



Changing Times:

How Technique and Technology Advancements Could Promote Woody Biomass Harvesting in the United States

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Introduction

- Woody biomass interest as a renewable energy is cyclical.
- Defined as:
 - small-diameter trees (≤ 9 inches) at diameter breast height (dbh)
- Techniques & technologies to promote biomass:
 - Dimensional spacing
 - Density stocking
 - Machine size

Biomass in the United States

- Southeast produces 19% of the world's pulp and paper on 2% of total global forest land.
- Differences between pulpwood harvesting:
 - Harvest between 5-9 years rather than 10-16 years
 - Biomass price is drastically lower than pulpwood
 - Biomass requires substantially more processing for the same product as pulpwood

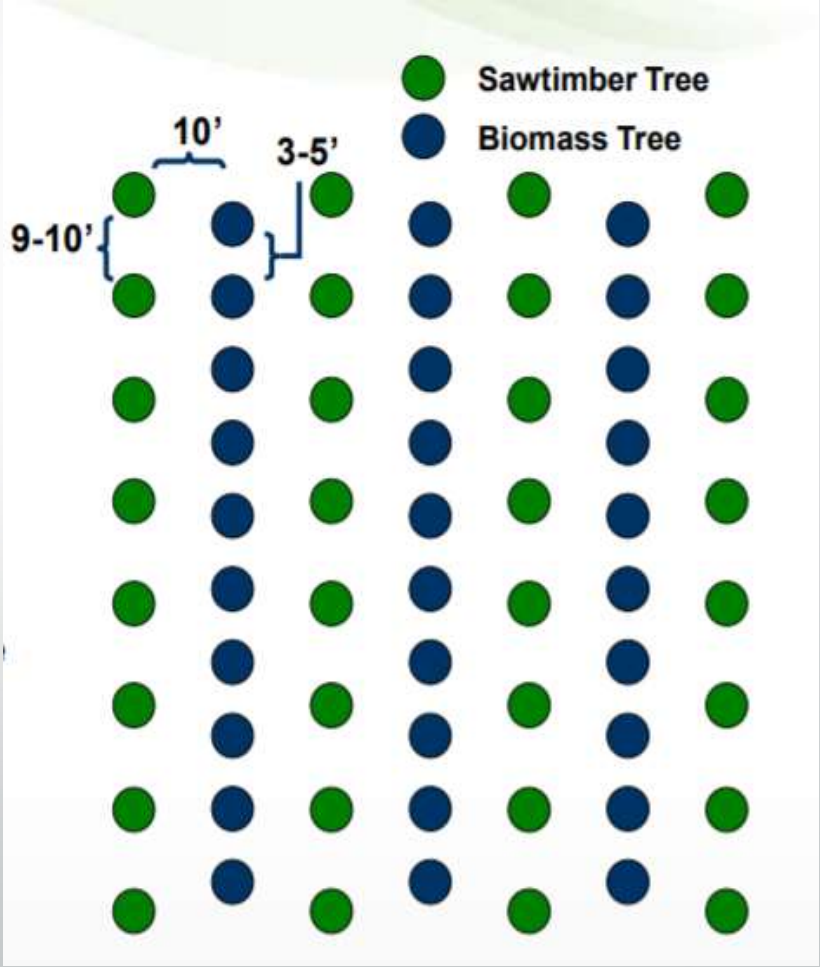


Small Scale Harvesting



Flex Stands™

- * High density plantings
- * Biomass harvest, ages 6-9
- * Pulpwood thinning, age 16
- * Sawtimber harvest, ages 24-30
- * Supply all markets
- * Flexibility to change plans



Source: ArborGen "When the Forest Meets the Market Powerpoint"

Rectangularity



Rectangularity Options

TPA*	Normal Spacing*	Alternative Option*
436	10 ft. by 10 ft.	20 ft. by 5 ft.
605	9 ft. by 8 ft.	12 ft. by 6 ft.
908	8 ft. by 6 ft.	12 ft. by 4 ft.

