ENVIRONMENTAL IMPLICATIONS OF THE EU'S INCREASED RELIANCE ON WOOD PELLETS FROM THE SOUTHEAST US

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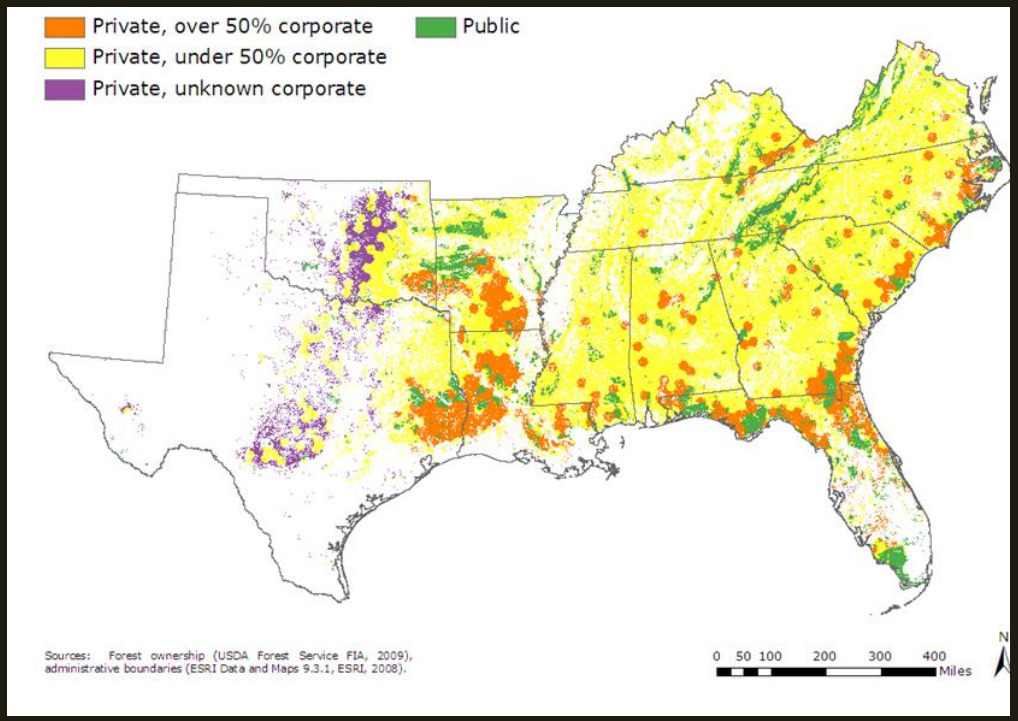
Agenda

1. Key points about the southern forest system
2. Implications of pellet sector supply needs
3. Environmental implications of growth of industrial pellets
4. Analysis of forest attributes in procurement area

Southeast US

KEY POINTS ABOUT THE SOUTHERN FOREST SYSTEM

Forest Ownership



- About 60% total forestland is NIPF, 29% total is corporate/industrial.
- A majority of NIPFs harvest despite only ~41% on the Coastal Plain citing timber as primary objective.
- Not many NIPF holdings are covered by a written management plan, 13% receive advice.
- No plan = increased risk of not identifying biodiversity and not adopting other SFM practices.

Source: National Woodland Owners Survey; WRI.

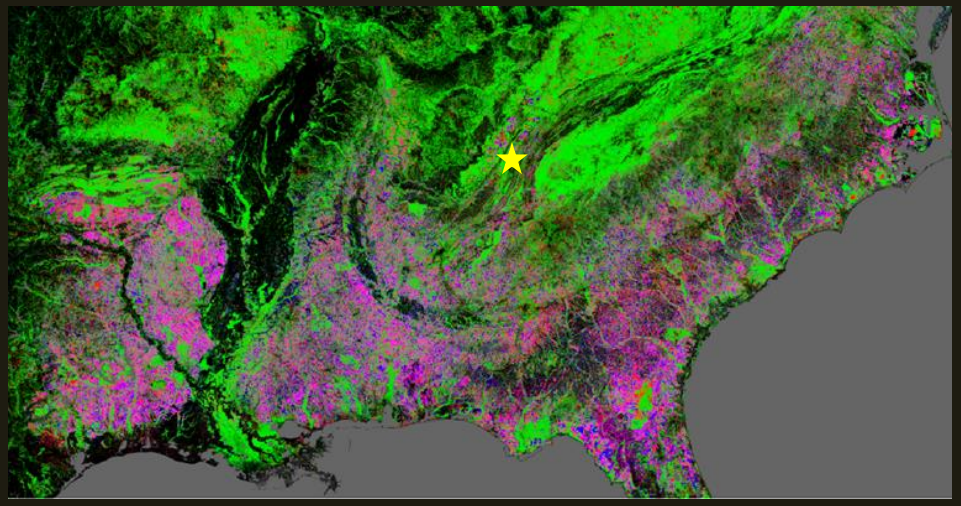
Forest Industry

- Southeast US:
  - ~60% of US timber
  - 17 – 28% of global roundwood (1999 and 2012)

- +16 million Ha of pine plantation (~19% of the forest)

