DETERMINING FARMERS' PREFERENCES FOR A WORKING WETLANDS PROGRAM

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ABSTRACT

Wetlands play important role in the ecosystem and are a link between land and water. This study investigates a voluntary working wetlands pilot program focusing on small, temporary and seasonal wetlands present on croplands. The program compensates farmers for the positive externality provided by maintaining wetlands on their land. The objective of the study is to determine farmer preferences for a program introduced in the Prairie Pothole Region of North Dakota and with alternative attributes, as well as, their perceptions and attitudes towards other conservation programs and practices. The population is limited to program participants. Results from a choice experiment designed to consider hypothetical program attributes showed increase in program length, payment and flexibility in payment, increases probability of enrollment. Farmers prefer programs that are less restrictive especially with requirements for conservation farming examined in the study. They also require a relatively high financial incentive to participate in the program.

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LIST OF ABBREVIATIONS

ACEP .....Agricultural Conservation Easement Program

AES .....Agri-environmental Schemes

BMP .....Best Management Practices

CSP .....Conservation Stewardship Program

CRP .....Conservation Reserve Program

DCE.....Discrete Choice Experiments

EPA .....Environmental Protection Agency

EQIP.....Environmental Quality Incentives Program

ERS .....Economic Research Service

EU .....European Union

FRRP.....Farm and Ranch Land Protection

FSA .....Farm Service Agency

FWP .....Farmable Wetlands Program

GRP.....Grassland Reserve Program

NASS .....National Agricultural Statistics Service

NRCS .....National Resources Conservation Services

PES.....Payment for Environmental Services

PPR .....Prairie Pothole Region

SAWE .....State Acres for Wildlife Enhancement

UK.....United Kingdom

US .....United States

USDA.....United States Department of Agriculture

WHIP .....Wildlife and Habitat Incentives Program

WRP.....Wetland Reserve Program

WTA .....Willingness to Accept

WWP.....Working Wetlands Program

CHAPTER 1. INTRODUCTION TO THE STUDY

1.1. Background

Wetlands play an important role in the ecosystem and are a link between land and water. They serve as transition zones where the flow of water, the cycling of nutrients, and the energy of the sun meet to produce a unique ecosystem characterized by their hydrology, soils, and vegetation (EPA, 2001). Wetlands are found on every continent except Antarctica and are grouped into two main categories: coastal or tidal wetlands and inland or non-tidal wetlands.

Tidal wetlands are found along the Pacific, Atlantic, Alaskan and Gulf Coasts and are closely linked to the nation's estuaries, where sea water mixes with fresh water to form an environment of varying salinities (EPA, 2001). Non-tidal wetlands are common on flood plains along rivers and streams (riparian wetlands), in isolated depressions surrounded by dry land (e.g., playas, basins, and potholes), along the margins of lakes and ponds and in other low lying areas where the ground intercepts the soil surface or where precipitation sufficiently saturates the soil. Types of inland wetlands common to particular regions of the country include:

- Bogs and fens of the northeastern and north-central states and Alaska
- Wet meadows or wet prairies in the Midwest
- Inland saline and alkaline marshes and riparian wetlands of the arid and semi-arid west
- Prairie Potholes of Iowa, Minnesota and the Dakotas
- Playa lakes of the Southwest and Great Plains
- Bottomland hardwood swamps of the South
- Pocosins and Carolina Bays of the South east Coastal States
- Tundra wetlands of Alaska

Wetlands found in the United States fall into four general categories: marshes, swamps, bogs and fens (EPA, 2001). Marshes are wetlands dominated by soft-stemmed vegetation, while swamps have mostly woody plants. Bogs are freshwater wetlands often formed in old glacial lakes, characterized by spongy peat deposits, evergreen trees and shrubs. Fens are freshwater peat-forming wetlands covered mostly by grass, sedges, and reeds.

1.2. Motivation for the Study

In recent years, there has been considerable focus on the conservation of wetlands (Yu and Belcher, 2011). Wetlands are very productive ecosystems. They provide a range of important ecological functions and services, including flood and water flow control, surface and groundwater recharge and discharge, water quality maintenance, nutrient retention, nursery and habitat for biodiversity and other life support functions. These translate directly into economic value associated with flood protection, improved water quality and supply, and more or better recreational fishing and hunting (Birol and Cox, 2007). The EPA (2001) indicates that more than one-third of the United States' threatened canal endangered species lie only in wetlands and many other animals and plants depend on wetlands for survival. A wealth of natural products originating from wetlands are used in the United States including fish and shellfish, blueberries, cranberries, timber, and wild rice as well as medicines that are derived from wetland soils and plants.

Despite the productivity and usefulness of wetlands and their associated riparian zones, they have been extensively degraded by human activity (Yu and Belcher, 2011). Their presence on cropping lands and interference with yields has contributed partly to the number of programs in place for wetland conservation and restoration in the Prairie Pothole Region in North Dakota, South Dakota and Minnesota (Reimer, 2012).

These programs generally fall into two categories. One category is land retirement programs. The most prominent is the Conservation Reserve Program (CRP) administered by the Farm Service Agency (FSA) of the United States Department of Agriculture (USDA), currently the largest public-private partnership. There is also the Wetland Reserve Program (WRP) administered by the Natural Resources Conservation Service (NRCS) of the USDA, a smaller program with its annual expenditures being about one-tenth of those for the CRP. Participants in the WRP voluntarily restore their wetlands to protect and enhance them and wildlife habitat. The program offers a permanent easement or 30-year easement or contract, and a restoration cost-share agreement (NCRS, 2012). The NRCS pays a rental rate based on the terms of enrollment. Landowners pay taxes on the property and retain title to the land and thus the right to control access and recreational use. Land retirement programs requirements to remove land from agricultural production causes disinterest for farmers to participate due especially because of increases in farm commodity prices.

The second category includes the working lands programs which include the Environmental Quality Incentives Program (EQIP) and the Conservation Stewardship Program (CSP), among others (Reimer 2012). Working lands programs have shorter contract lengths and lands are not retired from agricultural use. Focus on environmental problems and farm sector preferences have increased interest in working lands programs, which are sometimes considered a blend of agricultural productivity and environmental protection (Reimer, 2012). The Agricultural Act of 2014 continues to support conservation programs with emphasis on working land conservation programs (ERS, 2014). In the new law, conservation programs have been consolidated, reducing program numbers from 23 to 11.

In the current work we investigate farmer-preferences for a working lands program entitled the Working Wetlands Program (WWP). The aim of this program is conserving small wetlands in croplands through the introduction of a new voluntary, incentive-based program. The targeted small temporary and seasonal wetlands are important elements in duck production for areas in North Dakota. The wetlands also provide habitat to a multitude of species as well as play a role in flood reduction, water storage and water quality.

Their presence on agricultural lands, however, causes a decrease in seeded acres and yield, and negatively impacts the efficiency of seeding, spraying and harvesting. As a result, one might argue that, by maintaining these wetlands, producers are providing a positive externality while reducing income opportunities on their private lands. Within this framework, the WWP emerged as a program to compensate producers accordingly. The program is newly offered to qualifying producers in the Prairie Pothole Region (PPR) of North Dakota.

The purpose of the current research is to develop an understanding of the perspectives of producers that enroll in the program, including measuring their satisfaction and soliciting feedback that may be important as the program is refined to better meet the needs of producers as well as maintaining conservation benefits. Although there is substantial literature on landowner attitudes and willingness to participate in wetlands programs, much of the work is dated and it does not extend into the design of new programs such as the WWP. The study assesses farm, demographic, attitudinal, and economic characteristics of participating farmers and their farms as well as preferences for program attributes.

1.3. Research Objectives

The overall objective is to determine farmers'/ranchers' preferences for a WWP. Specific objectives to help achieve this include: (1) Identifying producers' attitudes towards wetlands and

how they affect their farms and ranches and (2) Identifying the factors that influence their willingness to participate in a WWP.

The study is structured as follows: Chapter Two provides a literature review on farmers' preferences for conservation programs and factors influencing adoption, trends in agricultural conservation programs and some methods used to analyze similar studies. The theoretical framework, empirical analysis, and data collection procedures are discussed in the third chapter. The fourth chapter discusses results from the analysis and the last chapter presents the conclusions, implications and limitations of the study.

CHAPTER 2. LITERATURE REVIEW

2.1. Introduction

This chapter reviews literature related to farmers'/ranchers' preferences for agricultural conservation programs and factors affecting adoption of conservation programs. The chapter is organized into five sections as follows: agricultural conservation programs, trends, approaches and mechanisms; determinants of farmer participation/adoption of conservation and management practices and programs; producers' preferences for conservation easement programs; producers' attitudes/perceptions and their influence on wetland conservation; and empirical studies on landowner attitudes and conservation practice adoption.

2.2. Agricultural Conservation Programs: Trends, Approaches and Mechanisms

Conservation programs have been part of U.S farm legislation since the 1930s although program goals and objectives have evolved over time. Most conservation programs can be grouped into two categories, land retirement programs and working lands programs (Reimer, 2012). Introduced in 1985, the CRP is the largest and oldest land retirement program. The goal of the CRP has evolved over time and currently the program aims at re-establishing valuable land cover to help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat. Environmentally sensitive lands are removed from agricultural production and species that will improve environmental health and quality are planted.

