LANDOWNER VIEWS ON WETLAND ENHANCEMENT AND RESTORATION IN AND ADJACENT TO THE CREDIT RIVER WATERSHED

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Research Report

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EXECUTIVE SUMMARY

The area of wetlands in the Credit River watershed has declined over several decades — a trend that is projected to continue. Such degradation threatens to further reduce the supply of several ecosystem services that flow from wetlands, which provide significant benefit to residents of the region. Therefore, it is important to protect existing wetlands, create new ones, or restore those that have been lost in the Credit River watershed. These actions can be difficult to implement and often require the participation of private landowners. It may be possible to develop wetlands conservation programs that encourage the voluntary participation of private landowners using financial or non-financial incentives.

In this report, we sought to: (i) document landowner wetland management history; (ii) understand landowner preferences and attitudes about wetlands and the ecosystem services they provide; (iii) assess the willingness of landowners to implement wetland restoration or enhancement on their property; and (iv) evaluate landowner preferences for compensation (monetary and non-monetary), implementation details (e.g. types of incentives, conversion activity, extent of commitment, etc.), and overall willingness to accept compensation for wetland restoration or enhancement on their property. Types of activities considered included converting land directly into wetlands (i.e., restoration) as well as converting land into meadows/trees to enhance existing wetlands.

Two surveys were developed (one for farmers and one for non-farmers) that included questions about landowner's wetland management history and their attitudes toward wetlands. These questionnaires also included a choice experiment, which was used to assess landowner willingness to accept compensation for certain characteristics of an incentive-based wetlands conservation program (such a program would involve either converting land directly into a wetland or converting it to trees/meadows to help enhance existing wetlands in the area). The two surveys were sent to a sample of farm and rural non-farm households located in or adjacent the Credit River watershed.

Analysis of survey responses revealed that farm and non-farm landowners had similar wetland management history and attitudes about wetlands and the services they provide, views about the current state of wetlands in the watershed, and perspectives on factors that would motivate landowners to implement wetland conservation activities.

Several of the major findings related to the management of wetlands from both surveys are as follows:

- Over 50% of respondents indicated they had wetlands on their land.
- Over 30% of respondents indicated that they had enhanced wetlands on their land.
- Over 6% of respondents indicated that they had created wetlands on their land.
- Those creating or enhancing wetlands undertook a variety of actions and relied on a number of funding sources, though their actions were primarily self-financed.
- Respondents to both surveys, on average, regarded ecosystem services flowing from wetlands as important. Of the five ecosystem services considered, respondents on average ranked water purification as most important and recreation & education as least important.

- Respondents, on average, thought that the current state of wetlands in the Credit River watershed in terms of their amount and quality (i.e. health) was relatively good and that accessibility to view wetlands was adequate.
- In terms of the non-monetary incentives that might motivate landowners to participate in wetlands enhancement or restoration, respondents on average indicated that information on how wetland loss affects them would be the most important motivator. They rated public recognition as the least important motivator (of those listed).
- In terms of the monetary incentives, respondents to both surveys on average thought that one time payments provided more motivation to participate in wetland conservation than annual payments.

Findings from the farm survey choice experiment questions revealed the following:

- Farmers indicated they would require, on average, an annual payment of $655.57/acre/year to participate in a wetlands conservation program that sets aside productive land.[1] They would require, on average, an annual payment of $171.86/acre/year to set aside marginal land.
- Potential farmer participation rates in a wetland restoration program were estimated to range between 39.6% and 56.6%, depending on the program scenario and payment rate that would be offered.

Findings from the non-farm landowner survey choice experiment questions revealed two groups of landowners, with those in the first group being more likely to: (i) have high school or less as their highest level of education; (ii) be motivated by financial incentives; and (iii) prefer five or ten year wetland conservation contracts, compared to those in the second group (who were correspondingly more likely to have greater than high school education, not be motivated by financial incentives, and prefer either one year or fifteen or more year contracts).

- Group 1 of non-farm landowners (33% of respondents) would require, on average, a high payment of $617.95/year for a program requiring them to convert their land to meadows, assuming they were not given technical assistance. At the other extreme, they would be willing to pay, on average, as much as $23.46/year for a program requiring them to convert their land to trees, assuming they were given technical assistance. Willingness to accept compensation for a program requiring them to convert their land directly into wetlands ranged from $199/year to $434/year, depending on program characteristics.
- Group 2 of non-farm landowners (67% of respondents) would require, on average, no financial compensation for implementing any type of wetland conservation program (i.e., trees, grasslands, or wetlands) on their land.
- Potential non-farmer participation rates in a wetland restoration program were estimated to range between 36.8% and 56.7% for Group 1 and between 92.5% and 98.0% for Group 2, depending on the program scenario, and payment rate that would be offered.

This research suggests that with the appropriate program design and incentives, a significant proportion of landowners in or adjacent to the Credit River watershed would be willing to participate in a wetlands enhancement/restoration program.

[1] All compensation payments estimated using the CE method were based on the assumption that the costs of the conversion were borne by the government.

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1. INTRODUCTION

Wetlands in the Credit River watershed, and the wider region, are critically important natural capital. They supply many ecosystem services, which can be defined as the benefits that humans derive from ecosystems, such as water purification and flood/drought control (Turner et al. 2008). Wetlands are also important habitat for plants and animals. In fact many species at risk in southern Ontario require wetland habitat (Environment Canada 2004). The economic value of the ecosystem services supplied by wetlands in the Credit River watershed is significant. Kennedy and Wilson (2009) estimated that the ecosystem services supplied by existing wetlands are worth at least $187 million per year. Lantz et al. (2010) surveyed households in the watershed and found that on average they were willing to pay over $200 each year for a 5 year wetlands retention and restoration program. This amounts to more than $220 million when aggregated to all households in the region over the life of the retention and restoration program.

Though wetlands provide significant value, their area in the Credit River watershed has been declining over several decades. Historical records indicate that 48%, or 13,331 acres, of wetlands in the watershed have been lost or degraded since 1954 (Credit Valley Conservation Authority 2009). Today, only 6% of the watershed's surface area is covered by wetlands (Kennedy and Wilson 2009). This is below the guideline of at least 10% established for major watersheds in the Great Lakes region (Environment Canada 2004). These guidelines also recommend establishing a vegetated buffer, known as the Critical Function Zone, around existing and restored wetlands to maintain wetland function (Environment Canada 2004).

Since wetlands provide a host of important ecosystem services to society, it is important to protect and enhance the ones that remain, as well as restore those that have been drained. This can be difficult, especially in the case of the Credit River watershed region where the best restoration opportunities often occur on private land. Since the benefits of wetlands are largely realized by the general public (i.e., water purification, flood/drought control, wildlife habitat, and other valuable services), landowners in general do not have an incentive to maintain or protect them (since they cannot generate a return by charging the public for supplying them in a private market), and therefore they tend to be insufficiently supplied (Fisher et al. 2008). One option for protecting or restoring wetlands is to provide incentives to landowners for modifying their land management. These incentives may be financial, such as direct government payments and tax incentives, or non-financial, such as technical assistance and public recognition.

The overall goal of this research is to explore farmer and non-farmer preferences of design elements for a wetland management and incentive program in the Credit River watershed. In particular our research is focused on four related objectives:

1) Understand landowner preferences and attitudes toward wetlands and the ecosystem services they provide

2) Document property and wetland management history (wetland drainage, environmental farm plan, etc.)

3) Evaluate the willingness of landowners to implement wetland restoration or enhancement on their property

4) Evaluate landowner preferences for compensation (monetary and non-monetary), implementation details (e.g. types of incentives, extent of commitment, etc.), and overall willingness to accept (WTA) compensation for wetland restoration or enhancement on their property.

This report is organized as follows. Section 2 reviews the relevant literature on payments for ecosystem services and determining appropriate compensation levels. Section 3 provides details of the methods used in this study. Section 4 presents and discusses the results of the analysis, and a conclusion is provided in Section 5. Several appendices follow.

2. RELEVANT LITERATURE

Programs relying on economic incentives to encourage private landowners to supply ecosystem services are increasingly common. In the United States the Conservation Reserve Program compensates farmers for establishing vegetative cover on highly erodible lands (USDA 2012). Though currently under review similar measures are part of the Europe's Common Agricultural Policy (EC 2005). Incentive schemes have more recently been initiated in Canada (for a comprehensive overview see Sustainable Prosperity 2011). The Growing Forward program, jointly administered by the federal and provincial or territorial governments, involves initiatives that compensate farmers for a portion of the costs of using certain beneficial management practices (AAFC n.d.). Farmers may also receive direct payments for restoring ecosystems to better supply ecosystem services as part of the Alternative Land Use Services program in certain parts of Canada (ALUS 2011) or the farmer-led Ecological Services Initiative in British Columbia (ESI 2011). Non-governmental organizations may also provide landowners with economic incentives (e.g. purchasing conservation easements on ecologically significant private land) (Brown et al. 2011).

Many types of incentives have been used specifically to encourage the enhancement or restoration of wetlands (Sustainable Prosperity 2011). One such incentive program is known as wetlands banking, which is based on a policy of no-net-loss. Such programs often require landowners or managers who degrade wetlands or wetland functions to create or restore wetlands in another location. The most high profile example of wetlands banking is in the United States. The no-net-loss policy enacted as part of the Clean Water Act requires that unavoidable negative impacts on wetlands be offset by creating or restoring wetland habitat with an area and quality larger than that lost (i.e. impacts must be compensated). Some Canadian provinces (e.g. New Brunswick) have similar no-net-loss policies, though Ontario does not (Rubec and Hanson 2009).

Other incentive programs focus on providing direct financial incentives to landowners for wetland enhancement or restoration. For instance, under PEI's Alternative Land Use Services (ALUS) program, farmers receive payments for establishing or maintaining fences adjacent to wetlands (Government of PEI 2012). Private landowners in Oxford County, Ontario are eligible to receive compensation to help offset some of the costs of conserving or enhancing wetlands (Clean Water Program n.d.). Examples of non-governmental organization incentive programs include Ducks Unlimited Canada's nationwide Habitat Conservation Program, which is focused on wetland

rehabilitation and protection, and in certain cases may use direct payments (Sustainable Prosperity 2011). Ducks Unlimited has also been involved in piloting a reverse auction to purchase conservation easements on wetlands from private landowners in Saskatchewan and Manitoba (Brown et al. 2011).

An important part of developing an incentive-based conservation program to protect wetlands is determining the amount of compensation that landowners require for enrolling some of their land (Yu and Belcher 2011). This payment should be large enough to induce landowners to enrol enough of their land so as to meet environmental goals, but be within the program administrators' budget. Such a program should be appropriately designed so as to encourage enrolment at least cost to the administrators (Vercammen 2011).

Attention must also be given to landowner attitudes towards conservation activities. Results of previous studies indicate that attitudes about wetlands have an important influence on conservation decisions (Yu and Belcher 2011). Other influences that affect participation in a conservation program include length of the contract, flexibility in the program, and the level of paperwork, among others (Ruto and Garrod 2009).

3. STUDY DESIGN

While several approaches can be used to assess landowner preferences and WTA compensation for wetland protection programs (see Appendix B), our research proceeded with focus groups and a questionnaire that employed a choice experiment (CE), as described below.

3.1 Focus groups

To inform the development of the survey, three focus group discussions were held with rural landowners in the area about their attitudes and perceptions about wetlands, wetland enhancement and restoration, and different incentive programs. Two of the focus groups consisted mainly of farmers, while the other consisted of non-farm landowners. Participants were invited through contact lists of local agricultural associations, as well as through CVC's database of people who had previously attended environmental workshops.

The focus group structure was designed by Dr. Shashi Kant of the University of Toronto. The discussions each consisted of three parts.

1. Perspectives about wetlands, their importance and restoration, and knowledge about existing wetland restoration programs
2. Attitudes towards wetland enhancement/restoration
3. Perspectives about the merits and limitations of different incentive programs and suggestions to make those programs more attractive

While open and free-form discussion was encouraged, the facilitator posed a series of questions for each part of the discussion in order to elicit the most relevant responses for informing survey development.[2]

Participants in all focus groups identified several benefits of wetlands, broadly fitting into the categories of economic, enjoyment, and environmental benefits. Some participants also noted that natural areas can have negative effects on farming, such as increased weed and pest populations, and un-drained land being of worse quality for farming than drained land. It was also suggested that wetlands can negatively impact property values if land is to be developed. There was a general agreement about the loss of wetlands in the area, through development, illegal dumping, and tiling of agricultural land.

