

Optimum Timing and Application of Prescribed Fire and Stem Clipping to Obtain Maximum Sprouting Success in Shortleaf Pine (*Pinus echinata* Mill.)

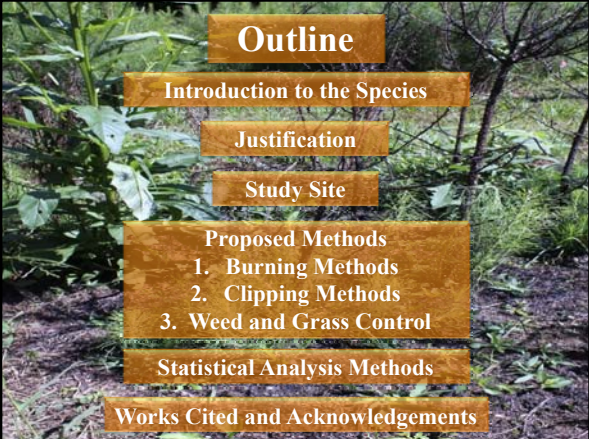


David Clabo
M.S. Candidate
University of Tennessee
Dept of Forestry, Wildlife and Fisheries
October 31, 2012 12:20 PM Room 160 PBB





Outline

- Introduction to the Species
- Justification
- Study Site
- Proposed Methods
 - 1. Burning Methods
 - 2. Clipping Methods
 - 3. Weed and Grass Control
- Statistical Analysis Methods
- Works Cited and Acknowledgements



Introduction

- Wide Native Range
 - 22 States (approximately 440,000 square miles) (Willet 1986).
- Grows better than other southern pine species on less fertile, upland soils (Lawson 1990).
- Has the ability to sprout at up to 6 to 8 inches in DBH (Fowells 1965).
- J-shaped basal crook
 - Contains axillary buds (Guldin 1986)




digital.library.edu

na.fs.fed.us

Introduction


5. This trait allows the species to survive where other pine species may decline (Lawson 1990).
6. Basal crook develops 2-3 months after germination (Guldin 1986).
7. Recent findings suggest the basal crook is not always necessary for sprouting success (Lilly et al. 2011) .
8. Lilly et al. (2011) found most sprouts develop slightly above the basal crook on the bud cluster



forestencyclopedia.net

Introduction

9. Shortleaf pine has slow growth as seedlings → tap root formation (Hardin et al. 2001).
10. Multimodal growth pattern: 1 to 3 feet per year usually stopping by July (Guldin 1986) .
11. Most trees reach maturity at or before 170 years (Hardin et al. 2001).



The Decline of Shortleaf Pine

1. Loblolly pine has become the dominant southern yellow pine in the southern U.S. (Birch et al. 1986)
2. Natural shortleaf pine stands are succeeding into longer lived hardwoods without disturbance. (Coffey 2011, Dennington 1991).
3. Currently, the species is declining -52% decline in stems ≥ 1" DBH since the early 1980s (Oswalt 2011).
4. Conditions suitable for establishment and propagation are uncommon. -Requires bare mineral soil for establishment (Coffey 2011)

flickrhivemind.net

Justification

General

- Shortleaf pine offers several advantages over other southern pines.

1. Wide native range: adaptability
2. Disease resistance (except littleleaf disease in wet, clayey soils) (Czabator et al. 1978, Coder 1997)
3. Denser, heavier wood (USDA 2007)
4. Better crown form and pruning ability (Dorman 1976, Guldin 1986)

Ecological

- Pine-hardwood mixtures are declining (Sheffield et al. 1989)
- Decline in Shortleaf Pine-bluestem grass woodland and savanna habitats (Elliot et al. 2012)
- Seeds eaten by a variety of birds and small mammals (Martin 1961) (Stephenson et al. 1963).
- Important habitat component for many wildlife species (Masters 2007).

fireecology.okstate.edu

Justification

- Renewed interest across the southeast in restoring these degraded ecosystems (Atkinson 2011) (Guldin 2007).
- Little is known about the appropriate timing of disturbance (burning or clipping) to reduce competition and increase shortleaf pine sprouting success in young seedlings.
- Few previous studies have focused on the effects of clipping (Campbell 1985) and fire (Cain and Shelton 2000) (Lilly et al. 2012) (Williams 1998) to promote shortleaf pine sprouting in the seedling age range.
- No known studies on shortleaf pine sprouting have been conducted on suitable areas east of the Mississippi River.

