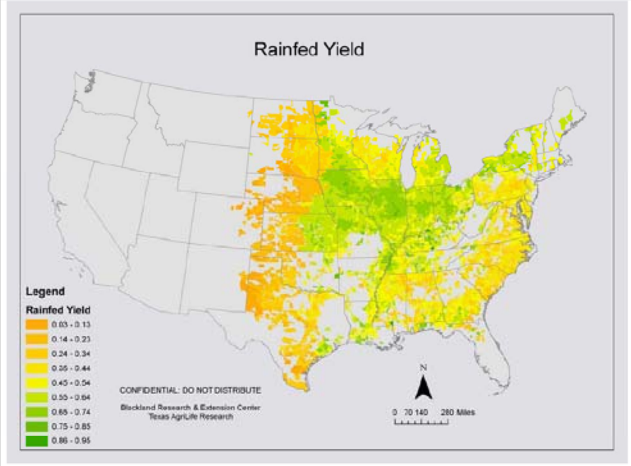
Determining Bioenergy Feedstock Availability Across the United States

Background

The key to sustain an agriculturally-based bioenergy industry is to secure the supply of lignocellulosic oil or starch feedstock in an economically and environmentally sustainable fashion. Simulation models are being used to estimate biomass productivity and its inter- and intra-annual variation. Combined with appropriate climate and soil databases, these simulation models are the most efficient way to obtain feedstock production estimates, along with a realistic assessment of yield variability.

An example of the average productivity for summer crops in the USA is presented here. This map was generated by combining outputs from thousands of simulations for several summer crops and data from the National Resource Inventory (NRI). This information can be refined for regions or crops of interest to establish realistic goals of feedstock supply for the bioenergy industry. The NRI will provide the basis for estimating reductions in sediment, nutrients, and pesticides from farm fields, increased water use efficiency, and enhancement of soil quality for any given region.



Relative yield for rainfed summer crops in the United States cropland simulated with the EPIC model. Yellow and light green colors represent good yields in Texas and southern states; dark green colors are biased by the high yields in the Midwest.

Through efforts of the Blackland research team, together with the USDA Conservation Effects Assessment Project (CEAP) has generated multiple data resources including *yields of all crops grown in the U.S.* at field and watershed-scales. Our research lab has compiled databases and information necessary to perform such crop yield and probability analyses based on weather, soils and crop management. These databases lend themselves to estimation of biomass production and variability based on changes in weather, irrigation, fertility, and management practices, specifically for the production of species grown on U.S. cropland.

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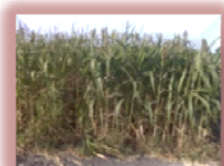
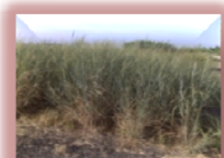
Strategic Approach



Blackland Research and Extension Center of Texas AgriLife Research, scientists have developed the software and database to assess productivity and the environmental impacts and economic consequences of management systems on crop, range, and forest lands. We combine spatially explicit soil, climate, operations with land-use/land cover databases of the USDA-NRI with the agricultural system/hydrologic simulation models EPIC., APEX and SWAT to produce robust estimates of the agricultural biomass production and its variability based on water and nutrients supply for a given location, soil, and/or weather pattern (historic or forecasted). These models/databases are regularly used to estimate environmental impacts or benefits, such us erosion rates and nutrient requirements and retention. Partial reports on oilseed crops have been routinely reported for the CTV-TAMUS Oilseed project.

In order to evaluate sustainable production potential several tasks must be achieved:



- Identify suitable areas for production of agronomic bio-feedstock operations,
- Identify a specific quantity of biomass to be produced by those areas,
- Identify best bioenergy crops or combination of crops for regions or landscapes.
- Determine reliable production levels from year to year,
- Determine whether long-term sustainability in respect to water/irrigation and environmental implications in respect to air, water and soil quality,
- Delineate factors which most influence economic sustainability,
- Estimate land and water resource demands and fertilizer, fuel, and other energy related input requirements of bioenergy crops.
- Simulate long-term production potential of bioenergy crops such as corn grain, sugarcane, biomass from switchgrass, sugarcane, corn silage, and sweet sorghum forage, and biodiesel from canola and soybeans,
- Develop stochastic probabilities of bioenergy profits from long-term historical weather data,
- Estimate long-term stochastic bioenergy production probabilities from historical climatic data to assess the sustainability of supplies, facilitating optimum plant location, and
- Assess environmental impacts such as soil erosion, nutrient losses, water/soil quality, and soil carbon degradation when converting to bioenergy crops.

Contact

Tom Gerik, Resident Director
Blackland Research and Extension Center
Temple (254) 774-6128

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