All those engaging in discussion had some form of wetland, current or historic, on their properties. Farm participants demonstrated quite extensive knowledge of incentive programs surrounding wetland restoration and enhancement, while non-farm landowner participants were more limited in their knowledge, referencing mostly tree planting and tax incentive programs.

All participating landowners agreed that, as owners of property, they have a responsibility to current and future generations to maintain their land in good condition. However, they also acknowledged that others downstream from them benefit from the services being provided by the natural features on their lands, and so they felt that they should not take full financial responsibility for maintaining these ecological services.

When asked about their willingness to participate in wetland restoration projects, those in the farm focus groups expressed fear of future regulation, especially in terms of allowing access to their land by CVC, and the possibility of restrictive government controls due to endangered species moving into new habitat created on their lands. Non-farm landowner participants were less wary or knowledgeable about these regulations.

In the discussion about different options for incentive programs, the farm participants overwhelmingly identified two quite different types of agricultural landowners: commercial agricultural producers, who make their living from farming, and hobby or “lifestyle” farmers. For commercial farmers, financial incentives for retiring land would be the deciding factor on whether or not to participate in wetland restoration projects. For hobby farmers, other types of incentives, such as public recognition and technical assistance, might be just as influential. Suggestions for the kind of incentives commercial farmers might be willing to accept to take land out of production included: $200 to $300 per acre per year; a $5000 one-time payment; or an annual payment based on forgone net crop revenue. Non-farm landowner participants showed quite different motivations, with less of an emphasis on financial incentives and more interest in public recognition and technical assistance.

Based on the discussions with landowners participating in the focus groups, it was determined that it would not be possible to design a single survey which would be applicable to all landowners. For

[2] The focus groups were held on the evenings of February 13, 15, and 16 at the Terra Cotta Conservation Area. On February 13 the facilitator was Dr. Shashi Kant (University of Toronto), while on February 15 and 16 the facilitator was Tatiana Koveshnikova (CVC).

example, in a draft survey, one of the CE question program characteristics was the type of land to be converted, which could be either “productive” or “marginal”. Clearly these designations do not apply to landowners who do not farm their land. The draft survey also included various financial incentives (annual payments) for respondents to choose between. From the focus group discussions, it became clear that not all landowners would expect the same level of financial incentives for the same amount of land. Thus we developed two surveys, one for farmers and another one for non-farm landowners. The main difference between these two surveys was in the set-up of the CE questions, where the program characteristics would be adjusted to better correspond to the specific situation of these two respective types of landowners and expected motivations of farmer vs. non-farm rural landowners, as explained below.

3.2 Questionnaire development

The two questionnaires were developed over several months in early 2012. After a thorough literature review, several iterations of draft questionnaires were developed and initially assessed by the research team. Local experts, including staff at Credit Valley Conservation Authority, were also consulted during this process. In addition, the three focus groups described above provided valuable feedback on these early drafts of the questionnaire. The final drafts of the questionnaires were tested in one final focus group, led by a member of the research team (Dr. Van Lantz), with a mix of local landowners.

Both the farm and non-farm landowner surveys contained the same five sections. The first section included questions related to the respondent’s land. For example, how many acres they own, where the land is located, how they use the land and whether there are wetlands on the land. The second and third sections included questions about the respondent’s land and wetland management practices and perspectives. Questions were asked using a scale (e.g. “strongly agree” to “strongly disagree”, as well as “don’t know”). The CE, which is further discussed in the following paragraphs, comprised the fourth section. The fifth section collected socio-economic characteristics of respondents including age, gender, educational level, and household income. Information from these sections was used in the analysis of the CE questions (Section 4) to help explain responses. A summary of answers to these questions is provided in Appendix A.

The CE, presented in the fourth section, was composed of the valuation scenario, CE questions, as well as follow-up questions. The CE questions were designed to elicit landowner preferences and willingness to accept (WTA) compensation for various characteristics (i.e. attributes) of a wetland conservation program. A list of potential attributes, and related levels, was initially developed in consultation with relevant literature. This list was refined through discussions with staff from Credit Valley Conservation and participants in the aforementioned focus groups.

As mentioned above, focus group participants highlighted that farm and non-farm landowners have different considerations when deciding whether to enrol in a wetlands conservation program. Certain attributes that farmers consider relevant to this decision may not be relevant to non-farm landowners. This issue is common in CE conducted with landowners. It is possible to overcome this issue by getting landowners to imagine they own a hypothetical area of land (e.g. Matta et al. 2009; Rossi et al. 2011) or to use general attributes applicable to all landowners (e.g. Ruto and Garrod

2009). However, since we were interested in attributes specific to farmers, and wanted to include non-farm landowners in our analysis, we chose to develop two different versions of the CE[3].

The attributes selected for the farm CE were: type of land to convert (marginal or productive); conversion activity (meadow, trees, or wetland)[4]; number of acres converted (1, 3, or 5); public recognition (yes or no); and annual payment per acre converted. Focus group participants felt that the land type attribute would not apply to non-farm landowners. As such, for the non-farm landowner CE, this attribute was replaced with another indicating whether the program provides technical assistance. The number of acres to be converted was also reduced since it was thought that non-farmers had less of their land available for conversion compared to farmers. While a financial incentive attribute was still included in the non-farm landowner CE, it was changed to an annual lump-sum payment (i.e., not on a per acre basis). The payment levels were also lower than those used for the farm CE since focus group participants felt that, while non-farm landowners might expect payment for providing an ecological service to society, they are not losing the same level of income as farmers by setting aside land for wetland restoration or enhancement. Thus, the attributes selected for the non-farm version of the CE were: conversion activity (meadow, trees, or wetland); number of acres converted (0.5, 1, or 1.5); technical assistance (yes or no); public recognition (yes or no); and annual payment. Further details on the selected attributes are presented in Table 1.

These attributes were combined to create several alternative versions of a hypothetical wetland conservation program and then grouped into choice sets (see Figure 1 for an example). Each respondent was asked to answer six choice sets (see Appendix B for more details).

Before being presented with the choice sets, a preamble explained the wetlands conservation program. This preamble contained a general introduction, program conditions (e.g. contract length, etc), a description of the program's attributes, and instructions on how to answer the CE. The six choice sets followed. In each choice set, respondents were asked to choose from one of three alternatives. The first two alternatives (labelled Programs A and B) described different hypothetical wetland conservation programs. The levels of the attributes comprising each program varied by scenario (see Appendix C for detail). If respondents were not interested in enrolling in either program they could select the "No Program" alternative. Those selecting this option would be indicating that they would not convert any of their land, given the alternatives presented in the choice set.

[3] The remainder of the questionnaire was identical for farm and non-farm landowners.

[4] The conversion activity was not limited to wetlands since a respondent does not necessarily own or lease land suitable for establishing wetlands. The additional conversion activities, meadows and trees, were selected since they can be implemented on most parcels of land and they can also buffer wetlands from surrounding land uses (i.e. they act as critical function zones).

Table 1: Attributes and attribute levels used in the study

Attribute	Definition	Levels
Farm Survey:		
Land Type	Land can be productive or marginal (i.e. less fertile, sloping, etc.) farmland	Marginal Productive
Conversion Activity	Land can be converted to meadow, trees, or wetland	Meadow Trees Wetland
Number of Acres	Area of land to be converted	1 acre 3 acres 5 acres
Public Recognition	Signage on property, stewardship banquets, and awards are provided	No Yes
Annual Payment	Annual payment per acre to the landowner	$50 $150 $250 $350 $450 $550
Non-Farm Survey:		
Conversion Activity	Land can be converted to meadow, trees, or wetland	Meadow Trees Wetland
Number of Acres	Area of land to be converted	0.5 acre 1 acre 1.5 acres
Technical Assistance	Technical advice from experts from the government or other groups involved	No Yes
Public Recognition	Signage on property, stewardship banquets, and awards are provided	No Yes
Annual Payment	Annual payment to the landowner	$0 $50 $100 $150 $200 $250

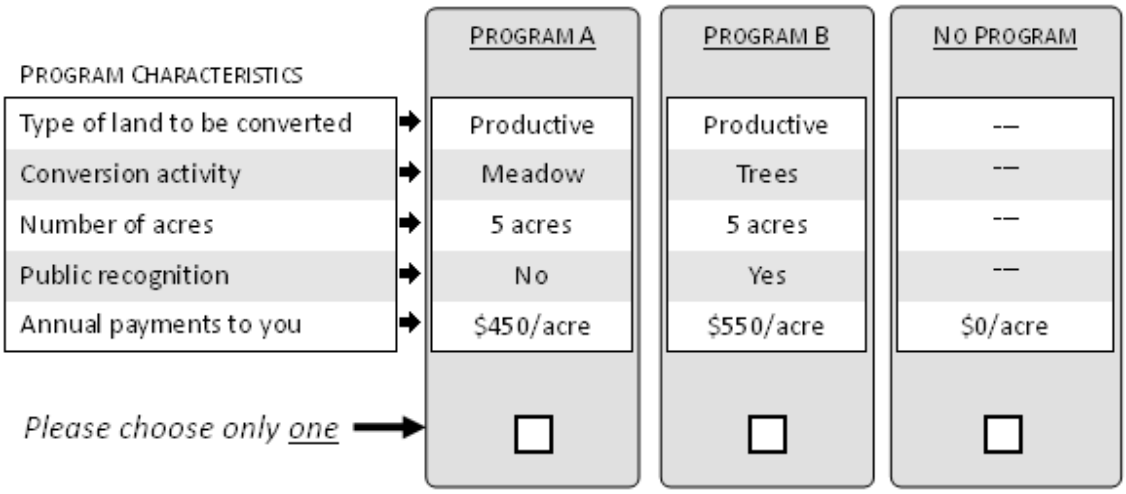

Figure 1: An example of a choice set from the farm survey

Several different techniques were used to ensure the reliability of the CE's results by reducing hypothetical bias. First, the following cheap talk script (List 2001; Lusk 2005) was included in the preamble immediately before the choice sets: *"Please consider the options carefully – as if you were entering into a real contract with the government – since the program would have a limited budget and could only fund a limited number of projects"*. Second, respondents were asked a number of follow-up questions in order to identify possible protest bids or strategic behaviour (Bateman et al. 2002). For example, if the respondent chose "No Program", they were asked why they chose that response, with choices being "*The annual payment was too low*", "*The contract length was too restrictive*", and "*I don't trust the government*".

3.3 Sampling and survey implementation

We chose to use a mail survey since this approach is less expensive than in-person or telephone surveys and is advantageous in that it avoids interviewer effects and allows respondents to complete the survey according to their schedule (Champ 2003). Since no list of farmers and landowners located in the watershed was available, we relied upon Canada Post's Unaddressed AdMail (Canada Post 2012) service to contact a random sample of farm and rural non-farm households. While this sampling approach is not ideal, it is a relatively inexpensive option compared to personal drop-offs and has been used to contact farmers in the past (e.g., Yu and Belcher 2011).

A selection of 1,012 farm households and 2,337 rural non-farm households along delivery routes in the Regions and Counties of Peel, Halton, Wellington, Simcoe, and Dufferin were identified and sent questionnaires. All surveyed rural non-farm households were located in the watershed. However, surveyed farm households were located inside and outside of the Credit River watershed to increase the sample size: 107 were located on postal routes completely inside of the watershed; 531 were located on routes completely outside of the watershed; 104 were located on routes partially within the watershed; and the precise location of 207 farm households could not be identified. Both the farmer and non-farmer versions of questionnaire were designed to be relevant to both watershed and non-watershed landowners.

Table 2: Distribution of sampled households

Municipality	Farm		Non-farm	
	Count	%	Count	%
Peel Region	131	12.9	1,477	63.2
Halton Region/Wellington County	120	11.9	860	36.8
Dufferin County	364	36.0	---	---
Simcoe County/York Region	397	39.2	---	---
Total	1,012		2,337	

The process of surveying respondents followed a modified Tailored Design Method (Dillman 2007). An initial wave of survey packages, including a cover letter and questionnaire, was sent to farmers and rural non-farm households in April 2012. Approximately two weeks later a reminder card encouraging landowners to fill out the survey was sent out. Another two weeks thereafter a second survey package was mailed. To get the attention of those being surveyed the survey packages were sent out in oversized brightly coloured envelopes. Credit Valley Conservation's logo was prominently displayed on the envelope. A postage-paid, business reply, return envelope was included in the survey package and respondents were asked to return the completed questionnaire in the mail using this envelope. To encourage participation all respondents were eligible for a draw for one of several cash prizes, including: one $500 grand prize; two $200 prizes; three $50 prizes; and ten $25 prizes. Survey respondents were asked to mail their ballots back in a second postage-paid return envelope provided in the survey package to ensure anonymity of survey responses.

