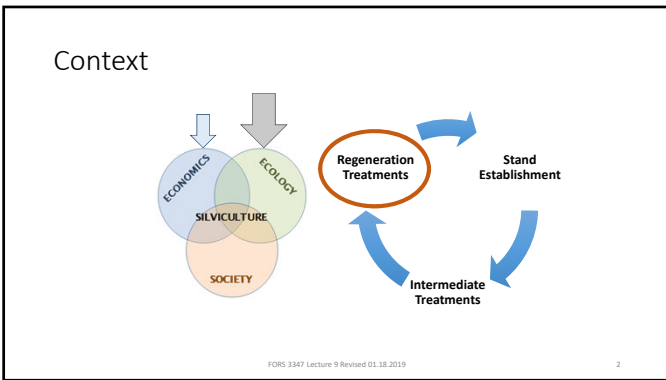


Silviculture
FORS 3347
 Instructor: Dr. Jeremy Stovall
 Lecture 9:
 Uneven Aged Regeneration Methods



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

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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

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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



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Tolerances of American Forest Trees

Eastern Conifers:			
Very Tolerant	Tolerant	Intermediate	Intolerant
e. hemlock	red spruce	e.white pine	e.redcedar
balsam fir	black spruce	slash pine	red pine
Atl. whitecedar	white spruce	baldcypress	pitch pine
	n. white cedar		shortleaf pine
			loblolly pine
			Virginia pine
Eastern Hardwoods:			
e. hophornbeam	red maple	yellow birch	black walnut
Amer. hornbeam	silver maple	sweet birch	butternut
Amer. beech	boxelder	Amer. chestnut	pecan
Amer. holly	basswood	white oaks	hickories
sugar maple	tupelos	red oaks	paper birch
flow. dogwood	persimmon	black oak	yellow-poplar
Florida maple	buckeyes	Amer. elm	sassafras
		hackberry	black cherry
		magnolias	honeylocust
		white ash	Kentucky coffeetree
		green ash	catalpa
		black ash	sweetgum
			willows
			quaking aspen
			bigtooth aspen
			cottonwoods
			grey birch
			black locust
			Osage-orange

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Western Conifers:

Very Tolerant w. hemlock alpine fir w. redcedar Pacific yew Calif. torreyia	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 Coutter pine knobcone pine bishop pine noble fir junipers	Very Intolerant whitebark pine foxtail pine digger pine bristlecone pine western larch alpine larch
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Western Hardwoods:

vine maple Canyon live oak bigleaf maple madrone Calif. Calif. laurel	tanoak red alder gold. chinquapin Oregon ash white oak Oregon white oak	quaking aspen cottonwoods
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Uneven Aged Stand

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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

Wenatchat, USDA, R. Reynolds USA 111 8 92

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Uneven Aged Systems

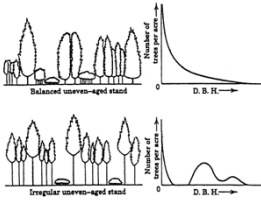
- Maintains continuous canopy cover
 - Entire stand remains under mature trees
 - Harvested opening widths varies by system
- Emphasizes sawtimber & veneer production
 - Low pulpwood production



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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



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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

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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**



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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



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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



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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

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Uneven Aged Systems: Procedure

Even Age Systems

Uneven Age Systems

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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

John Tallner, USDA Forest Service, www.forestservice.gov NGA3046059

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Uneven Age: Patch Selection



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Uneven Age: Group Selection

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

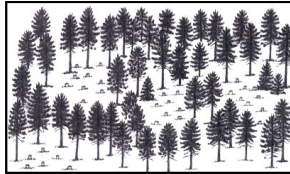
- in which trees are removed, and
- new age classes are established,
- in **small groups**.

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, NADP, and USN-DNR, 2008. Forest Management 201: A Handbook for Forest Management in the North Central Region. Web-Based Forest Management Guides. Located at: <http://nrs.fs.fed.us/eng/efmg/Ref010/04/index.htm>. Accessed on: 8/29/2011.

Adams, D. L., J. D. Hodges, D. L. Luthi, L. N. Long, R. C. Seymour, and J. A. Helms. 1994. Structure Terminology with Appendix of Draft Ecosystem Management Terms. Structure Instructors Subgroup of the Structure Working Group of the Society of American Foresters. Located at http://nsl.or.missouri.edu/Structure/Structure_terminology.htm. Accessed on: 7/26/2011.

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Uneven Age: Group Selection



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Uneven Age: Group Selection

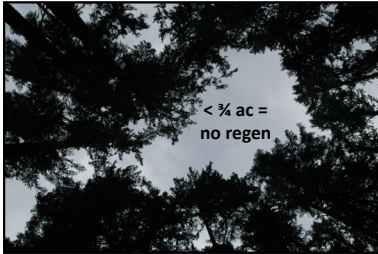


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Group Selection

Douglas – Fir, Oregon, 200 ft total height



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Group Selection



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Uneven Age: Group Selection



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Application of Group / Patch Selection

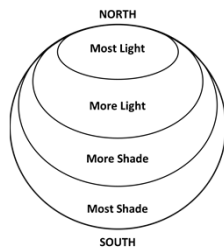
- Locate groups to be harvested among the oldest or largest trees in the stand
- Area Regulation
- Openings must be wide enough to allow good regeneration establishment
 - Due to shading effects of edge, best success and growth of intolerant seedlings may be restricted to 2/3 or less of the area in a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

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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



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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



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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



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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"

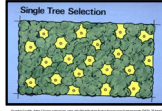
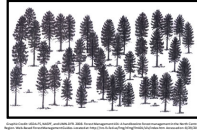


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Uneven Age: Single Tree Selection

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.



Adams, D. L., D. D. Higgins, D. L. Luff, J. N. Long, R. S. Seymour, and J. A. Nelson. 2006. Silviculture Terminology with Appendix of Draft Ecosystem Management Terms. Silviculture Instructional Module of the Silviculture Training Group of The Society of American Foresters. Located at <http://link.oxfordjournals.org/lookup/suppl/doi:10.1093/oxfordjournals/forestry.a600001.a600001.pdf>. Accessed on: 1/26/2016.

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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

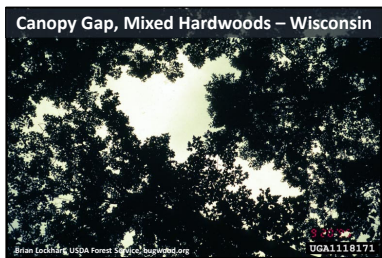


Single-tree selection system -- after cut

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Uneven Age: Single Tree Selection



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UGA1110174

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Uneven Age: Single Tree Selection



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Uneven Age: Single Tree Selection



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Uneven Age: Single Tree Selection



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Single Tree Selection



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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

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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)



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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



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Single Tree / Group Selection



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