Underplanted Shortleaf Pine Seedling Survival and Growth in the North Carolina Piedmont

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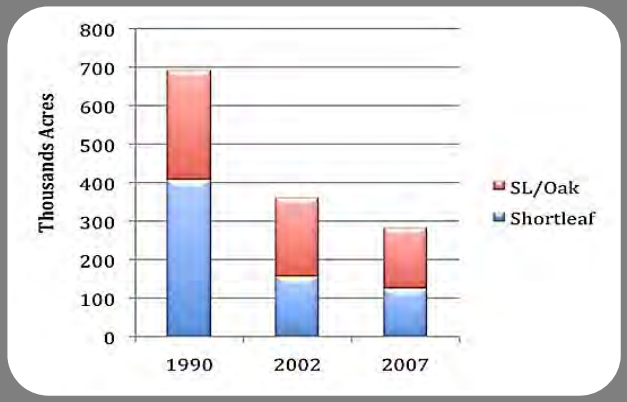
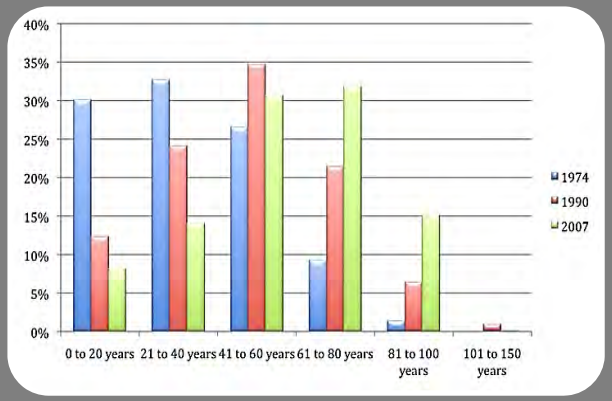
Introduction