3.4 Data analysis

Questions related to: (i) landowner property and wetland management history; and (ii) landowner preferences and attitudes about wetlands and the ecosystem services they provide were analysed by calculating frequency distributions of responses. The CE data for farm and non-farm surveys were analysed using multinomial logit and latent class models, respectively. From this analysis, landowner satisfaction levels (or likelihood of participation) associated with a change in each attribute were estimated, along with WTA compensation values for each attribute and total WTA compensation values for various wetland enhancement and restoration programs (see Appendix B for details).

4. KEY RESEARCH FINDINGS

4.1 General survey results

4.1.1 Survey responses

Of the 1,012 questionnaires sent to farm households, 151 were returned fully or partially completed. Four hundred and twenty two of the 2,337 questionnaires sent to rural non-farm households were returned fully or partially completed. Thus the farm and non-farm surveys achieved response rates of 14.9% and 18.1%, respectively (Table 3). These response rates are lower than those reported in similar CE surveys conducted with landowners (e.g. 27% in van Putten et al. (2011) to 59% in Horne (2003)). Our response rates are also lower than the 74.5% rate achieved by Milburn (2011), who surveyed rural non-farm landowners in Southern Ontario. However, our response rates compare favourably with other landowner surveys in Ontario (e.g. 14% in Tassie (2005) and 21% in

Environics (2001)) and are notably higher than the 6.1% response rate achieved by Yu and Belcher (2011), who also used Canada Post's Unaddressed AdMail to contact farmers.

Table 3: Survey Responses

Surveys	Farmer	Non-Farmer
Delivered	1,012	2,337
Returned	151	422
Response rate	14.9%	18.1%

As shown in Table 4, the municipality with the highest number of responses for the farm survey was Dufferin County, followed by Simcoe/York Regions, Halton/Wellington Regions, and then Peel Region. The municipality with the highest rate of response for the non-farm survey was Peel Region, followed by Halton/Wellington Regions.

Table 4: Municipalities in which respondents reside

Municipality	Farm			Non-Farm		
	Frequency	% of total	Response rate (%)	Frequency	% of total	Response rate (%)
Peel Region	19	12.7	14.5	251	59.8	17.0
Halton Region/Wellington County	25	16.7	20.8	167	39.8	19.4
Dufferin County	56	37.3	15.4	---	---	---
Simcoe County/York Region	50	33.3	12.6	2	0.5	---
Item non-response	1			2		

The majority of respondents to the farm version of survey indicated that they owned land outside of the Credit watershed[5] (Table 5). On the other hand, the majority of those who responded to the non-farm version of the survey indicated that they owned land within the watershed. This result was expected since the majority of farm and non-farm households that were sent questionnaires were located outside and inside the watershed, respectively. Several respondents to each version of the survey indicated that they owned land inside and outside of the watershed. A few respondents indicated that they did not own any land. These individuals may lease their land, in the case of the farm survey, or live in an apartment, in the case of the non-farm survey (since some of the non-farm participants may live relatively close to town centers).

Table 5: Location of respondent land holdings

Location of land holdings	Farm		Non-Farm	
	Frequency	%	Frequency	%
Inside the Credit watershed	27	18.0	305	72.3
Outside the Credit watershed	112	74.7	86	20.4
Inside and outside the Credit watershed	10	6.7	29	6.9
Does not own land	1	0.7	2	0.5
Item non-response	1		0	

As would be expected, most of the respondents to the farm version of the survey indicated that agriculture is the primary use of their land (Table 6). However, a large number of respondents to this version of the survey indicated that the primary use of their land was residential. This may be simply due to some farmers who live on their farmland picking residence over agricultural use

[5] Therefore, the results of farm version of the survey may reflect the preferences of those owning land outside of the Credit River watershed.

when asked to choose (especially those who consider themselves hobby farmers or those who lease their farmland to another farmer).

In contrast, the vast majority of respondents to the non-farm version of the survey indicated that their primary land use is residential (Table 6). However, 7.7% of the respondents stated that agriculture is their primary land use. This further suggests that the classification of farm and non-farm populations is blurry when considering hobby farms and landowners that rent their land to another farmer.

Table 6: Primary use of land owned by respondents

Primary Land Use	Farm		Non-Farm	
	Frequency	%	Frequency	%
Agriculture	77	51.0	32	7.7
Forestry	2	1.3	1	0.2
Residence	66	43.7	382	91.4
Other	5	3.3	3	0.7
Item non-response	1		4	

4.1.2 Wetland management history and landowner attitudes

Farm and non-farm landowners responded quite similarly to questions regarding their wetland management history (Table 7). Specifically, for farmers, while a large majority (at 67%) indicated they had wetlands on their land, a smaller percentage (at 30%) had enhanced them, while a smaller percentage yet (at 6%) had created them. For non-farm landowners, a majority (at 57%) indicated they had wetlands on their land, a smaller percentage (at 27%) had enhanced them, while a smaller percentage yet (at 8%) had created them.

Table 7: Respondent history with wetlands

Wetlands on land	Farm		Non-Farm	
	Frequency	%	Frequency	%
Have wetlands	100	67.1	234	56.5
Does not have wetlands	49	32.9	180	43.5
Enhanced wetlands	30	30.0	62	26.5
Created wetlands	6	6.0	19	8.1
Item non-response	2		8	

A variety of actions were undertaken by those respondents who indicated that they created or enhanced wetlands. Many respondents dug or restored ponds (wetlands), while others planted trees and shrubs or cleared waterways (e.g. removing garbage). Several agricultural producers indicated that they had fenced wetlands to keep livestock out or removed fields adjacent to wetlands from production, or did not till them. Other respondents enhanced habitat (e.g. bird boxes), stocked ponds with fish, and even built trails or boardwalks to enhance recreation. While the majority of actions were funded privately, several other sources of funding were accessed including: Ontario's Managed Forest Tax Incentive Program; the Peel Rural Water Quality Program; the Environmental Farm Plan; Ducks Unlimited; and various Conservation Authority programs (Credit Valley, Toronto and Region, Nottawasaga Valley, as well as Grand River).

After being presented with information on the benefits of wetlands, respondents were asked to rate the importance of five wetland ecosystem services, including: water purification (i.e. water quality);

flood, drought, and erosion control; wildlife habitat provision; carbon storage; as well as recreation & education. The majority of respondents to each version of the survey indicated that the benefits provided by wetlands were either very or somewhat important (Table 8). Thus, overall it appears that respondents feel that these five ecosystem services supplied by wetlands are important. In particular, respondents appeared to attach the most importance to water purification, followed by habitat provision, then flood, drought, and erosion control, carbon storage, and finally recreation & education.

Table 8: The importance of wetland benefits, by farm and non-farm survey respondents (% of total)

Wetland Benefits	Very Important		Somewhat Important		Not Important		No Opinion	
	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm
Water Quality	84.7	92.5	12.9	5.4	1.6	0.9	0.8	1.2
Erosion Control	65.6	69.7	29.6	22.8	4.0	5.1	0.8	2.4
Habitat	71.0	78.9	25.0	19.6	4.0	0.0	0.0	1.5
Carbon Storage	43.4	50.3	38.5	30.4	10.7	9.0	7.4	10.2
Recreation & Education	37.1	40.1	45.2	47.9	17.7	8.7	0.0	3.3

Respondents to both versions of the survey were also asked to assess the current state of watershed wetlands in terms of their amount and quality, as well as accessibility to view them. Answers to this question suggest that respondents feel that the amount and quality, as well as accessibility to view wetlands are relatively good. Specifically, over half of respondents, from both versions of the survey, rated the amount and quality of wetlands as either excellent or good (Table 9). Over half of respondents to the farm survey, and just under half of those responding to the non-farm survey, rated accessibility to view wetlands as either excellent or good. Though these answers suggest that respondents view the current state of wetlands favourably, it does not provide an indication of whether they are concerned about their ongoing degradation.

Table 9: Perception of the current state of wetlands in the Credit River watershed (% of total)

Current state	Excellent		Good		Fair		Marginal		Don't Know	
	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm
Amount of wetlands	24.0	22.2	44.0	42.8	16.8	13.5	5.6	4.5	9.6	17.1
Quality of wetlands	15.2	19.3	50.4	37.2	16.8	15.4	6.4	5.1	11.2	23.0
Accessibility to view wetlands	15.4	15.3	40.7	33.0	20.3	21.6	12.2	12.0	11.4	18.0

After being presented with information on the decline of wetlands in the Credit River watershed respondents to both versions of the survey were informed that they could help reverse this trend by enhancing or creating wetlands on their land. Following this information, they were asked about what may motivate local landowners to participate in wetland enhancement and restoration activities. Responses to this question from the farm and non-farm versions of the survey were similar (Table 10). With the exception of public recognition, the majority of respondents to both versions either strongly agreed or agreed with all motivations listed. Respondents to both surveys were largely neutral about public recognition as a motivator, although a larger portion either strongly agree or agree than disagree or strongly disagree.

Table 10: Landowner motivations for participating in wetland restoration and enhancement activities (% of total)

Motivation	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		Don't Know	
	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm
Public recognition	8.8	9.7	28.6	34.3	42.2	39.7	10.2	7.5	6.1	3.9	4.1	4.9
Concern over wetland loss	18.2	20.4	51.4	52.6	22.3	18.0	2.7	3.2	2.7	0.2	2.7	5.6
Information on how wetland loss affects them	29.3	29.1	52.4	58.3	13.6	8.7	1.4	0.7	2.7	0.2	0.7	2.9
Technical assistance	26.0	22.6	51.4	56.9	17.1	13.1	2.1	3.2	2.1	0.2	1.4	3.9
If neighbours enhance or restore wetlands	14.4	14.9	50.0	51.2	30.1	24.6	1.4	2.4	2.7	0.7	1.4	6.1
One-time payment	34.0	23.5	32.7	39.1	21.8	20.5	3.4	6.6	4.1	3.2	4.1	7.1
Annual payment	29.3	19.8	38.1	38.8	16.3	24.9	6.8	7.3	4.1	3.7	5.4	5.6

Examining the means and medians of a ranking scale (0 = don't know; 5 = strongly agree) used in the landowner motivation questions above confirms the findings that respondents feel public recognition provides landowners with the least amount of motivation to participate in wetlands restoration (Table 11). Based on the median of the ranking scale, respondents to both versions of the survey appear to suggest that the remaining motivations are likely to motivate landowners equally well. Interestingly, based on the mean of the ranking scale, respondents to both surveys seem to think that information on how wetland loss affects landowners is (marginally) the strongest motivator.

Table 11: Landowner motivations to participate in a wetland conservation program (represented using means and medians of a ranking scale from 5 to 0)[a]

Motivation	Mean		Median	
	Farm	Non-Farm	Farm	Non-Farm
Public recognition	3.24	3.12	3	3
Concern over wetland loss	3.73	3.72	4	4
Information on how wetland loss affects them	4.07	4.02	4	4
Technical assistance	3.87	3.93	4	4
If neighbours enhance or restore wetlands	3.59	3.68	4	4
One-time payment	3.52	3.77	4	4
Annual payment	3.47	3.65	4	4

[a] Otherwise known as a Likert scale, with: Strongly agree = 5; Agree = 4; Neutral = 3; Disagree = 2; Strongly disagree = 1; and Don't know = 0.

In terms of financial compensation, responses to both surveys appear to suggest that one-time payments motivate landowners slightly more than annual payments (Table 11). Interestingly, relative to individuals responding to the farm survey, those responding to the non-farm survey appear to agree more with the idea that landowners are motivated by financial compensation. Respondents to both versions of the survey seem to think that technical assistance motivates landowners slightly more than financial assistance and public recognition. The results of the CE, discussed in the next section, provide further information on landowner preferences for such program characteristics.

