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Landowner Behaviour in the Upper Thames and Grand River Watersheds: A Study of Factors That May Explain the Conservation Behaviour of Farmers

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MPA Research Report

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Executive Summary

This study was designed to gain insight into the factors that may explain why some farmers remove conservation lands while other farmers restore conservation lands. The study gathered information from a survey that was administered to rural landowners in the Upper Thames River and Grand River watersheds in southwestern Ontario. The survey was implemented at a time when the agriculture sector appeared to be experiencing significant economic changes and many resources management professionals were expressing concern about the fate of conservation lands through the change process. A literature is included which provides insights into the value of conservation lands and the changing economic conditions in the study area. The policy framework for conservation in the study area is then reviewed and the literature reviews concludes with an in-depth analysis of the research on factors that may affect conservation behaviour. The study does not attempt to establish a link between pressure on conservation lands and changing conditions but instead, using this frame, it explores various factors that may affect a farmer's decision to remove or restore conservation lands.

Eight independent variables that may explain the conservation behaviour of farmers in the study area were assessed. A significant positive correlation was found between property size and net change in conservation land since 2006. A significant positive correlation was also found between length of farm ownership and net change in conservation land. Weak correlations were found for age, debt load and a Conservation Ethic Index score and while these correlations do not meet the minimum standard for significance and strength that were set for the study, they do provide some guidance for future research and policy makers. For example, the study found that there is a lower standard, positive correlation between age and conservation behaviour meaning that

younger farmers are less conservation oriented. This finding, along with the finding that conservation behaviour is negatively correlated to debt load, can inform both future research and practitioners that are designing or implementing conservation programs and policies in the study area.

The study concludes that there are some factors that can be used to predict conservation behaviour but that caution must be exercised when interpreting these results. First, the study concludes that the type of BMP that is being considered for adoption is an important factor to consider when attempting to predict behaviour. Second, the study concludes that the local context of the study area can have a significant impact on the behaviour of farmers. The study accepts the finding of other researchers that local social, cultural, economic and environmental factors are key determinants for conservation behaviour. Given the strong influence of local conditions, care must be taken when this research is relied on to make predictions about other others. Finally, this study acknowledges that the survey methodology that was used to obtain research data is subject to non-response bias. The possibility that there is a non-response bias must be carefully considered in any interpretation of the meaning of the results of this study.

Acknowledgements

There are many people and organizations to acknowledge for their support of me in completing this research. I cannot specifically mention everyone that deserves to be acknowledged but to all, thank you.

I do need to specifically mention a few. To my academic supervisor Dr. Bob Young, thank you for your guidance, constructive feedback and encouragement. Thank you to Ryan Trenholm of Simon Fraser University and Dr. Van Lantz of University of New Brunswick for securing the funding to conduct this significant and interesting survey and for allowing me to add questions to the survey that assisted me with pursuing my specific research interests. I would like to thank Tracy Ryan of the Grand River Conservation Authority for her assistance with the logistics for the Grand River portion of the survey. I must also mention the support of the faculty and my classmates in the Masters of Public Administration program at Western University for their assistance and friendship as I have worked my way through the program.

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Finally, I am most grateful for the unwavering love and support of my wife Heather, and my children Josh and Rachel.

This Final Research Paper is dedicated to the memory of Jane M. Bowles. Jane was relentless in her work to increase our understanding of natural heritage systems and she was unwavering in her advocacy for protection and restoration of natural heritage systems. Although she is gone, her legacy is an inspiration to all that work in the natural heritage field.

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1. Introduction

The farm landscape of southwestern Ontario appears to be changing. Conservation features including woodlots, watercourse buffers, windbreaks and wetlands are being converted to agricultural production and it is widely believed that the conversion is being fueled by sustained higher agricultural commodity prices and a significant increase in farmland prices (Roulston, 2013). The shifting economic conditions appear to be leading to the demise of environmental lands that are allocated to conservation uses as landowners strive to maximize the amount of land available for production agriculture.

This study assesses the conservation behaviour of farmers based on the results of a survey that was administered in the spring of 2013. The study explores the relationship between the removal or restoration of conservation lands by farmers and potential explanatory variables of age, property size, household income, level of education attained, length of ownership, reliance on agricultural income, debt level and underlying conservation ethic. The land cover types that are assessed as conservation lands are lands left untilled, fence line, windbreak, trees, shrub land meadow, ditch and wetland. The study provides insights about farmers in the Upper Thames and Grand River watersheds and the changes that are occurring to the rural landscape in this vast area of southwestern Ontario. The study provides information that is useful to organizations that implement programs related to stewardship and agricultural land use.

This study makes the assumption that conservation lands are being converted to agricultural production and that this conversion is related to higher commodity prices and higher land prices. It does not attempt to establish a link between rising commodity and land prices and pressure on conservation lands but instead, attempts to answer the following research question:

> Are there are factors that explain why some farmers convert conservation lands to agricultural production while some farmers establish conservation lands on their property.

This question is explored through a cross sectional study involving a survey of landowners in, or near, the Upper Thames and Grand River watersheds. Details about the study area are provided in the methodology section. The study examines the relationship between net change in conservation land since 2006 and eight independent variables: landowner age, property size, household income, level of education attained, length of ownership, reliance on agricultural income, debt level and underlying conservation ethic.

2. Problem Definition

There has been considerable discussion amongst resources management agency staff, municipal staff and the farm community about the recent increase in agricultural commodity prices and surging land prices in the southwestern Ontario area. The discussion about higher commodity prices and the increase in land value and land

rental costs is accompanied by discussion about the fate of conservation lands which are an integral part of the southwestern Ontario farm landscape. Keith Roulston of *The Rural Voice* magazine (January, 2013) documents conversations with various professionals in the forestry, soil conservation, water management and agricultural extension fields, and all are in agreement that pressure is being applied on conservation lands in southwestern Ontario. This study provides insights into farmer characteristics and behaviours that can inform organizations that are involved in promoting stewardship and conservation such as Provincial Ministries, municipalities, conservation authorities, farm organizations and advocacy groups.

3. Theory and Literature Review

i. Benefits of Conservation Lands

The agricultural landscape of southwestern Ontario has evolved significantly since settlement. It is reported that up to 80 % of the pre-settlement landscape was wetland (McLaughlin, 1991, Ducks Unlimited Canada, 2010). In the early years of settlement, various government policy and legislative tools provided incentives and a coordinated framework to promote the draining of wetlands and the clearing of woodlands (McLaughlin, 1991). As time went on, negative impacts from widespread draining of wetlands and clearing of woodlands became evident and this eventually led to the passing of the Ontario Conservation Authorities Act in 1946. This legislation provides an enabling framework for municipalities to coordinate resource management efforts on a watershed basis (Richardson, 1974). The farm landscape continues to evolve as the

industry reacts to advances in equipment and cropping technology, livestock management and the shifting economics of the agriculture business.

Despite all of this change, remnants of natural heritage remain on the agricultural landscape. Some of the remnant areas likely remain simply because they would be too difficult or costly to clear for farmland or because it is marginal agricultural land due to soil quality or topography (McLaughlin, 1991). It is possible that these features may have been retained for their amenity value for recreation or because they are seen as cultural linkages to the farm history or the family legacy (McLaughlin, 1991, Millburn, 2011). It is also possible that some of the remaining natural heritage has been retained because there is an appreciation for the environmental or conservation value of these remnants or the feature, such as a woodlot, is considered to be an integral component of the farm operation that provides products such as fuel wood, timber or maple syrup for on farm use or sale to generate additional revenue (McLaughlin, 1991, Millburn, 2011).

Conservation lands in the agricultural landscape provide benefits to the farm operator, the local community and society as a whole. At the farm level, watercourse buffers, fence lines, windbreaks, wetlands and woodlands can prevent water and wind erosion, provide a moderating climate effect and lead to an increase in yield for nearby crops (Environment Canada, 2004, Cassidy). These benefits involve trade-offs in terms of the direct loss of some land from active production, loss of crops to wildlife impact

(Kammin et al., 2009, Troy et al, 2005,) and the problem that the location of natural features on the landscape may limit the landowner's ability to configure field sizes and shapes to optimize cropping efficiency (Yu and Belcher, 2011). The remaining open drains on the landscape can be particularly problematic for field configurations as these channels, whether they were originally natural watercourses that have been modified to improve conveyance or they are newly constructed ditches, are located on the basis of natural topography. Many of the smaller open ditches have been "tiled in" to "square off" fields and to gain more land for production; however, there is an economic limit to the size of a watercourse that can be tiled. These open drainage systems provide habitat for aquatic species (UTRCA, 2012), nesting and feeding habitat for waterfowl and corridors to allow for wildlife movement (Environment Canada, 2004, Ducks Unlimited Canada, 2010).

