Regional Effects of Changes in Pine Plantation Growth

Bob Abt
Jesse Henderson

NC STATE University

Pine Plantation Research and Decision Support Tool Rollout

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USDA United States Department of Agriculture

National Institute of Food and Agriculture

Background and Outline

- Our research started when biological results were completed:
    - Special thanks to Evan Brooks– Virginia Tech
    - Brief context and methodology discussion
    - Tons of preliminary results
    - Caveats – Next Steps

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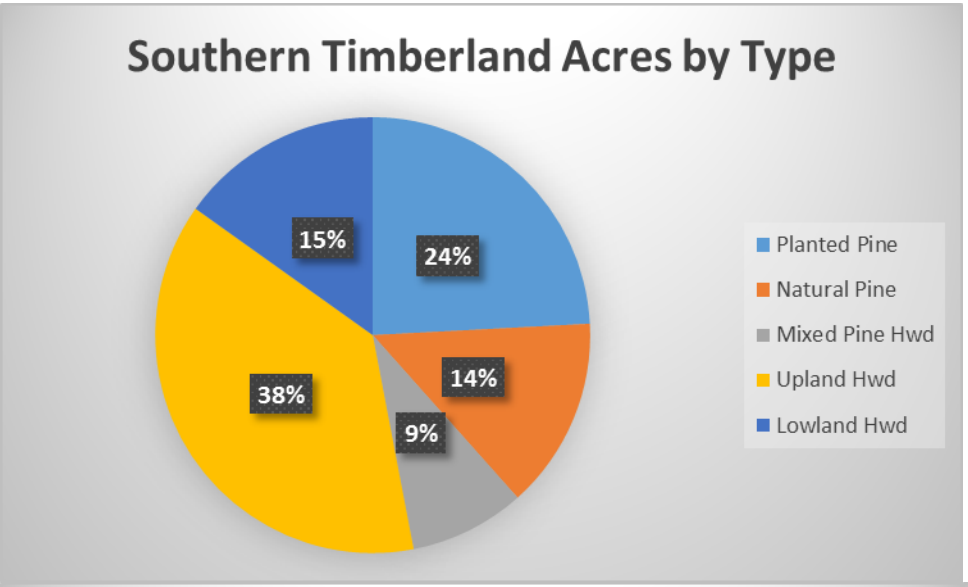
Plantations in a Landscape Context