4.2 Choice experiment results

The majority of farm and non-farm survey respondents to the CE questions selected either Program A or Program B in all six choice sets which with they were presented suggesting that they were interested in participating in a wetlands conservation program. None of the alternatives appeared to dominate the others in any one of the choice sets. However, the proportion of farm and non-farm respondents who indicated that they were very certain about their answers to each choice set never exceeded eleven percent. While cases with uncertain responses are often recoded, we left these cases unmodified for our analysis. Specific details about the frequencies of respondent choices are provided in Appendix C.

Corresponding with current best practices when assessing responses to CE questions, respondents who were identified as protesting or yea-saying were removed from further analysis. Fifty one (33.8 %) of the respondents to the farm survey and 144, or 34.1 %, of the respondents to the non-farm survey indicated that they did not trust the government or that they thought that wetlands should be restored regardless of payment levels. These cases were not included in the analysis presented below leaving 100 farmer questionnaires and 278 non-farmer questionnaires[6]. Specific details about responses to these screening questions are provided in Appendix C.

Table 12: Data used in the analysis of the choice experiment

Data Used in Analysis	Farmer	Non-Farmer
Returned Surveys	151	422
Protests or strategic behaviour	51	144
Used in analysis[a]	100	278
Observations	600	1668

[a] To use as many responses as possible, missing observations were imputed using Latent Gold software.

Often respondents did not answer a particular question (i.e. item non-response). There are two common approaches for dealing with these responses (Whitehead 2006). List-wise deletion involves deleting those cases with missing data. Alternatively, missing data can be imputed (or estimated using information from responses to other questions). While removing incomplete cases is often the most robust approach it can introduce sample bias. Imputation addresses sample bias, though it may impact the standard errors and bias the statistical significance of imputed variables upwards (Allison 2002). While there is debate about which approach is superior, we chose to impute missing data using imputation routines due to our low sample size. This corresponds to the approach most commonly taken when dealing with contingent valuation data (Bateman et al. 2002).

4.2.1 Farm survey

The choice data from the farm survey was analyzed using a MNL model. While the overall explanatory power of the model was relatively low, it was within the range found in similar studies in the literature (e.g. Rossi et al. 2011). Additionally, while many of the attribute coefficients were not found to be significantly different from zero (i.e., they did not influence the likelihood of participants selecting a program), two groups of attribute coefficients were significantly different

[6] Respondents identified as protesters or yea-sayers were removed from the analysis only for the choice experiment section of the survey.

from zero (see Appendix C for details). Specifically, the type of land converted and the annual per acre payment appeared to be important factors considered by respondents when selecting whether or not to participate in a wetland conservation program. For land type, the coefficients suggested that a landowner's level of satisfaction would be negatively impacted (i.e., they would be less likely to participate) if a wetland conservation program required them to convert productive land compared to marginal land. For the annual per acre payment, the positive coefficients observed indicated that (as expected) respondents would be more likely to participate in the program if higher levels of financial compensation were offered.

Farmer WTA compensation estimates for participating in a wetland conservation program are presented in Table 13. Since the majority of non-financial coefficients were insignificant, only two WTA compensation estimates were calculated. Specifically, farmers were, on average, willing to accept $655.57 and $171.86 in annual compensation to enrol productive and marginal land, respectively, in a wetlands conservation program (independent of the conversion activity or acres considered). Farmer participation rates in a wetland conservation program were estimated to range between 39.6% and 56.6%, depending on the program scenario and payment rate that would be offered.

Table 13: Farmer willingness to accept (WTA) compensation values and percentage participation, by program scenario and payment rate[a]

Attribute	Scenario 1	Scenario 2
Type of land	Productive	Marginal
Conversion activity	Meadow/Wetland/Trees	Meadow/Wetland/Trees
Acres	1-5	1-5
Public recognition	Yes/No	Yes/No
$WTA/ac/yr	$655.57	$171.86
% participation (at $WTA/ac/yr payment)	50.0%	50.0%
% participation (at $50/ac/yr payment)	39.6%	47.9%
% participation (at $550/ac/yr payment)	48.2%	56.6%

[a] $WTA (estimated as the negative of compensating surplus) estimates were calculated using attributes with significant coefficients only (see Appendix C). Insignificant coefficients were set to zero.

4.2.2 Non-farm landowner survey

The choice data for the non-farm landowner survey was analyzed using a latent class model. Here, two distinct classes of non-farm landowners were determined, with those in Class 1 being more likely to: (i) have high school or less as their highest level of education; (ii) be motivated by financial incentives; and (iii) prefer five or ten year wetland conservation contracts, compared to those in Class 2 (See Appendix C for more details).

The explanatory power of the model for Class 1 was similar to that of the farmer CE (i.e, relatively low), while the explanatory power of the model for Class 2 was relatively high (see Appendix C for details). In terms of attribute coefficients, both classes of landowners would be less likely to participate in a wetlands program if it required converting land to meadows compared to a wetland, and more likely to participate if it required converting land to trees compared to a wetland. The area of land converted (at least within the range considered) was not a significant factor affecting the

likelihood of Class 1 participation. For Class 2, the findings indicated that they would be less likely to participate in a wetlands program if it required converting 1 acre of land compared to 0.5 acres, and would apparently be more likely to participate if it required converting 1.5 acres of land compared to 0.5 acres. Additionally, providing technical assistance would increase the likelihood of Class 1 non-farm landowners participating in a program, while it would decrease that for Class 2. While public recognition was not a significant factor in affecting the likelihood of those in Class 1 participating in a program, it would increase the likelihood of those in Class 2 participating. Finally, while higher amounts of financial compensation increased the likelihood of those in Class 1 participating in a program, it was not a significant factor in affecting participation of those in Class 2.

Non-farm landowner WTA compensation estimates for participating in a wetland conservation program are presented in Table 14 (see Appendix C for details). For wetland conservation programs converting land to meadows, Class 1 respondents required, on average, annual payments of $617.95 and $382.71 with and without technical assistance, respectively. To convert land to trees, those in Class 1 required an annual payment of $211.78 if not offered technical assistance, while they were willing to pay an annual amount of $23.46 if the program included technical assistance. For a program converting land to wetlands, those in Class 1 required annual payments of $433.92 and $198.68 for programs with and without technical assistance, respectively.

WTA compensation for Class 2 respondents was $0. This can be interpreted as respondents not requiring financial compensation for participating in a wetlands enhancement and restoration program. However, as revealed in Table 14 (footnote b), these respondents were marginally more likely to participate in a wetland program that provides public recognition.

Participation rates were estimated to range between 36.8% and 56.7% for Class 1 and between 92.5% and 98.0% for Class 2, depending on the program scenario, and payment rate that would be offered.

Table 14: Non-farm landowner willingness to accept (WTA) compensation values and percentage participation, by program scenario and payment rate[a]

Attribute	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Conversion activity	Meadow	Meadow	Trees	Trees	Wetland	Wetland
Acres	0.5-1.5	0.5-1.5	0.5-1.5	0.5-1.5	0.5-1.5	0.5-1.5
Technical assistance	No	Yes	No	Yes	No	Yes
Public recognition	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
$WTA/yr (Class 1)	$617.95	$382.71	$211.78	-$23.46	$433.92	$198.68
$WTA/yr (Class 2)	$0	$0	$0	$0	$0	$0
% participation Class 1 (at $WTA/yr payment)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
% participation Class 1 (at $0/yr payment)	36.8%	41.9%	45.7%	51.0%	40.8%	46.0%
% participation Class 1 (at $250/yr payment)	42.2%	47.5%	51.4%	56.7%	46.3%	51.7%
% participation Class 2[b] (at $0 or more/yr payment)	94.8-97.6%	92.5-96.5%	96.4-98.3%	94.7-97.5%	95.6-98.0%	93.6-97.0%

[a] $WTA (estimated as the negative of compensating surplus) estimates were calculated using attributes with significant coefficients only (see Appendix C). Insignificant coefficients were set to zero.

[b] The range in percentages largely reflect whether or not public recognition is provided, with higher levels of participation associate with the provision of public recognition.

5. CONCLUSION

The findings of this survey indicate that landowners in and around the Credit River watershed share similar overall attitudes about wetlands and have a similar history associated with wetland management. Over half of the respondents surveyed have wetlands on their land, although most have not taken it upon themselves to create new wetlands. That being said, a third of the sample has enhanced the wetlands on their land they in some way, either by digging (restoring) ponds, planting trees, or putting up fencing to keep livestock out. However, statistically significant differences do exist with regard to their preferences over wetland conservation incentives (monetary and non-monetary), implementation details (e.g. types of conversion activities, extent of commitment, etc.), and overall WTA compensation for wetland conservation on their property.

5.1 Farmer preferences for wetland conservation incentives

Farmers tend to have relatively homogeneous preferences and require more compensation for setting aside productive land than marginal land, likely based on their assessment of foregone income from no longer operating on that land. WTA values ranged from $171.86 (per acre, per year) for setting aside marginal land to $655.59 (per acre, per year) for setting aside productive land. Technical assistance, public recognition, conversion activity, and the scale of conservation within the range considered did not tend to have a significant influence on their required level of compensation.

5.2 Non-farm landowner preferences for wetland conservation incentives

Non-farm landowners, on the other hand, tended to have more heterogeneous preferences. Survey respondents were broken up into two different classes of respondents. The first group (Class 1) of respondents were more likely to be less educated, highly motivated by financial incentives, prefer five or ten year contracts, and gain satisfaction from a program that provided technical assistance when compared to the second group (Class 2) of respondents. The second group was more likely to participate in a wetland program that provided public recognition, provided a wide range of contract lengths. This group was relatively less motivated by money compared to the first group.

The first group required significant levels of compensation that varied considerably, depending on the type of conversion activity and whether or not technical assistance was offered. WTA values ranged from -$23.46 (per acre, per year) to $433.92 (per acre, per year). This implied respondents would be willing to pay $23.46 (per acre, per year) to participate in a conservation program that converted meadow land into treed land and offered technical assistance, but would need $433.92 (per acre, per year) in compensation to convert meadow land into wetlands with no technical assistance. The second group of respondents did not require compensation; however, their participation level in a conservation program would vary depending on whether or not technical assistance and public recognition was included. Participation rates ranged from 92.5% to 98.3% depending on what attributes were included in the program.

5.3 Study limitations

It is important to note the limitations to this study. For instance, obtaining a sufficient number of farmers located in the watershed for the survey was difficult given the limitations in Canada Post's farm address database. An attempt was made to increase the number of observations by including farmers located adjacent the watershed. Thus, the results of the farm survey may not completely reflect the preferences of agricultural producers solely in the watershed. Additionally, the response rates to both questionnaires were relatively low, which may imply that the study results do not reflect the views of the entire population of landowners in the region. The low number of observations for the farm survey may have also contributed to the lack of significance among the attributes included in the CE. This lack of significant attributes made it somewhat difficult to interpret preferences, and in turn, provide advice on the appropriate wetlands conservation program design. Finally, our analysis identified a sizable proportion of protest responses which we excluded from the CE analysis (following previous literature). Alternative treatment of these responses could lead to different program design and incentive preferences for both groups of landowners compared to what is presented in this report.

Notwithstanding the above limitations, this research indicates that with the appropriate program design and incentives, a significant proportion of landowners in or near the Credit River watershed would be willing to participate in a wetlands conservation program.

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APPENDIX A: ADDITIONAL SURVEY RESULTS

A1. Respondents' land

Just over 40% of farmers and rural non-farm landowners indicated that the land that they own is part of the Greenbelt (Table A1).

Table A1: Respondent's land located in the Greenbelt

Greenbelt Landowner	Farm		Non-Farm	
	Frequency	%	Frequency	%
Yes	63	**42.6**	188	**44.5**
No	51	**34.5**	66	**15.6**
Don't know	34	**23.0**	158	**38.3**
Item non-response	3		10	

Approximately 25% of farmers and 79% of non-farm landowners indicated they owned land within the watershed. While the average size of land owned by farm and non-farm respondents was 102.5 and 21.4 acres respectively, the holdings inside the watershed were, on average, smaller than the holdings outside of the watershed. As expected, the average size of farmer land holdings was several times larger than that of non-farm landowners (Table A2).

