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United States Department of Agriculture

Shortleaf Pine: One species, or nine? Thoughts from the Arkansas Skunk Works

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"Between every two pine trees there is a door leading to a new way of life.“

~John Muir

Shortleaf (L) and loblolly (R) pines
Reynolds Research Natural Area
Crossett EF, Ashley County, AR

Photo by JM Guldin, Oct 2007

Muir's quote has certainly been true in my case

I'm enjoying the last decade of a career in the company of shortleaf pine

State record shortleaf pine (RIP)
Ashley County, AR

Photo by DC Bragg, Oct 2007

“I frequently tramped eight or ten miles…to keep an appointment with… an old acquaintance among the pines.” *~Henry David Thoreau*

MA 22
Shortleaf pine-bluestem
Poteau RD
Ouachita NF
Scott County, AR

Photo by JM Guldin, Jan 2010

“Wilderness..is a refuge from society…a place to smell the pines.” *~Also Leopold*

Little Missouri River, through the Winding Stair Womble RD, Ouachita NF, near Langley, AR

Photo by JM Guldin, Feb 2011

“Every creature is better alive than dead, men and moose and pine trees, and he who understands it aright will rather preserve its life than destroy it.” ~*Henry David Thoreau*

Shortleaf pine climbing Forked Mountain
JWF RD, Ouachita NF; Perry County, AR

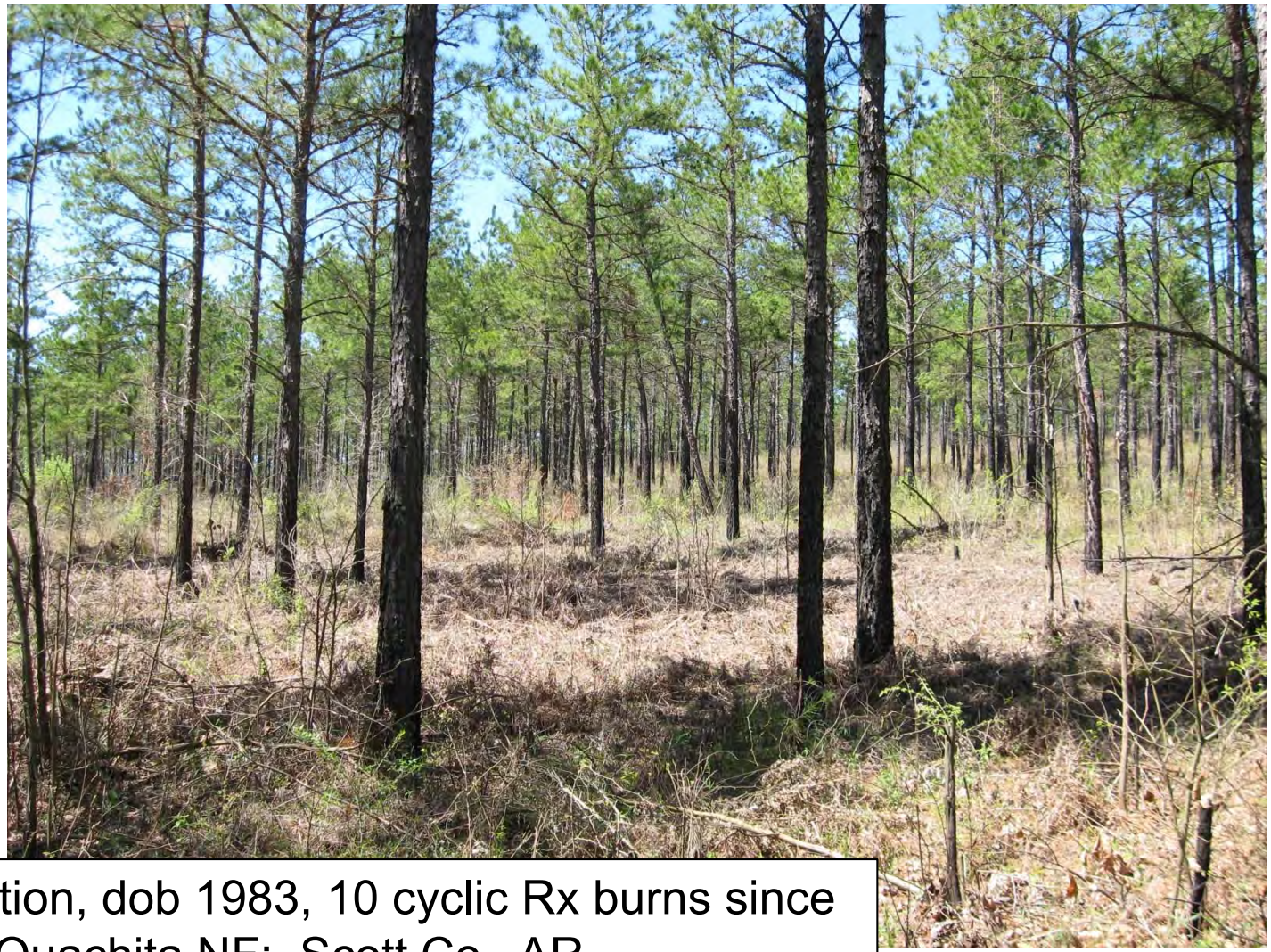
Photo by JM Guldin, Mar 2011

“Who leaves the pine-tree, leaves his friend,
Unnerves his strength, invites his end.”
~Ralph Waldo Emerson

Uprooting during Dec 2013 ice storm
Poteau RD, Ouachita NF; Scott Co., AR

Photo by JM Guldin, Jan 2014

To plant a pine, one need be neither god nor poet, one need only own a good shovel. *~Aldo Leopold*



Hicks Plantation, dob 1983, 10 cyclic Rx burns since
Poteau RD, Ouachita NF; Scott Co., AR

Photo by JM Guldin, Apr 2008

“In the calm thou o’erstretchest the valleys
With thine arms, as if blessings imploring…”
~James Russell Lowell,
“To A Pine-Tree”

Shortleaf pine, Crystal Mountain overlooking the Winona basin
JWF RD, Ouachita NF; Perry County, AR

Phots o by JM Guldin, Oct 2014

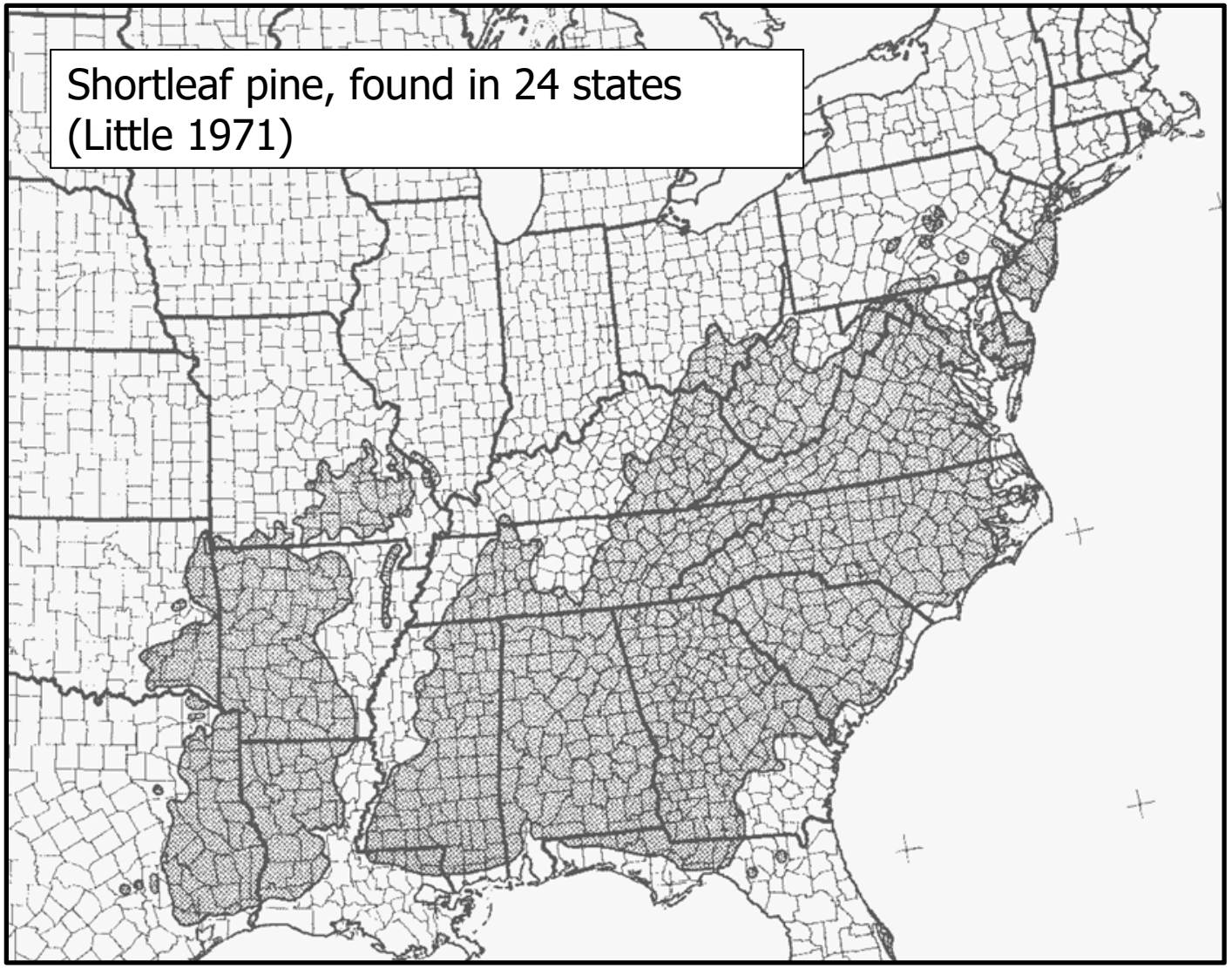
So, my personal challenge—

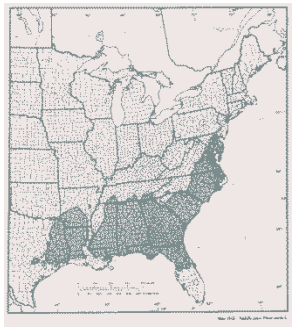
Understanding why a species so resplendent in the Interior Highlands and West Gulf Coastal Plain is so impoverished elsewhere

Shortleaf pine old-growth stand
Hwy 19, south of Round Spring
Pioneer Forest, L-A-D Foundation
Shannon Co, MO

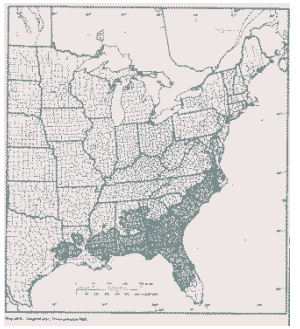
Photo by JM Guldin, Mar 2015

The natural Range of shortleaf pine is more extensive than the other major southern pines





Loblolly pine



Longleaf pine

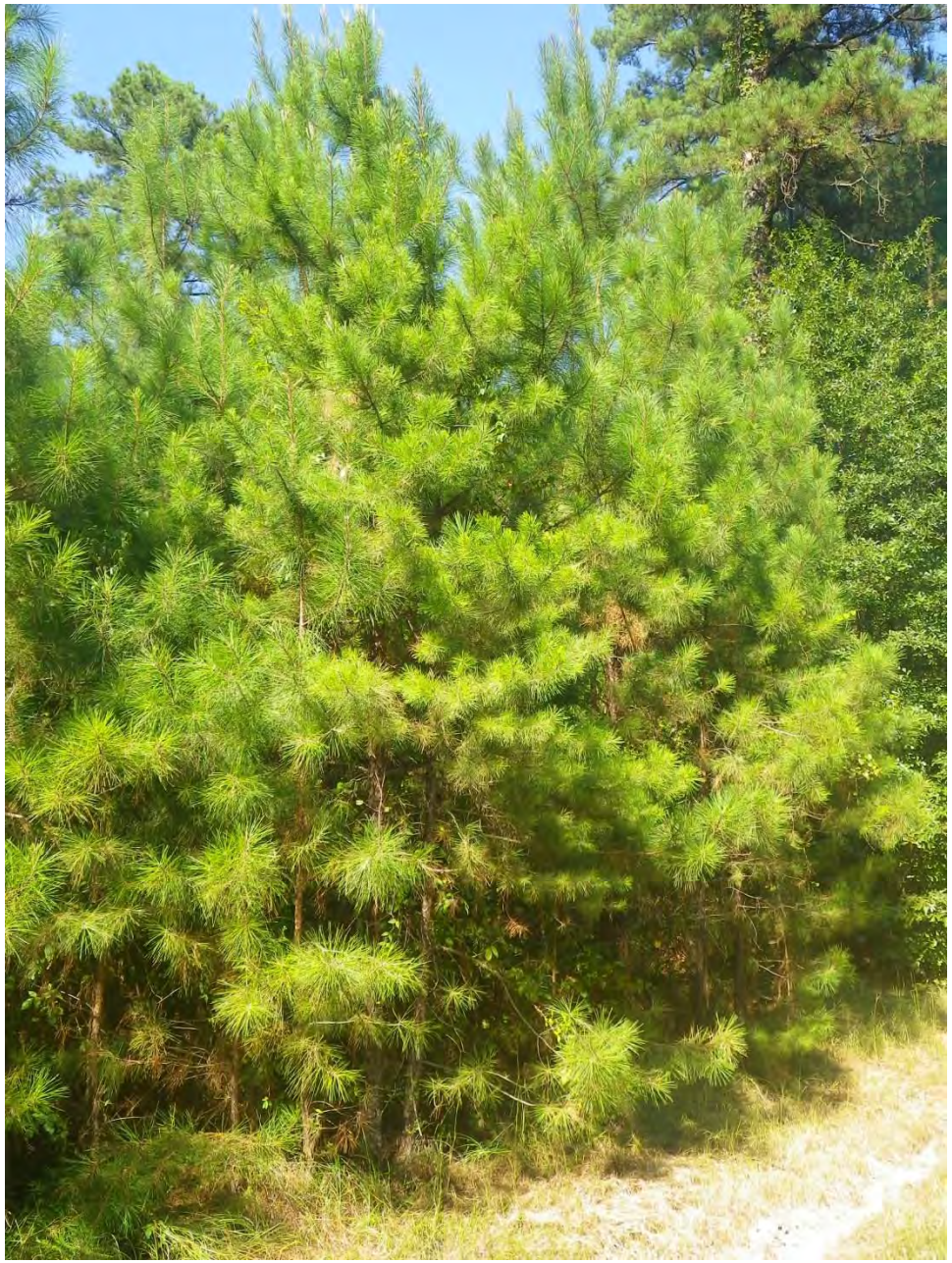
Slash pine

Shortleaf pine—a major component of three SAF Forest Cover Types

- The shortleaf pine type (#75)
- The loblolly pine-shortleaf pine type (#80)
- The shortleaf pine-oak type (#76)
- A minor component in 15 other forest types, typically with loblolly, longleaf, pitch, Virginia, and eastern white pine
- Also found with xerophytic oaks throughout the Appalachians and Interior Highlands

Generalizing about shortleaf pine:

In the Coastal Plain, shortleaf is limited by competition from other species, esp. loblolly pine



Saplings of shortleaf and loblolly pine
Crossett EF, Ashley Co., AR

Photo by JM Guldin, Aug 2015

In the Appalachians and Ozarks, it is limited by soils, sites, history, and ecological or successional conditions that favor other species such as oaks

Rich stump of shortleaf pine in managed oak stand
Pioneer Forest, Salem MO

Photo by JM Guldin, Oct 2004

Mohr (1897): In Missouri forests, the the fine tall pines tower high above the stunted Scarlet, Black, and White oaks and hickories, but the growth of these hardwoods almost completely overpowers the second growth of pine.

