GIS BASED ASSESSMENT AND SUPPLY LOGISTICS OF MISCANTHUS PRODUCED FROM STRIP-MINED LANDS

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ABSTRACT

United States has a potential to produce large amount of lignocellulosic feedstock namely, energy-crops, agricultural-residues, forest-residues, etc for building a sustainable biorefinery. In addition to croplands, marginal and strip-mined-lands can be converted to cultivate dedicated energy-crops (e.g. Miscanthus) for bioenergy applications. However, sustainable production, supply logistics of harvesting, transport and delivery to a biorefinery at low cost is highly challenging due to sparsely distributed lands. The main objectives of this research were to assess sustainably available Miscanthus from strip-mined lands in Ohio and to develop a supply logistics simulation model to continuously schedule feedstock delivery and to estimate cost of delivered feedstock for a capacitated biorefinery (100,000 dry Mg/y). The supply logistics model simulated the entire field operations from cultivation, harvesting & baling, storage and transport of Miscanthus delivered to a biorefinery using a discrete-event simulation platform and interfaced with GIS transport network distance. The model simulated continuous delivery of feedstock to a biorefinery operating for 330 days an year with 24/7 operations. The Miscanthus supply logistics operations required number of field equipment for constrained three month harvesting and year around supply of feedstock to a biorefinery with an estimated annual average feedstock cost of $70 per dry Mg from 7 km average transport network distance. Cost contributions from cultivation, collection, transportation and storage of Miscanthus were 46%, 17%, 28% and 9% of biomass delivered respectively.

Keywords: strip-mined land, Miscanthus crop, feedstock delivered cost, field operations.