ORECCL-OAK RIDGE ENERGY CROP COUNTY LEVEL DATABASE

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ABSTRACT

A database on energy crop potential is being developed. This database will provide, for every county in the United States, information on the availability and cost of cropland and the yields, production costs and projected prices of energy crops. The database will be an EXCEL spreadsheet that can be downloaded from an Internet site. The 15 variables in the database are described in the paper.

Keywords: energy crops, switchgrass, short rotation woody crops, data, database

OVERVIEW OF DATABASE

The Biofuels Feedstock Development Program (BFDP) at Oak Ridge National Laboratory is developing a county-level database on energy crops. This database, which encompasses all U.S. counties, will provide both the public and state and local agencies easy access to energy crop information specific to their state or country. The database will also be useful for assessing geographic variation in the potential for energy crop development.

The county-level database will be a compilation of current information on land availability and rents and energy crop yields and production costs. It will also include probable farmgate prices for energy crops as calculated from information within the database. The database, which will initially include data on switchgrass, hybrid poplar, and willow, will be searchable by either state and county name or the five digit Federal Information Processing Standards (FIPS) numeric code for the state and county. It will be available as an EXCEL spreadsheet that can be downloaded from the Internet BFDP web site by the end of 1996.

http://www.esd.ornl.gov/BFDP/BFDPMOSAIC/btfbfpd.html

A Word Perfect file and an ASCII text file documenting the database will also be available at the same Internet site.

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CONSTRUCTION OF DATABASE

The construction of the database is outlined in Figure 1. County land use and land rent information will be derived from U.S. Department of Agriculture (USDA) data while energy crop yields and production costs will be derived by BFDP.

Land Use and Land Rent

The amount of cropland and pasture physically suitable for switchgrass and/or short rotation woody crops (SWRC) production will be derived for each county using USDA 1992 Agricultural Census information on land use and expert opinion on where specific energy crops can be grown. SWRC production in a county will be constrained to either willow or hybrid poplar production and identification of the SWRC species that would be grown in the county is one of database variables. If a county falls into a region which is not suitable for energy crop production (i.e., hybrid poplar, willow or switchgrass production) that will be noted in the database. Otherwise the acreage of cropland suitable for energy production will be defined as all cropland in the county except that cropland used for pasture, orchards or vegetables. These latter three types of cropland are excluded because they will be more costly to convert to energy crop production and/or they have a different land rent value than conventional crops (orchards and vegetables are high value crops and unlikely to be converted to energy crop production). The acreage of pasture suitable for energy crop production will be defined as the sum of the acres of cropland used for pasture and the acres of pasture/land. USDA differentiates cropland used for pasture/land.

The total amount of cropland in each county as reported in the 1992 USDA Agricultural Census and the amount of land in the Conservation Reserve Program (CRP) as of the 12th sign-up (1992) will also be included in the database. These two variables will be reported for every county irrespective of whether or not the county falls in a region of the county suitable for energy crop production. The CRP acreage will be taken from a USDA database provided to BFDP from USDA (T. Osbourne, personal communication).

Four different estimates of land rent will be provided for each county. These are the 1993 state cash-rent values for cropland and pasture land as reported by the Economic
Research Service (ERS) of USDA (ERS 1993); the average annual CRP payment ($/acre/yr) for all CRP-enrolled land in the country; and a derived county-level cropland cash-rent value. The latter land-rent estimate will be derived by multiplying the state cash-rent value for cropland by the ratio of the county farmland value ($/acre) to the state-average farmland value ($/acre) as reported in the 1992 USDA Agricultural Census. This derived value of land rent is based on the assumption that county to county variation in land rent ($/acre/yr) within the state mirrors county to county variation in farmland value ($/acre) within the state. The average CRP rental rate will be calculated by dividing the total annual CRP payments to the county by the total number of CRP acres in the county as of the 12th sign-up.

