Presentation to the Biomass Research & Development Technical Advisory Committee
September 18, 2019
Pete Madden
Principal, Edgemere Consulting, LLC
Pellet supply - why the US?

U.S. has >750M acres of forest land

U.S. Forests surveyed and growing substantially

U.S. forests are the same size now as they were in 1930 and have been growing year on year since the 1950s - volumes have increased by over 50% in the last 50 years

Protected by statutes, regulation and BMP’s

Designed to ensure forests continue to grow

Sustainable forest management

U.S. South

Climate supports short timber rotation 25-28 yrs pine

Very significant volumes available

Current harvest is 300Mt to 350Mt /yr

Forest residuals are under used

On average 50% more growth than removals

87% of Forests are privately owned

Net volume of trees per acre has increased

Historic CRP program benefits

Sources:
Forest area – USGS National Land Cover Database 2001
Ownership – CBI Protected Areas Database, Version 4.0
USFS Forest Inventory & Analysis (FIA)

- Continuous growth and yield plots started with the McSweeney–McNary Act of 1928
- Today comprises of 4.5 million remote sensing plots, 125,000 permanent field plots, over 100 characteristics measured on each plot, 1.5 million trees sampled
  - Volume/Diameter/Height/Vigor/Species/Condition/Growth/Mortality/etc.
- Congress mandated a national assessment of the nation's renewable resources through the Forest and Rangeland Resources Planning Act of 1974. (RPA)
- According to the USFS, America’s low point for forested land was around 735 million acres in 1920. By the year 2000, that number was up to 750 million and has remained near those same levels for decades.
Loblolly Pine Resource
Loblolly Pine is an early successional tree species
Mass Controlled Pollination (MCP) Example
Pulpwood and Chip Demand in the South: Hardwood and Softwood

Source: Forisk Consulting
International Paper to Close Alabama Mill

Weakening Demand in Digital World Displaces 1,100 Employees

By Bob Titus
Updated Sept. 12, 2019, 9:37 a.m.

International Paper Co. plans to close its biggest paper mill, displacing 1,100 workers and citing shrinking demand for paper in an increasingly digital world.

For workers at the Courtland, Ala., plant, the timing of the announcement couldn’t have been worse. It comes a day after the company, whose sales and profit have been going from bad to worse, announced it had cut its dividend 17% and said it would buy back $1.5 billion of stock.

With more consumers emailing, paying bills online and storing files electronically, the market for copy paper and envelopes it once dominated is falling for the past decade.

LP shuts Athens, Georgia, and Silsbee OSB mills

15 March 2010

Louisiana-Pacific (LP) has permanently closed its OSB mills in Athens, Georgia and Silsbee, Texas to the North American market.

During a recent conference call related to LP’s Q4 and full-year 2009 financials, the company said it has made the decision to go ahead with the permanent closure of both mills.

LP has been struggling to stay competitive in the OSB market, which has been hit hard by oversupply and weak demand.

International Paper closes pulp mill in Louisiana

International Paper on Monday announced it will close the 100 percent pulp mill operating at its North Louisiana site, with a weak economy across the region and a lack of pulp orders.

We have carefully reviewed our pulp demand by our customers and required additional capacity to reduce our pulp production and close the mill indefinitely,” said Wayne Bradlow, president of the company’s North American pulp and paper operations.

Pulp & paper industry sees more than 60 mill closures in past year

More than 60 pulp and paper mills were closed and 35 idled production from 2013-2014

BOSTON, MA, Jan. 22, 2015 (Press Release) – These and other important changes in global pulp and paper mill production were published recently in the Lockwood-Post Directory. The directory is produced by RISI, the leading information provider for the global forest products industry.

“Understanding mill operation globally is critical for those competing for business in the industry. The Lockwood-Post Directory readers to track critical changes that are taking place worldwide's most influential mills,” said Jon Roiger, Senior’s Analytics and head of the Mill Intelligence Services division.