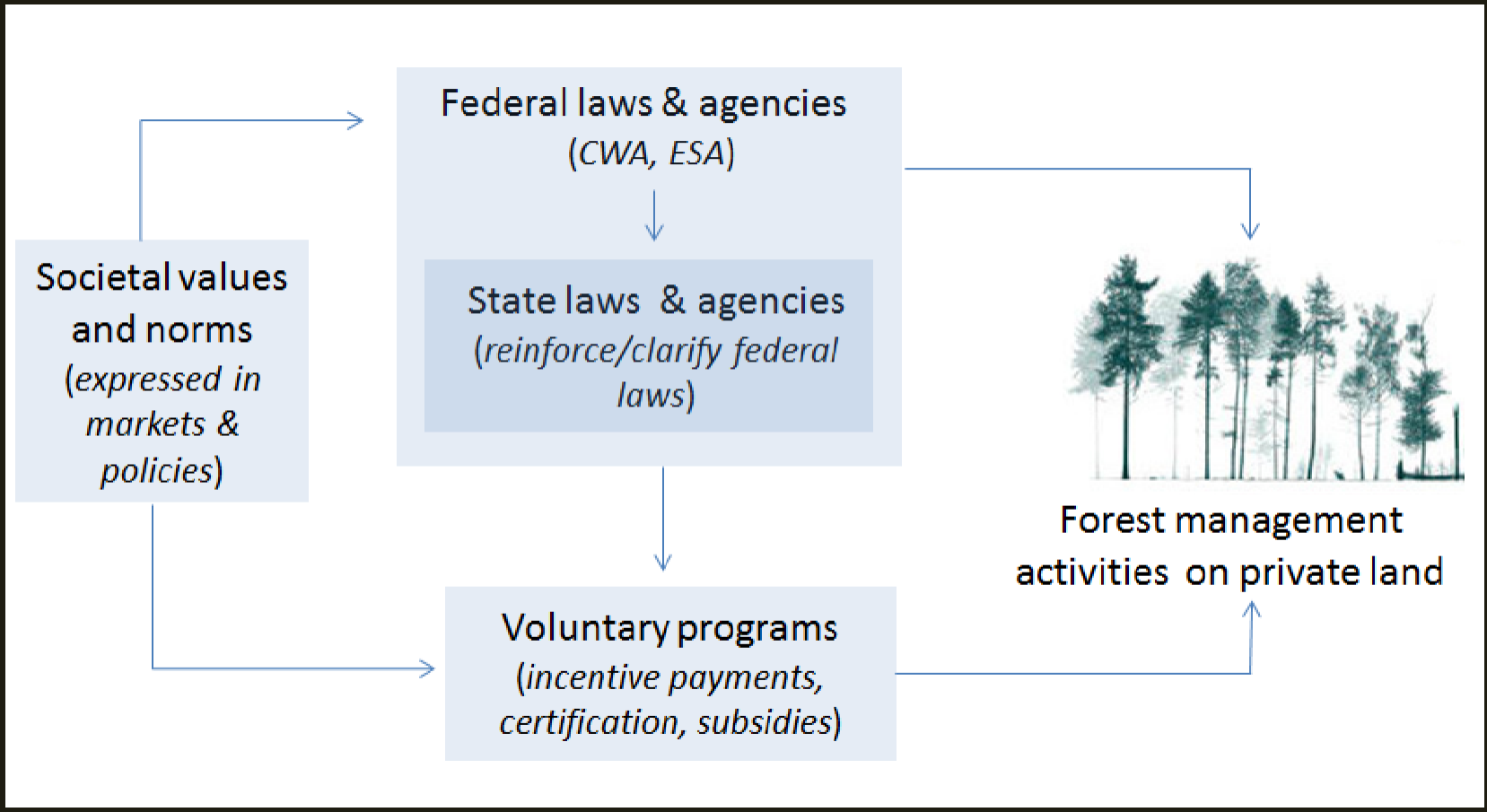
  - ~18% global softwood supply
  - 22% softwood pulp production
  - ~90% of fluff pulp production

- Plantations drove much of the inventory and carbon stock expansion over the last ~60 years



Source: Wear and Greis, 2013; RISI, 2015; Hansen et al., 2013.