The remaining natural areas on the landscape provide important wildlife habitat which is a local benefit but also a broader societal benefit (Environment Canada, 2004, Troy et al., 2005, Daley et al., 2004, Kammin et al. 2009, Warner et al., 2000, Turner et al., 2008). Setbacks from watercourses and conservation tillage measures such as contour plowing and grassed waterways can have a significant positive effect on water quality (Lemke et al., 2011). Studies have shown that the land management practices and non-point sources of water quality contamination in the Thames River watershed can have an effect on local water quality but also water quality down the Thames system and into Lake St. Clair and Lake Erie (Thames River Implementation Committee, 1982). Burkart and James (1999) document the significant impact of

agricultural runoff from the Mississippi River watershed on water quality in the Gulf of Mexico.

Farmers are on the front line of conservation and have been leaders in advancing land stewardship and conservation planning throughout the years (Richardson, 1974, Leopold and Bell, 2012). Significant water quality problems have been linked both directly and indirectly to farm runoff (O'Connor, 2002, Burkart and James, 1999). In a survey of Quebec farmers, Ghazalian (2009) found that farmers have a heightened awareness of the perceptions of their industry and that they make conservation choices based on this awareness. A similar observation is reported by Rahelizatovo and Gillespie (2004) based on research involving Louisiana dairy farmers. Farmers do have a great land stewardship and conservation legacy, however, their activities have been linked to water quality problems. The farm community is aware and it is anticipated that as their business continues to evolve in response to environmental, social and cultural factors, they will need to keep their environmental impacts in mind.

ii. Economic Influences

While the agriculture landscape is partly a product of the economic factors that have influenced it over time, it is believed that current economic conditions are causing a shift that may have a profound long term effect. Corn and soybeans are the most prominent field crops in southwestern Ontario (Stats Canada, 2013(1), Kittson et al., 2011) and as

shown in Figure 1 and Figure 2, these commodities have been trading at high levels since 2007 (Index Mundi Commodity Price Indices, 2013 (1) and 2013 (2)).

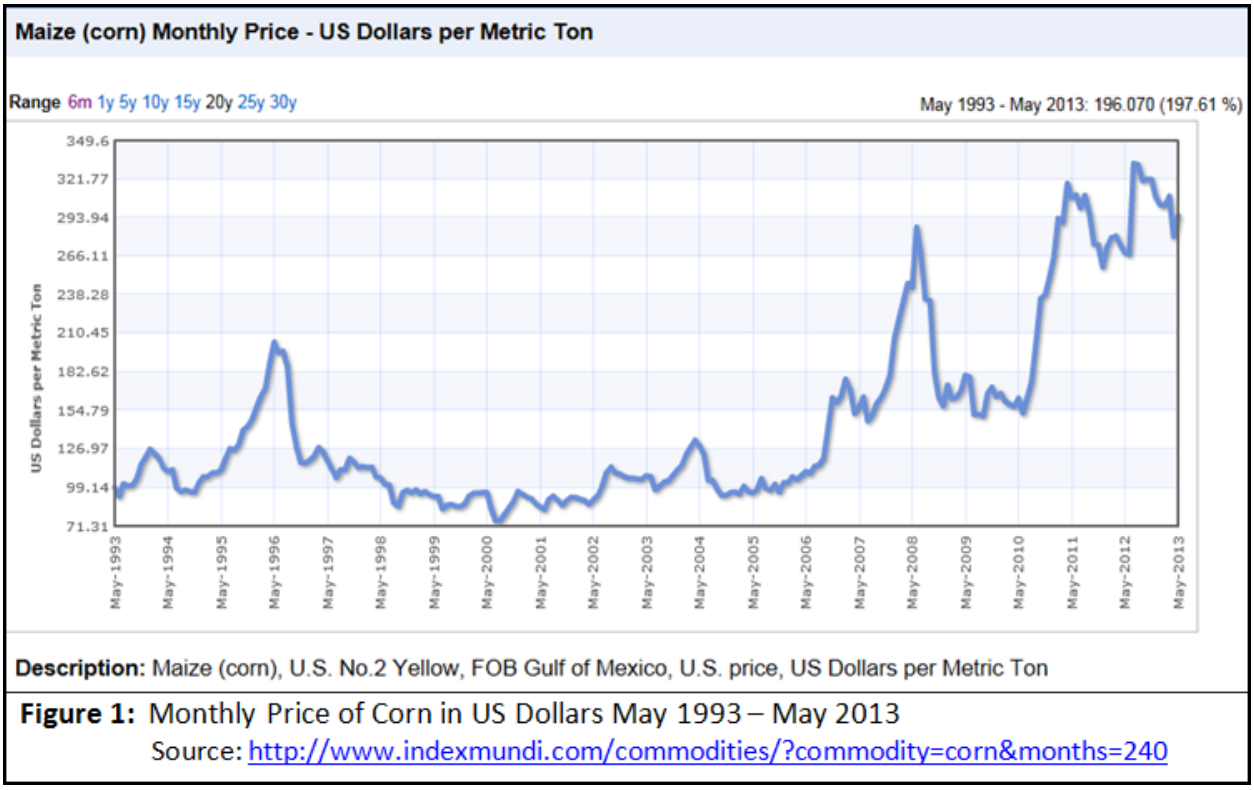

Figure 1: Monthly Price of Corn in US Dollars May 1993 – May 2013
Source: http://www.indexmundi.com/commodities/?commodity=corn&months=240

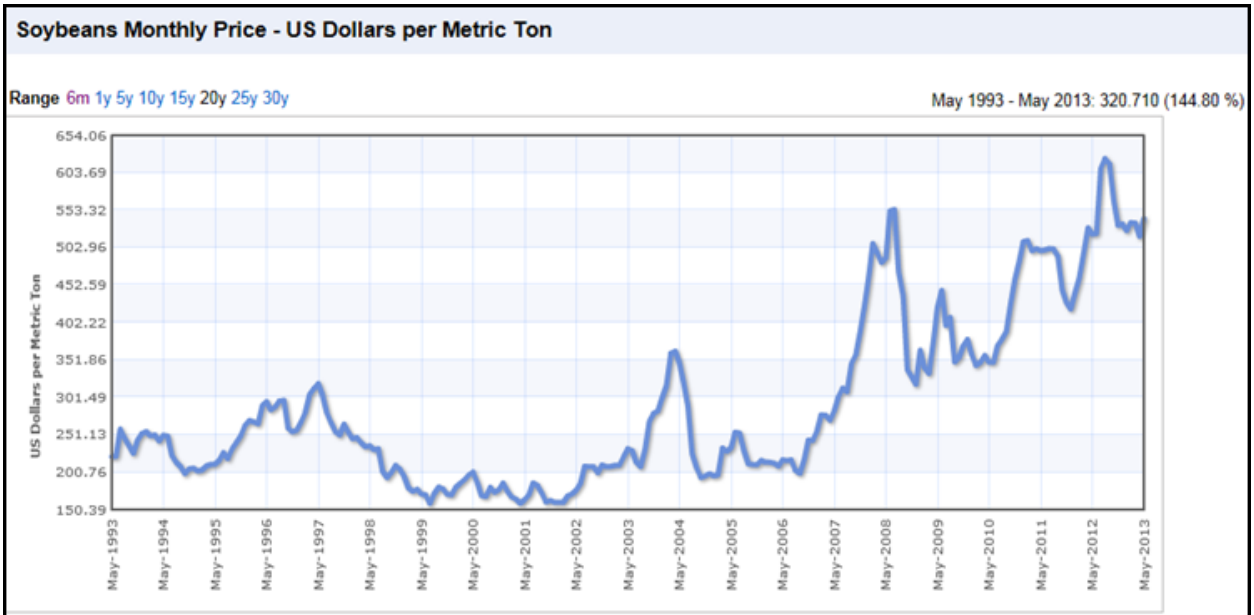

Figure 2: Monthly Price of Soybeans in US Dollars May 1993 – May 2013
Source http://www.indexmundi.com/commodities/?commodity=soybeans&months=240

Table 1 shows the Farm Products Price Index for grain crops in Canada for the period 1992 – 2011 (Stats Canada, 2013(2). This index discounts prices using 1997 as the base year (1997 = 100). This index shows that inflation adjusted grain prices (includes corn and soybeans) have been relatively high from 2007 until 2011.

