



# ***Status of Shortleaf Pine Genetic Resources – Current and Future***

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***Fifth Biennial Shortleaf Conference***  
***Shortleaf Initiative, October 2019***

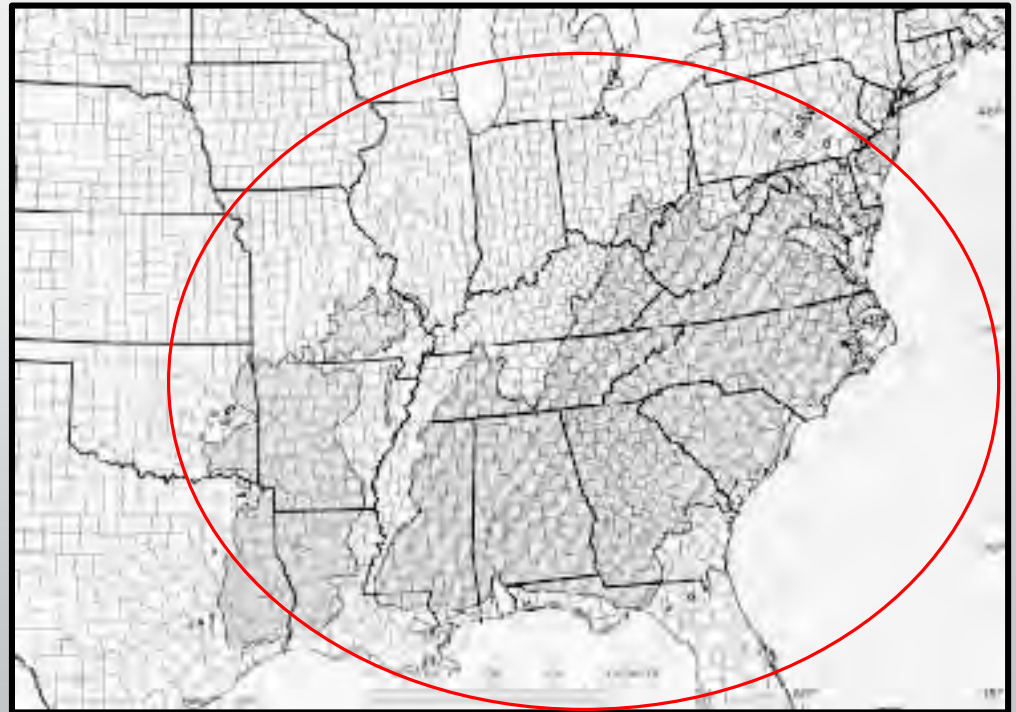
# *Talking Points*

- *Background*
- *Forest Service shortleaf genetic resources (seed bank, seed orchards, progeny tests, seed production areas)*
- *“suspected hybridization” rumors*
- *Considerations to support reforestation and restoration*

# *Shortleaf pine*

*Pinus echinata* Mill.