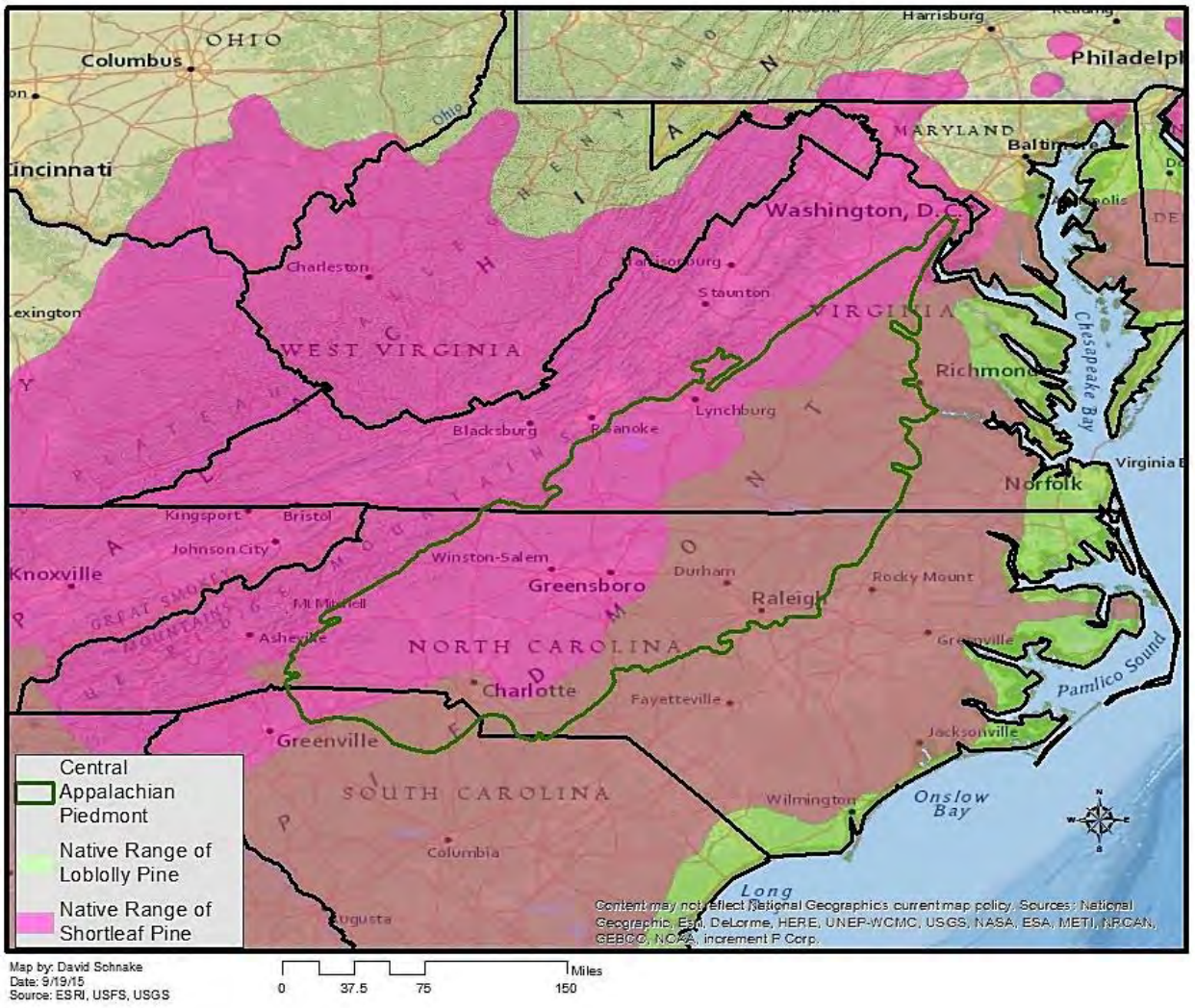


Shortleaf acreage is declining in North Carolina

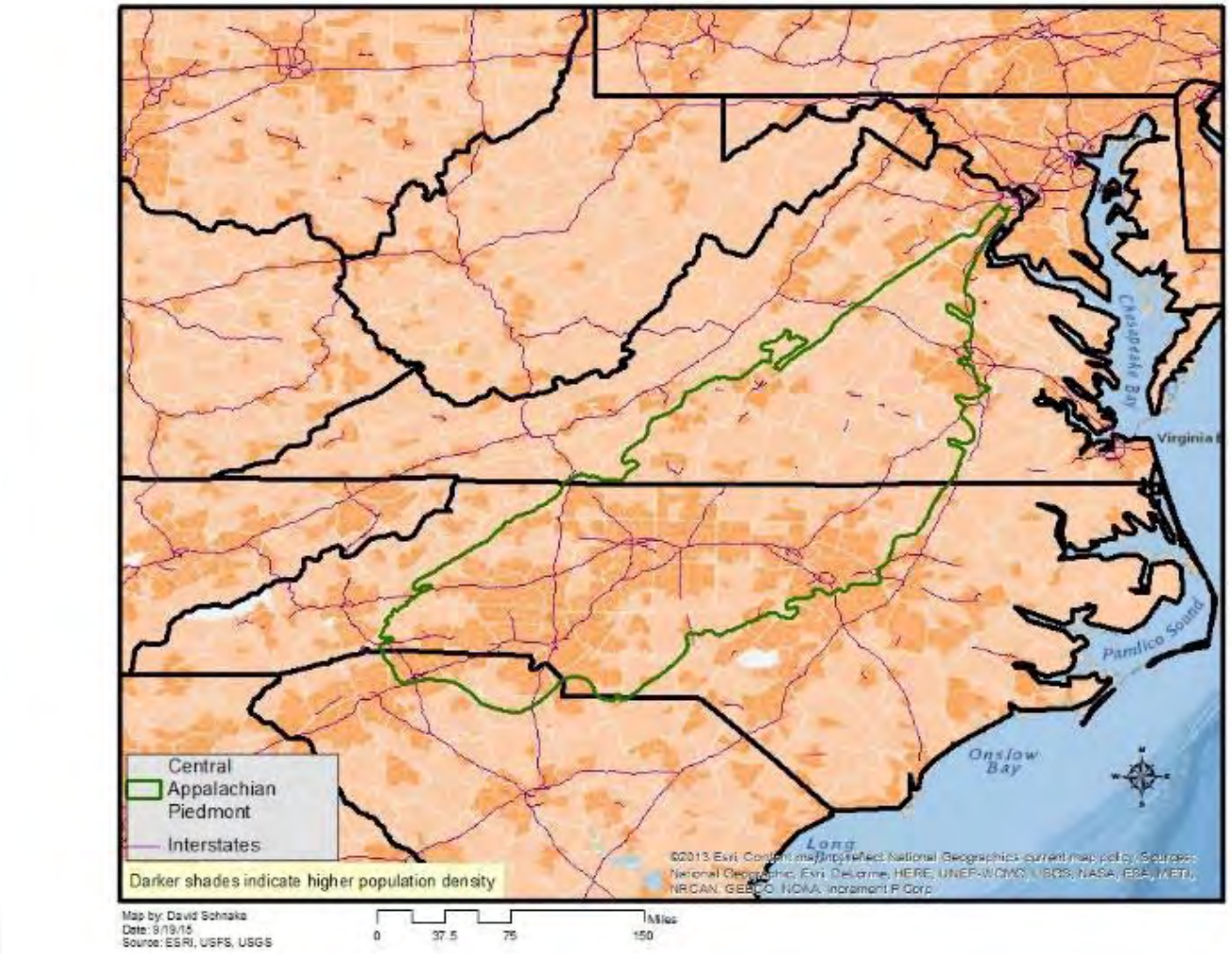


Regeneration-focused management is needed to balance the proportion of seedlings to overstory trees

Shortleaf pine can grow very well in parts of North Carolina



We need to consider changing landowner values and new management constraints when developing regeneration plans



Underplanting might be a suitable option for some landowners where:

Shortleaf underplanted beneath a hardwood overstory

- Visual impacts of forest management are a concern
- Overstory retention is desired or required

Past Underplanting Research

Kabrick, J. M., Dey, D. C., Shifley, S. R., & Villwock, J. L. (2011). Early survival and growth of planted shortleaf pine seedlings as a function of initial size and overstory stocking.

Jensen, J., Smith, C., Johanson, M., & Gwaze, D., (2007). Underplanting shortleaf pine in the Missouri Ozarks.

Inverse relationship between overstory density and seedling growth

Jensen, J. & Gwaze, D. (2007). Underplanting shortleaf pine at Coldwater Conservation Area in Missouri.

Guldin, J. M. & Heath, G. (2001). Underplanting shortleaf pine seedlings beneath a residual hardwood stand in the Ouachita Mountains: results after seven growing seasons.

Objectives

Evaluate the effectiveness of underplanting as a method of establishing a shortleaf pine component in mixed stands in the Central Appalachian Piedmont

- Evaluate the impact of overstory density on survival and growth of underplanted seedlings on a North Carolina Piedmont site.
- Evaluate differences in survival and growth between containerized and bareroot shortleaf pine planting stock.

Methods
Study Site

Study site prior to harvest

NCDA&CS Umstead Research Station. Durham County, NC.