Table A2: Respondent's land area in acres

Land Area in Acres	Farm		Non-Farm	
	Mean	Range	Mean	Range
Holdings inside watershed	54.5	0.5 to 200.0	18.8	0.25 to 270.0
Holdings outside watershed	108.7	0.5 to 2,600.0	23.8	0.25 to 358.0
Total land holdings	102.5	0.5 to 2,800.0	21.4	0.25 to 361.3

Only 12.2% and 5.8% of farm and non-farm respondents, respectively, purchased their land before 1970. The percentage of farm and non-farm respondents purchasing their land in each subsequent decade increased substantially over the past number of decades (Table A3).

Table A3: Respondent's land purchase

Land Purchased	Farm		Non-Farm	
	Frequency	%	Frequency	%
Before 1970	18	**12.2**	24	**5.8**
1970 to 1980	18	**12.2**	46	**11.1**
1981 to 1990	26	**17.6**	81	**19.5**
1991 to 2000	36	**24.3**	119	**28.6**
2001 to 2012	50	**33.8**	146	**35.1**
Not applicable	1		2	
Item non-response	2		4	

Farmers specified that they have relatively more of their land in crop, orchard, and pasture compared to non- farm landowners (Table A4). At the same time, a slightly higher % of farmers reported they had various natural land cover types on their land.

Table A4: Respondent's land features[a]

Land Features	Farm		Non-Farm	
	Frequency	%	Frequency	%
Crop or orchard	76	**50.7**	74	**18.4**
Pasture	89	**59.3**	86	**21.4**
Forests	92	**61.3**	243	**60.4**
Meadows	51	**34.0**	115	**28.6**
Wetlands	93	**62.0**	224	**55.7**
Other	21	**14.0**	82	**20.4**
Item non-response	1		20	

[a] A respondent could check multiple boxes. As such, one cannot sum frequencies or percentages.

As one might expect, farmers are more likely to generate income from farming or forestry, either by engaging in these activities themselves or by leasing their land to others who engage in farming or forestry, relative to non-farm landowners (Table A5). Few farmers and non-farm landowners have generated income from leasing their land for hunting or recreation, or from development of their land.

Table A5: Respondent's income from land

Income from Land[a]	Farm		Non-Farm	
	Frequency	%	Frequency	%
Farming	76	**50.3**	32	**7.8**
Forestry	10	**6.6**	8	**2.0**
Leasing for hunting	1	**0.7**	0	**0.0**
Leasing from recreation	1	**0.7**	2	**0.5**
Leasing for farming or forestry	30	**19.9**	26	**6.3**
Development or sale of land	1	**0.7**	4	**1.0**
Item non-response	0		12	

[a] A respondent could check multiple boxes. As such, one cannot sum frequencies or percentages.

The most common retirement plan is for farm and non-farm landowners to sell their land. Also notable is that relatively more farmers (36%) intend on giving their land to family after they retire compared to non-farm landowners (21%) (Table A6).

Table A6: Respondent's retirement plans

Retirement Plan	Farm		Non-Farm	
	Frequency	%	Frequency	%
Sell	63	**41.7**	190	**45.5**
Give to family	55	**36.4**	87	**20.8**
Give to land trust	1	**0.7**	3	**0.7**
Don't know	23	**15.2**	90	**21.5**
Other	7	**4.7**	48	**11.5**
Item non-response	2		4	

A2. Respondents' land management

Respondents were asked to indicate the importance of reasons for owning land (Table A7).

- The majority of farmers indicated that using the land that they own to make a living was either very important or important, while the majority of non-farm landowners indicated that this reason was either of little importance or unimportant.
- Similarly a large minority of farmers indicated that owning their land to complement their income was either very important or important, while the majority of non-farm landowners indicated that this reason was of little importance or unimportant.
- Farmers and non-farm landowners gave fairly similar responses to several of the reasons for owning land with which they were presented. The majority of farmers and non-farm landowners indicated that owning land as an investment for future gain, as a location for their permanent residence, for recreation, for the sake of future generations, or to preserve ecosystems was either very important or important.
- Similarly, the majority of farmers and a large minority of non-farm landowners indicated that owning land to maintain a family legacy was either very important or important.

Table A7: Reasons that landowners own land (% of total)

Reason for Owning Land	Very Important		Important		Neither Important or Unimportant		Of little Importance		Unimportant		Don't Know	
	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm
To make a living (farm, forest, or other income)	27.4	6.7	24.0	8.4	16.4	18.8	11.0	13.3	21.2	51.6	0.0	1.2
To complement my income	17.0	4.3	24.1	12.8	19.9	16.0	11.3	16.0	27.7	49.4	0.0	1.5
As an investment for future gain	23.1	21.4	36.4	40.9	17.5	15.2	13.3	10.2	9.8	11.2	0.0	1.0
As a location for my permanent residence	76.7	83.7	18.5	14.1	2.7	1.2	0.0	0.0	2.1	0.7	0.0	0.2
For recreation (hunting, fishing, walking, etc.)	25.5	25.3	36.2	38.3	14.9	14.0	9.9	4.9	12.8	16.2	0.7	1.2
To maintain a family legacy	20.4	16.5	23.2	20.2	28.9	28.8	12.0	11.1	13.4	21.2	2.1	2.2
For the sake of our future generations	26.6	21.7	38.5	34.9	18.9	23.9	4.9	4.5	7.7	12.7	3.5	2.2
To preserve ecosystems	29.4	29.1	43.4	38.4	16.8	19.1	3.5	5.1	7.0	5.9	0.0	2.4

Respondents were asked to indicate the level of responsibility they felt to others (Table A8).

- Farmers and non-farm landowners reported similar levels of responsibility. Most farmers and non-farm landowners indicated that they had either a very high or high responsibility to: their family; adjacent landowners; their community; and the larger ecosystem.

Table A8: Landowner's responsibility to others (% of total)

Responsibility to Others	Very High Responsibility		High Responsibility		Low Responsibility		Very Low Responsibility		Don't Know	
	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm
To my family (including past & future generations)	45.6	39.3	39.6	37.8	8.1	11.7	4.7	8.8	2.0	2.4
To adjacent landowners	24.7	23.0	54.1	58.8	17.2	12.0	3.4	3.7	0.7	2.5
To my community	23.3	21.0	50.0	57.3	21.9	15.8	4.8	3.7	0.0	2.2
To the larger ecosystem	41.1	36.1	39.7	53.0	13.0	6.3	4.1	2.4	1.4	2.2

Respondents were asked about their agreement with statements about land ownership (Table A9).

- Farmers and non-farm landowners gave similar responses to many of the statements about private land ownership. The majority of farmers and non-farm landowners indicated that they either strongly agree or agree that: their land should provide for the needs of future plants and animals; what they do on their land affects people aside from their family; environmentally sensitive areas on private land should be protected from being altered or damaged; actions on neighbours' land affects them and their land; and landowners should work together if it means the land would be better off.
- Similarly, the majority of farmers and a large minority of non-farm landowners strongly agreed or agreed that there is too much government regulation of private land use.

Table A9: Landowner's view on private land (% of total)

Views on Private Land	Strongly Agree		Agree		Neither agree nor disagree		Disagree		Strongly Disagree		Don't Know	
	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm
My land should provide for the needs of future plants and animals	43.3	41.1	39.3	40.0	10.0	16.0	5.3	1.7	1.3	0.5	0.7	0.7
What I do on my land affects people aside from my family	38.7	34.8	45.3	47.0	12.7	11.8	2.7	4.1	0.7	1.7	0.0	0.7
There is too much government regulation of private land use	34.0	19.8	19.3	20.7	26.7	36.7	12.0	13.8	4.0	4.8	4.0	4.3
Environmentally sensitive areas on private land should be protected from being altered or damaged	32.0	38.4	42.7	44.4	13.3	11.0	7.3	4.1	3.3	1.4	1.3	0.7
What neighbours do on their land affects me and my land	37.3	40.4	48.0	48.5	12.7	8.1	2.0	1.4	0.0	0.7	0.0	1,0
Landowners should work together if it means the land would be better off	36.7	38.2	50.0	51.2	11.3	8.8	2.0	0.5	0.0	0.0	0.0	1.2

Respondents were asked to indicate their level of agreement with several statements about landowner rights (Table A10).

- Farmers and non-farm landowners responded similarly to several of the statements with which they were presented. The majority of farmers and non-farm landowners either strongly agreed or agreed with the statements that they had the right to: restrict others' access to their land; transfer land ownership without restriction; and do anything with their land as long as their actions to not conflict with the interests and values of the local community.
- The majority of farmers and non-farm landowners either strongly disagreed or disagreed with the statement that landowners could do whatever they wanted with their land without regard to others.

Table A10: Landowner's views on the rights of private land ownership (% of total)

As a landowner I have the right to…	Strongly Agree		Agree		Neither agree nor disagree		Disagree		Strongly Disagree		Don't Know	
	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm
…restrict others' access to my land	63.3	60.6	32.7	35.4	2.0	3.1	1.3	0.7	0.0	0.0	0.7	0.2
…transfer ownership of my land without restriction	44.0	37.8	34.0	34.9	8.7	11.2	8.7	10.5	2.7	4.1	2.0	1.4
…do whatever I want with my land without regards for others	6.7	3.1	6.7	4.5	18.7	12.9	46.0	51.3	22.0	27.4	0.0	0.7
…do anything with my land as long as my actions do not infringe upon neighbours' rights	19.3	13.2	38.7	37.3	10.7	15.3	23.3	24.9	8.0	8.6	0.0	0.7
…do anything with my land as long as my actions do not conflict with the interests and values of the local community	18.7	11.5	42.0	45.3	13.3	20.8	20.7	15.0	4.7	6.2	0.7	1.2

Respondents were asked to indicate their level of agreement with a few statements regarding landowner responsibilities (Table A11).

- Farmers and non-farm landowners responded similarly to the three statements with which they were presented. The majority of farmers and non-farm landowners indicated that they either strongly agree or agree that they have the responsibility to: be a good steward of their land and to maintain it in a good condition for future generations; leave the land in a better condition than when they acquired it; and take into account the values and interests of society at large when making decisions about their land.

Table A11: Landowner's views on the responsibilities of private land ownership (% of total)

As a landowner I have the responsibility to…	Strongly Agree		Agree		Neither agree nor disagree		Disagree		Strongly Disagree		Don't Know	
	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm
…be a good steward of my land and to maintain it in a good condition for future generations	63.3	61.4	34.7	37.1	1.3	1.2	0.7	0.0	0.0	0.0	0.0	0.2
…leave the land in a better condition than when I acquired it	44.0	44.4	37.3	40.9	15.3	13.1	2.0	1.4	0.0	0.0	1.3	0.2
…take into account the values and interests of society at large when making decisions about my land	22.0	22.2	46.7	48.3	15.3	21.1	12.0	5.7	3.3	2.2	0.7	0.5

A3. Landowners' characteristics

The majority of respondents to both versions of the survey were male. The proportion of male and female respondents to the farm version is almost identical to the proportion of male and female respondents to the non-farm version (Table A12).

Table A12: Respondent's gender

Gender	Farm		Non-Farm	
	Frequency	%	Frequency	%
Female	65	**43.6**	184	**44.1**
Male	84	**56.4**	233	**55.9**
Item non-response	2		5	

The average age of those responding to both versions of the survey was almost identical (Table A13). Farmers had a mean age of 58.4 years, while Non-Farmers had a mean age of 58.0.

Table A13: Respondent's age

Age	Farm		Non-Farm	
	Mean	Range	Mean	Range
Age in years	58.4	24 to 89	58.0	23 to 92
Item non-response	8 observations		17 observations	

Respondents to the farm and non-farm versions reported similar levels of education. The majority of non-farm landowners reported that their highest level of education was a diploma or bachelors degree, followed by a graduate degree, high school, and then elementary school. Similarly, most farmers reported that their highest level of education was a diploma or bachelors degree, followed by high school, a graduate degree, and then elementary school (Table A14).

Table A14: Respondent's education

Education	Farm		Non-Farm	
	Frequency	%	Frequency	%
Elementary	4	**2.7**	11	**2.6**
High school	32	**21.8**	77	**18.5**
Diploma or bachelors degree	86	**58.5**	247	**59.2**
Masters or PhD degree	25	**17.0**	82	**19.7**
Item non-response	4		5	

A larger percentage of farmers (47.3%) than non-farm landowners (34.0%) reported that they grew up in a rural community, while a larger proportion of non-farm landowners (38.6%) than farmers (27.7%) reported that they grew up in a suburban community (Table A15). A similar percentage of farmers (25.0%) and non-farm landowners (27.5%) grew up in urban communities.