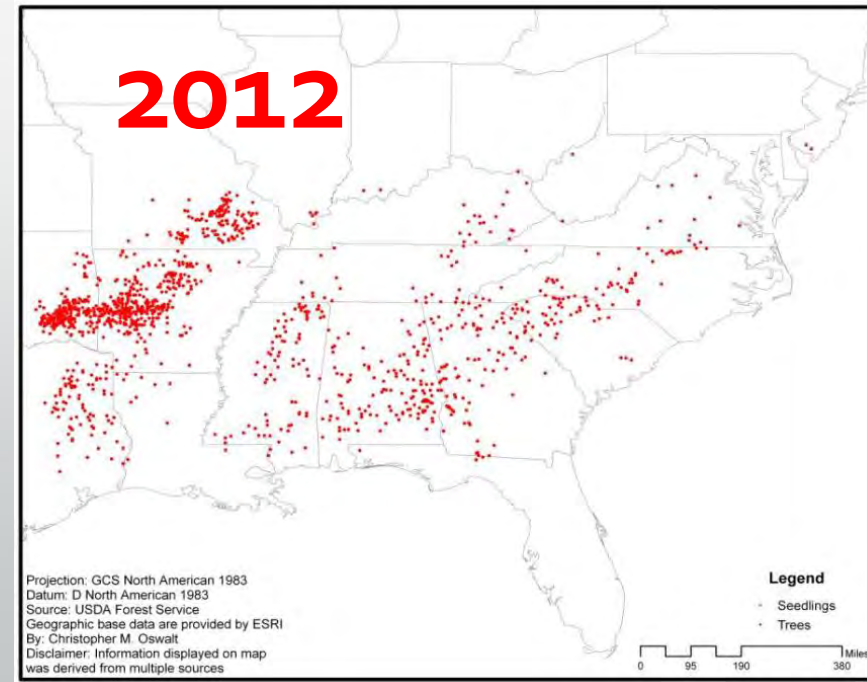
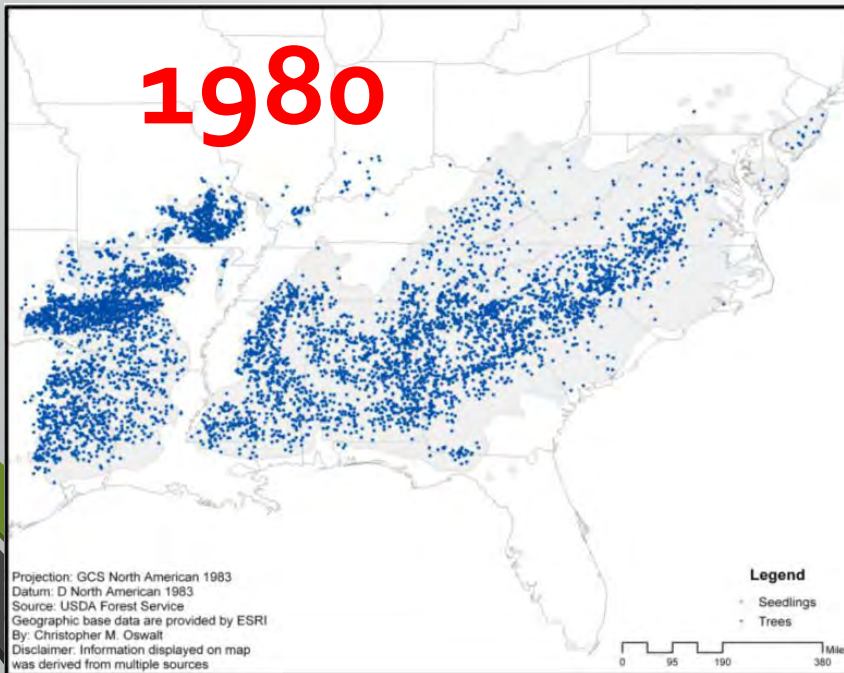
- *Largest range of the 4 major commercial southern pines*
- *Across 22 states*
- *Fire adapted ecosystem*
- *Cone crop every ~ 5-7 years*
- *Seed shelf life ~15 years*



# *FIA data showing the decline of Shortleaf pine*

*Oswalt, 2013*

- Imperiled ecosystem, 50% lost over the past 40 years
  - Due to pine beetle outbreaks, lack of fire, changes in forest management practices, changes in land uses



**Necessary to know about the existing *shortleaf genetic resources* if we are to support increased shortleaf restoration, a Shortleaf Survey was circulated in 2012 & 2015, addressing:**