afoa.org


Objectives

1. Sprouting success of shortleaf pine at ages 1, 2, and 3 years after planting following burning and clipping.
2. Compare sprouting between seedlings that received a clipping treatment versus those that received a burning treatment in March.
3. Examine the number of sprouts produced in relation to the timing of burning during the growing season in middle to late March, July, and early November.
4. Examine the height growth and stem diameter growth differences of unburned seedlings (the controls) versus burned seedlings at 1, 2, and 3 years of age after planting and burning.


Objectives

5. Examine the height growth and stem diameter growth of unclipped seedlings (the controls) versus clipped seedlings at ages 1, 2, and 3 after planting and clipping.
6. Determine the influence of total height prior to burning on the resulting number of sprouts per seedling, after the burn treatments in each of the 3 years, and in relation to the period of the growing season burns are applied.
7. Determine the percent mortality of seedlings that are burned or clipped at ages 1, 2, and 3 years old after a treatment is applied. For burned seedlings only, determine the growing season period that will result in the highest percent mortality if burning conditions across years are similar.


Study Site Location



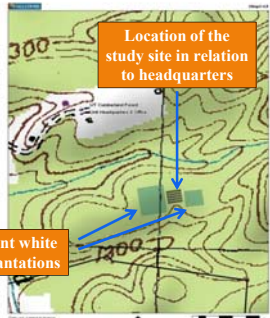
UT Cumberland Forest located in southeast Morgan, County Tennessee



Study Site Location



Little Brushy Mountain Unit of the Cumberland Forest




Location of the study site in relation to headquarters

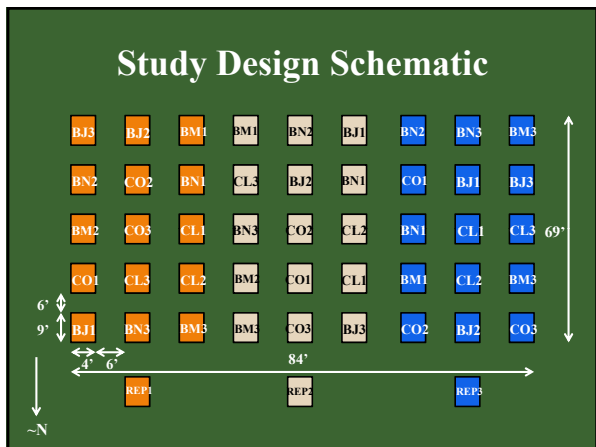
Adjacent white pine plantations

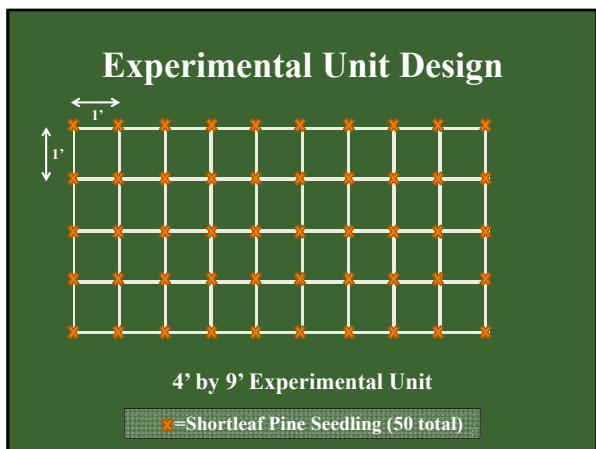
Study Site

- 5,796 square feet previously maintained field



- Uniform soil consisting of Lonewood silt loam 5-12% slopes
- 2,250 1-0 stock shortleaf pine seedlings planted on 2/25/2011.
- Site index for shortleaf pine at base age 50 is 70 feet (USDA 2012).

