Advantages and Disadvantages of Untrimmed Wood in the Supply Chain

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Abstract

Very few companies that purchase forest products accept untrimmed trees (whole-trees including limbs and tops). Those that do accept untrimmed trees have been doing so for decades. A potential benefit of hauling untrimmed trees is higher in-woods productivity due to less processing of the trees. Disadvantages for the logging contractor can include specialized trailers and more time spent trimming and binding loads. The mill benefits by receiving two products (pulpwood and fuel wood/hog fuel) on the same load. Disadvantages can include a more complicated process for setting the purchase price and increased capital cost for additional processing and handling equipment required at the mill to delimb and top the trees and convey the material. The landowner may benefit from lower site prep costs as a result of the removal of limbs and tops from the stand. This paper reports on a pilot study that examined the hauling of untrimmed wood to a pulp mill and examines some of the advantages and disadvantages of utilizing untrimmed wood across the supply chain (landowner, logging contractor and the receiving mill).

Keywords: Whole tree, harvesting, loading, transportation, trucking, untrimmed

Introduction

The increase in biomass usage for fuels and energy has required a re-examination of harvesting and transportation systems to efficiently deliver these products. Harvesting systems for biomass markets may produce a traditional tree stem or it may produce a bundle, bale, chips, or chunks. These products require different handling and transportation systems. Some biomass markets can take forest residues or whole trees (including stem wood, bark and needles) as a feed stock. Therefore, there is less need to remove limbs and tops or deconstruct the tree other than to make transport more efficient.

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In traditional forest industries the wood fiber of the bole is the major product, so the removal of limbs, tops and bark is required. The majority of the time this is achieved by delimbing and topping the tree in the stand and debarking at the mill. In-woods clean chipping delimbs, tops, and debarks in the woods. These operations leave a potentially marketable product in the woods that must be gathered and transported separately. Transporting untrimmed wood or whole trees directly to the mill would appear to be a viable option to achieve increased productivity and efficiency.

The Georgia Pacific (GP) Foley Mill in Perry, Florida purchases untrimmed trees. The mill, formally owned by Proctor and Gamble, and then Buckeye Cellulose, has been purchasing whole trees for more than three decades. The mill utilizes the limbs and bark for energy production and the stem wood to make specialty fiber products. Foley Timber and Land purchased the former Proctor and Gamble land base and continues to supply whole trees to the GP Foley mill.

This paper highlights a pilot study undertaken to investigate the advantages and disadvantages of hauling untrimmed wood. Future research will investigate in more detail harvesting and transportation costs as well as site and productivity impacts compared to processed pulpwood.

Background

Researchers from the Forest Operations Research Unit of the USDA Forest Service located in Auburn, Alabama conducted a pilot study of loading and transporting untrimmed trees to the GP Foley mill in Perry, Florida in the spring of 2014.

The dominate plantation pine species in the Perry, Florida (Taylor County) region is Slash Pine (*Pinus elliotii*). Foley Land and Timber manages a large portion of their land holdings to maximize growth for the GP Foley mill's fiber requirements. This is generally an 18 to 22 year rotation with a planting density of around 1000 trees per acre. The timber is clearcut at the end of the rotation with no intermediate thinnings. At the time of clearcut, a typical stand will consist primarily of pulpwood with a small portion of chip-n-saw logs. The pulpwood is cut and hauled to the mill with the tops and limbs intact. Hauling the trees intact combines two products into one operation.

To haul untrimmed (whole) trees, logging contractors modify their trailers with "baskets" between the rear bunks. The baskets consist of side panels and a belly pan above the trailer frame rails. The basket helps contain the limbs and tops within the trailer and thus requires less trimming of the load to make it legal to haul on public highways. The logging trailer baskets are illustrated in Figures 1 - 5.

Figure 1: A logging trailer modified with a “basket” for hauling untrimmed pulpwood.

Figure 2: A logging trailer being loaded with untrimmed pulpwood.

Figure 3: A loaded trailer of untrimmed pulpwood.

Figure 4: A logging trailer with a raised belly pan in the rear “basket”.

Figure 5: A logging trailer with “basket” and a horizontal bar used to raise the tops of the trees off the ground.

The baskets are custom built by the contractors or by local welding/fabrication shops. Some baskets simply consist of a belly pan and a few vertical bars welded on horizontal supports between the last two sets of bolsters. Other baskets have a raised belly pan with flared edges and an intricate steel mesh along the sides (Figures 1 and 3). In Figure 5, the trailer has a horizontal bar across the back to raise the tops of the trees up in an effort to reduce the amount of trimming required for legal hauling. The contractor involved in the pilot study estimated that a typical basket added 1000 to 1500 lbs. to the weight of the trailer.

Data Collection

An elemental time study was performed to measure the landing/deck productivity of a logging contractor loading untrimmed pulpwood and processed chip-n-saw logs. A stopwatch and a video camera were used to measure the landing time elements. Stopwatch times of the major cycle elements are reported here. A loading cycle includes the time to position the truck for loading, the time to load the trailer and the time to trim and bind the load. Future analysis of the video data will be used to further break down the sorting and processing times for each loading cycle.

