Bioenergy Production in Planted Pine Forests

FACT SHEET 3.3

INTRODUCTION

For several decades the number of planted pine acres has steadily increased and should account for about 25 percent of the southern acreage by 2040[1]. This increase has been primarily propelled by the demand for fiber for various wood products. Sawtimber and veneer quality trees are the most valuable products of these forests. However, thinnings are essential during the developmental stages of a plantation. In the past, the products of these thinnings were used as pulpwood. However, the pulpwood market has steadily decreased during the past several years. Because of this, other markets must be developed for pine plantation owners. The creation of a bioenergy market would provide an outlet for wood being displaced through the loss of pulpwood markets.

OPPORTUNITIES FOR BIOMASS PRODUCTION IN PLANTED PINE FORESTS

Highly productive bioenergy systems involve intensive management and many of these plantations are already part of an intensive management system. So harvesting for bioenergy can be integrated easily into the management operations. The most significant opportunities are associated with residue harvesting following clearcutting operations. However, pre-commercial thinnings and woody weed control can provide additional sources of biomass, in addition to wood that is no longer being sent to pulp markets.

source: C. D. Foster, Texas Cooperative Extension

Image 1. Planted pine forests are located throughout the southern United States.

Utilizing clearcut residues can reduce site establishment costs and reduce the risk of fire. In Sweden, research indicates a 3 to 7 percent reduction in site establishment costs[2]. The removal of slash and stumps, in addition to traditional harvesting techniques, increased productivity in Finland[3]. While these examples are international in scope, similar results are feasible in the South. In fact, research indicates a savings of $81 to $101/acre in the South[4].

Improving stand growth rates may also increase biomass availability from a given stand. Typical responses to intensive silvicultural practices are shown in Table 1[5]. Direct biomass opportunities largely arise from utilizing current residues, while indirect opportunities arise from improved long-term productivity per acre. The most promising practices include using improved genetic material, good planting stock, fertilizing to overcome deficiencies, weed control, and draining wet sites. Take care to ensure that the energy gained is greater than the energy required to produce the additional biomass.

Foster, C.D. ; C. Mayfield. 2007. Bioenergy Production in Planted Pine Forests. Pages 117–120.
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OPERATION	YEARS FROM PLANTING	BIOMASS OPPORTUNITIES	
		Direct	Indirect
Seed sourced	-2	—	Improved growth
Nursery	-1	—	—
Site preparation	-1 to 0	?	Improved growth
Planting	0	—	Alter stocking
Initial fertilization	0	—	Improved growth
Weed control	0 to 3	?	Improved growth
Thinning* Mid-rotation fertilization	12–15	Utilize thinnings	Improved growth
Clearcutting	(15) 25–35 (45)	Utilize residues	—

source: Data Source: Don J. Mead

Table 1. Typical Pine Plantation Silviculture in the Southern U.S. Showing Opportunities for Biomass for Bioenergy
? Indicates that additional biomass might be available when clearing of site or harvesting woody weeds.
** Thinning often begins at this age. Sometimes multiple thinnings are prescribed, particularly where the emphasis is on higher-value logs.*

In some cases, it may be beneficial to increase stocking rates to gain additional production of biomass for bioenergy[6,7]. Strategies for producing chipwood or pulpwood will be close to maximizing biomass productivity. Plantations grown for multiple products such as posts, sawlogs, and chipwood include thinning operations that promote the growth of larger logs. Material from these thinnings can be used for bioenergy.

Agroforesty practices in which double and triple rows of trees are planted can be adapted to meet bioenergy needs. Thinnings can provide material for bioenergy and promote growth on the remaining trees. Alternatively, agroforestry crops can be grown strictly for bioenergy production.

CONCLUSIONS

Pine plantations of the South are prime candidates for the production of biomass for bioenergy as well as other wood products. The intensively managed pine plantations can be adapted easily to produce biomass for bioenergy. Residues from silvicultural thinnings, clearcut operations, woody weed control, and pre-commercial thinnings can provide sources of additional biomass for bioenergy. In addition, much of the material previously harvested for pulpwood can be used for bioenergy in areas where pulpwood markets have been diminished. By making small adjustments in production practices, pine plantation owners can reap the benefits of the creation of a bioenergy industry in the southern United States.

For more information, refer to the Encyclopedia of Southern Bioenergy (http://www.forestencyclopedia.com/Encyclopedia/bioenergy) or Forest Bioenergy (http://www.forestbioenergy.net/). Specific information related to pine plantations can be found in the Biomass Production by Forest Type section under Planted Pines (EID 70547) in the Encyclopedia of Southern Bioenergy.

ENDNOTES

1 Alig, R.J.; Adams, D.M.; Mills, J.R.; Butler, B.J.; and Moulton, R.J. 2003. Private forest management and investment in the US South: Alternative future scenarios. In: Teeter, L.; Cashore, B.; and Zhang, D., eds. Forest policy for private forestry: global and regional challenges. Wallingford, Oxon, UK: CABI: 149-163.

2 Asikainen, A.; Bjorheden, R.; and Nousiainen, I. 2002. Cost of wood energy. In: Richardson, J.; Bjorheden, R.; Hakkila, P.; Lowe, A.T.; and Smith, C.T., eds. Bioenergy from sustainable forestry: Guiding principles and practice. Dordrecht, The Netherlands: Kluwer Academic Publishers: 125-157.

3 Saarinen, V-H. 2006. The effects of slash and stump removal on productivity and quality of forest regeneration operations - preliminary observations. Biomass and Bioenergy. In press.

4 Gan, J. and C.T. Smith. 2007. Co-benefits of utilizing logging residues for bioenergy production: the case for East Texas, USA. Biomass and Bioenergy. (In review).

5 Mead, D.J. and Foster, C.D. 2006. Planted Pine. In: The Forest Encyclopedia Network. http://www.forestencyclopedia.net, Encyclopedia Identification: 70547. [Date accessed: November 3, 2006].

6 Mead, D.J. 2005a. Opportunities for improving plantation productivity. How much? How quickly? How realistic? Biomass and Bioenergy. 28: 249-266.

7 Mead, D.J. 2005b. Forests for energy and the role of planted trees. Critical reviews in plant sciences. 24: 407-421.