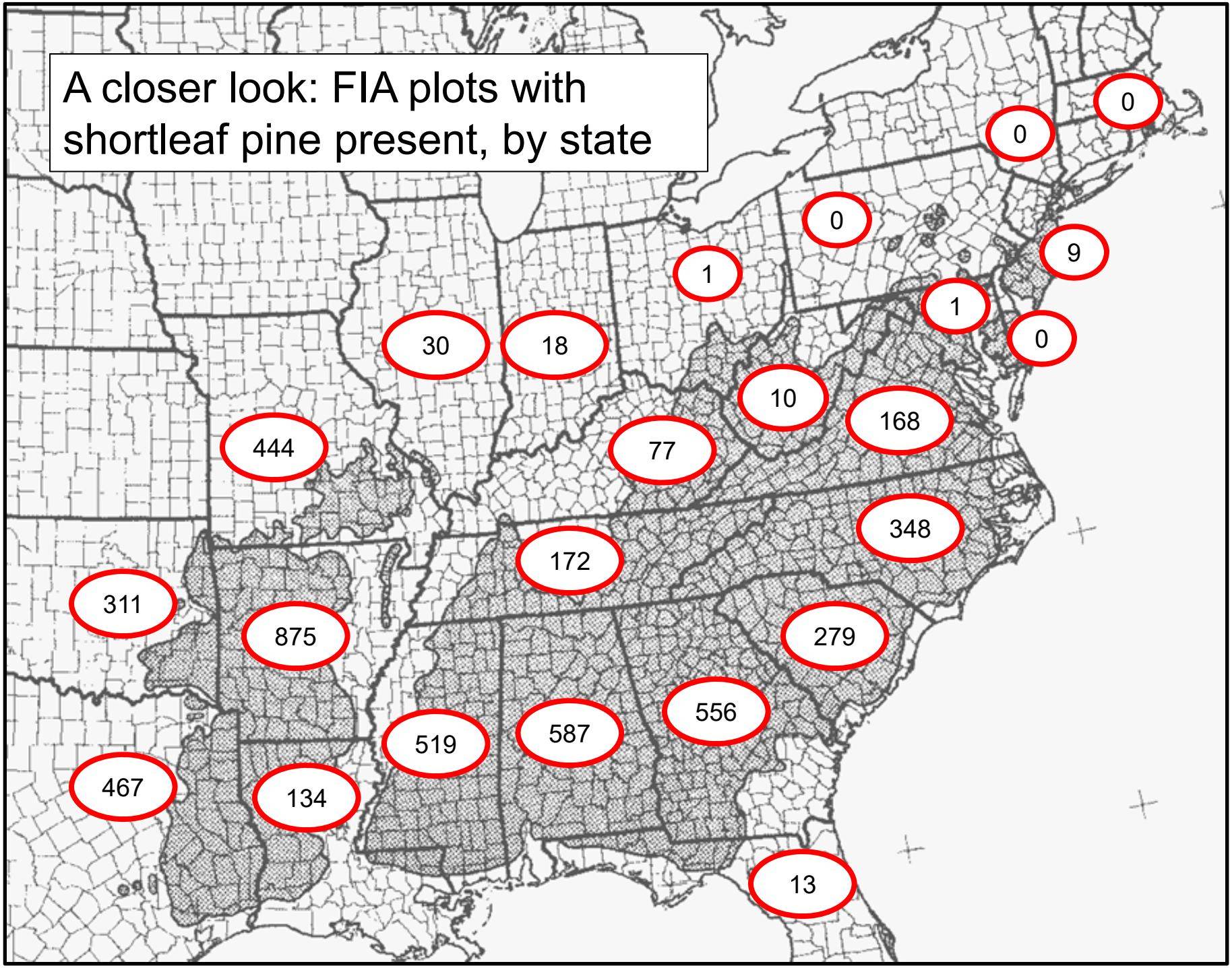
Shortleaf pine management
Pioneer Forest
Shannon CO., MO

Photo by JM Guldin, Oct 2014

Everywhere, shortleaf is increasingly limited by withdrawal of fire from the landscape

The typical condition in mature shortleaf-dominated stands in the Ouachita Mountains, prior to restoration
Poteau RD, Ouachita NF
Scott Co., AR

Photo by JM Guldin, May 2006


A closer look: FIA plots with shortleaf pine present, by state
0
0
0
9
1
1
0
30
18
10
168
444
77
348
172
311
875
279
556
519
587
467
134
13

But take FIA data with a grain of salt, or perhaps a salt lick…

…I KNOW there is shortleaf pine in Pennsylvania

Shortleaf pine in Pennsylvania Blue Ridge
Lost Creek Rod and Gun Club
(founded by my grandfather, cousins still active members)
Juniata Co, PA

Photo by JM Guldin, Apr 2013

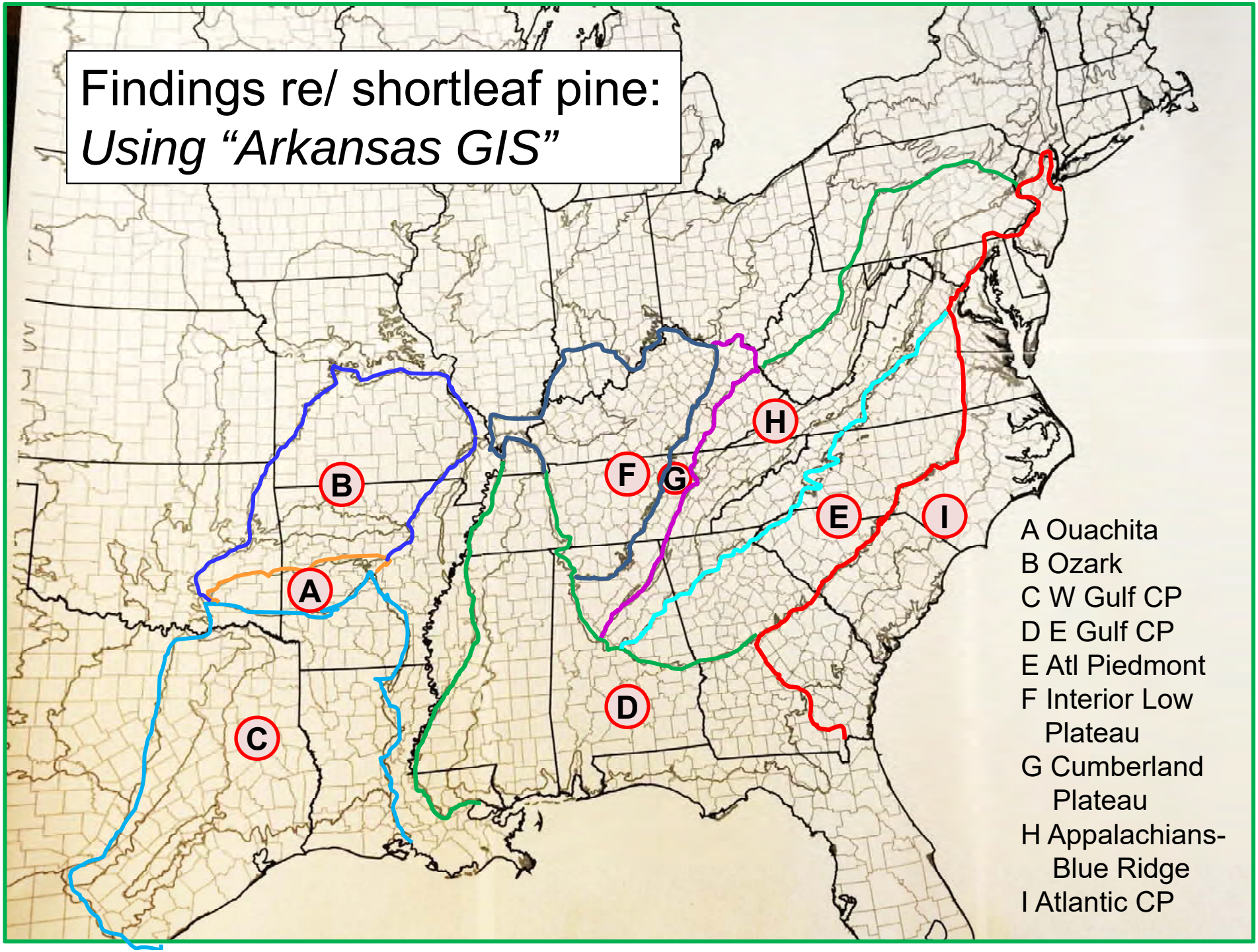
That simple data tally suggests that the occurrence and prevalence of shortleaf pine is different across the eastern US.

- How, and why, is it different?
- And --what does that say about approaches to restoration?

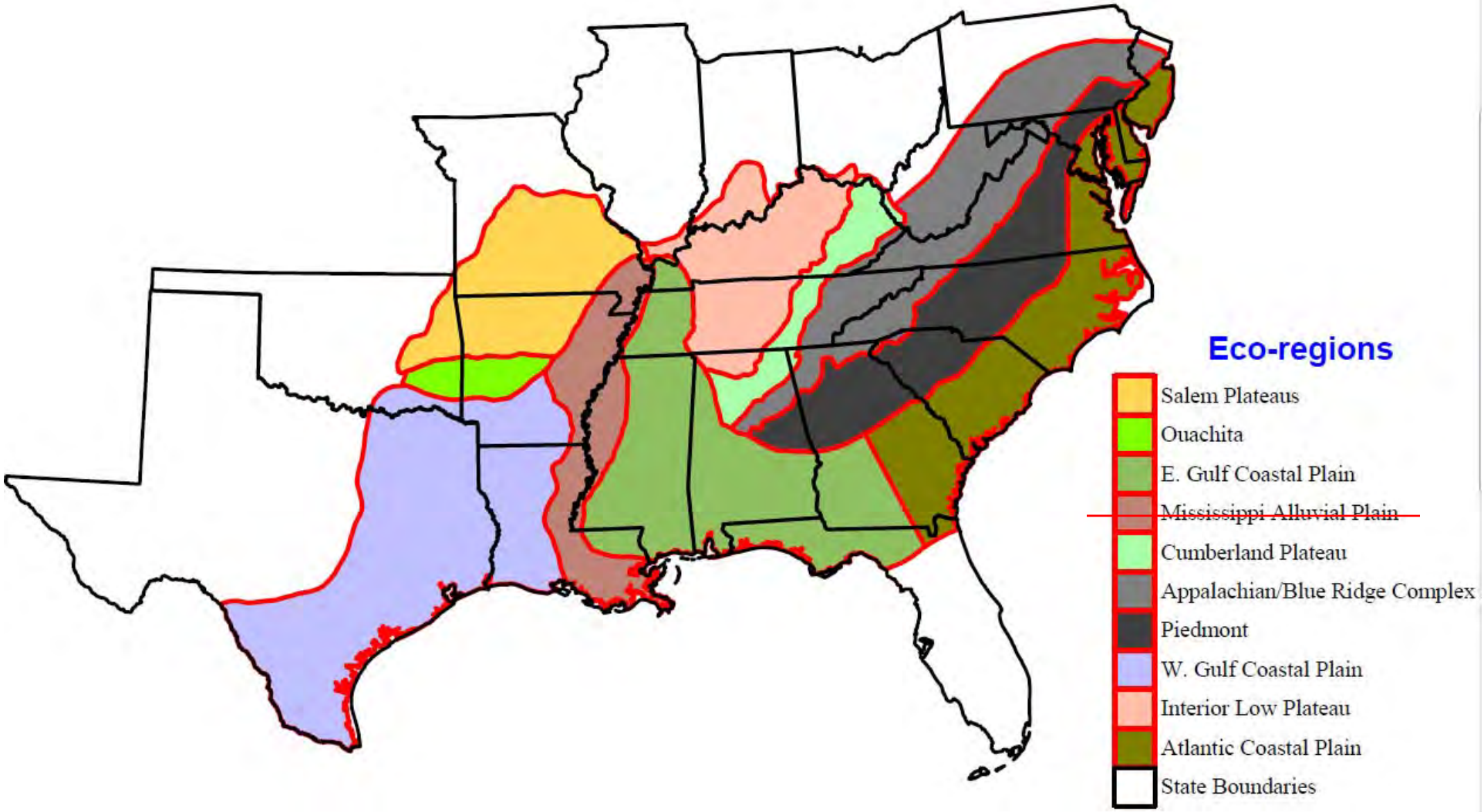
Shortleaf pine, multiple age cohorts
Red Hills of the Florida Panhandle
Tall Timbers Research Station
Leon Co, FL

Photo by JM Guldin, Feb 2009

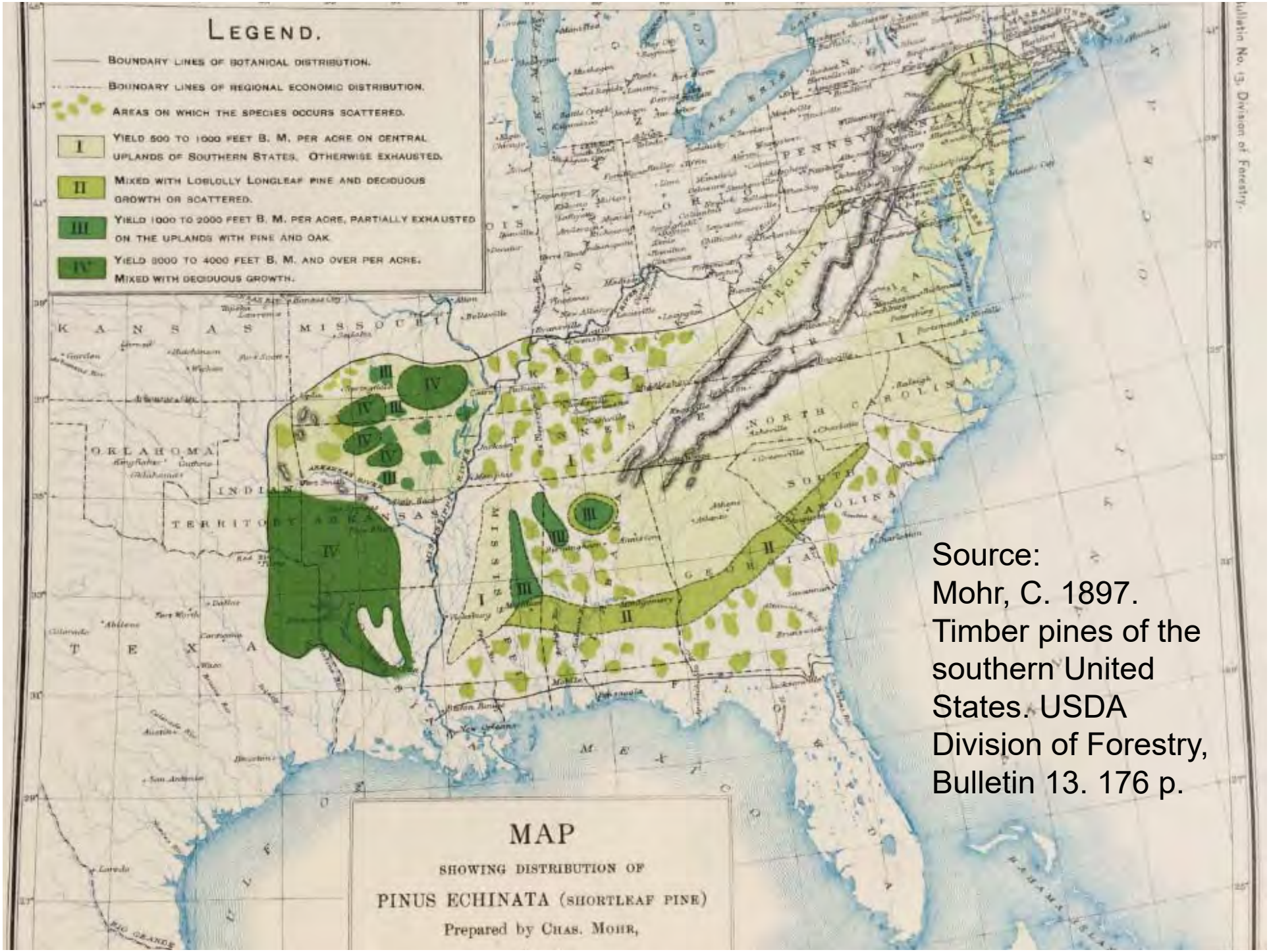
Findings re/ shortleaf pine:
Using "Arkansas GIS"



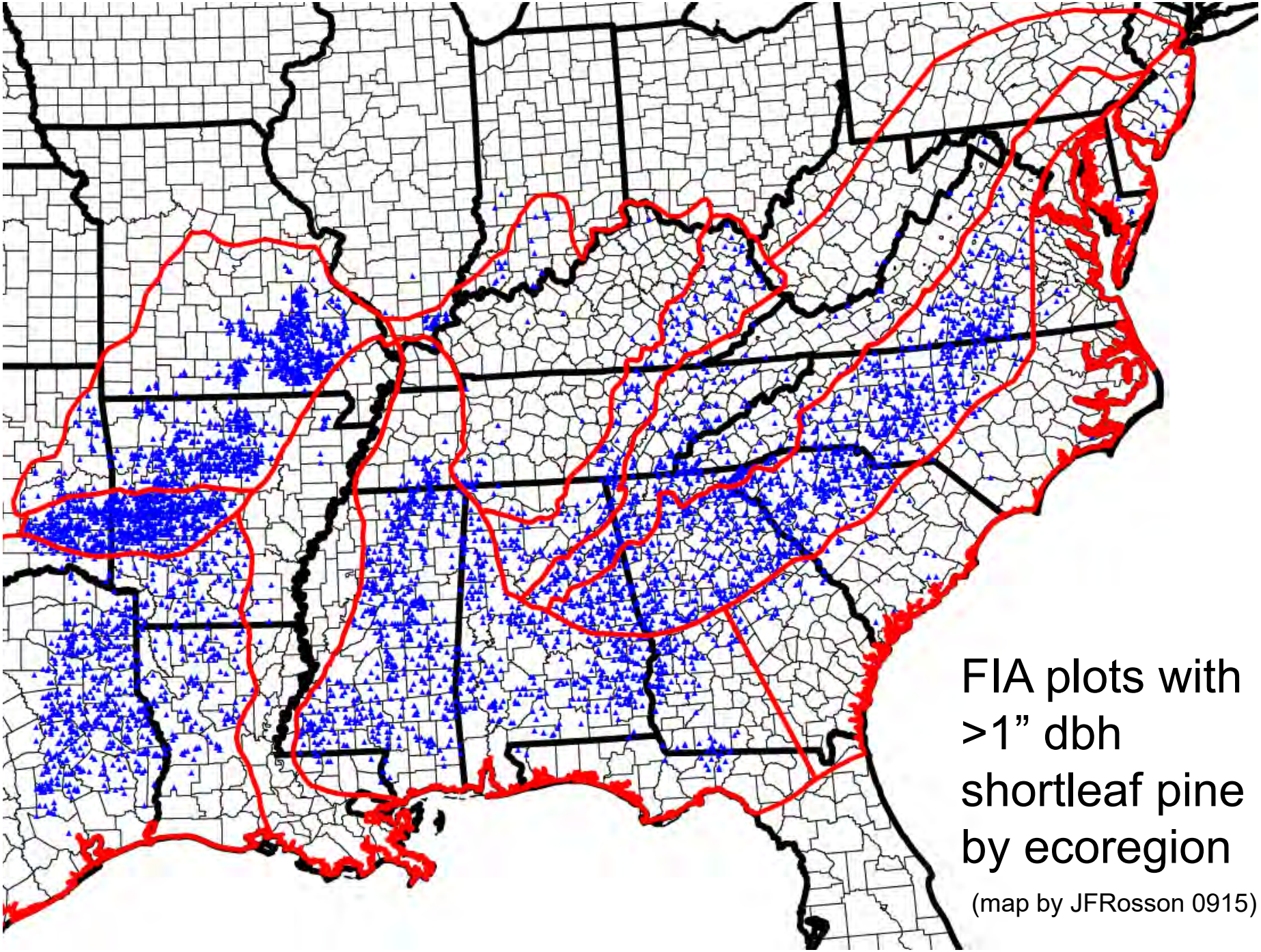
Relevant ecoregions (Bailey et al.), we think, in the natural range of shortleaf pine



