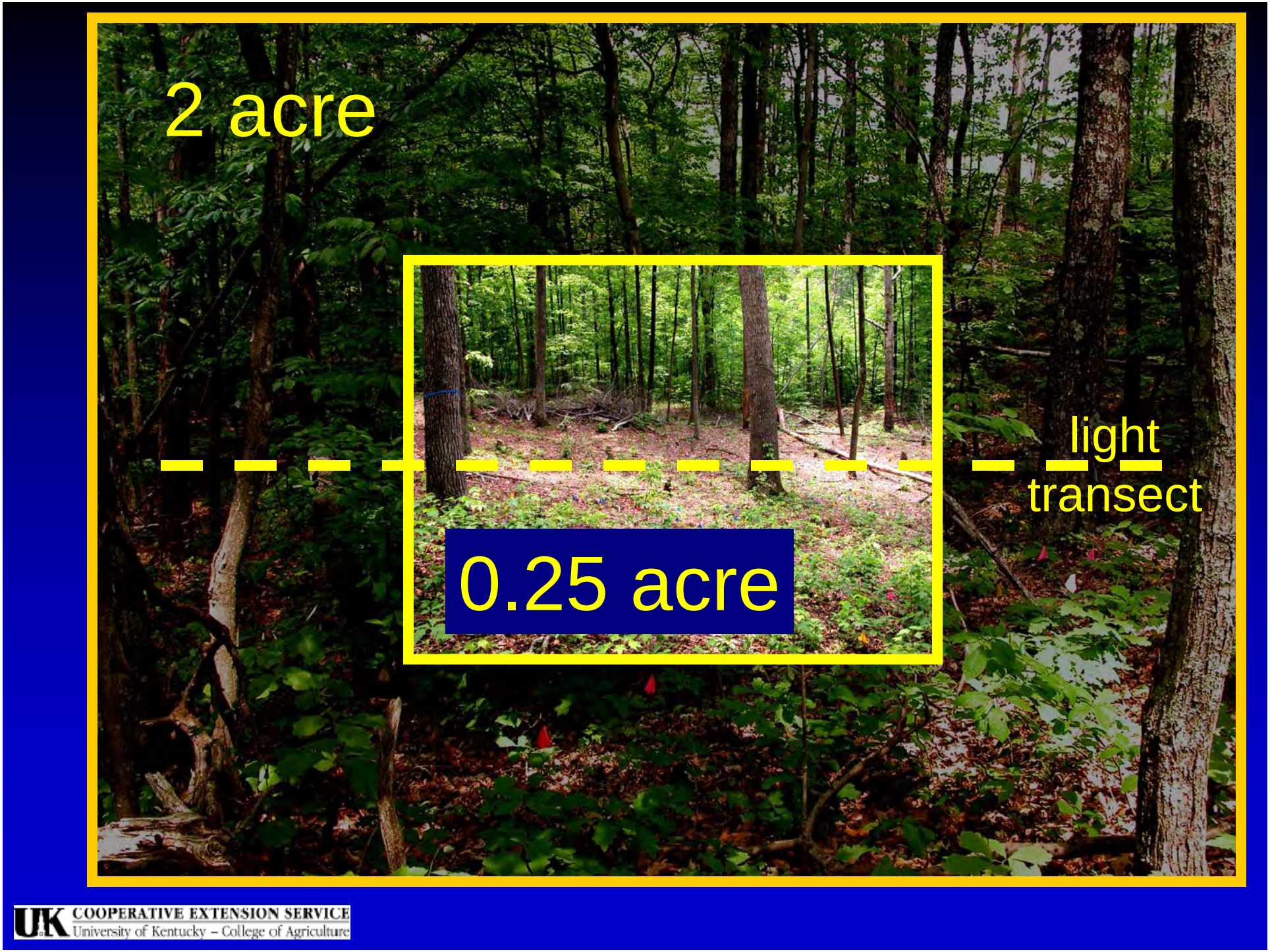
Replicated mid-story removal in Q. alba dominated stands.