The study site was located just outside the city of Perry in Taylor County Florida. The slash pine (*Pinus elliotii*) stand was 21 years old with a planting density of 1000 trees per acre. Tree size ranged from 3.1 to 10.9 inches Diameter at Breast Height (DBH) and from 24.7 to 77 ft. in length. The stand was clearcut with a rubber-tired feller-buncher equipped with a shear head and skidded to the landing with a rubber-tired grapple skidder. At the landing trees were sorted (pulpwood and chip-n-saw) with a trailer mounted knuckleboom loader and vines and scrub hardwoods were separated out. The pulpwood was loaded as whole trees (untrimmed) and the chip-n-saw timber was limbed and cut to a 5 inch top diameter. All tops from the chip-n-saw that were greater than 16 ft. in length were mixed into the loads of whole tree pulpwood. Florida law requires that overhanging timber from logging trucks not exceed 15 ft. Trailer lights must be visible and the load must carry two flags and a flashing light to legally travel on public roads. The pulpwood loads were trimmed with a gas powered pole saw. The knuckleboom loader was also used to remove excess limbs and tops overhanging the rear of the trailer on some loads. Three truck and trailer combinations were assigned exclusively to this crew to haul both chip-n-saw and pulpwood.

Results

Over an 8 hour period, 12 complete observations of loading were observed. Table 1 summarizes the load data. Eight of the loads were untrimmed pulpwood and 4 loads were processed chip-n-saw logs. The average total cycle time for each product was identical at 31.7 minutes for chip-n-saw and pulpwood. The average time to load each product (excluding positioning and trimming/binding) was 23.8 minutes for the chip-n-saw and 22.2 minutes for the untrimmed pulpwood. Average number of stems per load of pulpwood was 162 compared to 62 for chip-n-saw. This represents 61% more stems per load of pulpwood, but loaded in 7% less time. Trimming and binding time for the pulpwood was 29% longer than that of the chip-n-saw at 8.7 minutes on average compared to 6.2 minutes per load of chip-n-saw.

Table 1: Pilot study data for loading untrimmed pulpwood and chip-n-saw logs in Perry, FL.

	Chip-n-saw						
	Position (min)	**Load (min)**	**Trim (min)**	**Stems**	**Gross (lbs.)**	**Tare (lbs.)**	**Net (lbs.)**
Obs	4	4	4	4	5	5	5
Min	1.1	16.9	5.0	56	77140	28640	46520
Max	2.7	37.5	7.3	68	84520	30620	55720
Avg	1.8	23.8	6.2	62	81024	29568	51456
	Untrimmed Pulpwood						
Obs	7	8	9	8	9	9	9
Min	1.0	11.3	6.0	124	76960	28680	48280
Max	2.7	29.3	13.0	201	83720	30640	53180
Avg	1.8	22.2	8.7	162	80475	29700	50775

Load tickets were obtained for each load. Gross weight averaged 81,024 lbs. and 80,475 lbs. for chip-n-saw and pulpwood respectively. Since the same 3 trucks were used to haul both products, the average tare weight was almost identical at 29,568 lbs. for the chip-n-saw loads and 29,700 lbs. for the untrimmed pulpwood loads. The average payload for each product was approximately 25 tons.

Discussion

Untrimmed wood (whole trees) as a purchased feedstock would potentially benefit many of the emerging woody biomass industries as well as existing timber industries. The limitations have been transportation regulations and historical precedents in how forest products are harvested, processed and transported. The GP Foley mill in Perry, Florida shows that these limitations can be overcome.

Advantages for the landowner and harvesting contractor include harvesting and hauling two products (pulpwood and fuel/energy wood) at the same time. The contractor is able to remove more gross tonnage from the stand with a single operation utilizing standard harvesting equipment. Harvesting productivity should increase as well by eliminating the need to delimb and top the trees. Watson and Stokes (1987) estimated that by hauling whole trees to the mill, in-woods production could potentially be increased by 20 to 30%. The landowner benefits in several ways. First, they are able to sell more tonnage from the stand and by doing so in one operation, reduce site impacts such as compaction and management interruptions. The removal of the limbs and tops also reduces site preparation costs and can increase plantable ground. In order to respect privacy and competition issues, specific pricing details are not presented. The landowner in this pilot study indicated that the price it was paid for the untrimmed trees was between that of processed pulpwood and fuel wood. The landowner felt that the

advantages of selling whole trees outweighed any disadvantages. The purchasing mill receives a steady supply of pulpwood required for its fiber operations and fuel wood to produce energy for the facility.

Disadvantages include increased costs for the harvesting contractor to fabricate "baskets" at the end of log trailers to more efficiently transport untrimmed trees. The added weight of the baskets could also reduce payloads. The untrimmed trees also require more trimming and binding to ensure compliance with transportation regulations. Landowner disadvantages include potential site productivity loss due to the loss of nutrients from the efficient removal of limbs and needles from the site. Disadvantages to the mill include a more complicated pricing structure for its feed stock and increased capital expenses to install and maintain the additional facilities required to process the untrimmed trees at the mill.

Conclusions

A pilot study in the spring of 2014 was undertaken to investigate the potential advantages and disadvantages of untrimmed wood in the supply chain. Initial results indicate that loading time is reduced when compared to chip-n-saw, but trimming and binding time is increased. Average payload was equal to that of the chip-n-saw loads and was well below the maximum legal load limit for forest products in Florida (88,000 lbs. with permit). The fiber mill in Perry, Florida has been purchasing whole trees for over three decades. The mill, the major landowner and the harvesting contractors in the region, have successfully implemented the process into their business and management practices. The success at this mill and the initial data from the pilot study suggest that other woody biomass industries may also benefit from a similar system.

A larger more comprehensive study is currently being implemented to compare harvesting and transporting untrimmed pulpwood to trimmed pulpwood. The study will also investigate site impacts and include a cost comparison between trimmed and untrimmed harvesting systems.

References

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