Energy Crop Yields and Production Costs

Although energy crop yield and production cost values will be reported at the county level, they will be derived at a regional (multi-county) level, because existing energy crop yield data are generally inadequate for predicting yields with county-level specificity. Thus an important step in developing the database is defining the yields, boundaries and counties of homogenous energy-crop production regions. The boundaries and energy crop yields of these regions will be developed using expert opinion, published yield values, available yield data from research trials, and existing yield models. These production regions will vary by energy crop type as switchgrass and SRWC yields do not demonstrate the same geographic pattern. If a county falls in a region of the country not suitable for switchgrass and/or SRWC production that will be noted appropriately in the database.

A median, optimistic and pessimistic yield value will be developed for each switchgrass or SRWC production region. The yield value will represent the average annual yield over the lifetime of the energy crop. By lifetime we mean the number of years between original planting and final harvest. For hybrid poplar this is the same as the rotation length as we assume the stand will be replanted after each harvest. For willow, the lifetime is presumed to be 22 years, with the first harvest occurring at the end of the 4th growing season and a harvest occurring every 3 years thereafter. For switchgrass, the lifetime is assumed to be 10 years. As it takes two years for a switchgrass stand to reach mature annual production and there is no harvest in the first year of the stand, the average annual yield of switchgrass is less than that of the stand at full annual production.

The yield will represent the harvested yield before any storage losses. It will not include the effects that weather or management failures or major insect or disease problems might have on yields. Furthermore, the yield represents that which would be expected if:

1. The stand was planted on former cropland (as opposed to former pasture).
2. The stand was planted in the year 2000.
3. Best management practices were followed.
4. The best genetic stock was used.
5. Crop establishment was successful.

The median yield is the median yield an expert would expect if the energy crop was planted on "typical cropland" in that production region. The pessimistic yield is an estimate of the 25th percentile yield across all cropland in that region. The optimistic yield is an estimate of the 75th percentile yield across all cropland in that region. That is,
if all cropland in the region were planted to the energy crop using good practices and the best stock, energy crop would expect 50% of the land to achieve at least the "median" yield. They would expect 25% of the land to achieve a yield less than the "pessimistic" yield and they would expect 25% of the land to achieve a yield greater than the "optimistic" yield.

Once energy crop production region are defined along with their associated energy crop yields, then yield-specific production costs will be generated for switchgrass and hybrid poplar using crop production models developed by Walsh and Becker (1996, this volume). Willow production costs will be defined using estimates from the State University of New York, Syracuse (D. Robinson, personal communication). Both variable production costs and total economic production costs excluding land rent will be given. Variable production costs will include fertilizer, seed, herbicides, fuel and custom operation costs. Total economic production costs include the value of the farmer's labor and fixed machinery costs (i.e., depreciation and opportunity cost) in addition to variable production costs. The total economic costs do not include any of the fixed costs associated with land (e.g., taxes) as these costs are presumably imbedded in the rent values.

Calculation of Farmgate Prices of Energy Crops

The region-specific median yields and their associated production costs will be linked to the county-level data on land rent to calculate the median farmgate price of switchgrass and/or SRWC within the county. The farmgate price ($/ton) for each energy crop type in each county is calculated as the break-even price associated with the expected median yield and production cost of the energy crop in that county and the county-level cash rent (Equation 1).

\[
\text{Price ($/ton)} = \frac{\text{rent ($/acre/yr)}}{\text{cost ($/acre/yr)}} / \text{yield (tons/acre/yr)}
\]  

The derived county-level cash rent value will be the preferred land rent variable for this calculation. If it is not available, then the average CRP payment or the state cropland rental payment will be used. Which land rent variable is used to determine the median farmgate price will be noted within the database.

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Figure 2. Example of First Eight Lines in Orecl Database.
THE 35 VARIABLES IN THE ORECCL DATABASE

Variables Which Define Location

1. Full name of state.
2. Full name of country.
3. Five digit FIPS code for state and country.

Variables Which Describe Potential Switchgrass Yield

If the country fall in a region of the country not suitable for unirrigated switchgrass production, a numeric code (such as -9999) indicating unsuitability will be inserted in each of the switchgrass yield cells (Variables 4-6) for that county.

4. Median estimated yield (dry tons/acre/yr) of unirrigated switchgrass.
5. Optimistic estimated yield (dry tons/acre/yr) of unirrigated switchgrass.
6. Pessimistic estimated yield (dry tons/acre/yr) of unirrigated switchgrass.