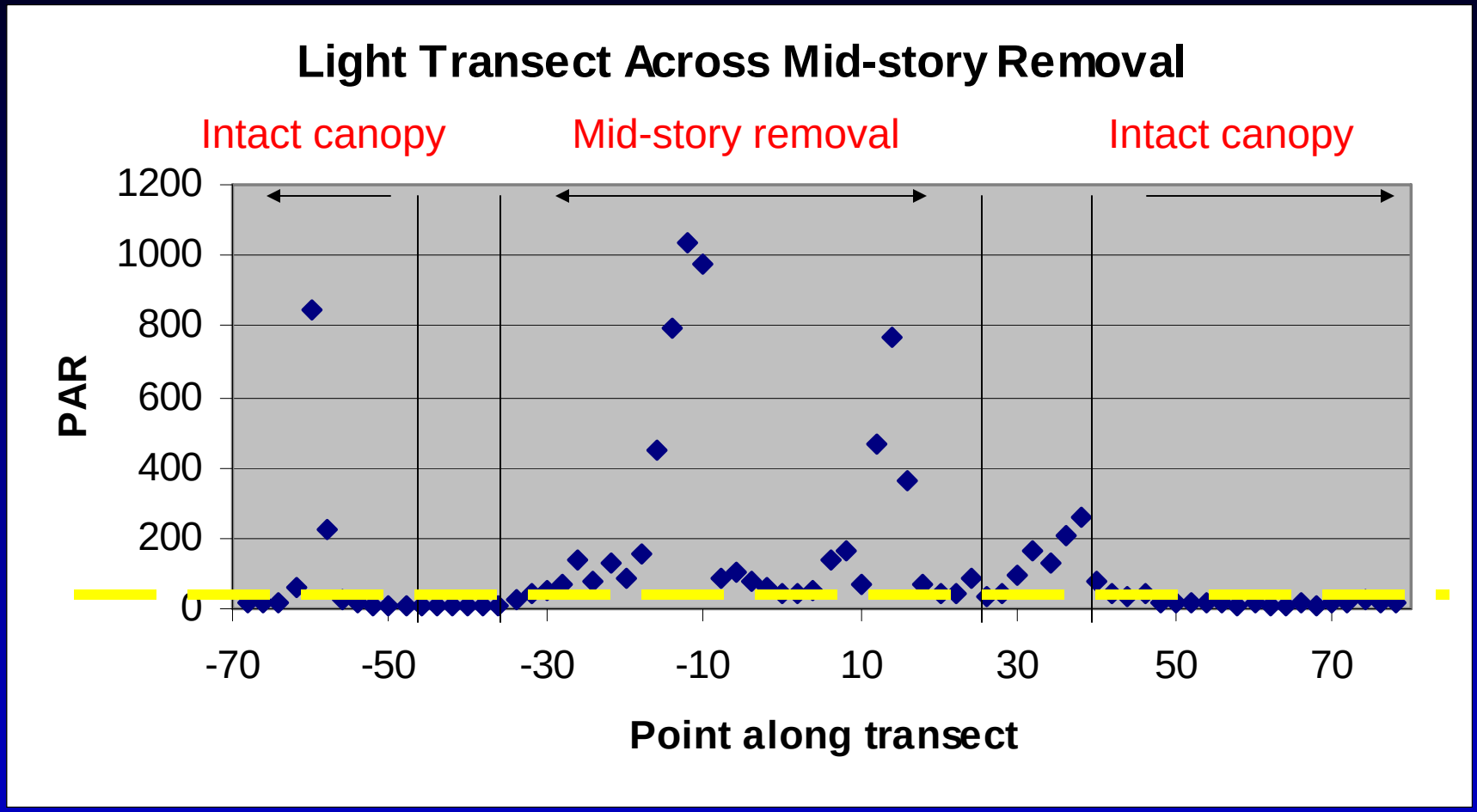
INTACT CANOPY AND MID-STORY

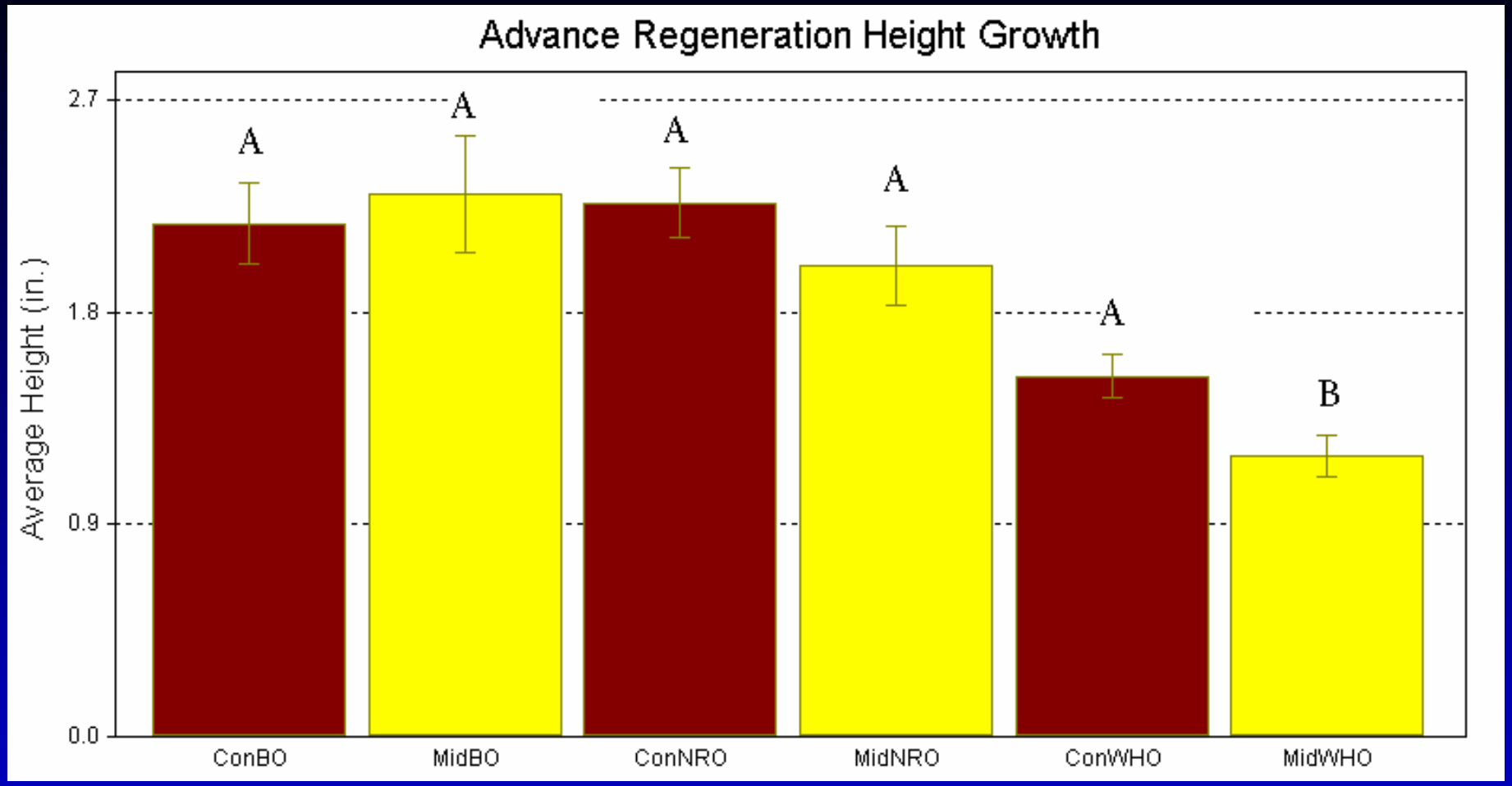


MID-STORY REMOVAL TREATMENT