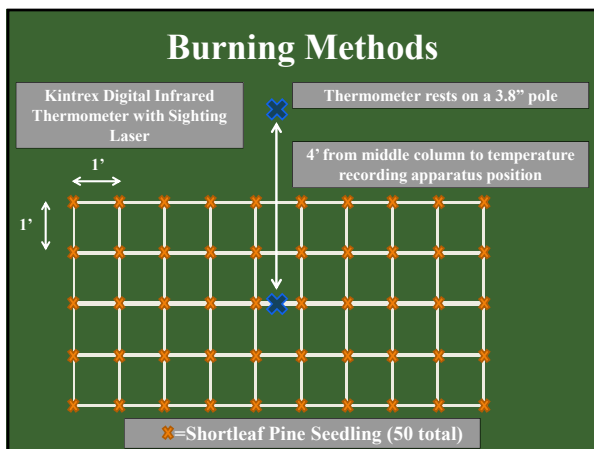







Burning Methods

1. 3 experimental units scheduled for burns in March, July, and early November of 2011, 2012, and 2013.
2. Prior to burning, seedlings are measured for height and basal diameter.
3. Burning permits from TDF
4. Dried white pine needles are applied using 5 gallon buckets.
 - One full (not compacted) bucket per column length.
 - Two full buckets (not compacted) around the perimeter
 - 6 full buckets total



Burning Methods

- Fire weather data including: wind speed, relative humidity, and ambient air temperature
- Measure soil temperature during burns (Fisher Scientific thermometer with a remote sensor)
- Temperature recordings every 15 seconds until complete flameout
- Data used to compare the duration and intensity of fires across years and growing season periods.



Clipping Methods

1. 3 experimental units are clipped in March of 2011, 2012, and 2013
2. Prior to clipping, seedlings are measured for height and basal diameter.
3. Seedlings are clipped approximately 1" to 2" above ground level.
4. All sprouts are clipped in addition to the main stem.



Controls

There are 3 controls in each replicate.

- Measured for height and basal diameter in March of each year for the length of the study.

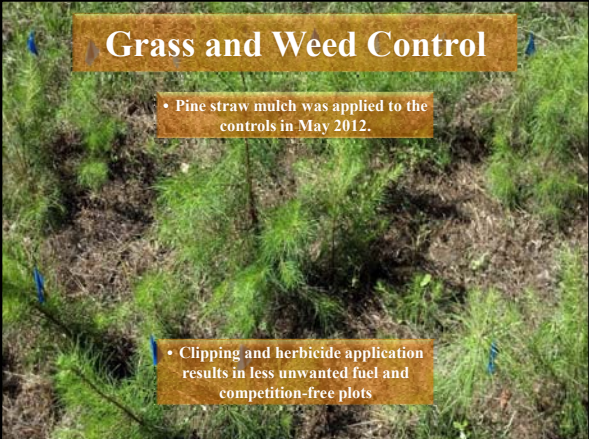


Grass and Weed Control



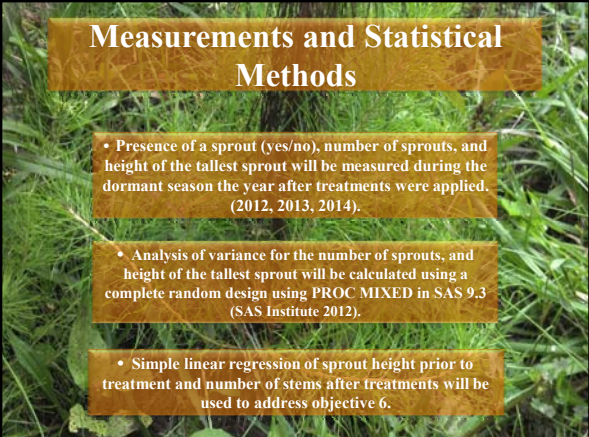
- Grasses and weeds are clipped and herbicide is applied by sponge wicking.
- Prior to burns and periodically
- A solution of 2 ounces of Cornerstone® Plus (glyphosate) per gallon of water is applied by sponge. Ortho® Brush-B-Gone (triclopyr) is applied to control woody vegetation as needed.
- Less than .5 ounce of Spreader Sticker ionic surfactant.