Policy Framework



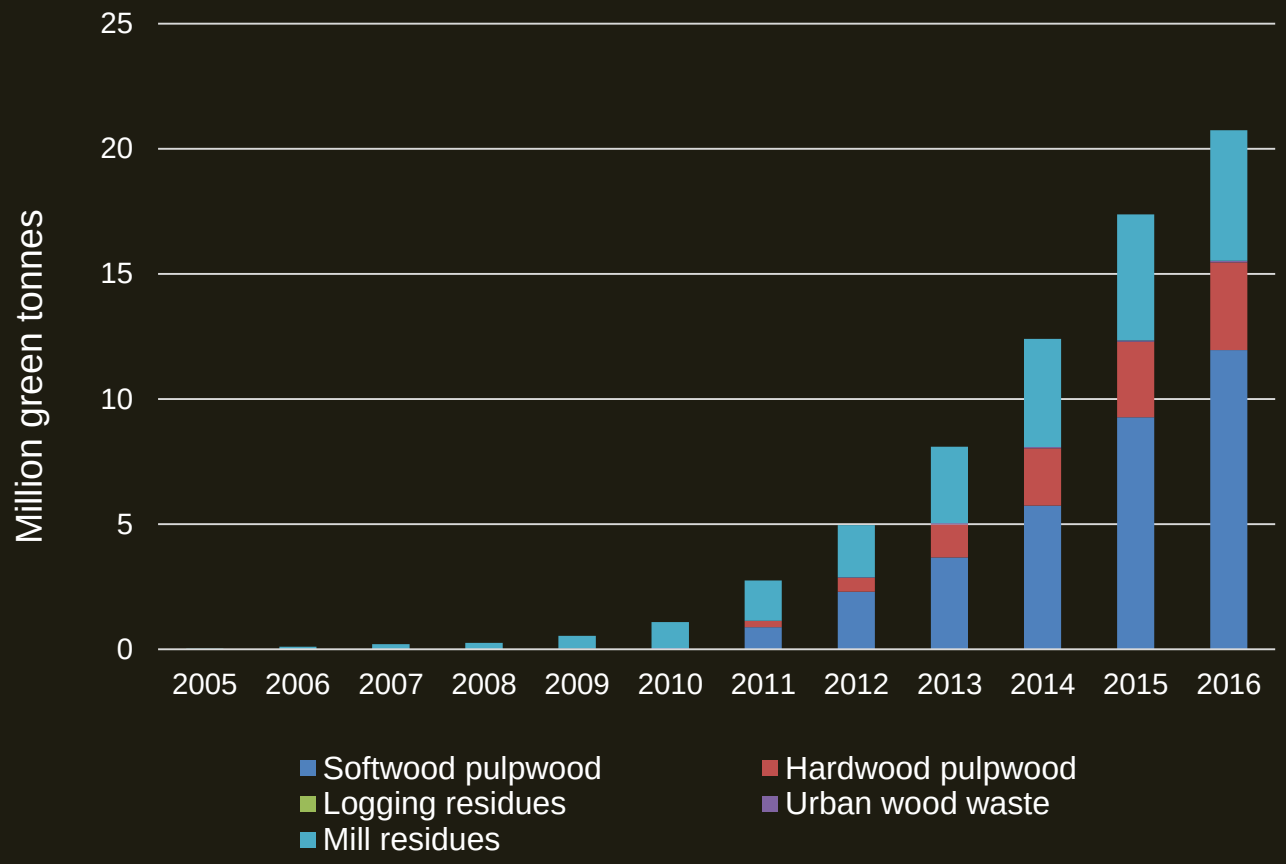
Forest Bioenergy

IMPLICATIONS OF PELLET SECTOR SUPPLY NEEDS

Industrial Pellet Feedstock Supply

- Installed capacity: 9.1 million tonnes (May 2015). ~11 million tonnes expected 1/1/2016.
- Volume exported: ~4.5 million tonnes in 2015.
- Capable of utilizing hardwoods or softwoods.
- Supply = Lowest cost/lowest ash-content fiber + sustainability criteria + cost limitation.

Actual or Announced Feedstock Supply



- Non-sawtimber roundwood bought as roundwood, mill residuals, in-woods chips, microchips.

Source: Adapted from Abt et al., 2014.

Projected Supply Needs for Wood Pellet and Non-pellet Bioenergy

	2015	2020
	Million green tonnes (~50% mc)	
US Southeast pellet production	9 to 27	9 to 49
US Southeast non-pellet bioenergy	6 to 21	10 to 29

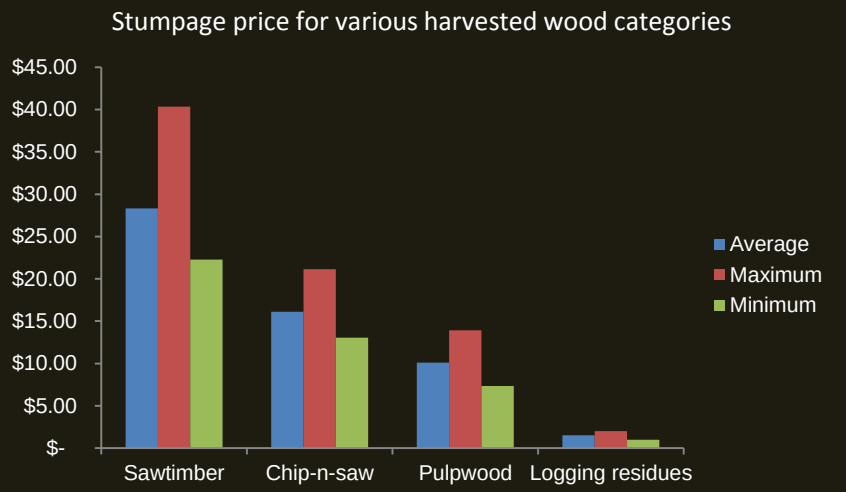
- 22 million GT = ~20% of current pine pulpwood supply for paper production in the South
  or
  168,654 Ha/year of total growing stock of average pine plantation,
  or
  549,216 Ha/year thinning of all small/medium trees (3.4% of all plantations annually)

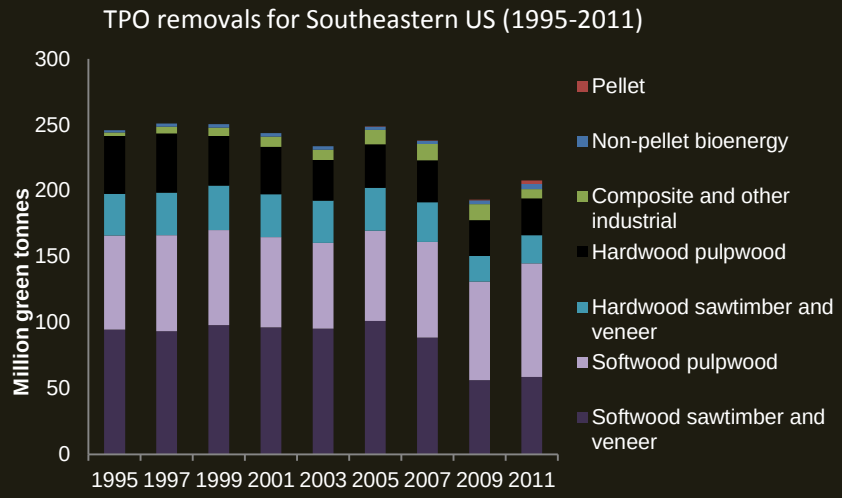
- Domestic demand for co-firing is uncertain, dependent on Clean Power Plan/accounting.