News alert: Georgia Pacific to lay off 700 at Port Hudson facility

By Stephanie Riegel - January 10, 2019

Georgia-Pacific will close Jarratt plant Nov. 1, lay off 79 employees

Production at fiberboard factory will be moved to facility near Houston

The company said the Jarratt facility had been operating for 52 years and was located in Southside, Virginia.

The Atlanta-based company notified employees and local officials of the pending closure of its Greenville County facility Wednesday, a day after announcing plans to invest $150 million in a new fiberboard mill near the Fort Overton community.

Georgia-Pacific will move production from Jarratt to its new facility, which is expected to begin operations in late 2019.
Pellet Feedstocks

Forest harvesting

- **Sawlogs**
  Highest value, must be large and straight

- **Pulpwood/Thinnings**
  Low value, can be random size and shape

- **Residues**
  No value, waste product if no market, can be expensive to process

Mill residuals

- **Wood Chips**
  Highest value residuals, often used in pulp industry

- **Sawdust**
  Lower value, often used on site in kilns or biomass boilers

- **Dry Shavings**
  Requires minimal processing, readily adaptable for pellets
Wood BioEnergy Example

Benefits of forest-based feedstock
- Plentiful, renewable resource
- Mature industry supply chains
- Requires minimal irrigation, fertilization
- Ideal combustion characteristics

Benefits of pelletizing
- Efficient, cost-effective bulk transport
- Low moisture content = >BTU value
- Adaptable for use at coal-fired facilities
- Stringent specs = reliable performance
Pellet Industry Concentrated in U.S. South

23 Industrial Pellet Mills
8 Ports

Enviva 3.2M*
DBI 1.5M
Georgia Biomass 0.75M
Highland (via BRT) 0.6M
Fram 0.6M
Colombo 0.5M
Texas Pellets 0.5M
Westervelt 0.25M
Others 0.2M

Total (potential nameplate) 8.1M

(*MT)
Closed Industry Mills and Operating and Announced Pellet Mill Locations

Demand for roundwood and chips, green tons

<table>
<thead>
<tr>
<th>Closed Pulp/Paper and OSB Demand</th>
<th>Operating and Announced Pellet Facility Demand</th>
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<td>28,084,918</td>
<td>23,837,006</td>
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Note: demand is reported for roundwood and chips (including residuals). Pellet totals exclude facilities <200k short tons of pellet capacity (which represent an additional 2.0 million tons of wood).

Legend
Pellet Facilities Status
- Operating
- Proposed
- Under Construction
Closed Industry Mills Type
- Pulp/Paper
- OSB

Note: announced pellet mills shown pass Forisk viability screens. Map excludes pellet facilities <200k short tons of pellet capacity.

Source: Forisk Consulting - 2015
Drax Biomass Example

Morehouse BioEnergy
Bastrop, LA
525kt pa

Amite BioEnergy
Gloster, MS
525kt pa

LaSalle BioEnergy
LaSalle, LA
450kt pa

Baton Rouge Transit
Port Allen, LA
2Mt pa
Classified Landsat Image for ABE 1985
Classified Landsat Image for ABE 2015
Acres by Class for ABE 1985

Forest - 3,738,314 ac
NonForest - 2,317,744 ac
Water - 152,132 ac

Acres by Class for ABE 2015

Forest - 3,921,532 ac
NonForest - 2,075,351 ac
Water - 207,841 ac
Wood BioEnergy Manufacturing Process
Export Storage Domes at the Port of Baton Rouge
U.S. Bio-Energy Examples

Proctor and Gamble in Albany, GA has a 50-megawatt biomass-fueled steam and power plant.
U.S. Bio-Energy Examples

Graphic Packaging paperboard mill in Macon, Georgia converted to 100% biomass energy.

$80 million invested in high-efficiency biomass boiler and 40-megawatt turbine generator

CO2(e) emissions reduced by 200,000 tons per year

Excess electricity is placed on grid
“In the long term, a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fiber, or energy from the forest, will generate the largest sustained mitigation benefit.”

- IPCC Special Report on Land and Climate (Ch 4, 4.8.5, page 66)