Grass and Weed Control

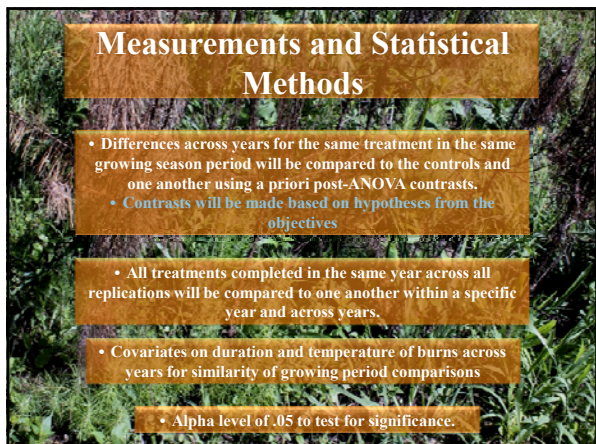


- Pine straw mulch was applied to the controls in May 2012.
- Clipping and herbicide application results in less unwanted fuel and competition-free plots

Measurements and Statistical Methods



- Presence of a sprout (yes/no), number of sprouts, and height of the tallest sprout will be measured during the dormant season the year after treatments were applied. (2012, 2013, 2014).
- Analysis of variance for the number of sprouts, and height of the tallest sprout will be calculated using a complete random design using PROC MIXED in SAS 9.3 (SAS Institute 2012).
- Simple linear regression of sprout height prior to treatment and number of stems after treatments will be used to address objective 6.



Measurements and Statistical Methods

- Differences across years for the same treatment in the same growing season period will be compared to the controls and one another using a priori post-ANOVA contrasts.
- Contrasts will be made based on hypotheses from the objectives
- All treatments completed in the same year across all replications will be compared to one another within a specific year and across years.
- Covariates on duration and temperature of burns across years for similarity of growing period comparisons
- Alpha level of .05 to test for significance.

Literature Cited

- Atkinson, K.L. 2010. The shortleaf pine initiative. Symposium on Shortleaf Pine Research: Past, Present and Future. Department of Natural Resource Ecology and Management (NREM), Oklahoma State University. Stillwater Oklahoma. 12/2/2010. pp. 16-18.
- Birch, F.W, M.H. Hansen, W.H. McWilliams, R.M. Sheffield. 1986. The shortleaf resource. Symposium on the Shortleaf Pine Ecosystem. Arkansas Cooperative Extension Service. Little Rock, Arkansas. 3/31/1986-4/2/1986. pp 9-24.
- Cain, M.D., M.G. Shelton. 2000. Survival and growth of *Pinus echinata* and *Quercus* seedlings in response to simulated summer and winter prescribed burns. Canadian Journal of Forest Research. 30(11): 1830-1836.
- Campbell, T.E. 1985. Sprouting of slash, loblolly, and shortleaf pines following a simulated precommercial thinning. USDA Forest Service Research Note SO-320. pp 3.
- Coder, K.D. 1997. Littleleaf disease on loblolly pine a selected bibliography. University of Georgia School of Forest Resources Extension Publication FOR 97-019. 6/1/2012. <<http://warnell.forestry.uga.edu/warnell/service/library/index.php3?docID=258>>.
- Coffey, Clarence. 2011. The history of shortleaf pine on the Cumberland Plateau. Proceedings of the Shortleaf Pine Conference: East Meets West, Bridging the Gap with Research and Education Across the Range. Alabama Cooperative Extension System and the USDA Forest Service. Huntsville, Alabama. 9/20/2011-9/22/2011. pp.2-6.
- Czabator, E.L., W.R. Phelps. 1978. Fusiform rust of southern pines. USDA Forest Service. Forest Insect & Disease Leaflet 26. 3/16/2012. <<http://www.na.fs.fed.us/spfo/pubs/fids/fusiform/fid-fusi.htm>>.
- Dennington, R.W. 1992. Making natural regeneration methods work with shortleaf pine. Proceedings of the Shortleaf Pine Regeneration Workshop. United States Department of Agriculture Forest Service. Southern Forest Experimental Area. New Orleans, Louisiana. General Technical Report SO-90. 1992. Little Rock, Arkansas. 10/29/1991-10/31/1991. pp.167-171