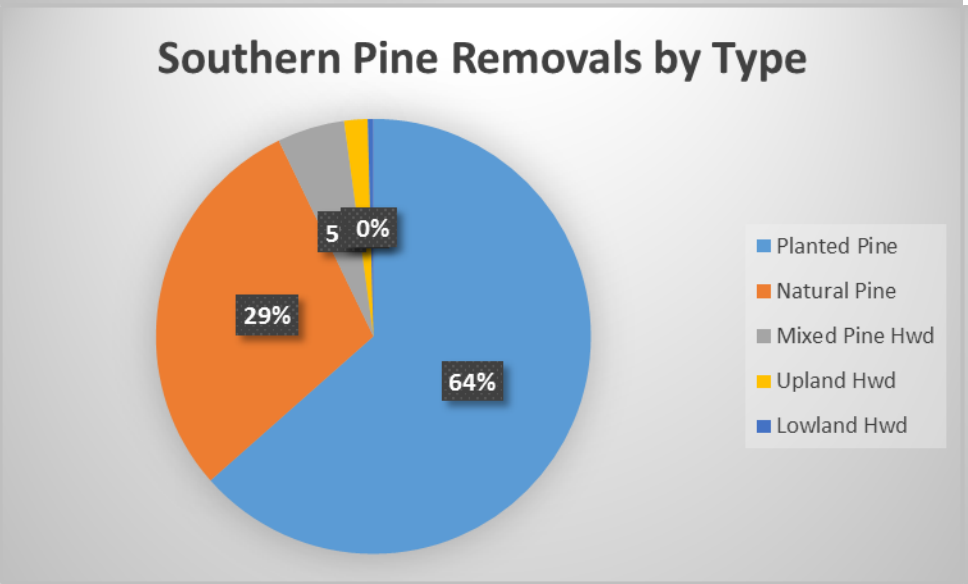


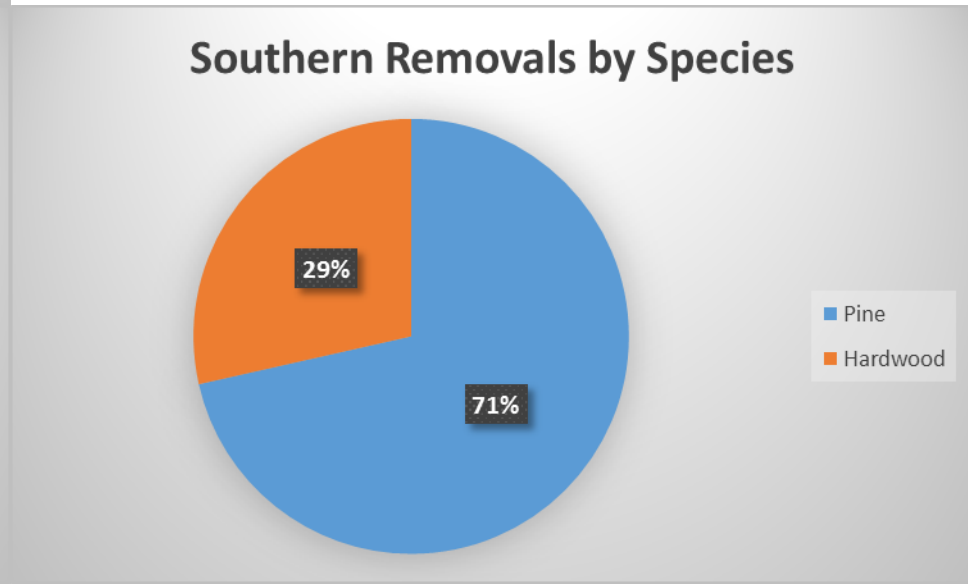
Southern Plantations

24% of timberland

45% of removals

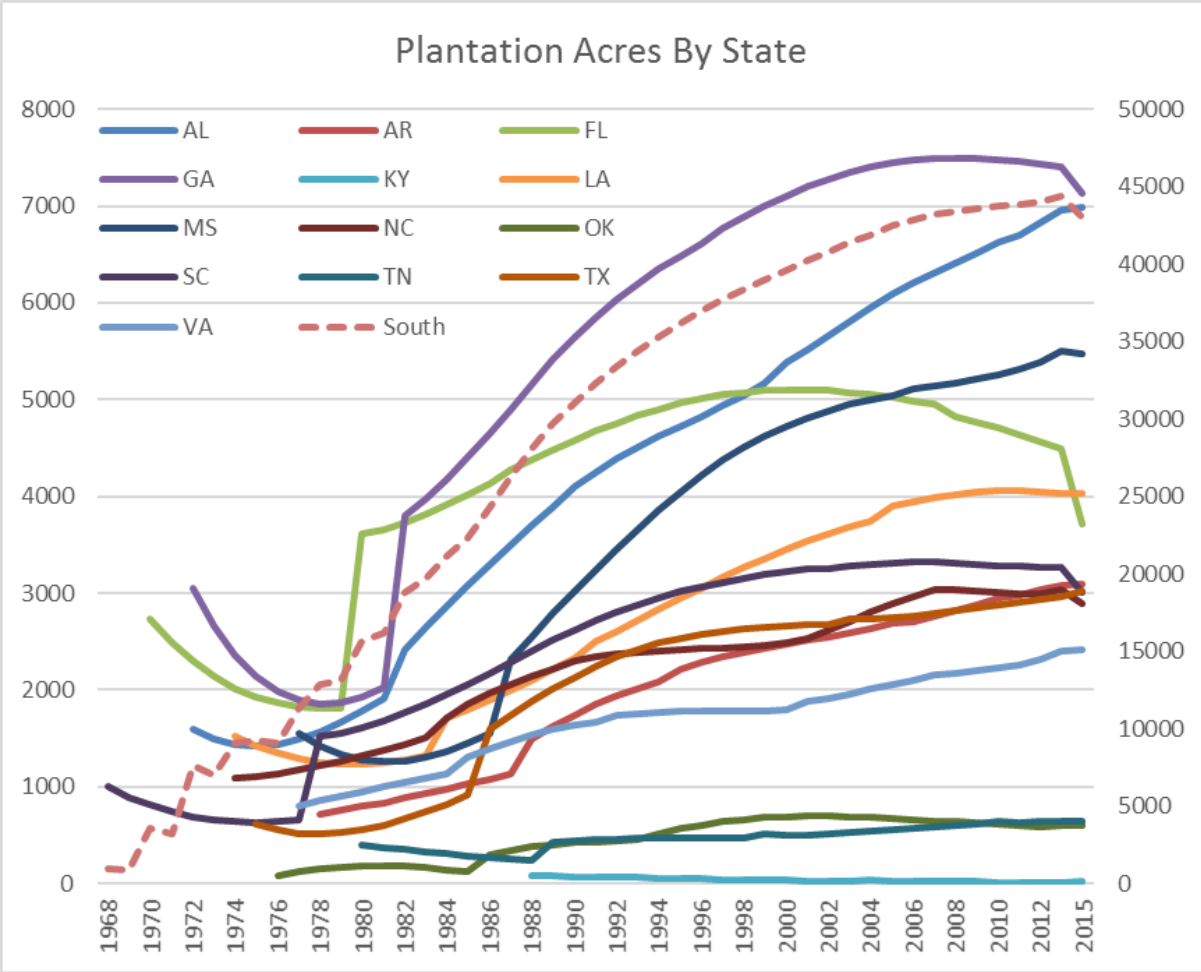
64% of pine removals





Current State of Plantations

Plantation Acres Have Peaked



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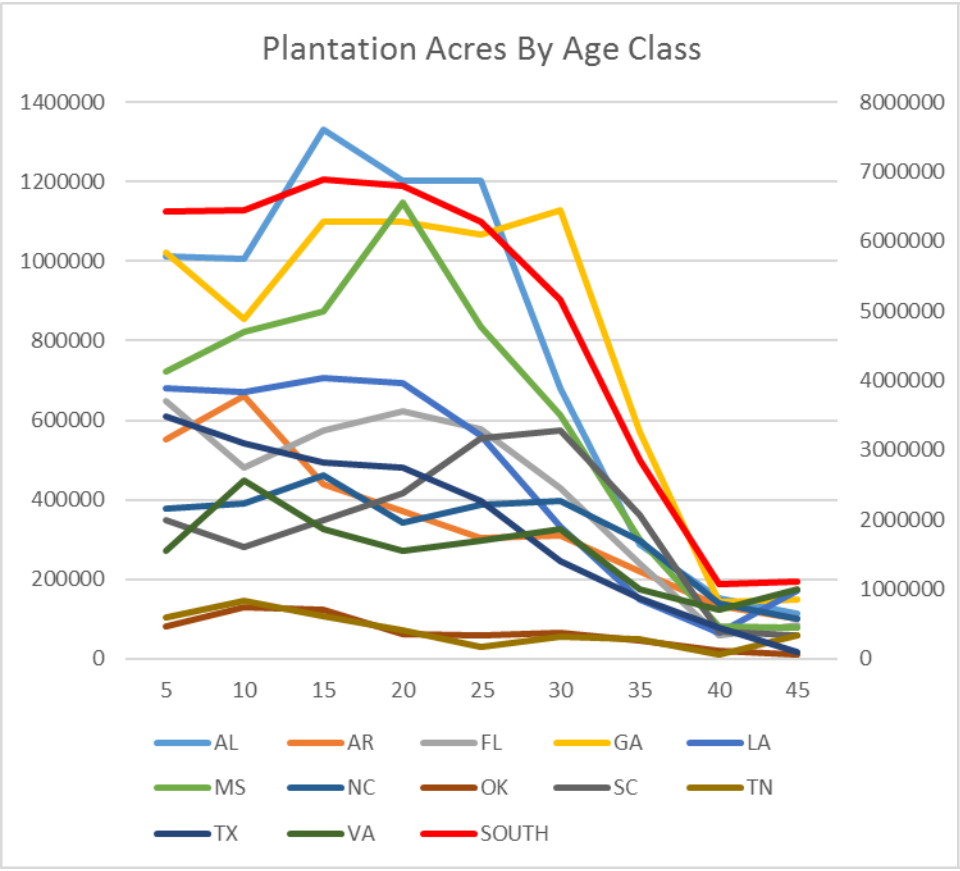
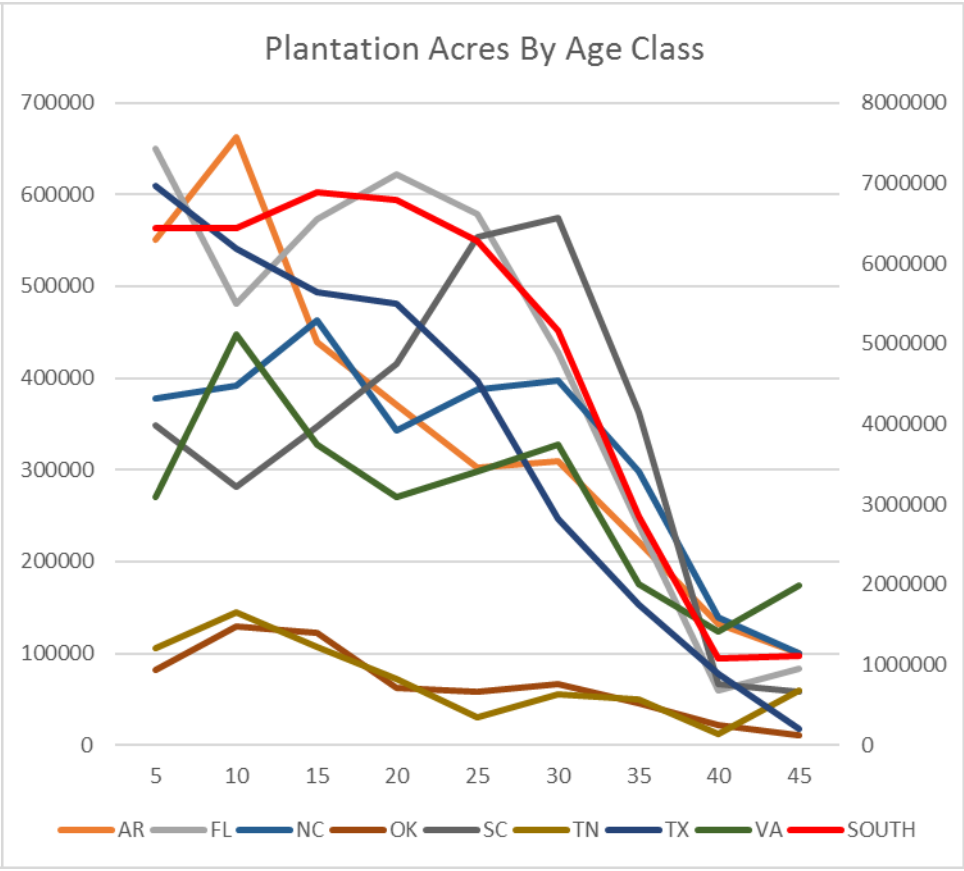
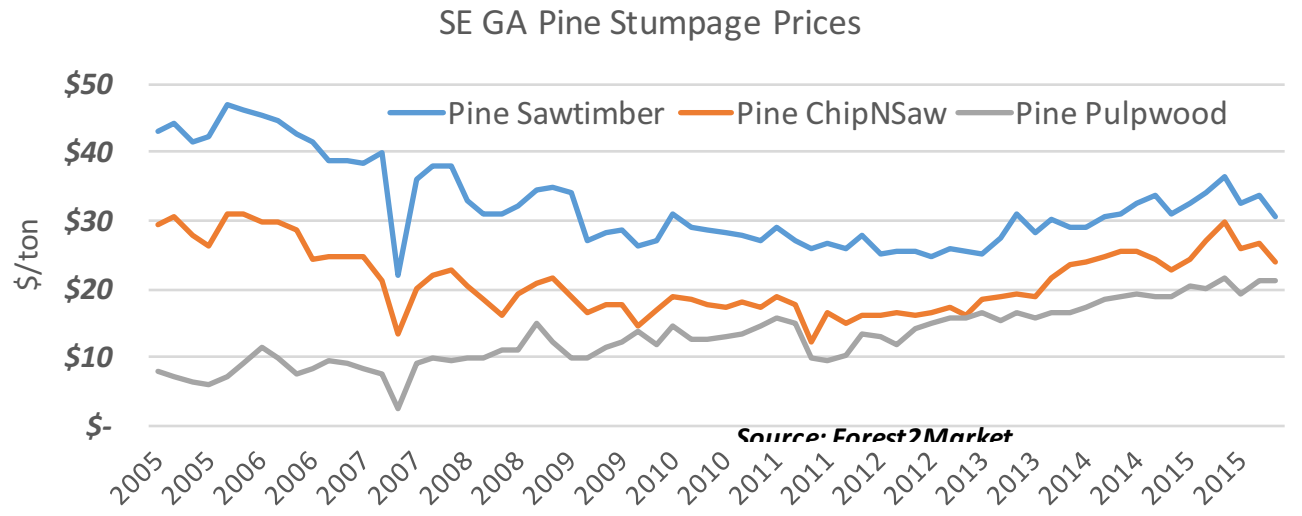
Current State of Plantations

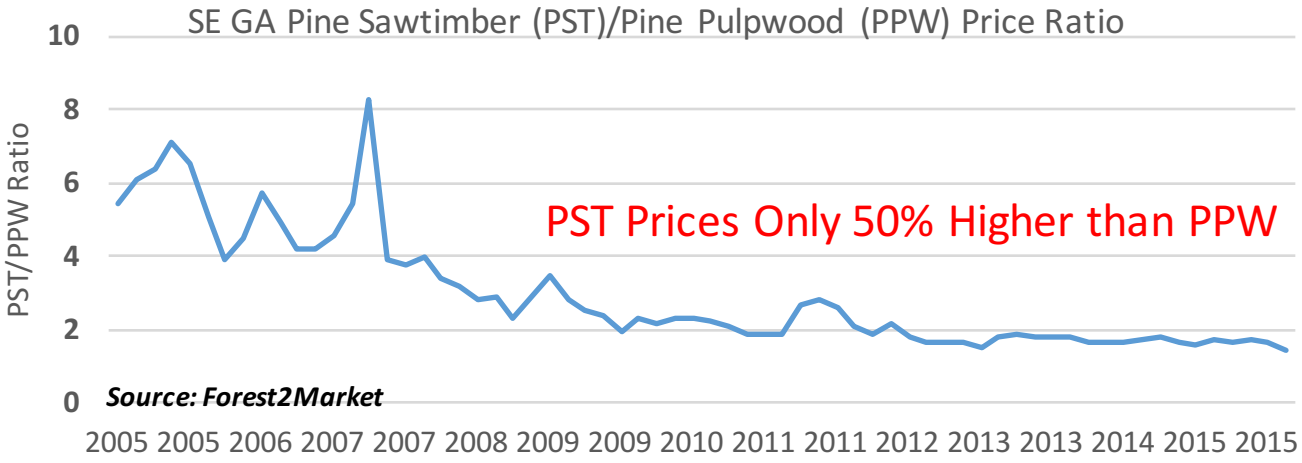
Age Class Distribution will drive the next 50 years