It is a voluntary program with a fixed contract length of ten or fifteen years. Another land retirement program, the WRP, was designed to assist eligible farmers with technical and financial assistance to promote conservation on their wetlands through a 30-year or permanent easement. The program provides cost–share funding for wetland restoration and the landowner retains ownership and access while wetlands are protected from development (Ferris and

Siikamaki, 2009). Ferris and Siikamaki indicate that conservation and agricultural communities consider both the CRP and WRP important programs. Benefits noted are that they are voluntary, farmers retain land ownership, and programs support commodity prices, contribute towards habitat advancement, and support wildlife.

Besides these two main land retirement programs, there are other relatively smaller programs. These include the Grassland Reserve Program (GRP), Farmable Wetlands Program (FWP), State Acres for Wildlife Enhancement (SAWE), and Farm and Ranch Land Protection Program (FRPP) all administered by the FSA department of the USDA. The FRPP concentrates on non-governmental organizations by providing funds for the development of easements on agricultural land while the GRP is geared towards the protection of native grasslands, pasture and grazing land from development through easements (Reimer, 2012). While land retirement programs continue to help meet important conservation objectives, attention is gradually moving towards working lands conservation.

Some working lands programs initiated by Congress include the Environmental Quality Incentives Program (EQIP), Conservation Stewardship Program (CSP) and Wildlife Habitat Incentives Program (WHIP) administered by the NRCS of the USDA. EQIP was introduced in 1996 to provide cost-share payments and technical assistance to farmers for adopting conservation practices on active agricultural lands. In 2002, the CSP was introduced. It provides annual payments to farmers to address resource concerns on their farms. EQIP contracts are one to ten years in length. CSP contracts are five years in length. These and other working lands programs help bridge the gap between environmental protection and agricultural production (Reimer, 2012). From 2002, expenditure on working lands programs have seen tremendous growth especially for the EQIP and CSP. In the 2014 Farm Bill, 2014 to 2018 expenditures on

working lands programs is estimated at $1.35 billion to $1.75 billion for EQIP and $1.049 billion to $1.781 billion for CSP (ERS, 2014).

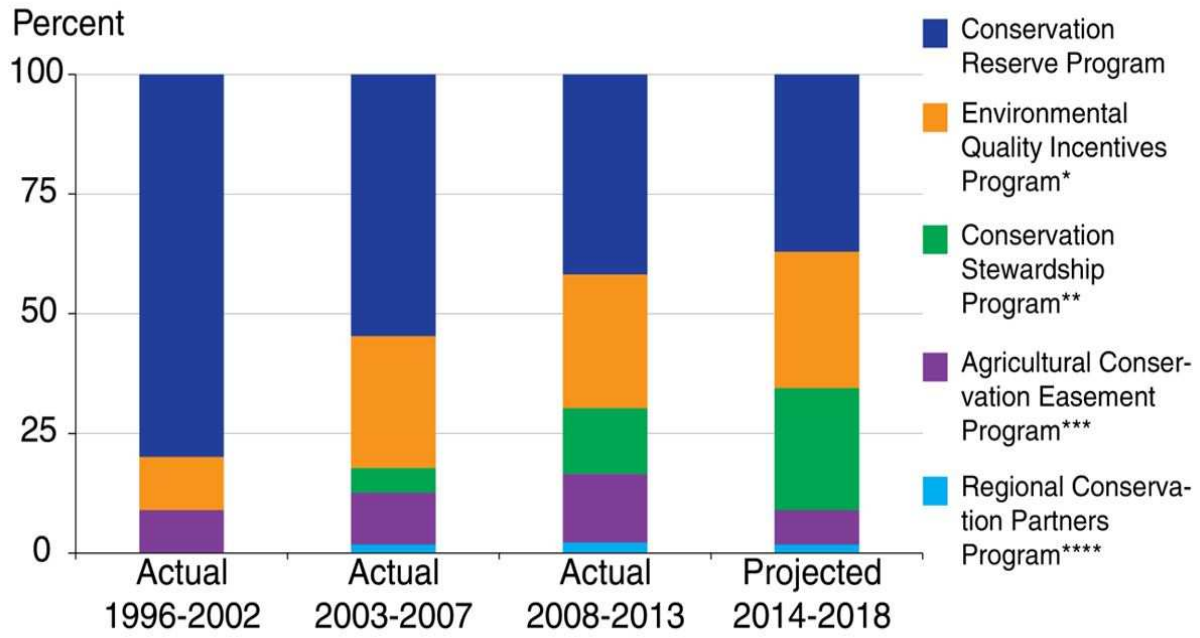

Figure1: Analysis of actual expenditures for 1996-2013 and spending estimates for 2014-2018
Source: USDA Economic Research Service

Funding for the two programs has been projected to cover more than 50 percent of spending on conservation programs over the life of the Farm Bill, including an increase in enrollment up to 10 million acres yearly for CSP and an increase in funding for EQIP from $1,350 to $1,750 million for the same period. On the other hand, land retirement and conservation easement programs will see a decline in enrolled acres. The cap on the CRP acreage has been reduced by 25 percent from 32 million acres under the 2008 Act to 24 million by 2017. The Wetland Reserve Program (WRP), Grassland Reserve Program (GRP) and Farm Ranch Land Protection Program (FRLPP) have been consolidated under one program, the Agricultural Conservation Easement Program (ACEP).

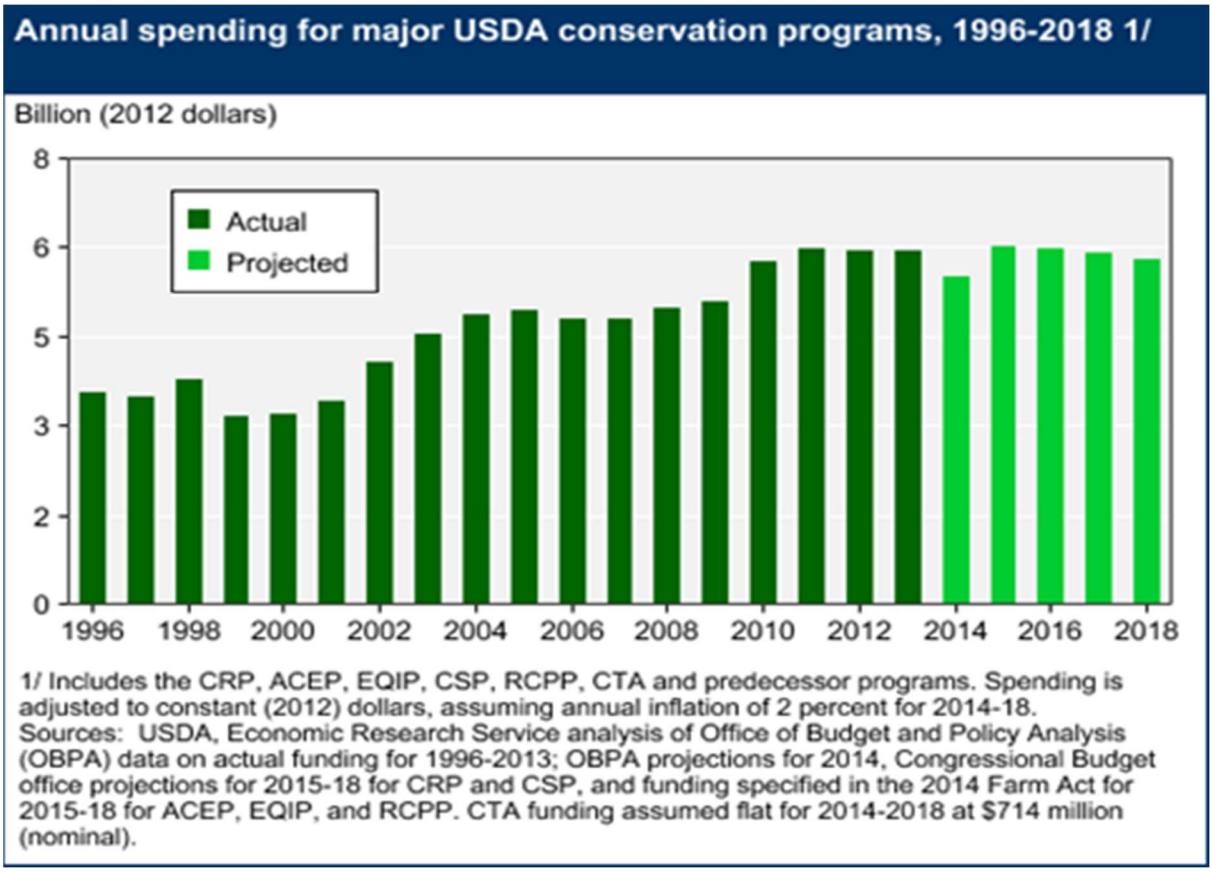

Figure 2: Analysis of actual expenditures for 1996-2013 and spending budget for 2014-2018
Source: USDA Economic Research Service

2.3. Determinants of Farmer Participation in Conservation Programs

The U.S Federal government spends billions of dollars every year on conservation programs. The use of financial incentives certainly motivates conservation practices and participation in programs, but research indicates other factors are also important (Reimer, 2012).

In a study of 268 farmers in a typical mid-western watershed in Michigan, Ryan et al. (2003) found that farmers' attachment to their land was the main motivator for the adoption of conservation practices rather than receipt of financial compensation. Farmers reported that they participate in conservation practices that help in the management of their farms and protect their streams. Ryan et al. concluded that the protection of riparian resources in agricultural watersheds

required conservation strategies that respect farmers' attachment to their lands and their practice of good stewardship.

Hua et al. (2004) in their study conducted with farmers in Ohio studied factors that influence decisions to enter into government conservation programs. They found the relationship between age, education and adoption to be ambiguous. This was because in their study, age and education were not significant in their influence on adoption decisions as they were in other research. Having an off-farm job has a negative effect on the participation in conservation programs.

