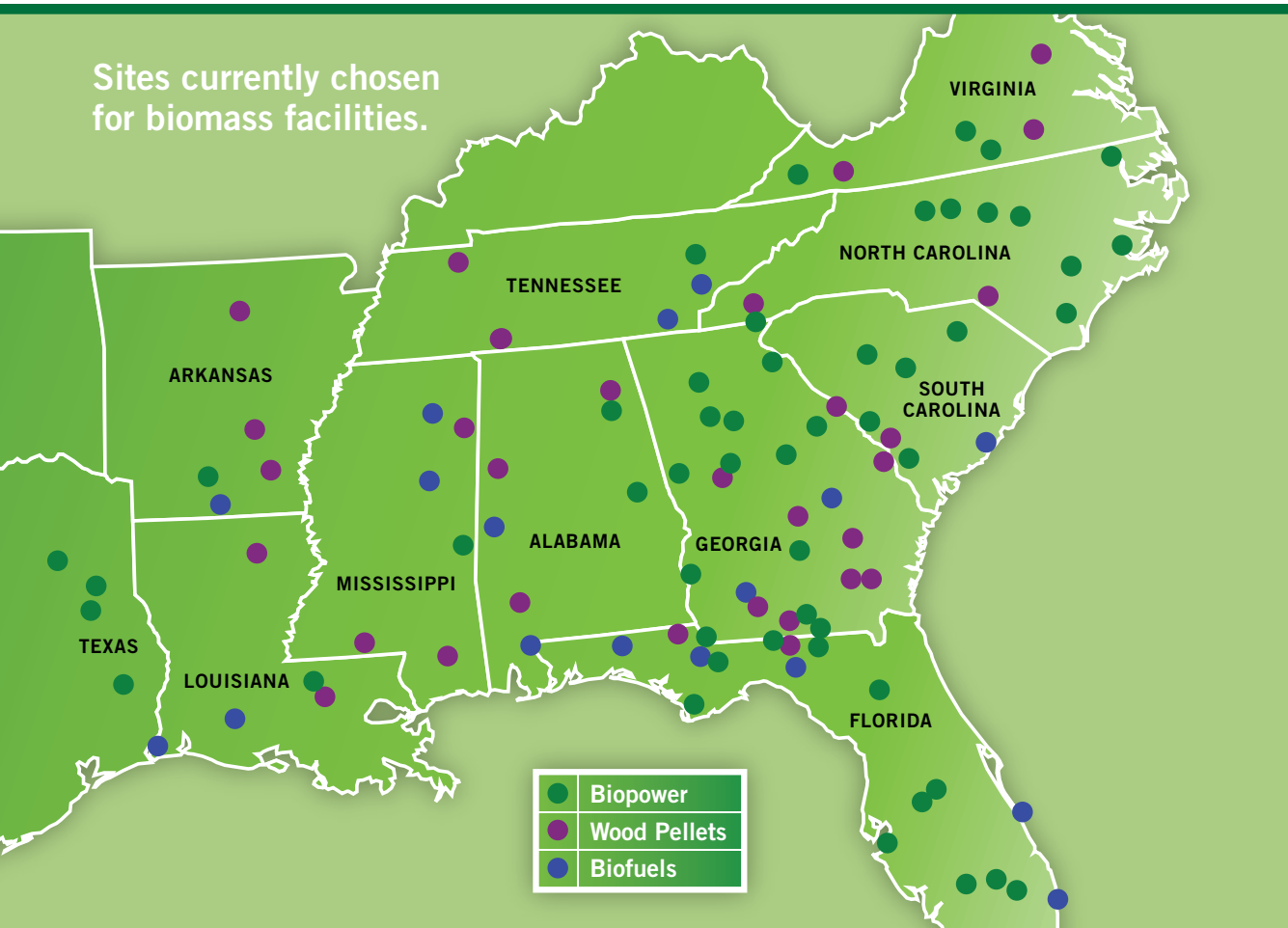


With the number of biomass sites expected to double, your best bet is to use the FlexStand™ System for improved profits and environmental benefits.