Table A15: Type of community in which respondents grew up

Place Grew Up	Farm		Non-Farm	
	Frequency	%	Frequency	%
Urban	37	**25.0**	114	**27.5**
Suburban	41	**27.7**	160	**38.6**
Rural	70	**47.3**	141	**34.0**
Item non-response	3		7	

Unsurprisingly, given the rural focus of the surveys, the majority or respondents to the farm and non-farm surveys reported that they have spent most of their adult life in a rural community (Table A16).

Table A16: Type of community in which respondents spent their adult life

Place Spent Adult Life	Farm		Non-Farm	
	Frequency	%	Frequency	%
Urban	14	**9.6**	42	**10.4**
Suburban	28	**19.2**	105	**26.1**
Rural	104	**71.2**	255	**63.4**
Item non-response	5		20	

The majority of respondents to both versions of the survey reported that they were working either full-time or part-time, while a large percentage indicated that they were retired. Notably, only 2.0% of farmers and 2.9% of non-farm landowners reported that they were unemployed (Table A17).

Table A17: Respondent's employment status

Employment Status	Farm		Non-Farm	
	Frequency	%	Frequency	%
Working full-time	75	**51.0**	199	**48.0**
Working part-time	24	**16.3**	52	**12.5**
Retired	45	**30.6**	151	**36.4**
Unemployed	3	**2.0**	12	**2.9**
Student	0	**0.0**	1	**0.2**
Item non-response	4		7	

As would be expected, more farmers (41.2%) than non-farm landowners (11.8%) indicated that they were members of a farm organization. However, a higher percentage of non-farm landowners than farmers indicated that they held membership in all but one of the remaining types of organizations listed (Table A18).

Table A18: Respondent's membership in organizations[a]

Organization	Farm		Non-Farm	
	Frequency	%	Frequency	%
Environmental or conservation	23	**15.5**	59	**26.7**
Hunting or fishing	20	**13.5**	46	**20.8**
ATV or snowmobile	12	**8.1**	18	**8.1**
Farm	61	**41.2**	26	**11.8**
Woodlot	7	**4.7**	28	**12.7**
Other	14	**9.5**	44	**19.9**
Item non-response	3		1	

[a] A respondent could check multiple boxes. Do not sum frequencies or percentages.

While Farmers and non-farm landowners reported similar household incomes, a notably larger percentage of non-farm landowners (32.2%) than farmers (20.8%) reported a household income larger than $100,000 while a larger proportion of farmers (25.4%) than non-farm landowners (18.5%) indicated that their household income was between $50,000 and $74,999 (Table A20).

Table A19: Respondent's household income in the past year

Household Income	Farm		Non-Farm	
	Frequency	%	Frequency	%
Less than $10,000	7	**5.4**	18	**5.0**
$10,000 to $29,999	12	**9.2**	26	**7.2**
$30,000 to $49,999	18	**13.8**	56	**15.4**
$50,000 to $74,999	33	**25.4**	67	**18.5**
$75,000 to $99,999	33	**25.4**	79	**21.8**
More than $100,000	27	**20.8**	117	**32.2**
Item non-response	21		59	

APPENDIX B: ADDITIONAL DETAILS OF THE CHOICE EXPERIMENT METHODS

B1. Determining compensation and preferences for program characteristics

Several different techniques can be used to estimate the amount of compensation[7] that landowners require for participating in environmental improvement schemes as well as their preferences for other program characteristics (Haab and McConnell 2002). Among these techniques are stated preferences, which gather information by observing responses to hypothetical scenarios in surveys, and revealed preferences, which obtain information by observing actual behaviour in existing markets. An additional option is to transfer estimates of WTA from elsewhere, though little is known about the accuracy of using benefit transfer for assessing WTA since it appears that this technique has yet to be rigorously assessed.

Stated preference techniques are particularly suited to assessing landowner preferences for wetland conservation programs and have been used on several occasions to estimate WTA. The main types of stated preferences are the contingent valuation method and choice experiments (CEs). The contingent valuation method can be used to elicit farmer WTA for a single variant of a conservation scheme. This technique has been used on a few occasions to assess farmer WTA for conserving and protecting wetlands. The WTA of farmers in Saskatchewan was assessed for not draining sloughs and setting aside 40 acres of prime agricultural land in the middle of a field for fifteen years (Van Kooten and Schmidt 1992), as well as for setting aside a vegetated buffer zone, at least 10 metres in width, around wetlands for ten years (Yu and Belcher 2011). In Florida, Shrestha and Alavalapati (2004) used contingent valuation to determine farmer WTA for implementing several silvopasture practices, including creating or restoring wetlands. Contingent valuation has been used to determine farmer WTA for implementing other types of conservation practices including: diverting agricultural land to woodland (e.g. Gasson and Potter 1988; Bateman et al. 1996; Shrestha and Alavalapati 2004; Shaikh et al. 2007a, 2007b); establishing vegetated riparian areas on farmland (e.g. Lant 1991; Lohr and Park 1994, 1995; Amigues et al. 2002; Lynch et al. 2002; Shrestha and Alavalapati 2004); and adopting a variety of other land management practices (e.g. Cooper and Osborn 1998; Vanslembrouck et al. 2002; Cooper 2003; Wossink and van Wenum 2003; Thomas and Blakemore 2007; Sun et al. 2009).

Until recently the use of CEs for assessing landowner preferences for conservation schemes was relatively rare and this technique has not been used for this purpose in Canada. Indeed it appears that there has only been one study using CEs in a context related to wetland conservation. Hope et al. (2008) employed this technique to determine farmer preferences in India for adopting organic farming as a way to reduce water pollution in a wetland. Many studies have used CEs to determine farmer preferences for conservation schemes in other contexts including: conserving biodiversity or endangered species (e.g. Horne 2006; Matta et al. 2009; Sorice et al. 2011); afforestation (e.g. Broch and Vedel 2012; Broch et al. 2012); water quality protection schemes (Beharry-Borg et al. 2012); actions to improve the supply of ecosystem services in watersheds (Sangkapitux et al. 2011); a variety of other land management practices (Horne and Petäjistö 2003; Christensen et al. 2011; Rossi et al. 2011); and general characteristics of conservation programs (e.g. Ruto and Garrod 2009; Esinposa-Goded et al. 2010; van Putten et al. 2011).

7 The amount of compensation that a landowner requires for implementing a certain action, such as creating a wetland, is termed "WTA".

Revealed preferences can also be used to assess landowner WTA and preferences for other conservation program characteristics. However, this group of techniques is limited as it relies on information from existing programs and cannot gather information on farmers and landowners who are not conservation program participants. Market prices, via forgone revenue or rental rates, can be used to determine opportunity costs of program participation and thus the amount of compensation required. Indeed the Conservation Reserve Program bases some of its payments on rental rates (USDA 2012). Auctions can also be used to determine landowner WTA. Auctions have been used on a few occasions in the Canadian Prairies. Hill et al. (2011) report on a reverse auction for wetland restoration piloted in 2009 in Saskatchewan's Assiniboine River watershed by Ducks Unlimited Canada and the Assiniboine Watershed Stewardship Association. Ducks Unlimited Canada also piloted another auction to determine landowner WTA for conservation easements on ecologically sensitive land in Saskatchewan and Manitoba (Brown et al. 2011). An alternative option for examining landowner preferences for conservation programs is to analyze the determinants of their participation in actual programs such as the Environmental Farm Plan (e.g. Smithers and Furman 2003; Atari et al. 2009; Yiridoe et al. 2010) or Ontario's Rural Water Quality Program (e.g. Dupont 2010). Other studies have conducted meta-analyses to assess determinants of program participation (e.g. Knowler and Bradshaw 2007; Prokopy et al. 2008; Baumgart-Getz et al. 2012).

Our research proceeded with CE to estimate WTA and landowner preferences for wetlands conservation program characteristics. As a stated preference technique, CEs incorporate a wider range of values than would be possible for other (e.g., revealed preference) approaches. For example, an assessment of forgone revenue or rental rates, which represents a revealed preference approach, only accounts for those costs reflected in the market (Jack et al. 2009). Similarly, stated preference techniques are able to assess preferences for program characteristics that are not currently part of existing incentive schemes, while other approaches cannot. Though pilot auctions are able to overcome these limitations and are favourable since resulting values are based on actual landowner decisions under competition (Reeson et al. 2011), they can be complicated and costly to implement. Finally, in comparison to the contingent valuation method (another stated preference approach commonly used in the literature), CEs are advantageous since they allow the examination of how multiple program characteristics affect a landowner's decision to participate (Matta et al. 2009).

The CE method is rooted in Lancaster's theory of consumer choice which states that consumption decisions are based on the utility derived from the attributes of a good or service being consumed (Lancaster 1966; Pearce et al. 2006). As part of a choice experiment, a respondent is asked view a series of choice sets with each set containing multiple alternative profiles of a good or service. The good or service being considered is represented by certain key attributes and the levels that each attribute takes are varied over the alternative profiles. For each set, respondents are asked to choose their preferred alternative. In order to properly estimate willingness to pay or accept, respondents should also have the option to select the status quo. CEs are becoming increasingly popular since they allow researchers to simultaneously value, and assess tradeoffs between, multiple environmental characteristics (Willis 2002) as well as provide an internal scope test (Pearce et al. 2006). Further details about CEs are provided in Louviere et al. (2000).

B2. Choice experiment model specification and willingness to accept calculation

The conceptual framework for the CE is based on the random utility model (MacFadden 1974), which is rooted in Lancaster's theory of consumer choice (i.e. utility resulting from a good's consumption is derived from its characteristics). Random utility theory assumes that a utility function is divisible into deterministic and stochastic components. The deterministic portion is a function of the utility resulting from the characteristics of the different alternatives observable to the researcher, while the stochastic portion accounts for the unobservable influences on respondent utility.

$$U_{iq} = V_{iq}(X_{iq}) + e_{iq} = \beta(X_{iq}) + e_{iq} \quad \textbf{(1)}$$

where: U_{iq} is the utility of respondent q for i different alternatives
V_{iq} is the deterministic element of U_{iq}, typically a linear index of attributes (X)
e_{iq} is the stochastic, unobservable element

The probability that any respondent chooses a particular alternative *A* over all other alternatives is based on the probability that the utility derived from choosing alternative *A* exceeds that derived from all other alternatives. This probability is based on the characteristics of the alternative (i.e. its attributes), a respondent's socioeconomic characteristics, and the unobservable error component. Formally, the probability that a respondent q will choose alternative i from a set J, compromised of j alternatives, can be written as:

$$P([U_{iq} > U_{jq}] \; \forall \; i \neq j) = P([V_{iq} - V_{jq}] > [e_{iq} - e_{jq}]) \quad \textbf{(2)}$$

where: U_{iq}, V_{iq}, and e_{iq} are defined as above
U_{jq} is the utility of respondent q for alternative j
V_{jq} is the deterministic element of U_{jq}, typically a linear index of attributes (X)
e_{iq} is the stochastic, unobservable element for alternative j

In order to explicitly represent this probability statement it is necessary to make an assumption about the distribution of the error term. For the multinomial (conditional) logit model a Weibull or Gumbell (i.e. extreme value) distribution is usually assumed. A further assumption is that the error terms are independently and identically distributed (Boxall and Adamowicz 2002; Colombo et al. 2005). These assumptions allow Equation 2 to be written as follows:

$$P_{iq} = \frac{\exp(\mu V_{iq})}{\sum_{j=1}^{J} \exp(\mu V_{jq})} \quad \textbf{(3)}$$

where: V_{iq} and V_{jq} are defined as above
P_{iq} is the probability of respondent q choosing alternative i
μ is the scale parameter, representing dispersion, which is often assumed to equal one

Given the assumption that V_{iq} is linear and additive in the parameters (i.e. $V_{iq}=\beta' X_{iq}$), Equation 3 can be re-written as:

$$P_{iq} = \frac{\exp(\mu\beta' X_{iq})}{\sum_{j=1}^{J} \exp(\mu\beta' X_{jq})} \quad \textbf{(4)}$$

where: P_{iq} and μ are defined as above
X_{iq} represents the explanatory coefficients of V_{iq}, including the choice alternative's attributes, and the socioeconomic characteristics of respondent q
X_{jq} represents the explanatory coefficients of V_{jq}, including the choice alternative's attributes, and the socioeconomic characteristics of respondent q
β is a vector of coefficients associated with the explanatory variables

