



Silviculture

FORS 3347



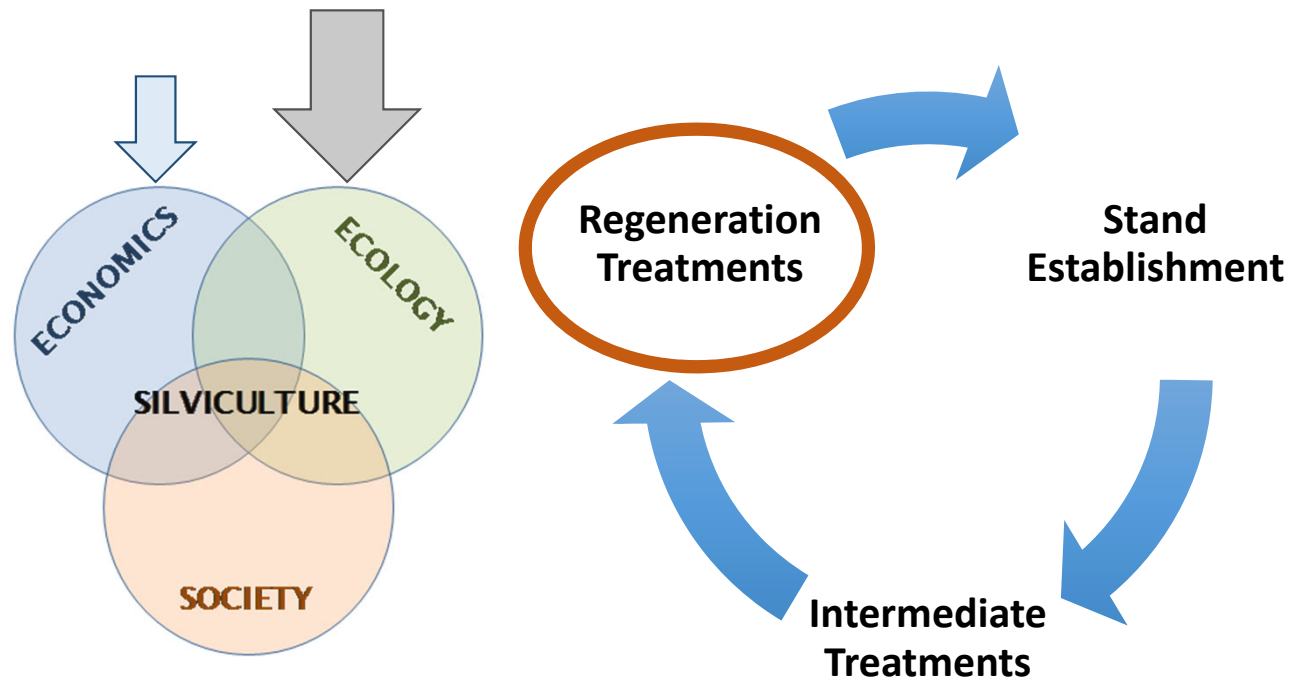
Instructor: Dr. Jeremy Stovall

Lecture 9:

Uneven Aged Regeneration Methods



Context



Methods of Regeneration

Favors shade intolerant spp. ↔ *Favors shade tolerant spp.*

Even Aged

1. Clearcut

2. Seed-tree

3. Shelterwood

----- 4. + Deferment -----

Two Aged

----- 5. With reserves -----

Uneven Aged

6. Patch selection

7. Group selection

8. Single tree selection

How Will A Stand Develop?

- Use silvics of each species
- Predict how stand will look after 1 rotation period using
 - Single tree selection
 - Group selection
 - Patch selection
- Justify proposed structure and composition

Cover Types

- Willow – Water – Laurel Oak
 - Nuttall oak, red maple, green ash, sweetgum
- Longleaf Pine – Scrub Oak
 - Bluejack, blackjack, post oaks
- Douglas-fir – Western Hemlock
 - Western redcedar, grand fir, western white pine
- Interior Ponderosa Pine
 - Lodgepole pine, western larch



Tolerances of American Forest Trees

Eastern Conifers:

