Potential Sources of Woodchip Fuel for Furman's Future Biomass Plant

Gwyn Fowler

Department of Earth and Environmental Sciences, Furman University, Greenville, SC 29613

Abstract

Furman University is working to develop cost effective, environmentally friendly biomass plant to reduce dependence on fossil fuels, improve air quality, and support the local lumber industry. Biomass accounts for nearly three percent of total U.S. energy consumption, but it is the largest renewable energy resource (accounting for 47 percent of the renewable portion of total energy production). Biomass energy is derived from three distinct energy sources: wood, waste, and alcohol fuels. It can be used as a solid fuel, or converted into liquid or gas for the production of electric power, heat, chemicals, or fuels. Furman plans to use wood chips from local sawmills within a 75 mile radius to implement a clean and efficient energy source. In this project, the use of GIS is necessary to evaluate the spatial relationships between locations of the sawmills and Furman University. A total of 19 sawmills were found, an estimates of weekly wood chip production, and distance of the sawmills from Furman was established. The resulting maps and graphs will help the team of planners at Furman to identify the most efficient means of supplying wood chips to the future plant.

Introduction

Creating renewable energy is a core idea of Furman's commitment to sustainability. A school similar to Furman that has built a wood chip biomass plant recently is Middlebury College, located in Vermont. Middlebury uses wood chips from sawmills within a 75 mile radius. Local sawmills within this small radius keep energy production local and do not require excess transportation which could increase carbon dioxide emissions. Middlebury hired a broker, who found a network of loggers, sawmills, and land clearing operations as suppliers within a specific price range. Wood chip suppliers provide transportation to the biomass plant. The plant provides half of Middlebury's heating. Furman and Middlebury are comparison in size (2,600 and 2,300 students, respectively). Middlebury uses 20,000 tons of wood chips and mill residue combined per year. Ash from the plant is collected and used in local fertilizer companies products. Zero carbon is released from burning chips minus the carbon that is absorbed by growing trees. Middlebury's biomass plant is expected to cut carbon dioxide output by 40 percent, and reduce their use of fuel oil by 50 percent. After summarization of Middlebury College's biomass plant, it is clear the Furman and the local community can benefit from such a project.

Forestry is the number one among manufacturing industries in jobs (44,708) and payroll ($2.4 billion). Timber is the state's #1 agricultural commodity at $870 million annually. Therefore, a biomass plant that requires such large quantities of wood chips would aid to stimulate the forest industry. This project was created to explain the preliminary stages involving the location, distance, and estimates of the sawmills near Furman University. In addition, the project also provides a visual for the community that is unfamiliar with the benefits of biomass production. The information found can be used for other campuses in the Greenville area, and inform the county of the potentials of renewable energy.

Methods

Location of Sawmills: Sawmills within a 75 mile radius were found using Google Earth. A list was compiled of all of the potential mills (30 in total). At the end of the selection process, 19 sawmills were used. Coordinates were then inputted into Microsoft Excel. Images of sawmills were also gathered using Google Earth (Figures 3-4).

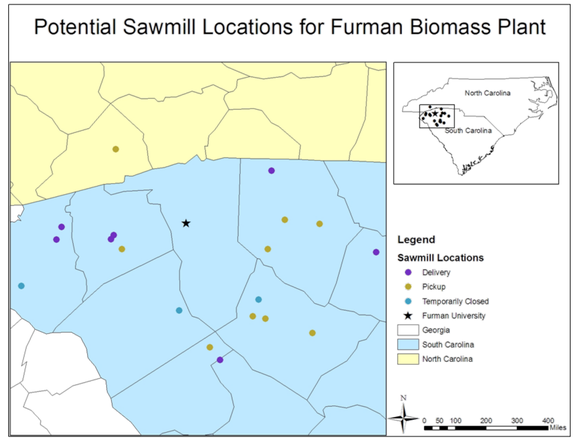
Distance of Sawmills from Furman: All of the addresses of the sawmills were placed in Google Maps, to give the shortest driving distance to Furman. The distances were then cross referenced using MapQuest and Google Earth. Results in miles were placed into Microsoft Excel.

