

# Basics of the Oak Shelterwood Method



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# Current Oak Regeneration Situation



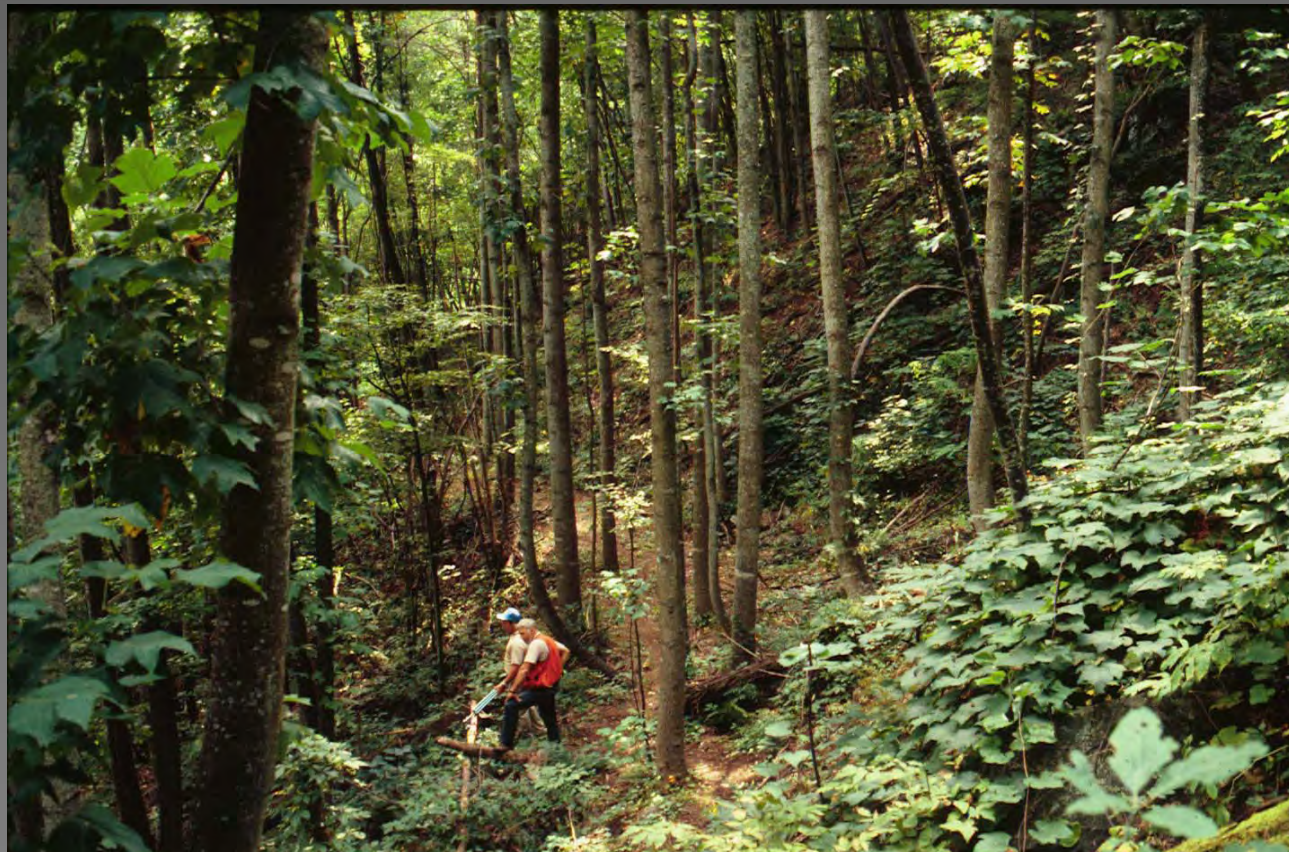
**lower productivity site – oak regeneration generally abundant**

