Feedstock Logistics in the Southeast

(Woody biomass logistics are a commercial reality, thus the focus will be on herbaceous biomass)

The Southeast will lead the nation in the production of bioenergy.

Biomass as Feedstock for a
Bioenergy and Bioproducts Industry:
The Technical Feasibility of a
Billion – Ton Annual Supply

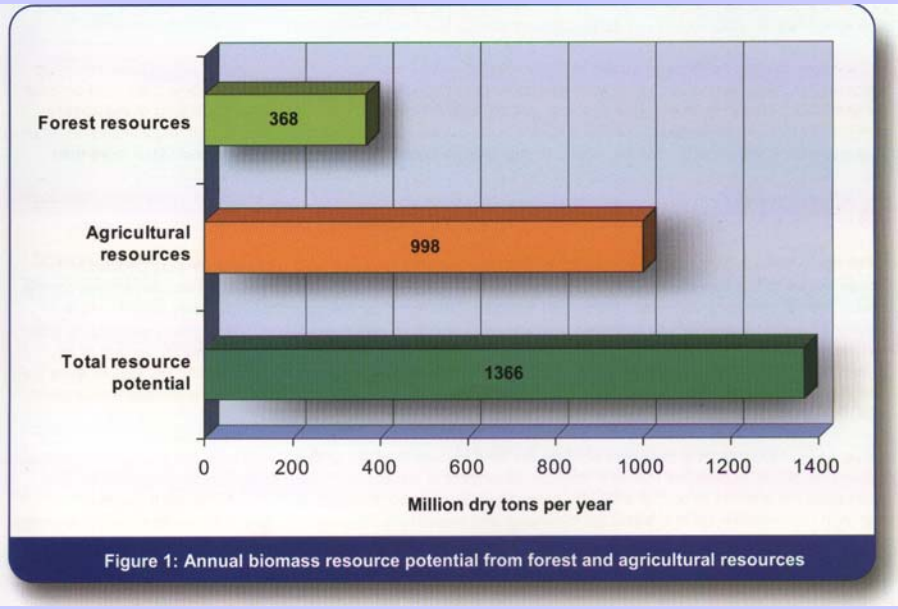

Figure 1: Annual biomass resource potential from forest and agricultural resources

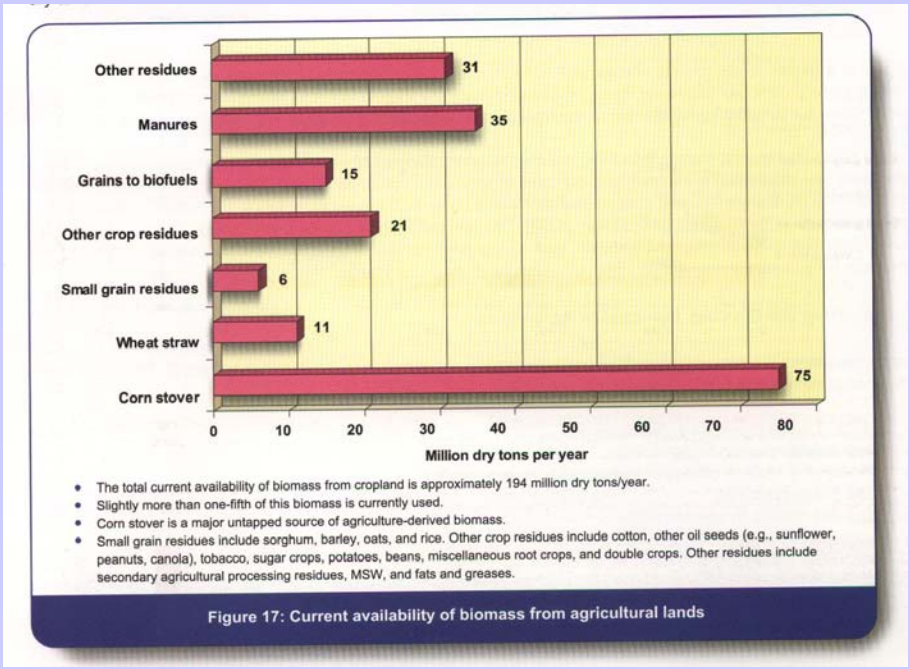

Figure 17: Current availability of biomass from agricultural lands

Corn stover: 25 ton/h plant

25 ton/h x 24 h/d x 7 d/wk x 47 wk/y
= 197,400 ton/y

Harvest season: 5 wk/y

How many harvesting machines do I need?