Source: Adapted from Abt et al., 2014. Cocchi et al., 2011; Forisk Consulting, 2014; RISI Inc., 2013.

Market Dynamics

- Exports spurred on by subsidies during recession/housing downturn. Paying capacity of pellets is debated and has significant implications.
- Forecasted 2025 demand for pellets and bioenergy yield large non-sawtimber pine roundwood price hikes (Abt et al. 2014).
- Increased pine pulpwood prices are in part attributed to pellets. Also associated with slack sawtimber demand and increased pulpwood demand elsewhere.





Source: Abt et al. 2014; Prisley 2014; Forisk 2014; RISI; Abt, 2014; Abt et al., 2014.

Market Dynamics

- Pulpwood consumption by traditional industry is projected to increase ~7% by 2019 from a 2014 baseline.
- Since 1998, a **29.5 million GT reduction** in pulpwood demand (mostly hardwood) from other pulpwood-based industries. Pellet mill demand at total capacity (operational, announced, under construction) equals a **25.9 million GT increase**.
- At least 7 examples of pellet mills locating in gaps of pulpwood demand, environmental consequences?
- Use of logging residues (i.e. slash) to reduce competition and increase environmental benefits?
- Will pellet expansion be constrained by price increases?

Source: Forisk Consulting; Hawkins Wright; Forest 2 Market; Abt et al., 2014; RISI.

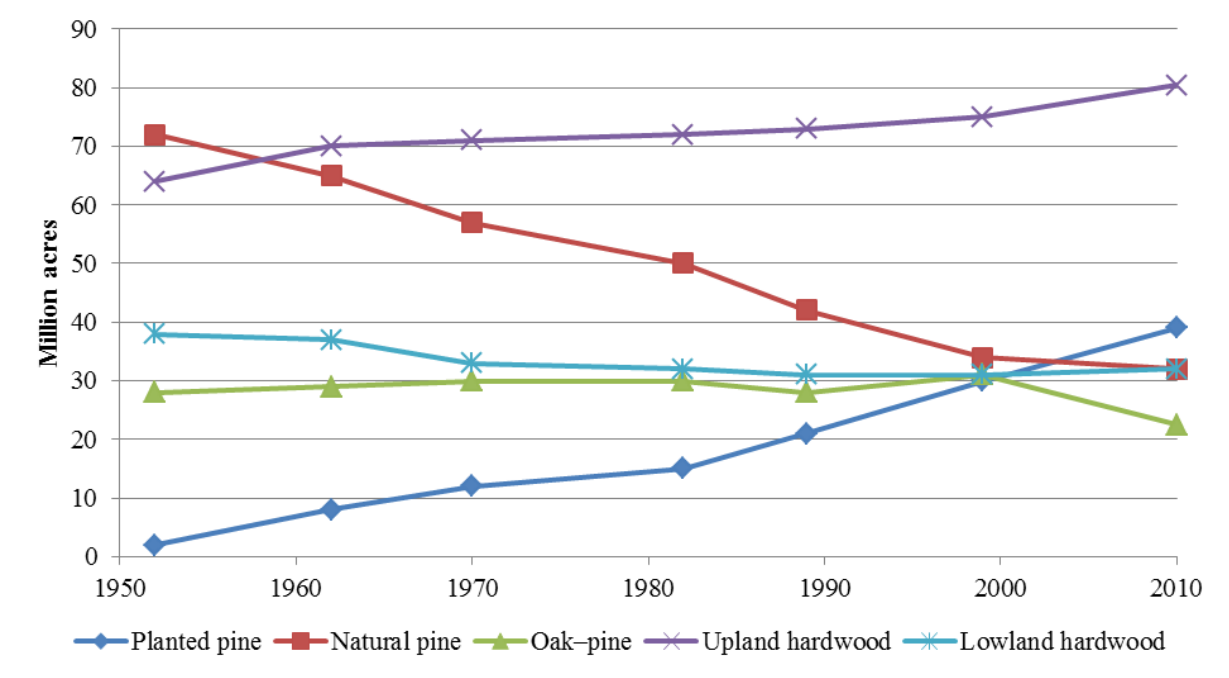
Forest Bioenergy

ENVIRONMENTAL IMPLICATIONS OF GROWTH IN INDUSTRIAL PELLETS

Forest Type Conversion and Land Use Change

- Up to ~10 million Ha of forest loss forecasted by 2050 (USFS and USGS).
- Conventional wisdom: "*the forest that pays in the forest that stays*."
- Acrimony stems in part from a lack of recent empirical data in the models used to examine the role demand plays in reducing land use change (*incentivizing reinvestment in forests*) and/or facilitating conversion (*making land clearing more cost-effective*).
- The forecasted land-use scenarios of Abt et al. (2014) suggest that plantation acreage expands out till about 2025, ~2.4 million Ha additional planted pine.
- While increased prices yield more planting, high pulpwood prices alone are unlikely to justify forestland ownership/retention given competing uses.