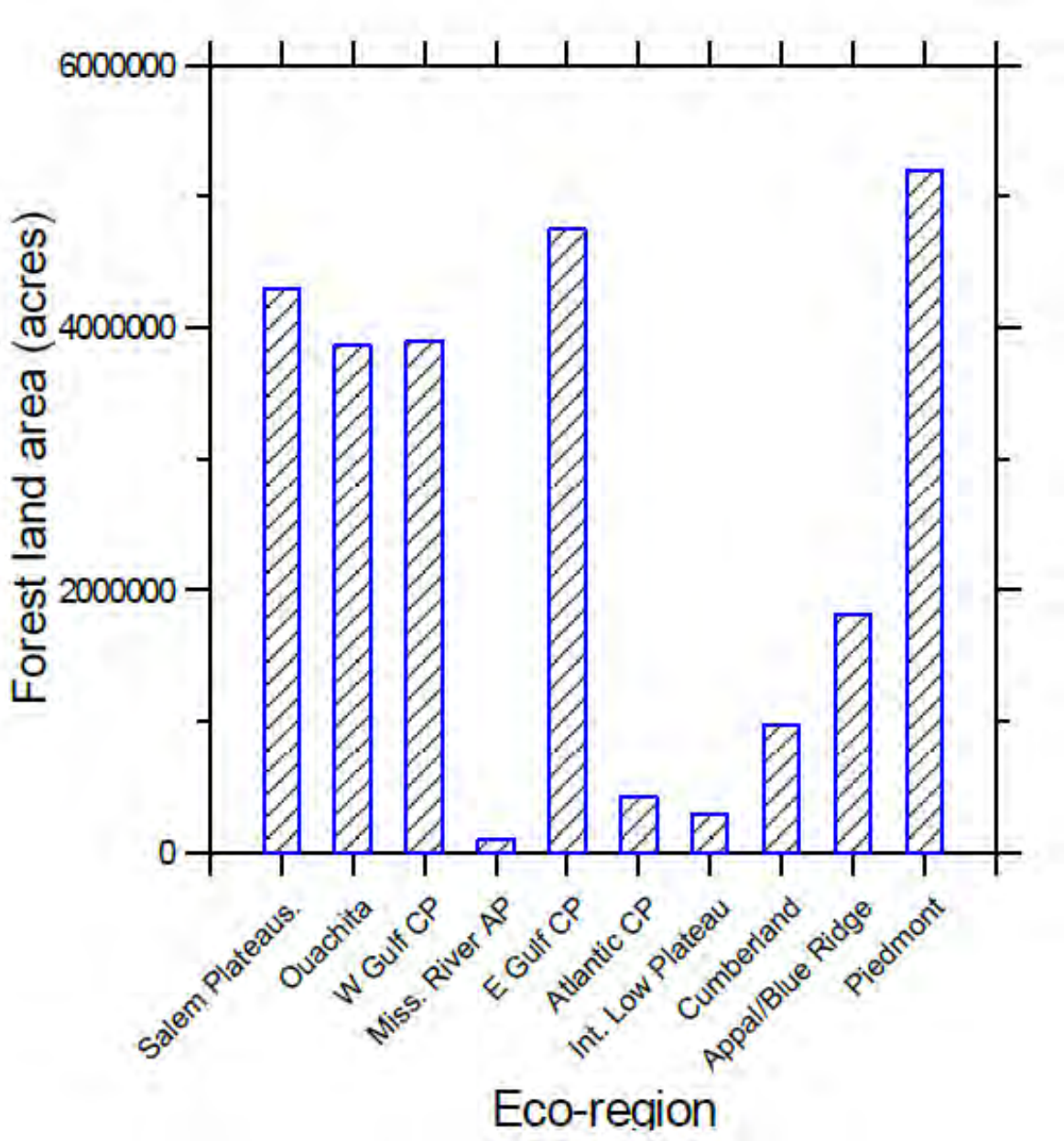
(map by JFRosson 0915)



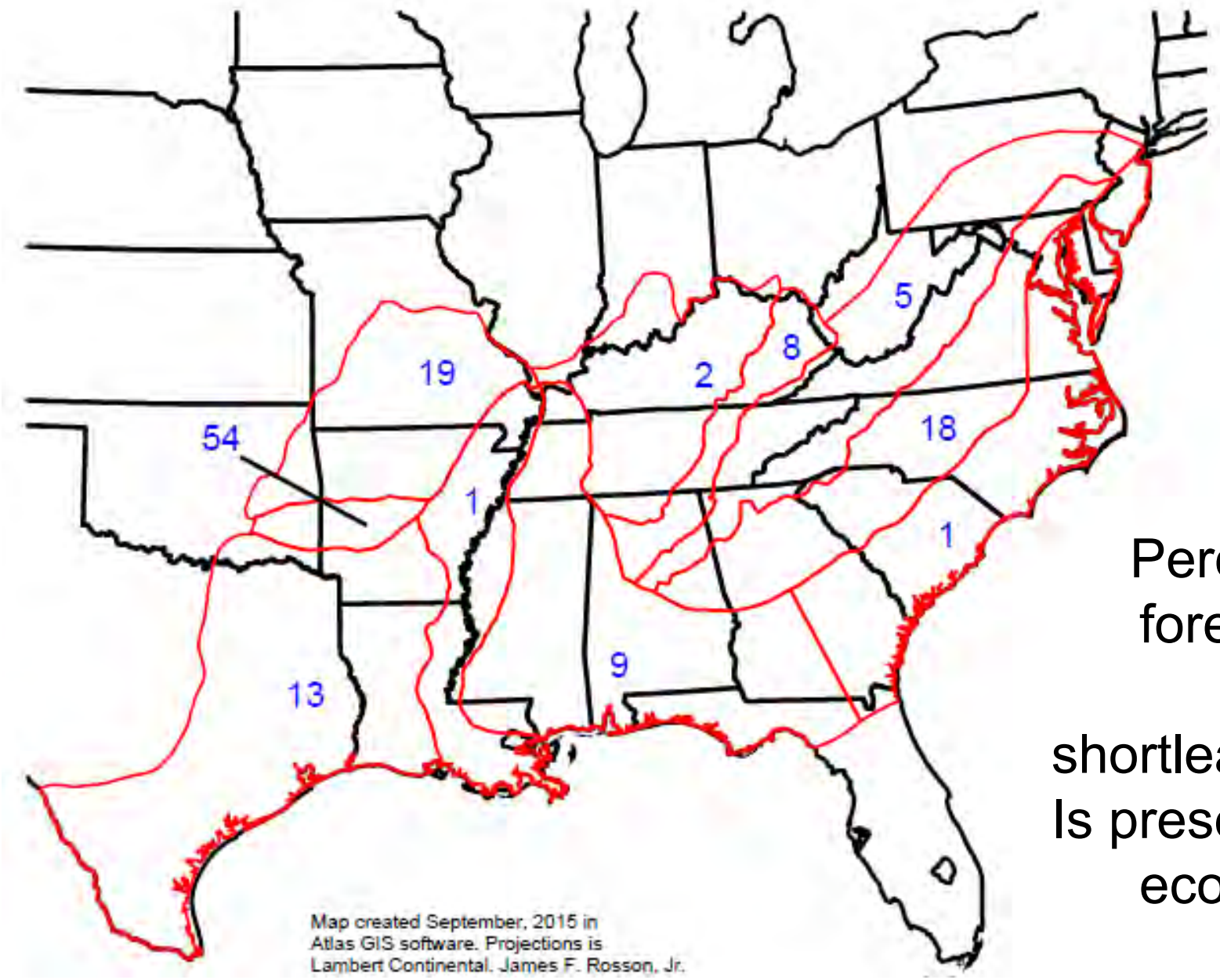
Source:
Mohr, C. 1897. Timber pines of the southern United States. USDA Division of Forestry, Bulletin 13. 176 p.


FIA plots with
>1” dbh
shortleaf pine
by ecoregion
(map by JFRosson 0915)

Forest land area with shortleaf pine (≥ 1.0 in. dbh) in the eastern US.



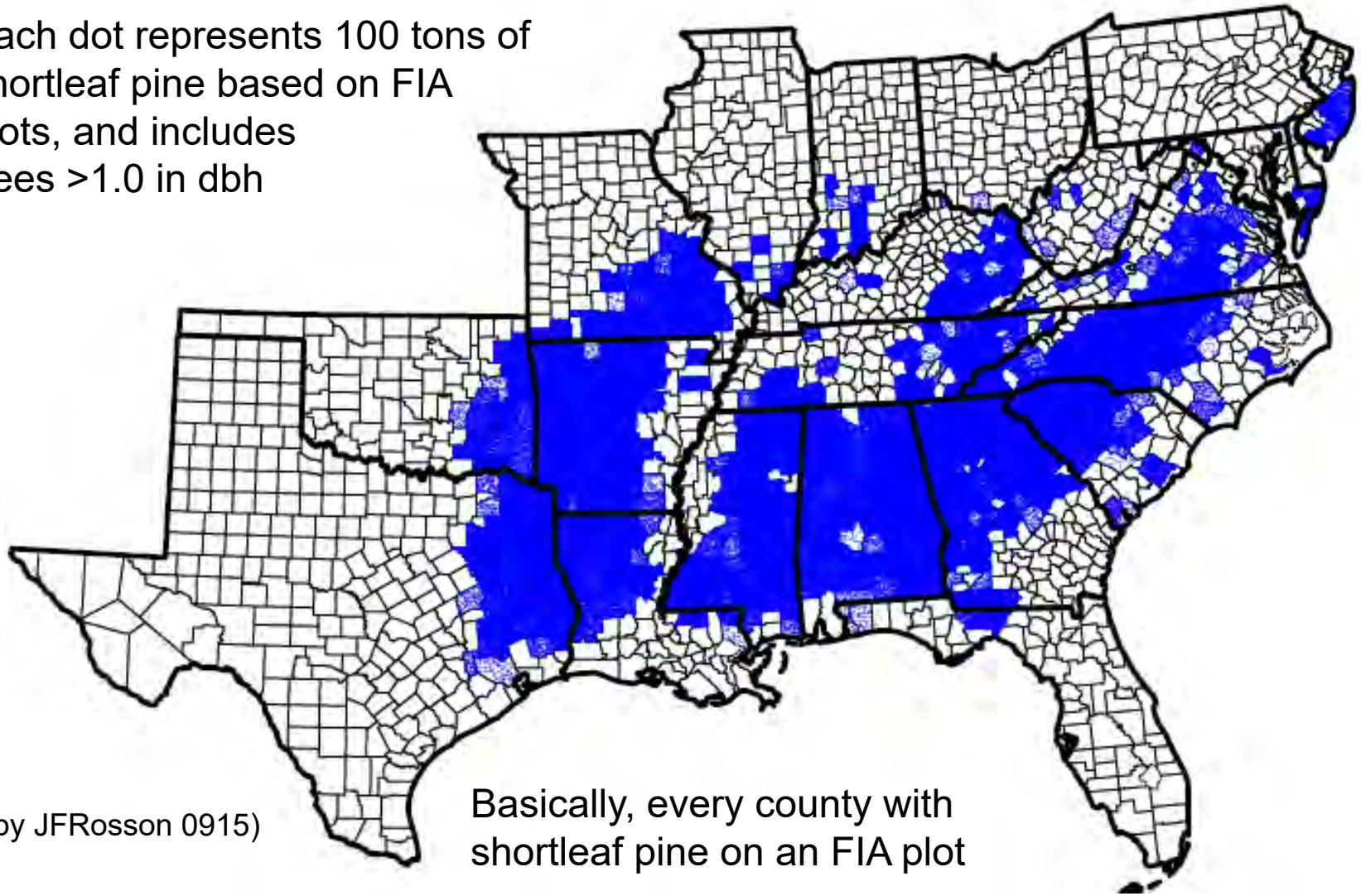
(graph by JFRosson 0915)



Percent of forestland where shortleaf pine Is present, by ecoregion

Shortleaf pine spatial distribution in eastern US

Each dot represents 100 tons of shortleaf pine based on FIA plots, and includes trees >1.0 in dbh

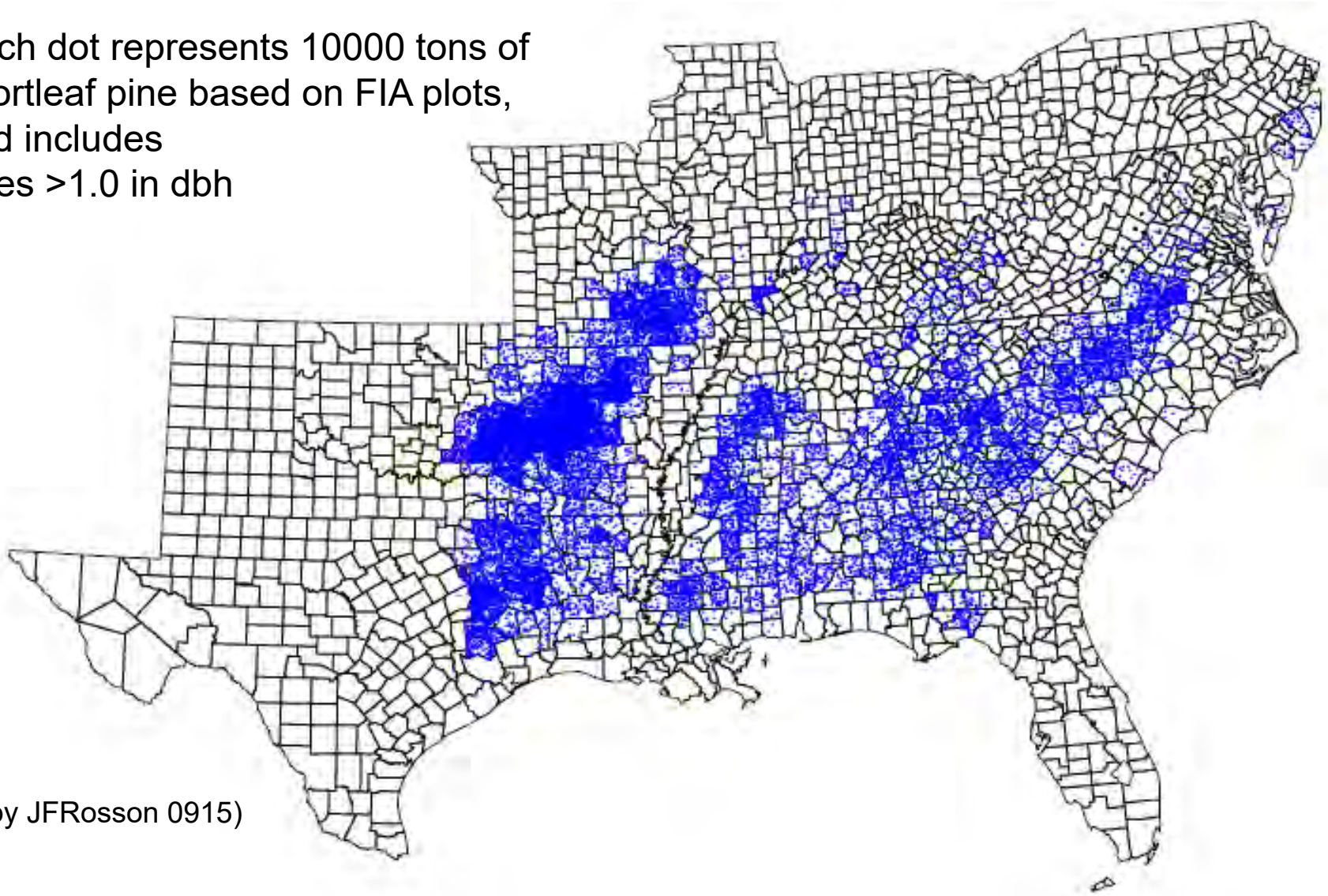


(map by JFRosson 0915)

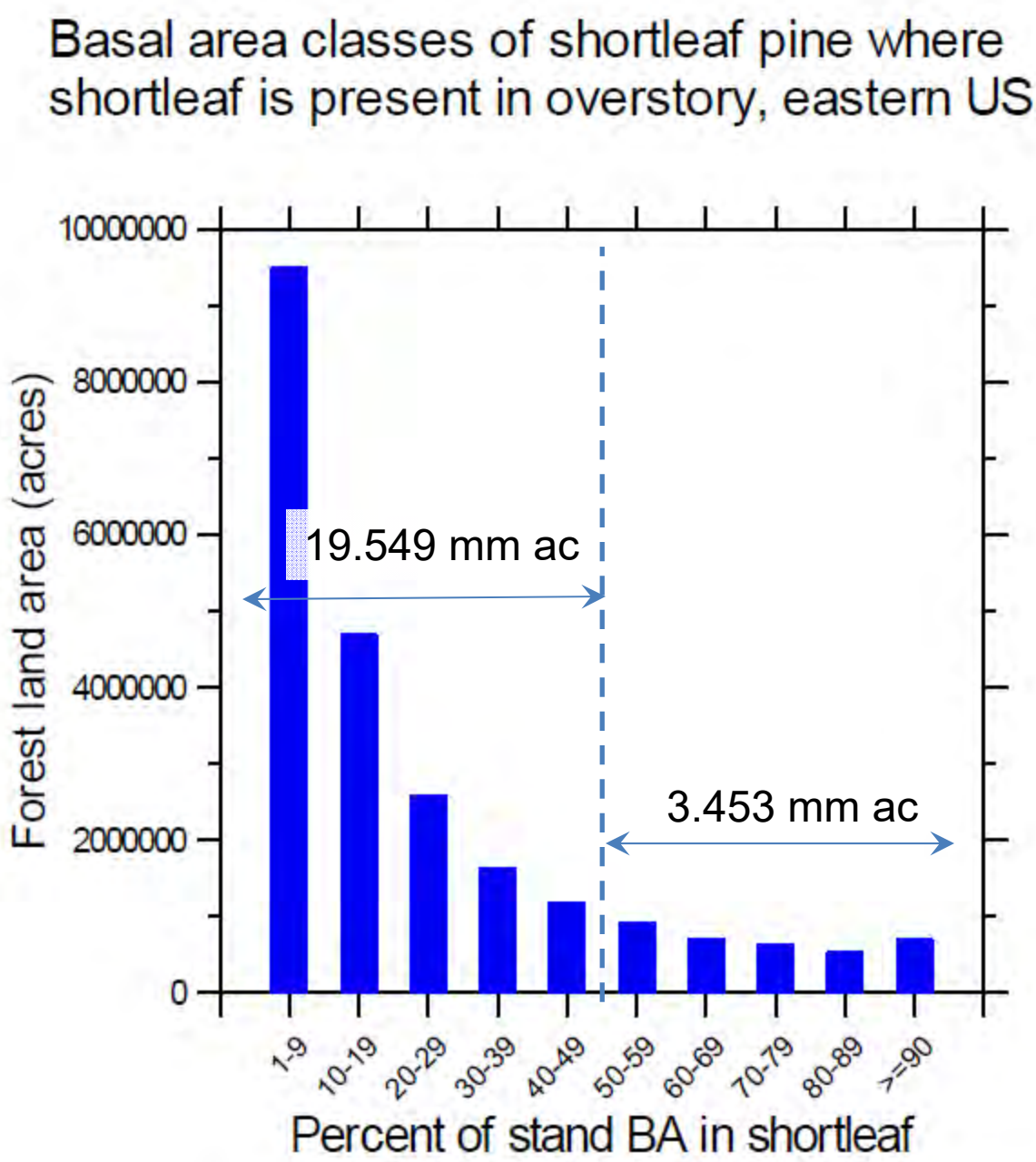
Basically, every county with shortleaf pine on an FIA plot

Shortleaf pine spatial distribution in eastern US

Each dot represents 10000 tons of shortleaf pine based on FIA plots, and includes
trees >1.0 in dbh



(map by JFRosson 0915)



Based on 23,002,115 ac of shortleaf pine "overstory" stands (≥ 5.0 in. dbh) in the eastern US.