Statement	Answer	
<b>Seed Orchard Resources</b>	ACRES	
First Generation		
Second Generation		
Advanced Generation		
Seed Production Areas		
<b>Current Orchard Management</b>	YES	NO
Original orchards retained, not managed, no seed collected		
Orchards retained, not managed, some seed collected		
Orchards retained, limited management, seed collected		
Orchards retained, actively managed, seed collected		
Orchards retained, actively managed, seed collected, additional genetics work underway or planned		
Orchards removed		
New orchards recently established on _____ acres		
Never had shortleaf orchards		
<b>Seed Inventory</b>	POUNDS/ 1 <sup>st</sup> or 2 <sup>nd</sup> GEN SEED?	
Approximate annual seed collection (averaged for last five years)		
Approximate pounds of seed in storage		
Seed Age		
<b>Program Intentions Next Five Years</b>	YES	NO
Maintain status quo		
Increase management intensity and seed collection activity		
Discontinue shortleaf efforts, remove orchards		
Mothball orchards for the time being		
Kiln Facility (Write in YES or NO and LOCATION)		
Geographic sources for shortleaf in your program: _____		
_____		
<b>Geographic area where seed/seedlings are adapted for out-planting:</b> _____		
_____		
Additional Comments:		



**Number of Seed orchard acres**

**Orchard management**

**Seed inventory**

**Program intentions**

**POC: Barb Crane, Regional Geneticist**

# Shortleaf Survey Results

Agency	Shortleaf Seed orchard / seed production areas, ACRES	Number of progeny tests	Totals acres SHL
Forest Service	527 / 0	155 shortleaf	527
States *	70 / 0	?	70
Industry	0 / 0	?	0
Private	?	?	



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# ***Forest Service Shortleaf pine genetic resources***