Forest Type Conversion and Land Use Change



- Plantations rapidly expand in response to markets. Further expansion forecasted.
- Policy framework does not limit conversion of natural forest to plantations.
- Is the past the prologue for the future?

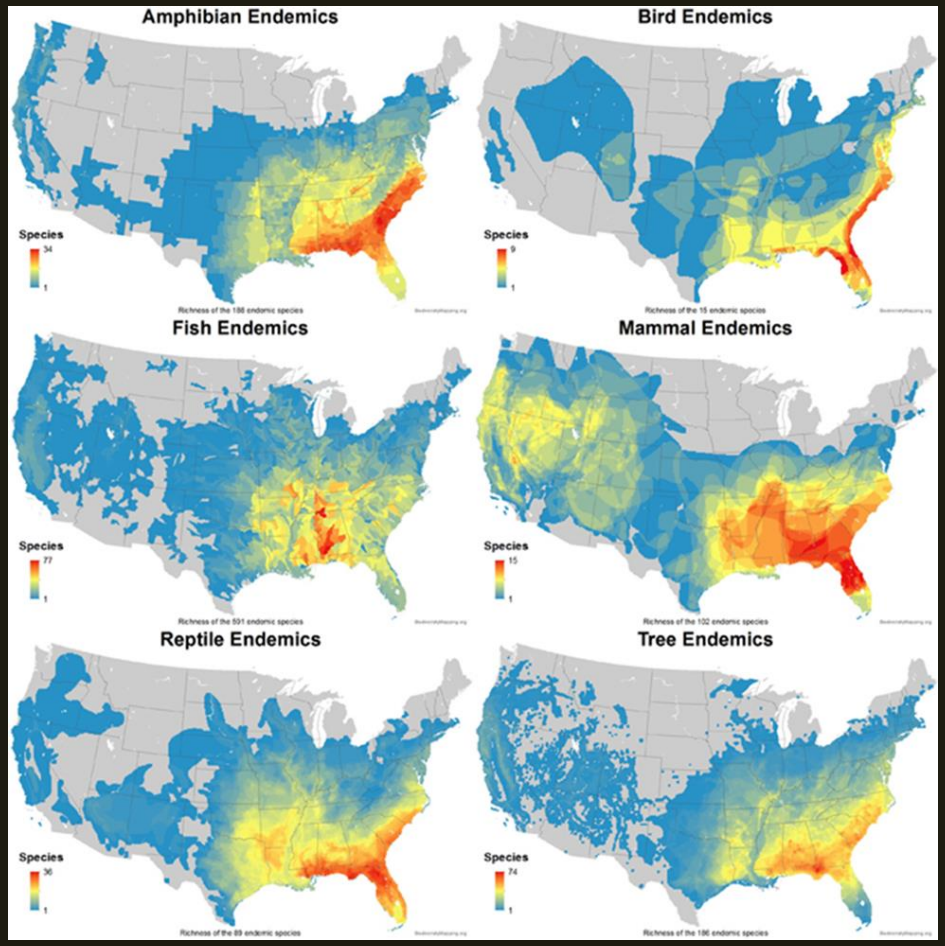
Source: Wear and Greis, 2013.

Forest Type Conversion and Land Use Change

- Plantation expansion forecasted even without full return of sawlog markets.
- First pressure point on biodiversity.
- Increasing plantation acreage could result in a tradeoff between carbon storage and biodiversity.
- Policy framework does not limit conversion of natural forest to plantations, certification programs handle this issue differently.

Source: Wear and Greis, 2013.