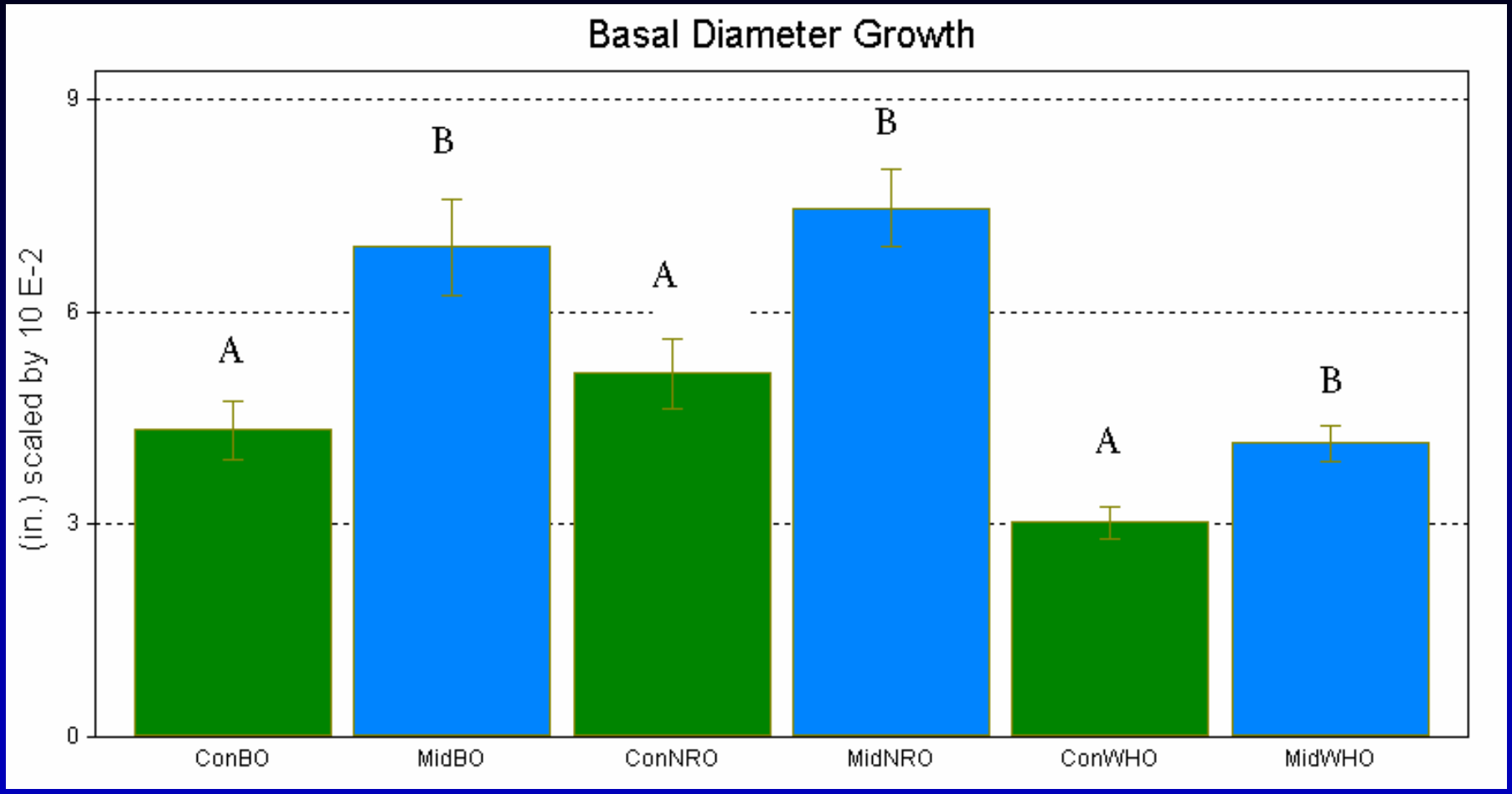

2 acre
0.25 acre
light
transect


Light Transect Across Mid-story Removal
Intact canopy
Mid-story removal
Intact canopy
PAR
1200
1000
800
600
400
200
0
-70
-50
-30
-10
10
30
50
70
Point along transect