An off-farm job may increase the opportunity cost of transaction time to learn and enroll in conservation programs. It could also be an indication for the need of additional income by the farmer thereby resulting in a lower willingness to adopt. This is because the conservation programs cover only a portion of adoption cost. The findings also indicated that farms likely to meet eligibility conditions are those with larger acreages of owned and rented land. Also, farm lands operated by owners are more likely to be enrolled than lands operated by renters (Hua et al. 2004).

An analysis of the factors influencing farmers' participation in forestry management programs by Dolisca et al. (2006) indicated that providing opportunities for farmers to increase their incomes stimulates environmental participation. Education and gender were also important factors identified in their study to encourage participation. Illiterate farmers were less likely to participate whereas female farmers were more positive in promoting participation. Research focusing on farmers in New Zealand and their approach to wetland and waterways management on their farms outlined some factors that motivate adoption. They pointed out that most of the farmers were motivated to restore and protect wetlands because draining wetlands to make them

productive was no longer accepted amongst farmers. They also found that wetlands were not developed necessarily for useful benefits for the farm but rather for aesthetic appreciation of wildlife and plant life found in wetlands (Mcleod et al., 2006).

Abdulla (2009) investigated the impact of ownership on Iowa land owners' decisions to adopt conservation practices. Results indicated that status of land, whether owned or rented impacts decisions to adopt conservation programs. Age, education, place of residence of farmer, agricultural land, reasons for owning land and knowledge about cost-share program were also identified as contributing factors (Abdulla, 2009)

Prokopy et al. (2008) in an analysis of 55 studies conducted in the United States, identified educational level, capital income, farm size, access to information, positive environmental attitudes, environmental awareness, and utilization of social networks as factors that positively affect adoption of conservation practices. They concluded that younger farmers with access to these factors were more likely to adopt. Tosakana et al. (2010) however found that many of the human capital variables (educational level, management experience and full time commitment to farming) identified by Prokopy et al (2008) were not statistically significant factors influencing likelihood of adopting the use of gully plugs and buffer strips. They identified producers' perceived effectiveness of conservation practices as a factor having the greatest impact on adoption. Respondents with larger acreages were more likely to invest in gully plugs (Prokopy et al., 2008).

In a study on landowners' willingness to adopt wetlands conservation in Saskatchewan, Yu and Belcher (2011) found Willingness to Accept (WTA) estimates and land rental rates to have similar distributions and concluded that landowners considered the opportunity cost of their land when making decisions on conservation programs. Conservation payment was not the only

factor influencing participation. Programs that improve the private benefits and reduce costs were more likely to be adopted by farmers. Also, programs targeted at farms with plans to handover to a successor and those with experience managing wetlands were more likely to adopt (Yu and Belcher, 2011).

Baumgart-Getz et al., 2012, concluded that effective Best Management Practices (BMP) adoption should combine complementary social factors to increase their impact. They also noted that the use of networks to implement extension efforts and disseminate information provides a logical way to extend the reach of factors found to have a significant effect on BMP adoption. Environmental awareness and attitudes were identified as positive influences on BMP adoption.

A recent review of literature on the adoption of conservation practices conducted by Wachenheim and Lesch (2014) reported on the effect of conservation program adoption variables. Examples of variables described from literature as inconsistent in their effect on conservation program adoption are age, education, farm size, area planted, and income. Factors consistent in their influence among papers reviewed are experience, attitude towards conservation management, family labor, gross farm income, profitability, information sources and program participation. They also stressed that not all factors influencing adoption are financial (Wacheinhem and Lesch, 2014).

2.4. Producers Preferences for Conservation Programs

Ranch and farm operators' preferences also affect their decision to participate in conservation easement programs. For the design and implementation of such programs to be successful, their thoughts and inputs must be taken into consideration. Birol et al. (2006) from a study on wetlands in Greece, found that farmers preferred wetland management programs with higher levels of biodiversity, open water surface area, research and education opportunities and

training of locals in environmental friendly practices. Higher levels of each of the above were found to increase the rate of participation in programs (Birol et al., 2006).

Ruto and Garrod (2009), as part of an European Union (EU) research project, investigated farmers' preferences for the design of agri-environmental schemes (AES) in the United Kingdom (UK) and discovered that farmers preferred shorter rather than longer contracts and that longer contracts must be accompanied with greater financial incentives. Farmers also preferred contracts with flexibility where they can decide on areas of their farms to include in a program. The administrative process was also a major concern; farmers preferred programs with less paperwork.

Investigating farmers' preferences for different design options for AES in Europe specifically in Spain, Espinosa-Goded et al., 2010, focused on farm management practices that encourage participation. They found that allowing farmers to undertake maintenance and management activities on their farmland encourages them to participate in programs even with lower compensation. Restrictions on these activities will require higher payments to encourage participation. Parkhurst (2011) evaluated program attributes especially payments, that encourage producer participation. Their study showed that ranch and farm operators were more interested in potential payments for ecosystems. The ranch and farm operators preferred programs with shorter contract lengths and higher payments, concluding that contract payments must be increased any time contract length increases. Farmers in California preferred programs managed by conservation organizations followed by private companies, federal agencies and state agencies while North Carolina respondents preferred state agencies.

Greiner (2015) identified factors influencing farmers' participation in contractual biodiversity conservation, finding that pastoralists and grazers in Northern Australia prefer more

monetary incentives for longer contracts and flexibility in contracts. This result was similar to that of studies by Ruto and Garrod (2009); Espinosa-Goded et al. (2010) and Yu and Belcher (2011). Results from Greiner's study did not indicate any significant effect of some demographic factors such as property size, family operated or corporation-owned farms, age, education and previous experience with conservation programs on the decision to participate in biodiversity conservation programs. It was concluded that contract attributes rather than socio-demographic factors affect the decision to adopt conservation programs.

2.5. Producers' Attitudes/Perceptions and their Influence on Wetland Conservation

Producers' attitudes affect their adoption of conservation practices and these can be looked at from the economic, farmer and general perspectives. Yu and Belcher (2011) found that farmers' attitudes and perceptions about wetlands play an important role in conservation decisions. They identified landowner experience, planning horizons and their perceptions of wetland values as very important factors to consider in the development of conservation programs. Johan et al. (2008) characterized farmers as independent, close to nature and the environment, and concerned about natural resources. They found proximity to nature and natural resources did not necessarily translate into a conservation ethic. The study also made reference to a survey in the United States revealing 82% of farmers describing themselves as sustainable managers of land resources and 90% reported feeling close to the earth.

Rispoli and Hambler (1999) identified women adult farmers to be more positive in terms of attitudes to wetland conservation. They found most farmers to be mindful of the importance of wetlands for biodiversity and supported the restoration of wetlands. Whitten and Bennett (1999), reported that socio-economic factors such as level of education and economic levels, and

physical constraints such as wetland type and size can affect perceptions about wetland management programs, in addition to financial incentives and costs.

Lockie and Rockloff (2005), in their extensive study on landholder attitudes towards wetlands and wetland conservation programs, found that respondents had enough knowledge about environmental conservation and landholders were skilled enough to manage their natural resources. Some views were that current programs and incentives were inadequate to represent the value and importance of wetlands to private landholders. Risk sharing, trust, recognition of private investment, flexibility in programs, education and information sharing were core factors identified to increase participation in conservation programs.

Burton et al. (2007) investigated community attitudes towards water management in Western Australia and concluded that both rural and urban residents find conservation of the environment very important. Both resident groups also support using their lands for agricultural purposes and were willing to support less damaging water management options and programs that contribute to enhancing agricultural production. Residents from both sides had little knowledge about agricultural problems such as the damage agricultural activities can have on the environment. Residents were of the view that the public should get involved in addressing environmental problems by compensating farmers who have to forgo some agricultural activities to avoid environmental damage.

Trenholm et al. (2013) conducted a study within the credit river watershed in Canada to investigate wetland management history and attitudes of landowners' towards wetlands. Farmers considered ecosystem services originating from wetlands as important. Water purification was ranked as the most important service while recreation and education services fell under the least important among the five ecosystem services considered. Landowners were satisfied with the

amount and quality of wetlands as well as accessibility to view wetlands of the credit river watershed. In terms of payment to participate in programs, one time payments are preferred to annual payments and providing information on how wetland loss affects participants is also essential (Trenholm et al., 2013).

2.6. Empirical Studies on Landowner Attitudes and Conservation Practices Adoption

Studies on conservation adoption, farmer attitudes and preferences have used varied methods to analyze determinants of adoption and assess attitudes of farmers towards conservation programs. Ryan et al. (2003), used factor analysis to identify discrete categories of attitudes and attributes. Respondents' ratings of attitudes identified by authors were averaged and used to develop scales. They used t-tests and one-way analysis of variance to compare participant groups. In a study to identify factors influencing farmers' participation in forestry management programs, Frito et al. (2006) built a conceptual and empirical model using qualitative information collected during focus group meetings and from surveys. These were analyzed using statistical methods such as cross correlation, structural equation modeling and multiple regression analysis to determine the links between farmers' participation in forest management and their socioeconomic and attitudinal characteristics.

Tosakana et al. (2010), in their study to determine the adoption of conservation practices by farmers in the Northwest Wheat and Range Region, used an ordered probit model to predict the probability of adoption of each conservation practice (gully plugs and buffer strips) on various landscapes and slopes. The model identified key variables affecting farmers' adoption decisions based on farmers' field attributes, socioeconomic characteristics and attitudes, and farm attributes (Toskana et al, 2010).