(graph by JFRosson 0915)

A couple of numbers that are solid from the FIA database:

Total eastern acres with shortleaf pine, Dbh >1.0 inches	23,829,076 ac
Total forest land in these ten ecoregions	238,750,384 ac

We can’t make this stuff up:

1) Almost exactly 1 in 10 forested acres in the South (9.987%) has some shortleaf pine on it

2) On about 85 percent of those acres with shortleaf pine, it is less than 50% of stand BA

3) On more than 50 percent of those acres with shortleaf pine, it is less than 20% of stand BA

This speaks to the scale and scope of the challenge in shortleaf pine restoration.

Subjective approach:

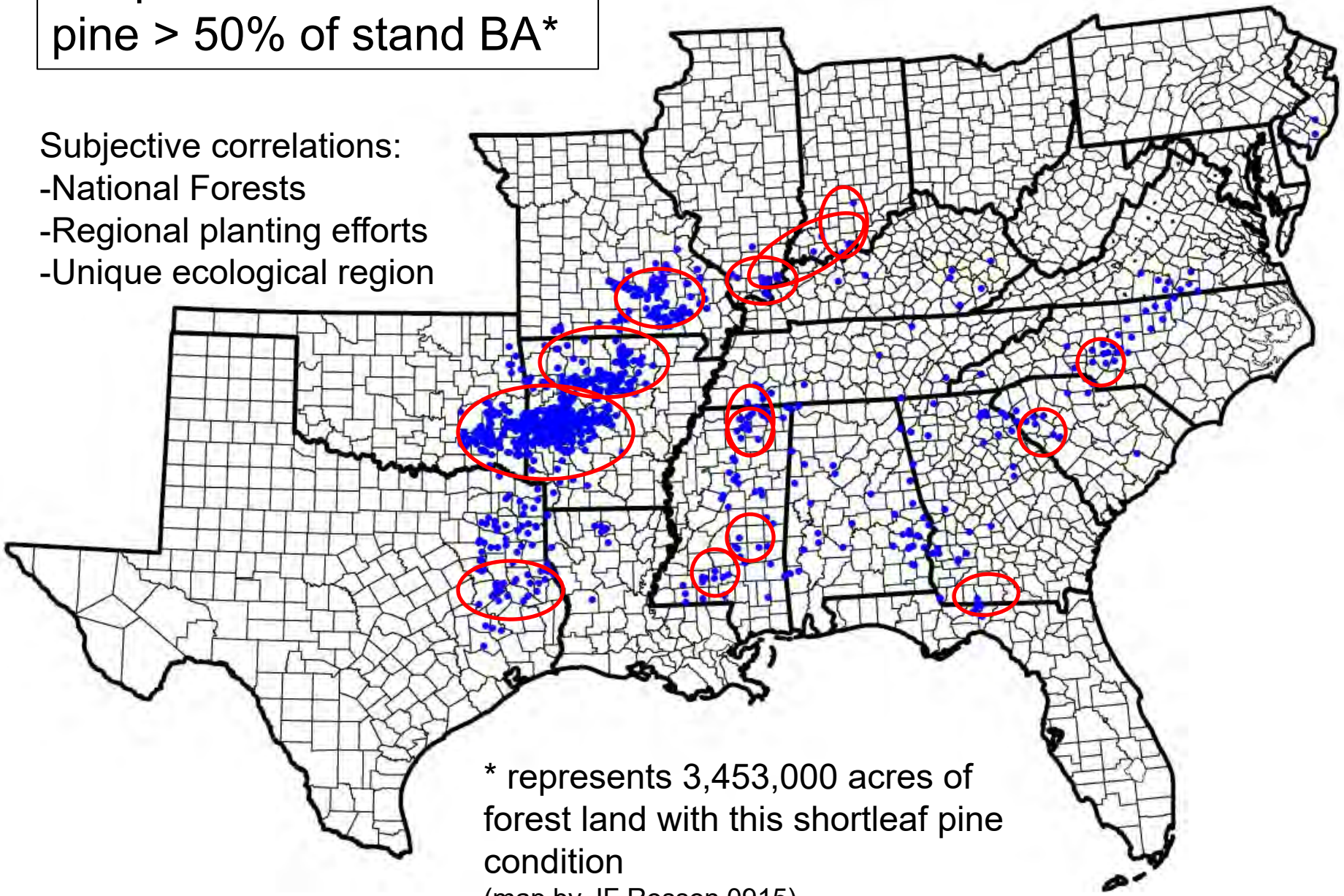
We stratified the natural range of shortleaf pine by Bailey's ecoregions

We pooled FIA plots within each ecoregion

We conducted simple analyses of shortleaf pine stocking by ecoregion

FIA plots where shortleaf pine > 50% of stand BA*

Subjective correlations:
-National Forests
-Regional planting efforts
-Unique ecological region

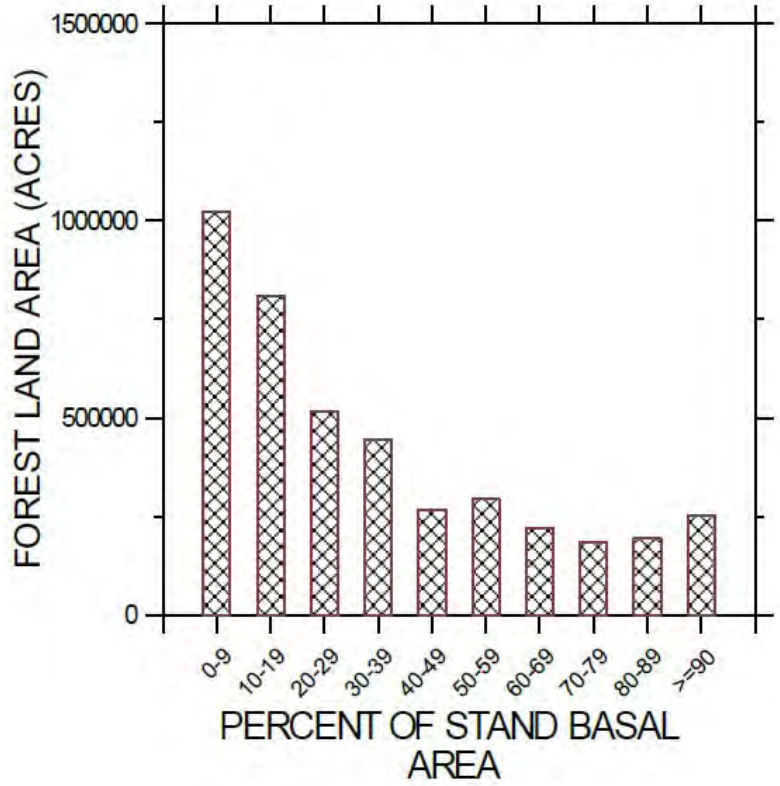


* represents 3,453,000 acres of forest land with this shortleaf pine condition

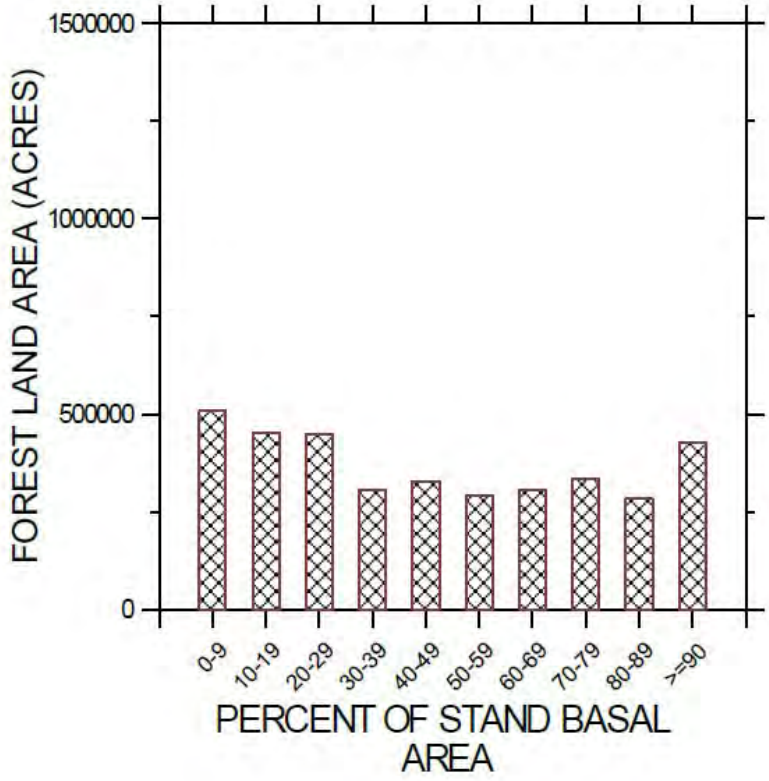
(map by JF Rosson 0915)

Percent basal area in shortleaf pine by ecoregion

Ozarks-Salem Plateau



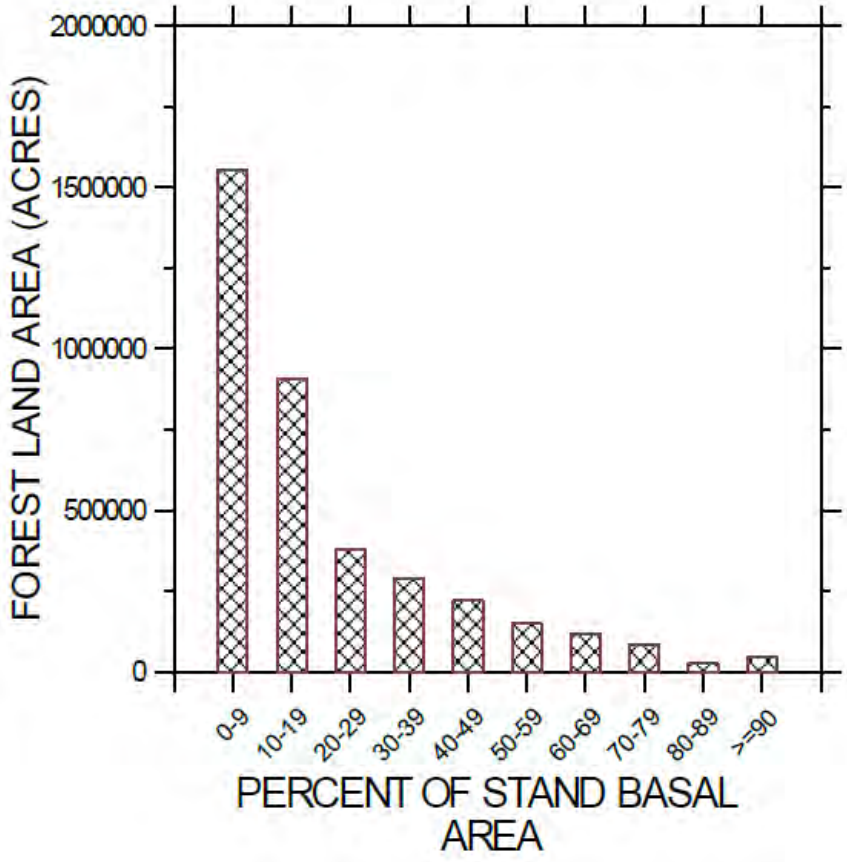
Ouachita Mts



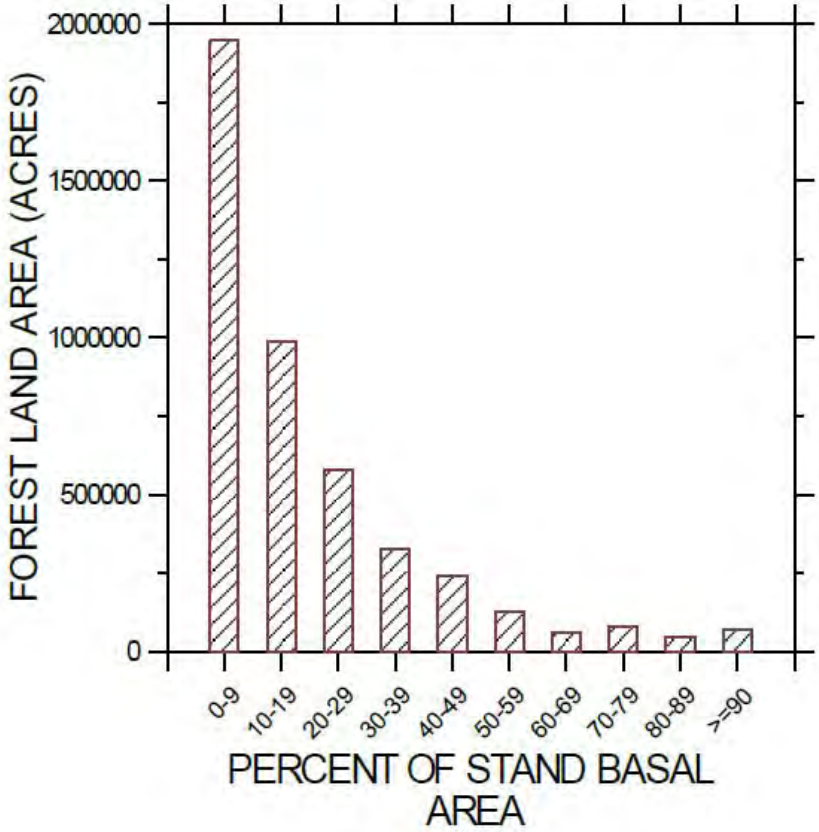
(graphs by JF Rosson 0915)

Percent basal area in shortleaf pine by ecoregion

West Gulf Coastal Plain



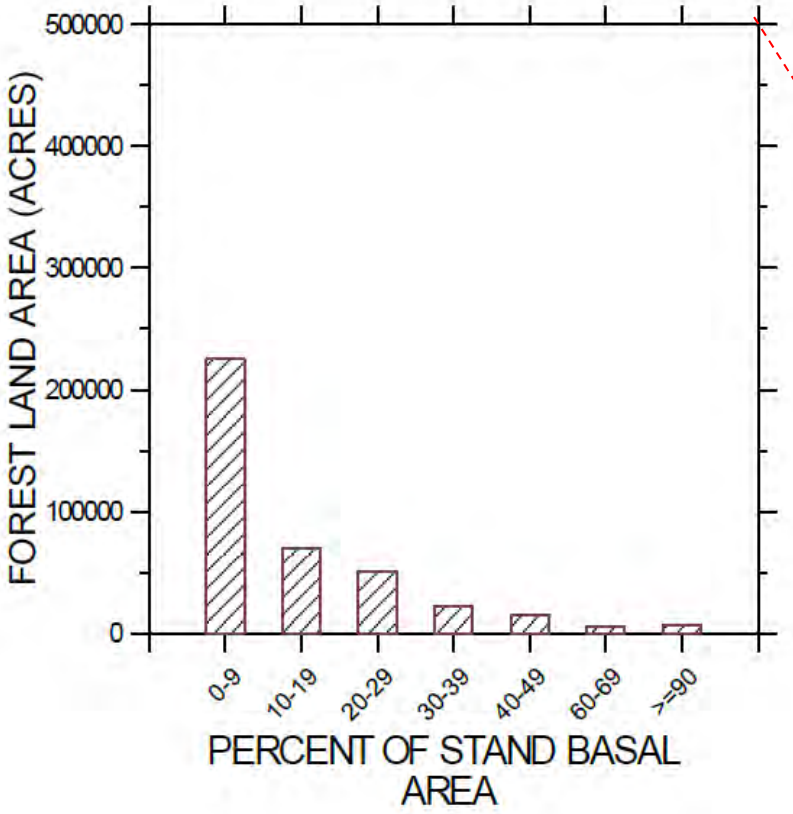
East Gulf Coastal Plain



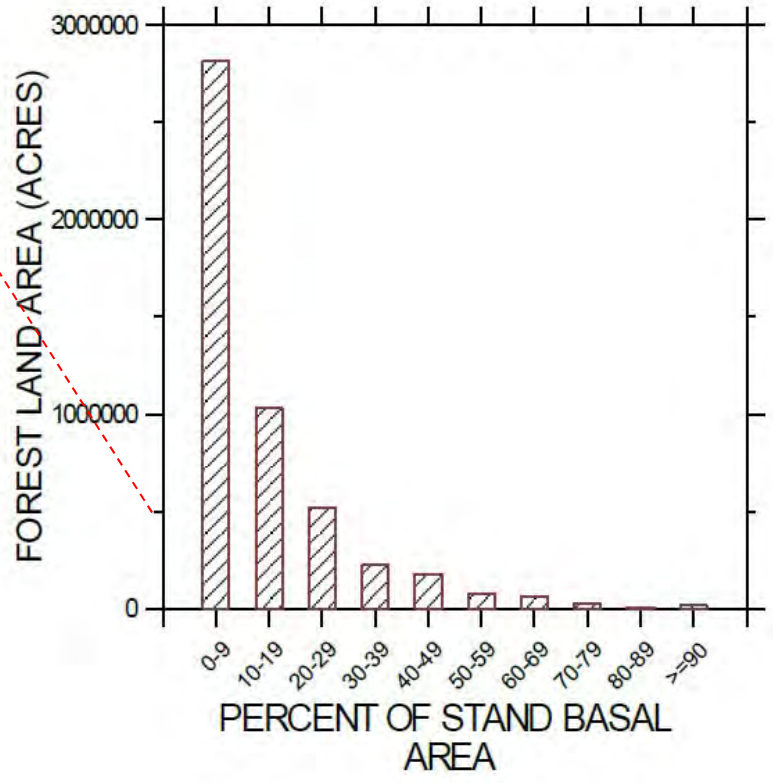
(graphs by JF Rosson 0915)