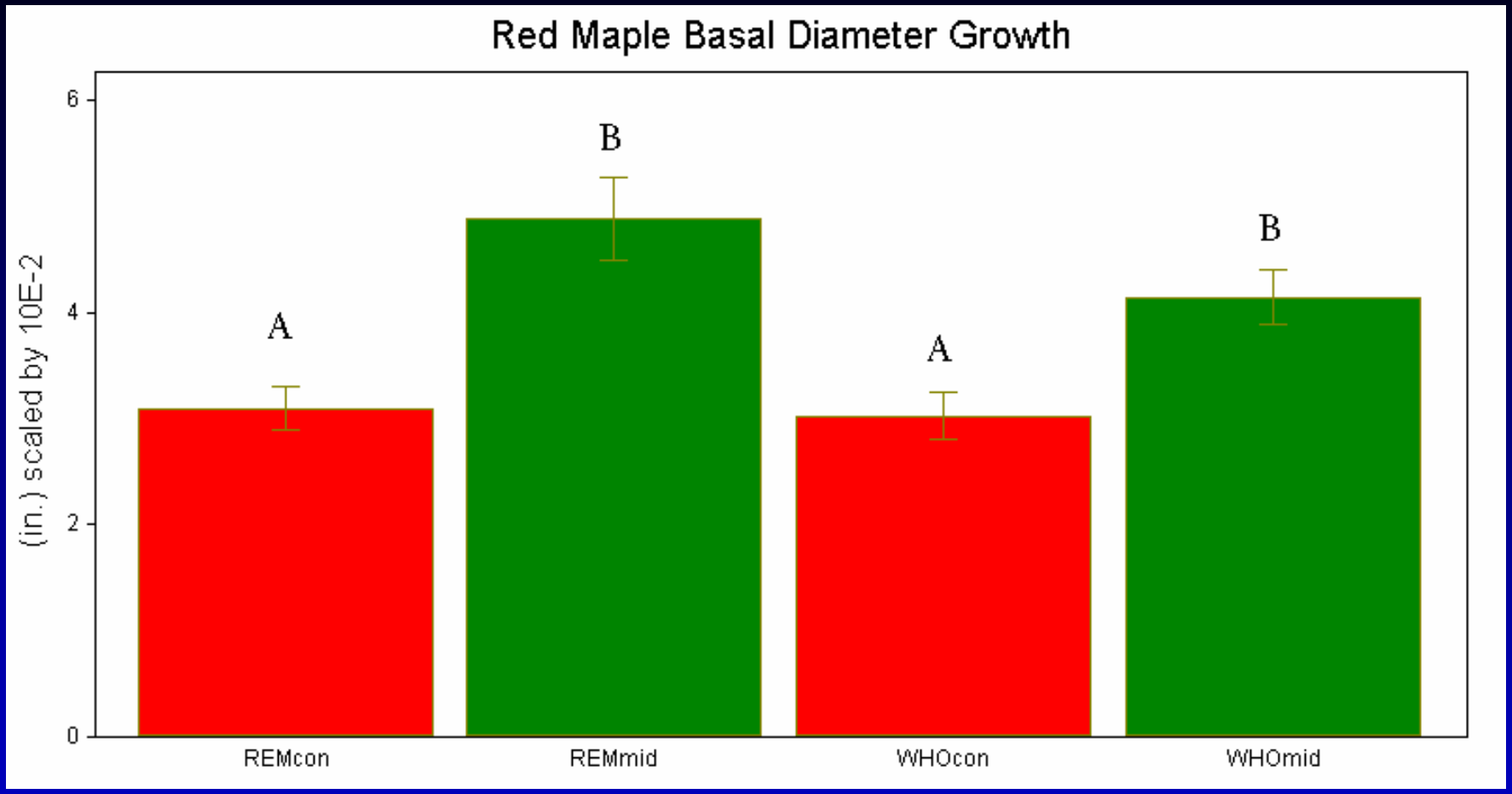
Q. velutina Q. rubra Q. alba

control mid-story



Q. velutina Q. rubra Q. alba

control mid-story



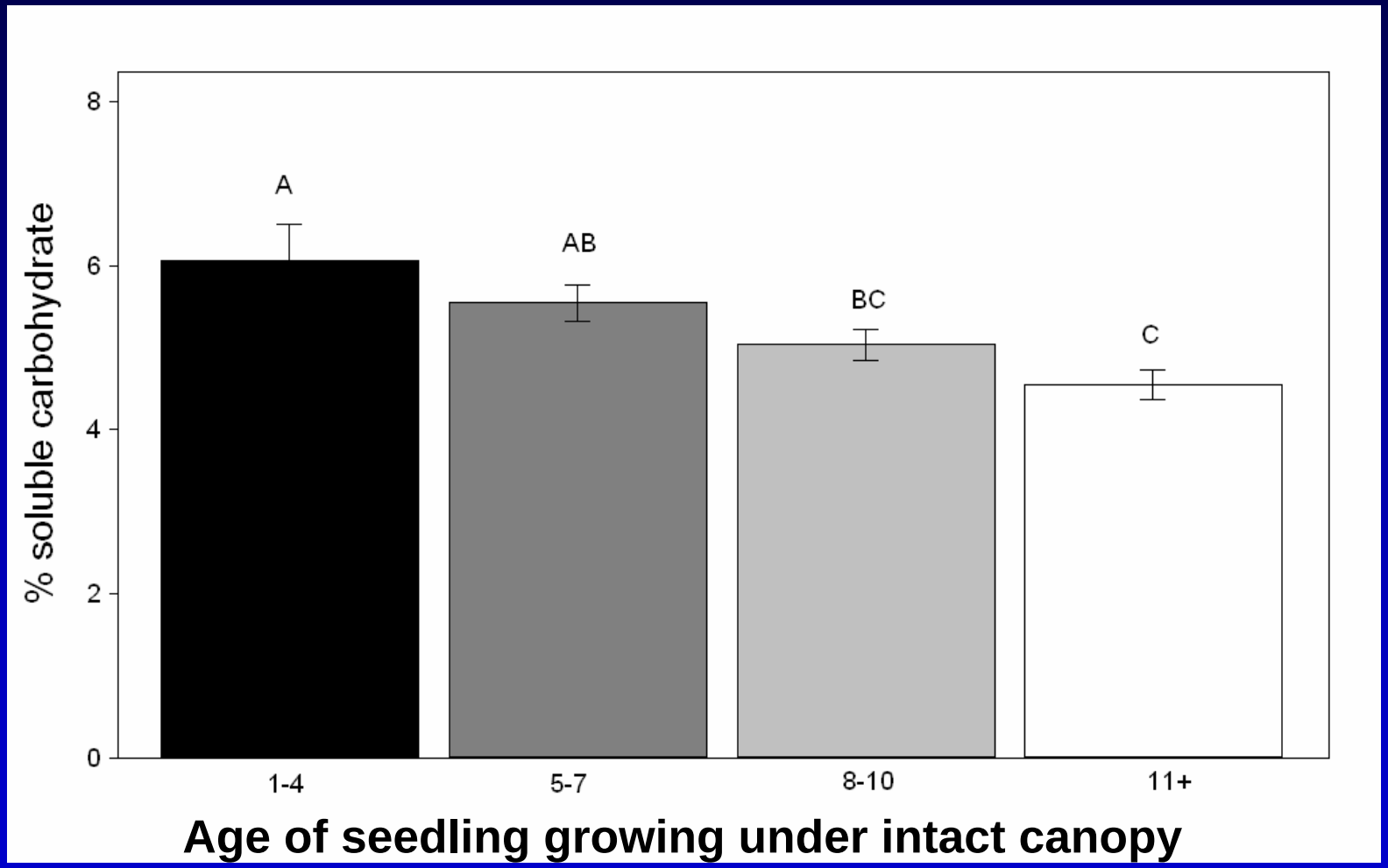
A. rubrum

Q. alba

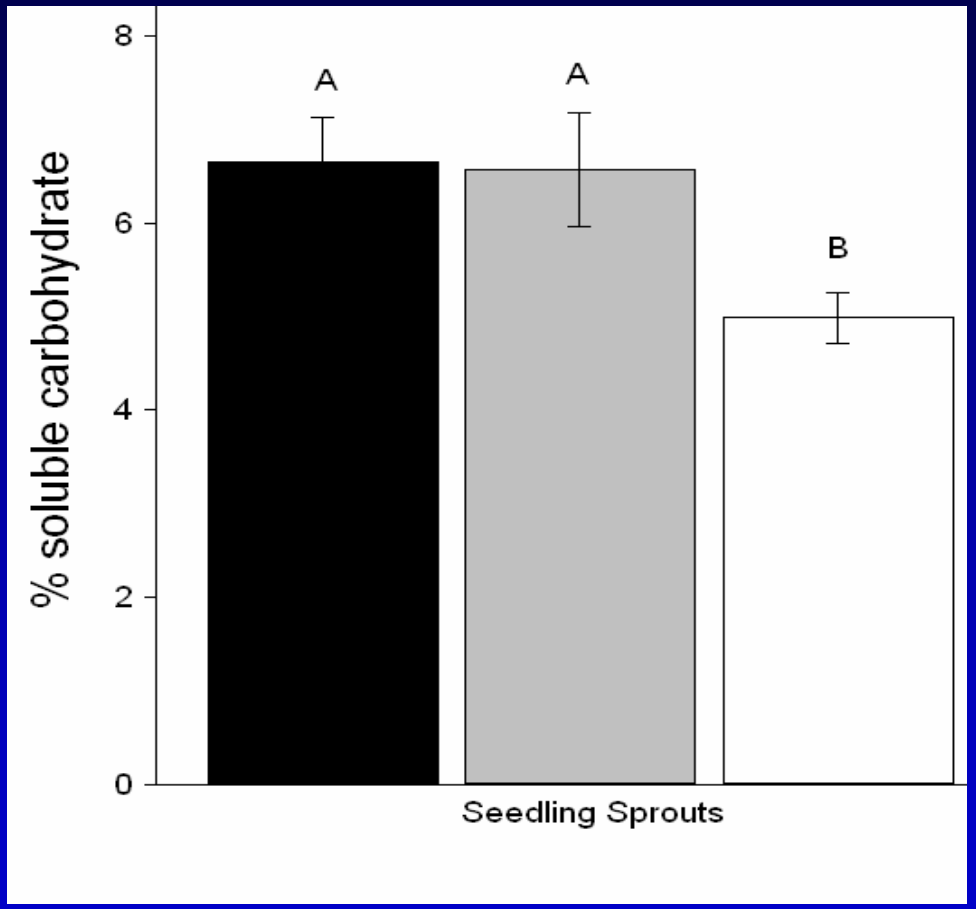
control

mid-story

Effect of years of suppression on soluble carbohydrates of *Q. alba* advance regeneration roots



Soluble carbohydrates of *Q. alba* advance regeneration roots



Research Conclusions

- Intact canopies with significant mid-stories reduce light levels affecting oak regeneration
- Oak shelterwood method using mid-story removal can improve light levels and affect oak advance regeneration development
- Evidence that length of suppression and sprouting may play a role in timing of treatment effect and potential overall treatment effects