One criticism of the multinomial logit model is that it assumes homogeneous preferences, which means that everyone in the population of interest is assumed to have identical preferences (Colombo et al. 2005). Rather than make this often unrealistic assumption, latent class modeling (LCM) allows for preference heterogeneity[8]. Respondents with similar preferences are grouped together into latent classes (S) according to their answers to the CE. A multinomial logit model is then fit to each class. As such preferences are assumed to be homogeneous within classes, but are allowed to vary across classes. The probability of individual q choosing alternative i is now conditional on the individual being part of class s (Boxall and Adamowicz 2002; van Putten et al. 2010).

$$P_{iq|s} = \frac{\exp(\mu_s \beta_s' X_{iq})}{\sum_{j=1}^{J} \exp(\mu_s \beta_s' X_{jq})}, \quad s = 1,...,S \quad \textbf{(5)}$$

where: X_{iq} and X_{jq} are defined as above
$P_{iq|s}$ is the probability of individual q choosing alternative i given that they are in class s
μ_s is the scale parameter specific to class s
β_s is a vector of coefficients associated with the explanatory variables specific to class s

The probability that individual q will be a member of class s is (Boxall and Adamowicz 2002; van Putten et al. 2011):

$$H_{qs} = \frac{\exp(\alpha\lambda_s' Z_q)}{\sum_{s=1}^{S} \exp(\alpha\lambda_s' Z_q)} \quad \textbf{(6)}$$

where: H_{qs} is the probability that individual q will be a member of class s
α is a scale factor normalized to one
λ is a vector of coefficients for class s
Z_q indicates a set of individual characteristics that determine class membership

[8] Other models, such as the random parameters logit, also account for heterogeneous preferences. However, latent class models are particularly advantageous since they identify market segments and thus allow for better insight into the distribution of a policy's impacts (Boxall and Adamowicz 2002).

Combining Equation 5 with Equation 6 yields the unconditional probability of choosing alternative *i* as specified in Equation 7 (Boxall and Adamowicz 2002; van Putten et al. 2011):

$$P_{iq} = \sum_{s=1}^{S} P_{iq|s} H_{qs} = \sum_{s=1}^{S} \left[\frac{\exp(\mu_s \beta_s' X_{iq})}{\sum_{j=1}^{J} \exp(\mu_s \beta_s' X_{jq})} \right] \times \left[\frac{\exp(\alpha \lambda_s' Z_q)}{\sum_{s=1}^{S} \exp(\alpha \lambda_s' Z_q)} \right] \quad \textbf{(7)}$$

where: P_{iq}, X_{iq}, X_{jq}, μ_s, β_s, α, λ, and Z_q are defined as above

Once the parameters have been estimated using Equations 4 or 7, marginal WTA can be calculated. This marginal value represents the compensation required for a discrete change in an attribute (i.e. from one level to another). It provides information on the relative importance of each attribute to respondents (Colombo et al. 2005). Marginal WTA is equivalent to the marginal rate of substitution between the attribute of interest (e.g. type of land converted) and the payment attribute. It is calculated by taking the ratio of the partial derivative of the utility function with respect to the attribute of interest and the partial derivative of the utility function with respect to the payment attribute. For a linear utility function the marginal rate of substitution, and thus marginal WTA, is calculated by dividing the parameter for the attribute of interest by the parameter on the payment attribute and taking the negative of this ratio (Matta et al. 2009; Rossi et al. 2011).

$$mWTA = -\frac{\partial V / \partial Attribute}{\partial V / \partial Payment} = -\frac{\beta_{Attribute}}{\beta_{Payment}} \quad \textbf{(8)}$$

where: $\beta_{Attribute}$ is the parameter estimate for the attribute of interest
$\beta_{Payment}$ is the parameter for the for the payment attribute

Positive values of marginal willingness to accept (WTA) calculated using Equation 8 represent an amount that respondents would be willing to accept, while negative values represent an amount that they would be willing to pay or forgo (Rossi et al. 2011).

If the utility function is not linear, for example if the payment attribute is best represented as a polynomial, estimating marginal WTA becomes more complicated. However, it is still calculated by taking the ratio of two partial derivatives. If the payment level is a polynomial then the denominator, and thus marginal WTA, varies with the level of payment.

Compensating surplus (CS), which is a measure of welfare, can be estimated for different variants of a wetland conservation program. These variants are represented by scenarios in which the attribute levels are set to represent different outcomes or states of the world (e.g. different wetland conservation programs). Following Hanemann (1984), the general formula for estimating compensating surplus is:

$$CS = -\frac{(V_0 - V_1)}{\beta_{Payment}} \quad \textbf{(9)}$$

where: V_0 is the utility of the landowner before enrolling in the wetland conservation program
V_1 is the utility of the landowner after enrolling in the wetland conservation program

Since the status quo levels of each attribute were unknown for each respondent to our choice experiment, the utility of the status quo situation (i.e. before respondents enrol in a program) was represented using a constant term indicating if the respondent selected the "No Program" option (Espinosa-Goded et al. 2010).

For latent class models compensating surplus estimates are conditional on class[9] (Milon and Scrogin 2006). Class specific compensating surplus values can be estimated according to Equation 10:

$$CS_{i|s} = -\frac{1}{\beta_{s(Payment)}}\left[\ln\left(\sum_{j\in J}\exp\left(\beta_s V_j^0\right)\right) - \ln\left(\sum_{j\in J}\exp\left(\beta_s V_j^1\right)\right)\right] \quad \textbf{(10)}$$

where: β_s is defined as above
$\beta_{s\,(Payment)}$ is the parameter for the payment attribute for class s
V_j^1 is the utility of landowners after enrolling in wetland conservation program j
V_j^0 is the utility of the landowner before enrolling in wetland conservation program j

Positive CS calculated using Equations 9 and 10 represents a dollar amount that the landowner would forgo to be part of the program (i.e. WTP), while negative CS represents the financial compensation required by the landowner to participate in the program (i.e. WTA) (Esipnosa-Goded et al. 2010).

B3. Choice experiment attributes and scenarios

The attributes considered in the CE were combined to create several alternative profiles, or versions, of a hypothetical wetland conservation program and then grouped into choice sets. Different combinations of attributes and levels resulted in a full factorial design with 216 (or $3^2 \times 2^2 \times 6^1$) alternatives. Since it is not feasible to implement a survey with this number of alternatives, an orthogonal main effects fractional factorial design was generated using the %MktEx macro in SAS

[9] Note that marginal WTA is also class specific.

(Kuhfeld 2010). This resulted in 72 alternatives grouped into 36 choice sets. The design was reviewed by the research team to ensure that there were no dominant alternatives in a choice set. When dominant alternatives were detected the design was modified slightly. While this process may compromise orthogonality the correlation between attributes remained low.

Asking an individual to view and respond to 36 choice sets is unreasonable (e.g. fatigue), a problem that can be remedied by blocking choice sets into groups. The %MktEx macro was used to block the 36 choice sets into six groups (i.e. blocks), each containing six choice sets. Each respondent was asked to answer the six choice sets, and six different versions of the questionnaire, corresponding to the six blocks, were mailed out. Care was taken to ensure the blocks were mailed out to respondents randomly.

B4. Choice experiment data analysis

The CE data for farm and non-farm surveys was analysed using multinomial logit and latent class models, respectively, in LatentGOLD Choice 4.5. The latent class model was not used for the farm data due to the relatively small sample size, which caused the latent class model to exhibit unstable characteristics along with unreasonably high standard errors (which is typically the case when class sample sizes become small). Effects, or orthogonal, coding was used to code the levels of nominal attributes (Holmes and Adamowicz 2003). Doing so allowed us to estimate parameters for all levels taken by a specific attribute. Parameters estimated for the levels taken by any particular attribute coded with effects codes will sum to zero. In the case of the non-farmer survey, the levels for the payment attribute were mean centred and scaled to remove correlation between this variable's linear and quadratic forms (Iragüen and Ortúzar 2004).

Once the parameters for each CE model were estimated, marginal WTA compensation for specific wetland program attributes (characteristics) was calculated. Compensating surplus was then estimated for different hypothetical wetland conservation programs. Several different program variants were created by varying the non-financial attributes. While estimates of compensating surplus can be calculated for 36 different program variants for each survey, in this study CS was only estimated for a subset of these possible scenarios (for cases where the coefficients used in the calculation were significantly different from zero at the 10 % level of significance).

APPENDIX C: ADDITIONAL CHOICE EXPERIMENT RESULTS

C1. Farmer choice experiment results:

The majority of respondents to the farmer choice experiment selected an alternative to the status quo for each choice set (Table C1). It also appears that, with the possible exceptions of the status quo alternative in the fourth choice set and Program B in the fifth choice set, none of the alternative choices dominated the other alternatives. Respondent certainty generally decreased with each successive choice set. For all but the first choice set, the majority of respondents indicated that they were uncertain about their choice of alternative and the proportion of respondents who were very certain about their selection never exceeded ten percent.

Table C1: Distribution of respondent answers to the farmer choice experiment

Choice	Choice Set 1		Choice Set 2		Choice Set 3		Choice Set 4		Choice Set 5		Choice Set 6	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Program												
A	40	27.8	43	30.3	40	28.2	34	23.9	36	25.4	50	35.5
B	57	39.6	43	30.3	51	35.9	43	30.3	70	49.3	50	35.5
None	47	32.6	56	39.4	51	35.9	65	45.8	36	25.4	41	29.1
Item non-response	7		9		9		9		9		10	
Certainty												
Very certain	14	9.7	12	8.5	9	6.3	11	7.7	11	7.8	12	8.6
Somewhat certain	65	45.1	55	38.7	54	37.8	50	35.2	48	34.0	50	35.7
Uncertain	65	45.1	75	52.8	80	55.9	81	57.0	82	58.2	78	55.7
Item non-response	7		9		8		9		10		11	

The overall R^2 and adjusted R^2 (i.e. $R^2(0)$) values for the multinomial logit model were 0.001 and 0.011, respectively. Though an R^2 value between 0.2 and 0.4 is preferable (Louviere et al. 2000), other landowner studies have found similarly low R^2 values (e.g. Rossi et al. 2011).

The coefficient estimates are presented in Table C2. The coefficients for all but two attributes were insignificant. The type of land converted appeared to be a deciding factor for respondents. The requirement to convert productive land instead of marginal land appeared to decrease respondent utility. The annual payment per acre was also an important factor. The positive coefficients observed for the payment attribute indicate that respondent utility increased with the amount of financial compensation offered.

An alternative specific constant (ASC), which equals one if the respondent selected either "Program A" or "Program B" and zero if they chose "No Program", was included in the model. The ASC accounts for factors that impact a landowner's utility that were not included in the choice set. For the MNL model, the coefficient on the ASC was significant and negative. This suggests that, all else equal, respondent utility was negatively impacted by participation in a wetland conservation program. Negative ASC values imply a potential status quo bias which occurs when respondents do not want to move away from their current situation (Adamowicz et al. 1998). Status quo bias may occur if: respondents find the choice task too complex and thus opt for no change at all; respondents are uncertain about the tradeoffs they are willing to make; or they do not trust the government to actually implement their preferred option.

Table C2: Farm parameter estimates for multinomial logistic model (without protests)

Attribute	Level	MNL	
		Parameter	***z-score***
ASC		-0.2896*	-1.9509
Land type	Marginal	0.1693***	2.5307
	Productive	-0.1693***	-2.5307
Activity	Meadow	-0.0957	-1.0663
	Trees	0.0459	0.5144
	Wetland	0.0498	0.5520
Acres	1	-0.097	-1.0393
	3	-0.0148	-0.1601
	5	0.1118	1.2207
Recognition	No	-0.0122	-0.1858
	Yes	0.0122	0.1858
Payment		0.0007*	1.6931
R^2		0.001	
adj-R^2(0)		0.011	
N		100	

*, **, and *** denote that the parameter is significantly different from zero at the 10%, 5%, and 1% level, respectively.