Percent basal area in shortleaf pine by ecoregion

Atlantic Coastal Plain



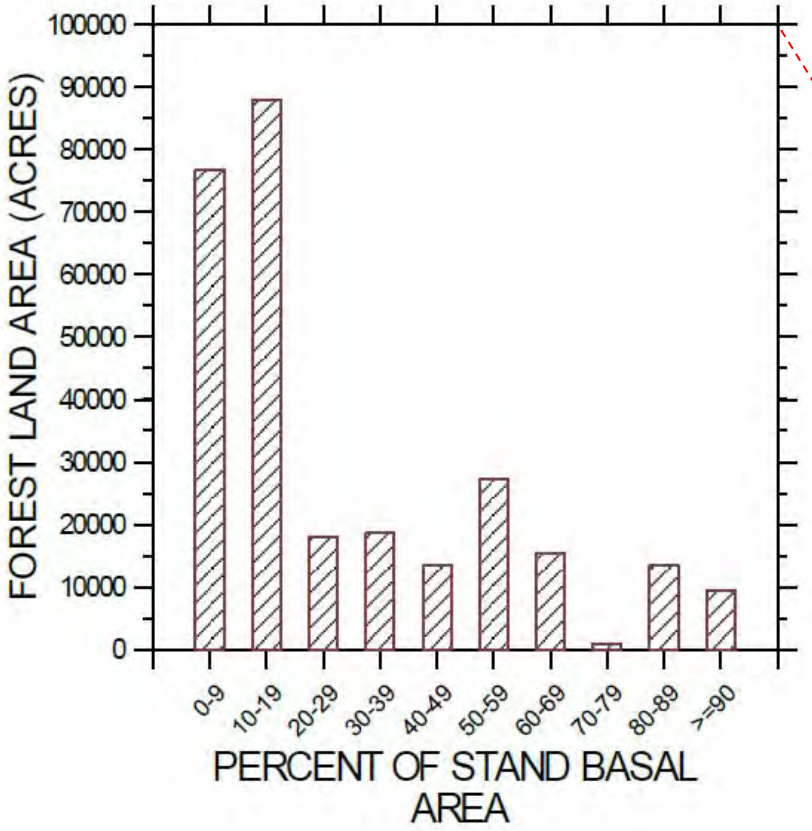
Piedmont



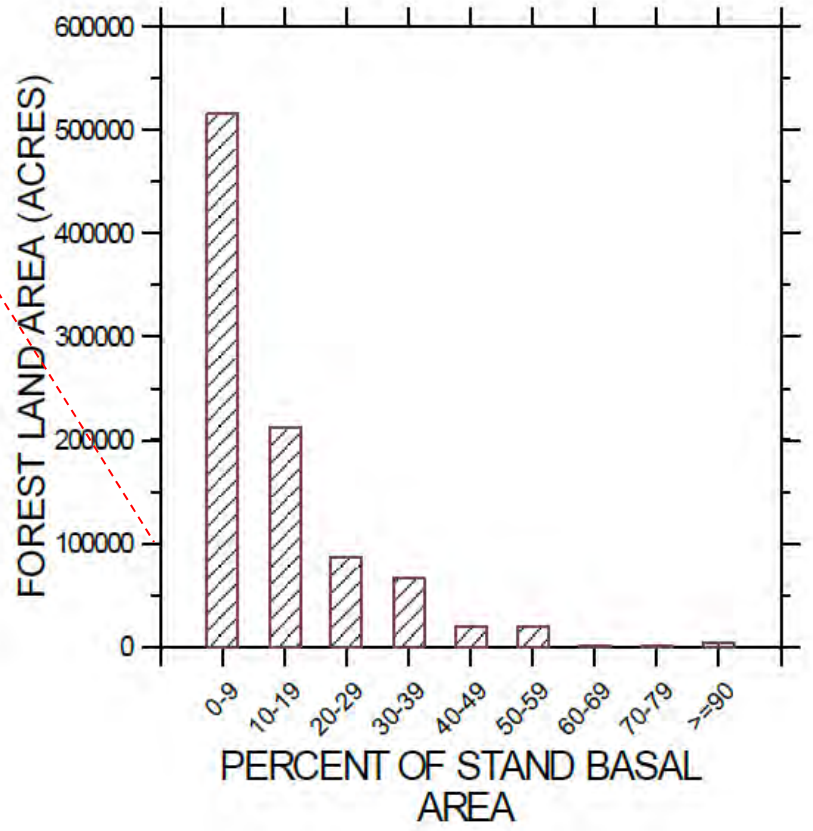
(graphs by JF Rosson 0915)

Percent basal area in shortleaf pine by ecoregion

Interior Low Plateau



Cumberland



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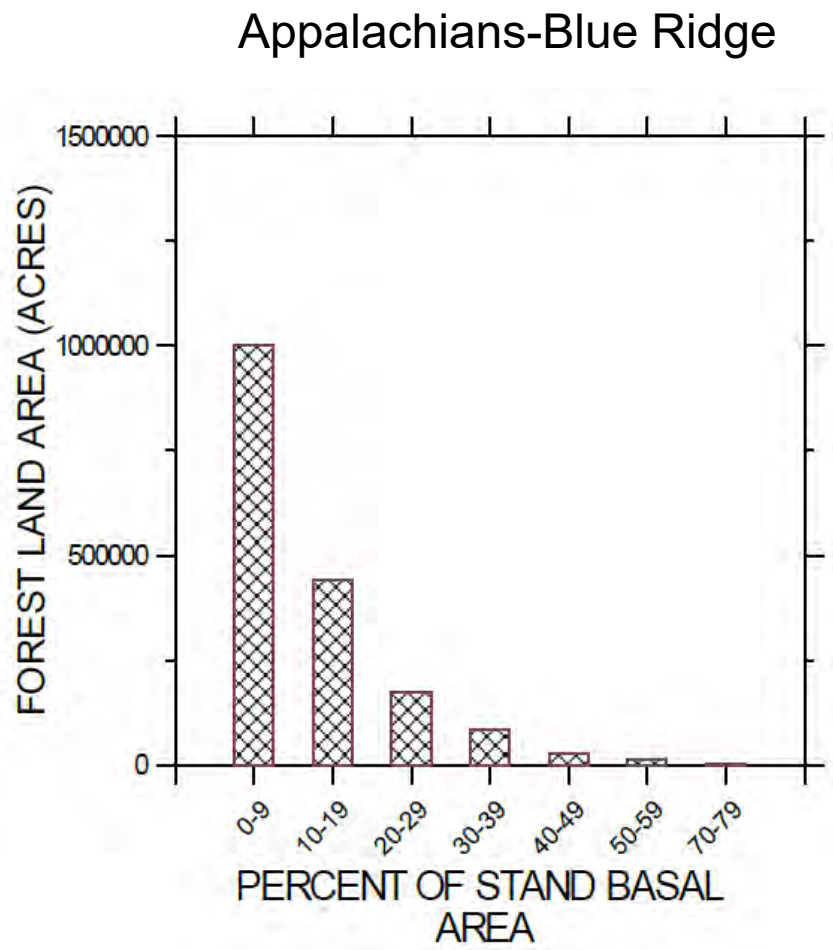
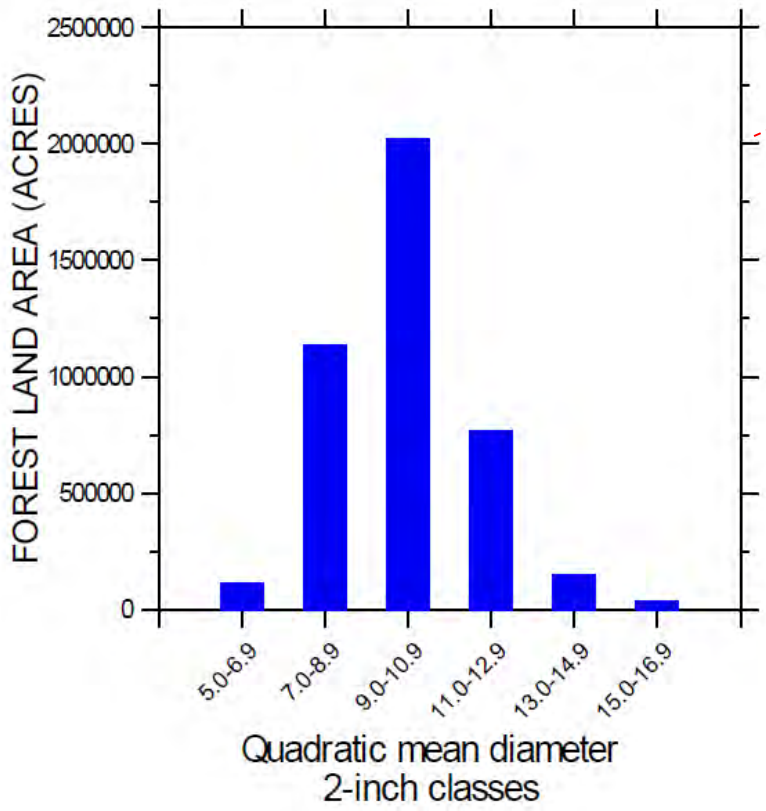
Percent basal area in shortleaf pine by ecoregion



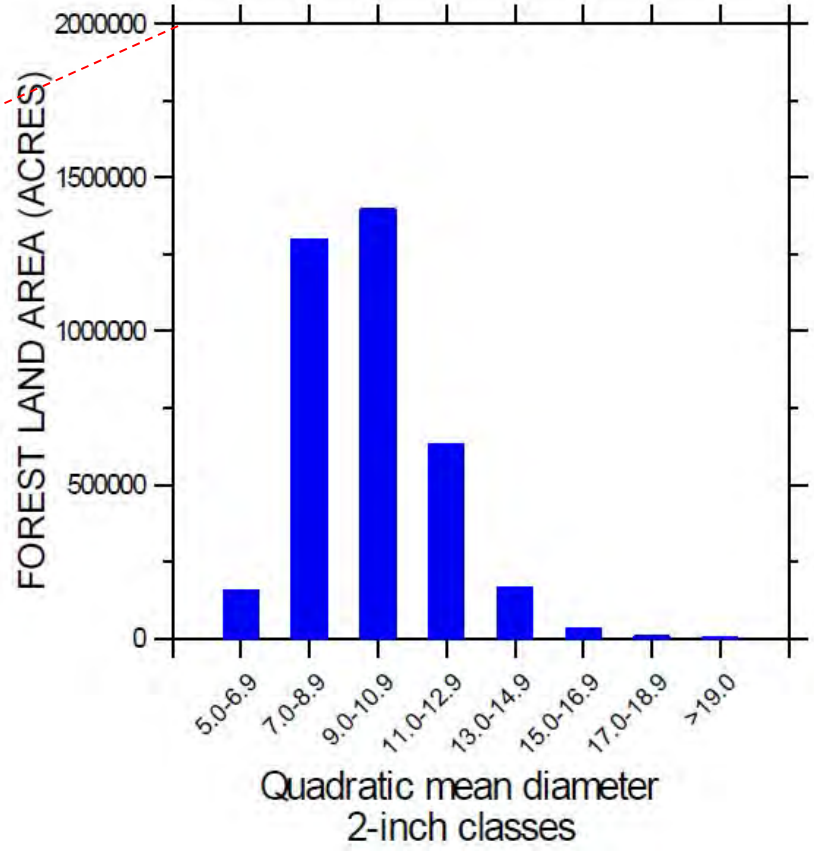
(graphs by JF Rosson 0915)

Area occupied by shortleaf pine by size class (based on quadratic mean dbh) by ecoregion

Ozarks-Salem Plateau



Ouachita Mts



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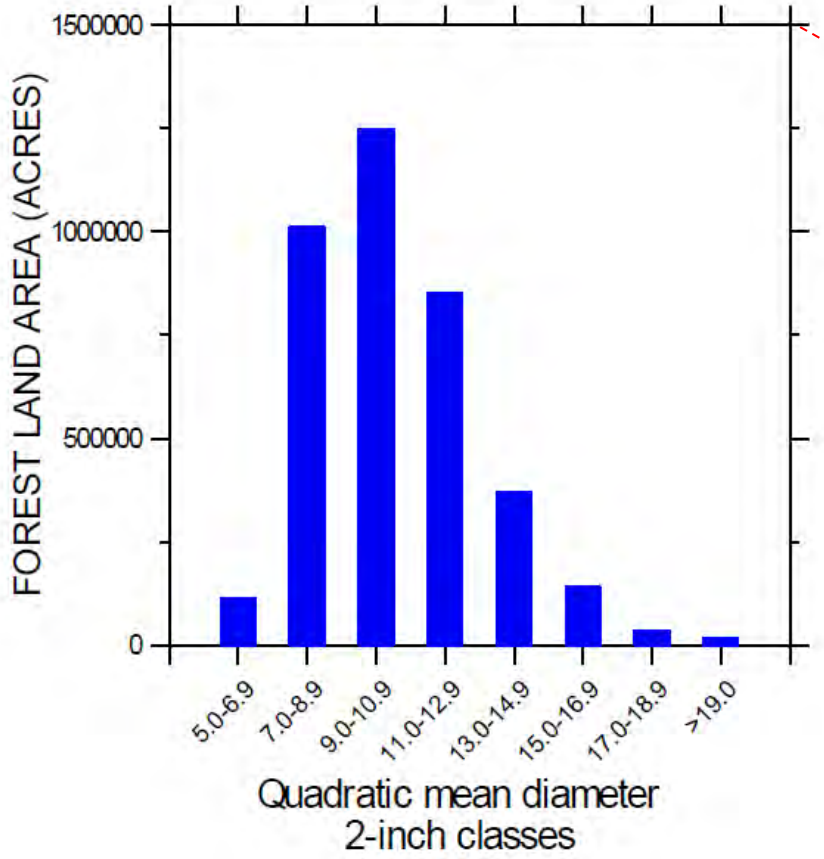
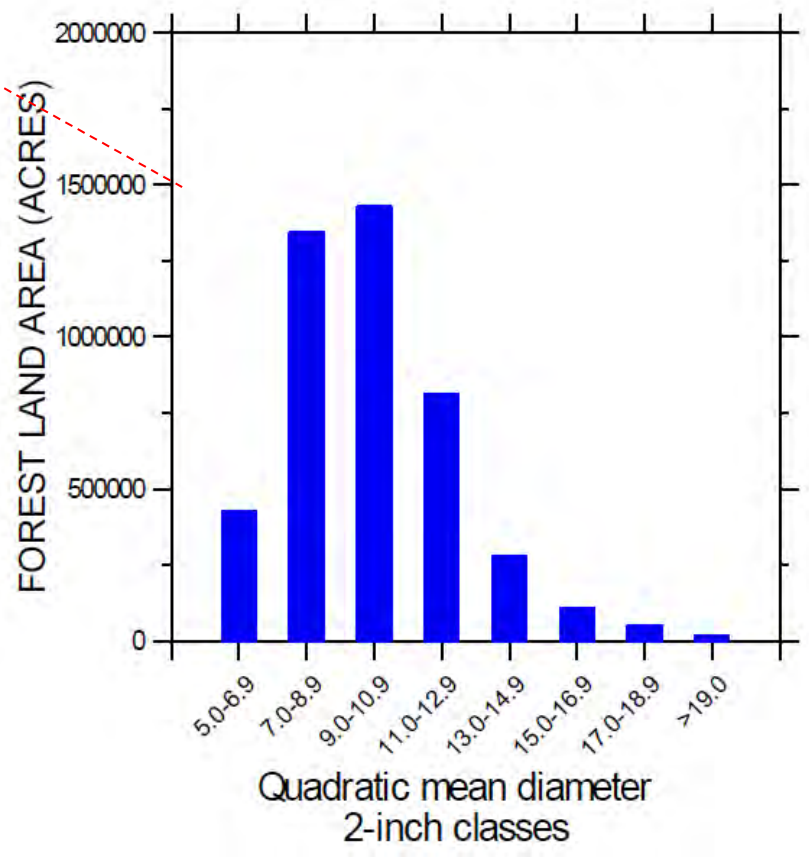
West Gulf Coastal Plain



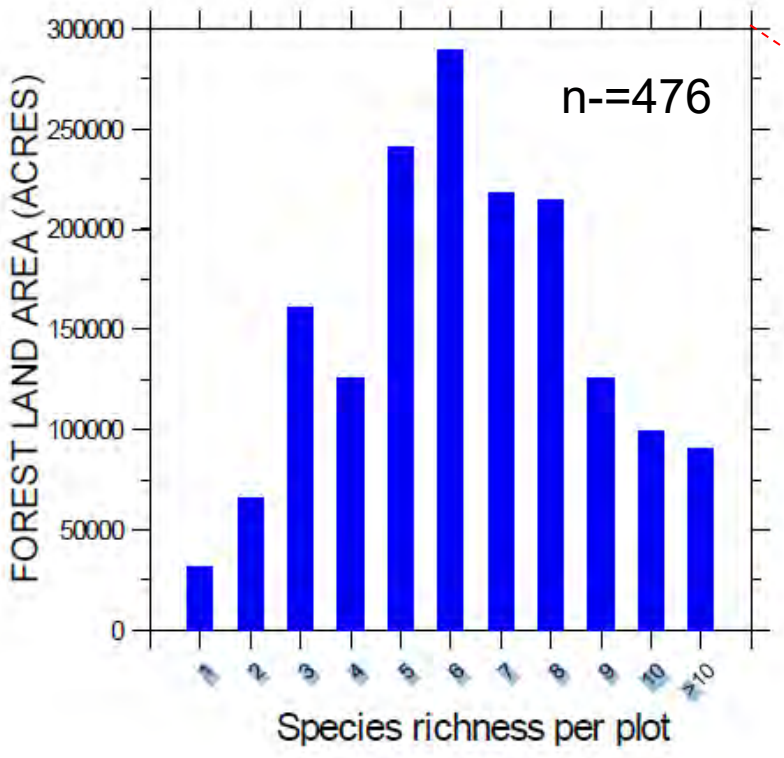
East Gulf Coastal Plain



(graphs by JF Rosson 0915)

