



Woody Biomass Systems

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www.envivamaterials.com

Enviva Materials: Partnering with Industry for a Cleaner Future



Enviva Materials grows, harvests, and collects approximately 500,000 tons of energy-rich wood and crop residues every year and transforms them into biomass fuel for renewable energy applications.

Enviva operates biomass operations in the US, Europe, Latin America, and the Caribbean. We are known throughout these areas for our ability to source a wide variety of feedstock and adapt to any environment.



Common Forms of Woody Biomass



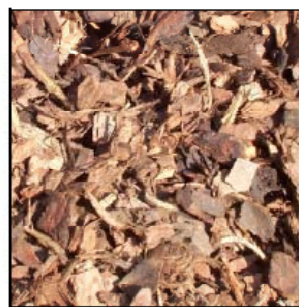
Processed Residues



Wood chips



Sawdust



Ground bark

Unprocessed Residues



Sawmill slabs



Logging residue

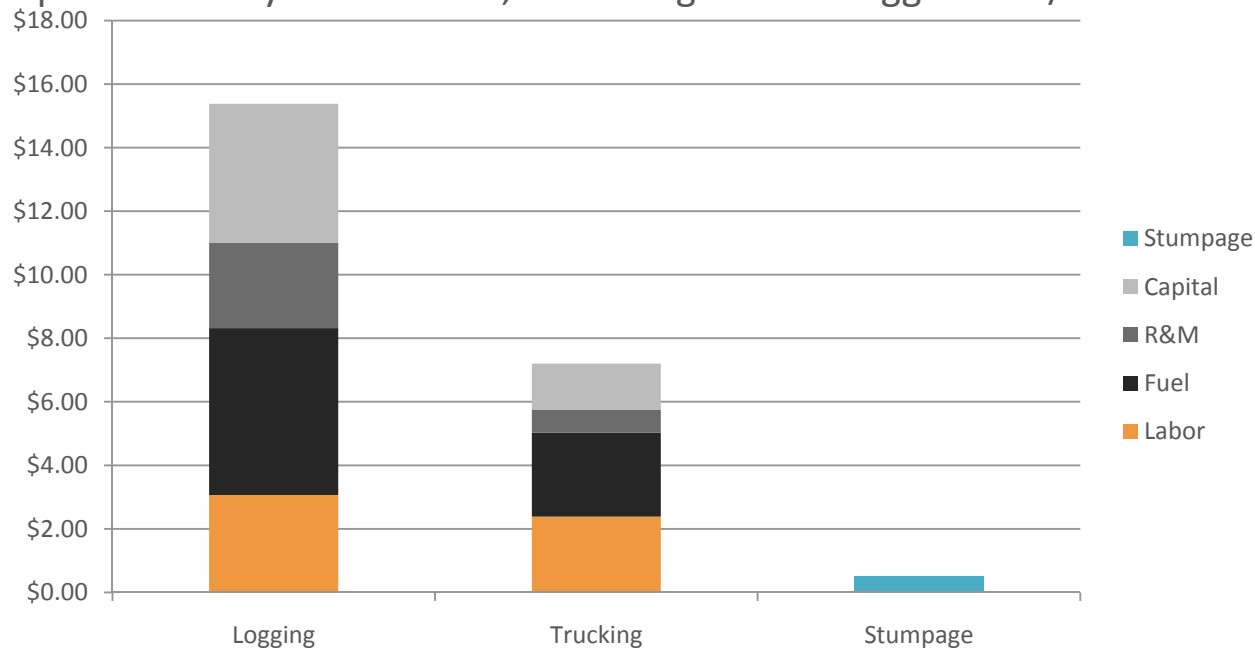
- **Primary forest products**, namely pulpwood and saw timber, are harvested as feedstock for paper mills and saw mills.
- **Secondary biomass** is generated by logging activities and forestry-related industries. This type of biomass includes tree tops, branches, stumps, sawdust, wood chips, and bark by-products of paper mills and saw mills.



Cost Drivers for Logging Residues



- Although it is the most important commodity in the biomass industry, wood comprises only a small percentage of the total cost of delivered biomass. Fuel and labor costs are a much larger component.
- Investors may be more likely to consider biomass companies that control these costs by hedging against fuel price volatility with futures, and hiring on-staff loggers and/or truckers.





“The Wooden Rule”



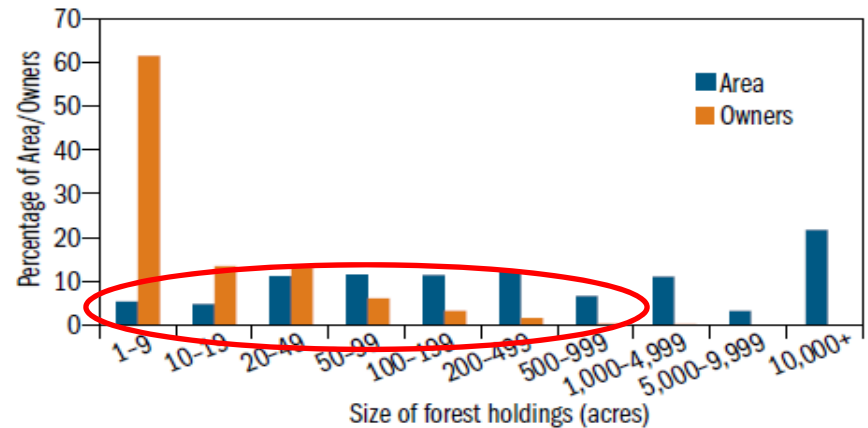
- There are three key pieces in the biomass supply chain. Logger, markets and stumpage. Among the three stumpage, the raw material, is least controllable.
- “He who has the wood, rules.”