Random utility theory has also been the trend in recent studies to explain the conservation behavior of landowners. Yu and Belcher (2011) used Random Utility Maximization (RUM) theory based on the assumption that the landowner will be willing to take steps to conserve wetlands and riparian zones on the land when the utility provided by adopting conservation is greater than the next best alternative. The underlying model involved the landowner's expected utility consisting of the individual's income, conservation choices, attributes such as personal characteristics, individual preference and land quality that may affect land use decisions. Binary and multinomial probit models were used to analyze the influence of attitudinal characteristics.

A number of studies have used discrete choice experiments especially in determining preferences or program design attributes that encourage adoption. This is also normally accompanied by some econometric analysis. Parkhurst (2011) used choice experiments to determine ranch and farm operators' attitudes regarding payments for ecosystem services. The three program attributes considered were contract length, program administration and payment level. A conditional logit model with fixed effects was used to analyze effects program attributes have on choices made by respondents. The conditional logit model estimates the likelihood that a rancher will participate in a program, given any combination of options. Greiner et al. (2014) used a Discrete Choice Experiments (DCE) to determine effective payments for ecosystem services schemes to protect the North Australia's biodiversity values, and assess farmers' preferences.

Choice experiments have been useful in valuation studies and also determining preference for conservation programs (Birol and Cox, 2007; Birol, Karousakis and Koundouri, 2006; Espinosa-Goded et al, 2010; Ruto and Garrod, 2009; Greiner, 2015). Carlsson et al (2003)

valued wetland attributes using a choice experiment. They were able to determine attributes that would be considered when decisions are being made on the value of wetlands. A random parameter model was used. Results indicate that biodiversity and walking facilities (walking tracks for running and jogging and information signs about plant and animal life) contribute immensely to welfare.

2.7. Summary

This chapter reviewed relevant literature on the evolution of conservation programs, factors to increase adoption of conservation practices, farmer/landowner preferences in the design of conservation programs and farmer perception/attitudes affecting the adoption of conservation programs. Agricultural conservation programs have evolved overtime from land retirement programs such as CRP and WRP to working lands programs including EQIP and CSP. In subsequent Farm Bills, programs have evolved as the relative allocation of funds. In the current Farm Bill, programs have been consolidated for flexibility, accountability and adaptability at the local levels (USDA, 2014).

Research demonstrates that financial incentives are not always the main motivator for the adoption of these conservation programs or practices. Farm size, education, gender, age, capital income, programs that provide opportunities to increase incomes, farmers having knowledge about the program, access to information, environmental attitudes, increased private benefits and decreased costs, farms with succession plans, and experience managing wetlands have also been identified as factors influencing adoption. Research in general supports the notion that farmers prefer conservation programs that have high level of biodiversity, provide research, education and training opportunities, and allow farmers to maintain and manage activities on their farm-land, even when compensation is lower. Also, contract structure and shorter contract lengths are

most preferred while longer contract lengths, in general, must have higher financial incentives. Contracts are preferred that are flexible and allow farmers to decide areas of their land to include in the program.

Farmer's attitudes such as perceptions of wetland values influence adoption. Farmers are independent and close to nature and the environment, and are concerned about natural resources. They see themselves as sustainable managers. Farmers are mindful of the importance of wetlands for biodiversity and in general support restoration of wetlands. Risk sharing, trust, recognition of private investment and information sharing have also been shown to be important. Both contract attributes and socio-demographic factors affect the decision to adopt conservation programs. The effects of age, education, management experience, and full time commitment to farming identified in the research on adoption were not consistent. Little in the literature focuses on participation in wetlands programs and none that we identified focused on working wetlands programs. The objective of this study is to provide information with respect to working wetlands programs.

CHAPTER 3. METHODS

3.1. Introduction

This chapter describes the choice experiment design, survey instrument, data collection approach, and background information about the survey area. Primary descriptive statistics of respondents are shown and details of the theoretical and empirical framework used to analyze data collected are provided.

3.2. Choice Experiment Design

Choice experiments are an example of a stated preference method that can be helpful to provide information for design of new programs (Greiner, 2015). The method can be used to determine the relative ranking and economic value of different attributes of a program. They reveal preferences of the respondents, provide an estimate of trade-off between attributes, and identify required compensation associated with participation in programs with differing characteristics (Parkhurst, 2011). The method has been used in a number of studies to help in the design of agri-environmental programs and payment for environmental services (PES) programs (Greiner, 2015; Ruto and Garrod, 2009; Espinosa-Goded et al. 2010).

In designing a choice experiment, the initial step is to choose relevant attributes and appropriate levels for these attributes for a good or service such that the stated preferences address pertinent issues or concerns (Nganje et al., 2008). Focus group discussions and consultations with experts as well as extensive pre-testing procedures can be used to assist in determining the right attributes and levels to use (Birol and Cox, 2007). For the current study, attributes and levels used in the choice experiment were identified through an extensive review of literature on studies related to conservation and wetland management programs, a pre-test exercise with staff and students from farm families in the Department of Agribusiness and

Applied Economics and discussions with partners at Delta Waterfowl and NRCS. The attributes and levels chosen are presented in table 1.

Table 1: Working wetland program attributes and attribute levels used in choice experiment

Attribute	Definition	Levels
Length of contract	Duration of contract	5 years/10 years/15 years
Rental Payment	Percentage of county rental rate reported by NASS for the land on which the wetland resides	70%, 85%, 100%, 110%
Terms	Terms of payment in relation to duration of contract	Fixed at start for the length of contract or midterm readjustment to reflect changes in local rental rates
Annual use of no-till	Requirement for conservation on the tract within which the wetland resides	Yes/No
Planting and maintaining a cover crop once every three years	Requirement for conservation on the tract within which the wetland resides	Yes/No
Planting a winter cereal crop every fourth year	Requirement for conservation on the tract within which the wetland resides	Yes/No

There were six different attributes identified. Length of contract has three levels (5 years, 10 years, 15 years); rental payment has four levels (70%, 85%, 100%, 110%) of county rental rate; terms of payment has two levels (fixed, readjusted) and annual use of no till, planting of cover crops, and planting of cereal crop have two levels each (yes/no). A linear D-optimal design procedure (Optex) in SAS was used to create choice sets. This design is from the collective factorial, where the collective factorial is an L^{AC} factorial, where C is the number of alternatives with each having A attributes with L levels. Through this procedure, thirty (30) choice sets with mutually exclusive and collectively exhaustive levels within each attribute were derived. Each respondent was presented with all choice sets each having three different options. An example of the choice task is presented in table 2.

Table 2: Example of choice set

ATTRIBUTE	OPTION A	OPTION B	OPTION C
Length	15years	10years	
Payment	70%	100%	
Terms	Mid-term Adjustment	Mid-term Adjustment	Opt Out
No-till required	Yes	No	
Cover crops required	No	Yes	
Winter Cereal required	No	Yes	
RANK			

Option A includes an annual payment reflecting 70% of the local rental price at the time of enrollment. It is a 15-year contract with a mid-contract rental payment adjustment (after seven years). No-till must be used on the tract where the wetland resides.

Option B includes a higher annual payment, that equal to the rental price at the time of enrollment. It is a 10-year contract, with payment readjusted after 5 years. Producers are required to plant a winter cereal crop every fourth year and a cover crop every third year.

Option C is not to enroll in a Working Wetlands Program contract.

A respondent who prefers for example, Option B over Option A, but would enroll in both, will have ranking that would look like this.

Table 3: Example of ranking option B over option A

OPTION A		OPTION B		OPTION C	
RANK	2	RANK	1	RANK	3

For a respondent who prefers to enroll in Option B, but not Option A, the "no contract" option would be the second choice and the rankings would look like this.

Table 4: Example of ranking with option 2 preferred over option 3

OPTION A		OPTION B		OPTION C	
RANK	3	RANK	1	RANK	2

3.3. Survey Instrument Design and Data Collection Approach

The main objective of the study was to determine preferences for a working wetlands program by eliciting information from farmers and ranchers who had voluntarily signed up for participation in a pilot working wetlands program for North Dakota implemented by Delta Waterfowl in partnership with NRCS. The study was part of the main project implementation plan; farmers and ranchers who agreed to take part in the program, by default agreed to consider taking part in the study. The farmers and ranchers are farm operators in the PPR in the eastern half of North Dakota, where small wetlands are prevalent. Survey questionnaires were mailed to producers on October 21st, 2015. This process was used because it is less expensive and advantageous in that it avoids interviewer effects and allows respondents to complete the survey according to their schedule especially taking into account the time of the year which was during the harvest season. This was followed up with phone calls to make sure producers had received the questionnaires.

Fifteen out of 31 questionnaires mailed were received. Producers were still going through some project administration processes. Some producers included in the survey proved ineligible for the program and new applicants were included. Another set of questionnaires were mailed on February 5th, 2016 to the new applicants and those who did not respond to the first set mailed. A total of 64 questionnaires were mailed and responses were received from 32 producers (including one producer who proved ineligible) representing 50% and this was used for the analysis.

The survey questionnaire had an introductory note explaining the content of the instrument. The survey consisted of six parts. The first part contained questions about farm and farm operations of the landowners. The second part inquired about the types of conservation practices undertaken on the farm, and the next set of questions elicited farmer knowledge of and

thoughts on conservation. It was important to also know their thoughts on the working wetlands program they enrolled in, including what motivated their participation and their expectations. The fifth set of questions was on some socio-demographic characteristics of the farmers and the last part consisted of the choice set questions.

