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Consumers' Willingness-to-Pay for Perennial Grass Conversion to Renewable Energy in South-Central Minnesota

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Introduction

- The energy crisis in the late 2000s drove researchers and energy users to find cheaper alternatives to fossil-fuel based energy sources
- One solution, cultivating perennial grass for electricity generation, will produce positive externalities, such as improved water quality and increased open space
- This primary and secondary objectives were to determine the economic feasibility of converting existing row crops to perennial grasses and to identify the important environmental qualities to be enhanced after the conversion, respectively

Research Methods

- A questionnaire collected and measured environmental preferences, WTP, and demographic data. A cover letter, definitions sheet with before and after images of row crops and perennial grasses in the fall and spring, and a postage-paid return envelope were also mailed with the questionnaire
- 2,500 randomly-selected respondents ages 18 and older from Carver, Dakota, and Scott counties were mailed a questionnaire from August – October 2009
- The contingent valuation and hypothetical trip cost models were estimated using OLS and Tobit regressions to predict one's WTP against the variables listed below
- The models' independent variables were the respondent's age, years of education, number of people living in the household, 2008 gross annual income, sex, distance from Madelia, MN, average interest in recreational services, the importance given to global climate change mitigation and increased green/open space, and the length of stay at a converted site
- The total revenue, a function of perennial grass' net return, users' WTP calculated from the questionnaire, and the environmental service payment, a landowner would receive from converting row crops to perennial grasses were calculated

Results

- 29 percent of respondents returned the questionnaire
- 52 percent of respondents were not WTP to visit the converted area, versus 82 percent who were not WTP to visit a non-converted site
- The typical respondent is male, 56 years old, has 15 years of education, lives in a 2-person household worth nearly \$300,000, is married, and employed full-time
- Respondents ranked Clean Water for Drinking as the most important environment service, followed by Clean Water for Recreation, Reduced Flooding, Increased Green/Open Space, Global Climate Change Mitigation, Increased Animal Biodiversity, and finally Increased Plant Biodiversity

Selected References

- Conservation Marketplace of Minnesota. (2010). *May 12, 2010 draft business plan: Minnesota river basin*
- Mitchell, R. C., & Carson, R. T. (1984). *A contingent valuation estimate of national freshwater benefits: Technical report to the US environmental protection agency*. Washington D.C.

Significance of Variables in Contingent Valuation and Hypothetical Trip Cost Models for OLS and Tobit Regressions

Variable	Units	Contingent Valuation Model Using OLS	Contingent Valuation Model Using Tobit	Hypothetical Trip Cost Model using OLS	Hypothetical Trip Cost Model Using Tobit
Age	Years				
Education	Years	***	***	***	***
Number in Household	People				
Income	Dollars				
Sex	Male/Female	**			**
Distance from Madelia	Miles				
Average Interest in Rec. Services	Numerical Rank	****	****	****	****
Global Climate Change Mitigation	Numerical Rank	****	****	****	****
Increased Green/Open Space	Numerical Rank		**		**
Time Spent at Site	Days	**	****		

Note: ****, ***, and ** denote significance at the 0.01, 0.05, and 0.10 significance levels, respectively

Revenue Earned by Landowner Under Different Scenarios



Name	Scenario Represented
Baseline	Original Calculation
Case 1A	Lower Net Returns of Corn and Soybean
Case 1B	Higher Net Returns of Corn and Soybean
Case 2A	Fewer People Visiting Recreational Area
Case 2B	More People Visiting Recreational Area
Case 3A	Lower Switchgrass Net Return
Case 3B	Higher Switchgrass Net Return
Case 4A	Unlimited Credit Stacking; Lower Prices for Environmental Services Used
Case 4B	Unlimited Credit Stacking; Higher Prices for Environmental Services Used

Discussion

- The free-rider problem explains why it is hard to exclude those non-paying respondents from enjoying the improved environmental benefits since the benefits cannot be contained to only one area
- The variables age, distance, and income were not significant at the 10 percent level or greater. These variables were not significant since most respondents live about 77 miles from Madelia, MN
- Age was inconclusive since there are old people who are WTP to visit an area while some younger respondents would not visit or pay for such an area
- The revenue earned from harvesting corn and soybean crops is greater since the conversion costs generally exceed the revenues earned from harvesting perennial grass, except when unlimited credit stacking, or payments for ecosystem improvements, is allowed

Conclusions

- There is some support for converting row crops to perennial grasses for improved recreational and environmental services. However, most respondents were not WTP for these changes
- Landowners will only to choose to convert their lands to perennial grasses under the right economic conditions, such as in the case for allowing for unlimited credit stacking



Perennial Grasses in Spring



Perennial Grasses in Fall



Annual Row Crops in Spring



Annual Row Crops in Fall

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