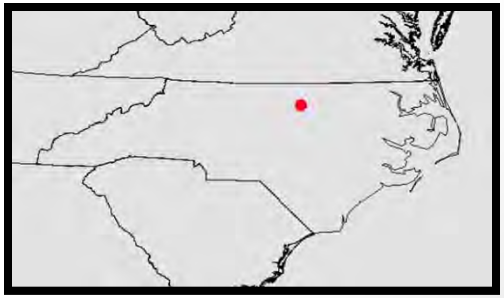
Mixed Hardwood-Pine

Abandoned agricultural land

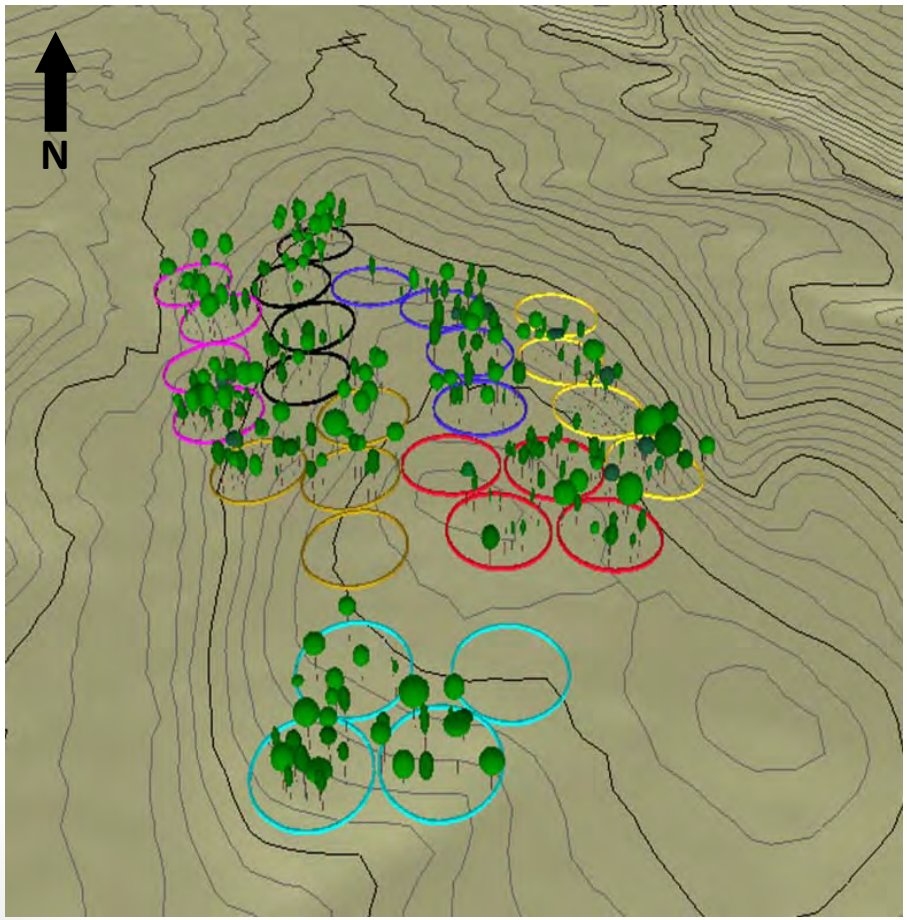
Soils: silt loam and sandy loam

Annual precipitation: 45.2 inches

Elevation: 440 – 480 ft.



Methods
Experimental Design



Graphic generated with EnVision software developed by Robert J. McGaughey, USDA Forest Service Pacific Northwest Research Station

- Four residual overstory basal area treatment levels: BA 0, BA 15, BA 30, BA 45
- 1/3-acre circular treatment plots
  1/10-acre seedling measurement plot positioned at plot center
- Seven replicated blocks of each residual BA treatment
- Three stock types

Methods
Stock Type

Three shortleaf pine stock types are being analyzed

Containerized with a large plug (**NCLP**)	1-0
	1.5 x 4.75 depth plug
	NC seed source
Containerized with a small plug (**NCSP**)	1-0
	1.6 x 3.5 depth plug
	NC seed source
Bareroot (**VABR**)	1-0
	VA seed source