Tree species richness where shortleaf pine is the number 1 dominant in the overstory

Ozarks-Salem Plateau



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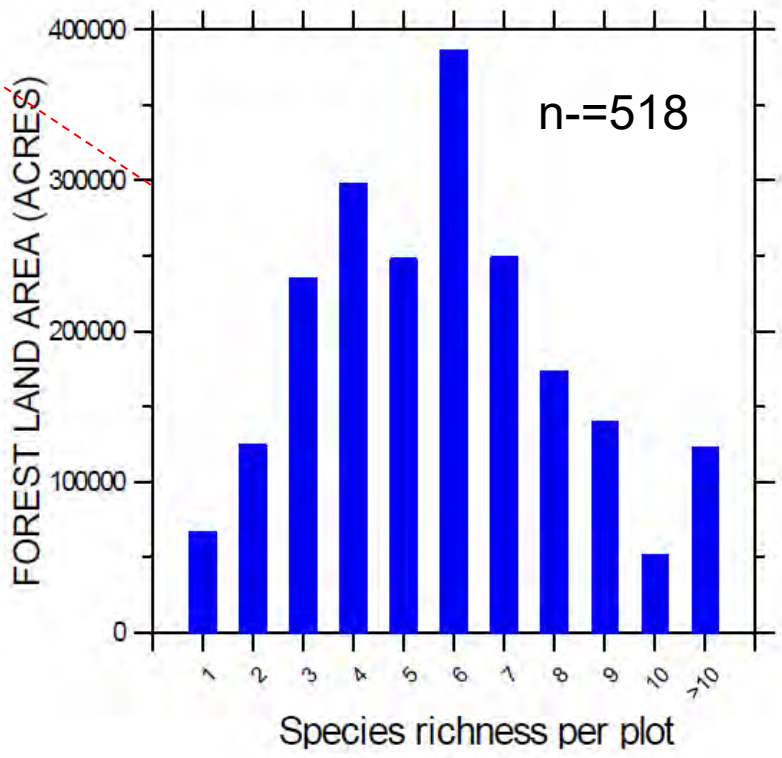
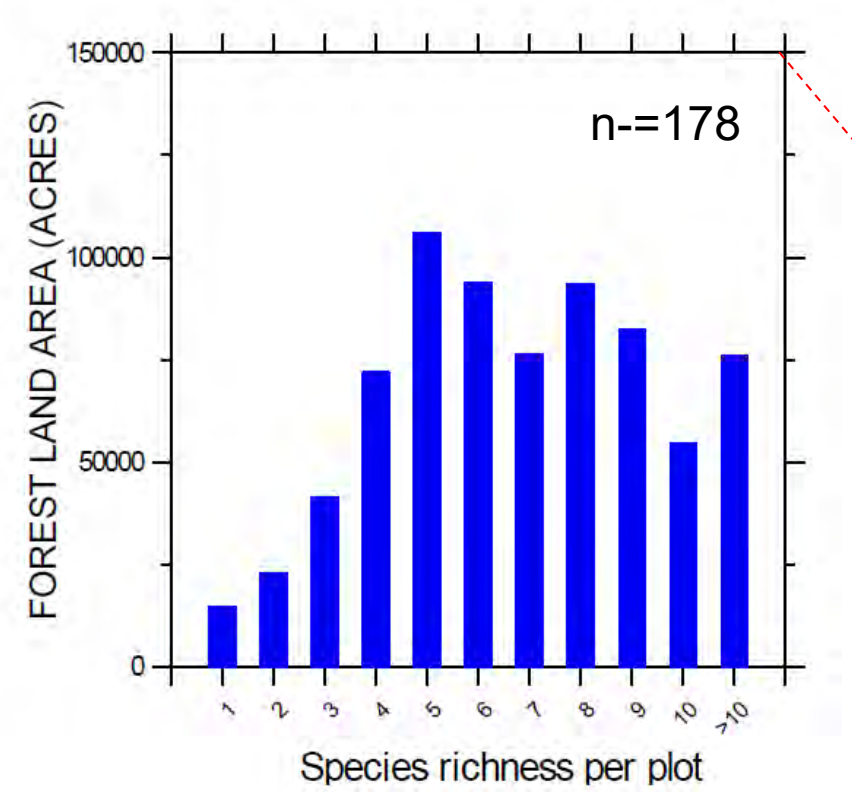


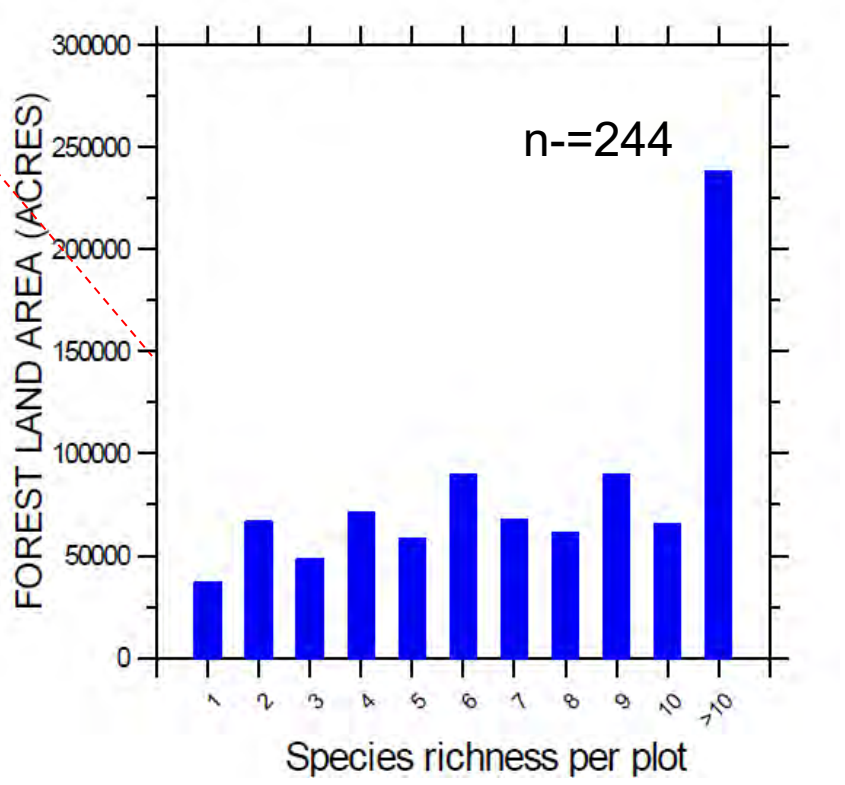
(graphs by JF Rosson 0915)

Tree species richness where shortleaf pine is the number 1 dominant in the overstory

West Gulf Coastal Plain

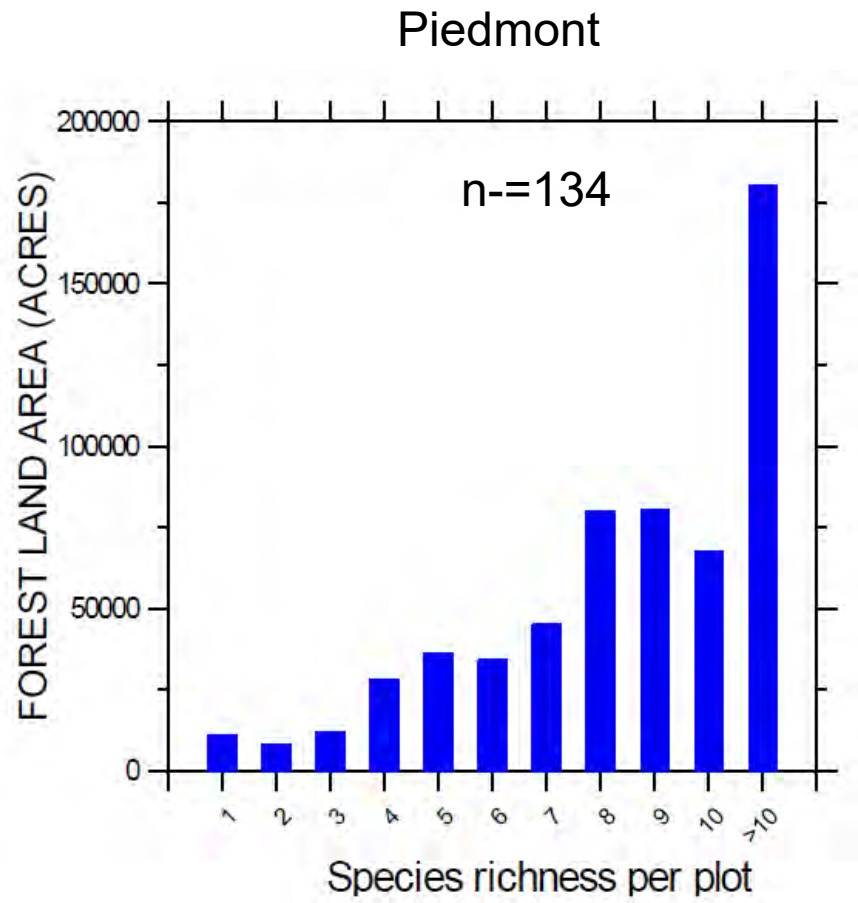


East Gulf Coastal Plain



(graphs by JF Rosson 0915)

Tree species richness where shortleaf pine is the number 1 dominant in the overstory



(graphs by JF Rosson 0915)

Restoration of shortleaf pine will be more easily accomplished in some locations rather than others

Rugged terrain of the Central Ouachita Mts, (M231Ac)
Caddo RD
Ouachita NF
Montgomery Co, AR

Photo by JM Guldin, June 2015

And, can we assume the goal of restoration is shortleaf pine-grassland habitat, which is underrepresented on the landscape?

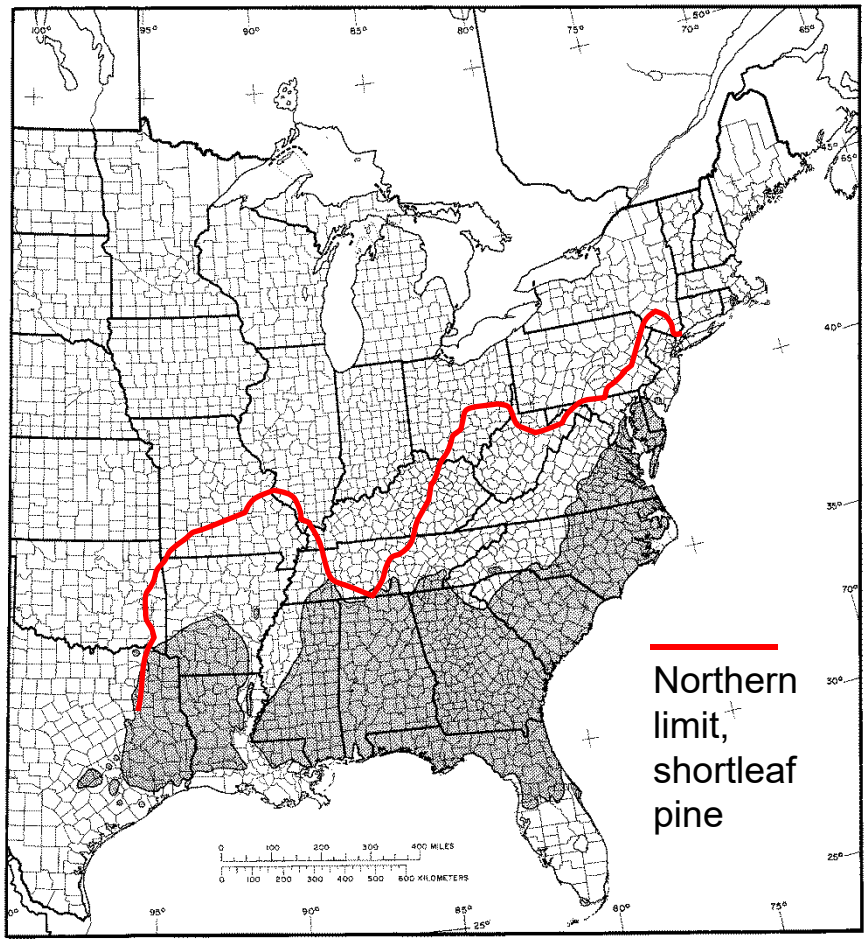
Excellent example of restored shortleaf pine-bluestem woodland
North of Black Fork Mt
Mena RD
Ouachita NF
Polk Co, AR

Photo by JM Guldin, Jan 2010

Factors to consider in restoration of shortleaf pine

1. Is the site north of the natural range of loblolly pine?

IMO, it will be hard to convince landowners to shortleaf pine if the site is within the natural range of loblolly pine, especially for Gulf Coastal Plain sites
-growth rates
-genetics



Natural range, loblolly pine (Little 1971)

If not, among the challenges is actually proper identification of shortleaf pine
-wide variation in morphology

3Photo by JM Guldin, Dec 2013

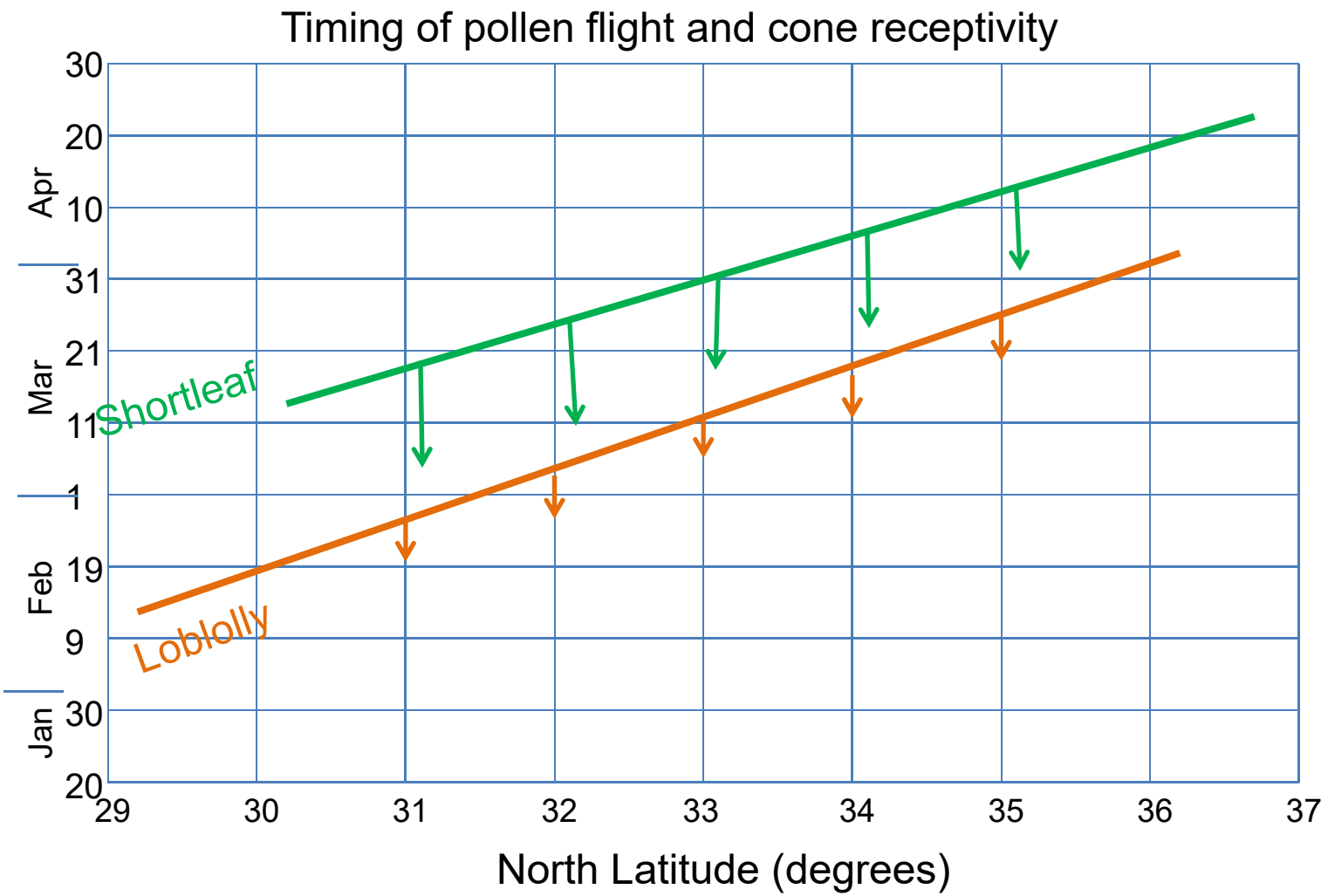
Variation in cone size, all apparently from shortleaf pine
Saline Co, AR

There is good scientific evidence suggesting the common occurrence of hybrids between shortleaf and loblolly pines

Loblolly is the paternal pollen source, shortleaf the maternal fertilized cones—gene flow from loblolly into shortleaf

Photo by JM Guldin, Aug 2013

…which could be exacerbated by changing climatic conditions (warmer in springtime)…



(Source: Dorman and Barber 1956)

…or by by planting loblolly pine north of its natural range.