Make reforestation count. Use the FlexStand™ System.



The number of sites chosen for biomass facilities in the southeastern U.S. is constantly growing. If there is a planned facility near you, your wood could be supplying that facility.

Get the most benefit from your forestlands using the FlexStand™ System. To learn more, or to find out if there is a FlexStand™ seminar in your area, call our forestry experts at 1-888-888-7158.

FlexStand™ System Guide

HOW TO PLANT AND MANAGE FORESTS FOR IMPROVED ECONOMIC, ENVIRONMENTAL AND SOCIAL BENEFITS.

As the marketplace for wood products evolves, and the mission for reforestation becomes more critical to the environment, landowners must plant and manage stands that sustain a balance among economic, environmental and social benefits. The FlexStand™ System provides a higher economic return on your investment while improving environmental and social benefits related to resource conservation. It also allows accounting to be based on the expected function of each stand component, which is desirable in gaining certification for both timber and carbon.



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What is the FlexStand™ System?

Hedge against unknown markets (energy, carbon dioxide, pulp, sawtimber or poles) and fully capitalize on new technology to increase production and quality of the timber being grown in your well managed forests.

The FlexStand™ System is a method of reforestation that optimizes land use and resources by growing trees specified for multiple end products on the same acre. It is an efficient and responsible system of planting and managing tree stands to provide the greatest benefits for both your bottom line and for resource conservation. Benefits of using the FlexStand™ System include the following:

- Keeps your land profitable in all kinds of timber markets.
- Allows planting of advanced genetics across more acres.
- Targets resources on valuable crop trees, saving money and decreasing impact on the environment.
- Allows for high-efficiency thinning.
- Makes accounting possible on the expected function of each stand component.

FlexStand™ System Site Prep

The FlexStand™ System can be established on most sites but is best suited for topographies that permit row thinning. We have based the information provided here on an upland site, where moderately well drained or better soils do not require costly shearing and bedding treatments. For information on other site types, ask one of our trained professionals.

Site prep can include burning if logging debris is heavy and conditions permit. If using chemicals for prep, allow time for herbicide residue to dissipate so as not to damage the planted pines.

Did you know?
Directed treatments conserve valuable resources and reduce chemical usage, which is desirable when considering forest certification programs.

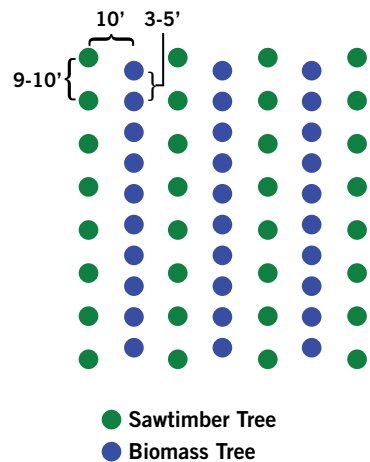


Figure 1: Simple FlexStand™ Schematic

FlexStand™ Planting

Seedlings

Choosing seedlings that are proven to give the best return on investment for individual products is critical.

Biomass Seedlings: Choose Elite open pollinated (OP) seedlings that have been genetically proven to be good at capturing inherent site resources and converting them to biomass.

Crop (Sawtimber) Seedlings:

MCP® Seedlings or varietal SuperTree Seedlings® have the genetic traits to be assigned as potential sawtimber products at the time of establishment. Use of these superior genetics will help ensure the following:

- Fusiform rust infections will be kept to a minimum.
- Large branches should not develop at the wider within row spacings.
- Most of the 180–200 trees left after thinning will be of sawtimber quality.

Schematic

The simplest FlexStand™ concept is planting alternating rows of biomass (pulp or energy products) and sawtimber trees 10 feet apart as illustrated in Figure 1 (left). A FlexStand™ System can be established in many configurations, such as having the OP biomass row as the take-out row in planned 3rd, 4th or

5th row thinning. Alternate configurations are attractive if stands are being established with between-row spacings of 12–16 feet. However, the consequences of planting fewer biomass rows is a lower amount of biomass for pulp or energy being taken out at the time of thinning and less efficient thinning operations. This guide will give details only on the configuration shown in Figure 1.