Markets Have Changed





Build-up of Sawtimber Keeps PST Prices Down:

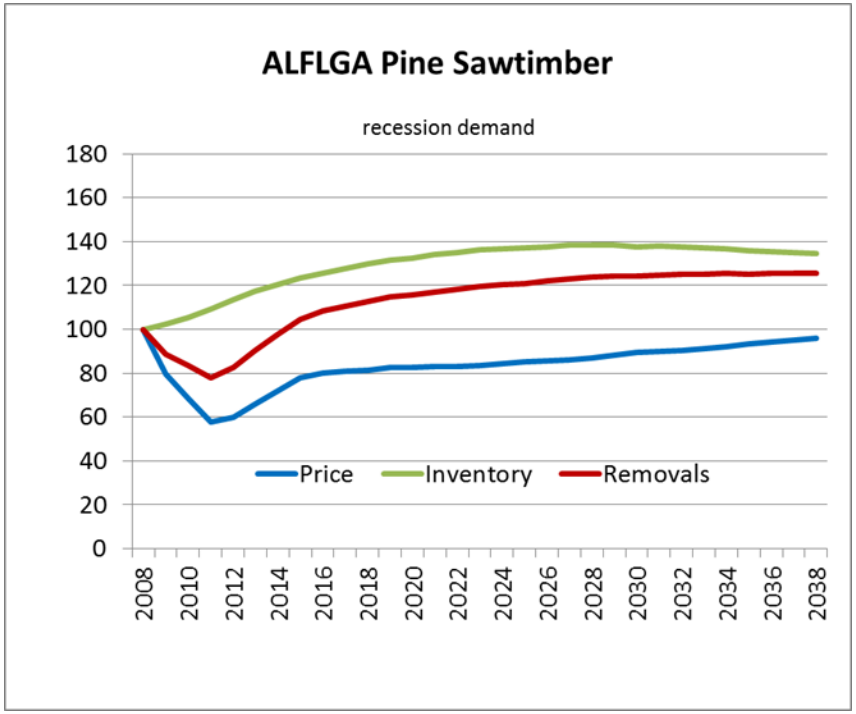
Delays and Lowers Probability of Replanting

Less Acres in Younger Age Classes

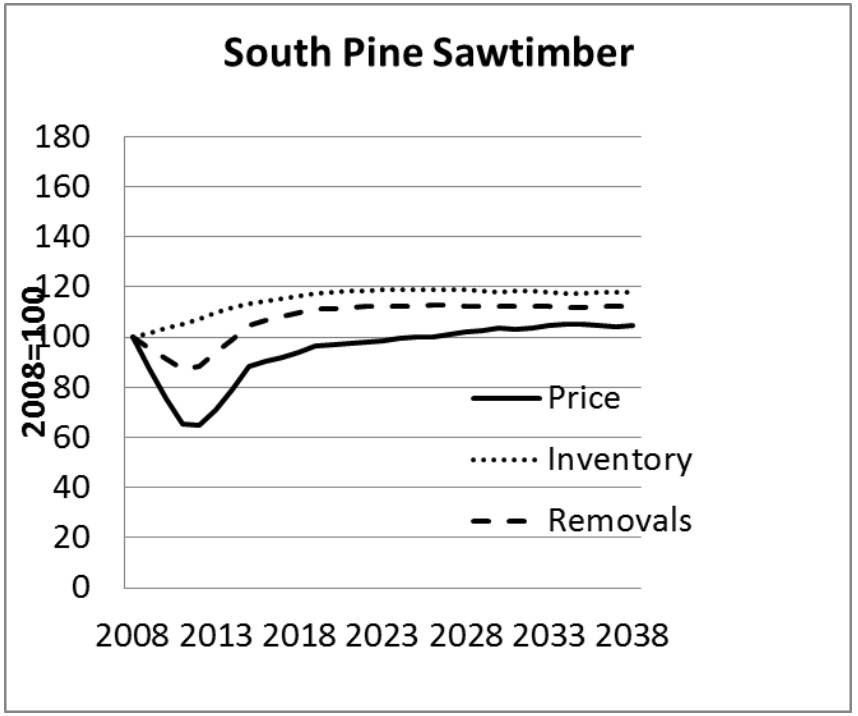
Less Deployment of New Genetics

Less Replanting to Plantations

ALFLGA pine sawtimber



South pine sawtimber



Next 50 Years Is an Extension of This Context

- Built into our starting data
  - Current Harvest Patterns
  - Current Plantation Age Class
  - Current Growth
- Our Projections
  - Two Demand Scenarios
    - Constant Demand and Constant Price
  - Plantations Only
  - Constant Plantation Acres
  - **Pinemap Growth**

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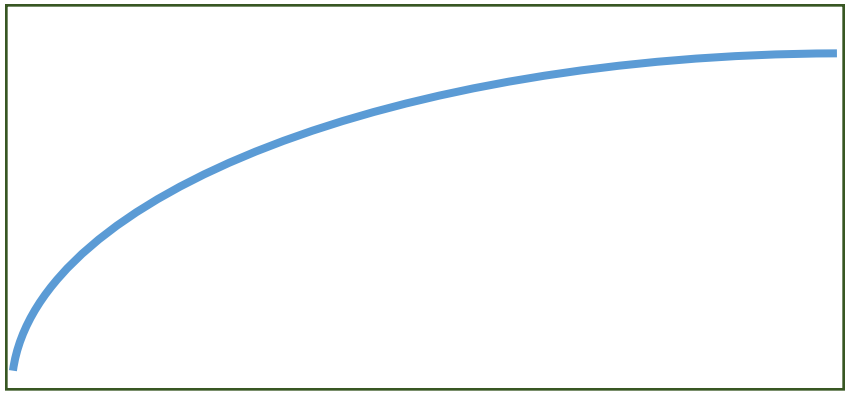
5GB of 3PG Growth Data: Regression Equation by FIA Survey Unit

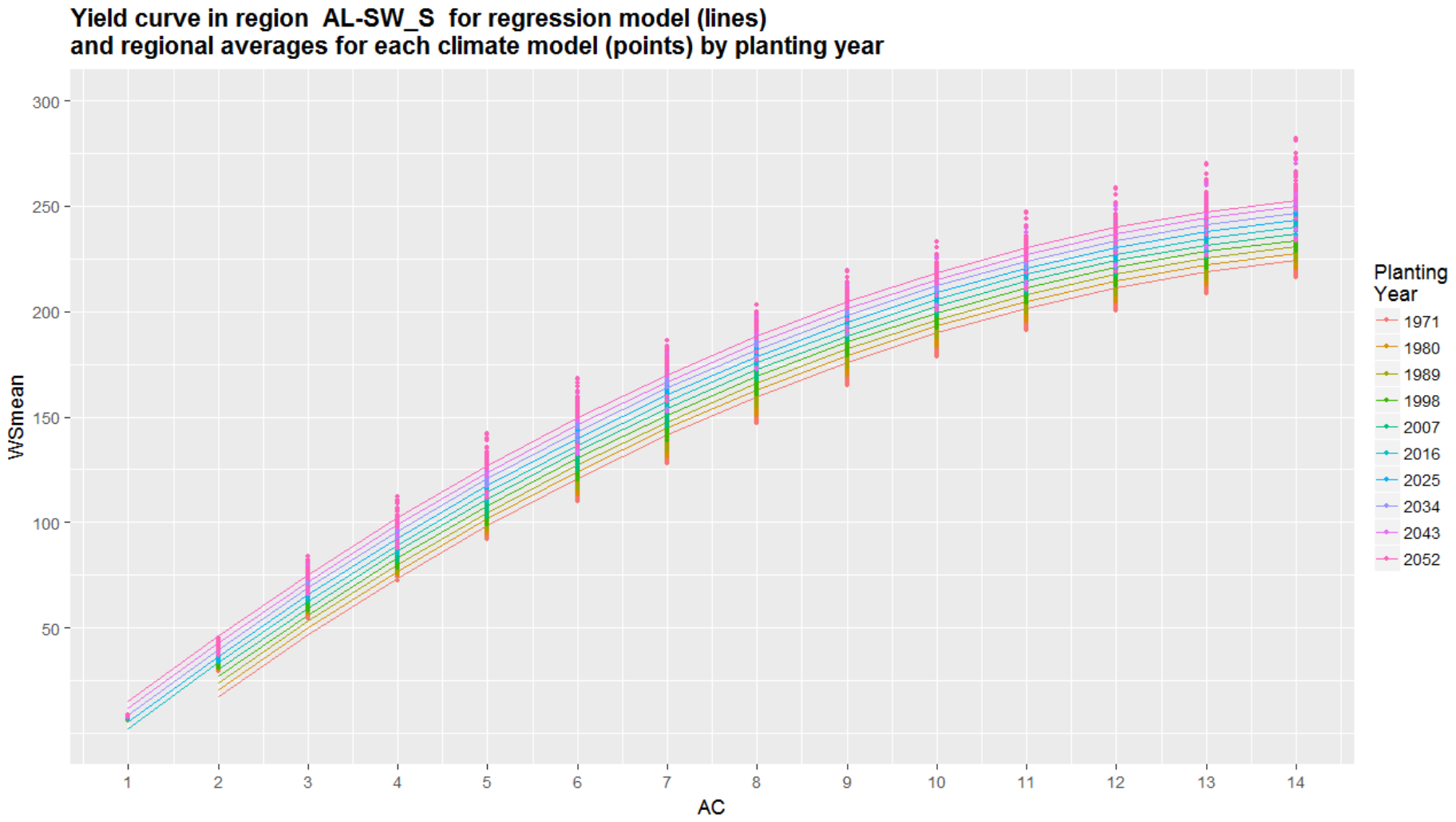
$$WS_{mean} = \beta_0 + \beta_1 \cdot \mathrm{AC} + \beta_2 \cdot \mathrm{AC}^2 + \beta_3 \cdot \mathrm{PY}$$

yield intercept age class planting year (intercept adjuster)