Methods Implementation

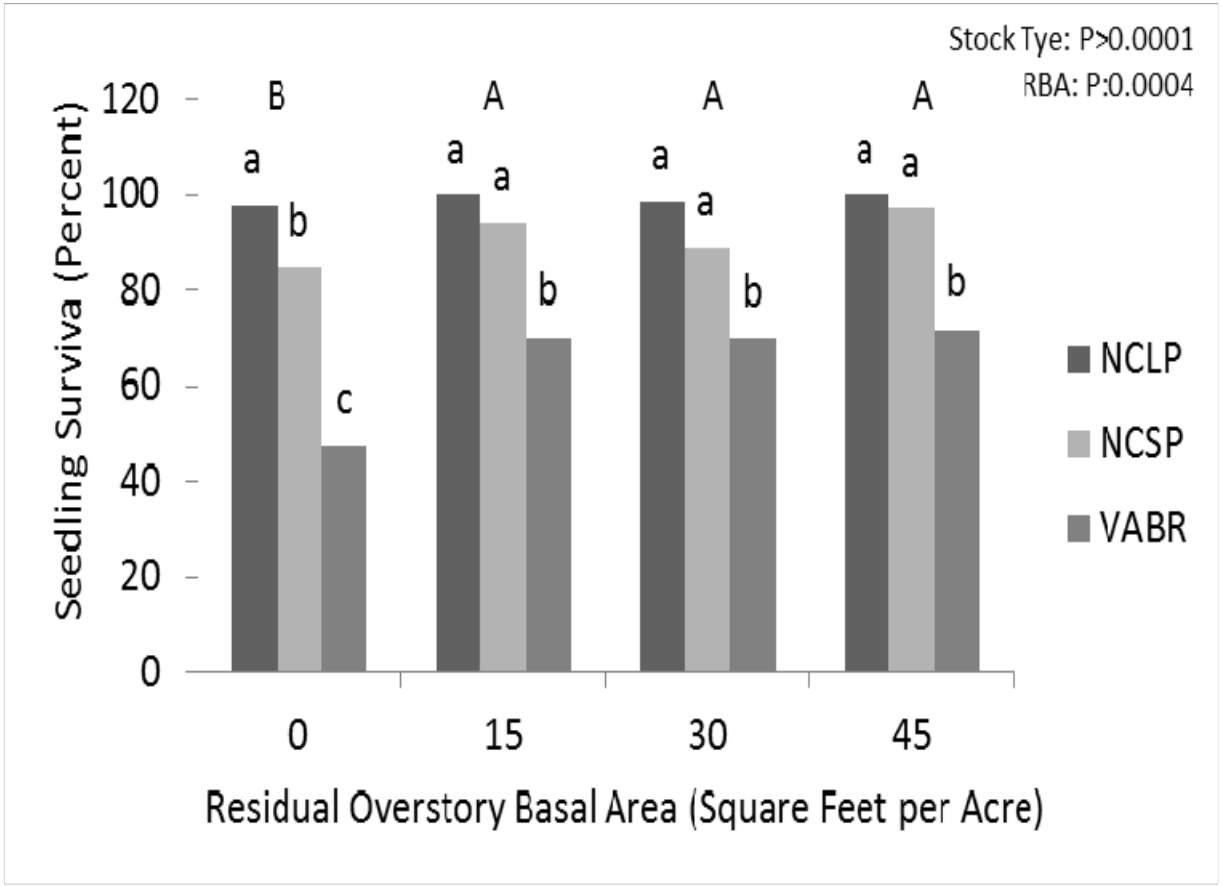
Marked the leave trees within each plot to ensure uniform overstory distribution and comparable average diameters

Harvested to targeted residual basal areas in August and September, 2012.

Planted and recorded initial sizes in January/February, 2013.