Very Tolerant

e. hemlock
balsam fir
Atl. whitecedar

Tolerant

red spruce
black spruce
white spruce
n. white cedar

Intermediate

e.white pine
slash pine
baldcypress

Intolerant

e.redcedar
red pine
pitch pine
shortleaf pine
loblolly pine
Virginia pine

Very Intolerant

e. larch
jack pine
longleaf pine

Eastern Hardwoods:

e. hophornbeam
Amer. hornbeam
Amer. beech
Amer. holly
sugar maple
flow. dogwood
Florida maple

red maple
silver maple
boxelder
basswood
tupelos
persimmon
buckeyes

yellow birch
sweet birch
Amer. chestnut
white oaks
red oaks
black oak
Amer. elm
hackberry
magnolias
white ash
green ash
black ash

black walnut
butternut
pecan
hickories
paper birch
yellow-poplar
sassafras
black cherry
honeylocust
Kentucky coffeetree
catalpa
sweetgum

willows
quaking aspen
bigtooth aspen
cottonwoods
grey birch
black locust
Osage-orange

Western Conifers:

Very Tolerant

w. hemlock
alpine fir
w. redcedar
Pacific yew
Calif. torrey

Tolerant

Sitka spruce
Engel. spruce
mtn hemlock
Pacific silver fir
grand fir
white fir
red fir
incense-cedar
redwood
Port-Orford cedar

Intermediate

w. white pine
sugar pine
Monterey pine
blue spruce
Douglas-fir

Intolerant

limber pine
pinyons
ponderosa pine
Jeffrey pine
lodgepole pine
Coulter pine
knobcone pine
bishop pine
noble fir
junipers

Very Intolerant

whitebark pine
foxtail pine
digger pine
bristlecone pine
western larch
alpine larch

Western Hardwoods:

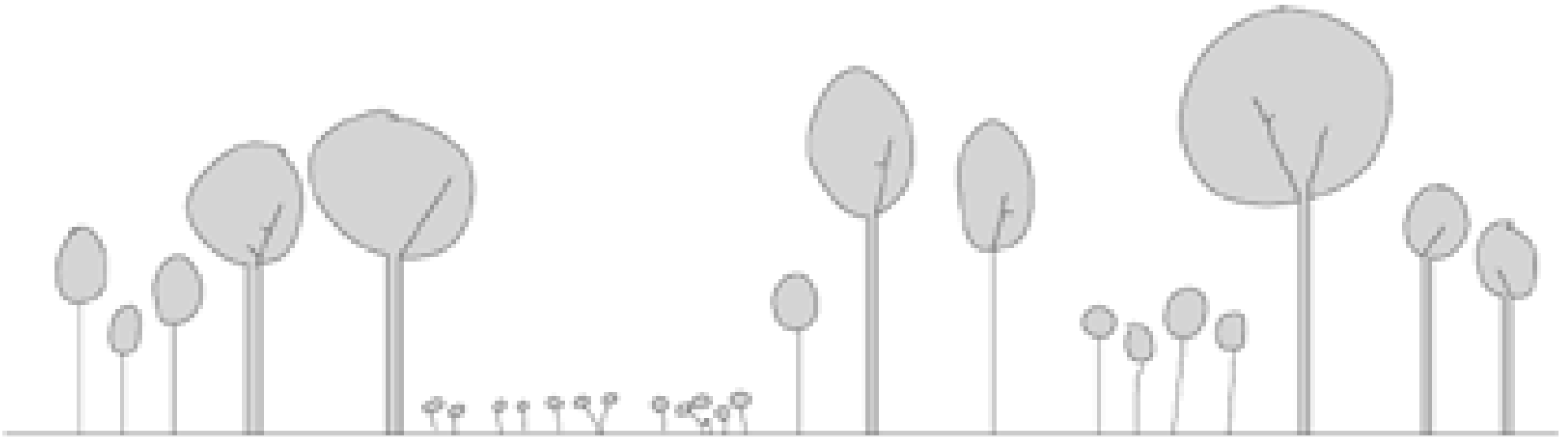
vine maple

tanoak
Canyon live oak
bigleaf maple
madrone Calif.
Calif. laurel

red alder
gold. chinquapin
Oregon ash
white oak
Oregon white oak

quaking aspen
cottonwoods

Uneven Aged Stand



Jargon Issues

- Uneven-aged regeneration systems: selection systems
 - Not equivalent to "selective" cutting
 - "Selective" logging and "select-cut"
 - Refers to harvest that is not a clearcut
 - Imprecise
 - Also refers to:
 - Thinning
 - Shelterwood establishment cut
 - High-grade harvest