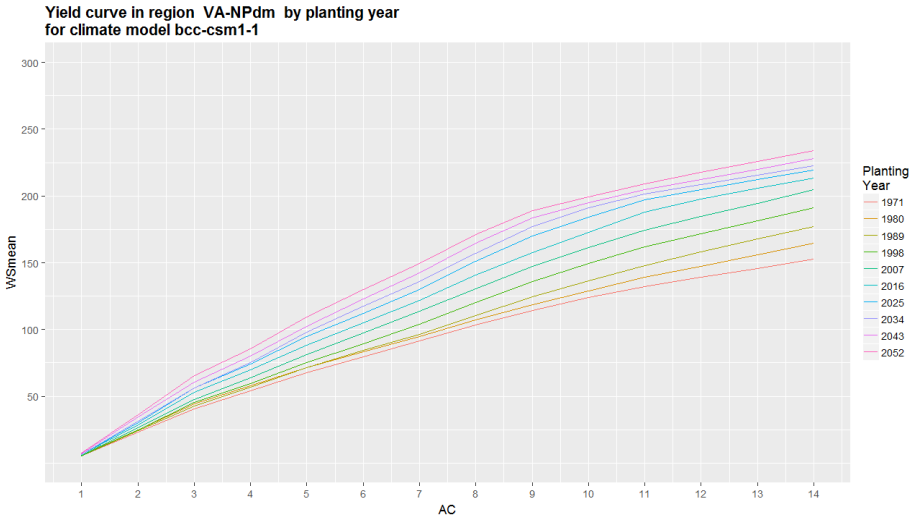


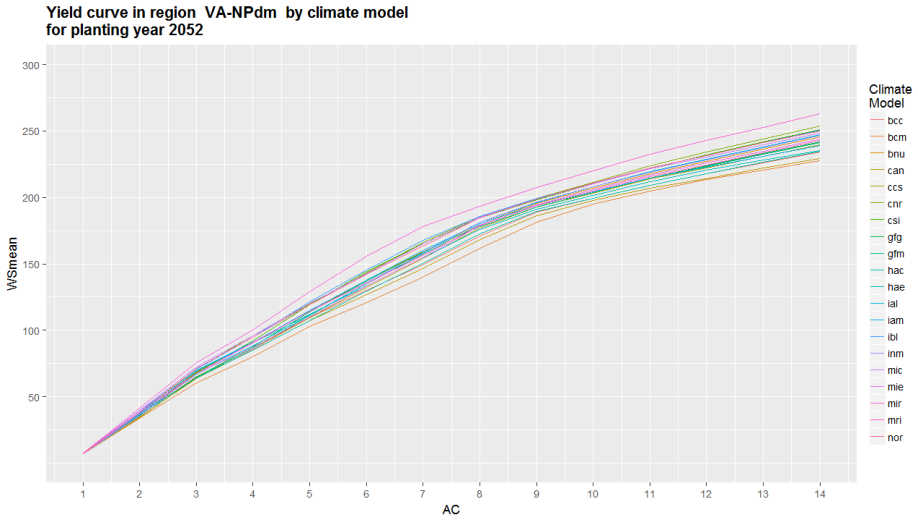
$R^2 = .967$

Regression Results by Survey Unit



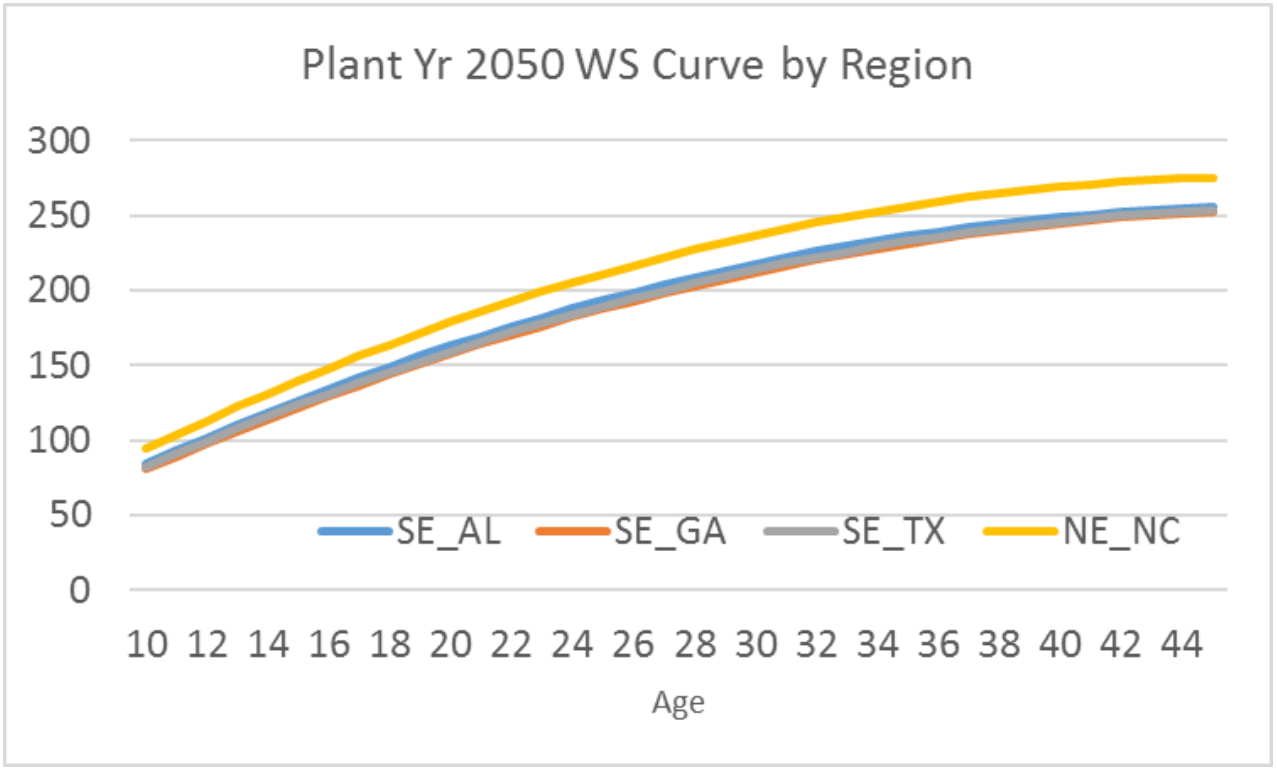
Growth Distribution Across Climate Models and Planting Year





2050 WS Curves – Location Matters

but not a huge difference



Applying 3PG Results to Current FIA Growth

- **Creating a Growth Multiplier**
- Note that each age class in the FIA data has a different base year which is the year it was planted.
- Assume that PltYr for 2012 growth from the 3PG regression is comparable to current SRTS FIA data
- Multiplier = $\widehat{WS}_{projyr\ age}/\widehat{WS}_{2012\ age}$
- Apply multiplier to FIA 2012 growth (cuft/ac/year)

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Applying Model Results to Current FIA Growth

- **Example**
- Multiplier = $\widehat{WS}_{projyr\ age}/\widehat{WS}_{2012\ age}$

	Intercept	AC	Acsq	PltYr	
SE_AL	-742.271	34.46082	-1.07763	0.352773276	
RG1, Annual Growth Multiplier for a 30 yr old stand in 2025					
RG	CurrYr	Age	AgeCls	Yield Curve BasYr	WS
1	2050	20	6.666667	2030	**155.702882**
Using 2012 FIA SRTS Growth as Base for Index					
RG	CurrYr	Age	AgeCls	Yield Curve BasYr	WS
1	2012	20	6.666667	1992	**142.297498**
				Multiplier	**1.09420675**