Pressure on Biodiversity



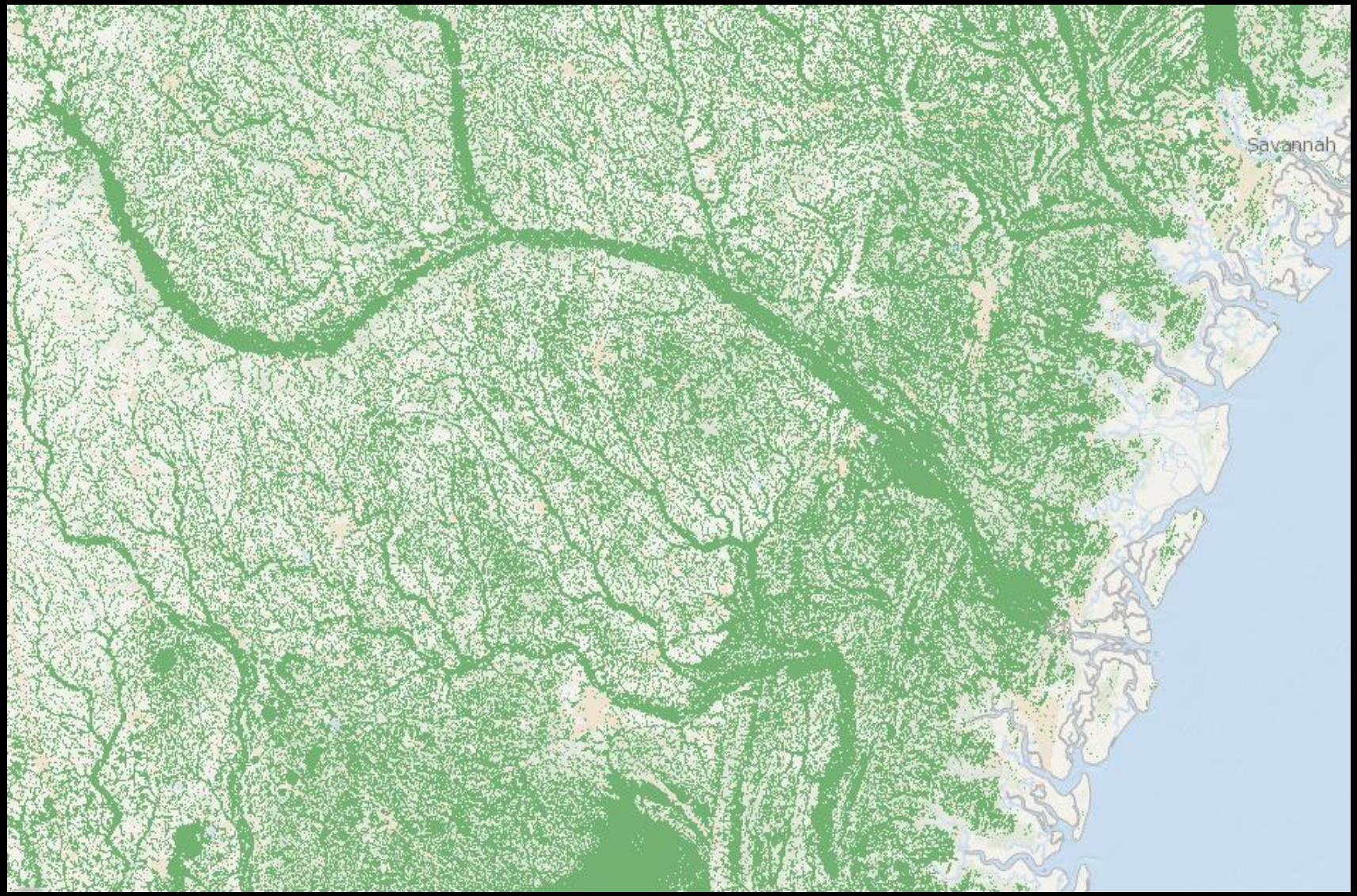
- Globally significant biodiversity (Coastal Plain designated the 36th global biodiversity hotspot)
- 11% of species are “at-risk” (i.e. vulnerable, imperiled, critically imperiled, or thought to be extinct). (NatureServe, similar to IUCN)
- Habitats of concern on Coastal Plain: Naturally-regenerated pine, forested wetlands. ID’ed by US Forest Service, FSC US, and others.
- Most of these habitats and spp. occur on privately owned land without protected status.

Source: Jenkins et al., 2015; Wear and Greis, 2013; FSC US, 2015; Critical Ecosystem Partnership Fund, 2016.

Pressure on Biodiversity: Forested Wetlands

- 12 million Ha (lowland plantations, Cypress, bottomland hardwoods).
- 12% in +80 year age class
- Many contain high biodiversity (e.g. +70 tree species) and high carbon stocks.
- Loss/degradation a concern. By 1985, about 30% of the original extent drained and converted to other uses.
- ~25% of forested wetlands in North Carolina converted to pine plantations (1950 – 1990).
- Cypress declined in Georgia 16% , 1991 - 2005.

Source: Hefner and Brown 1985; Spring, 1991; Conner et al., 2012.



Forested Wetlands in the Coastal Plain in southeast Georgia. Note the city of Savannah in the upper right corner.

Source: South Atlantic Landscape Conservation Cooperative, National Land Cover Database (2011).

Pressure on Biodiversity: Naturally-Regenerated Pine

- Naturally-regenerated stands produce about 1/3 volume of intensively managed plantations.
- Longleaf, 25% of terrestrial spp. in US and Canada, only ~2% remaining.
- Significant recent losses. By the mid-2000s, a ~35% loss (+300,000 Ha) of the extent of the early-1990s.
- Remaining fragments of Longleaf and Shortleaf are scattered under varying protections.
- In Georgia, 87% of longleaf is in private ownership, mostly small NIPF parcels.

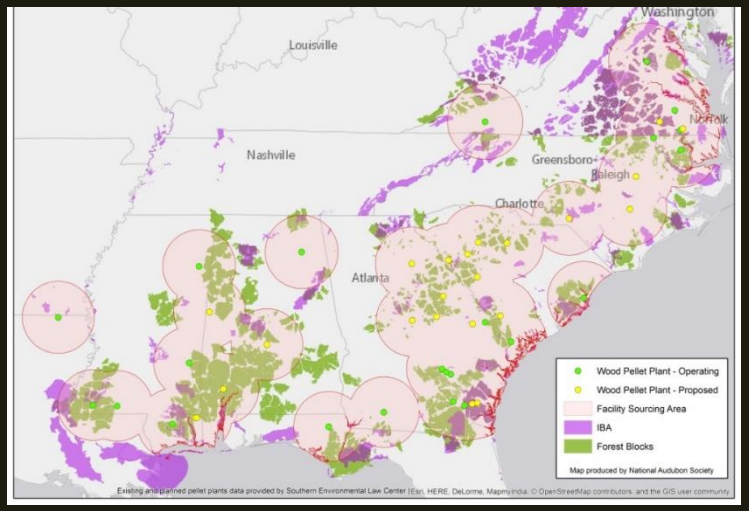
Source: Frost, 1993; US Forest Service.