# Current Oak Regeneration Situation

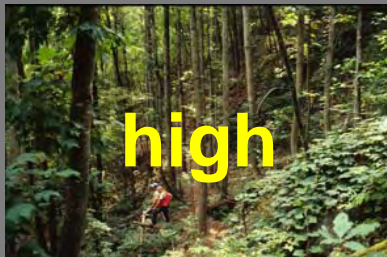


**medium site – oak regeneration sporadic / intermediate abundance**

# Current Oak Regeneration Situation



**highly productive site – oak regeneration absent and/or small**



#  
species

low



high

leaf  
area

low



high

sunlight  
@  
ground

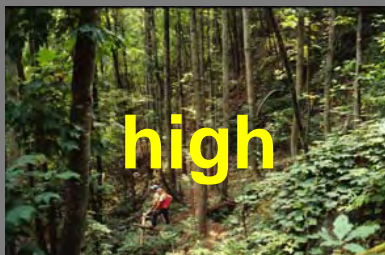
high



low

**Abundance  
of  
Oak Regeneration**

**sunlight  
@  
ground**



**Abundant**



**Sparse**

**high**



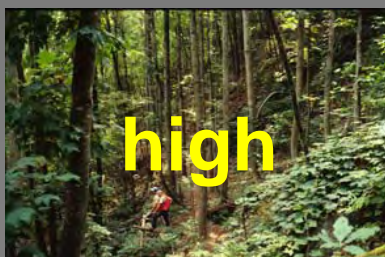
**low**



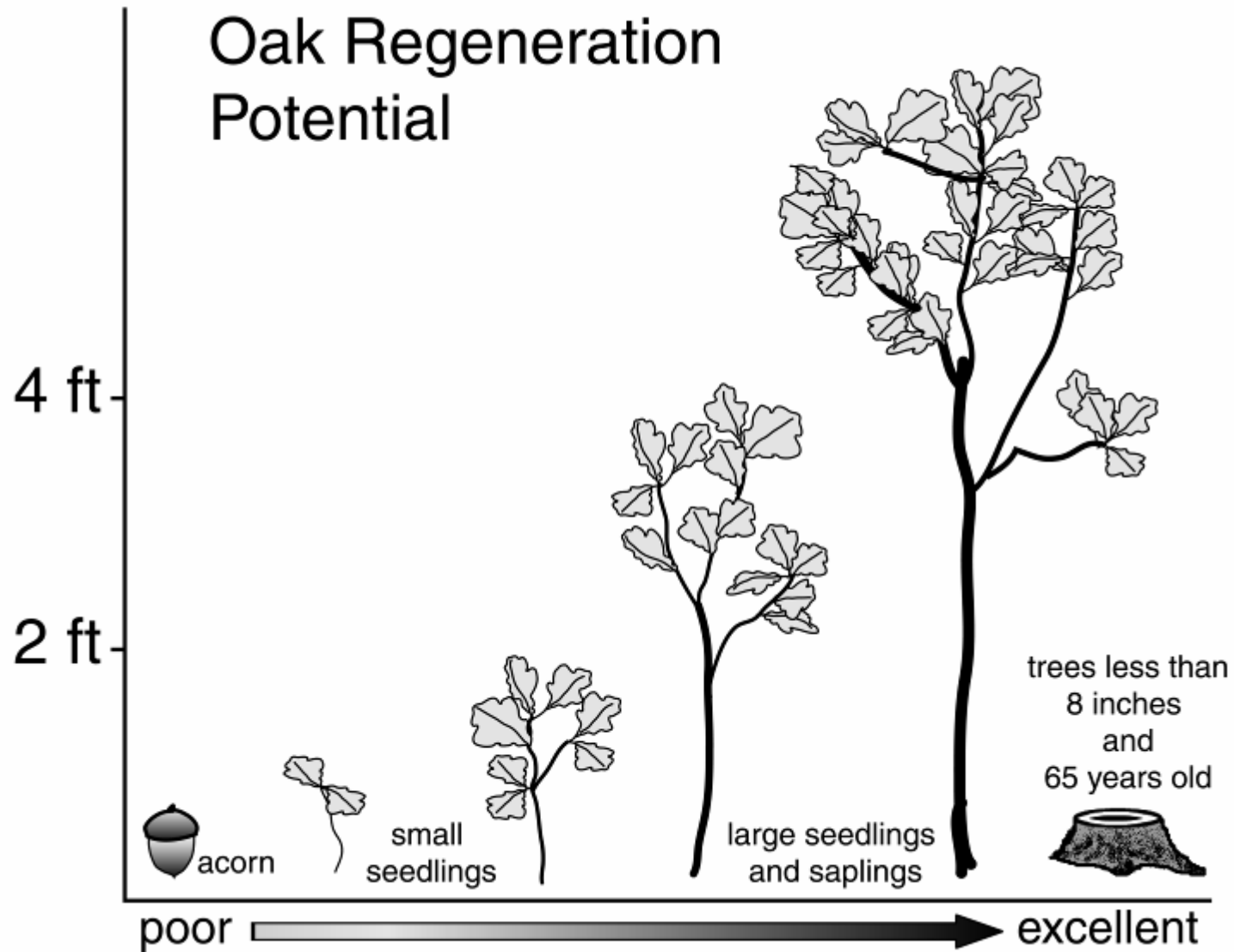
- abundant diffuse light
- large oak advance regeneration
- limited competitors



- limited diffuse light
- oak seedlings short lived
- small advance regeneration
- high number of competitors