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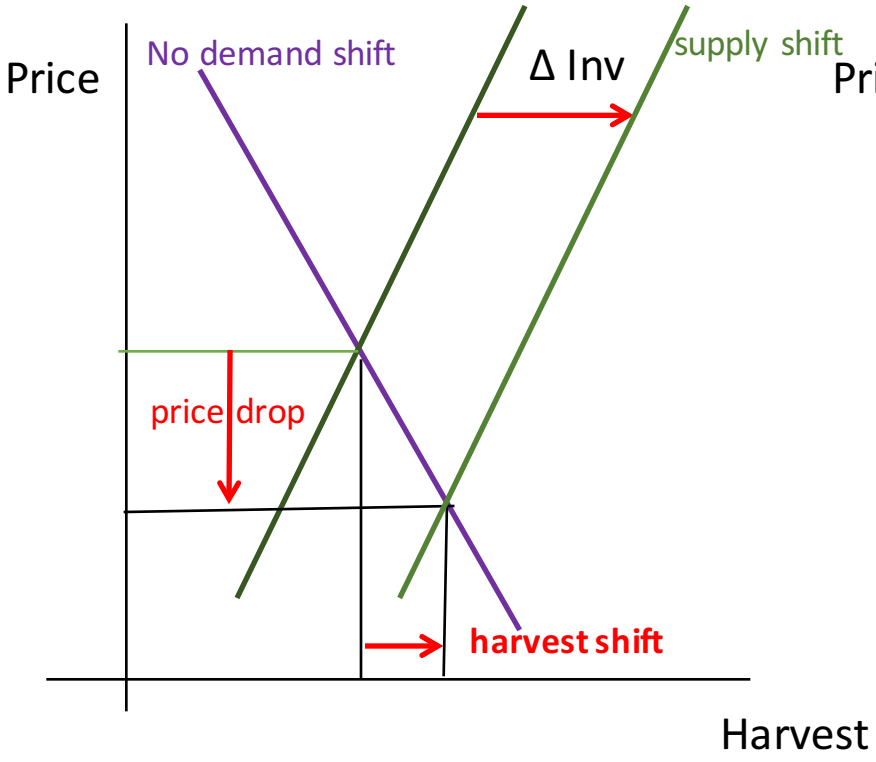
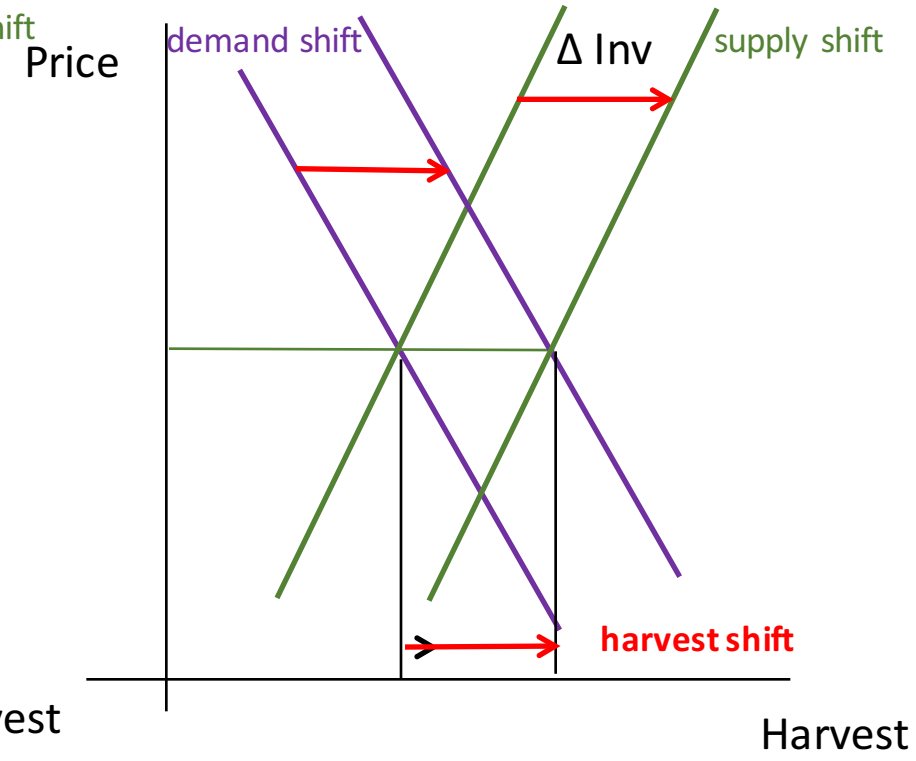
Two fifty year projections – 2011 – 2061
Plantations Only – Private Owners

Constant Demand by product and Constant Price by product

Constant Demand – more supply – a small increase in harvest due to low prices



Constant Price – implies that demand will shift out enough to offset supply increase



Market Results

- Constant Demand
  - Price decreases as supply increases
  - Small increases in harvest – less inventory turnover
  - Pinemap Growth Effect Muted
- Constant Prices
  - Price constant – Demand Increases with Supply
  - Larger increases in harvest – more inventory turnover
  - Pinemap Growth Effect More Pronounced

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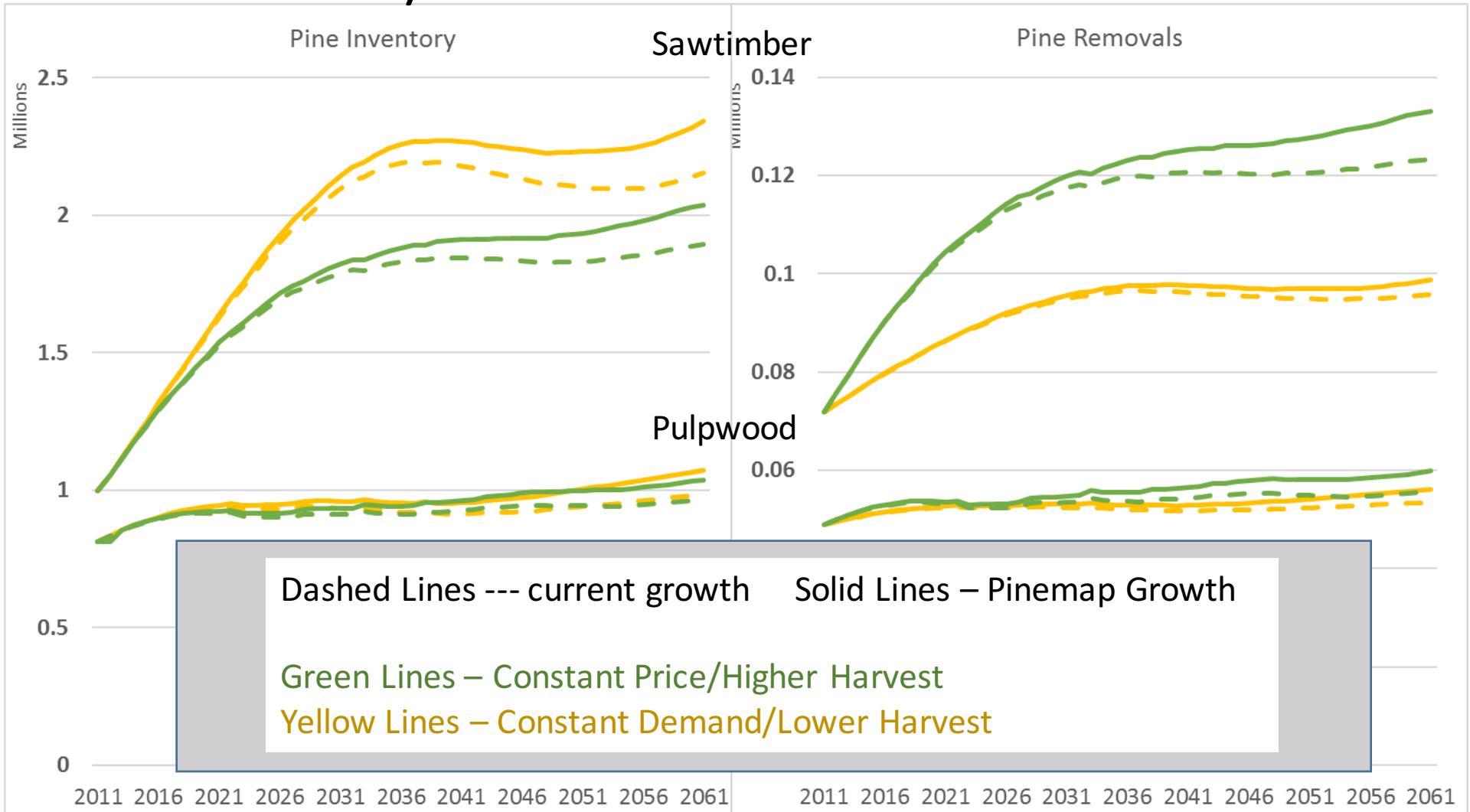
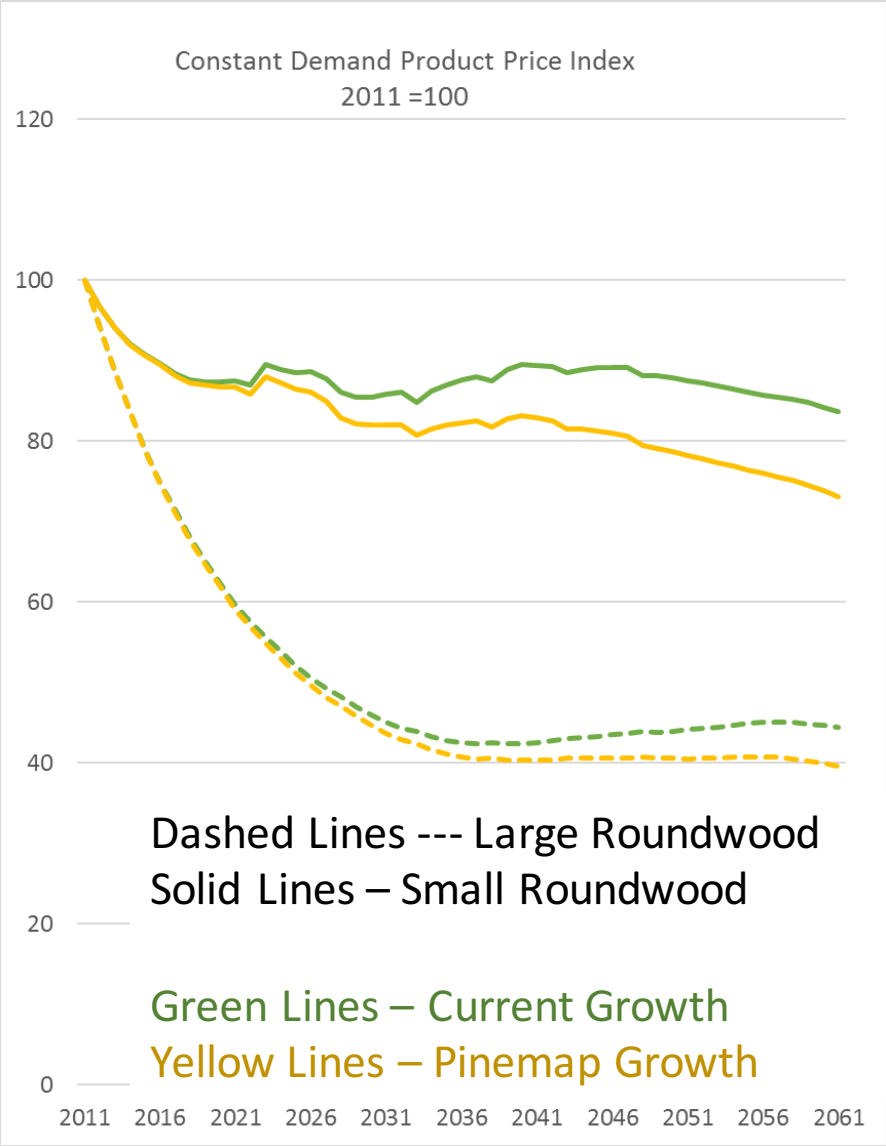
Inventory and Removals - Southwide



