Modeling a Biomass Transportation Process

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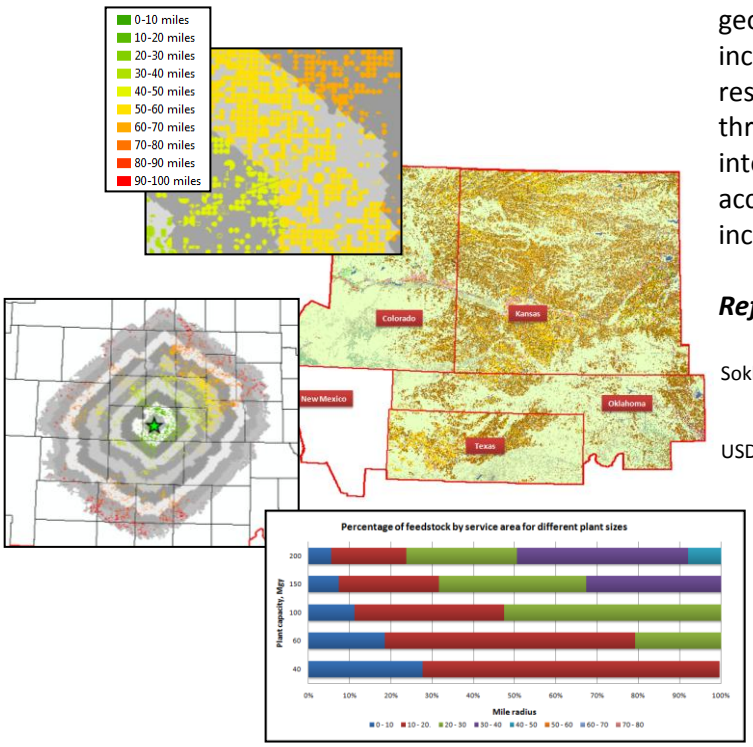
Goals:

1. Develop a new method using a geographical information system (GIS) to improve analysis of feedstock availability.

2. Modify and enhance an existing system simulation model to analyze the transportation and receiving operations of biomass feedstock delivered from in-field/on-farm storage locations to the receiving facility of a cellulosic ethanol plant located in the State of Kansas.

3. Perform a sensitivity analysis of the enhanced model to determine the variation in the key output parameters as key input parameters are changed.



Statement of Problem:

Extensive research has been undertaken to evaluate various renewable feedstocks capable of being converted into biofuel efficiently. Corn stover has received much attention in the past because it is considered the largest grain crop residue potentially available for use as bioenergy feedstock (DOE, 2005). It has been estimated that more than 238 million tons of corn stover (dry basis) is available annually in the United States (Sokhansanj et al., 2002). The challenge lies in strategically locating biomass conversion facilities in order to supply them with this corn stover in an economically feasible manner. The logistics challenge is dominated by factors such as facility location, feedstock availability, and transportation costs. A feedstock's dispersed spatial and seasonal availability are amongst the challenges associated with the optimized selection of a facility's location and the quantification of feedstock availability. These challenges are also known to significantly contribute to feedstock transportation costs. Ultimately, correct facility location selection will result in more precisely quantifying feedstock availability and predicting transportation costs.

Current Activities:

We are currently working on improving the method we proposed that quantifies feedstock availability using a geographical information system (GIS). We are doing this by incorporating the effects of yield variance within a county on residue and field sustainability, accounting for soil erosion limits through removable residue quantities, and incorporating risk into the analysis through yield variance and markets. Significant accuracy improvements are expected after these variables are incorporated to the analysis.

References:

Sokhansanj, S., A. Turhollow, and R. Perlack. 2002. Stochastic Modeling of Costs of Corn Stover Costs Delivered to an Intermediate Storage Facility. ASAE Paper No. 024190. St. Joseph, Mich.: ASAE.

USDA. 2005. Biomass as Feedstock for a Bionergy and Bioproducts Industry: The Technical Feasibility of a Billion Ton Supply. Energy Efficiency & Renewable Energy. Washington, D.C.: US Department of Energy. Available online at http://www.eere.energy.gov/biomass/. Accessed 30 May 2010.