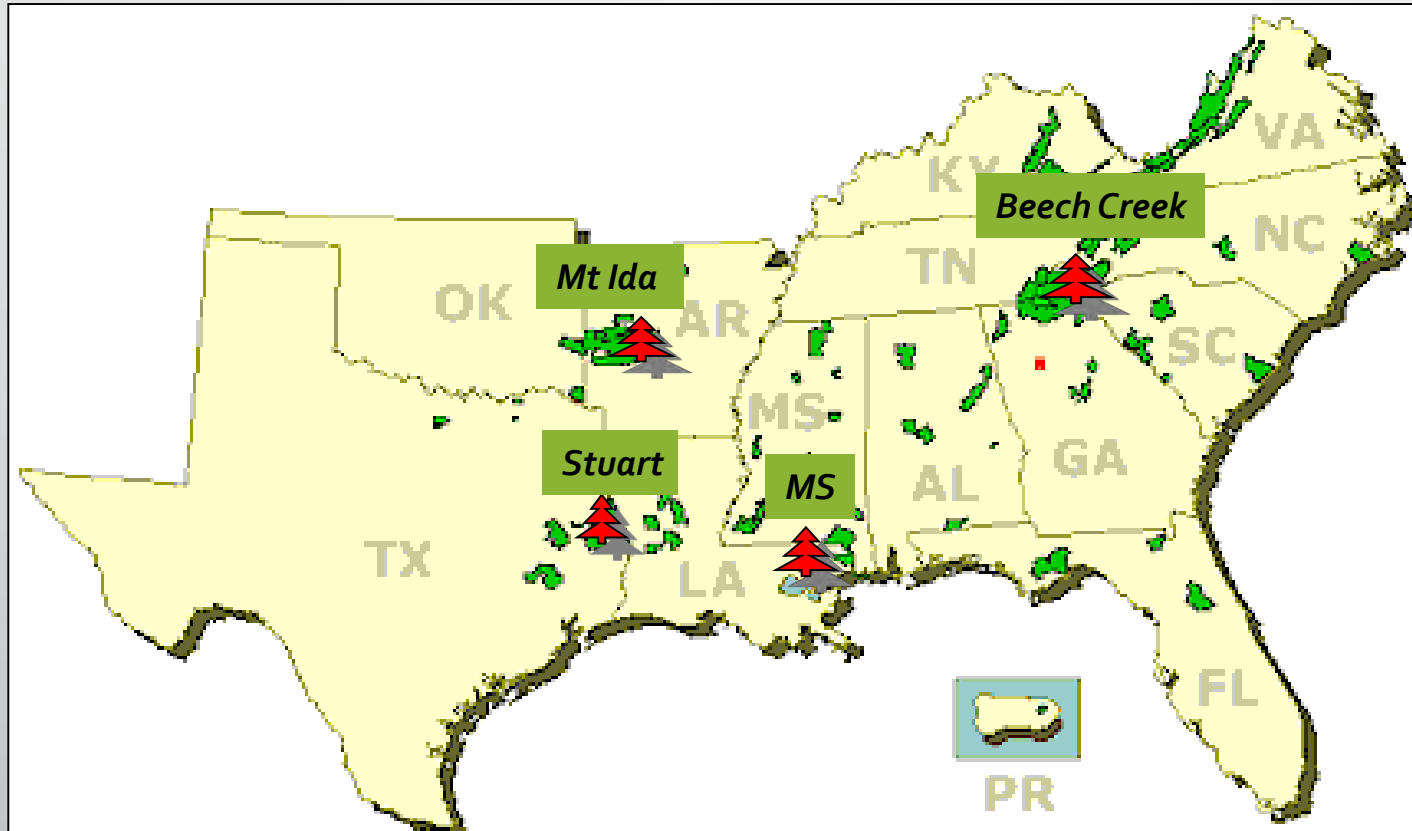


## **Shortleaf seed orchards:**

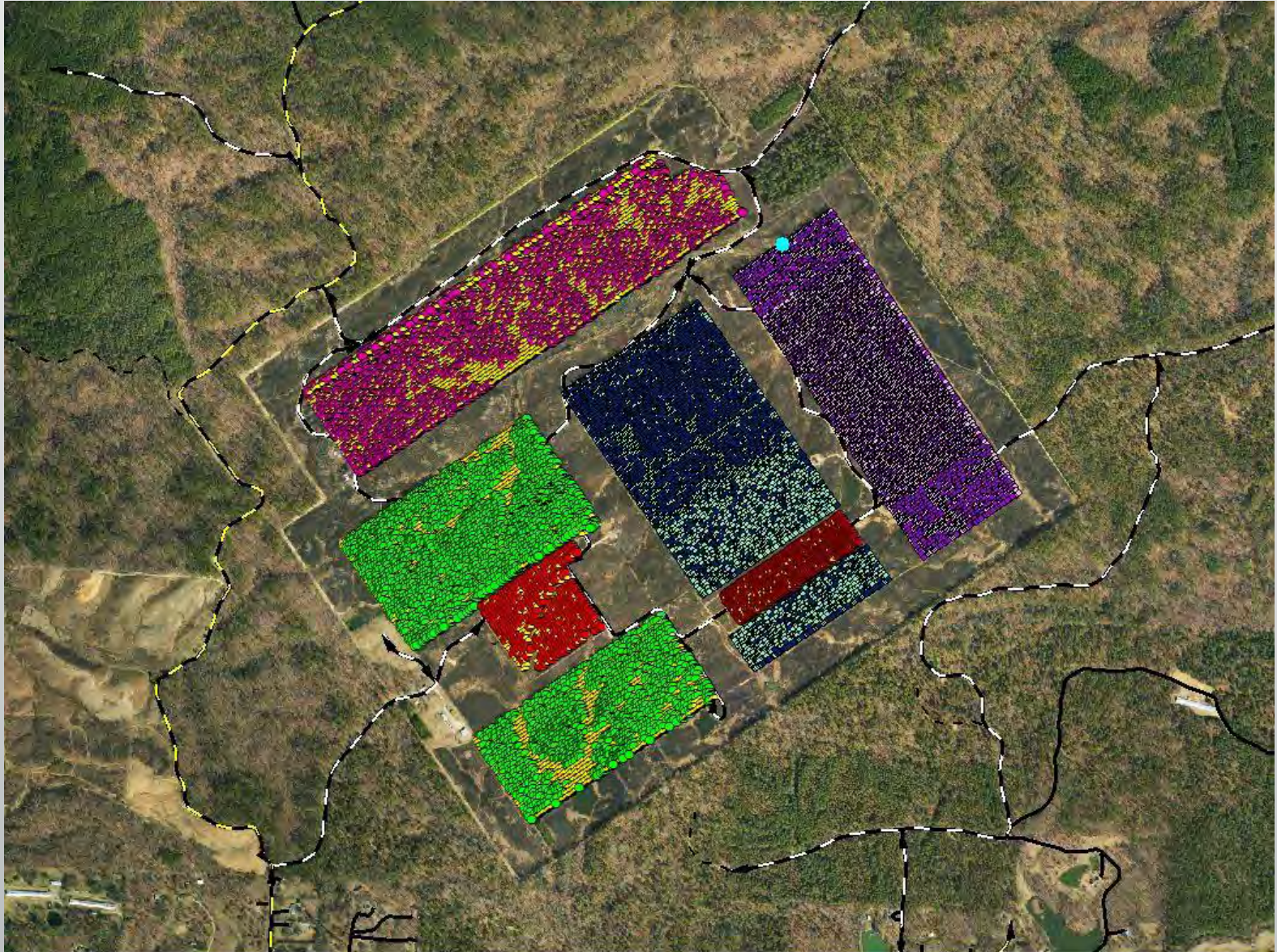
- **505 acres 1<sup>st</sup> Generation, planted 1960's**
- **27 acres 2<sup>nd</sup> Generation, planted 1990's**
- **0 acres 3<sup>rd</sup> Generation**
- **0 acres Seed Production Area**