Table 1: Farm Product Price Index for Grains in Canada (1997 = 100)
Source: Stats Canada (2013)

Commodity groups	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total crops[2]	77.1	80.5	88.9	105.7	110.9	100.0	96.9	87.8	84.3	93.1	109.3	105.1	100.6	88.2	92.6	117.5	144.8	126.7	119.4	141.4
Grains[2]	73.5	76.0	85.4	114.7	122.1	100.0	94.0	85.2	83.1	95.1	111.0	105.9	94.1	76.7	84.1	133.3	168.6	129.9	115.3	147.2

The sustained relatively high commodity prices appear to be at least in part contributing to a surge in land prices. Re/Max (2012) reports that for some areas, such as South

Huron County/Mid-Perth County, land values nearly tripled from September of 2010 to September of 2012. Table 2 includes data for select areas of Ontario from The RE/MAX Market Trends Report, Farm Edition 2012. While not as dramatic, an upward trend is also reported for the traditional United States Corn Belt (Pates, 2012). Bloomberg Magazine reports that corn production is replacing wheat in some areas of the Canadian Prairies and that this, along with the assembly of farmland by non-farm corporations as an investment strategy, is pushing the price of farmland higher (Bjerga, 2012). As the price of the land increases, so does the rental rate commanded by landowners (RE/MAX, 2012, Pates, 2012 and Bjerga, 2012, Kittson et al., 2011, Niekamp, 2009). Higher land values will increase the overhead costs for those farmers who are purchasing additional land and it increases operating costs for farmers who are renting land (Niekamp, 2009). These increased costs put pressure on farmers to maximize the use of the land that they have for production agriculture and this can lead farmers to forego soil conservation measures or even return marginal farmland or other conservation lands to agricultural production (Ervin & Ervin, 1982, Kammin, 2009). This concern that farmers may be opting for short term gain over conservation is summed up best by Roulston in his statement:

> "Ironically at a time when land is seen as too valuable to waste in windbreaks, buffer strips and fencerows, the very topsoil that makes the land valuable for crops can be endangered by the lack of those soil-conserving practices."
>
> (Roulston, 2012).

Table 2: Excerpt from Re/Max Market Trends Farm Edition: September, 2012
Canadian Farmland Price Per Acre by Market For the Period 2010 – 2012

Market	2010 Price Per Acre	2011 Price Per Acre	2012 Price Per Acre
Windsor/Essex County	$5,000 - $6,500	$5,000 - $6,500	$5,000 - $6,500
-Leamington	$7,000 - $7,800	$7,000 - $7,800	$7,000 - $10,000
-Lower Essex County	$4,800 - $5,200	$4,800 - $5,200	$5,000 - $5,500
Chatham-Kent	$4,000 - $12,000	$5,000 - $15,000	$5,000 - $15,000
London-St. Thomas			
-Middlesex East	$8,000	$9,000	$10,500
-Middlesex West	$5,000	$6,000	$7,500
-Elgin County East	$6,000	$7,000	$8,500
-Elgin County West	$4,500	$5,000	$6,500
-Lambton North	$6,000	$8,000	$9,500
-Lambton South	$4,000	$4,400	$5,900
Woodstock/Stratford	$8,400 - $8,600	$9,000	$15,000
Tillsonburg			
-Oxford Township	$9,500 - $11,500	$10,000 - $12,500	$10,200 - $12,750
-Bayham Township &Norfolk Township	$5,200 - $7,500	$5,500 - $8,000	$5,600 - $8,150
Kitchener-Waterloo	$9,000 - $9,500	$10,000 - $11,000	$11,000 - $15,000
South Simcoe Bruce County/Huron County			
-South Huron &Mid-Perth	$7,000 - $11,000	$10,000 - $14,000	$16,000 - $18,000
-Mid-Huron	$6,000 - $8,000	$8,000 - $10,000	$12,000 - $15,000
-North Huron &Bruce County	$3,000 - $5,000	$4,500 - $7,000	$5,000 - $8,000
Grey County	$2,500 - $3,000	$3,000 - $4,000	$3,000 - $6,000

iii. Policy Framework

Pal, 2010, classifies policy instruments available to government into the three main categories of 1) Do Nothing, 2) Act Indirectly and 3) Act Directly. The three main categories can be further divided into groups of actions which are shown in Figure 3. The groupings are shown on a continuum that ranges from less coercive to more coercive. The groupings also range from less government control to more government control.

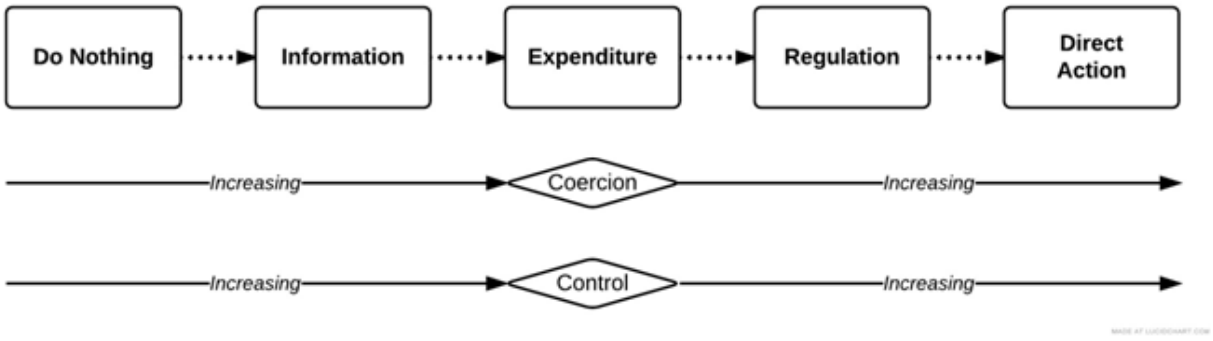

Figure 3: Instrument Choices for Implementation (Pal, 2010)

Table 3 provides a brief summary of the policy environment for conservation planning in Ontario. The policy environment tools range from education which is least coercive through to acquisition of land which is a direct action tool. Table 3 provides an explanation of each of the tools and some examples of policy implementation that are applicable in the Upper Thames and Grand River watershed areas.

Table 3: Summary of Policy Tools Directed at Conservation Measures

Policy Measure	Description	Examples
Education	Creating a broad awareness of the importance of resource and actions that can be taken to maintain and restore conservation lands. Education and stewardship are closely linked.	The Subwatershed Report Cards[1] issued by the Upper Thames River Conservation Authority (UTRCA) provide information on terrestrial, aquatic and groundwater resources at the local community level. Local actions for improvement are also suggested in the report cards.
Stewardship	Providing the tools to landowners and the community to undertake measures which sustain and improve conservation lands	The UTRCA and GRCA offer technical advisory services related to soil conservation, tree planting, habitat restoration and community forestry[2,3].
Incentives	Measures that encourage or reward good management practices. The incentive can be financial or simply recognition. Incentive measures are often paired with stewardship.	The Clean Water Program[4] offered by Conservation Authorities in the Oxford, Perth and Middlesex County areas, is an example of an incentive program. Financial and technical assistance is provided to landowners to assist with implementation of best management practices that will maintain or enhance water quality.
Regulatory Measures	Measures that control an individual's freedom to act for the benefit of the individual, the community or the broader public interest.	The Ontario *Planning Act*[5] and the Provincial Policy Statement[6] provide a framework for protection of certain significant natural heritage areas. The Ontario *Endangered Species Act*[7] requires protection of certain species and the *Conservation Authorities Act*[8] gives conservation authorities the ability to regulate development and alteration of wetlands. The Huron County Forest Conservation By-Law[9] provides the County with the authority to regulate the destruction or injuring of trees.
Acquisition	Direct action measure of outright purchase of land or easements as a means of obtaining management control	The UTRCA and GRCA own and manage various wetland properties. Most of these properties were purchased to protect them from clearing[10,11].