# Oak Regeneration Potential



# Stand 1

Oak SI=73

Age=71

Composition-80% oak

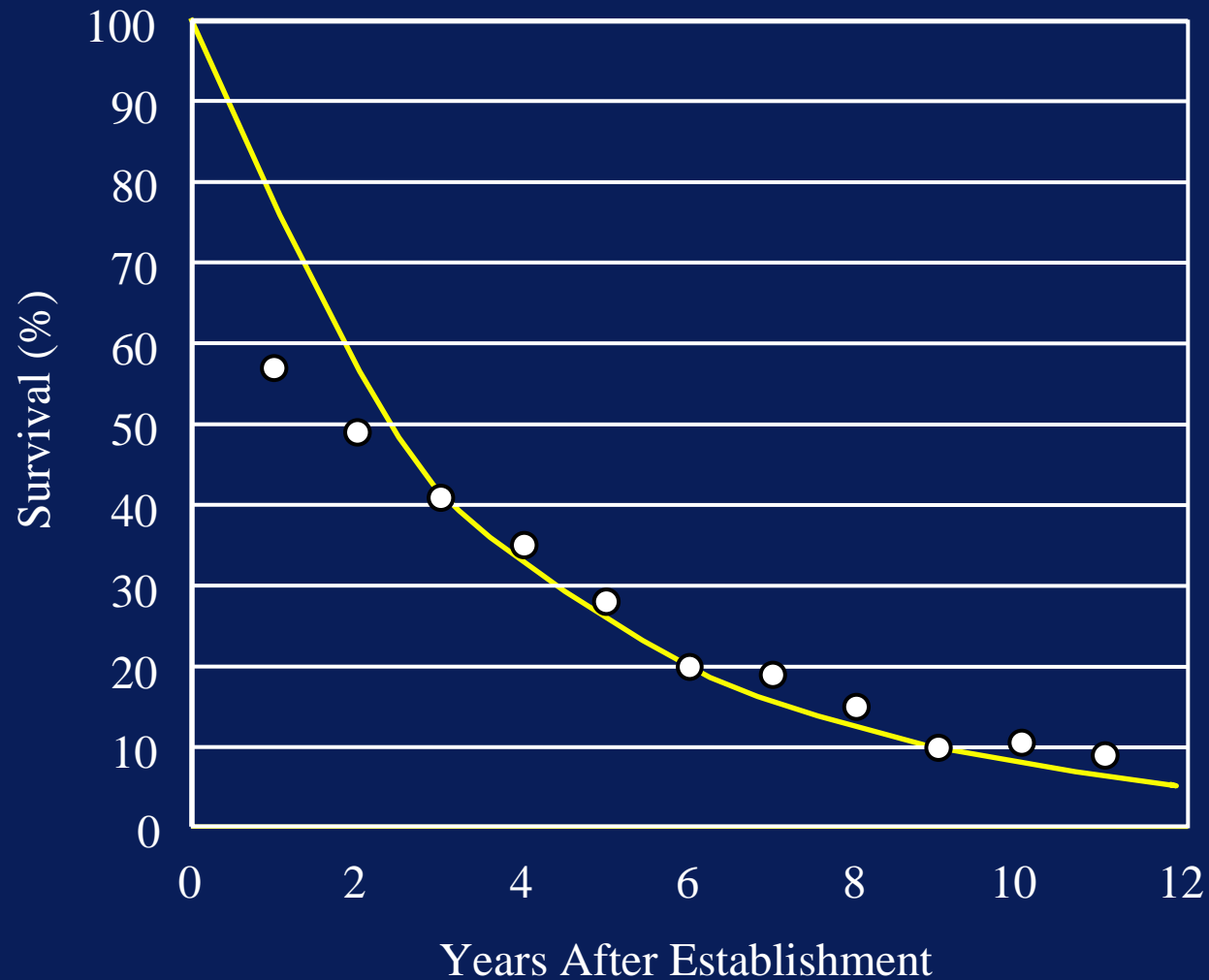
Residual BA=66 sq. ft.

## Regeneration after CC (#/a)

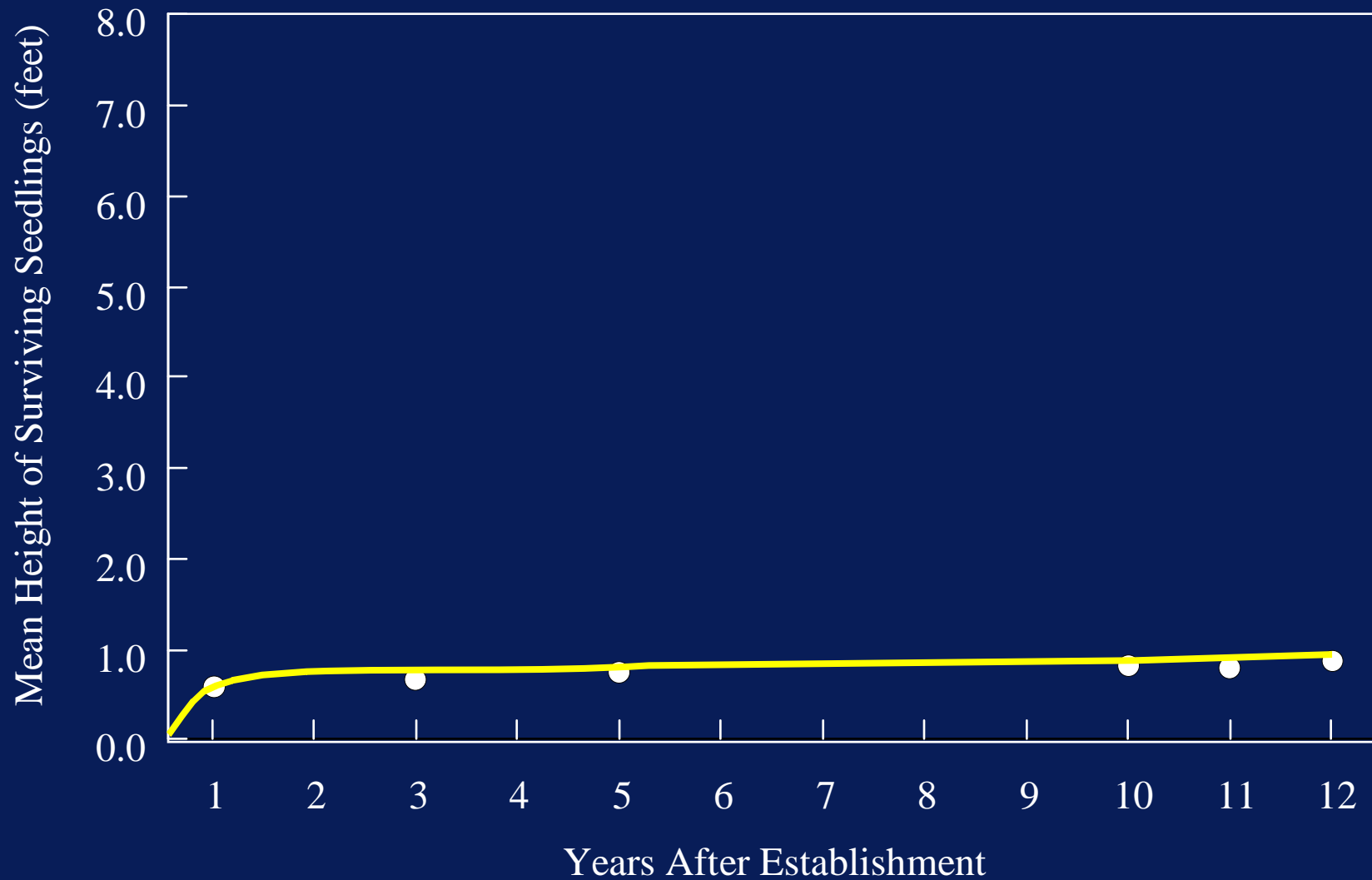
	Preharvest	1 <sup>st</sup> growing season	Free-to-grow @ 17 years
Oaks	5,999	7,061	6
Yellow- Poplar	500	6,187	275
Other desirable	313	376	6
Less desirable	6,625	5,999	306