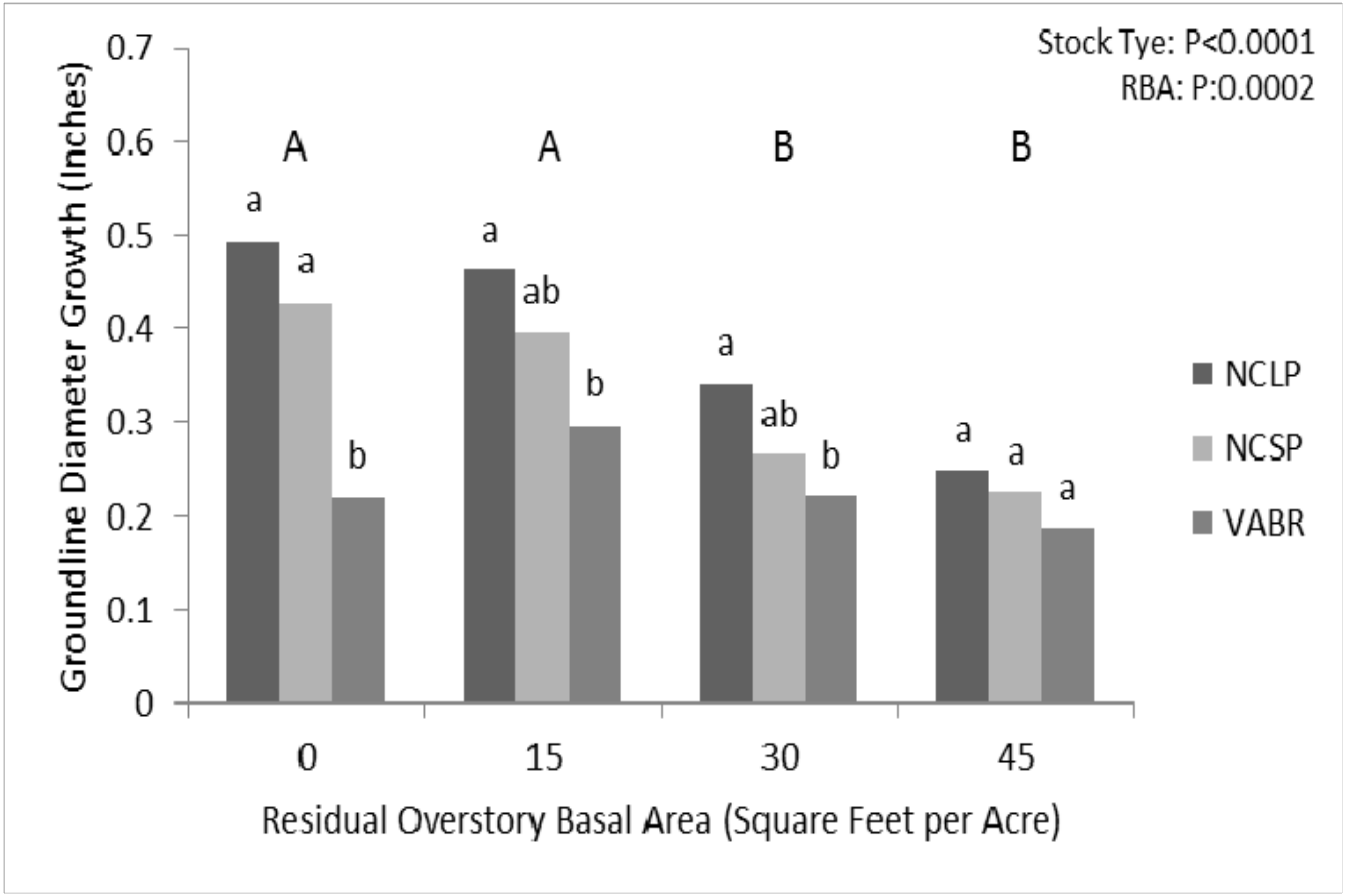
Recorded survival, seedling height, and seedling groundline diameter following first and second growing seasons