The marginal WTA per acre resulting from the farmer survey are presented below in Table C3. Only a few of these values, including those for the ASC and type of land converted, were calculated from significant coefficients. The compensation required by respondents for enrolling in a wetland conservation program, all else equal, was estimated to be $413.71 per acre. Additionally, respondents required $483.71 per acre more to convert productive land rather than marginal land. All other WTA values were calculated using insignificant attribute coefficients. These results suggest that respondents required less compensation per acre when they: were asked to convert to trees and wetland instead of meadow; were asked to convert larger areas of land rather than smaller areas; and received public recognition.

Table C3: Farm implicit prices per acre per year (positive values represent required part-worth WTA compensation)

Attribute	Level	Multinomial Logit[a]	
		Effects[b]	mWTA[c]
ASC		$413.71	$413.71
Land type	Marginal	-$241.86	--
	Productive	$241.86	$483.71
Activity	Meadow	$136.71	--
	Trees	-$65.57	-$202.29
	Wetland	-$71.14	-$207.86
Acres	1	$138.57	--
	3	$21.14	-$117.43
	5	-$159.71	-$298.29
Public recognition	No	$17.43	--
	Yes	-$17.43	-$34.86

[a] WTA values for the land type attribute and ASC were calculated from significant coefficients. Other values were calculated using insignificant coefficients.
[b] Calculated using the parameters in Table C2.
[c] Calculated by taking the difference between "Effects" WTA.

C2. Non-farm landowner choice experiment results:

As with the farm version, the majority of respondents to the non-farm choice experiment selected an alternative to the status quo for each choice set (Table C4). None of the alternative choices clearly dominated the other alternatives in any of the choice sets. Respondent certainty appeared to fluctuate within a fairly narrow range over the successive choice sets. The proportion of respondents selecting very certain ranged between 7.2% and 10.8%, while the share selecting somewhat certain ranged from 41.1% to 45.1%, and the proportion indicating they were uncertain ranged between 44.1% and 51.6%.

Table C4: Distribution of respondent answers to the non-farmer choice experiment

Choice	Choice Set 1		Choice Set 2		Choice Set 3		Choice Set 4		Choice Set 5		Choice Set 6	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Program												
A	147	36.0	152	37.5	136	33.9	156	38.5	150	37.1	152	37.9
B	149	36.5	128	31.6	138	34.4	108	26.7	133	32.9	151	37.7
None	112	27.5	125	30.9	127	31.7	141	34.8	121	30.0	98	24.4
Item non-response	14		17		21		17		18		21	
Certainty												
Very certain	44	10.8	35	8.7	29	7.2	34	8.5	39	9.7	29	7.3
Somewhat certain	184	45.1	171	42.3	165	41.1	164	41.2	167	41.6	167	41.9
Uncertain	180	44.1	198	49.0	207	51.6	200	50.3	195	48.6	203	50.9
Item non-response	14		18		21		24		21		23	

Several candidate latent class models, each having a different number of classes, were fit to the non-farm choice experiment data. The three and four class latent models failed to converge and were removed from consideration. Of the remaining candidate models, the Bayesian and Akaike criterions suggested that the two class model fit the data better than the one class model (i.e., a MNL model). Additionally, the overall R^2 and adjusted R^2 (i.e. $R^2(0)$) values for the two class model were 0.10, and 0.1073, respectively, while those resulting from the one class model were several times smaller. Therefore, the two class model was selected as the preferred model.

Table C5: Selection of the number of classes for non-farm latent class model

Class	LL	BIC(LL)	AIC(LL)	AIC3(LL)	$R^2(0)$	R^2
1-Class Choice	-1726.47	3503.592	3470.944	3479.944	0.0125	0.0054
2-Class Choice	-1667.46	3441.837	3372.912	3391.912	0.1073	0.1
3-Class Choice[a]	-1621.16	3405.524	3300.323	3329.323	0.1699	0.1566
4-Class Choice[a]	-1600.33	3397.62	3270.65	3305.65	0.2035	0.1895

[a] Model is unstable as it failed to converge to a single maximum after repeated runs. Results presented are from the run that achieved the largest log-likelihood value.

The results of the two class latent model are presented in Table C6. The ASC (constant term) for each class was significant. The negative coefficient on the ASC suggests that the utility of first class was negatively impacted by participation in a wetlands conservation program, all else equal. The opposite was true for the second class. Both classes in the latent model experienced negative utility

when required to convert land to meadows and positive utility when asked to convert to trees[10]. The area of land converted was not a significant factor in the decision of those in the first class, while respondents in the second class experienced negative utility when the program required them to convert one acre, and positive utility when asked to convert 1.5 acres. The utility of respondents in the first class was positively impacted by an offer of technical help, while such an offer decreased the utility of those in the second class. Community recognition was not a significant factor in the decision of those in the first class. However, respondents in the second class derived positive utility from community recognition. Financial compensation was represented using as a quadratic relationship. The amount of financial compensation was not a significant factor in the second class's choice, though it was for the first class. For the first class the squared payment variable was significant and, though close to being significant at the 10% level, the linear payment variable was deemed insignificant. However, the observed relationship suggests that the utility of respondents in the first class would increase at an increasing rate as the level of compensation rises.

Table C6: Non-farm parameter estimates for latent class model (without protests)

Attribute	Level	Class 1		Class 2	
		Parameter	***z-score***	***Parameter***	***z-score***
ASC		-0.2872***	-4.2247	3.2451***	6.5500
Activity	Meadow	-0.1671***	-3.0072	-0.1671***	-3.0072
	Trees	0.2017***	3.8951	0.2017***	3.8951
	Wetland	-0.0346	-0.6386	-0.0346	-0.6386
Acres	0.5	0.1027	1.4713	-0.0628	-0.6377
	1	-0.0018	-0.0258	-0.2025*	-1.9036
	1.5	-0.1009	-1.4275	0.2653**	2.5462
Technical help	No	-0.1068**	-2.1041	0.202***	2.8145
	Yes	0.1068**	2.1041	-0.202***	-2.8145
Public recognition	No	0.0685	1.384	-0.1646**	-2.1356
	Yes	-0.0685	-1.384	0.1646**	2.1356
Payment		0.0454	1.553	-0.047	-1.0879
Payment squared		0.0402**	2.0318	-0.0298	-1.0411
Intercept		-1.807***	-3.8777	1.807***	3.8777
Covariates:					
Contract: 5 year[a]		2.4825***	4.102	-2.4825***	-4.102
Contract: 10 year[b]		2.011***	3.4315	-2.011***	-3.4315
High School[c]		0.7318**	2.5343	-0.7318**	-2.5300
Financial Motivation[d]		0.1852***	3.2084	-0.1852***	-3.2084
R^2		0.0096		0.0	
$R^2(0)$		0.022		0.2703	
N		182		96	

*, **, and *** denote that the parameter is significantly different from zero at the 10%, 5%, and 1% level, respectively.

[a] Respondent indicated a preference for a 5 year contract length

[b] Respondent indicated a preference for a 10 year contract length

[c] Respondent's highest level of education is high school

[d] Respondent in agreement that landowners are motivated to participate in wetlands conservation programs by annual or one-time payments as represented by the sum of Likert scores for these two statements

Covariates were added to the latent class model to help illustrate the composition of each class. Only the model in which all covariates were significant is presented in Table C6 above. The

10 The utility of the conversion activity was not found to statistically differ between the classes (the Wald (=) statistic was not significant at the 10% level). Thus, this attribute was grouped across classes for the analysis.

coefficients for each of these variables suggests that respondents in class 1 are more likely than those in class two to: (i) prefer five or ten year contracts; (ii) have high school as their highest level of education; and (iii) be motivated by financial incentives.

The annual marginal WTA compensation values calculated using data from the non-farm landowner survey are presented in Table C7. While marginal WTA values are presented for all attributes, those for the second class of the latent model are unreliable since the coefficient on the payment attributes were insignificant. The compensation required by respondents in the first class of the latent model for enrolling in the program was $316.14 per year. Those respondents in the first class also required $406.17 more in compensation to convert to meadows in comparison to trees. Though its coefficient is insignificant, a similar result was observed for wetlands. When provided with technical help, respondents in class one had a WTA that was $235.24 less than if they are not provided with such assistance. While the coefficients representing the number of acres enrolled and public recognition were insignificant, the results suggest that those in class one would require more compensation for programs requiring them to convert larger areas of land and offering them community recognition.

Table C7: Non-farm implicit prices per year (positive values represent required part-worth WTA compensation)[a]

Attribute	Level	Latent Class 1[b]		Latent Class 2[c]	
		Effects[d]	mWTA[e]	Effects[d]	mWTA[e]
ASC		$316.30	$316.30	$3,452.23	$3,452.23
Activity	Meadow	$184.03	--	-$177.77	--
	Trees	-$222.14	-$406.17	$214.57	$392.34
	Wetland	$38.11	-$145.93	-$36.81	$140.96
Acres	0.5	-$113.11	--	-$66.81	--
	1	$1.98	$115.09	-$215.43	-$148.62
	1.5	$111.12	$224.23	$282.23	$349.04
Technical help	No	$117.62	--	$214.89	--
	Yes	-$117.62	-$235.24	-$214.89	-$429.79
Public recognition	No	-$75.44	--	-$175.11	--
	Yes	$75.44	$150.88	$175.11	$350.21

[a] Values presented are calculated using the mean of the payment levels (i.e. 125)
[b] Only the WTA values for the meadow and trees conversion and technical help were calculated from significant coefficients. While the coefficient on the linear payment variable is not significant at the 90% level it was used to represent the payment attribute as quadratic for the calculation since it was close to being significant (p-value of 0.12).
[c] These WTA values are unreliable since the coefficient on the payment attribute was insignificant. Since this coefficient is a denominator the resulting WTA values are actually undefined.
[d] Calculated using the parameters in Table C6.
[e] Calculated by taking the difference between "Effects" WTA.

C3. Farmer and Non-farm landowner choice experiment follow-up questions:

As shown in Table C8, reasons other than those presented in the questionnaire were the most common drivers of a respondent selecting the status quo alternative. Approximately one third of respondents to both versions of the survey selected "Other".

Table C8: Responses to the question screening for protests[a]

Reasons for Choosing "No Program"	Farm		Non-farm	
	Frequency	%	Frequency	%
The annual payments were too low	15	9.9	31	13.1
I believe these projects would lower my property value	8	10.1	7	3.0
The amount of land involved was too large	11	13.9	55	23.2
The amount of land involved was too small	2	2.5	24	10.1
I do not think retaining or restoring wetlands is an important issue	2	2.5	2	0.8
The 5-year contract length was too restrictive	2	2.5	6	2.5
I don't trust the government***	13	16.5	32	13.5
Other	26	32.9	80	33.8
Not applicable	63		96	
Item non-response	9		89	

[a] A respondent could check multiple boxes. Do not sum frequencies or percentages.
*** Respondents selecting this reason were identified as protests

The responses to the follow-up question screening for yea-saying are presented in Table C9. The most common reason selected by respondents to both the farm and non-farm surveys was that wetlands should be protected regardless of the level of compensation. It is notable that a lower percentage of those responding to the non-farm survey indicated that their choice was driven by the amount of payment than respondents to the farm survey.

Table C9: Responses to the question screening for yea-saying[a]

Reasons for Choosing "Program A" or "Program B"	Farm		Non-farm	
	Frequency	%	Frequency	%
The annual payments were the main reason for my choices	24	20.0	32	9.9
We should restore wetlands regardless of payment levels***	41	34.2	119	36.8
The public recognition for my conservation effort was the main reason for my choices	1	0.8	10	3.1
It's equally important to provide payments and recognition to landowners who restore wetlands in my area	32	26.7	87	26.9
Other	22	18.3	75	23.2
Not applicable	22		33	
Item non-response	9		66	

[a] A respondent could check multiple boxes. Do not sum frequencies or percentages.
*** Respondents selecting this reason were identified as yea-saying.

Respondents to both version of the survey indicated a preference for shorter contract lengths, with the majority selecting 5 years. This is not surprising as focus groups suggested as much, and the valuation scenario was set up as a program with a 5 year contract.

Table C10: Preferred contract length of respondents choosing a wetland conservation program (i.e., Program A or B in the survey) at least once

Preferred Contract Length	Farm		Non-farm	
	Frequency	%	Frequency	%
1 year	`6	13.1	49	15.6
5 years	74	60.7	194	61.6
10 years	18	14.8	49	15.6
15 years	2	1.6	2	0.6
20 years	4	3.3	7	2.2
More than 20 years	8	6.6	14	4.4
Item non-response or not applicable	29		107	

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