3.4. Background Information about Survey Area

The PPR also known as the "Duck Factory" of North America (North Dakota, South Dakota, Wisconsin, Minnesota) produces over half of the continent's waterfowl. It also provides the most productive breeding habitat in North America for hundreds of other migratory bird species. This 300,000 square mile region was created by retreating glaciers roughly 12,000 years ago, and once contained approximately 25 million wetlands, or an average of about 83 per square mile; a density unmatched anywhere in the continent. Submerged and floating aquatic plants take over the deeper water in the middle of the pothole while bulrushes and cattails grow closer to shore. Wet, sedgy marshes lie next to the uplands (EPA, 2012).

Participants in the survey were from the PPR of North Dakota. They were from eleven different counties including; Dickey, Renville, Ward, Bottineau, Sargent, Stutsman, Ransom, Burke, Pierce, Lamoure, and Barnes

Figure 3: Map of the Prairie Pothole Regions in the U.S.A and Canada
Source: United States Fish and Wildlife Services

3.5. Theoretical Framework

Discrete Choice modelling has its theoretical background from Lancaster's Consumer Theory which is based on the assumption that goods are consumed for the characteristics they possess and these characteristics are the objects of consumer preference or utility (Lancaster, 1966). Discrete choice modelling also has its economic basis in Random Utility Theory (Birol and Cox, 2007). Random Utility Theory assumes the utility maximization principle, that is, the farmer/landowner knows his/her utility function with certainty and is a well informed decision maker capable of evaluating alternatives and choosing that which gives the greatest relative utility (Greiner, 2015). For the study, a farmer will choose one contract or option say A over B, if $U(X_A, Y) > U(X_B, Y)$ where U represents his/her indirect utility function, X_A the attributes of alternative A, X_B the attributes of B, and Y the personal (e.g. socio-demographic and attitudinal) and property characteristics (e.g. size, land productivity, farm profitability, ownership structure) that influence the farmer's utility.

3.6. Empirical Framework

In this study, respondents were asked to rank choice sets consisting of three different alternatives: two hypothetical WWP enrollment options with varied contract attributes, and a "no contract" option. To evaluate the individual preferences indicated by respondents in relation to the different attributes and characteristics of the choice set, an exploded logit model with no ties in ranking was employed. This is because respondents assigned unique ranks to each item. The exploded logit model which has been used extensively in marketing research is a generalization of a familiar conditional logit regression model introduced by McFadden (1974). This model is also known as rank-ordered logit model in economic literature proposed by Beggs, Cardell, and

Hausman (1981) and further advanced by Hausman and Ruud (1987). The model is based on the Random Utility theory.

For this study, respondents' assigned unique ranks to each item; therefore assume each respondent ranked J choice sets with Y_{ij} denoting the rank assigned to a WWP choice Y by respondent i. If there are J alternatives per choice, then Y_{ij} can take on integer values from 1 to J where "1" most preferred and "J" least preferred choice. According to Random Utility Model (RUM) (Luce, 1959; McFadden, 1974; Allison and Christakis, 1994), it is assumed respondent i has a utility U_{ij} for each choice j. In general, J can differ across respondents, but in this case, it is assumed to be constant and that respondents valued the same set of choices. From utility theory, we assume respondent i will rank for example, choice j higher than another choice k whenever $U_{ij} > U_{ik}$. Also each utility U_{ij} consists of a systematic component μ_{ij} and random component ε_{ij}:

$$U_{ij} = \mu_{ij} + \varepsilon_{ij} \tag{1}$$

where error term (random component) ε_{ij} is assumed to be independent and identically distributed with an extreme value distribution also known as the Gumbel or double exponential distribution. The systematic component (μ_{ij}) represents the set of explanatory variables which can be represented in as a linear function:

$$\mu_{ij} = \beta_j x_i + \gamma z_j + \theta w_{ij} \tag{2}$$

where x, z, and w are column vectors of measured variables and β, γ, and θ are row vectors of coefficients to be estimated. The x_i vector contains variables that describe respondents but do not vary over choices and one of the β_j vectors must be set equal zero to achieve identification (the choice of the reference item is arbitrary). The z_j vector contains variables that vary across choices but are the same for all respondents. The w_{ij} vector contains variables that describe a relation

between choice *j* and respondent *i* (i.e. interaction between characteristics of contracts and respondent's variables (Allison and Christakis, 1994).

Equation (2) becomes equivalent to the usual multinomial logit model if γ, θ are both 0 and a conditional logit model if θ is 0 and γ and β are nonzero. Exploded logit model is used here because an observed rank ordering of J choices may be regarded as an explosion into $J - 1$ independent observations such that $U_{i1} > U_{i2} > \ldots\ldots > U_{ij}$ gives rise to $(U_{i1} > U_{ij}, j=2,\ldots\ldots J)$, $(U_{i2} > U_{ij}, j=3,\ldots J), \ldots (U_{i(J-1)} > U_{ij})$ (Salomon, 2003). Data collected reflected this sequence where respondents had to rank choices with the highest preference chosen over other two choices, the second choice is chosen over the third after the first choice has been excluded from the choice set. The Independence from Irrelevant Alternatives (IIA) assumption implying that ε_{ij} terms are independent across choices makes this explosion possible. (Allison and Christakis, 1994). For a single respondent, the random utility model implies the following (Allison and Christakis, 1994).

$$L_i = \prod_{j=1}^{J} \left[\frac{exp\{\mu_{ij}\}}{\sum_{k=1}^{J} \delta_{ijk}\, exp\{\mu_{ik}\}} \right] \tag{3}$$

Where δ_{ijk}=1 if $Y_{ik} \geq Y_{ij}$, and 0 otherwise

3.7. Estimation of the Exploded Logit Model

To estimate the exploded logit model, the maximum likelihood procedure for estimating proportional hazard models is employed (Allison and Christakis, 1994). For a sample of n respondents, equation (3) implies a log likelihood of

$$\log L = \sum_{i=1}^{n} \sum_{j=1}^{Ji} \mu_{ij} - \sum_{i=1}^{n} \sum_{j=1}^{Ji} log \left[\sum_{k=1}^{Ji} \delta_{ijk}\, exp(\mu_{ik}) \right] \tag{4}$$

The linear model for μ_{ij} in equation (2) is substituted into the above equation (4) which is maximized with respect to the β_j coefficient vector. The likelihood is proven to be globally

concave meaning if a maximum is found, it is global rather than a local maximum (Beggs et al., 1981). The PHREG procedure in SAS was used to estimate the model.

CHAPTER 4. RESULTS AND DISCUSSIONS

4.1. Introduction

This chapter provides results and discussion on the descriptive statistics of farmers, information on their farms, results from the attitudinal questions and program attributes identified that promoted their participation in the WWP. The survey targeted farmers with small temporary and seasonal wetlands who qualified, applied and were selected to participate in the WWP. Questionnaires were mailed to 64 farmers enrolled in the program. Ten farmers had two or three farms from different counties enrolled. Only farms in the PPR of North Dakota were eligible.

4.2. Descriptive Statistics

All respondents were male and between 20 and 70 years old. The largest percentage (47) were between 51 and 70 years old; 37% were between 31 and 50 and 15% were between 20 and 30 respectively. The average age of respondents was 48 years old; younger than the average age of primary farm operators in North Dakota, which is 55.3 years old (USDA NASS, 2012 Census of Agriculture). Over 60% of respondents had some college education; 28.1% reported having bachelor degrees, 28.1% others attended some college and 9.4% completed graduate degrees.

A majority of respondents (78%) own and reside on their farms. Twenty-eight percent listed farming as their main occupation with sales less than $250,000 and 25% of respondents have large family farms (sales between $250,000 and $499,999). Forty-one percent of the farmers have very large family farms (sales ≥ $500,000). Sixty-nine and forty-one percent of the farmers and spouses work full time on their farms, respectively. The spouses of forty-seven percent of farmers work full-time off farm for supplemental income. The number of years until retirement reported by farmers ranged from one to thirty. Fifty-two percent of the farmers have

up to 10 years to retire, seventeen percent have between 11 and 20 years and twenty-one percent have between 21 and 30 years to retire. Table 5 below provides a summary of the demographics of the respondents.

Table 5: Summary of demographics of respondents

Variable	Statistics
Gender	100% (Male)
Age	20-30 = 16%, 31-40 = 12%, 41-50 = 25%, 51-60 = 28%, 61-70 = 19%
Mean Age	47.5
Education	High school graduate = 25%, Some college = 28.1%, Bachelor's degree = 28.1%, Completed graduate degree = 9.4%, Associate degree = 6.25%
Reside	78.12% on farm 12.5% town or city 9.37% rural area, outside of town
Type of farm	40.6% very large farms (sales ≥ $500,000) 28.1% farming occupation (sales < $250,000; farming is main occupation) 25.0% large family farms (sales between $250,000 and $499,999)
Relationship to farm	75% owners, 12.5% renter owner, 6.25% renters
Farm with	46% (family), 7% (sibling), 7% (no one), 7% (spouse), 33% (no answer)
Do not work off farm	Farmer – 69%, Spouse – 41%
Work full-time off farm	Farmer – 13% Spouse – 47%
Retirement age	1-10yrs = 52%, 11-20yrs = 17%, 21-30yrs = 21%

4.3. Summary on Land Management

Summary statistics for land management are provided in table 6 below. A majority of the respondents who are owners of their farms reported being the primary decision makers. About 16% of respondents raise livestock (beef cattle) or have horses on their wetland acres. Wheat, soybeans and corn are the three most common crops grown. Other crops mentioned were flax, canola, peas and oats. The average farm land was 3,871 acres of which 1,640 is owned and 2,231 is rented by respondents. The average number of wetlands less than two acres on the farms of respondents was 65.4 (119 acres) and the average number of wetlands greater than two acres is

25.3 (124 acres). For the average farmer, the percentage of wetlands dry in most years is 24, 12.3% are dry in more years than not, 12.2% are dry in about half of the years, 14.2% are dry in less than half of the years and 30.4% are never dry.