Biomass Rows: Elite OP seedlings are planted in alternate rows 3–5 feet apart in order to produce maximum biomass for use as pulpwood or energy wood at the time of the first thinning. Because biomass is a lower valued product, only minimum resources are needed to get these rows off to a good start.

Crop (Sawtimber) Rows: MCP® Seedlings or varietal SuperTree Seedlings® are planted in alternate rows 9–10 feet apart. This spacing permits trees in the crop row to grow rapidly in diameter from the beginning to the end of the rotation, ensuring that the maximum amount of sawtimber dimension material will be produced. With these defined rows, protection and growth enhancement treatments can be directed only on these higher value products.

Herbaceous Weed Control

The FlexStand™ System allows for better focusing of resources to the designated crop tree rows. With only 200–240 sawtimber trees per acre (tpa) planted in defined rows, it becomes practical to apply directed herbicide treatments, fertilization and tip moth control, providing considerable savings. Resource focusing will reduce forest management costs as well as the amount of chemicals that are applied. This is good from an environmental standpoint and should be recognized as a positive in meeting certification standards. Other benefits include the following:

- Allows for a second banded herbaceous weed control to be applied to stimulate growth on the high valued sawtimber component in a cost-effective manner.
- Tip moth control and deer protection become more practical and cost effective when applied only to the crop tree component in zones where pest pressure is high.
- Reduces amount of fertilizer used.
- Allows ground application instead of air application—a plus from the environmental aspect.

FlexStand™ System Harvesting

FlexStand™ System thinning should be done when stand basal area attains 140–150 square feet per acre. Thinnings remove all biomass rows and the few defective trees from the crop rows to leave the best 180 final crop trees. A conservative estimate for the expected site index (SI) for the upland crop trees would be 77 for the Elite OP biomass component and 80 for the MCP® Seedlings crop trees.

Determining FlexStand™ System Yields

We have calculated expected FlexStand™ System yields from a test stand located on average upland sites and by using the Neolob growth and yield model developed by MeadWestvaco. Predicted yields (Figure 2, below) are based on comparing the following: A conventional planting of 535 tpa OP, versus 535 tpa MCP® Seedlings, versus a FlexStand™ System (Figure 1) with 535 tpa OP

in biomass rows and 240 tpa MCP® Seedlings in the crop rows. Thinning age, estimated thinning green tons per acre and clearcut (CC) green tons per acre are also shown. We define product dimensions as: **Pulpwood:** Greater than or equal to four inches in diameter up to 9.9 inches in diameter and taken to a 2-inch top. **Chip-n-Saw (CNS):** Greater than or equal to 10 inches in diameter breast height (dbh) up to 12.9 inches and taken to a 6-inch top. **Sawtimber:** Greater than 13 inches in dbh and extending to an 8-inch top.

The yields in Figure 2 were used to estimate the expected net present value (NPV) for upland stands assuming a price range for the thinnings of \$5–\$20 per green ton for the biomass component, \$15 per green ton for CNS and \$39 per green ton for sawtimber. At a biomass stumpage of

\$20 per green ton, it was assumed that CNS grade wood is sold for biomass. Calculated NPVs are shown in Figure 3 (below).



Figure 3: Net Present Values (NPVs)

Regime	Site Index	Thin Age (years)	Thinning		CC-23yr		
			Biomass Row (Gtons/ac)	Crop Row (Gtons/ac)	Pulp (Gtons/ac)	CNS (Gtons/ac)	ST (Gtons/ac)
FlexStand™ System	OP=77 MCP=80	12	56	3	17	73	42
Pure MCP® Stand	80	12	23	21	16	75	45
Pure OP	77	12	18	21	18	73	33

Figure 2: Predicted yields for a sample FlexStand™ System, a pure MCP® stand and a pure OP stand. Thinning yields could be increased by about 15 percent if branch and bark tissue are used for energy biomass.