* TPA (Trees Per Acre)

* (Planting Distance Between Row) ft. by (Planting Distance Between Tree) ft.

Ptaeda Modeling vs Field Testing

- Past studies focused cost-effectiveness of harvesting biomass not final volumes.
- Objective was to analyze green tons produced after biomass harvest by:
 - Harvested at year 8
 - FlexStand versus normal configuration (2.4 metres by 1.8 metres)
 - Field tested + modeled to emphasize result accuracy

Field Study Methods

- Solon Dixon Forestry Education Center in Alabama, U.S.
- Stand 1: Pinus Taeda Plantation
 - 0.41 hectare
 - 2.4 metre by 1.8 metre spacing
- Stand 2: Pinus Taeda Flex Plantation
 - 0.66 hectare
 - Every third row (3.05 by 1.22 metre) spacing
 - All other rows (3.05 by 2.44 metre) spacing
- Caterpillar 279D skid-steer
 - Fecon FBS1400 Single Knife Tree Shear attachment head

Ptaeda Modeling Methods

- 2 Models per stand:
 - 1: Biomass @ yr 8, Thin @ yr 16, Final Harvest @ year 28
 - 2: Thin @ yr 16, Final Harvest @ yr 28
- Model parameters matched field conditions as close as possible.
- 3rd row thinning method for biomass harvest.
- 70 target basal area for thin.

Summary Data for Harvested Stands

Stand 1:

DBH Class	Harvested Tree Count	Basal Area	Tons Harvested	Tonnes Harvested
3	6	0.99	0.78	0.71
4	9	2.65	1.97	1.79
5	26	11.95	10.69	9.7
6	34	22.51	18.92	17.16
7	12	10.81	8.99	8.15
8	1	1.18	1.00	0.91
9	0	0.00	0.00	0.0
Total	88	50.00	42.35	38.42

Stand 2:

DBH Class	Harvested Tree Count	Basal Area	Tons Harvested	Tonnes Harvested
3	3	0.05	0.52	0.47
4	16	0.09	6.33	5.74
5	32	0.14	19.81	17.97
6	16	0.20	12.59	11.42
7	10	0.27	11.80	10.7
8	1	0.35	1.50	1.36
9	1	0.44	0.03	0.03
Total	79	70.00	52.58	47.7

Summary Data for all Ptaeda Models

Spacing	Trees Per Acre	Treatment	Basal Area	Tons Harvested	Tonnes Harvested
8x6	908	Pre-Biomass Thin	94.2	26.8	24.3
	908	Biomass Thin	77.2	32.6	29.6
	908	Pre-Pulpwood Thin	145	97.9	88.8
	908	Pulpwood Thin	74.9	58.3	52.9
	908	Final Harvest	107.8	110.1	99.8
8x6	908	Pre-Pulpwood Thin	173.1	112.7	102.2
	908	Pulpwood Thin	74.9	55.9	50.7
	908	Final Harvest	100.3	99.6	90.3
10x4	727	Pre-Biomass Thin	89.3	29.5	26.8
	727	Biomass Thin	73.4	31.3	28.4
	727	Pre-Pulpwood Thin	142.9	98.6	89.4
	727	Pulpwood Thin	74.6	58.8	53.3
	727	Final Harvest	116.3	121.7	110.4
10x4	727	Pre-Pulpwood Thin	171.4	116	105.2
	727	Pulpwood Thin	74.6	56	50.8
	727	Final Harvest	105.9	106.1	96.3

Conclusion

- Woody biomass market will increase in the U.S. as the demand for biomass increases around the globe.
- Alternative machines are now available that are more compact and ideal for harvesting woody biomass.
- FlexStand™ and rectangularity could provide cost affordable methods alleviate issues caused by today's large machine sizes.
- Biomass thinning's result in just over half as much tonnage as a pulpwood thinning and increase final saw-timber harvests by a minimum of 10 tons.

Questions?



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