High Grading



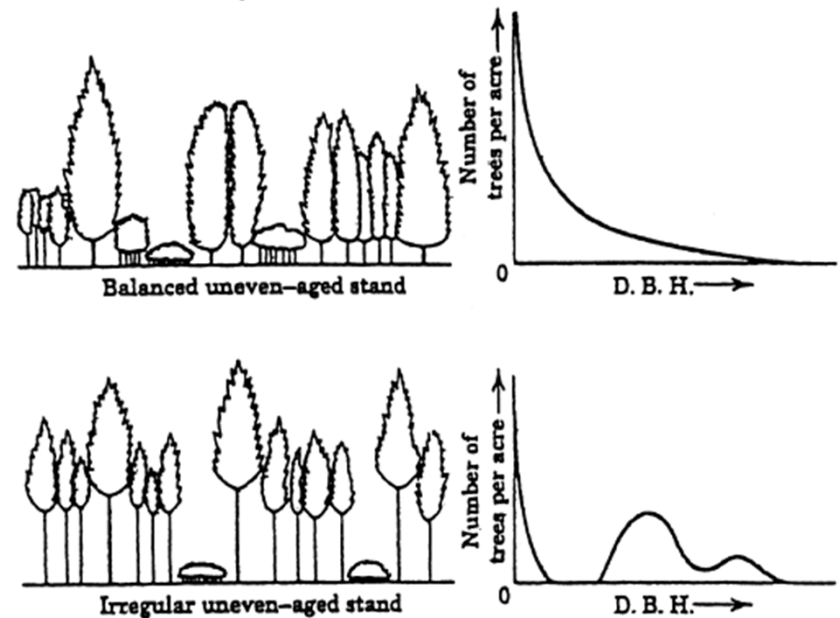
Uneven Aged Systems

- Maintains continuous canopy cover
 - Entire stand remains under mature trees
 - Harvested opening widths varies by system
- Emphasizes sawtimber & veneer production
 - Low pulpwood production



Uneven Aged Systems

- Put irregular stand into timber production without losing existing stocking
- Obtain a sustained yield at recurring short intervals
- Sustained yield in a selection system:
 - If stand is balanced: remove amount equal to growth each cutting cycle



Why Uneven Aged Systems?

	Criteria	Even Aged	Uneven Aged
	On-Site Seed Supply	Less	More
	Control over Regen	More	Less
	Shade Intolerant Regen	Ideal	Challenging
	Shade Tolerant Regen	Challenging	Ideal
	Genetic Improvement	Possible	Impractical
	Economic Returns	Larger but Less Frequent	Smaller but More Regular
	Achieving balanced, Sustained Yield	Simpler	Complex
	Damaging Erosion	More	Less
	Erosion from Road Entries	Less	More
	Root Competition	Less	More
	Expensive Site Prep	Necessary	Unnecessary
	Insects / Disease Risk	Can Be Higher	Often Lower
	Biological Diversity	Usually Less	Usually More

Uneven Aged Systems: Procedure

- **Rotation length:** average time period required to obtain crop trees of a specified target size
- Harvests occur regularly at short intervals (typically 3-10 years, but may vary) throughout the rotation
- The period between harvests (in years) is the length of the **cutting cycle**

Group Selection: Longleaf Pine



Uneven Aged Systems: Procedure

- **Harvest** mature trees:
 - Small groups
 - Large groups
 - Single trees
 - Provides space for regen
 - New age class or cohort
- **Sustained yield** requires frequent and accurate inventories
 - Best at the end of each cutting cycle
 - Accurate stand and stock table

High Quality Willow Oak



Uneven Aged Systems: Procedure

- **Tend** remaining cohorts
 - Maintain about equal area in each
 - Cut the worst
 - Leave the best
- Avoid **high-grading**
 - Each cutting includes:
 - Thinning
 - Improvement cutting
 - Both in trees other than target size