Assumptions

1. Machine capacity: 11.5 ton/h
2. Productive time per workday: 8 h
3. Harvest days: 65%

Number of machines required:

5 wk/y x 7 d/wk x 0.65 = 22.5 d/y

22.75 d/y x 8 h/d x 11.5 ton/h = 2,093 ton/y

$$\frac{197{,}400\ \text{ton/y}}{2093\ \text{ton/y/machine}} = 94\ \text{machines}$$

For some unknown reason, an entrepreneur wants to build a 25 ton/h plant in the Southeast.

Switchgrass: 197,400 ton/y

Harvest season: 24 wk/y

How many harvesting machine do I need?

Assumptions

1. Machine capacity: 11.5 ton/h
2. Productive time per work day: 8 h
3. Harvest days: 55%

Number of machines required:

24 wk/y x 7 d/wk x 0.55 = 92.4 d/y

92.4 d/y x 8 h/d x 11.5 ton/h = 8,500 ton/y

$$\frac{197{,}400\ \text{ton/y}}{8{,}500\ \text{ton/y/machine}} = 23\ \text{machines}$$

Corn stover: 2,093 ton/machine/y

Switchgrass: 8,500 ton/machine/y

Corn stover: 2,093 ton/machine/y

Switchgrass: 8,500 ton/machine/y

So What?

Annual Operating Hours

Corn stover: 182 h

Switchgrass: 739 h

$$\text{Harvest cost} = \frac{\$/\text{h}}{\text{ton/h}} = \$/\text{ton}$$

Machine capacity: 11.5 ton/h

Machine cost:

Midwest $35.54/h Southeast $17.28

$$\frac{\$35.54/\text{h}}{11.5\ \text{ton/h}} = \$3.10/\text{ton}$$

$$\frac{\$17.28/\text{h}}{11.5\ \text{ton/h}} = \$1.50/\text{ton}$$

To get a bioenergy plant to locate in your community, you need to answer two questions.

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How much feedstock is available?