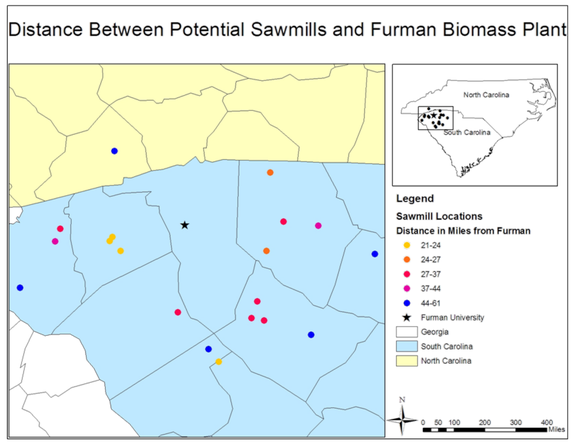
Estimates of Wood Chip Production: Phone numbers provided by Google Earth were used to call the sawmills asking for weekly estimates of wood chip production, mill residue production, and moisture content. The sawmills that provided information were then placed into Microsoft Excel and then inputted into ArcGIS.

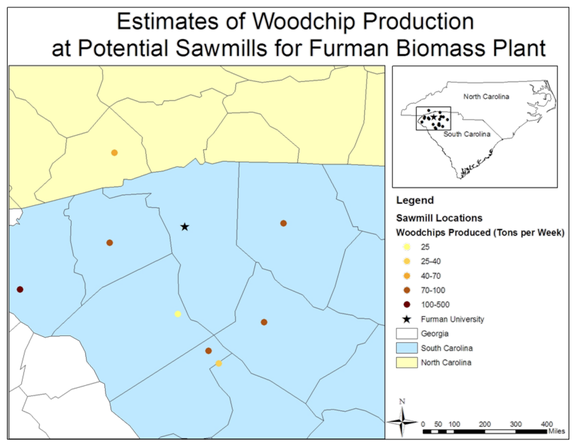
Analysis of Sawmills: Information gathered was then imported to ArcGIS in which a shape file from point data was created and overlayed with South and North Carolina shape files. Maps were then created using coordinates, distance from Furman, and estimates of wood chip production. Figures 1-2 were obtained using information gathered from the South Carolina Forestry Commission.

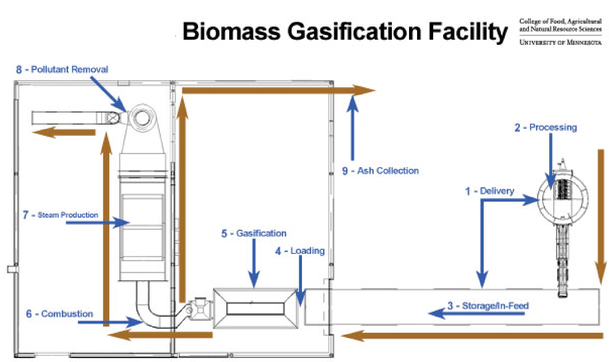
Acknowledgements

I would like to thank Dr. Bill Ranson at Furman University and Jack Byrne at Middlebury College for their knowledge and help, the sawmills who provided information and estimates, and Dr. Suresh Muthukrishnan who helped me throughout the projects completion. I would also like to thank the 2009 Fall EES201 class for their input.









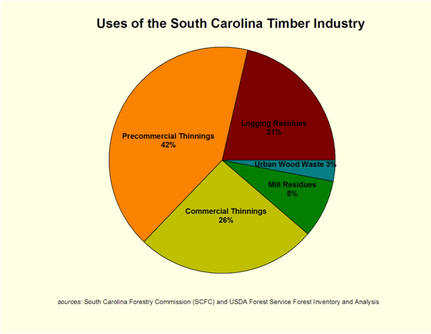


Figure 1: Uses of timber in SC that can be used for biomass fuel

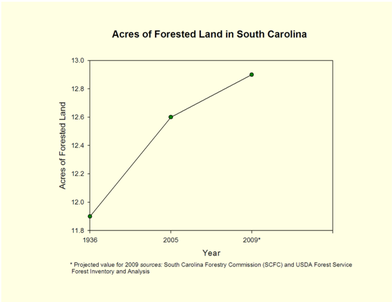


Figure 2: Increasing acreage of forested land in SC.