References:

1. UTRCA, 2013 (1).
2. UTRCA, 2013 (2).
3. GRCA (1).
4. UTRCA, 2013 (3).
5. E-Laws, 2013 (1).
6. MMAH, 2013.
7. E-Laws, 2013 (2).
8. E-Laws, 2013 (3).
9. The Corporation of the County of Huron, 2013.
10. UTRCA, 2013 (4).
11. GRCA (2)

The policy environment may explain why certain conservation lands remain on the landscape and it may influence what happens in the future. For example in the case of

wetlands, the UTRCA has regulatory authority under the Conservation Authorities Act (E-Laws, 2013(3)) that requires landowner's to obtain approval prior to any alteration or development in wetland areas. The UTRCA has implementation policies to guide the administration of this regulation and in general, no filling or development of wetlands is permitted (UTRCA, 2013 (5)). The GRCA has a similar regulatory and policy framework (GRCA 2013, (2)). As a result of these activities, wetland losses should be limited; however, there still may be cases where for example, a landowner proceeds to fill or drain a wetland without permission. Significant wooded areas and wetlands may also be protected in municipal official plans and zoning by-laws or by Tree Conservation By-Laws such as the Huron County Forest Conservation By-Law (Corporation of the County of Huron, 2013). It is noted that research conducted by Lamba (2009) involved interviews with farmers from the same region as this study and it was found that farmers complained that they are over-regulated. Anti-government sentiment and resistance to forced change are reported by other researchers as barriers to adoption of Best Management Practices (Kraft et al.,1996, Moberg and Dyer, 1994). It is clear that regulation is one policy instrument that can protect conservation lands however; it must be recognized that regulation can have unintended negative consequences. The maintenance of conservation lands on the southwestern Ontario farm landscape is more likely to be successful through the implementation of a range of policy measures, including tools such as education, stewardship and incentive measures and regulation as required. The balanced implementation of these measures will increase awareness of the value of conservation lands.

iv. Factors that May Predict Conservation Behaviour

The literature dealing with factors that influence the adoption of conservation measures is generally related to adoption of Best Management Practices (BMPs). Paudel et al. (2008) define BMPs as the voluntary practices that producers adopt, or structures that they build, to manage resources and mitigate environmental pollution from agriculture. BMPs cover a wide range of activities from the establishment and maintenance of watercourse buffers to measures such as the construction of covered manure storage facilities. Soil conservation measures are BMPs and they are implemented for the purposes of maintaining productive soil, improving yield and protecting water quality (Lynne and Rola, 1988). Some of the measures that are implemented for soil conservation or water quality purposes can also provide ecological benefits such as wildlife habitat (Kammin et al., 2009).

For the purposes of this study, the literature has been scanned for studies that provide insight into the independent variables that may affect conservation behaviour. The literature review includes the factors that may influence adoption for a wide range of BMPs as it is reasonable to assume that the adoption of soil conservation, water quality improvement or wildlife habitat benefitting measures are all indicators of conservation behaviour. It is clear from the literature that the factors that predict behaviour vary depending on the specific type of BMP measure that is adopted and also on local influences (Prokopy et al., 2008). The differences between BMPs can be explained by the shear breadth of BMP measures that could be implemented and the different financial, cultural and socioeconomic factors that may influence these choices. With

regard to local influences, it appears that factors such as the profile of environmental issues locally, government or non-government organization programming activities and local information networks can play a significant role in adoption decisions and these local influences make it difficult to make generalizations about factors that influence adoption (Ahnström et al., 2009, Lamba et al. 2009, Reimer et al., 2012). Nonetheless, it is useful for this study to consider the previous research in order to develop working hypotheses about the factors that are being considered and also to serve as a foundation to explain the findings and to discuss other factors that may be influencing adoption in the Upper Thames and Grand River watersheds.

Prokopy et al. (2008) completed an extensive review of the literature relating to BMP adoption and identified 55 studies for further analysis. The analysis by Prokopy et al. considered a wide range of BMPs and it assessed 34 variables to determine if they contribute to adoption at a level of significance of $\alpha = 0.05$. Table 4 is an excerpt from Prokopy et al. (2008) that highlights the results related to seven of the variables that were examined. As shown in the table, the analysis finds that the results of adoption for potentially explanatory variables are not consistent. For example 26 studies assessed age as a potential explanatory variable and the data was analysed using 109 different models. Five models found a positive significant relationship meaning that older farmers were more likely to adopt, and 13 models found a negative significant relationship meaning that older farmers were less likely to adopt. Ninety one of the models found that there is an insignificant relationship between age and BMP adoption. It is also interesting to note that the analysis reported that several of the studies found

conflicting results for the age variable for different types of BMPs. This leads to the conclusion that adoption is not only affected by the local context but also by the type of BMP measure that is considered.

Table 4: Excerpt from Meta-Analysis by Prokopy et al. (2008)

Vote count totals for each category and subcategory at $\alpha = 0.05$						
Variable	Brief explanation	Hypothesized direction	Positive significance	Negative significance	Insignificant	Total
Acres	Number of acres farmed	+	37 (21)	16 (7)	57 (21)	110 (34)
Age	Farmer age	-	5 (4)	13 (11)	91 (18)	109 (26)
Education	Farmer education or previous training	+	46 (21)	9 (7)	113 (31)	168 (42)
Farm experience	Years farming	+	3 (2)	8 (4)	47 (19)	58 (22)
Income	Measures of wealth such as income, crop value, etc.	+	33 (14)	14 (10)	109 (24)	156 (34)
Labor	Measures of increased labor available to the farm	+	24 (15)	5 (3)	98 (19)	127 (28)
Attitude - Environmental	Importance individual places on environmental quality	+	16 (6)	-	64 (7)	80 (10)
Notes: The numbers in parentheses indicate how many studies had this finding. For example in the first cell, acres was found positive in 37 different models occurring in a total of 21 studies. Usually when multiple models are used in one study, they all apply to the same dataset. Some studies report mixed results and are therefore counted in more than one column.						

Knowler and Bradshaw (2007) completed a synthesis of the research to attempt to identify those independent variables that regularly explain adoption. Their synthesis assessed the findings of 31 analyses from 23 published studies and they also concluded that there are no consistent indicators of adoption and that local context and the type of BMP involved are the likely reasons for variation. An excerpt from the results of Knowler and Bradshaw (2007) is included in Table 5. While the table shows that there is variation in the findings of the various studies, it also points to some notable trends that may inform the design of programs or the study of adoption behaviour. For example, just like Prokopy et al. (2008), Knowler and Bradshaw (2007) found that significant relationships have been found for age, farm size and education and that the direction of the significance has varied. While these two meta-analyses find that there is variation between the directions of significance and that studies often find an insignificant relationship, they do provide a sense of what might be anticipated and the direction of significance that could be hypothesized. The findings of Knowler and Bradshaw (2007) and Prokopy et al. (2008) provide a sense of the factors that might be expected to predict adoption but they also highlight variation related to BMP type and local context, which require some further analysis by examining these specific factors more thoroughly.

Table 5: Excerpt from Synthesis Completed by Knowler and Bradshaw (2007)

Frequency analysis for 46 variables from 31 conservation agriculture adoption analyses showing the results for significance and sign on estimated coefficients (number of incidences of variable is shown)

Variable	sig (+)	sig (-)	Insig	Total	Status[a]
Education	7	3	11	21	
Age	3	5	10	18	
Farm size	6	2	10	18	
Off-farm activities/income	3	4	4	11	
Experience	4	0	5	9	*
Attitudes towards conservation	2	0	5	7	*
Income	4	1	1	6	
Debt (level, ratio)	0	1	3	4	*
Output prices	0	1	2	3	*
Wealth indicators	0	0	3	3	**
Awareness of environmental threats	4	0	0	4	***
Importance of crop revenues in income	1	1	1	3	

[a] (*) indicates variable is a mix of insignificant and significant, but always the same sign when significant; (**) indicates variable is always insignificant; (***) indicates variable is always significant and same sign.