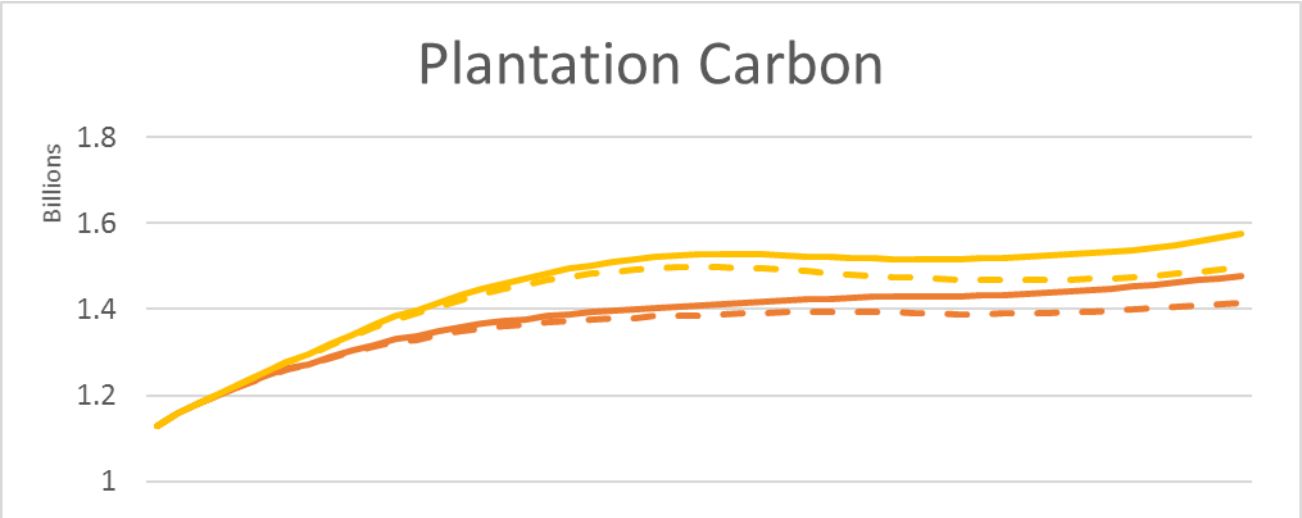
Influence of Genetics/Climate Change on Plantations Depends on Demand