Regarding land use, about 53% of farmers do not use part of their wetlands (accounting for 54.8% of wetlands) for any activity. Most farmers also do not leave their wetlands completely idle; 59% of farmers farm on part of their wetlands (57.6%) and 9% of farmers use their wetlands (13.3%) for grazing. Planting of cover crops, shelter belts, minimum tillage, no tillage and nutrient management are the five top most common conservation practices respondents use on their farms. Forty-seven percent of respondents do not have a conservation easement on their farms. Among the 41% who have an easement, 46% indicated it had not changed the assessed value of the farm and 54% reported it decreased assessed land value. Some mechanisms mentioned by respondents used to conserve their wetlands include: no burning, leaving land idle, no draining, weed control, buffer strips and conservation programs (CRP). About 61% and 69% of respondents have fifty percent or more of their total acres of wetlands in the WWP and some form of conservation agreement, respectively.

Table 6: Summary statistics for land management

Variable	Statistics
Primary decision makers	84% Owner, 6.25% Family, 3.1% Parent, 6.25% No answer
Types of livestock and numbers	16% have livestock 80% have beef cows and 20% have horses Average number of cattle = 197 Average number of horses = 2
Crops grown on wetlands and percentage of farmers growing that crop	Wheat – 97%, Soybeans – 66%, Corn – 44%, Barley – 38%, Sunflower – 25%, Hay – 13%, Edible Beans – 3%. Others include Flax, Canola, Peas, Oats, and Silage corn
Total farm land (acres)	Average total = 3,871
Acres owned (acres)	Average = 1,640
Acres rented (acres)	Average = 2,231
Wetlands $\leq$ two acres	Average number = 65.4 Average total acres = 119

Table 6: Summary statistics for land management (continued)

Variable	Statistics
Wetlands > two acres	Average number = 25.2 Average total acres = 124
Wetlands dry in most years	23.7%
Wetlands dry in more years than not	12.3%
Wetlands dry in about half of the years	12.2%
Wetlands dry in less than half the years	14.2%
Not dry/Never dry	30.4%
Percentage of farmers and practices occurring on wetlands	53% no use for part of wetlands, 59% farm on part of wetlands, 9% use portions of land for grazing, 19% use parts of wetland for other activities
Percentage of total acres of wetland and their uses	54.8% not used, 57.7% are farmed, 13.3% grazed, 74.3% used for other activities
Conservation practices used and percentage of farmers using each practice	Min Till – 59%, Cover Crops – 56%, Shelter Belts – 56%, No Till – 47%, Nutrient Mgt – 37%, Wildlife – 25%, Grass Waterways – 12%,
Percentage of farmers and their conservation easement on farm	47% - No, 19% - Yes, not changed easement value, 22% Yes, decreased assessed value, 12% no answer

Respondents were provided with a list of conservation programs and asked if they were aware of the program and if they had participated during the last five years. Relatively high number of respondents were aware of most programs but participation was low. Eighty-nine percent of respondents were aware of CRP General Signup, and half had participated in the program at some point in the past five years. Other programs with relatively high levels of awareness were CRP Continuous Signup, CSP, EQIP, and CRP Conservation Reserve Enhancement Program. CRP Continuous Signup, CRP General Signup, CSP and EQIP were the top programs in which respondents had participated.

4.4. Attitudinal Questions

Farmers were asked to indicate the level of importance of program specific, farm specific and external factors on their decision regarding participation in conservation programs. For program specific factors, level of payment received (4.7 average where 0 = not important, 1 = least important, and 5 = most important) and guaranteed payments (4.5) were very important; contract length (3.9) and maintenance requirements (3.8) were also important. Less important was the administrative process (2.5).

Respondents attached low weights to farm specific factors of transitioning out of farming (2.1) and machinery and equipment available (2.6). Thirty-four percent of farmers retiring within 1 to 10 years considered the transition factor as somewhat important while 53% did not see that factor as important. External effects likely to most impact farmland quality including soil quality and erosion control (4.0) and weed pressure (3.6) were of higher importance than other external effects including consistency with views on land use (3.4), wildlife population (3.0), hunting opportunities (3.1), water (3.1) and air quality (3.0), farm aesthetics (2.8), viability of the local area (2.6), and neighbors (2.2) in conservation program decision-making.

Table 7: Mean responses of factors that influence decision to participate in conservation programs

		Average level of importance (0 = not important; 1 = least important; 5 = most important)		
	Factor	Least important	Important	Most Important
Program specific	Administrative process	2.5		
	Level of payment received			4.7
	That payment is guaranteed			4.5
	Contract length		3.9	
	Maintenance requirements		3.8	

Table 7: Mean responses of factors that influence decision to participate in conservation programs (continued)

		Average level of importance (0 = not important; 1 = least important; 5 = most important)		
	Factor	Least important	Important	Most Important
Farm specific	Machinery and equipment availability	2.6		
	Preparation for transition out of farming	2.1		
External impact, Effect on:	Wildlife population		3.0	
	Water quality		3.1	
	Air quality		3.0	
	Soil quality, erosion control			4.0
	Farm aesthetics	2.8		
	Weed pressure		3.6	
	Hunting opportunities		3.1	
	Viability of the local area	2.6		
	Neighbors	2.2		
	Consistent with your views on land use		3.4	

Respondents were also asked to indicate their level of agreement with statements related to conservation, land rights and responsibilities and conservation programs. Respondents on average strongly agreed that they would not have participated in the WWP if they were not allowed to continue farming their wetlands when possible. They also strongly agreed that the decision of how the land is used is the right of the landowner, farmer or rancher that they should be paid for maintaining the wetlands and that farmers whose land use choices benefit the environment should be compensated.

Respondents were also apt to agree that producer participation in the wetland program development process is very important, promotion of healthy ecosystems is part of their responsibility as a steward of the land, the terms of the WWP are a good fit for their land in the long run, and conservation programs are effective. The average participant slightly agreed that

wetlands are important for maintaining wildlife in their areas, the conservation of wetlands is very important, and information on wetland conservation is easily accessible. Respondents disagreed that the conversion of wetlands must be stopped, wetland conservation should limit agricultural activities on private lands, there should be regulations to control the conservation of naturally-occurring wetlands to agricultural lands, and small wetlands benefit their operation. Mean responses to individual statements are shown in table 8.

Table 8: Average responses to statements related to thoughts about conservation

	Statement	**Average level of agreement***
Conservation	Wetlands are important to maintain wildlife in our area	3.2
	The conservation of wetlands is very important	3.2
	Information on wetland conservation is easily accessible	3.2
	It is important to protect wetlands on both private and public lands	3.1
	There should be regulations to control the conversion of naturally-occurring wetlands to agricultural lands	2.3
	Small wetlands have benefits for my operation	2.3
	Conversion of wetlands must be stopped	2.1
	Wetland conservation should limit agricultural activities on private lands	1.8
Land rights and responsibilities	The decision of how to use my land is my right as a landowner or farmer/rancher	4.3
	Landowners should be paid for maintaining wetlands	4.2
	Farmers should be compensated when their land use choices benefit the environment	4.1
	Promoting healthy ecosystems is part of my responsibility as a steward of the land	3.9
Conservation programs	I would not have enrolled in the Working Wetland Program if I was not allowed to continue farming my wetlands when possible	4.6
	Producer participation in the wetland program development process is very important	3.9
	The terms of the Working Wetlands Program are a good fit for my land in the long run	3.8
	Current conservation programs are effective	3.7

*** 1 = strongly disagree; 5 = strongly agree**

4.5. Working Wetland Program

Respondents were asked for their thoughts on the pilot WWP including their views, on program characteristics and enrollment process. Farmers were asked which characteristics they would like to see changed and which should remain as defined under the existing pilot program. In general, respondents (80%) accepted the current administrative process, payment rate, maintenance requirement, permitted land use options and contract length. The other 20% had some issues which have been summarized in table 9 below.

Table 9: Suggested changes to the current WWP

Administrative Process	• Quality of maps should be improved (too small and colorful) • Maps should indicate the exact wetlands enrolled rather than all wetlands on the land • Game and fish easements should not be considered
Payment Rate	• This should be increased because rates are below rental rates in some areas for farmland. • Rates should be increased to match cash rent prices and CRP prices • The higher the payment, the higher the participation
Maintenance Requirement	• Allow burning occasionally (Fall/Spring)
Contract Length	• Renew contract after every 5 years
Other Comments	• Add non crop wetlands • There should be payment for cover crops if wetland is not planted in Spring

Respondents were asked to rank policy options relevant for wetland conservation programs. Respondents deleted an average of two policy options. Most commonly deleted where easements (59.4%), regulation (36.4%) and incentivized regulation such as conservation compliance for farm program eligibility (30.3%). Among those who did not delete the policy option, incentives were most often ranked first (76.7% of those ranking this option ranked it first). Trailing far behind were incentivized regulation (21.7%), voluntary / education (20.7%),

and regulation (14.3%). Only 7.7% ranked technical assistance as the most important and no one ranked easements as most important.