Some research studies hypothesize that a positive relationship between age and adoption of conservation measures may be found as older farmers are more likely to have the financial capital or the established income to be able to afford the cost of implementing BMPs. Gould et al. (1989) found a significant positive correlation between age and adoption of conservation tillage measures in a study of Wisconsin farmers. Lamba et al. (2009) also found a positive correlation in a study of Ontario farmers' adoption of nutrient management plans and Ghazalian (2009) found that age was positively correlated to adoption for several BMPs, including riparian buffer strips, in a study of farmers in the Chaudière watershed in Quebec. Gould et al. and Ghazalian both concluded that older farmers are more likely to adopt because they are better positioned financially in terms of higher income or lower debt load. Alternatively, some research has found that there is a negative correlation between farmer age and BMP

adoption. In a study of Louisiana dairy farmers, Rahelizatovo and Gillespie (2004) found that older farmers were less likely to adopt BMPs, concluding that older farmers have shorter planning horizons within which to realize the full stream of benefits from investing in BMPs. They also argue that younger farmers are generally more educated and that they are therefore more aware of the environmental issues and more willing to try new technology. Atari et al. (2009) report that no relationship was found between age and uptake of the Nova Scotia Environmental Farm Plan Program. As noted in the review of Prokopy et al. and Knowler and Bradshaw, many studies report no relationship between age and BMP adoption and both studies also note that a finding of no relationship is likely under reported as many studies do not report all of their insignificant findings. Based on the review of the research it is clear that the findings for correlation between age and BMP adoption are mixed. Both Prokopy et al. (2008), and Knowler and Bradshaw (2007) report that when a significant relationship is found between age and BMP adoption, it is most likely that the relationship will be negative. This study explores age as a variable and it proceeds with the hypothesis that age will be negatively correlated with conservation behaviour.

As summarized in Table 4 and Table 5, Prokopy et al. (2008) and Knowler and Bradshaw (2007) both found that property size has been explored by many studies as a variable that may predict adoption behaviour. In cases where a significant relationship between farm size and BMP adoption has been found, the relationship is usually positive. The studies conducted by Lamba et al. (2009) and Ghazalian (2009) found a significant positive correlation between farm size and BMP adoption. Yiridoe et al.

(2010) also found that the probability of participation in the Nova Scotia Farm Plan increases with farm size. Rahelizatovo and Gillespie (2004) found a positive correlation between farm size and adoption of BMPs,suggesting that this finding is the result of larger farms having more resources and that larger properties present more opportunities for implementation of BMPs. Research conducted by Habron (2004) in Oregon and Tosakana et al. (2010) in northern Idaho and eastern Washington State found that there was no relationship between farm size and riparian tree planting and adoption of buffer strips as a BMP. In cases where a negative relationship between property size and conservation behaviour is found, it is hypothesized that the owners of smaller acreages are more likely to have off farm income and therefore have the financial resources and the tolerance for loss of production that may be associated with setting land aside for conservation purposes (Raymond and Brown, 2011). While the literature provides sound reasons for both directions of correlation for property size to conservation behaviour, this research adopts the hypothesis that larger farms will exhibit more conservation oriented behaviour.

Based on their review of the literature, Prokopy et al. (2008) hypothesized that higher income would be positively associated with adoption of BMPs as farmers with more income would be able to afford to invest in BMPs. Their review of the research found that in cases where a significant relationship is reported, it is usually positive. Knowler and Bradshaw (2007) also found that a positive relationship between income and conservation behaviour is more common in those models where a significant relationship is found. The research completed by Lamba et al. (2009) involving farmers

in Ontario found a positive relationship between income and BMP adoption. A survey of farmers in Nova Scotia related to participation in the Environmental Farm Plan program also found a positive correlation for income with participation (Atari et al., 2009, Yiridoe et al., 2010). It is logical that farmers who have more household income would be more likely to exhibit conservation behaviour because they would have the financial resources to establish conservation measures such as trees or watercourse buffers or they would be more willing to tolerate the loss of income from crops for land that is dedicated to these non-crop production uses. Higher commodity prices could increase income. Knowler and Bradshaw (2007) found that output prices have been considered as a variable in three studies but that in the one case where a significant relationship was found, the direction was found to be negative. It may be that higher commodity prices can lead to higher land prices and rental rates. The recent steep increase in land prices that has been documented could also be significantly increasing capital carrying costs for those farmers who recently bought their land, or recently added additional land to their overall landholding. The influence of this shift needs to be considered in this study but as a starting point, this research adopts the hypothesis that landowners with higher household income will be more conservation oriented.

Both Prokopy et al. (2008) and Knowler and Bradshaw (2007) found that level of formal education attained has been assessed in many studies. Both of these reviews confirm the intuitive assumption that education is more likely to be positively correlated to conservation behaviour but they also both report that there have been cases where a negative correlation has been found and that insignificant relationships are the most

common finding. Research conducted by Ervin and Ervin (1982) involving Missouri farmers and Gould et al. (1989) involving Wisconsin farmers found a significant relationship between education and willingness to adopt soil conservation measures. Raymond and Brown (2011) found that formally educated landowners tended to be more engaged in native vegetation planting in a survey of southern Australia landowners. Rahelizatovo and Gillespie (2004) found that education was positively correlated with BMP adoption in a survey involving Louisiana dairy farmers. Ghazalian (2009) and Lamba et al. (2009) report a similar finding in studies of Quebec and Ontario farmers. There are also several examples of researchers that hypothesized a positive relationship would be found between education level and conservation behaviour, but based on their studies concluded that there was no significant relationship (Tosakana et al., 2010, Yiridoe et al., 2010, Rosenberg and Margerum, 2008, Habron 2004). It is logical to assume that education and conservation behaviour should be positively correlated, as educated farmers would likely be more familiar with environmental issues and technology and would tend to be more concerned about public perception. This study adopts the hypothesis that education will be positively correlated with conservation behaviour.

Length of Ownership of land is not consistently covered in the literature. Both Prokopy et al. (2008) and Knowler and Bradshaw (2007) considered a “farm experience” variable which is somewhat representative of length of ownership. The hypothesized direction of correlation for farm experience is identified as positive by these two reviews, suggesting that farmers with more experience will be more conservation oriented. It is noted

however, that the Prokopy et al. review of 55 studies found a significant negative correlation more often than a positive correlation and Knowler and Bradshaw (2007) reported on four studies that a found a positive correlation and no negative correlations. This variance in results may be explained by the varying definitions of farm experience ranging from length of time as a farmer through to length of ownership of a property. The conflicting results for different interpretations of this variable are highlighted by the findings of Yiridoe et al. (2010) and Atari et al. (2009) in their research of the very same data set related to adoption of the Nova Scotia Farm Plan program. Yiridoe et al. (2010) conclude that a correlation of farm experience with Environmental Farm Plan uptake is not supported by the data; however, Atari et al. (2009) conclude that there is a positive correlation between length of farm ownership and uptake. The conflicting findings are even further highlighted by the finding of Raymond and Brown (2011), stating that there is a significant negative correlation between landowner's attitudes toward native vegetation planting and the amount of time that a family has lived on the farm. In summary, the research provides limited guidance on the influence of length of ownership on BMP adoption. To develop a hypothesis for this research, weight is placed on the concept that length of ownership of a farm property will translate into pride of ownership and a sense of stewardship for the resources on the property. Following this logic, it is anticipated that length of ownership will be positively correlated with conservation behaviour.

A farmer's reliance on agricultural income is another variable that can be measured in different ways and this can complicate attempts to rely on the research as a means of

developing a hypothesis. Prokopy et al. (2008) considered the availability of labour to the farm as a variable that may explain conservation behaviour. They hypothesized that availability of on-farm labour should be positively correlated with conservation behaviour because more time spent on the farm should translate into more time dedicated to conservation efforts. In their meta-analysis, Prokopy et al. (2008) found that in cases where significance is found, the direction of significance is most commonly positive. Knowler and Bradshaw (2007) considered two variables that may describe reliance on farm income. First, they found that "off farm activities/income" was explored in a total of 11 studies and that this variable was positively correlated with conservation behaviour in three cases, and negatively correlated in four cases, while no significant relationship was found in four cases. They also looked at "importance of crop revenues in income" and found that of the three studies that looked at this issue, one found a significant positive relationship, one found a significant negative relationship and the third found no significant relationship. Looking at specific research, Raymond and Brown (2011) found that landowners with higher off farm income were more highly engaged in native vegetation planting programs. Rosenberg and Margerum (2008) found that reliance on farm income is negatively correlated with landowner motivation to implement watershed improvement measures in five western Oregon watersheds. Specifically, they found that landowners who obtain more than 25 % of their income from their property are more than five times more likely to opt for productivity and profit over maintenance or improvement of their land for watershed health purposes. The studies by Raymond and Brown (2011) and Rosenberg and Margerum (2008) both find the same conclusion that reliance on farm income is negatively correlated with conservation behaviour. Various

studies have explored landowner attitudes toward wildlife conservation and they have consistently found that conservation attitudes are higher in cases where the landowner is less reliant on income from the farm (Moon and Cocklin, 2011, Pannell and Wilkinson, 2009, Troy et al. 2005, Petrzelka et al. 1996, Traore et al., 1988). Of the studies reviewed here, the BMPs that are considered are more of a societal benefit such as wildlife habitat and watershed health, rather than production benefitting BMPs such as conservation tillage. In the case of reliance on farm income, more emphasis must be placed on the category of BMP in hypothesizing the direction of the relationship. For those measures that lead to a societal benefit, it is hypothesized that reliance on farm income will be negatively correlated with conservation behaviour.

