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# **Estimating Producers' Willingness to Supply Switchgrass as a Bioenergy Crop**

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## Introduction

- Cellulosic biofuel:** The Energy Independence and Security Act (EISA) of 2007 mandated consumption of about 36 billion gallons of biofuel by the year 2022.
- Cellulosic biofuel feedstocks:** The three major cellulosic ethanol plants now in operation utilize corn stover as feedstock. Dedicated grass crops could also be used but they are more expensive.
- This project:** We wish to identify where switchgrass feedstock supplies in the upper Midwest would support the lowest feedstock costs.
- This report:** We report the results of a survey to estimate producers' willingness to produce switchgrass as a bioenergy feedstock.

## Objective

The main objective of the research reported here is to estimate potential producers' willingness to accept (WTA) for switchgrass production in terms of revenue per acre

## Analytical Method

- We assume the utility of the potential producer remains the same in both contingent valuation (CV) states:

$$v(p, q^0, m + WTA) = v(p, q^1, m) \quad (1)$$

- where  $q^0$  is the original acreage when the producer does not produce switchgrass.
- $q^1$  is the new acreage when the producer produces switchgrass.
- $v$  is the indirect utility.
- $m$  is the income of the producer
- $p$  is the price of the private good

## Methods

- Using Hanemann (1984) utility difference approach, we expressed (1) as:

$$v(m + WTA, z'_i \beta_o) + u_o = v(m, z'_i \beta_1) + u_1 \quad (2)$$

- Where  $z'_i$  is a vector of independent variables.
- $\beta$  is the vector of coefficients to be estimated.
- $u_i$  ( $i = 0, 1$ ) is the zero-mean error term.

- Following Alberini (1995), (2) is expressed as (3) below:

$$y_i^* = z'_i \beta + u_i \quad (3)$$

- where  $y_i^*$  is the producers' true WTA
- We assume  $y^*$  is distributed normal and used maximum likelihood estimation approach to obtain the parameters,  $\beta$ .
- We calculated the mean WTA across all respondents using:

$$E(WTA/\alpha, \beta, \bar{Z}) = [(\alpha/\sigma)/(\beta/\sigma)]\bar{Z} \quad (4)$$

- where  $(\alpha/\sigma)$  represents the normalized coefficient of the bid,
- $(\beta/\sigma)$  is the vector of normalized coefficients of the other covariates.
- and  $\bar{Z}$  is the mean vector of the covariates

## Survey Data

- The data were obtained from a contingent valuation survey mailed to 2500 potential switchgrass producers in the regions identified in figure 1, conducted for this study by USDA-NASS from October to December, 2014.
- One of three bids was assigned randomly to each respondent in each region.
- The bid levels and percentage of yes responses for each region are presented in table 1.
- The response rate was 54.36%