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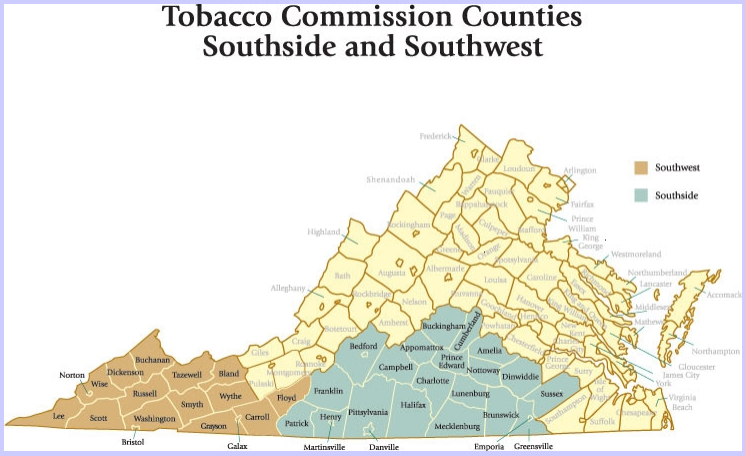
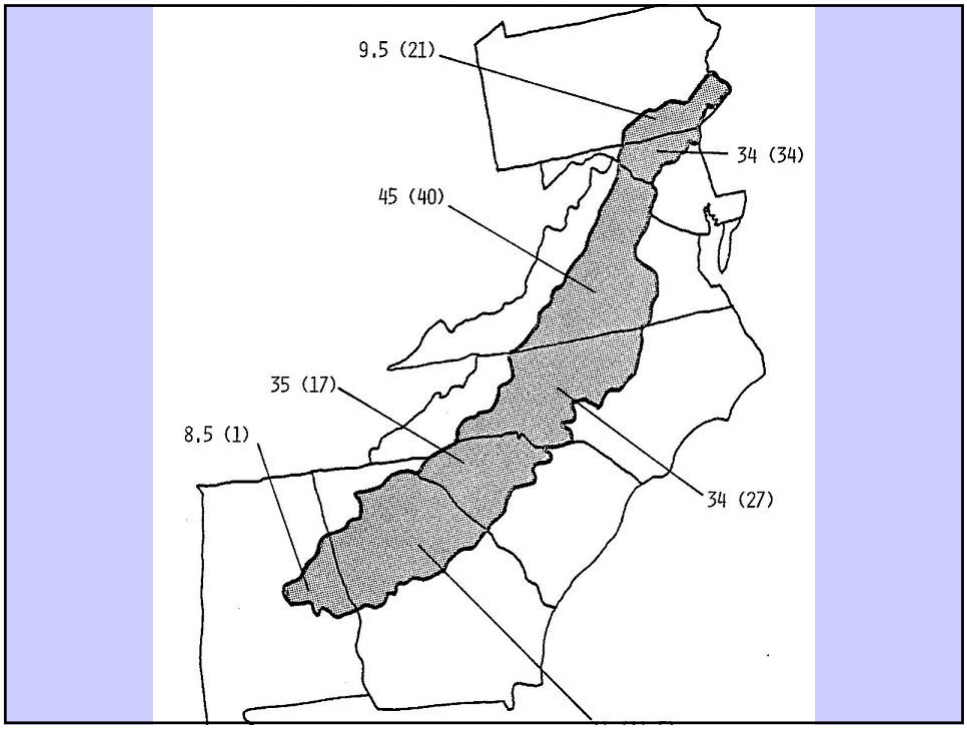
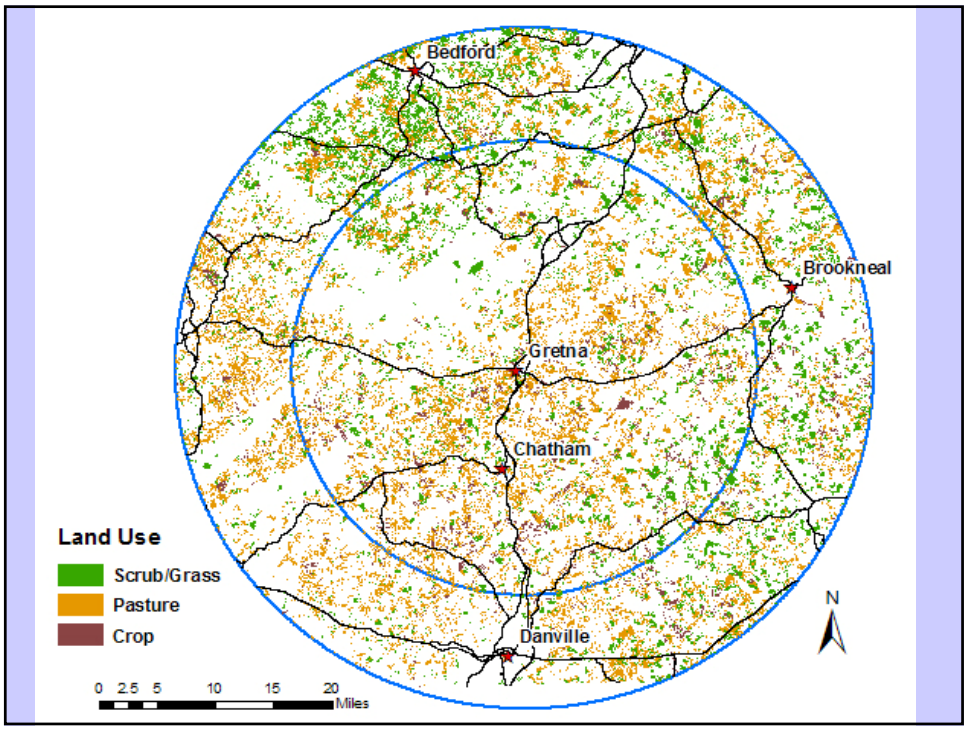
How much feedstock is available?

What is the average delivered cost?