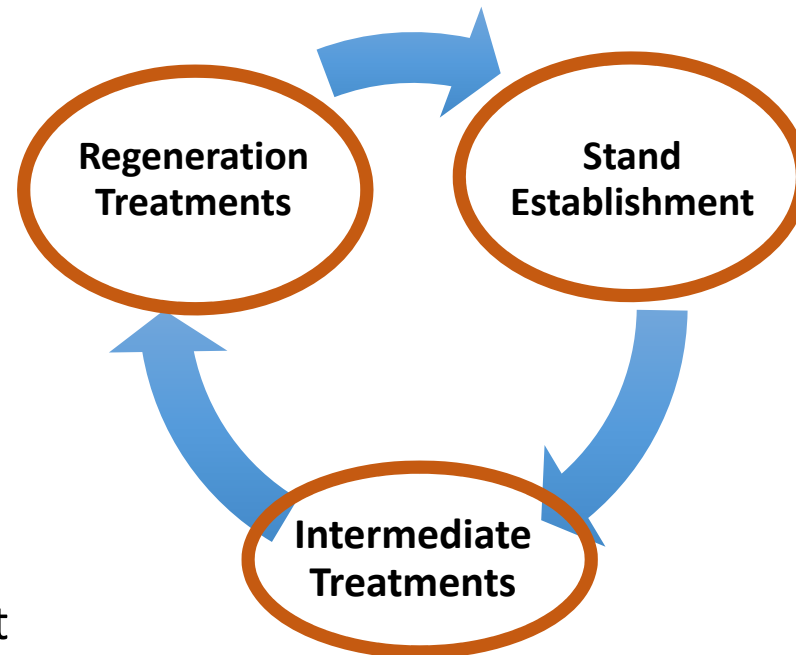
Improvement Cutting, Brown Loam Bluffs, MS

Removed: Poorly formed trees, undesirable species, midstory brush



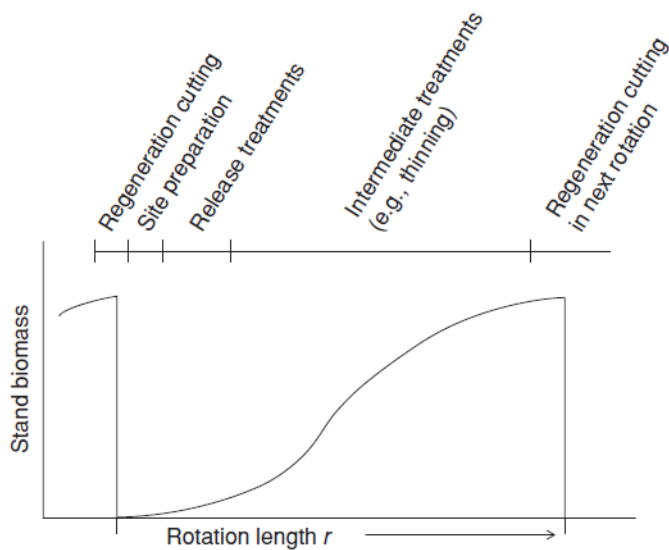
Uneven Aged Systems: Procedure

- By end of rotation treatments applied across entire stand
- At each entry (cutting cycle):
 - Concurrent application of treatments from all stages of silvicultural process in balanced uneven-aged stand
 - Treatments applied to subunits depending on their condition
 - Similar treatments at each harvest

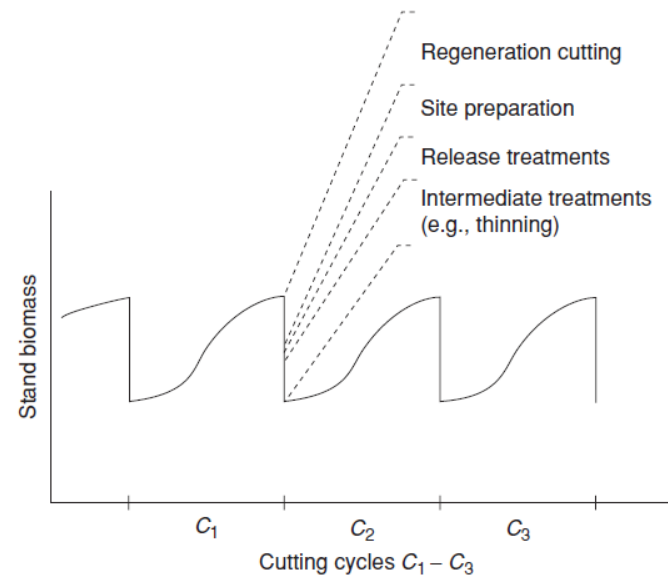


Uneven Aged Systems: Procedure

Even Age Systems



Uneven Age Systems



Guldin, J. M. 2006. Uneven-aged silviculture of longleaf pine. Pages 217-241 in S. Jose, E. J. Jokela, and D. L. Miller, editors. *The longleaf pine ecosystem: Ecology, silviculture, and restoration*. Springer, New York, NY.