Table 10: Ranking of policy options relevant for wetland conservation programs

Factors	Not appropriate	Ranked first
Regulation	36.4	14.3
Incentivized regulation	30.3	21.7
Incentives	9.1	76.7
Easements	59.4	0.0
Technical assistance	18.8	7.7
Voluntary education	9.4	20.7

Other questions regarding knowledge on wetlands in general and participation were included in the questionnaire. Respondents had the opportunity to explain their understanding of wetlands by listing specific criteria they use to identify a land as wetland. Responses had the following common criteria:

- Land with water and cattails that cannot be farmed 50% of the time.
- An area holding water on a consistent basis and cannot be used for agricultural purposes.

Most respondents felt they should be compensated for their lands that could not be used for agricultural purposes and this motivated their enrollment in the WWP. Some also thought it was important to support conservation programs to protect the environment and wildlife. Program attributes and regulations such as no permanent easement, land use when possible and understanding regulation contributed to a respondent's enrollment in the WWP.

4.6. Model Estimation Results

Each respondent ranked 30 choice sets, each consisting of three alternatives: two hypothetical WWP enrollment options with varied contract attributes, and an "opt out" or "no contract" option. To estimate the regression model, age and education (bsdeg with 1 = bachelor's degree or higher and 0 otherwise), were included as socioeconomic factors. These variables were

also interacted with the contract attributes. Table 10 provides summary of estimation results of the exploded logit model. The model fit statistic shows a good fit with a McFadden Pseudo R^2 (ρ^2) of 0.27. The ρ^2 value tends to be lower than the R-squared (R^2) and values between 0.2 and 0.4 are considered highly satisfactory. This is because ρ^2 cannot be calculated to minimize variance as in OLS models. The logistic regression model estimates maximum likelihood coefficients and ρ^2 shows a proportion reduction in error variance (Louviere et al. 2010).

$$McFadden\ Pseudo\ R^2\ (\rho^2) = 1 - \frac{LnL}{LnLo} \quad (5)$$

where L_nL is the log likelihood for the estimated model and L_nL_o is log likelihood of the model with only the intercept.

Table 11: Summary results from exploded logit model

Parameter	Coefficient	Standard Error
Opt 1	-2.94059***	0.3581
Opt 2	-2.97352***	0.3641
Length	0.00265	0.0160
bsdeglength	-0.11456***	0.0279
Payment	0.06822***	0.0068
agepayment	-0.0005996***	0.0001
bsdegpayment	0.00968**	0.0038
No-till	-3.92051***	0.4838
ageno-till	0.05376**	0.0094
Terms	0.05168	0.1038
Cover crops	-2.26640***	0.4767
agecover crops	0.03027***	0.0091
bsdegcover	-0.63990***	0.2356
Winter cereal	-3.74119***	0.5494
agewinter cereal	0.05196***	0.0102
Bsdegwinter cereal	-1.00673***	0.2659

*** and ** indicate statistical significance at α = 1% (0.01) and 5% (0.05) respectively

Options 1 and 2 have negative and nearly equal coefficients and are both significant at the 1% level. Coefficients are negative and this might be attributed to the fact that the current program does not include production requirements therefore including it to the program reduces the attractiveness of the program. Interaction terms and attributes except length and terms were found to be statistically significant in determining a farm operator's ranking of the alternatives in each choice experiment. Contract length had no statistical significant effect on enrollment in the WWP but it's interaction with education (bsdeglength) had a negative coefficient and was statistically significant. This indicates that there is a higher likelihood for farmers with a four-year college degree or higher to enroll in programs with shorter contract lengths. The contract payment attribute had a positive sign, meaning a higher payment level increases an operator's likelihood of WWP enrollment.

The negative sign on the interaction between age and payment (agepayment) indicates that older farm operators are willing to enroll in the WWP at lower payments. On the other hand, farmers with four-year degrees or higher (interaction variable bsdegpayment) require higher payments. The attribute terms and its interactions were not significant in the model. Three attributes of the choice sets were requirements for conservation farming within which wetlands reside. These include, annual use of no-till, planting and maintaining a cover crop once every three years and planting a winter cereal crop every fourth year. No-tillage requirement had a negative sign therefore contracts with no tillage requirement will reduce the likelihood of a farmer's enrollment in the WWP. No-tillage requirement interaction with age (agetill) has a positive sign; therefore the reduction in likelihood is not as great for older farmers under a requirement that no-till be used.

Requirement to plant cover crops has a negative sign, this attribute could reduce a farmer's likelihood to participate in the WWP. Interactions with age (agecover) indicates a higher probability for older farmers to participate in programs with requirement to plant cover crops. Interaction with education (bsdegcover) is negative therefore it is less likely for farmers with four years degree or higher to participate in a program with requirement to plant cover crops. Planting of winter cereal had a negative coefficient indicating that this requirement will reduce the likelihood of farmers enrolling in the WWP. Older farmers are more likely to reject programs with the planting of winter cereal (agewinter) and farmers with four years college education or higher are more likely to participate in programs with the requirement to plant winter cereals. Detailed results from the exploded logit regression can be found in appendix 1.

4.7. Marginal Effect Estimation

Results from the exploded logit model explains the effect of attributes on the decision of a farm operator to enroll in the WWP. To determine the extent to which program attributes affect the probability of enrollment, marginal effects were estimated using mean values for the main independent variables used in the model. Marginal effects explain the change in probability when independent variables increase by one unit (Torres-Rayna, 2014). Discrete change in the probability of enrolling in the WWP for dummy variables was determined by changing the dummy value from zero to one or one to zero, depending on the value in the base contract. The effects of socioeconomic factors on the probabilities of enrollment decisions are also determined. Mean values of the socioeconomic variables and program attributes currently in place were used as base contracts to help determine changes in probability of enrollment.

The base case is a 47 year old farm operator who does not have a bachelor's degree or higher offered a WWP contract with the requirements below.

- 5 year contract
- 100% of county rental rate
- Fixed payment terms at the start for the length of the contract
- No-till not required
- Planting of cover crops not required
- Planting of winter crops not required

Equation 6 below was used to estimate the probability of enrollment using the base case and changes in the factors used. Based on the above case, the probability of the farm operator enrolling on the WWP is 0.7516. This is not closer to 100% maybe due to the effects of socioeconomic variables included in the estimation.

$$(P_{enroll}) = \frac{exp(Venroll)}{1+exp(Venroll)} \quad (6)$$

Table 11 represents the marginal effects on the probability of enrollment considering a unit change in program attributes and socioeconomic variables used in the model. Marginal effects were determined using the Krinsky and Robb method. This method is based on the assumption that the estimators of the model parameters are consistent and have an asymptotically normal multivariate distribution. Multiple vectors of $\beta = \beta_s$, S = 1….S coefficients are drawn from the multivariate normal distribution that has a mean vector equal to the estimated coefficient vector *βhat* and the same estimated variance-covariance matrix as *εhat.* New vectors for each coefficient β_s are used to derive a new value of $f(x_i,\beta hat)$ (Dowd et al., 2014).

Results shown in table 11 indicate that an additional year added to contract length holding all other variables constant will increase the probability of enrollment by 0.0006. A unit change in payment as a percentage of local rental rate increases a farm operator's likelihood to enroll in the WWP by 0.0074 ceteris paribus. For example, a 10% increase in payment would

increase likelihood of enrollment by 0.7%. A change from fixed payment at the start to the end of contract period to a flexible mid –contract re-adjustment to reflect any changes in local rental rates increases the probability of enrolment by 0.0100 ceteris paribus. All three conservation farming requirements, annual use of no-till (-0.3203), planting and maintaining cover crops once every three years (-0.1852) and planting of winter cereal crop every fourth year (-0.2977) have negative effects if they are required on the probability of enrolling in the WWP contracts ceteris paribus. Their level of effect on the probability of enrollment is relatively high compared to the other attributes.

Increasing the age of a respondent by one year, reduces (-0.0111) the probability of enrollment. The older a farmer gets, the less likely he is to enroll in the WWP ceteris paribus. A change in the level of education of a farmer increases (0.0645) the probability of enrollment. Farmers with a bachelor's degree and higher are more likely to enroll in the WWP compared to those without a bachelor's degree ceteris paribus.

Table 12: Marginal effects on the probability of enrollment

Variable	Base case	Marginal effects on probability of enrollment
Length	5	0.0006 (-0.0066, 0.0091)*
Payment	100	0.0074 (0.0057, 0.0092)*
Terms	1	0.0100 (-0.0382, 0.0653)*
No-till	0	-0.3203 (-0.3203, -0.2548)*
Cover crops required	0	-0.1852 (-0.2562, -0.1148)
Winter cereal required	0	-0.2977 (-0.3736, -0.2202)*
Age	47	-0.0111 (-0.0167, -0.0059)*
Education (bsdeg)	0	0.0645 (-0.0588, 0.1838)*

* Numbers in parentheses are upper and lower bounds of the 99% confidence interval for the estimates.

4.8. Discussion and Implication

Based on the literature, it was expected that farm operators would prefer shorter contracts lengths but results from the study did not meet expectations. Contract length was not significant; respondents did not consider that attribute important in their decision making. This is also reflected in the marginal effects, as change in probability of enrollment is positive but small with an increase in contract length. The WWP respondents are enrolled in currently is flexible such that payments are made yearly and participants can opt out at any point in the contract without any penalties. Therefore, the number of years one enrolls in the program does not really affect the likelihood of enrollment.