9.5 (21)
34 (34)
45 (40)
35 (17)
8.5 (1)
34 (27)


Bedford
Brookneal
Gretna
Chatham
Danville
Land Use
Scrub/Grass
Pasture
Crop
N
0 2.5 5 10 15 20
Miles

Scenario 1

80% of scrubland /grassland attracted into production within 20-mi radius

Gretna	5.3%
Keysville	4.9%

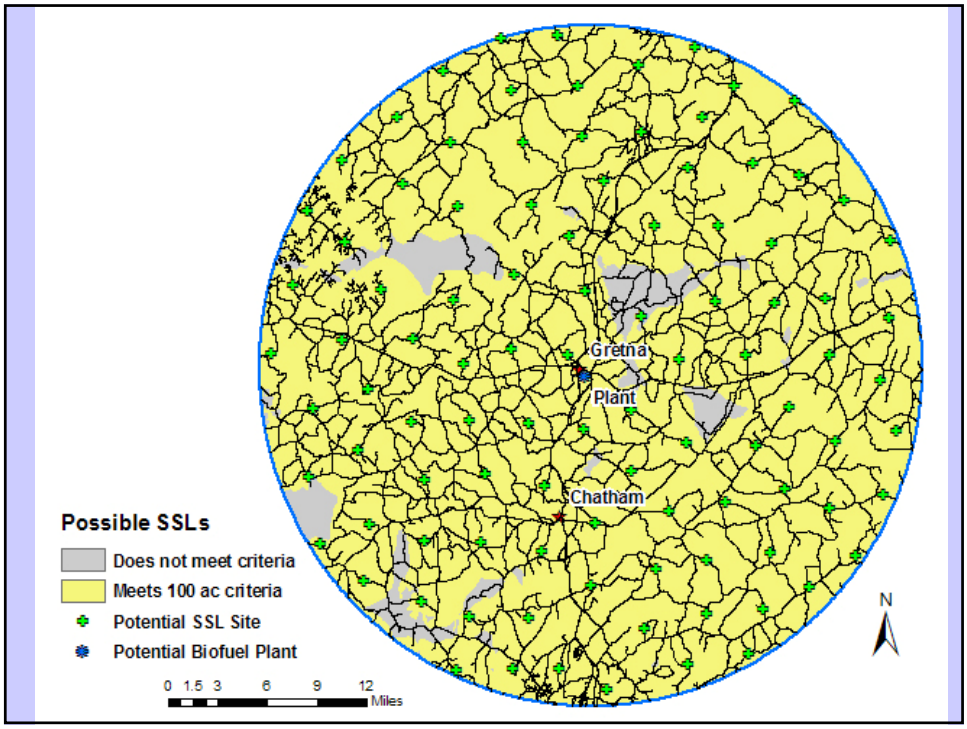
Scenario 6

80% scrubland/grassland

80% cropland

20% pastureland

Gretna	9.8%
Keysville	8.6%



30-mi radius around Gretna Scenario

Production Area per SSL (ac)	1	6
Mean	530	855
Max	2100	2390

Weighted Mass-distance Parameter

	Scenario	
	1	**6**
20-mi Gretna	20.3	19.0
30-mi Gretna	28.0	26.6
20-mi Keysville	18.5	18.6

30-mi Radius

If a Southeastern site has 10% of the surrounding land in feedstock production,

and the average yield is 4 ton/ac,

what size plant can be supplied 24/7, 47 wk/y?

90 ton/h

If a Midwest site is chosen for this same plant, and the average yield is

2 ton/ac,

what percentage of production land is required within a 30-mi radius.

20%

How practical is a 90 ton/h (2160 ton/d) plant?

Assumptions:

1. A 5-ft diameter round bale weighs 900 lb.
2. A truck load is 32 bales.

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1. A 5-ft diameter round bale weighs 900 lb.
2. A truck load is 32 bales.

A truck hauls 14.4 tons.

$$\frac{2160 \text{ ton/d}}{14.4 \text{ ton/truck}} = 150 \text{ trucks/d}$$

Pittsylvania Power Station

Typical	150 trucks/d
Record	311 trucks/d


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A Versatile New
Sugarcane for Florida

How are we going to unload 32 round bales in less than 10 min?

We need 24-h hauling year-round. This will give the minimum truck cost.

How are we going to accomplish this?