Uneven Age: Patch Selection

A method of regenerating **uneven-aged stands**

- in which trees are removed, and
- new age classes are established,
- **in large groups.**

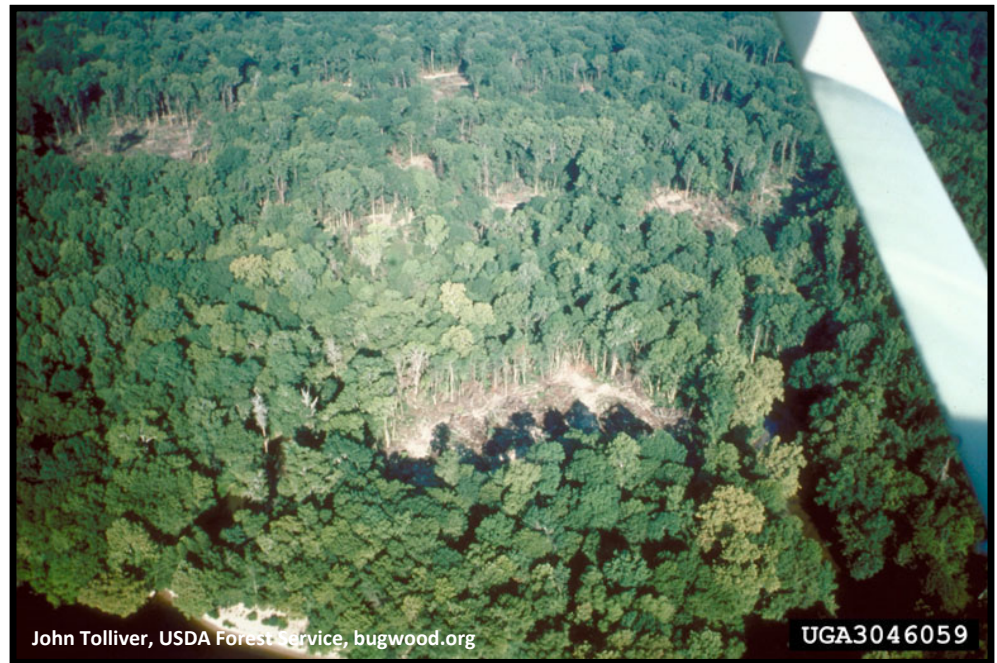
The **minimum width** of groups is

- **greater** than **twice the height** of the mature trees,
- with **large openings** providing
- **microenvironment** suitable for **intermediate** to **very intolerant** regeneration.

In the **Patch Selection System**,

- the **management unit** or **stand** in which
- regeneration, growth, and yield are **regulated**
- consists of a **landscape** containing an **aggregation of patches.**

Bottomland Hardwoods, Selma AL



Uneven Age: Patch Selection



Uneven Age: Group Selection

A method of regenerating **uneven-aged stands**

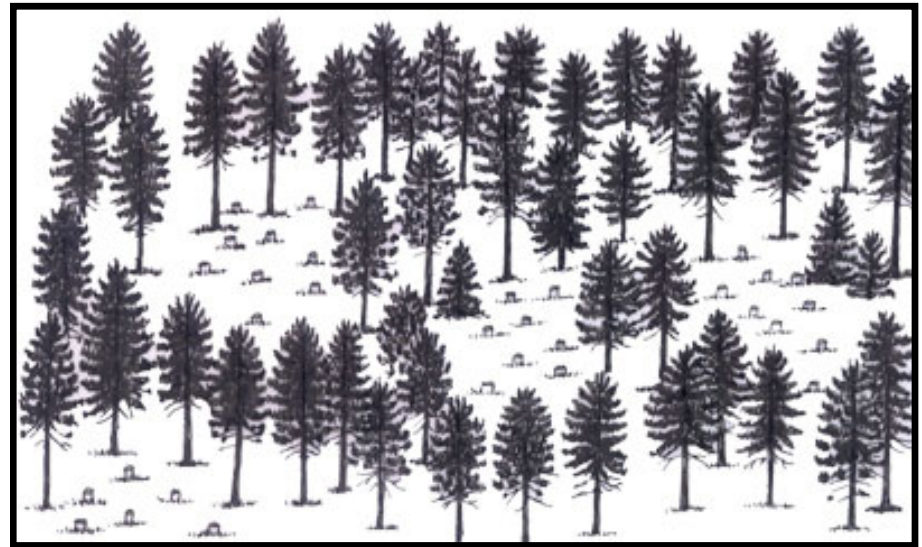
- in which trees are removed, and
- new age classes are established,
- **in small groups.**

The **maximum width** of groups is

- **less than twice the height** of the mature trees,
- with **small openings** providing
- **microenvironment** suitable for **tolerant** regeneration and
- with **large openings** providing
- **microenvironment** suitable for **more intolerant** regeneration and

In the **Group Selection System**,

- the **management unit** or **stand** in which
- regeneration, growth, and yield are **regulated**
- consists of a **landscape** containing an **aggregation of patches.**



Graphic Credit: USDA-FS, NASPF, and UMN-DFR. 2008. Forest Management 101: A handbook to forest management in the North Central Region. Web-Based Forest Management Guides. Located at: <http://nrs.fs.fed.us/fmg/nfmg/fm101/silv/index.htm> Accessed on: 8/29/2011.