# Basic Oak Regeneration Process

# Survival Curve for Red Oak Seedlings Growing In Undisturbed Conditions (Loftis 1983)



# Mean Height Attained by Red Oak Seedlings Growing In Undisturbed Conditions (Loftis 1983)



# Oak Regeneration Cycle

## high site index

## undisturbed canopy

- Bumper crop
- Seedling establishment
- Slow loss of cohort
- Slow to zero height growth
  - (loss of vigor)
- Ultimate loss of cohort

DOMINANCE PROBABILITIES AT AGE 20 FOR NORTHERN  
RED OAK ADVANCE REPRODUCTION

basal diameter of advance reproduction (inches)	site index		
	70	80	90
0.1	0.01	0.00	0.00
0.2	0.02	0.01	0.00
0.3	0.04	0.02	0.01
0.4	0.06	0.03	0.01
0.5	0.09	0.04	0.02
0.6	0.13	0.06	0.03
0.7	0.17	0.09	0.04
0.8	0.21	0.12	0.06
0.9	0.25	0.15	0.08
1.0	0.29	0.18	0.11
1.1 to 1.5	0.38	0.29	0.19
1.6 to 2.0	0.46	0.41	0.34

**In the absence of  
disturbance, large oak  
advance reproduction does  
not develop**

# Initial work in Georgia and Southern Appalachians: Percent Basal Area Reductions

- 0 percent
- 10 percent
- 20 percent
- 30 percent
- 40 percent





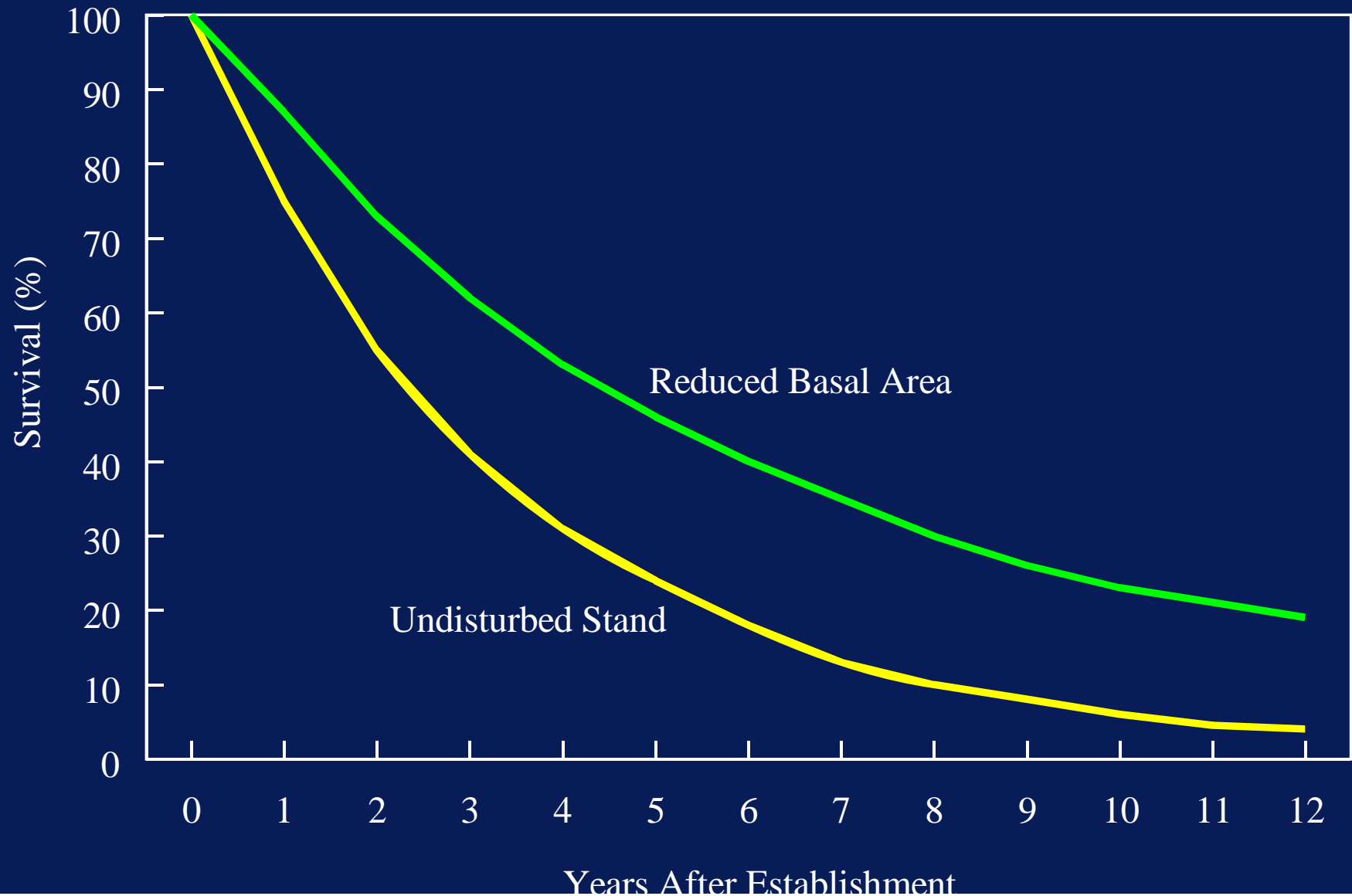




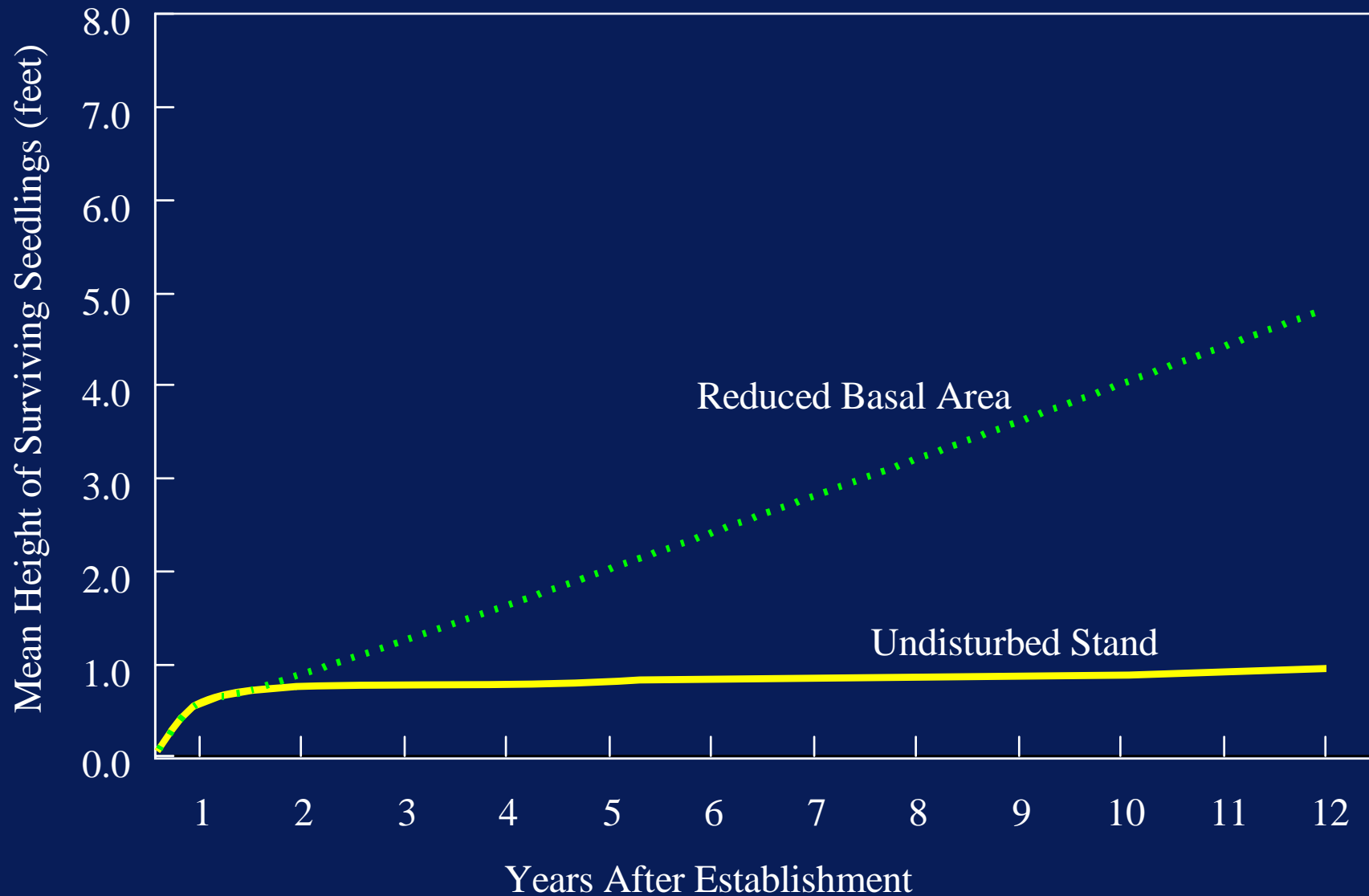




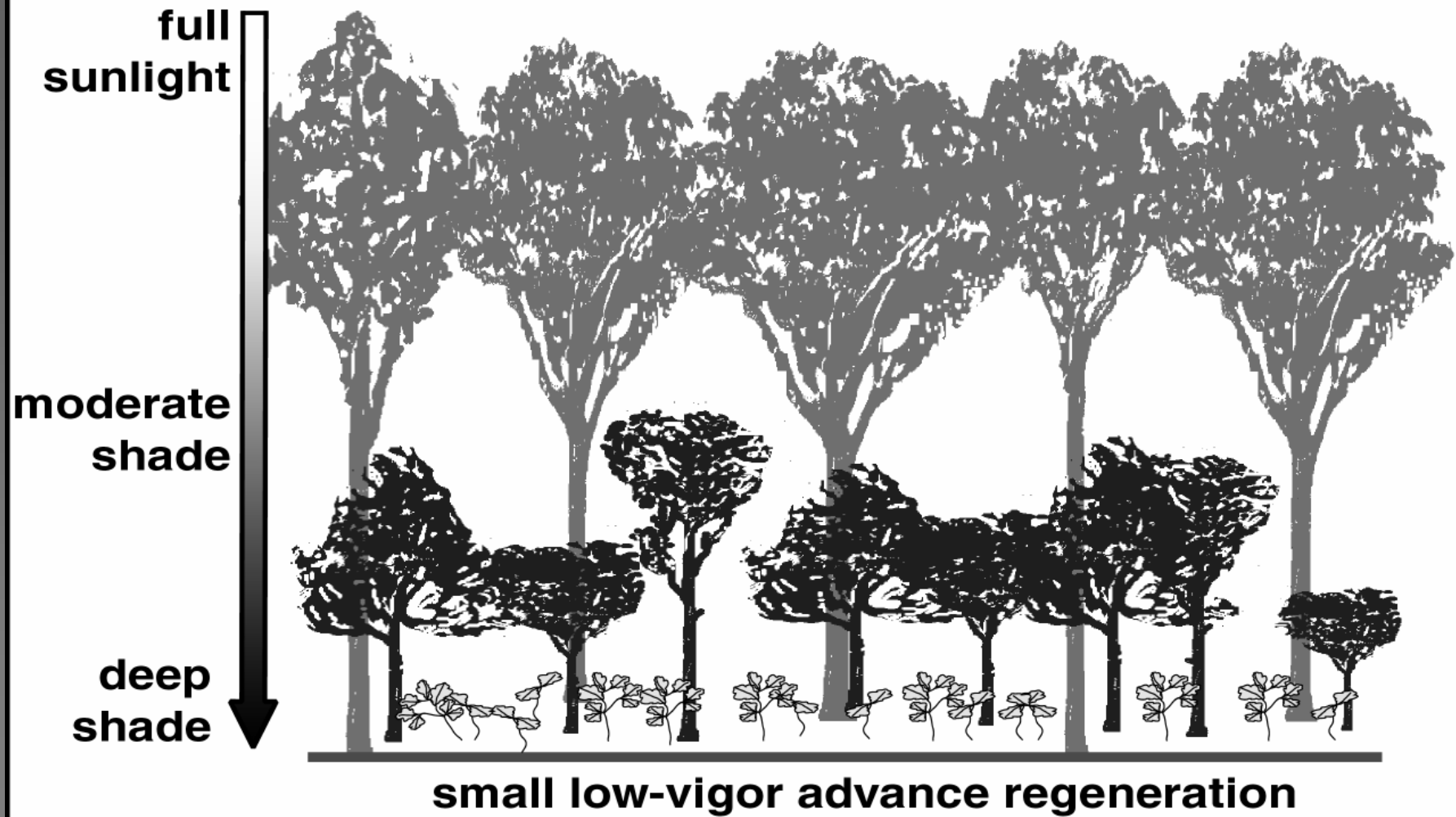
# Hypothesized Survival Response to a Reduction in Basal Area (Loftis 1983)