# FS Shortleaf pine seed orchards in NC, MS, LA, ARK



# Ouachita Seed Orchard



# Ouachita Second Generation Orchard, 25 Ac



**164 Families were selected (top 20%) from  
Progeny Test "Total 1,284 trees grafted –  
1,057 Living Today"**

## **Forest Service Shortleaf *progeny tests*:**

- **155, established 1982 - 1993, resurrected, documented, monumented, silvicultural recommendations written in 2015**
- **TO BE USED AS A BACKUP SOURCE FOR FUTURE SEED**



## **FS Shortleaf *seed inventory*:**

- **839 lbs. (75% is ARK source)**
- **Collected 2003 – 2014**
- **Represents 11 seed zones**
- ***Need Appalachian seed !***
- ***Collecting seed this fall***

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- **Is there really increased hybridization going on between species?**
  - Because of environmental factors such as climate variability?
- **Naturally occurring at a rate of < 5%**
  - Tauer, Will, Stewart (2012) theorized increases up to 40%
- **Hybrids appear to lose the adaptive crook to re-sprout after fire**
- **Do we need to be concerned about the seed orchard trees being hybrids or hybridizing?**
- **What is the genetic purity of our seed?**
- **Important to know “what” you are planting**

**Forest Service National Forest System  
Genetics program – initiated a large scale,  
multi-year DNA fingerprinting project**

- **National Forest System seed orchard managers did the needle tissue and seed bank collections**
- **Southern Research Station, Southern Institute of Forest Genetics (MS), did DNA marker development (using chloroplast DNA, paternal inheritance, e.g. pollen parent)**
- **National Genetics Lab “NFGEL”, Institute of Forest Genetics (Placerville, CA), did the lab work & DNA fingerprinting analysis**

<b><u>DNA fingerprinting RESULTS</u></b>	<b>Number of seed orchard families tested</b>	<b>Sources tested (mother trees and seed)</b>	<b>Seed years tested</b>
<b>Shortleaf (SHL)</b>	<b>619</b> (2 ramets each)	<b>AL, ARK, KY, LA, MS, MO, NC, SC, TN, TX, VA</b>	<b>1986 – 2017 intermittent</b>
<b><u>Results</u>- how many families had a hybrid fingerprint?</b>	<b>ZERO families in ARK, MS, NC orchards</b> <b>17 families in LA orchard</b>		<b>Only 2 out of 100 seed showed a hybrid fingerprint</b>