Adams, D. L., J. D. Hodges, D. L. Loftis, J. N. Long, R. S. Seymour, and J. A. Helms. 1994. Silviculture Terminology with Appendix of Draft Ecosystem Management Terms. Silviculture Instructors Subgroup of the Silviculture Working Group of the Society of American Foresters. Located at: http://oak.snr.missouri.edu/silviculture/silviculture_terminology.htm Accessed on: 7/29/2011.

Uneven Age: Group Selection

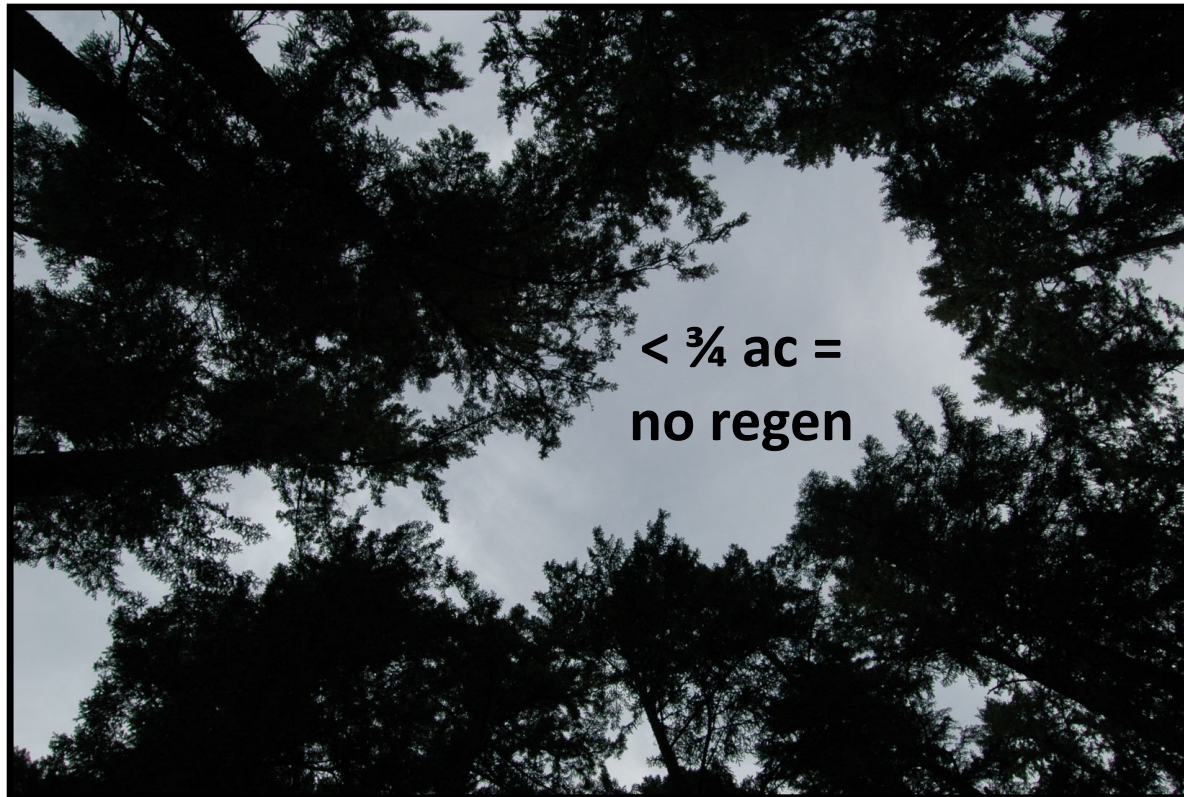


Uneven Age: Group Selection



Group Selection

Douglas – Fir, Oregon, 200 ft total height



Group Selection



Uneven Age: Group Selection

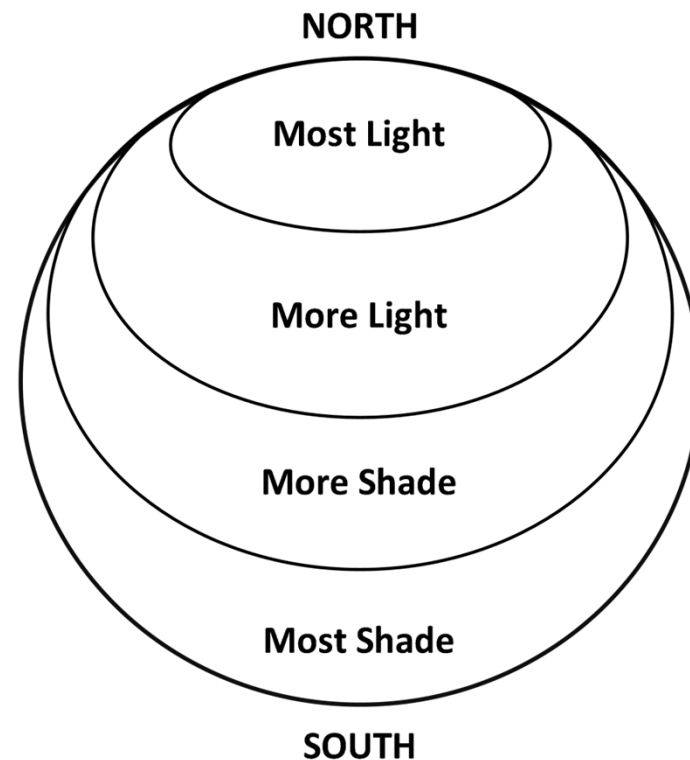


Application of Group / Patch Selection

- Locate groups to be harvested among the oldest or largest trees in the stand
- Area Regulation
- Openings must be wide enough to allow good regeneration establishment
 - Due to shading effects of edge, best success and growth of intolerant seedlings may be restricted to 2/3 or less of the area in a small opening
- Group selection: 1-2 x canopy height
- Patch selection: > 2x height, up to several acres

Application of Group / Patch Selection

- Gap shape is key
 - rectangular openings will be more efficient for logging than circular or square ones-narrow
 - rectangular openings provide more sun if oriented with their long axes east-west
- Complete felling of all trees in the openings is crucial to allow for adequate regeneration



Application of group selection

- Control of undesirable species should be considered
 - possibly pre- or post-harvest injection, basal bark herbicides, or cutting
