Effects of Regeneration Practices on the Growth of Loblolly Pine Plantations from the Perspective of Hierarchy Theory

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Objective

- Determine if variation in height growth is effected by high-production harvesting and subsequent site preparation
Why variation over means?

- Average dimensions affected by a plethora of processes and their rates
- Inability to construct consistent dose-response curves over the life time of the plantation
- Thresholds
- Mean comparisons dependent on variation
Basis for analyzing variation

- Property of hierarchy theory and tree growth is complex
- Asymmetric interaction between levels of organization
- Interaction manifested hierarchical integration or ordering
- Buffers & filters
Precedents

• Dendrochronology
  • Sensitivity to harsh conditions

• Example from Gulf of Maine fisheries
  • Removal of constraints by change in age structure and species composition
  • Switch from K-selected species to r-selected species
  • Increased sensitivity to physical environment

Cooperative Research in Sustainable Silviculture and Soil Productivity
Harvesting Levels

Maximum disturbance: Saw-shear and yarded with grapple skidders

Minimum disturbance: Hand-felled, limbed + topped in place, lifted from plot
Establishment practices

Chemical site prep

Banded herbicide

Fertilization

Burning

Bedding or ripping
Basic design

$H_o = \text{Hand-felled, boles only}$

$H_r = \text{Conventional harvesting}$

$S_o = \text{Aerial herbicide application site prep}$

$S_r = \text{Aerial herbicide + conventional site prep}$
Concentrate on a few treatments

- Harvesting at Bainbridge, Georgia
- Fertilization at Fred, Texas
- Burning at Bryceland, Louisiana
Harvesting Disturbance

Height increment (m/yr)

- Hand felled
- Machine harvested

Standard deviation of (ht inc)

Age (yr)
Fertilization

![Graph 1: Height increment (m/yr) vs. Age (yr)](image)

![Graph 2: Standard deviation of ln(height increment) vs. Age (yr)](image)

- **Unfertilized**
- **Fertilized**
Broadcast burning

- Height increment (m/yr)
- Standard deviation of ln(h) inc

Age (yr)

Unburned
Burned
The scatter plot shows the relationship between annual height increment (m/yr) and standard deviation of height increment. The plot includes data points for Fertilization, Harvesting, and Burning. The correlation coefficient (R) is -0.34, with a p-value of 0.009.
Conclusions

- Variation does not appear to increase the power of detecting harvesting and site preparation effects
- Negative correlation between height increment and its variation within a plot consistent with the idea that better growth conditions buffer the elongating terminal from the physical environment
- May also affect ability to detect negative effects of forest management practices on growth.