Loblolly plantation in the upper Lake Winona Basin, JWF RD, Ouachita NF, Perry County AR

Photo by JM Guldin, Mar 2013

2. Is the landowner seeking a pure shortleaf stand or a mixed pine or pine-hardwood stand?

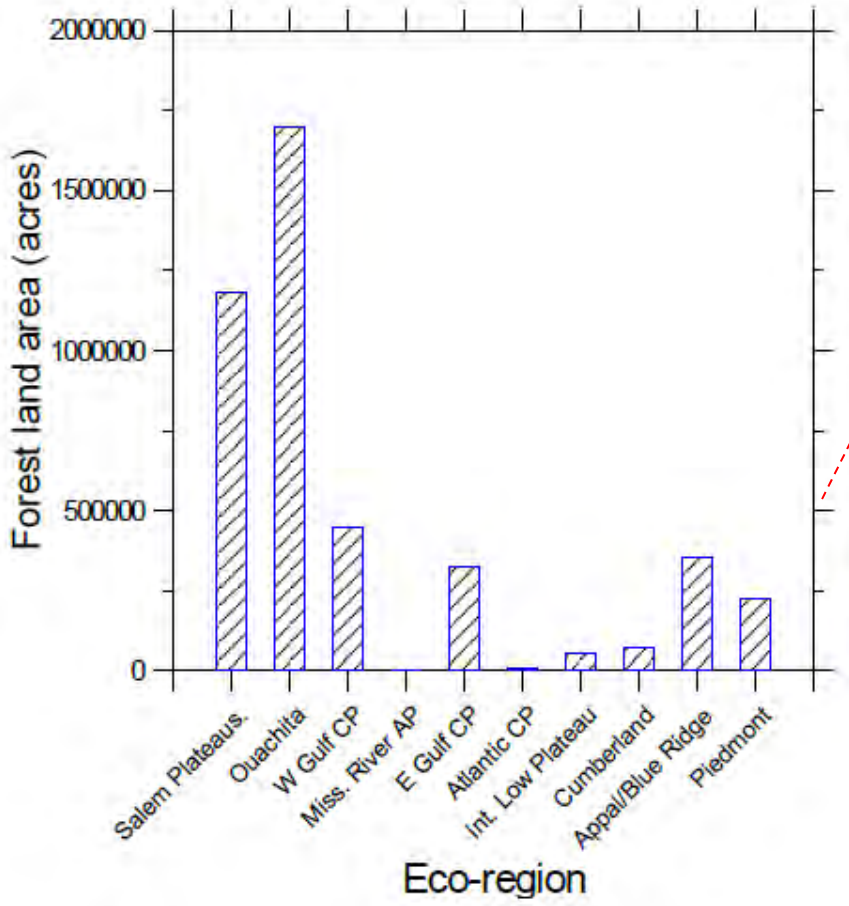
IMO, pure stands are less complicated silviculturally, both during stand establishment and subsequent development

Photo by JM Guldin, Jan 2014

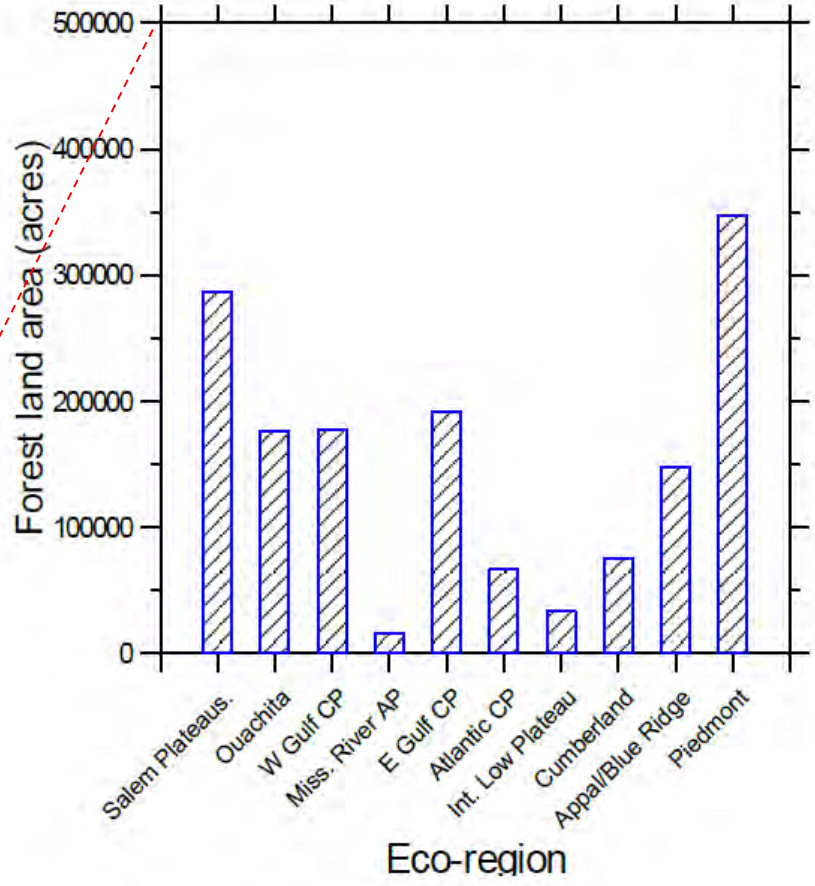
Photo by John Blanton May 2005

3. Is the site on public or private lands?

National Forests



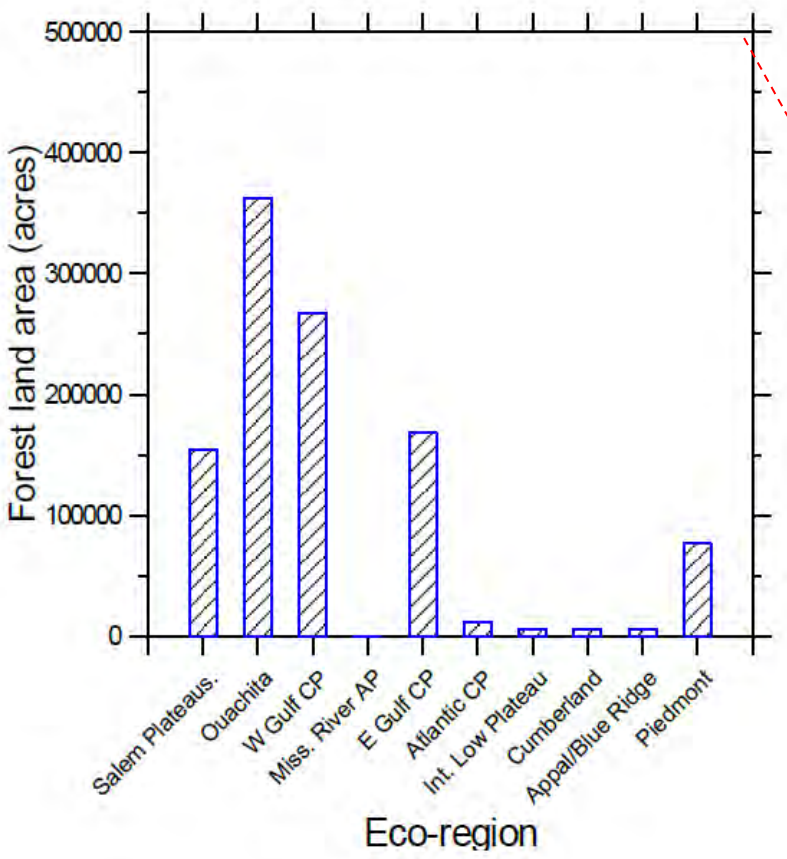
Other Public



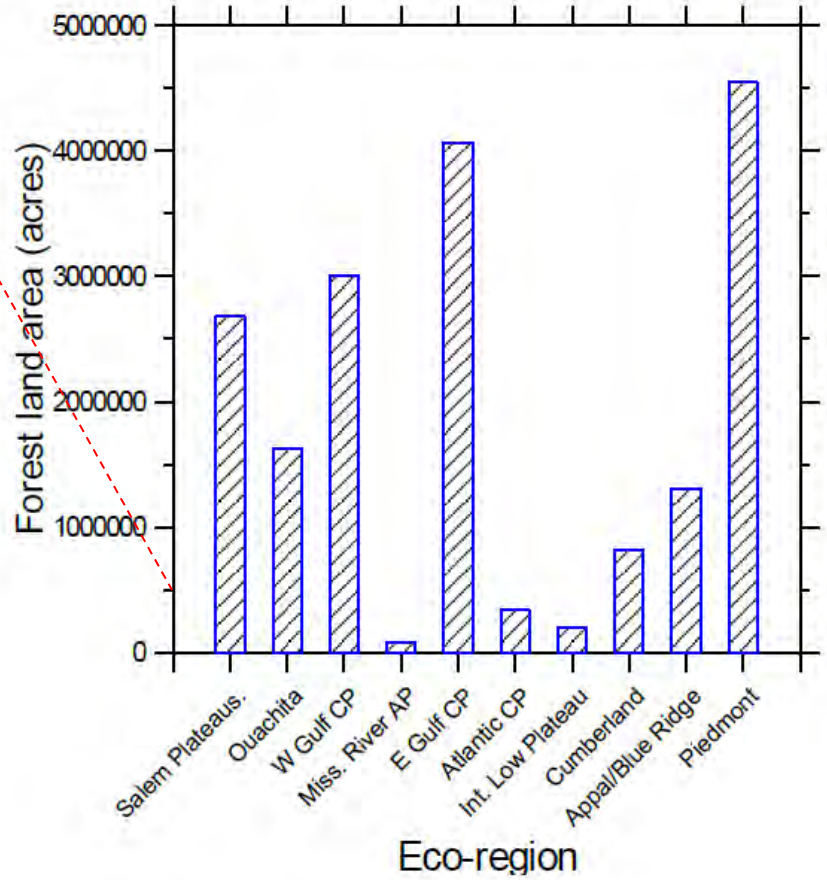
(graphs by JF Rosson 0915)

3. Is the site on public or private lands?

Forest Industry



NIPF



(graphs by JF Rosson 0915)

3. Is the site on public or private lands?

Public lands-great opportunity on a small land base

Forest Industry lands-not likely in Piedmont, Atlantic or Gulf Coastal Plain, or in the Ouachitas—loblolly pine is KING

Challenges on NIPF lands have ecoregional considerations

3. Is the site on public or private lands?

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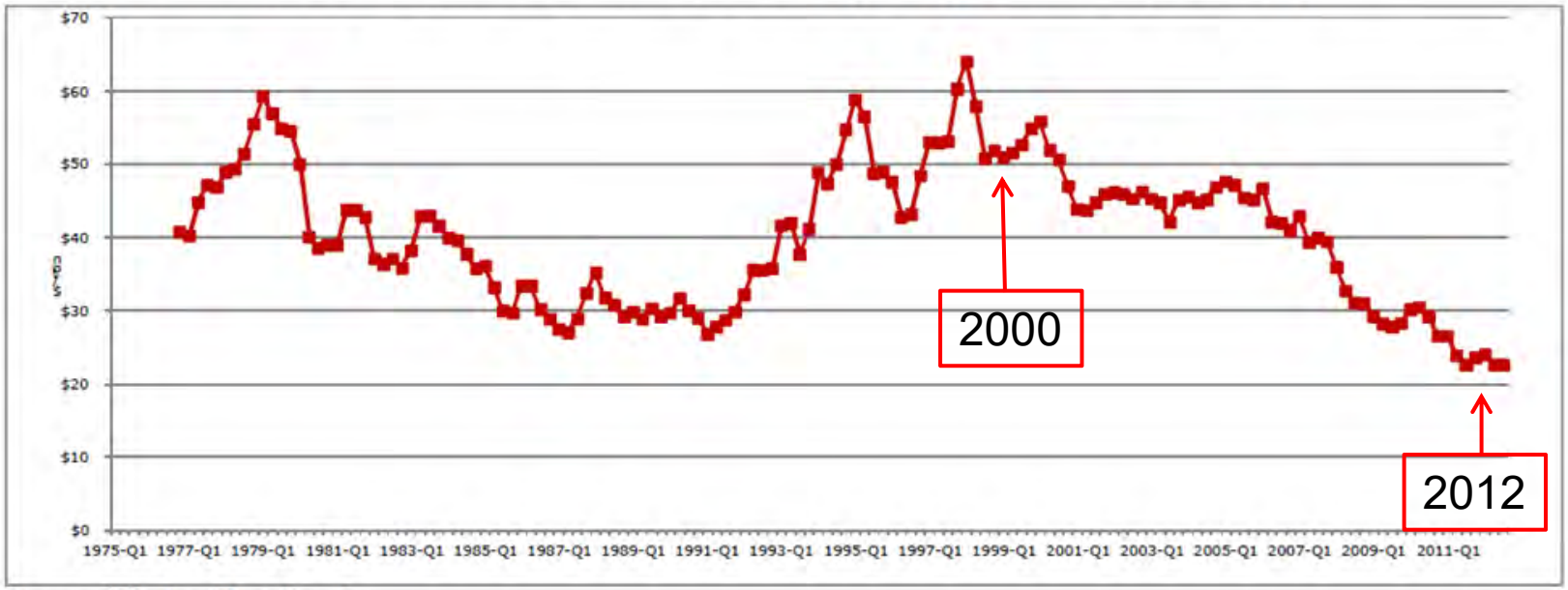
Challenges on NIPF lands have ecoregional considerations

For example, in the Coastal Plain; NIPF landowners face declining stumpage prices

Forest Research Notes **Vol 9 No 3**
3rd Qtr 2012

Figure 2. Southwide Sawtimber Stumpage Prices (real (inflation-adjusted) $)



Source: Timber Mart-South

From
http://www.forestresearchgroup.com/Newsletters/V9No3.pdf

And, prices relate to the glut of timber in Coastal Plain pine forests over the past decade

Timber glut worries state loggers

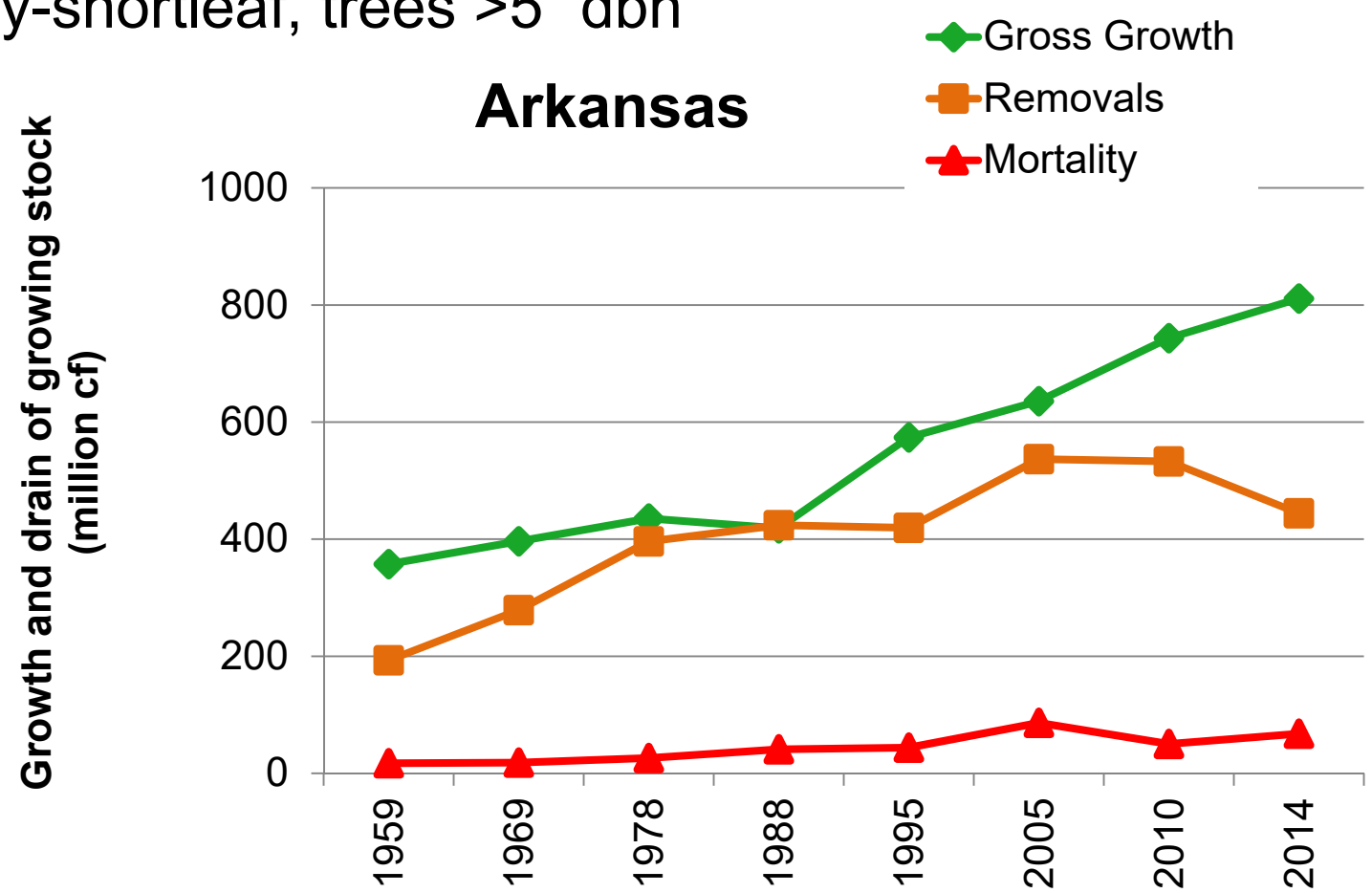
Ripples from housing bust still keeping trees standing

By Scott Morris
This article was published September 20, 2015 at 3:28 a.m.

PHOTO BY BENJAMIN KRAIN
A feller buncher operated by logging company LD Long Inc. cuts pines in a forest near Monticello last week. Economists say trees in Arkansas have been growing faster than they can be harvested.