Supply Increases without Demand Increases

- Low Prices
- Less Plantations*

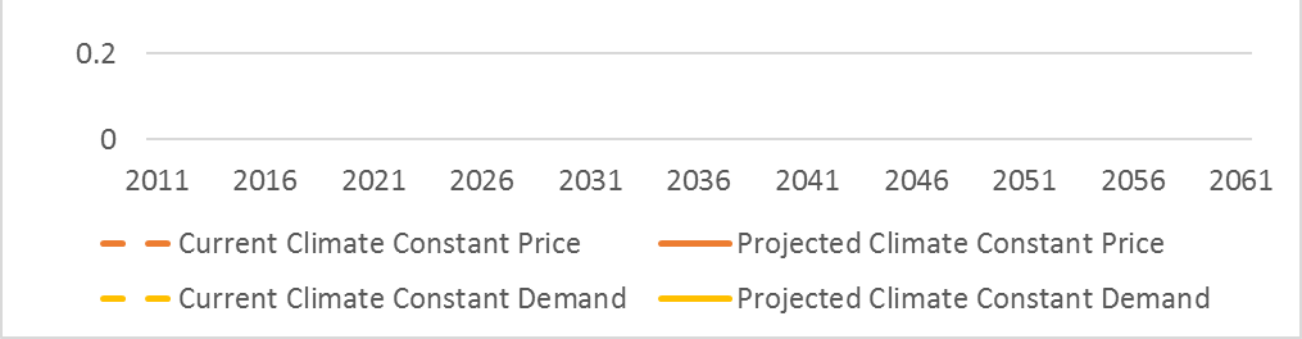
Plantation Carbon



Dashed Lines --- current growth Solid Lines – Pinemap growth

Orange Lines – Constant Price/Higher Harvest

Yellow Lines – Constant Demand/Lower Harvest

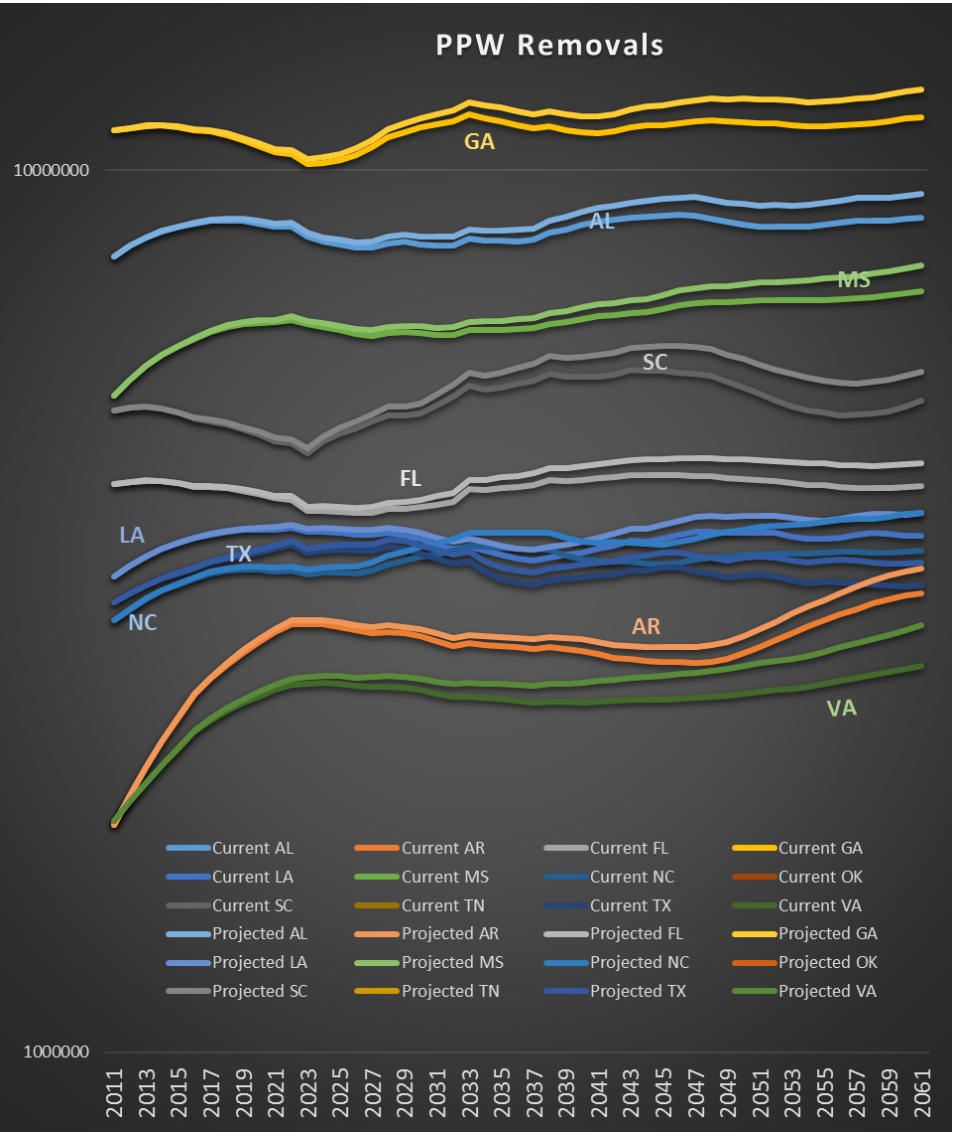


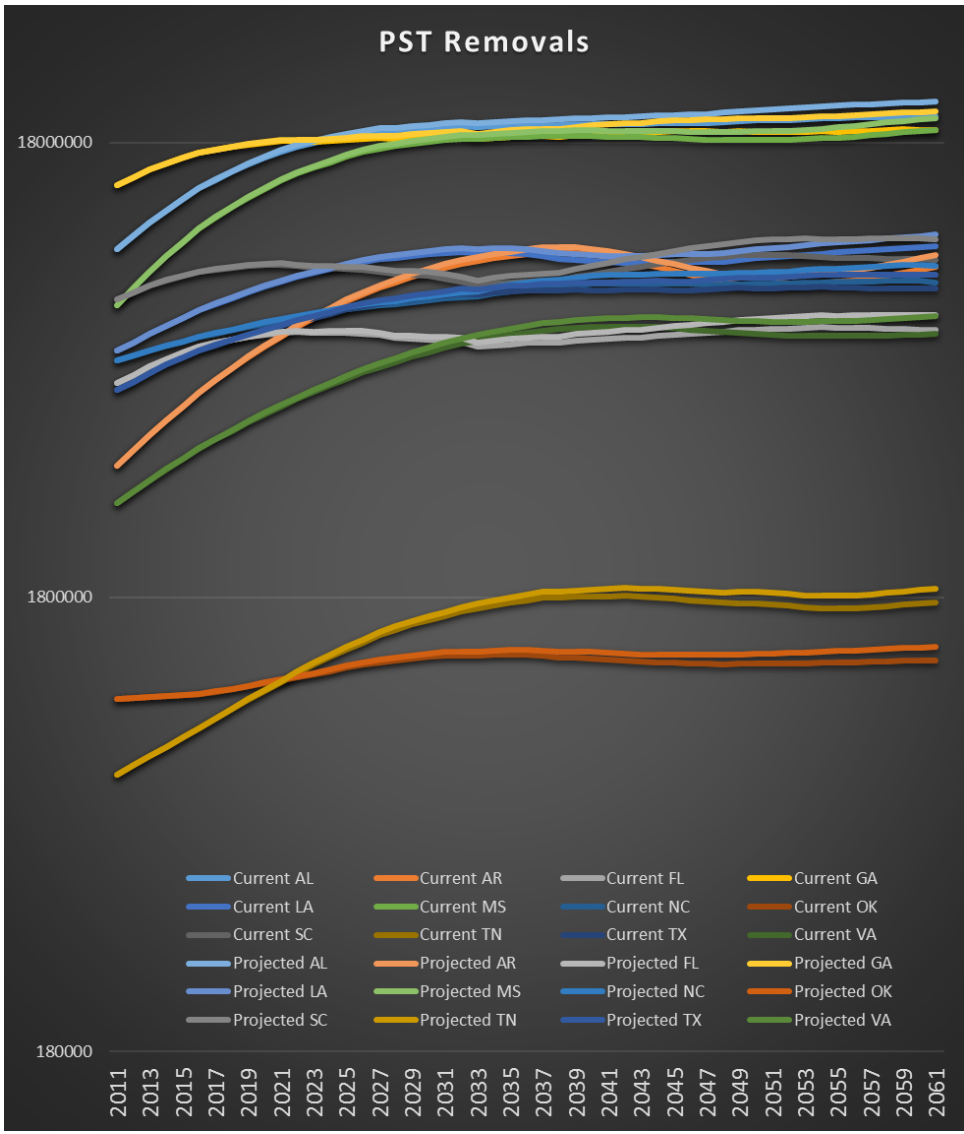
Spatial Implications

- Each regions starts with:
  - Current growth rates
  - Current age class distribution
  - Current growth/removal pressure by product
- Spatial Comparative Advantage
  - Pinemap growth has spatial signature
  - Speed of its impact affected by inventory turnover

Constant Price Removals - Climate Effect

By State/Product

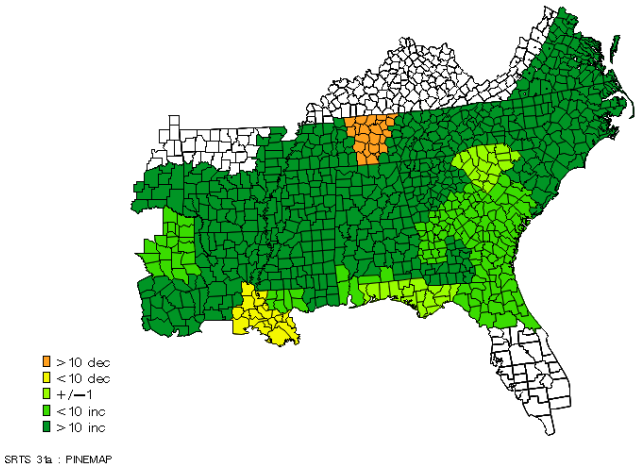




Spatial Shift Over 50 Years – Constant Price with Pinemap Growth

SY Pine Pulpwood Inventory

SU absolute %ch by 2061



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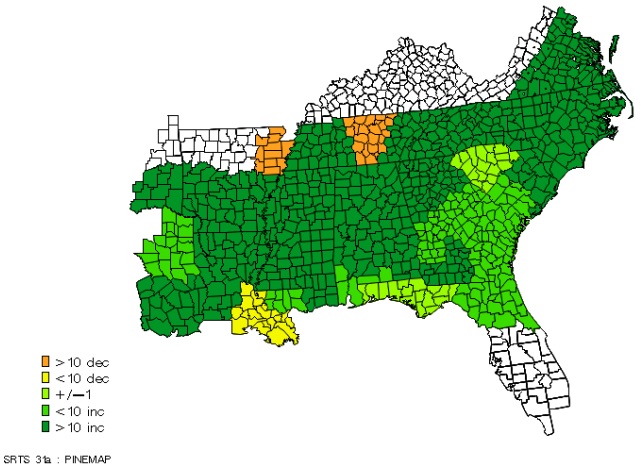
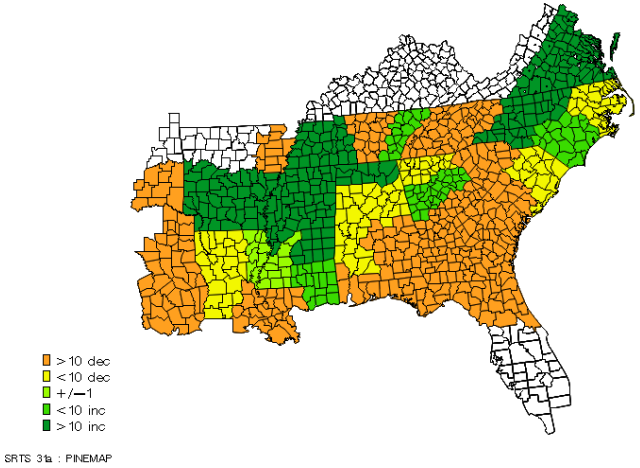


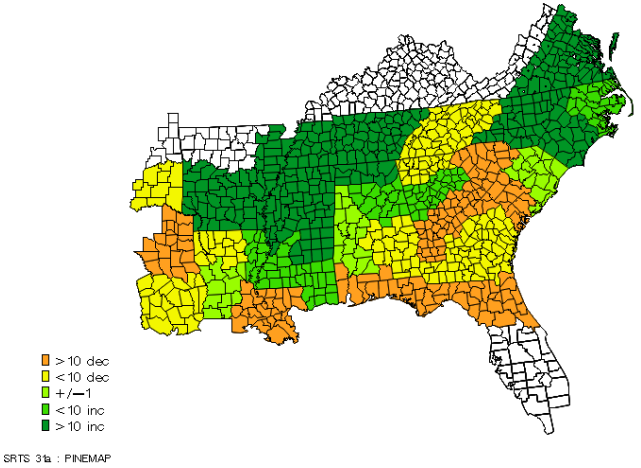
SY Pine Pulpwood Inventory

SU %ch by 2061 relative to 28% southwide



SY Pine Pulpwood Removals

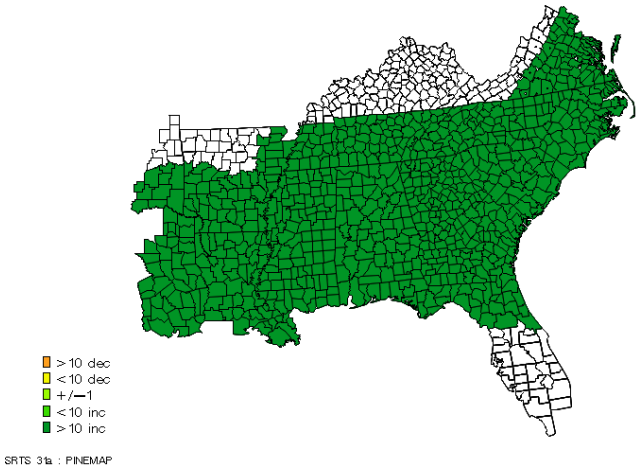
SU %ch by 2061 relative to 23% southwide