- Tend the remaining stand: at each harvest, employ improvement, presalvage, salvage, and thinning of scattered trees in the uncut stand areas between group openings



Application of Group / Patch Selection

- Difficult (or impossible) to locate groups within a stand following second or third entry
- Appropriate tool for non-timber objectives
 - wildlife openings,
 - aesthetics,
 - salvage/sanitation



Application of Group / Patch Selection

- If groups are managed as an individual “stand” and tracked through time as such, you are using even-aged silviculture at a small spatial scale: “Patch Clearcutting”



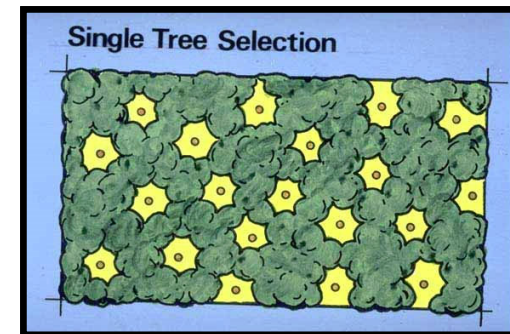
Uneven Age: Single Tree Selection

A method of creating new age classes in **uneven-aged stands** in which

- **individual trees** of
- **all size classes** are
- **removed**
- more-or-less **uniformly** throughout the stand to
- achieve desired stand structural characteristics.



Graphic Credit: USDA-FS, NASPF, and UMN-DFR. 2008. Forest Management 101: A handbook to forest management in the North Central Region. Web-Based Forest Management Guides. Located at: <http://nrs.fs.fed.us/fmg/rfmg/fm101/silv/index.htm> Accessed on: 8/29/2011.



Graphic Credit: <http://www.extension.umn.edu/distribution/naturalresources/components/3474-25.html>

Adams, D. L., J. D. Hodges, D. L. Loftis, J. N. Long, R. S. Seymour, and J. A. Helms. 1994. Silviculture Terminology with Appendix of Draft Ecosystem Management Terms. Silviculture Instructors Subgroup of the Silviculture Working Group of the Society of American Foresters. Located at: http://oak.snr.missouri.edu/silviculture/silviculture_terminology.htm Accessed on: 7/29/2011.