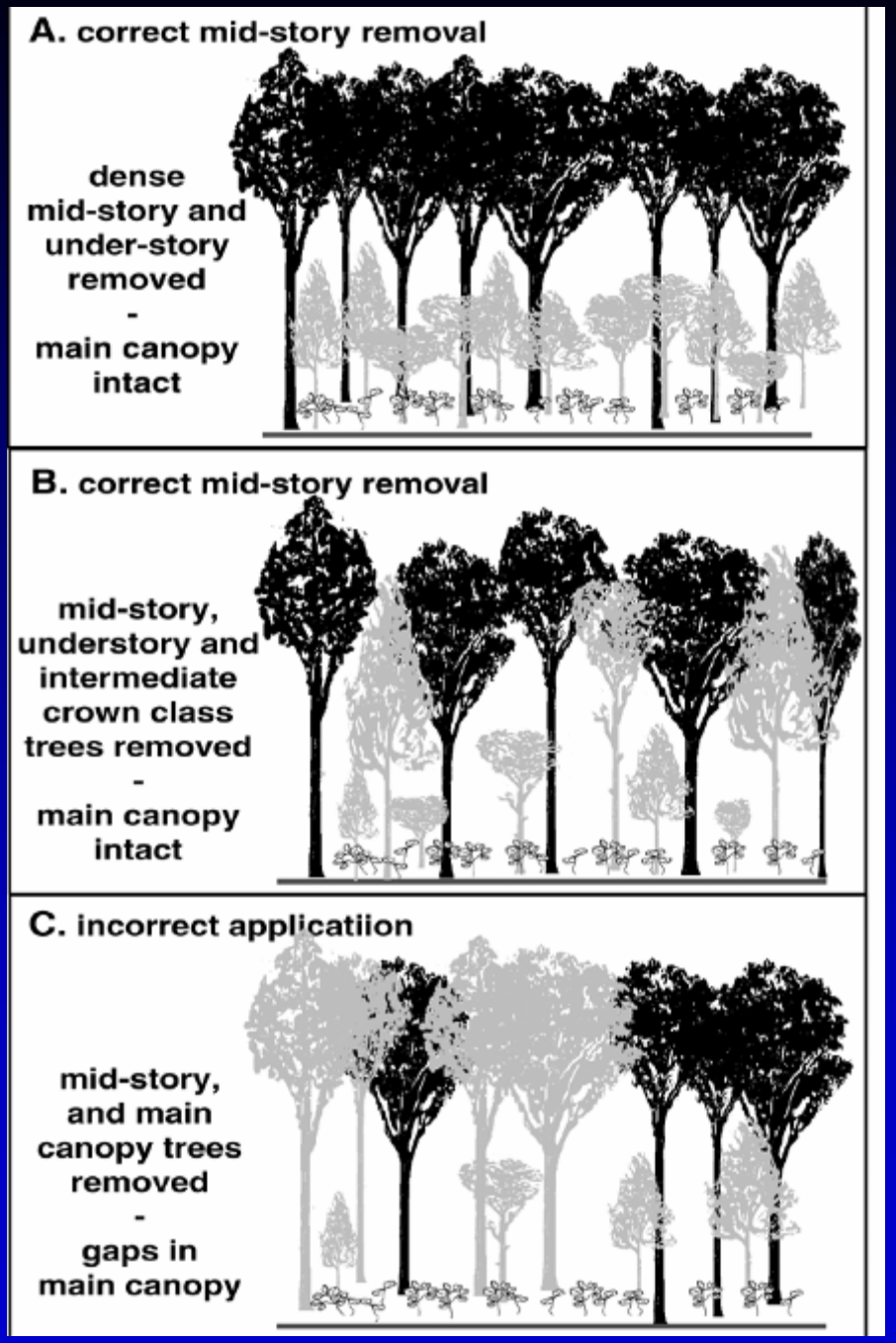
Applying the Oak Shelterwood Method

1. **Acorn crop producing new seedlings**
   - **and/or enhance with artificial regeneration**
2. **Mid-Story Removal**
   - **approximate 20 to 30% B.A. reduction using herbicides to increase diffuse light**
3. **Grow advance regeneration to 3 to 4 ft in height**
4. **Potential Follow-Treatment for Competitors**
5. **Overstory Removal**
   - **Full (stand level, group openings)**
   - **Partial (irregular shelterwood, deferment cut)**

Mid-story removal

Correct application removes mid/understories without generating main canopy openings.

Incorrect application where removals provide canopy gaps.



Summary of Oak Shelterwood Implementation

Stringer, J. 2006. Oak Shelterwood. Cooperative Extension Service, University of Kentucky, FOR-100. 7pp.

www.ukforestry.org

UT Extension SP676

Professional Hardwood Notes Technical Information on Hardwood Silviculture for Foresters

Oak Shelterwood: A Technique to Improve Oak Regeneration

Jeff Stringer, Extension Professor of Hardwood Silviculture, Department of Forestry, University of Kentucky

The oak shelterwood method has been developed to enhance the regeneration potential of oaks growing on intermediate and high-quality sites. The method involves a well-timed mid-story removal to improve the number and vigor of oak advance regeneration and a subsequent overstory removal to facilitate regeneration of the stand (Figure 1).

Oak Regeneration Dynamics

Successful regeneration of oak on intermediate and high-quality sites (upland oak site index > 65 to 70 feet) is limited due to the lack of the vigorous advance regeneration and/or saplings/pole-sized trees that are capable of sprouting. Vigorous advance regeneration and/or stump sprouters are required at the time of regeneration on intermediate and high-quality sites, due to the abundance of competing species. Oak advance regeneration that is small in stature and low in vigor can quickly become overtopped by co-occurring species after a regeneration event. On poorer-quality sites, oaks are subjected to less competition, and often contain an adequate pool of advance regeneration or trees that are capable of sprouting.

In many instances, oak stands on intermediate and high-quality sites contain well-developed, mid- and under-stories of shade-tolerant species typically composed of red maple, sugar maple and American beech. This stand structure leads to light levels at

Untreated with well-developed mid-story.