Spatial Shift Over 50 Years – Constant Price with Pinemap Growth

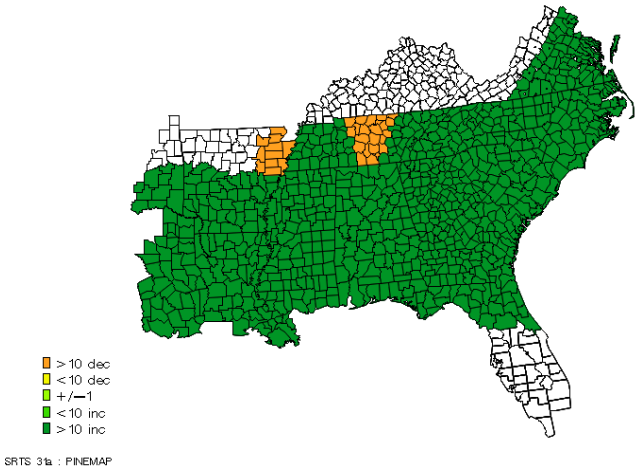
SY Pine Sawtimber Inventory

SU absolute %ch by 2061



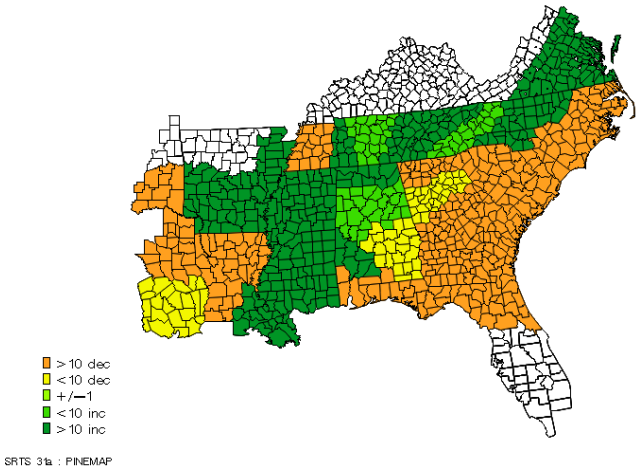
SY Pine Sawtimber Removals

SU absolute %ch by 2061



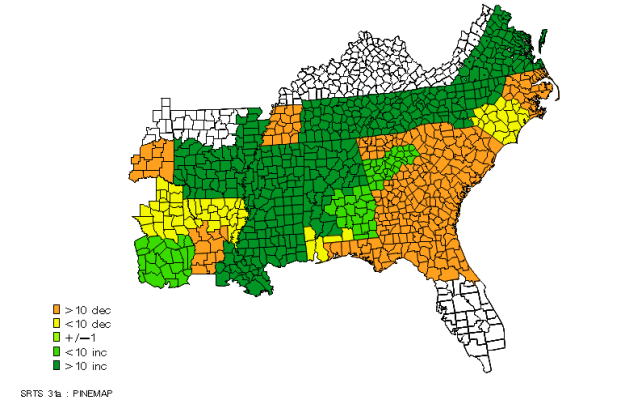
SY Pine Sawtimber Inventory

SU %ch by 2061 relative to 104% southwide

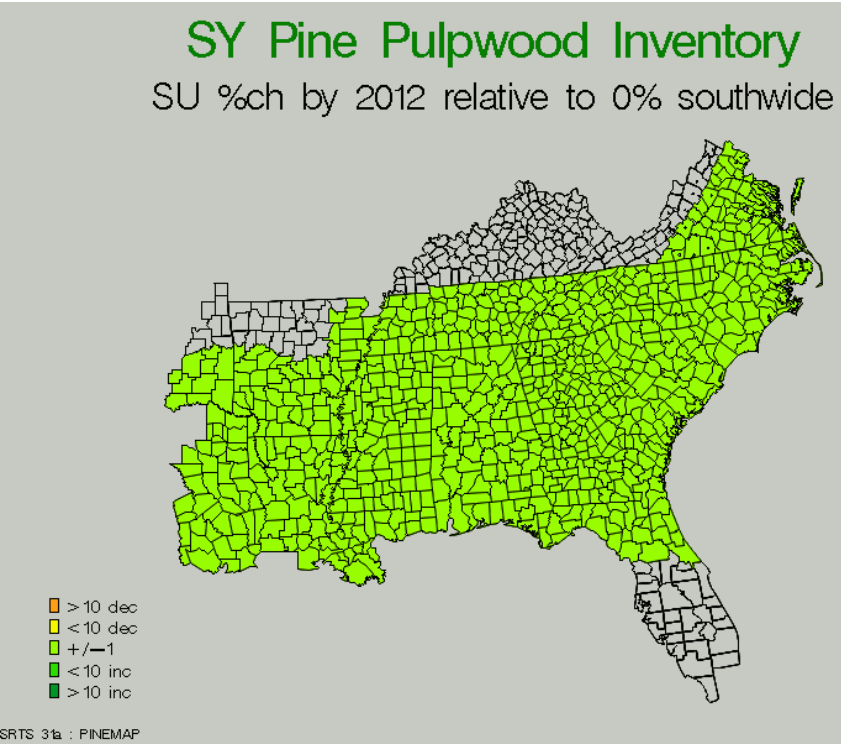


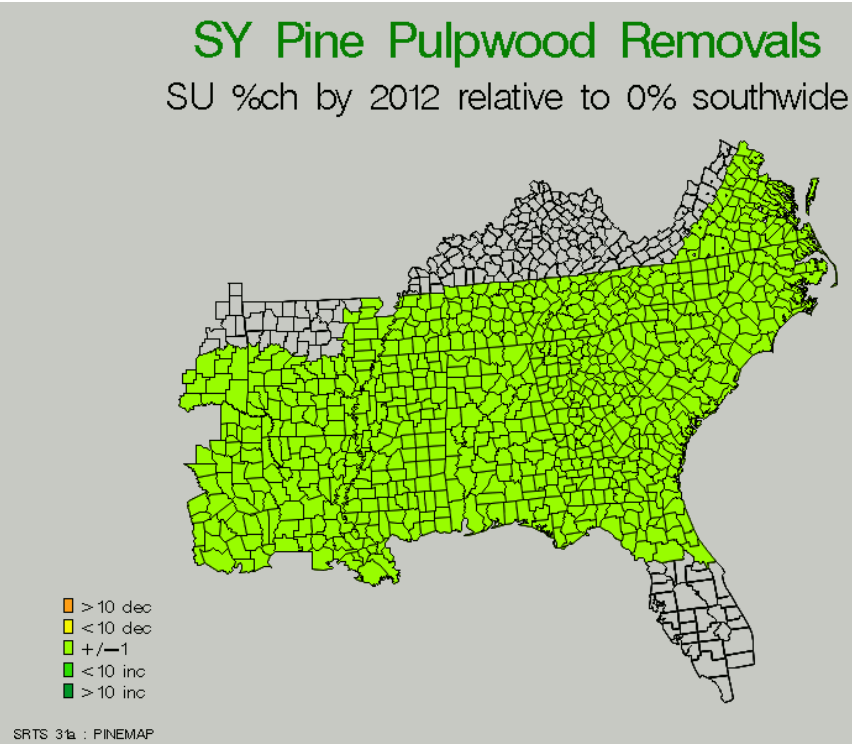
SY Pine Sawtimber Removals

SU %ch by 2061 relative to 85% southwide

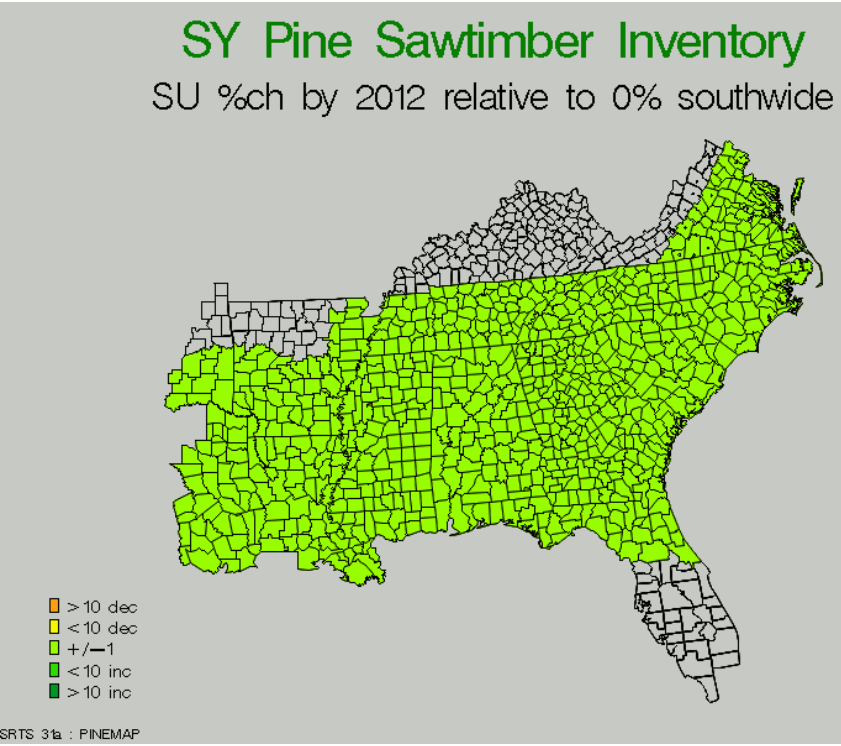


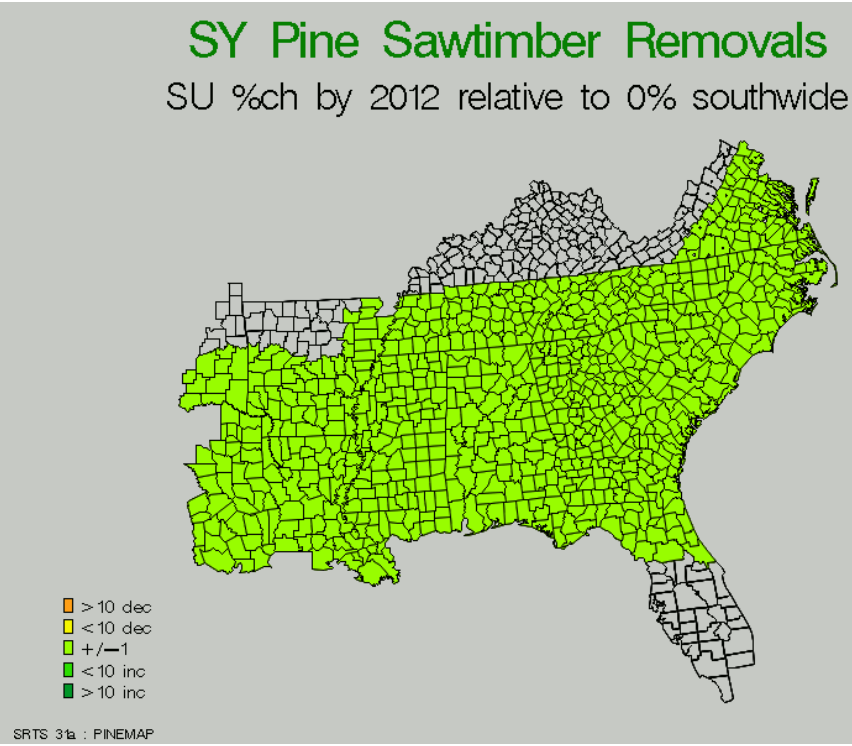
Price Mode | Pine Pulpwood





Price Mode | Pine Sawtimber





Conclusions

- Higher inventory and removals:
  - Stock effects are significant but relatively small
  - Affects spatial comparative advantage
- Likely to:
  - Concentrate harvest even more on plantations, leading to carbon gains in natural forest stocks
  - LCA effects could be dramatic due to relatively cheaper wood

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Caveats - Next Steps

- Effects probably optimistic due to no incorporation of risk effects (pests, drought, hurricanes, etc.)
- Need to vet methodology with Pinemap scientists
- Next steps
  - High demand scenarios
  - Land use response
  - Link to LCA?
  - Publications

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Questions?

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