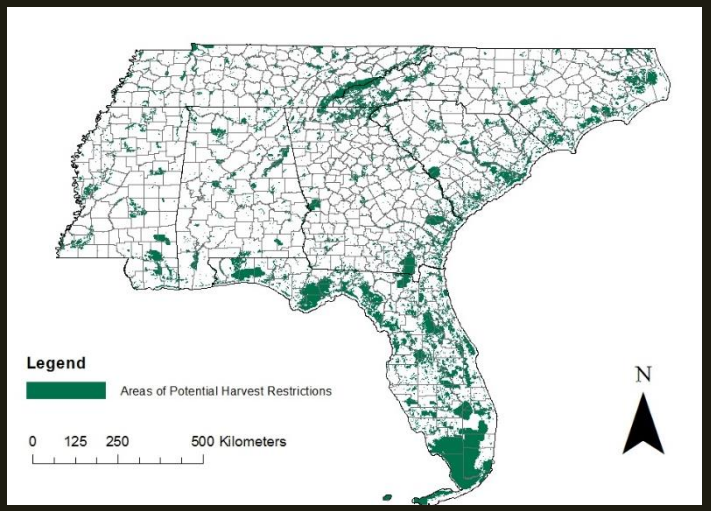
Pressure on Biodiversity

- Wood pellet mills have sourced from areas identified as having high biodiversity.
- A major point of contention with US ENGOs is the removal of trees they feel would have otherwise remained, raising concerns on: (1) biodiversity, (2) carbon sink.
- The price ratio between sawtimber and pulpwood is at a 20-year low. In some locations larger logs from hardwood forests are going into the production of industrial wood pellets.

Source: National Audubon Society, 2015; Galik and Abt 2015; Jenkins et al. 2015.

Pressure on Biodiversity





- No broad agreement on which areas matter the most.
- Claims of risks and sustainability need to be critiqued and defended.
- Examples of compromise exist. Georgia Pacific & Dogwood Alliance; 2.2 million Ha of ecologically sensitive areas removed from supply chain. Enviva removing some wetlands with high biodiversity value. Staples and Domtar increased FSC certification (+100,000 Ha in less than 2 years).

Source: National Audubon Society, 2015; Galik and Abt, 2015.

Debate on GHG Emissions

- Leakage can have positive or negative consequences for GHG mitigation and there are likely trade-offs between biodiversity and carbon.

- Arguments for:
  - At the regional and state level, timber volumes in multiple forest types continues to expand with net-growth exceeding timber removals.
  - Increased harvesting is forecasted, but removals are unlikely to outstrip growth region-wide.
  - Planting response means lower net emission over the long-term.

- Arguments against:
  - Opportunity costs or counterfactual scenarios.
  - Removals in supply areas can lead to local effects (biodiversity, G:D < 1, increased heterogeneity, short-term carbon sink decline .
  - Carbon sink is declining (USFS), why accelerate this in the short term?

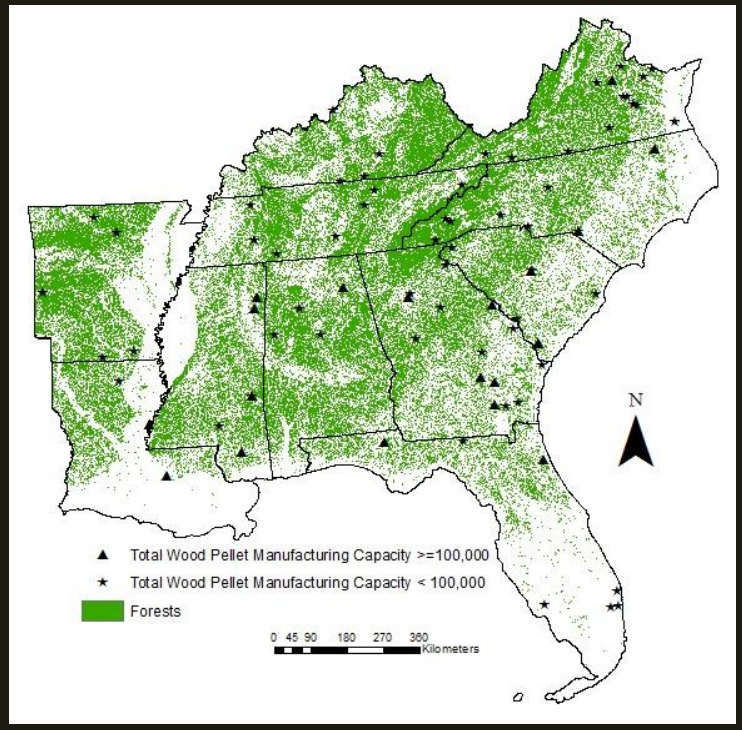
Source: Abt et al., 2014; RISI; Hawkins Wright; Forisk.

Southeast US

ANALYSIS OF FOREST ATTRIBUTES IN PROCUREMENT AREA

Analysis of Forest Attributes in Pellet Procurement Areas

- Systematic *ex post* assessment of forest attributes from FIA Database (2006, 2009, 2012). Net effects determined by statistical model.
- Pellet plant location and capacity from Wood2Energy Database.
- Limited time period due to data availability. Capacity more than doubled, 2012 – 2015.
- A framework for continued monitoring?