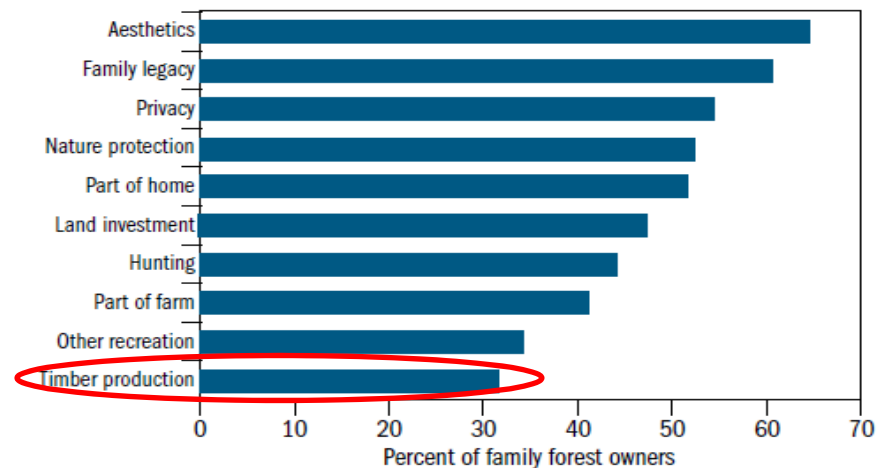
Forest Ownership



- In the South, small private landowners hold over 66% of forestland. In the vast majority of cases, the individual landowner does not have enough woody biomass in his possession to fuel an entire operation long-term.
- With fragmented ownership like this, long-term contracts are virtually impossible to obtain.
- Since small landowners' interests differ from those of large parties, strong relationships with multiple suppliers are of the utmost importance.



Primary reasons why families and individuals own forest land, 2006





Supply Contracts



- Investors are looking for low costs as well as high supply certainty, but the two rarely go hand-in hand in the world of woody biomass.
- Although some major landowners are willing to enter into 5-year contracts, offering biomass supply certainty, these rarely include fixed pricing. Cost certainty is virtually non-existent.
- In the few negotiations that do involve firm price structures, costs are frequently stipulated at a premium to current prices – sometimes as much as 20% higher – to protect wood owners perceived opportunity costs with increasing market demand.

Supply Contracts



- Sometimes suppliers offer long-term agreements, but, as they lack control over the wood, the supply and price structure of these contracts will be unstable:

“Initial Term” shall mean the period commencing on the Contract Date and ending on January 31, 2023.

Before the beginning of each Year of the Delivery Term subsequent to the first Year, pursuant to the annual pricing and volume review pursuant to Section 7.3 the parties shall agree on a new Contract Minimum/Maximum Range and a new Annual Contract Target Quantity for such Year.

[Recognizing that the conditions for wood supply are subject to change, the parties agree to submit to an annual pricing and volume review in accordance with the procedures set forth on Schedule 7.3.]

- Only a wood owner has control over supply, which is why “He who has the wood, rules”.



Getting Biomass Price and Quantity Stability



- Because the availability and pricing of woody biomass is affected by so many outside influences, fiber supply markets are almost always oriented with the short-term.
- Spot pricing, where either party has the ability to renegotiate costs, is fairly common.
 - Although this affords biomass consumers the ability to move relatively easily from a higher-cost supplier to a lower-cost supplier, gaining a decent amount of price certainty, the danger of being left with too little wood is significant.
 - Multiple short-term agreements with well-known, reliable sources are essential to quantity stability.

Fuel Flexibility



- Given the relative instability of the biomass market, it is important that biomass consumers develop options to hedge against fuel shortages, including being open to substitutes like sawdust, bark, and agricultural residues.
- Selling a customer on agricultural residue may prove more difficult, as their prices are currently higher, they are more expensive to process, and they have a lower calorific value than does wood. However, should wood biomass prices continue to rise, consumers may be more willing to adapt.



Corn Stover



Bagasse



Dedicated
Energy Crop



Coconut Shells



Rice Hulls

Fuel Flexibility In Action: Wood Pellets



- 1) Residuals from Sawmills and Other Wood Businesses
 - Can be lowest cost material source (sometimes dry)
 - Source quality managed through supplier selection
 - Reliant on viability of generator, can be extremely volatile over time

- 2) Delivered Product Chipped in Woods
 - Managing product consistency and quality requires careful logger selection and management
 - Seasonally available

- 3) Delivered Round Wood
 - Provides strongest control of product quality
 - Offers most purchasing and contracting flexibility
 - Requires scale of at least 150K+ ton pellet facility
 - Increases capital investment \$3-\$10 million per facility



Pellet Operations

Requires the least processing equipment, but requires ability to manage blending from multiple sources

Requires addition of primary size reduction equipment (hammer mills) and associated screening and handling equipment to reduce ash and properly size

Requires addition of primary debarking and chipping operations. Requires using bark on site for full value.



Achieve consistent pellet characteristics

- < 3mm particle size
- < 1.5 % ash
- < 10% moisture
- <5% dust per shipment

Summary



- He who has the wood rules but the wood is owned by many small non-industrial private landowners.
- To keep prices low but some level of quantity surety, look for multiple short-term supply contracts with creditworthy partners. This can most effectively be accomplished by building strong relationships with landowners over time. Where appropriate enter supply contracts with large landowners for a portion of feedstock requirements.
- To further guard against supply shortages, it is in the best interest of biomass companies to accept multiple forms of biomass, including sawdust, wood chips, bark, etc from multiple vendors.
- Diversifying into agricultural residues may be another option to consider.
- Although it does drive costs, wood is not the major expense a biomass operation incurs. Fuel, capital, R&M and labor are typically the highest cost items in the woody biomass cost tower.

Thank You



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