Literature Cited

- Dorman, K.W. 1976. The genetics and breeding of southern pines. USDA Forest Service agricultural handbook 471. Washington, D.C. pp. 407.
- Elliot, K.J., J.M. Vose, J.D. Knoepp, B.D. Clinton. 2012. Restoration of shortleaf pine (*Pinus echinata*)-hardwood ecosystems severely impacted by the southern pine beetle. Forest Ecology and Management 274: 181-200.
- Fowells, H.A., ed. 1965. Silvics of forest trees of the United States. USDA Forest Service Agricultural handbook no. 271. Washington, D.C. P. 762.
- Guldin, J.M. 1986. Ecology of shortleaf pine. Symposium on the Shortleaf Pine Ecosystem. Arkansas Cooperative Extension Service. Little Rock, Arkansas. 3/31/1986-4/2/1986. P. 25-40.
- Guldin, J.M. 2007. Restoration and management of shortleaf pine in pure and mixed stands – science, empirical observation, and the wishful application of generalities. In: shortleaf pine restoration and ecology in the Ozarks: proceedings of a symposium. General technical Report NRS-P-15. USDA Forest Service. Pp 47-58.
- Hardin, J.W, D.J. Leopold, F.M. White. 2001. Harlow and Harrar’s textbook of dendrology. New York. McGraw-Hill. pp. 146-48.
- Lawson, E.R. 1990. “*Pinus Echinata* Mill. Shortleaf Pine” In Burns, Russell M. and Barbara H. Honkala (tech cords). Silvics of North America: 1. Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington DC. Vol. 1, P. 316-326.
- Lilly, C.J., R.E. Will, C.G. Tauer, J.M. Guldin, M.A. Spetich. 2012. Factors affecting the sprouting of shortleaf pine rootstock following prescribed fire. Forest Ecology and Management. 265: 13-19.

Literature Cited

- Lilly, C.J., R.E. Will, C.G. Tauer, J.M. Guldin, M.A. Spetlich. 2010. Factors influencing shortleaf pine sprouting after fire. Symposium on Shortleaf Pine Research: Past, Present, and Future. Department of Natural Resource Ecology and Management (NREM), Oklahoma State University. Stillwater, Oklahoma. 12/2/2010. pp. 8-9.
- Martin, A.C. 1961. *American wildlife and plants: a guide to wildlife food habits; the use of trees, shrubs, weeds and herbs by birds and mammals of the United States*. New York, Dover Publications. 500 p.
- Oswalt, C.M. 2011. Spatial and temporal trends of the shortleaf pine resource in the eastern United States. Proceedings of the Shortleaf Pine Conference: East Meets West, Bridging the Gap with Research and Education Across the Range. Alabama Cooperative Extension System and the USDA Forest Service. Huntsville, Alabama. 9/20/2011-9/22/2011. pp. 33-37.
- SAS Institute. 2012. SAS version 9.3. SAS Institute, Cary, North Carolina.
- Sheffield, R.M., T.W. Birch, E.C. Leatherberry, W.H. McWilliams. 1989. The pine-hardwood resource in the eastern United States. *Proc of Pine-Hardwood Mixtures: A Symposium on Management and Ecology of the Type*. USDA Forest Service General Technical Report SE-58. Atlanta, Georgia. April 18-19, 1989. pp. 9-19.
- Stephenson, G.K., P.D. Goodrum, and R.L. Packard. 1963. Small rodents as consumers of pine seed in east Texas uplands. *Journal of Forestry* 61(7): 523-526.
- United States Department of Agriculture: Forest Service. 2007. The Encyclopedia of Wood. Washington. Skyhorse Publishing. pp. 1-14, 4-7, and 4-8.
- United States Department of Agriculture: Natural Resources Conservation Service. 2012. Web Soil Survey. 3/21/2012. <<http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>>.
- Willett, Larry R. 1986. Foreword. Symposium on the Shortleaf Pine Ecosystem. Arkansas Cooperative Extension Service. Little Rock, Arkansas. 3/31/1986-4/2/1986. pp. iii-iv.
- Williams, R.A. 1998. Effects of fire on shortleaf and loblolly pine reproduction and its potential use in shortleaf and loblolly ecosystem restoration. In: Proceedings of the 9th Biennial Southern Silviculture Research Conference. USDA Forest Service. General Technical Report SRS-20. pp. 321-325.