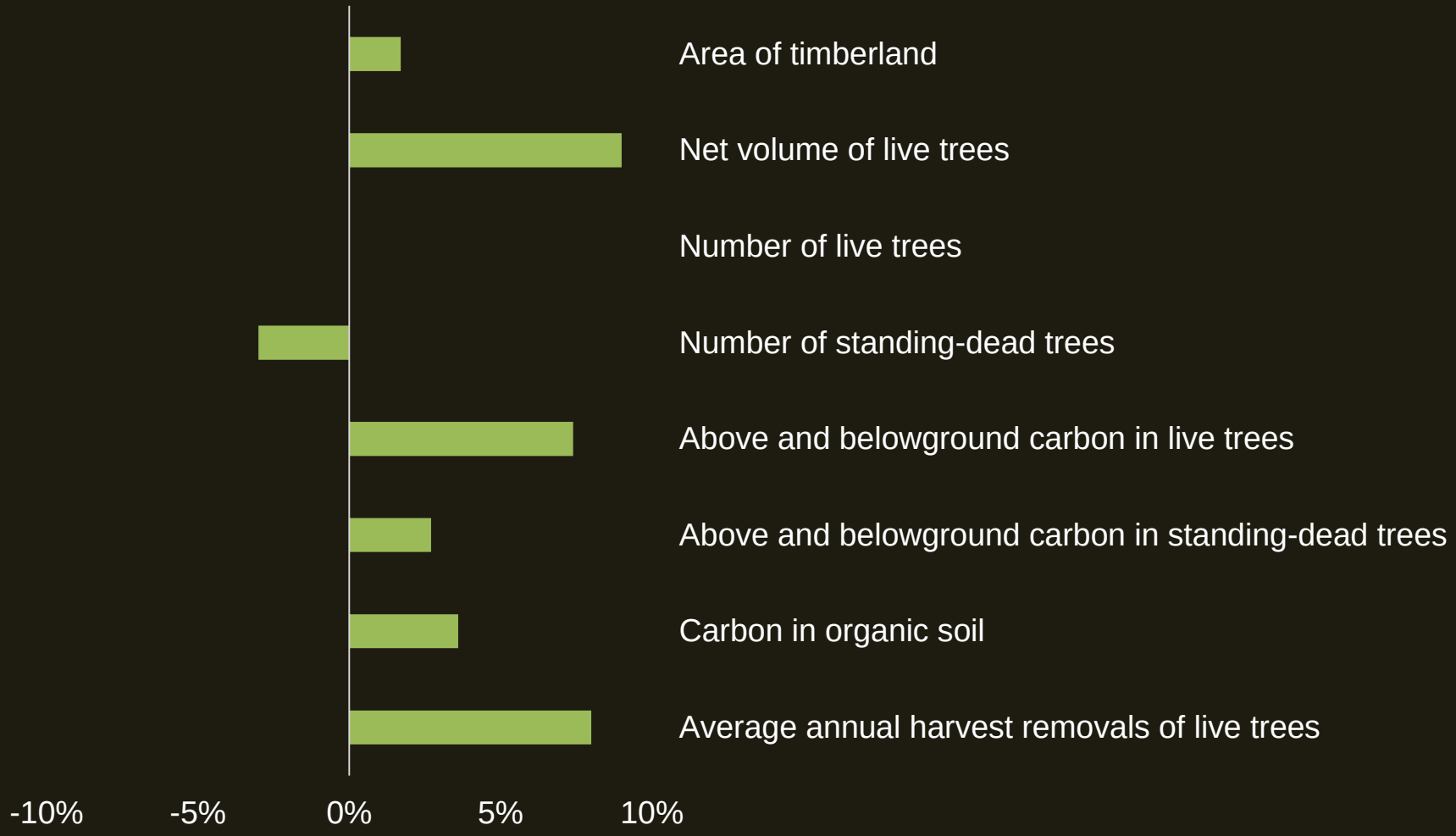


Analysis of Forest Attributes in Pellet Procurement Areas

Total number of wood pellet plants in sample	79
Total area sampled in estimation (ha)	160,711,140.2
Estimated average FIA field sample plots (total)	33,094
Estimated average FIA field sample plots (annual)	6,618

Trends in Forest Attributes within Southeast US Pellet Plant Procurement Areas (2006 – 2012

Preliminary Results



Ex Post Analysis Preliminary Findings

Preliminary Results

Results for pellet mills >100,000 tons/year on the coastal plain

- A slight decline in timberland area detected.
- A 10% decline in the number of loblolly/shortleaf pine trees on coastal plain which suggests thinning and pine pulpwood feedstock.
- 2009 – 2012 bottomland hardwoods, a decline in the # of live trees and an early indication of a decline in the volume of live trees and the associated carbon pool, early indication of a decline in the # of standing dead trees and associated carbon pool.

Results for pellet mills across the entire southeast

- No significant changes in observed trends regarding timberland area associated with EU pellet demand (2006 – 2012).
- No discernible effects on above and belowground carbon in live trees, nor changes in carbon in organic soil, across the region (2006 – 2012).
- Across the region (2006 – 2012) there was a decline in the # of standing-dead trees and a slight decrease in associated carbon pools.

Thank you!

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