Figure 3: Baillie Lumber Company

Figure 4: Piney Sawmill near Pisgah Forest

Results and Discussion

Location of Sawmills: The first map displays the location of the sawmills, and if they provide pickup or delivery of their products. What occurred that was not expected was the temporary closing of three of the mills. The sawmills only work 3-4 days for the logging industry, and due to recent economic times they have closed permanently or until work is needed. Delivery of wood chips is preferred, considering Middlebury College has their wood chips delivered as well. There are 7 sawmills that deliver. 9 sawmills provide pickup service of wood chips that should be considered. However, a large truck would be needed for delivery to Furman. There were no sawmills located in Greenville County, which would have been ideal for wood chip collection.

Distance from Furman: The second map displays the relationship between the sawmills and their distance from Furman University. As stated before, a 75 mile radius is needed. Only 4 sawmills are within 21-24 miles of Furman, which would be ideal (the shorter the distance the better). Of the five mills that are 44-61 miles from Furman, only one delivers wood chips to Furman, and another sawmill is closed temporarily. It is advisable to not use these sawmills considering the distance, and inconvenience for Furman to pickup the wood chips.

Estimates: Of the 19 sawmills contacted only 8 provided data of their wood chips produced in tons per week. When asked the moisture content of their chips, only one larger sawmill (Figure 3) was knowledgeable. Many estimates did not separate mill residue and wood chips, which is why there is only one map indicating estimates of wood chips. The one sawmill located in North Carolina is near the Pisgah Forest (Figure 4). Furman should keep in contact with this sawmill because they collect wood from the forest that has fallen naturally or from control burns. The estimates collected were small in number individually, however Furman intends to use multiple sawmills.

Conclusions

After interpretation of the location, distance, and estimates of the sawmills, it is clear there should be more research involving the quality of the wood chips (moisture content, mill residue estimates separate from wood chip estimates). There is an abundance of wood waste as fuel for a biomass plant (Figure 1). Figure 2 shows that the amount of forested area in South Carolina is increasing by 6.7% annually, while 4% is removed, and 0.7% suffers from natural mortality. Thus a 2% accumulation annually is promising for a biomass plant that plans to use wood chips as fuel. Also, over half of South Carolina forests are unmanaged, so collection of wood chips from a separate source other than sawmills is possible if they are temporarily closed. Consideration of delivery is necessary, since many of the sawmills are closed or require pick up of product. Building a biomass facility would be a feasible source of renewable energy for Furman, due to the ten to twelve year payback period. Construction of the plant could aid in assisting the economic state of the lumber industry, yet with the current economic state it is difficult to start a project that requires fuel from small sawmills that are closed.

References and Data Sources

1. Local Sawmill Data
Google Earth for coordinates, figures 4-6
Google Maps and MapQuest for distance from Furman
Sawmills that gave estimates of weekly wood chip production
2. Furman Data
Google Earth for coordinates
3. South Carolina and North Carolina data
Source: ESRI Data & Maps [CD-ROM], 2005. Redlands, CA: Environmental Systems Research Institute.
Content: County boundaries and state boundaries
4. South Carolina Timber Industry Data
Source: South Carolina Forestry Commission. 12 April 2009.
http://www.state.sc.us/forest/.
Content: Timberland per acre, wood residuals used
5. Middlebury Biomass Plant Data
Jack Byrne, Director of Sustainability Integration, Middlebury College
6. Biomass Flow Chart
Provided by University of Minnesota

Projection

Geographic Coordinate System: GCS North American 1983
Datum: D North American 1983
Prime Meridian: Greenwich