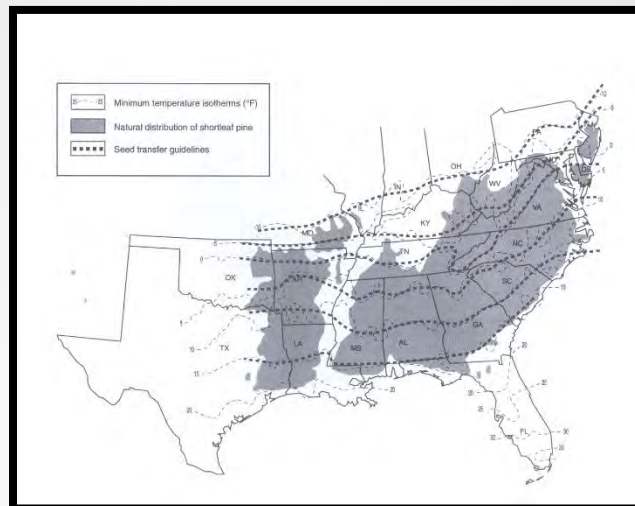
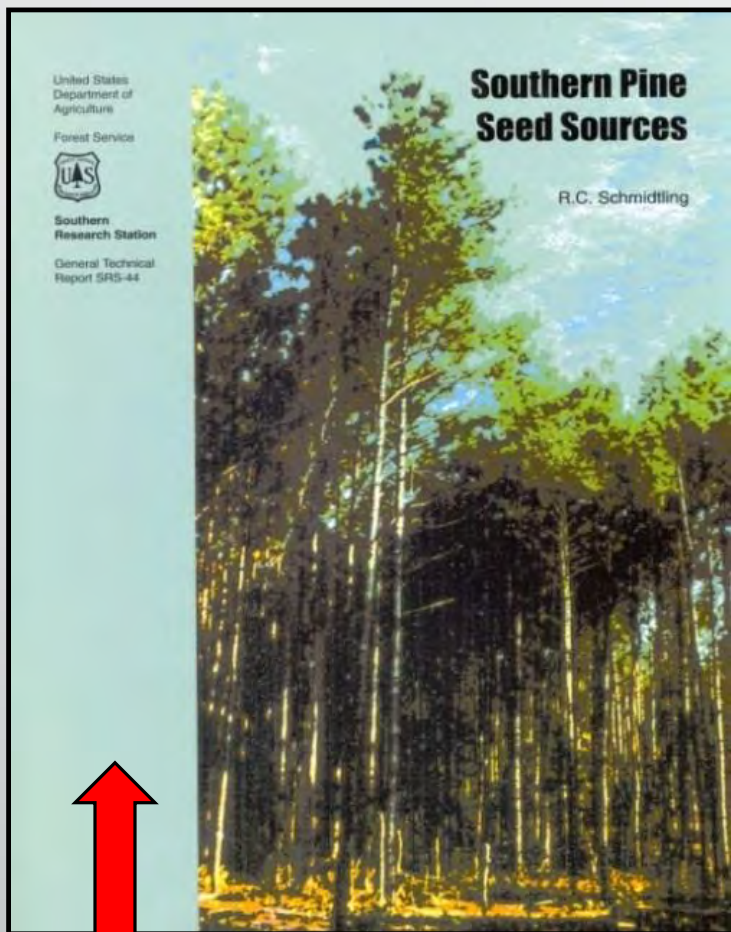


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# ***CRITICAL QUESTIONS:***

- ***What is the most appropriate genetic material to plant that will grow a healthy, diverse and sustainable forest?***
  - *With 75 - 100+ yr. rotations*
  - *“Determining Suitable Locations for Seed Transfer under Climate Change, Potter & Hargrove, 2014*
- ***Forests need to be resilient***
  - *Climate change variability's are occurring faster than some tree species ability to respond.*
  - *Is shortleaf a resilient species?*
  - *Is it a genetic generalist or specialist?*