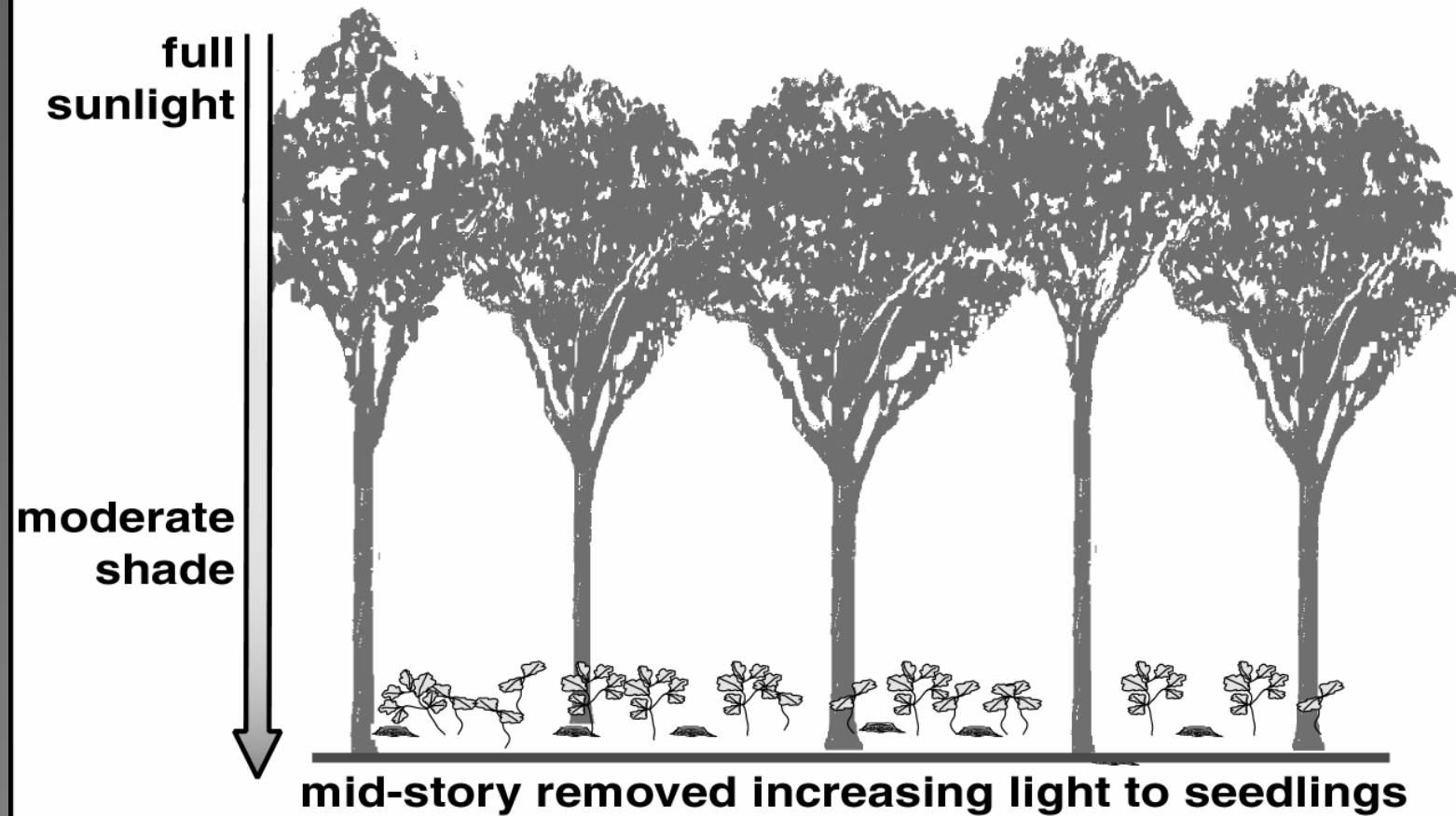
# Hypothesized Height Response to a Reduction in Basal Area (Loftis 1983)