FIGURE 11-2

Single-tree selection system creates and maintains a fairly uniform interspersion of age and size classes by removing individual trees to open space for a new age class and to reduce crowding among the immature ones. It creates few openings larger than the diameter of a mature tree crown.

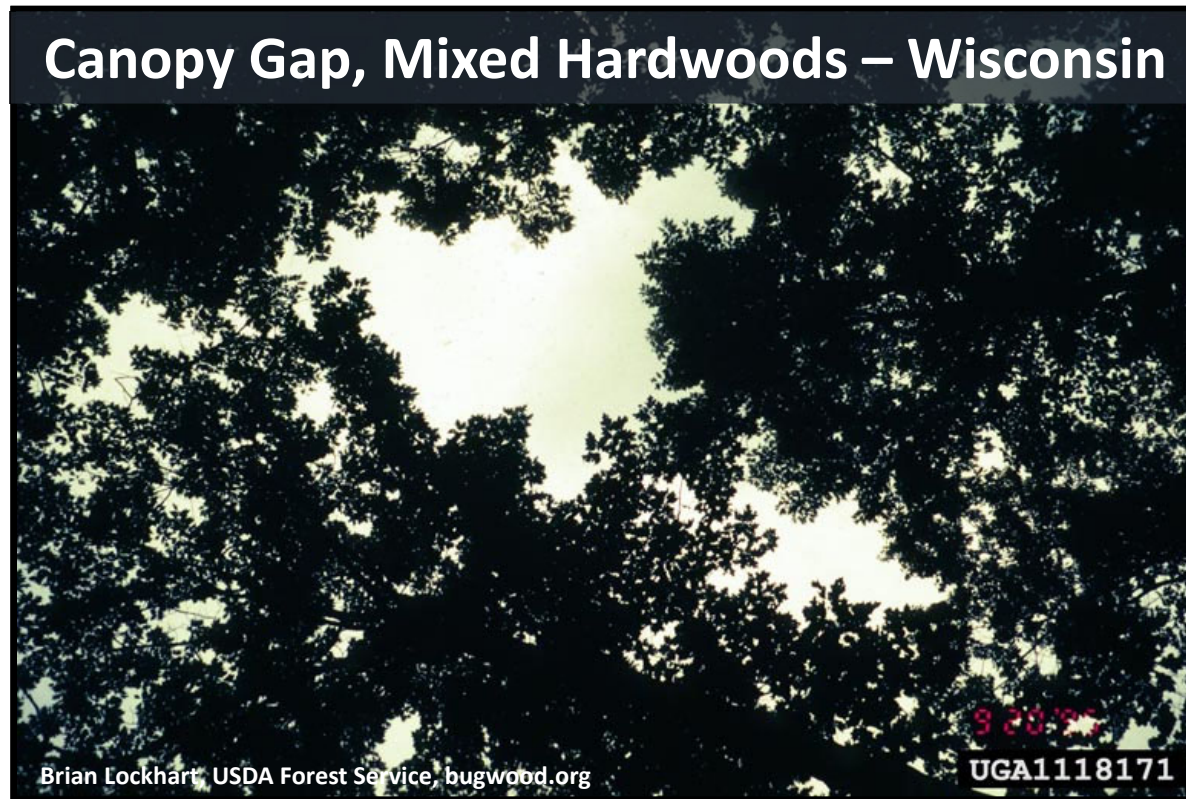


Single-tree selection system -- before cut



Single-tree selection system -- after cut

Uneven Age: Single Tree Selection



Uneven Age: Single Tree Selection



Uneven Age: Single Tree Selection



Uneven Age: Single Tree Selection



Single Tree Selection



Single Tree Selection

- Typically applied to very tolerant species
 - E.g., spruce-fir or beech-maple forest types
- Has been used successfully in the South
 - Loblolly-shortleaf pine, Crossett Experimental Forest (AR)
 - Oak forests in the Missouri Ozarks (Pioneer Forest)
 - Longleaf pine, southern Coastal Plain region
- And unsuccessfully: Bottomland hardwoods

Single Tree Selection

- Single tree selection applied in Appalachian and southern oak stands without intensive competitor control has generally resulted in a transition to shade tolerant species (i.e. red maple)



Single Tree Selection

- In practice
 - Logging difficult & costly
 - May result in high degree of damage
 - Aggressive control of competing tolerant species through herbicides or cutting is essential for success



Single Tree / Group Selection