Debt level has been considered in a relatively small number of studies. The meta-analysis completed by Prokopy et al. (2008) did not isolate debt level as one of the variables for consideration; however, Knowler and Bradshaw (2007) did identify debt level as a variable that had been assessed in four studies. Knowler and Bradshaw report that one study found a significant negative relationship between debt and conservation behaviour and that three other studies found no significant relationship. Knowler and Bradshaw (2007) also identified wealth indicators as a variable that had been studied but found that no significant relationships were reported in the three studies that considered this variable. In a survey of Louisiana dairy farmers, Paudel et al. (2008) and Rahelizatovo and Gillespie (2004) found that farmers with lower debt load are more likely to implement BMPs such as riparian forest buffers. They conclude that these farmers have the debt capacity to manage the cost to establish conservation

oriented BMPs and that they can afford the loss of income from the retirement of this land. Tosakana et al. (2010) considered debt load as a potential explanatory variable for adoption of buffer strips but they did not find a significant relationship. It does seem logical that farmers who have less debt load would be more likely to maintain or establish additional conservation measures and therefore, it is hypothesized that debt load will be negatively associated with conservation behaviour.

Prokopy et al. found that "environmental attitude" is a reasonably good predictor of adoption as 16 models found a positive correlation while zero models found a negative correlation and 64 models found no significant relationship. This finding is particularly interesting given that environmental attitude is a somewhat subjective variable compared to other variables such as age, income and acres that are very easy to operationalize. This suggests that environmental attitude is likely a better predictor of adoption behaviour than other variables and that it may apply across different types of BMPs and in different contexts. Knowler and Bradshaw (2007) report that awareness of environmental threats was found to be significant, and positively correlated, to BMP adoption in all four studies that examined this type of variable. This is similar to the finding that is reported by Prokopy et al. related to environmental attitude and supports the hypothesis that environmental awareness is positively correlated with conservation behaviour. Knowler and Bradshaw (2007) also found seven studies that reported on attitudes toward conservation and two of the seven studies found a significant relationship; both reported the relationship to be positive. The Missouri work completed by Ervin and Ervin (1982) attempted to construct a conservation ethic index based on

landowner attitudes but a relationship between this index and willingness to adopt soil conservation practices could not be established. Lynne et al. (1988) did however find a relationship between conservation attitudes and soil conservation efforts in a study of Florida farmers. Paudel et al. (2008) constructed an E-Score as a measure of a farmer's ethic and they found that farmers with a higher E-Score were more likely to adopt buffers around woodlots and next to watercourses and ditches. Reimer et al. also found a significant positive correlation between a landowner's expressed responsibility to others, or their stewardship ethic, and their adoption of grassed waterways and filter strips. A review of the literature finds that in cases where a significant relationship between a landowner's ethics and their conservation behaviour is found, the direction of the relationship will be positive. Consistent with this finding, this study hypothesizes that the Conservation Ethic Index score for landowners will be positively correlated with conservation behaviour.

v. Summary of Theory and Literature

The literature highlights significant variations in research results that attempt to explain conservation behaviour. Despite the variation, the literature provides a theoretical basis for the development of various hypotheses that may be explored. The variation can be somewhat explained by the local context of the various studies and the type of BMP measures that are being adopted. It is also important to consider that most of the research that was reviewed is more than five years old and that it covers a wide geographical area. While five years is not an extensive amount of time in terms of the evolution of the farm sector in southwestern Ontario, it does pre-date the most recent

shift in commodity prices and land prices that may be the most recent benchmark for farm economics in Ontario. Given the sometimes contrary results that are found in the review of conservation adoption literature, and the rapid economic change that has occurred in the study area, it is necessary to remain open minded in terms of analysing the data. These factors dictate that additional analyses of the data are required to attempt to isolate factors that may be influencing conservation behaviour.

4. Summary of Hypotheses

The history of settlement of southwestern Ontario, the current economic conditions and the policy context all frame the environment in which landowners make decisions about their land use. It is assumed that higher land values are putting pressure on farmers to increase efficiency. Making maximum use of the land available to them is one way to increase efficiency, but this approach could lead to a decision to choose short term production gain over conservation. This study explores factors that may explain the conservation behaviour of farmers. Based on a review of the literature and considering the frame, this study pursued the following hypotheses:

i. Landowner Age

Hypothesis (H_1)	Younger farmers will exhibit more conservation oriented behaviour
Null Hypothesis (H_0)	There is no relationship between farmer age and conservation behaviour

ii. Property Size

Hypothesis (H_1)	Owners of larger farms will exhibit more conservation oriented behaviour
Null Hypothesis (H_0)	There is no relationship between farm size and conservation behaviour

iii. Household Income

Hypothesis (H_1)	Farmers who have a higher total household income will exhibit more conservation oriented behaviour
Null Hypothesis (H_0)	There is no relationship between total household income and conservation behaviour

iv. Education Level

Hypothesis (H_1)	Farmers who have achieved a higher level of education will exhibit more conservation oriented behaviour.
Null Hypothesis (H_0)	There is no relationship between education level and conservation behaviour.

v. Length of Ownership

Hypothesis (H_1)	Farmers who have owned their property for a longer time will be more conservation oriented.
Null Hypothesis (H_0)	There is no relationship between length of ownership and conservation behaviour.

vi. Reliance on Farm Income

Hypothesis (H_1)	Farmers who have a higher reliance on farm receipts for their income will be less conservation oriented.
Null Hypothesis (H_0)	There is no relationship between reliance on farm receipts for income and the conservation behaviour.

vii. Debt Level

Hypothesis (H_1)	Farmers who have a higher level of debt will be less conservation oriented.
Null Hypothesis (H_0)	There is no relationship between debt level and conservation behaviour.

viii. Conservation Ethic Index

Hypothesis (H_1)	Farmers who have a higher conservation ethic index score will exhibit more conservation behaviour.
Null Hypothesis (H_0)	There is no relationship between conservation ethic index score and conservation behaviour.

The research attempts to disprove the null hypotheses (H_0).

5. Methodology

The study follows a cross sectional methodology with the data being derived from a comprehensive survey of rural landowners in the Upper Thames and Grand River watersheds.

i. Study Area

The study focuses on the upper watershed of the Thames River and the complete watershed of the Grand River. These two watersheds are located adjacent to one another in southwestern Ontario. The Upper Thames River watershed population is 515,640, the watershed area is 3,421 km^2 and it includes the urban municipalities of London, Woodstock, Stratford and St. Marys (UTRCA, 2013(1)). The watershed includes areas that are in the Counties of Huron, Middlesex, Oxford and Perth. The dominant land use in the Upper Thames watershed is agriculture with 75 % of the cover and this is followed by natural vegetation at 14 % and urban/built up land at 10% (UTRCA, 2013(1). The Grand watershed has an estimated population of 925,000 and an area of 6,800 km^2 (GRCA (3), 2013). Agriculture is the dominant land use in the northern and southern parts of the watershed and in total, 70 % of the watershed area is

farmed (GRCA, 2013). The central part of the watershed is the most populated and includes the urban municipalities of Kitchener, Waterloo, Cambridge, Guelph and Brantford. Smaller towns and villages include Fergus, Elora, Elmira, Grand Valley, Caledonia and Paris (GRCA (3), 2013). Maps of the Upper Thames River and Grand River watersheds are included in Appendix A and Appendix B.

This study explores the following research question:

> Are there are factors that explain why some farmers convert conservation lands to agricultural production while some farmers establish conservation lands on their property?