And, prices relate to the glut of timber in Coastal Plain pine forests over the past decade

Growth and drain of growing stock, loblolly-shortleaf, trees >5” dbh




► Need to be honest with landowners about the costs and returns of the restoration prescription
Ernest Lovett and the late Dr. John Gray inspect the 2004 harvest at Crossett EF

And remember—on private industry lands, loblolly pine is KING

From, this----

Management of Second-Growth Shortleaf-Loblolly Pine-Hardwood Stands

R. R. Reynolds[1]

This article was prepared as a basis for a discussion of forest management practices by several groups of foresters who met recently at the Crossett, Arkansas, Branch of the Southern Forest Experiment Station. It discusses considerations and procedures which may be involved in placing a tract of timberland under management. Because of its real practical value and widespread interest to foresters, it is presented here essentially as it was at the original meetings.

THE objective of timber management is to grow the maximum amount of high-quality timber per acre per year. At the present me we are a long way from these objectives on ost of our public and private forest lands. We re growing 50 to 200 board feet of relatively w-grade sawlogs per acre on land fully capable f growing 500 to 700 board feet. We are grow- ig grass where we should be growing trees. We re growing low-grade hardwoods on much of ur high-quality pine land. And, to date, we idea as to how fast our timber is growing. A survey or cruise, therefore, is our first consideration. This cruise need not be an intensive one, and the larger the property the smaller percent that is needed. In our case we will make a 5 percent line-plot cruise in order to get a good idea as to where our timber is located as well as obtain information on growth and volume. If we have access to aerial photographs of the area we will, of course, use these to make our base map and possibly our type map. If we cannot get

Journal of Forestry 1947

----to this

Planted loblolly pine stand, April 2010
Private industry land,
Bradley Co, AR

Photo by JM Guldin April 2010


Now, these upper Coastal Plain and Athens Piedmont sites are almost exclusively in loblolly pine plantations on inddustrial forestlands
Photo by JM Guldin June 2015

IMO, the biggest single reason for the decline in shortleaf pine area across the South over the past century has been the emphasis on industrial wood production using loblolly pine

4. To restore shortleaf pine-can prescribed fire be easily and frequently applied?

April Rx fire
Poteau RD,
Ouachita NF
Scott Co, AR

Photo by JM Guldin, April 2012

Periodic fire in advance of reproduction cutting is a big help in hardwood control

Photo by JM Guldin, Jan 2014

Repeated prescribed fire is a key

One GS after Rx fire

Two GS after Rx fire

Photos by JM Guldin June 2015

Three GS after Rx fire

Photo by JM Guldin Dec 2006

5. Are soils and site suited to shortleaf?? The species occurs most commonly on soils with prominent clay textures in surface and especially subsurface horizons

- **Piedmont**-commonly found on Hapludults:
  - thin subsurface clay horizons
- **Appalachian Highlands:** commonly found on Dystrochrepts
  - Moist, low base exchange, low carbonates
- **Coastal Plain:** found on deep well-drained sandy loam soils

Topographic position also ecoregionally important

Looking west over the Flatside Wilderness Area, JWF RD, Ouachita NF, Perry Co., AR

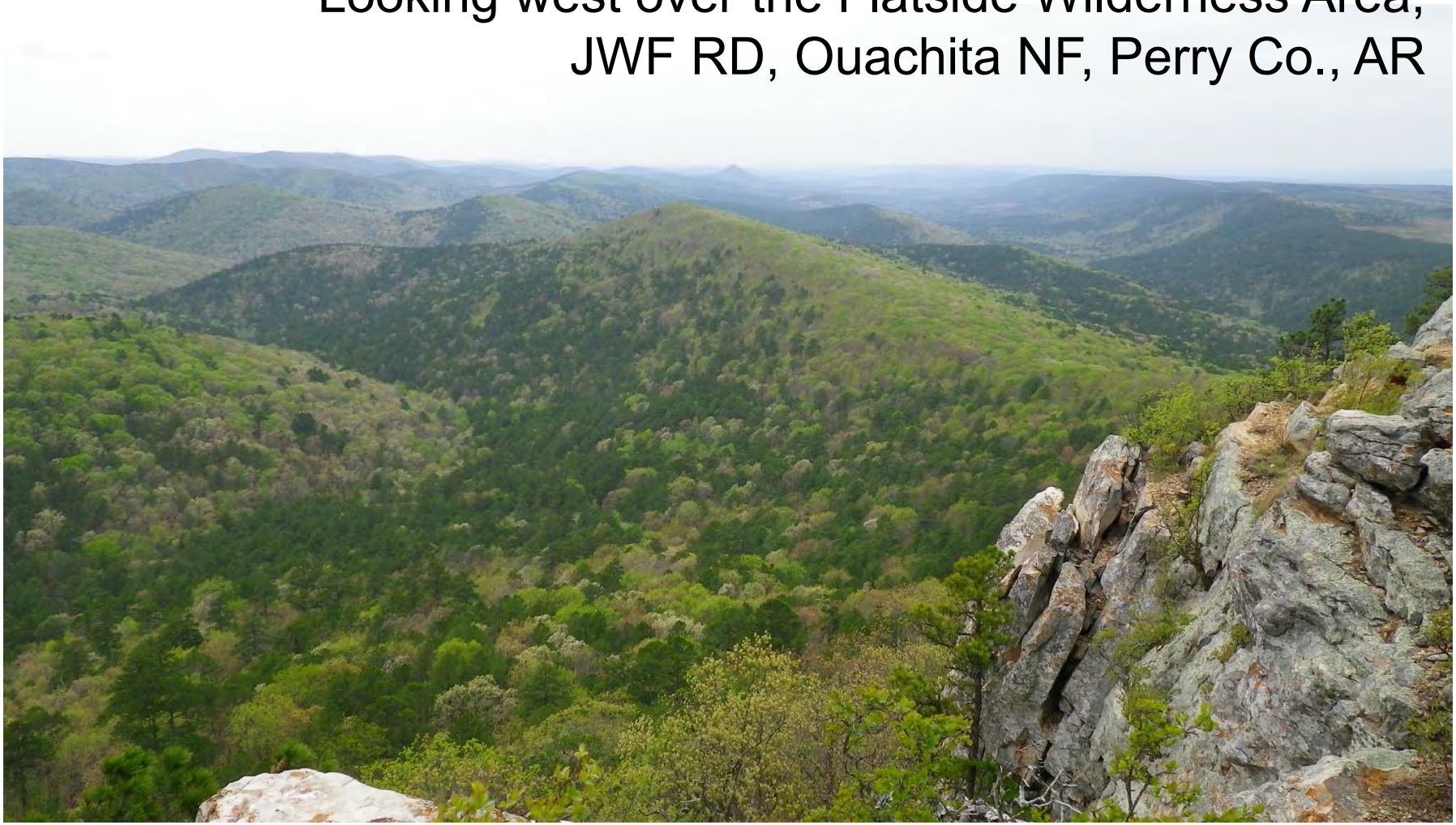


Photo by JM Guldin, April 2011

6. Are problems with competing vegetation likely?

Problems during planting
-herbaceous and woody component

Problems with natural regeneration:
-seed origin pines vs sprout origin hardwoods

Problems during stand development:
-recovery of understory herbaceous community

A program of repeated prescribed burning prior to natural regeneration is an excellent tool to reduce unwanted competition after harvest

Photo by JM Guldin, Jan 2015

And young shortleaf stands can be burned fairly early in their lives

Photo by JM Guldin, March 2013

Shelterwood regeneration, MA 22
Poteau RD, Ouachita NF

And, herbicides need to remain in the toolbox

Treated with imazapyr Not treated

Crossett EF, Ashley Co. AR

Photo by JM Guldin, Jan 2005

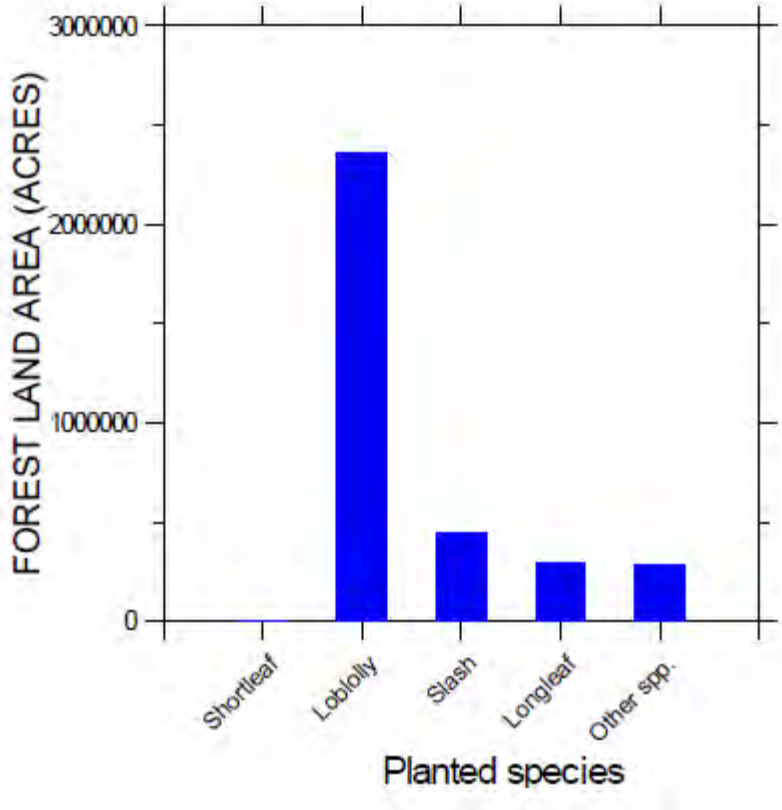
7. Are improved local seed sources available, and is seed production and nursery capacity sufficient?

1st gen Mo Ozarks shortleaf pine seed orchard
US Forest Service
Mt. Ida AR

Photo by JM Guldin, June 2015

But how much shortleaf pine is actually planted?

FIA data on seedling-sized planted stands:
Area of new planted stands
(no trees > 1.0 inches dbh in the stand)

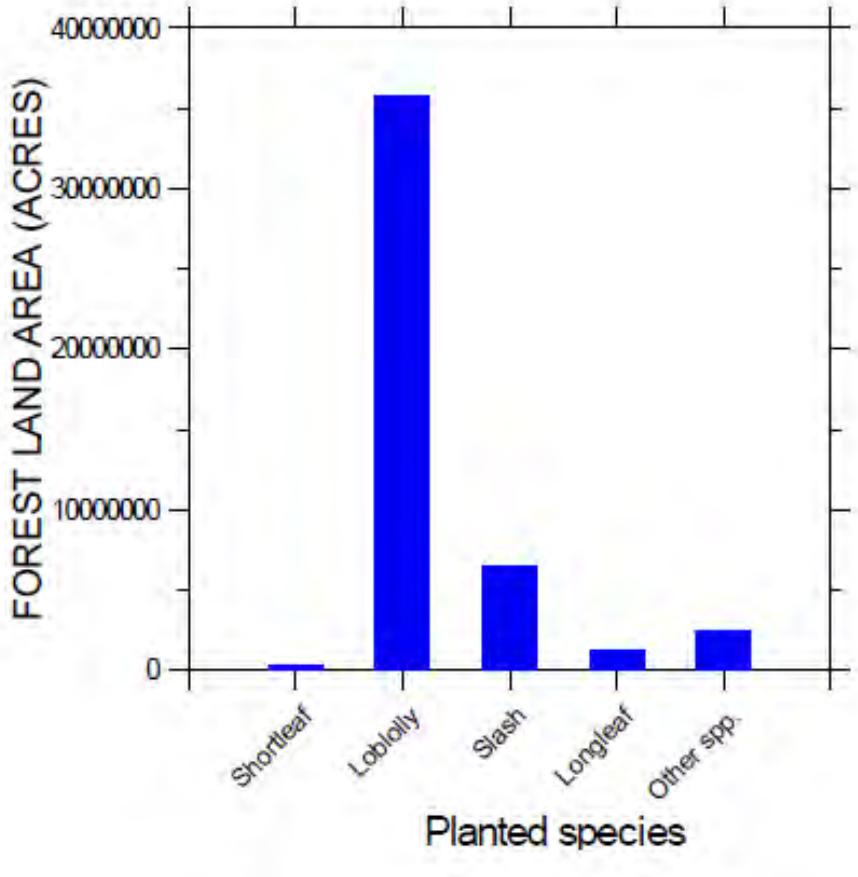


Total planted seedling area: 3,395,250 ac

Total planted shortleaf seedling area: 2,090 ac (at two FIA locations) (<0.06 percent of all planted)

(graphs by JF Rosson 0915)

But how much shortleaf pine is actually planted?
FIA data on tree-sized planted stands:
(trees > 1.0 inches dbh in the stand)



Total planted tree-sized area:
46,172,109 ac

Total planted tree-sized shortleaf area:
287,184 ac
(0.6 percent of total)

80% of these in the Ouachitas and Ozarks

(graphs by JF Rosson 0915)

Do we have seed supply and nursery capacity to dramatically increase shortleaf pine planting?

2nd^{t} gen Ouachita shortleaf pine seed orchard tree
Current year cone crop is visible in June
US Forest Service
Mt. Ida AR

Photo by JM Guldin, June 2015

8. Are local mills and markets available for shortleaf pine forest products?

Markets are critical for successful management and restoration.

Photos by JM Guldin Oct 2011

Among the reasons--loss of mill infrastructure!

Weyerhaeuser sawmill, Mountain Pine AR, 2003

Is there thought being given to a subjective decision model that suggests the ease with which restoration of shortleaf pine might be practically feasible? A draft might look like this:

W.A.G. Table of Subjective Rankings	Restore pure stands	Restore mixed stands	Restore private lands	Ability to burn at large scale	Suitable soil types	Competing vegetation	Seed sources and nursery stock	Mills and markets for pine
Ouachitas	High	Low	High	High	High	Low	High	High
Ozarks	High	High	High	High	High	Mod	High	Mod
West Gulf CP	Low	High	Low	High	Mod	High	Mod	High
East Gulf CP	*Low*	*High*	*Low*	*High*	*Mod*	*High*	*Mod*	*High*
Altantic CP	*Low*	*Mod*	*Low*	*High*	*Low*	*High*	*?*	*Mod*
Atlantic Piedmont	*Mod*	*Low*	*Mod*	*Mod*	*High*	*Mod*	*?*	*High*
Interior Lowland Plateau	*Low*	*Low*	*Low*	*Mod*	*Low*	*Mod*	*?*	*Low*
Cumberland Plateau	*Mod*	*Mod*	*Mod*	*Low*	*Mod*	*High*	*?*	*Low*
Appalachians-Blue Ridge	*Low*	*Mod*	*Mod*	*Low*	*Mod*	*High*	*?*	*Mod*

A FEW FINAL THOUGHTS

1. For public and private landowners in the Interior Highlands, have at it!

Scale of burning may differ between the Ouachitas and the Ozarks

Boles Motorway, Poteau RD, Ouachita NF, Scott Co. AR

Photos by JM Guldin March 2015

2. For private landowners in the Gulf Coastal Plain, work on your reasons for emphasizing shortleaf over loblolly, and be prepared for no one to agree with you

Methods of Cutting study
Crossett EF
Ashley Co. AR

Photos by JM Guldin Aug 2015

3. Face the challenge of a glut in pine pulpwood and sawtimber—how do you justify asking NIPF landowners to invest in shortleaf pine? Especially with hardwood prices?

Mixed pine-oak stand
Rabbit Ranch tract
Pioneer Forest
Reynolds Co. MO

Photos by JM Guldin May 2015

4. If you are making silvicultural decisions about mixed pine stands--can you distinguish between loblolly pine and shortleaf pine in the field? Your foresters? Your technicians?

Four species of pines in this stand--can you ID them?
Catahoula RD, Kisatchie NF, Gran Parish LA

Photos by JM Guldin May 2014

5. Prioritize stands for restoration that can be burned—not just once, but repeatedly, over time.

Winona RNA, largely unburned
JWF RD, Ouachita NF, Saline Co. AR

Photos by JM Guldin Sept 2011

Poletimber stand on Seven Covey Road
~10 cyclic prescribed burns
Poteau RD, Ouachita NF
Scott Co. AR

Photos by JM Guldin Jan 2015

6. Burn young stands, whether planted or natural, no later than age 5. Helps ensure elimination of not only loblolly pine and hardwoods, but also pine hybrids.

3-yr-rough after burning in new age cohort
Poteau RD, Ouachita NF
Scott Co. AR

Photos by JM Guldin July 2013

7. The biggest gains in shortleaf restoration over the next decade are likely to be increased emphasis on public lands.

New shortleaf pine restoration prescription being implemented. Oklahoma RD, Ouachita NF LeFlore Co. OK

Photos by JM Guldin Apr 2015

8. On private lands, prioritize restoring shortleaf pine in landscapes with public lands, to expand the area of restored habitat.

Real estate cut for possible land sale.
Private land,
Garland Co. AR

Photos by JM Guldin Apr 2010

9. Ponder low-cost restoration—favor any minor manageable shortleaf component that might be found in mixed stands

Both loblolly and shortleaf pines in this stand--can you ID them?
Poor Farm Forty, Crossett EF, Ashley Co. AR

Photos by JM Guldin Sept 2011

10. What's the target for planting shortleaf pine in restoration??
Our W.A.G.:
a) Plant 25, 000 ac annually?
b) Plant 600 TPA?
►Are we growing 15 million shortleaf pine seedlings every year?

Shortleaf pine, planted after ripping site prep
Cold Springs RD, Ouachita NF
Scott Co. AR

Photos by JM Guldin Aug 2007

SUMMARY:

Best prospects for restoration of shortleaf pine are on public lands, or nearby private lands

A proximal cause for the loss of shortleaf pine—the conversion of native natural pine stands to planted loblolly pine, a trend likely to continue through 2050

SUMMARY:

Challenges for wider adoption of shortleaf pine
-glut of wood from southern pine forests
-poor pine stumpage prices
-seed supply and seedling production

The advantages and disadvantages for restoration of shortleaf pine differ by ecoregions across the South

SUMMARY:

As a result—

There is probably not “one way” to restore shortleaf pine across the 24 states where it is found

Restoration is likely to differ dramatically, and will require tailored ecological assessments and silvicultural prescriptions—probably at the ecoregional scale

Questions? Comments?

jguldin@fs.fed.us

Shortleaf pine as far as the eye can see Black Fork and Horseshoe Mountains from the Talimena Scenic Drive

Mena RD, Ouachita NF
Polk Co. AR

Photos by JM Guldin June 2015