***Time for an update?  
Yes > working on updating  
seed zones >  
Eastern Seed Zone Forum  
(R8 & R9 project)***

***GTR SRS 44 (2001) > developed seed zones based on past and current genetic information & climatic conditions.***

- **HOWEVER** will it be pertinent for future seedling deployment? Under the threat of climate change?***
- Eastern Seed Zone Forum <http://eszf.sref.info/>***

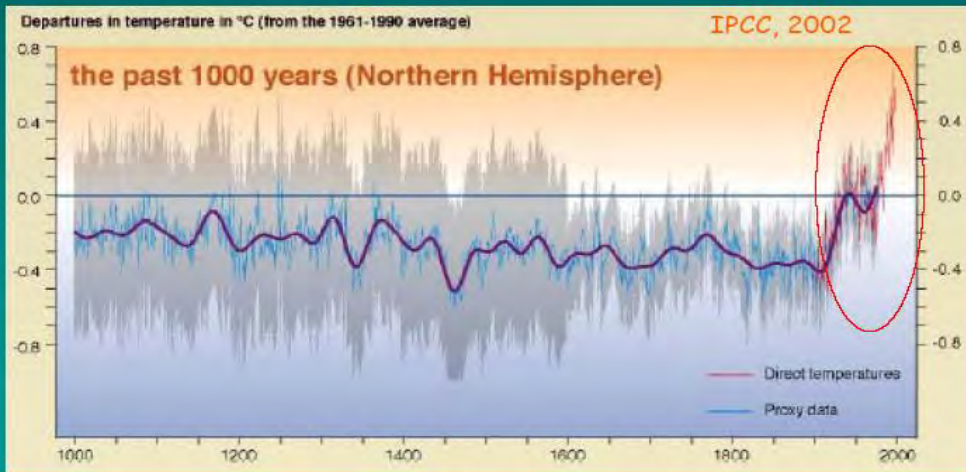


There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things that we know we don't know. But there are also unknown unknowns. There are things we don't know we don't know.

(Donald Rumsfeld)