## Survey Regions

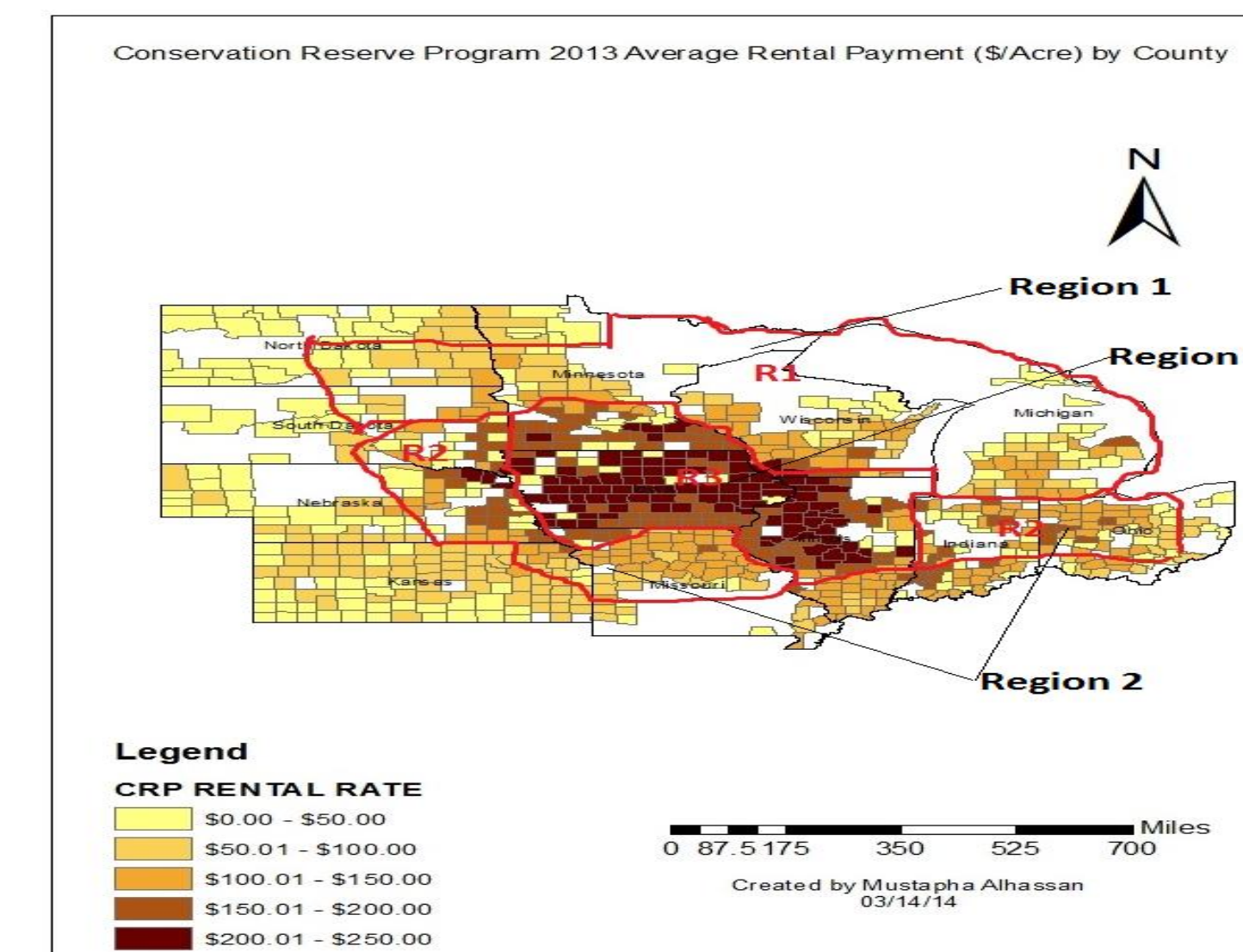


Figure 1. The survey regions

## Results

Table 1. Bid Levels and % Yes Responses

Bid (\$/acre)	% of Yes Responses	
	Produce	Lease
<b>Region 1</b>		
25	21	13
100	25	28
180	36	34
<b>Region 2</b>		
50	20	13
130	32	24
225	32	31
<b>Region 3</b>		
85	26	6
150	23	23
260	36	31

Table 2. Summary of analytical results

	Region 1	Region 2	Region 3
<b>WTA to produce switchgrass for biomass:</b>			
Mean WTA (\$/acre)	315	462	452
Marginal effect of \$1 bid on probability to accept	0.0009**	0.0006*	0.0007
<b>Mean WTA to lease for switchgrass for biomass:</b>			
Mean WTA (\$/acre)	258	384	355
Marginal effect of \$1 bid on probability to accept	0.0014***	0.0009***	0.0013**

Estimated from equation (4) using STATA *probit* and *margins* commands. Coefficients for other variables not shown here.

\*\*\*significant at 1% level, \*\* significant at 5% level, \* significant at 10% level

## Conclusions

- The mean WTA is higher than the 2013 CRP average rental rates in the regions.
- Mean WTA to *produce* is highest in the corn belt, lower in the fringes of the corn belt
- Mean WTA to *lease out production* is lower than WTA to produce, as expected.
- A \$100/acre increase in bid value would increase the probability of acceptance by 6 to 14%.

## References

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