Abstract: Early projections of agricultural biomass feedstocks available for energy production and biorefining were likely overestimated. Maintaining sustainable harvest volumes was downplayed and the possibility of biomass producers choosing not to harvest biomass was not considered. This project begins an effort to refine estimates of Minnesota’s biomass feedstocks by examining several factors.

Introduction: The increasing costs of crude oil in the last decade has spurred a great deal of interest in using agricultural biomass as a feedstock for production of heat, electricity, and liquid fuels in the United States. Several pilot and research systems are testing technologies that can produce energy from agricultural residues. A key issue for successful development of this technology is a reliable supply of biomass feedstocks (Table 1). The first estimates of biomass availability were released (Perlack 2005) about the same time many of these technologies were chosen for further development. Several companies have indicated that they are interested in pursuing large-scale deployment of biomass energy technologies should early testing prove successful. Therefore, there is a need to better understand the availability of feedstocks to fuel a new generation of biomass energy facilities.

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<th>Table 1. Key Criteria for Facilities Considering Biomass Feedstocks</th>
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<td><strong>Sustainable Quantities</strong>: As both a resource management and public relations issue, facilities must consider whether the amount of material collected is being harvested sustainably.</td>
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<td><strong>Consistent Quality</strong>: Biomass quality can vary greatly depending on harvesting equipment, storage conditions, and processing.</td>
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<td><strong>Continuous Supply</strong>: Probably the most important concern for many biomass facilities is that biomass be available on an ongoing basis.</td>
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The early estimates of available agricultural biomass were generated using primarily one source of data, the acreage of a crop grown in the United States. Unfortunately, multiple factors need to be taken into account in order to accurately gauge biomass supplies. The early estimates were overly optimistic because they did not address all factors. Table 2 lists some of the important factors used for fully assessing agricultural biomass availability. A more recent DOE update (DOE 2011) did begin to consider additional factors in the estimate, notably erosion and nutrient issues. However, more detail estimates will be needed before large, capital intense biomass energy production systems can be developed.

Table 2. Factors Affecting Supplies of Agricultural Biomass:

- **Crops Acreage**: The amount of land dedicated to biomass (Figure 1)
- **Yields**: Corn Biomass is usually produced at a 1:1 ratio by weight to grain
- **Sustainable Removal Rates**: Amount of material that can be removed with negatively impacting soil
- **Component(s) of Residue Used**: Using all biomass or a portion, for example cobs or stalk.
- **Harvesting Technology**: How much of the material can the equipment collect from the field on a consistent basis
- **Weather Patterns**: Will producers be able to harvest material in a region prior to winter (Figure 2)
- **Producer Participation-Williness of producers to harvest and sell material**

The broad goal of our research group is to eliminate barriers to deployment of renewable energy and provide economic development opportunities for rural communities. The objective of this study is to refine estimates of biomass in the state of Minnesota and identify locations in the state that may be best suited for developing biomass intensive industries. This project is in its initial stages and preliminary data is presented. Due to sustainability issues, this work focuses exclusively on corn residue.

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Early Findings:

- **Sustainability**: There is little data on regional sustainable harvesting, most data focuses on conditions of individual fields. Data sets may need to be created for regional estimates.
- **Weather**: There are significant concerns in Minnesota with rain during harvest, early winters, or late harvests. All of these conditions can affect both quantity and quality of biomass harvested.

**Participation Rate**: Anecdotal evidence suggests that a majority of corn farmers in Minnesota are not willing to participate in biomass harvesting and sales at this time.

**Methods**: Data for the project comes from multiple readily available sources; including the USDA, State of Minnesota, and survey data from farmers. The goal is to collect as much relevant information as possible to develop a model for estimating biomass availability in different regions of the state. With that information, the overall production of biomass in the state can be calculated. As the project progresses, data sources will be expanded and data refined to produce a more accurate estimate.

**References**