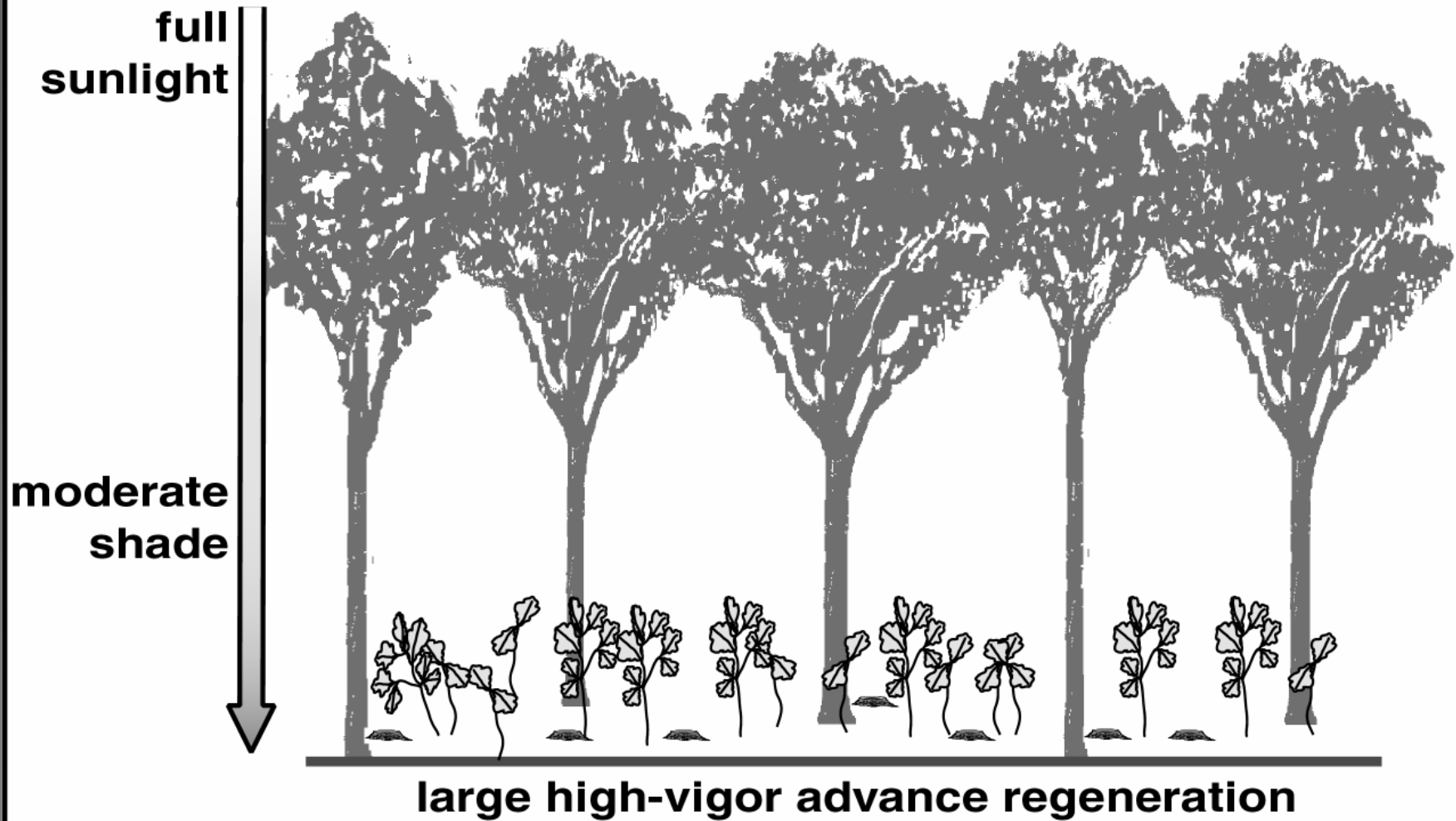
# INTACT CANOPY AND MID-STORY



## MID-STORY REMOVAL TREATMENT



# 5 TO 10 YEARS AFTER MID-STORY REMOVAL



# The Oak Shelterwood Process

- Establishment of new seedlings in existing stands
- Light is determined to be the limiting factor in oak seedling survival
- Development of established seedlings into regeneration sources that can compete successfully when released
- Release - timely and sufficient

# Research – MidStory Removal

## Northern Red Oak

- **Johnson 1980.** New ideas about regeneration of hardwoods
- **Loftis 1983.** Regenerating red oak on productive sites in the Southern Appalachians.
- **Loftis 1990.** Predicting Post-Harvest Performance of Advance Red Oak Reproduction in the Southern Appalachians
- **Lorimer et al. 1994.** Tall understory vegetation as a factor in the poor development of oak seedlings beneath mature stands.
- **Miller et al. 2003.** Effects of Pre-Harvest Shade Control and Fencing on Northern Red Oak Seedling Development in the Central Appalachians.

# Research – MidStory Removal

## Cherrybark Oak

- **Kaelke et al. 2001.** Trade-offs in seedling survival, growth and physiology among hardwood species of contrasting successional status along a light-availability gradient.
- **Deen et al. 1997.** The influence of mid-story and under-story control treatments on regeneration of red oak species following clearcutting.
- **Lockhart et al. 1992-1999.** ...cherrybark oak ...
- **Guo et al. 2000.** Effects of light regimes on the growth of Cherrybark oak seedlings.

# Research – MidStory Removal

## White, Black, Chestnut Oak

- **Dillaway, D., Stringer, J., and Reiske-Kinney, L. 2007.** Light availability influences root carbohydrates, and potentially vigor, in white oak advance regeneration. *Forest Ecology and Management* 250:227-233.
- **Dillaway, D., and Stringer, J. 2007.** Effects of shade on the growth of natural and artificially established white oak (*Quercus alba* L) regeneration. In *Proceedings 15th Central Hardwood Forest Conference*. USDA Forest Service e-GTR SRS-101: 638-643. (refereed proceedings)
- **On-going: John Lhotka, Jeff Stringer, Dylan Dillaway** – sponsored by USFS Southern Research Station

# Research – MidStory Removal

- shade from mid-story, under-story leaf area
- removing mid/under-story trees improves light levels
- removing overstory increases direct radiation fostering shade-intolerant competitors
- oak species on high quality sites (NRO and cherrybark) can respond to treatment
- timing of treatment response – lag

# Questions