The cross sectional study collected information on landowner characteristics and behaviours through the administration of a survey of rural landowners in, or near, the Upper Thames River and Grand River watersheds in southwestern Ontario. The basic research design is shown in Figure 4.

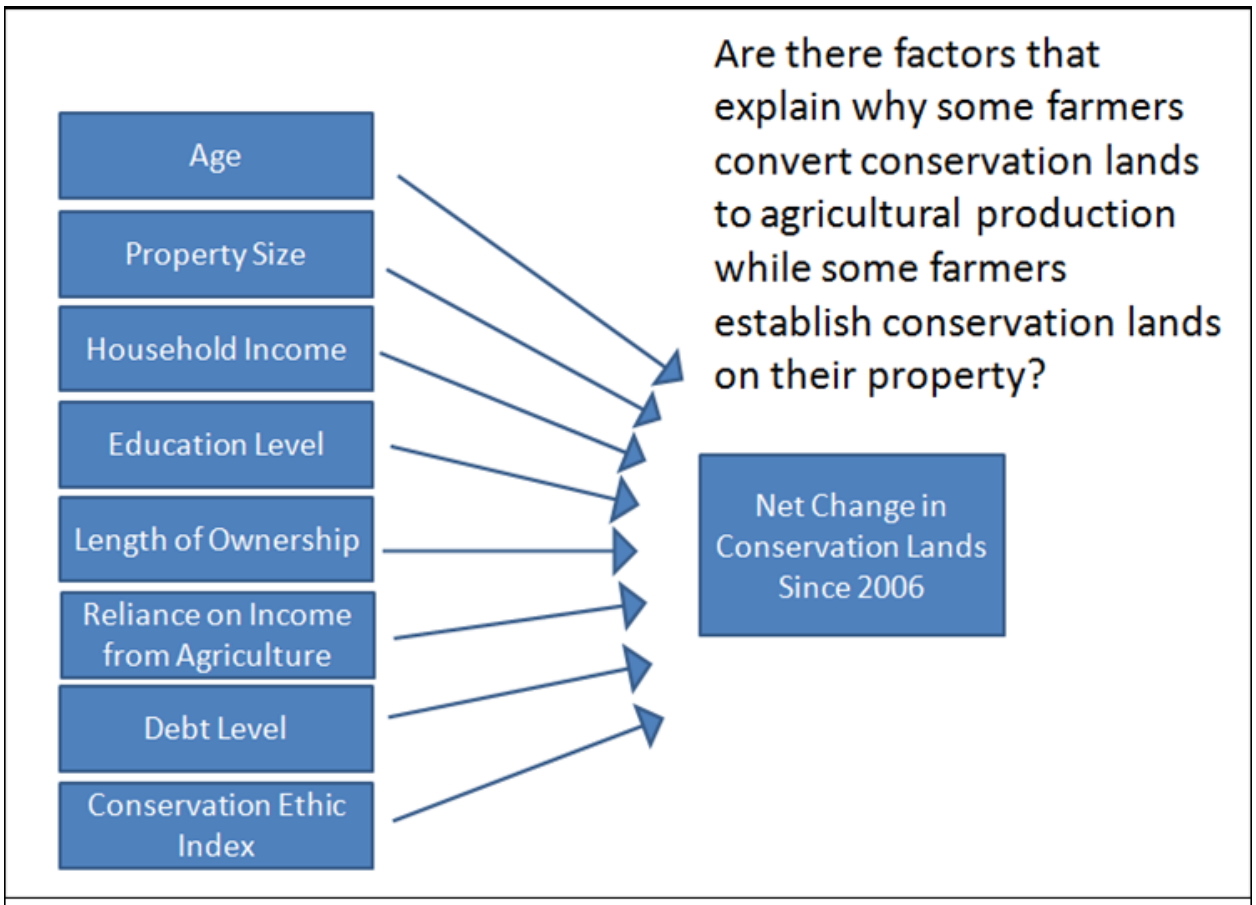

Figure 4: Basic Research Design

ii. Landowner Survey

The data for this study was obtained from a survey of rural landowners in, or near, the Upper Thames River and Grand River watersheds. The survey was developed by a team with members from the University of New Brunswick and Simon Fraser University. This team administered a survey in the Credit Valley watershed area near Toronto, Ontario, in 2012 (Trenholm et al., 2012). The 2012 survey focused on landowner views about wetland enhancement and the main component of the survey involved a "Choice Experiment" which assessed the interest of landowners in various programs that offer some form of compensation for them to allocate land to wetland or other conservation use. The research team agreed to make modifications to the Credit survey to allow

questions to be added that supported this study of landowner conservation behaviours and local coordination of survey implementation was led by the author. Information from the added questions, along with information from several of the questions from the original survey, was used for this study. A pre-test was not undertaken for this iteration of the survey. The modified survey was implemented in the Upper Thames River watershed and it was also implemented in the Grand River watershed. Funding for the survey was provided by the Social Sciences and Humanities Research Council of Canada.

For each watershed, a farmer and a rural landowner version of the survey was developed. The farmer and landowner versions of the surveys were the same except that some of the choices in Section 4 of the survey were different for farmers than for rural landowners. The data used for this study comes from questions that are included in Sections 1, 2 and 5 of the survey and these sections are the same in all four versions of the survey. The Upper Thames River Farmer Survey is included in Appendix C and the Grand River Landowner Survey is included in Appendix D. This provides the reader with an example of each survey.

The surveys were delivered using Canada Post's Unaddressed Admail™ service (Canada Post 2013). This service is used to target all houses or farm households in specified postal routes and this method has been used to contact farmers for past studies (Smyth et al., 2011, Yu and Belcher, 2011). Spatial data at the scale of the

postal route was not available so relevant routes were identified in each watershed using GIS software (Trenholm, 2013, Pers. Comm.). To allow for targeting of households within the Upper Thames and Grand River watersheds, postal codes and forward sortation areas with territories that did not lay more than 70% within the watershed were discarded (Trenholm, 2013, Pers. Comm.). For the Upper Thames watershed, surveys were sent to all rural route addresses along all of the identified postal routes. The same method was used for farm surveys in the Grand River watershed. Due to budgetary constraints, the surveys for rural landowners in the Grand River watershed were targeted at random postal routes. This randomized targeting of postal routes for rural landowners is a type of cluster sampling (Lohr 2010).

The farmer and rural landowner surveys were administered in the Grand River and the Upper Thames River watersheds simultaneously starting at the end of April 2013. Figure 5 shows the distribution of returned surveys. The surveys were administered using the modified tailored design method (Dillman 2007). Following this method, households were sent a survey package containing a cover letter and the questionnaire in the last week of April. The same households were sent a reminder card approximately one week later to remind occupants to complete the survey or to thank them if they had already done so. Approximately two weeks later, the same households were sent a complete second survey package. The response to the additional mailings can be seen as spikes in the return dates shown in Figure 5. Survey respondents were provided the opportunity to return a ballot with their completed survey to be entered into a draw to win one of six $100 gift cards offered in each watershed. Financial incentives

for participation have been used in surveys that involved a similar target audience (Rahelizatovo and Gillespie, 2004, Paudel et al., 2008). Table 6 provides a summary of the surveys sent and the number of respondents and response rate.