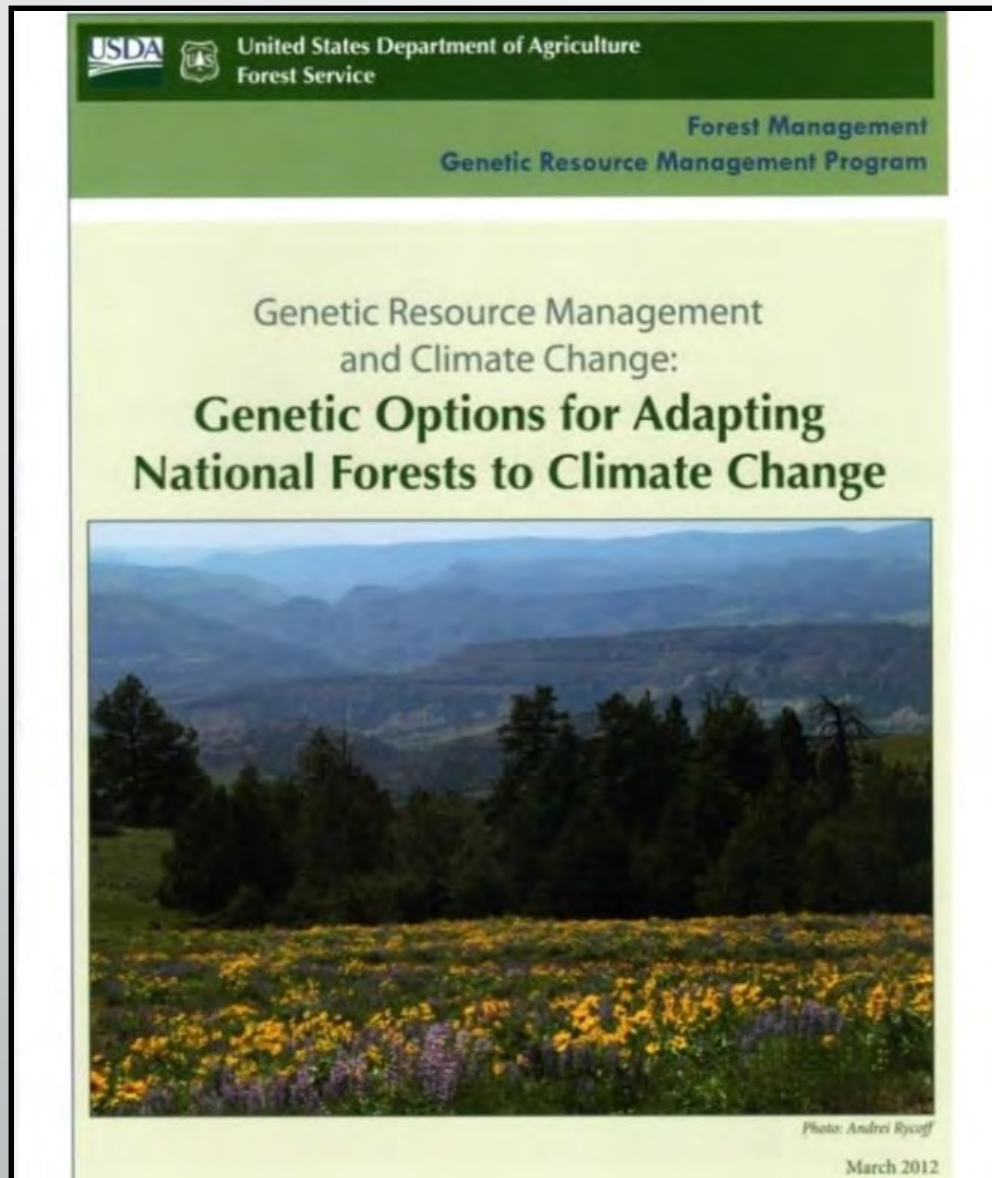
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## Temperature Change over the Past 1000 Years



**Climate change**  
**“known unknown”**

# Forest Service National Guidelines for National Forests

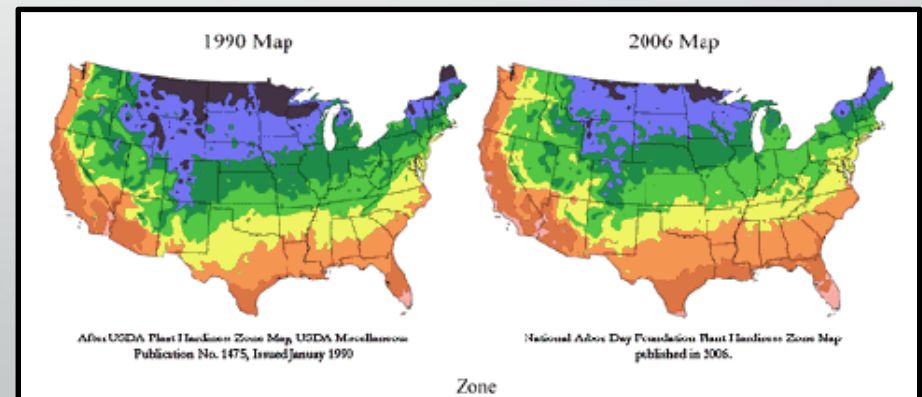


Erickson et. al. 2012

# *Planting in the right areas – for now and for the future*

## *Action item considerations:*

- Update seed zones for seedling deployment
- Mix seed lots from adjacent N/S seed zones, plant in N seed zones, e.g. mix zone 7 & 8 seed, plant in zone 8
- Seed forecasting – monitor seed needs
- Increase understanding of shortleaf tree physiology & seed biology
- Genecology studies – to understand adaptation, e.g. assisted migration studies




***Plant hardiness zone changes from 1990 to 2006***



***Thanks!***

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