Forest Regeneration on MOFEP
10 years later

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Management Activity

- **Management Treatments**
  - Even-aged Management
  - Uneven-aged Management
  - No Harvesting

- **Inventory**
  - Pre-harvest 1995

- **Harvest & stand thinning**
  - Summer 1996 to spring 1997

- **Inventory**
Even-aged: Clearcut Method

- Harvests every 80 to 120 + years - rotation
- Regen occurs at once - trees within 20 years of each other
- Can leave live trees and snags for wildlife
- Favors shade intolerant and mid-tolerant species
Uneven-aged : Single-tree Selection Method

• 15-20 year cutting cycle

• 3 or more age classes

• Harvest & regen takes place at each entry

• Reverse J diameter distribution

• Favors shade tolerant spp
Missouri Ozark Regeneration

Issues

• Sustain oak forests on high quality sites

• Restore shortleaf pine – oak forests

• Sustainability of uneven-aged systems
Sources of Reproduction

- **Seed**
- **Advance reproduction**
- **Stump sprouts**
Shortleaf Pine Ecology

Good seed crops every 5-10 years

Ash or mineral soil seedbed best

Shade intolerant – grows best in full sun

Seedlings need 55% full sunlight to grow

Outgrows hardwoods on poor quality sites

Large advance reproduction key to success
Oak Ecology

Intolerant to intermediate in shade tolerance

- Seedlings need 30 to 50% of full sunlight for growth
- Maximum growth occurs between 50 to 100% full sunlight

White oak  Scarlet oak

Slow juvenile shoot growth

Preferentially builds root systems

Over shoot growth

Large advance reproduction & stump sprouts key to success
50% of full sunlight

- 30% stocking
- >50% reduction in basal area
- 30 to 60 ft²/ac residual density
- d/h ratio > 1 in group openings
Harvest Treatment and Light

- Clearcut = full sunlight (f.s.)
- No Harvest = < 3 % f.s.
- Single-tree Selection = < 3 % f.s.
- Group Selection (1-2 tree heights) = 30 % f.s.
Density of White Oak Reproduction by Regeneration Method

Trees per acre

pre-harvest  year 2  year 6  year 10
Trees 3.3 ft tall to 1.5” dbh

Clearcut
Single and group
Single-tree
Unharvested

Harvest
Density of Red Oak Reproduction by Regeneration Method

Trees per acre

Trees 3.3 ft tall to 1.5” dbh
Oak vs Major Competitor
10 years after clearcutting

Trees 3.3 ft tall to 1.5” dbh

- White oak
- Red oak
- Major competitor

South & Southwest - Exposed
Upper & Lower Backslopes
Roubidoux & Gasconade
Lower Site Quality

North & Northeast - Protected
Upper & Lower Backslopes
Gasconade & Eminence
Higher Site Quality

Red maple, Blackgum, Sassafras
Composition of Tree Reproduction
10 years after harvest

Density of trees 3.3 ft tall to 1.5” dbh

- White oak
- Red oak
- Major comp.
- Other species
Proportion of oak in young stands by site quality and time

Ohio Valley
29 clearcuts
Oak originally >60% of stand volume

Hilt 1985
Overstory Density & Growth

Stump Sprout DBH 10 years after Harvest

Dbh age 10 (inches)

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<th>Clearcut</th>
<th>Group</th>
<th>Single-tree</th>
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Overstory Density & Growth

Stump Sprout Height 10 years after Harvest

- Clearcut
- Group
- Single-tree

Height age 10 (feet)

White oak, Scarlet oak, Black oak
Shortleaf Pine Regeneration Failure on MOFEP

• Hardwood leaf litter is an unfavorable seedbed

• Low light in No Harvest and Single-tree Selection is limiting

• Hardwood sprout reproduction out competes small pine seedlings
Conclusions

• Sustaining oak forests on high quality sites will be difficult without controlling competing hardwoods.

• Red oak species need larger open areas provided by clearcutting or group selection openings (≥ 0.3 acre).

• Restoring shortleaf pine will require site preparation for seed germination, or planting seedlings in combination with harvesting and control of competing hardwoods.

• Use of uneven-aged management favors white oak and requires the use of large group selection openings with competition control for red oak species and shortleaf pine.