Results – Year One Survival



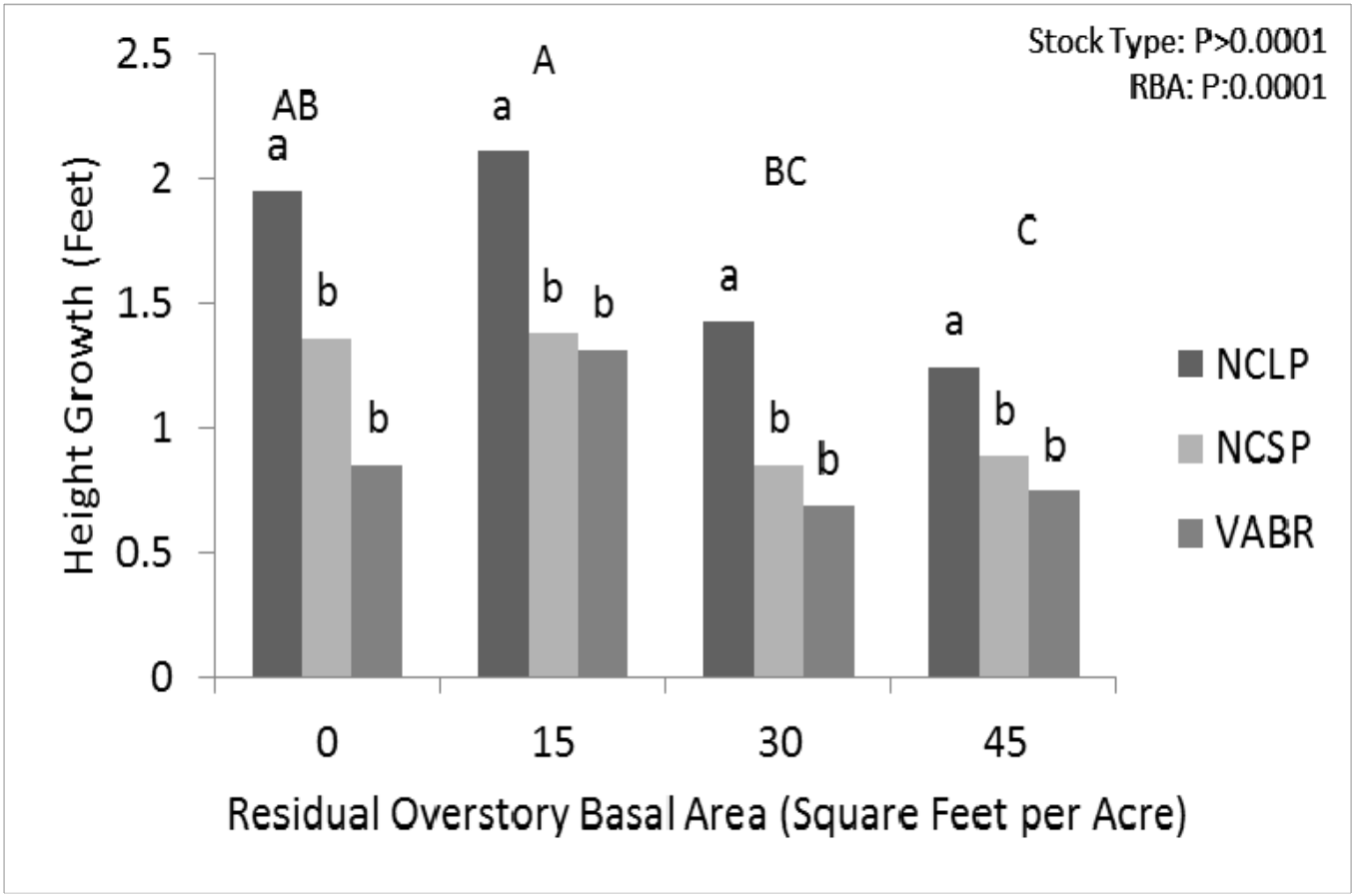
Stock type and residual basal area had significant effects on first year survival

Results – Year Two Groundline Diameter Growth



Residual basal area and stock type had significant effects on groundline diameter growth after two growing seasons

Results – Year Two Height Growth



Residual basal area and stock type had significant effects on height growth after two growing seasons

Discussion - Survival

Residual overstory basal area had a significant effect on survival

- The bareroot and containerized seedlings with small plugs had poor survival in the BA 0 plots
- Attributed to the harsh microclimate in BA 0 plots and dense herbaceous competition

Containerized stock had significantly better survival that than the bareroot stock

- Attributed to the more intact root systems of the containerized stock and possibly seed source.
- Differences between the two containerized stock are attributed to more area for root development in the large plug and depth.

Discussion - Growth

Heights and groundline diameters were largest in plots with no/low residual overstory density

- Inverse relationship between overstory density and seedling size

Containerized stock generally had larger heights and groundline diameters after two growing seasons

- Again attributed to the more intact root systems associated with the containerized seedlings, depth and area for root development between the two container sizes, and possibly seed source.

Management Implications

- Underplanting shortleaf pine seedling beneath a residual hardwood overstory appears to be a suitable method of establishing shortleaf pine.
- The suppression of competing vegetation and sheltering provided by low levels of overstory basal area may improve early survival without negatively impacting growth.

Management Implications

- Containerized stock outperformed bareroot stock on this harsh Piedmont site.
- Both containerized sources, which are currently available to landowners, performed very well.
- If the site allows, planting containerized seedlings with larger and deeper plugs may increase seedling survival and growth on harsh sites.

Questions

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