First growing season after mid-story removal.

Figure 1. Oak shelterwood method and the implementation of the mid-story removal treatment in a typical upland oak stand.

SREF

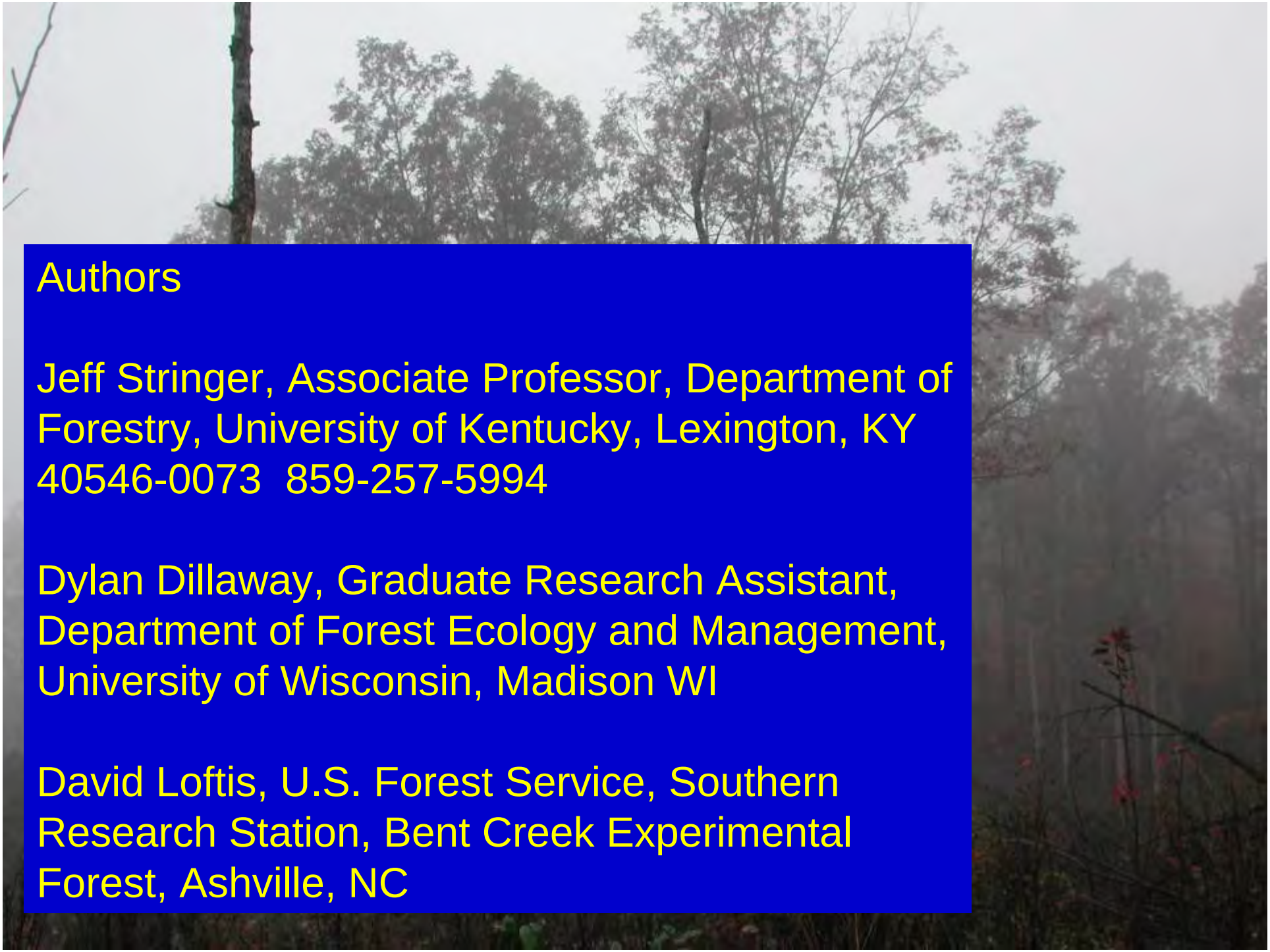
Tennessee Forestry

Cooperative Extension Service UK University of Kentucky College of Agriculture

THE UNIVERSITY of TENNESSEE

Problems

- Advance regeneration not present or significantly suppressed (loss of apical dominance, etc.)
- Lag time of response
- Encouragement of shade tolerant competitors



Authors

Jeff Stringer, Associate Professor, Department of Forestry, University of Kentucky, Lexington, KY 40546-0073 859-257-5994

Dylan Dillaway, Graduate Research Assistant, Department of Forest Ecology and Management, University of Wisconsin, Madison WI

David Loftis, U.S. Forest Service, Southern Research Station, Bent Creek Experimental Forest, Ashville, NC