Payment has positive effects on the probability of enrollment. A unit increase in payment increases probability of enrollment which is expected because farmers would enroll in programs that provide incentives and higher utility. However, the impact is not great. Providing farmers a payment option that allows re-adjustment to reflect changes in local rental rates increases the probability of enrollment. Payment terms has a positive effect but was not significant.

Factors such as age and education have been identified as farmer characteristics that contribute to their participation in conservation programs (Reimer et al., 2012). The age of farmers enrolled in the program can be considered an important factor since it has a negative effect on the probability of enrollment. The older farmers get, the less likely they are to enroll in the WWP. Forty-seven percent of respondents' have 1 to 10 years until they retire from farming. Younger land owners tend to be more responsive to changes and a broad range of conservation

practices and this can be attributed to higher educational levels, better understanding of practices and lower levels of risk aversion (Onianwa et al., 1999).

Farmers enrolled in the program having an educational level of bachelor's degree and higher have a higher probability of enrolling in the WWP. This result is in line with literature, Prokopy et al. (2008); Tosakana et al. (2010); Abdulla (2009) and Parkhurst (2011) found education to be positively associated with adoption rates. Abdulla (2011) hypothesized that education has a positive impact on the adoption of technology with the assumption that higher educational level increases the ability of a farmer to obtain, analyze and use available information about conservation technologies.

Program requirements of no-till have relatively high negative effects on the probability of enrollment, implying that farm operators enrolled in the WWP are not interested in practicing no-till. From the results, 59% of respondents practice minimum tillage because of the benefits derived from it, therefore allowing them to practice some level tillage will encourage participation. Requirements to plant cover crops and winter cereals have relatively high impacts on probability to enroll in the WWP. It is intuitive that farmers who enrolled in the WWP do not prefer specific production requirements for whatever reason (time, different than their current or planned production plans, lack of equipment). The program attributes are important and must be looked at critically especially those that are likely to affect program participation negatively.

CHAPTER 5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

Conservation programs have been part of U.S farm legislation since the 1930s, although program goals have evolved over time. Conservation programs can be grouped into two categories: land retirement programs (e.g., CRP, WRP) and working lands programs (e.g., EQIP, CSP). Concentration has focused on land retirement programs where land is removed totally from agricultural production to reduce the supply of agricultural commodities and meet conservation objectives. These programs are voluntary with fixed contract length or permanent easements, allow farmers to retain land ownership, and support commodity prices, contribute towards habitat advancement and support wildlife. Attention has gradually moved towards working lands programs. These programs provide cost-share payments and technical assistance to farmers for adopting conservation practices on active agricultural lands. They bridge the gap between environmental protection and agricultural production.

Wetlands are a vital part of the American landscape. Wetlands provide many valuable services through the recharge and purification of groundwater, recreational opportunities, protection from flooding and as source of food and wildlife habitat. USDA, and other government agencies, and non-government organizations have partnered to help restore and maintain these wetlands as well as promote their usage in ways that best support the environment while accommodating agricultural productivity. There are several programs targeted at the conservation of wetlands. They are generally voluntary or incentive-based, offering technical and/or financial assistance. These programs are important. Despite the productivity and usefulness of wetlands, they continue to be degraded by human activity. Their presence on cropping lands and interference with yields has contributed partly to the number of programs in

place for wetlands conservation and restoration, especially in the PPR of North Dakota, South Dakota and Minnesota. Currently there are no working lands programs for wetlands.

The main objective of this study was to investigate farmer preferences for a pilot working lands program introduced in the PPR of North Dakota. The program referred to as the WWP was designed to test a new concept in the conservation of small wetlands in croplands through a voluntary incentive-based working lands approach. The targeted small temporary wetlands are important elements in duck production, habitat for species and flood reduction in North Dakota. However, their presence on agricultural lands decreases seeded acres and yield. It can be argued that producers are providing a positive externality as they accept lower farm income in maintaining wetlands on their private lands. The WWP was created as a program to compensate producers. This study not only gauges farmer preferences for the program but also helps us understand producer perception and attitudes towards conservation programs and how they make their adoption decisions. This information is of considerable use as we work to refine the program.

The study was conducted to provide insight on the attributes that influence farmers' preferences for participating in the WWP through developing and analyzing hypothetical choice sets. A stated preference discrete choice experiment was used to elicit information from farmers who voluntarily signed up to participate in the pilot WWP. A total of 64 questionnaires were mailed to farmers and 32 responded, representing a 50% response rate. Respondents were asked to rank the choice sets as per their preference. Choices were analyzed using an exploded logit model. To help determine producer perception and attitudes towards conservation programs, sections of the questionnaire had attitudinal questions. Respondents were asked to indicate their

level of agreement with various statements associated with conservation practices and programs, and how important they consider various factors when they make conservation decisions.

Results indicated that farmers enrolled in the WWP are aware of most conservation programs but their participation in these programs is low. Farmers attach a high level of importance to program specific factors (level of payment, guaranteed payment, contract length, maintenance requirements) and external factors likely to impact farmland quality (soil quality and erosion control, weed pressure) when deciding whether to participate in conservation programs. The average participant in the WWP strongly agrees that allowing them to farm their wetlands when possible is the reason for their participation in the program. They strongly agree that decisions of how land is used is the right of the landowner, farmer or rancher and that payments should be made for maintaining wetlands. They also agree that farmers whose land use choices benefit the environment should be compensated.

Participants in the WWP agreed that producer participation in the WWP development process is very important. On the other hand, they disagreed it is necessary to stop the conversion of wetlands and that wetland conservation should limit agricultural activities on private lands. Concerning the thoughts on the WWP characteristics and enrollment process, 80% had no complaints about the current administrative process, payment rate, maintenance requirement, permitted land use options and contract length. Twenty percent thought that the quality of maps could be improved with an indication of the exact wetlands enrolled. It was also suggested that payment should be increased to reflect rental rates across the board, burning should be permitted occasionally, and the contract should be renewed every 5 years. For policy consideration, farmers indicated that provision of incentives, easements and incentivized regulation were the

most important factors to consider in wetland conservation programs. Technical assistance and voluntary education were also identified as important factors to be considered in policy making.

Results from the choice experiment revealed contract length and terms were not significant factors in determining the likelihood of enrollment in the WWP. Payment and production requirements of no-till, planting of cover crops, and planting of winter cereals were significant factors in their willingness to enroll in hypothetical versions of the WWP. Results from the marginal effects with reference to the base case indicated length, payment, terms and education have a positive effect on the probability of enrollment while age and planting requirements of no-till and planting of cover crops and winter cereals have a negative effect on the probability of enrollment in the WWP. Results suggest that farmers enrolled in the WWP prefer programs that are less restrictive especially with the requirements for conservation farming examined in the study. Farmers also require a relatively high financial incentive to participate in the program.

This study contributes to the limited literature on wetland conservation programs especially small wetlands in cropland in the prairie potholes of North Dakota. The study may have taken place a bit too early in the project implementation stage because the administrative process is still on-going and participants are fairly new to the program. However, the results are informative as they provide timely information to help in future review of the program.

One limitation identified with the study was the data collection method used. Every method has its own advantages and disadvantages but judging from responses received, a face-to-face interview with farmers could improve the data in that it would allow for clarification and for the research team to answer questions from farmers. Another limitation is the sample of farmers used for the study. Participants in the study are only farmers enrolled in the program.

Including those not enrolled who later were found to not qualify and those who did not choose to enroll would have provided information about perceptions of the program from a more general audience. It is recommended that a follow-up study be undertaken after the project implementation process is over and all qualified enrollees are verified to provide more information for future program review.

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APPENDIX: RESULTS OF EXPLODED LOGIT ESTIMATION

Model Fit Statistics		
Criterion	**Without Covariates**	**With Covariates**
-2 LOG L	2742.516	1998.973
AIC	2742.516	2030.973
SBC	2742.516	2122.472

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	743.5427	16	<.0001
Score	574.9917	16	<.0001
Wald	401.7723	16	<.0001

Analysis of Maximum Likelihood Estimates							
Parameter	**DF**	**Parameter Estimate**	**Standard Error**	**Chi-Square**	**Pr > ChiSq**	**Hazard Ratio**	**Label**
opt1	1	-2.94059	0.35812	67.4250	<.0001	0.053	
opt2	1	-2.97352	0.36411	66.6931	<.0001	0.051	
LENGTH	1	0.00265	0.01600	0.0274	0.8684	1.003	LENGTH
bsdeglength	1	-0.11456	0.02794	16.8079	<.0001	0.892	bsdeg*length
PAYMENT	1	0.06822	0.00684	99.3449	<.0001	1.071	PAYMENT
agepayment	1	-0.0005996	0.0001105	29.4499	<.0001	0.999	age*payment
bsdegpayment	1	0.00968	0.00385	6.3228	0.0119	1.010	bsdeg*payment
TILL	1	-3.92051	0.48384	65.6559	<.0001	0.020	TILL
agetill	1	0.05376	0.00939	32.7457	<.0001	1.055	age*till
TERMS	1	0.05168	0.10385	0.2477	0.6187	1.053	TERMS
COVER	1	-2.26640	0.47672	22.6017	<.0001	0.104	COVER
agecover	1	0.03027	0.00907	11.1288	0.0008	1.031	age*cover
bsdegcover	1	-0.63990	0.23558	7.3782	0.0066	0.527	bsdeg*cover
WINTER	1	-3.74119	0.54944	46.3643	<.0001	0.024	WINTER
agewinter	1	0.05196	0.01021	25.8995	<.0001	1.053	age*winter
bsdegwinter	1	-1.00673	0.26587	14.3384	0.0002	0.365	bsdeg*winter