Variables Which Describe Potential Short Rotation Woody Crop (SRWC) Yield

If the county fall in a region of the country not suitable for either unirrigated willow or hybrid poplar production, a numeric code (such as -9999) indicating unsuitability will be inserted into each of the SRWC yield cells (Variables 7-10) of the county.

7. Type of SRWC crop assumed - willow or hybrid poplar (Alpha).
8. Median estimated yield (dry tons/acre/yr) of unirrigated SRWC.
9. Optimistic estimated yield (dry tons/acre/yr) of unirrigated SRWC.
10. Pessimistic estimated yield (dry tons/acre/yr) of unirrigated SRWC.

Variables Which Describe Potential Landbase for Growing Energy Crops

Variables 11 and 12 will be reported for all counties whether or not they are suitable for energy crop production. Variables 13 and 14 will be set to numeric code (such as -9999) if the county is in a region not suitable for switchgrass production. Variables 15 and 16 will be set to numeric code (such as -9999) if the county is not suitable for SRWC production.

11. Total amount (acres) of all USDA classified cropland in county.
12. Total amount (acres) of Conservation Reserve Program land in the county as of the 12th sign-up.
13. Amount of cropland (acres) suitable for producing switchgrass.
15. Amount of cropland (acres) suitable for producing SRWC.
16. Amount of pasture (acres) suitable for producing SRWC.

Variables Describing Value of Land for Current Uses (Land Rent)

If the county falls in a state for which state-level cash-rent data are unavailable, then the average cash rent of the states surrounding that state will be calculated and that average value will be used as the variable value for Variables 17 and 18. If county-level data are...
If the county has no CRP acres (Variables 7 equals zero) a numeric code indicating no CRP land (such as -7777) will be inserted into the cell for Variable 20.

17. State-level cash rents ($/acre/yr) for unirrigated cropland.
19. Derived county-level cash rents ($/acre/yr) for cropland.
20. Average CRP rental rate ($/acre/yr) through the 12th sign-up (June 1992).

**Variables Describing the Cost of Producing Energy Crops**

21. Total economic production cost of switchgrass energy crops ($/acre/yr) excluding only land rent and assuming median switchgrass yield.
22. Total economic production cost of switchgrass energy crops ($/acre/yr) excluding only land rent and assuming pessimistic switchgrass yield.
23. Total economic production cost of switchgrass energy crops ($/acre/yr) excluding only land rent and assuming optimistic switchgrass yield.
24. Variable production cost ($/acre/yr) of switchgrass energy crops, assuming median switchgrass yield.
25. Variable production cost ($/acre/yr) of switchgrass energy crops, assuming optimistic switchgrass yield.
26. Variable production cost ($/acre/yr) of switchgrass energy crops, assuming pessimistic switchgrass yield.
27. Total economic production cost ($/acre/yr) of SRWC energy crops excluding land rent and assuming median SRWC yield.
28. Total economic production cost ($/acre/yr) of SRWC energy crops excluding land rent and assuming optimistic SRWC yield.
29. Total economic production cost ($/acre/yr) of SRWC energy crops excluding land rents assuming pessimistic SRWC yield.
30. Variable production cost ($/acre/yr) of SRWC energy crops, assuming median yield.
31. Variable production cost ($/acre/yr) of SRWC energy crops, assuming optimistic yield.
32. Variable production cost ($/acre/yr) of SRWC energy crops, assuming pessimistic yield.

**Variables Describing Farmgate Price**

The farmgate prices of switchgrass and SRWC biomass will be calculated using:
- The median switchgrass or SRWC yield value (Variable 4 or 8).
- The total economic production cost excluding land rent that corresponds with the median yield (Variable 21 or 27).
- The preferred land rent value (generally Variable 19).
- The land rent variable used in the calculation (Variables 17, 19, or 20) will be identified.

33. Source of land rent information used in farmgate calculation.
34. Estimated median farmgate price ($/dry ton) of switchgrass biomass.
35. Estimated median farmgate price ($/dry ton) of SRWC biomass.

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REFERENCES