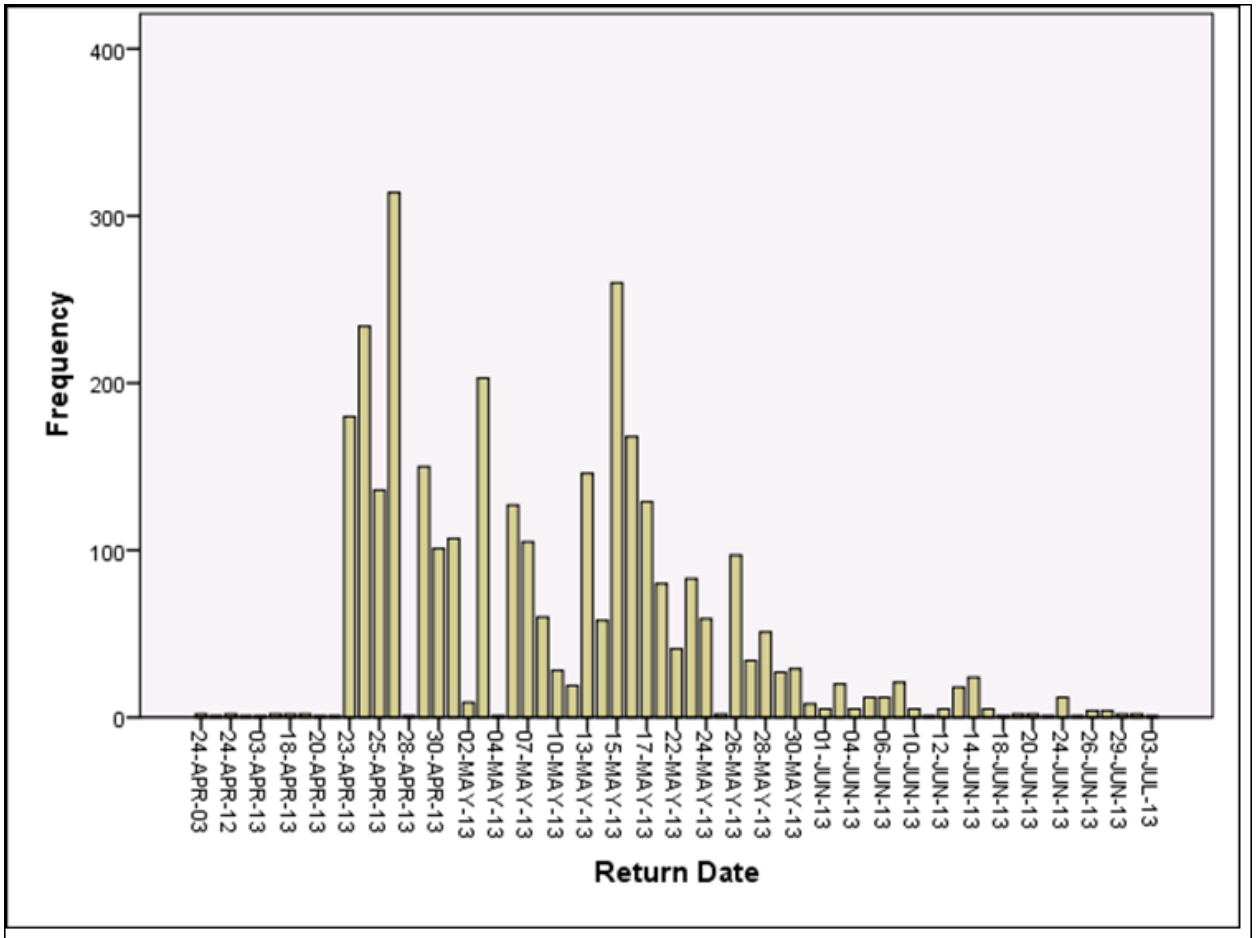

Figure 5: Distribution of Survey Return Dates

Table 6: Number of Postal Routes, Surveys Sent, Survey Responses and Response Rates

	Grand River		Upper Thames		Totals
	Farmer	Non-Farm	Farmer	Non-Farm	
Postal Routes	116	33	65	44	258
Survey Counts	4,600	5,937	3,404	4,149	18,090
Survey Responses	923	932	599	773	3,227
Response Rate	20.1 %	15.7 %	17.6 %	18.6 %	18.0 %

The average survey response rate of 18 % is higher than the 14 % response rate reported for a similar survey conducted in the Credit River watershed in Ontario by Trenholm et al. (2012) and a 15 % response rate reported by Paudel (2008). The 18 % response rate is lower than response rates found in the literature however, the surveys with higher response rates in the literature targeted their recipients using commodity organization mailing lists or government generated mailing lists of farmers (Habron, 2004, Rahelizatovo and Gillespie, 2004, Rosenberg and Margerum, 2008, Atari et al., 2009, Ghazalian, 2009).

iii. Data Entry

The surveys were returned to the UTRCA and the GRCA offices in pre-addressed, postage paid Canada Post Business Reply envelopes. The GRCA surveys were shipped to the UTRCA and all data entry was completed at the UTRCA under the supervision of the author. The research team provided funding to the UTRCA to hire staff to enter the data into an Access database. The code books for data entry and the basic data base were provided by the research team. The data for both watersheds was quality checked and then consolidated into a single data base and imported to IBM SPSS Statistics 21 for statistical analysis.

6. Measurement

It is critical that the concepts that are being considered are good indicators of what is happening in reality and that they are operationalized to allow for their accurate measurement. As discussed in the previous section, the data for this study is derived

from surveys conducted in the Grand River and Upper Thames River watersheds in the spring of 2013. A Farmer Survey and a Landowner Survey were created for each watershed for a total of four unique surveys. The only difference between the surveys for the two watersheds is the choices that are offered for the question that asks the respondent where their property is located. The difference between the Farmer Surveys and the Landowner Surveys is in the options that are available in the Choice Experiment part of the survey (Part 4). This study does not utilize any of the information from the Choice Experiment portion of the surveys. The Upper Thames River surveys are included in Appendix C and the Grand River surveys are included in Appendix D. Details about the measurement of the variables for this study are outlined in this section.

i. Assumptions

a. Focus on Farmers

This study is intended to be focused on farmers. As noted earlier, farmer and rural landowner versions of the survey were created for each target watershed. The method to target farm addresses verses rural landowner addresses in each of the two target watersheds was developed by Canada Post. The survey responses were analysed to determine if the Canada Post methodology did result in landowners with farm characteristics completing a farmer version of the survey and rural non-farm landowners completing the landowner version of the survey. To make this determination, the replies to the questions related to property size and income from agriculture were analysed and it was found that many respondents with farm characteristics had been delivered and completed a landowner survey and many respondents with rural non-farm characteristics had been delivered and completed a farmer version of the survey.

Based on this finding, it was determined that the answers to survey questions about farm income and property size would be a better way to isolate farmers for this study. To meet the definition of a farmer for this study, a landowner must have reported owning 100 or more acres of land and have indicated that 50 % or more of their income comes from agriculture. The distribution of cases that are generated as a result of this sorting is shown in Table 7. The table also shows the numbers of surveys that were sent to the target groups by the Canada Post methodology and the replies that meet the farmer criteria as set for this study. This summary highlights the mixed results that were achieved by the Canada Post AdMail approach.

Table 7: Number Surveys Sent and Survey Responses for Cases Reporting 100 Acres of Land or More and 50% or More Farm Income

	Grand River		Upper Thames		Totals
	Farmer	Non-Farm	Farmer	Non-Farm	
Postal Routes	116	33	65	44	258
Survey Counts (sent)	4,600	5,937	3,404	4,149	18,090
Survey Responses with 100 Acres or More and 50 % or More Farm Income	257	76	170	123	626

b. Missing Data

With the exception of Question 10, all questions in the survey that are not completed are reported as missing data. For question 10, survey respondents were asked to report the number of acres of various land cover types that they have on their property now. They were also asked to report increases or decreases since 2006. The data was analysed and it was determined that many respondents provided estimated acreages for some cover types but left other cover types blank. For the purposes of this study, it is assumed that the spaces that were left blank in Question 10 are zeros.

ii. Dependent Variable

a. Net Change in Conservation Lands Since 2006

This dependent variable for this study is the net amount of change in conservation lands since 2006. The data for the dependent variable is obtained from the answers that are provided for Question 10 of the surveys. To obtain the amount of increase, the values provided for the various land cover types for the "Change Since 2006: Increase *(acres)"* column were summed to obtain a total number of acres increased for the respondent. The total decreased was obtained by summing up the values provided for the "Change Since 2006: Decrease (acres)" column. The net change was obtained by subtracting the amount decreased from the amount increased and this is an interval variable.

iii. Independent Variables

The study is considering eight independent variables.

a. Landowner Age

The age of the landowner was obtained from the answer to question 27. The year of birth answer provided was converted to an age and this data is interval.

b. Property Size

The size of the property was obtained from question 2 of the survey. The total property size was determined by totalling the acreage of land owned inside the watershed with the acreage of land owned outside the watershed and this is an interval variable.

c. Household Income

The total household income of the respondent was obtained from the answer provided to question 31 of the survey. The respondents were asked to make a choice of one of six categories and the data that is obtained is ordinal however the amounts reflect magnitude and therefore the data can be treated as interval.

d. Highest Level of Education Attained

The level of education attained by the respondent was obtained from question 28 of the survey. The question asks respondents to choose from a level of education category and while this generates ordinal data, the data can be processed as interval.

e. Length of Ownership

The length of time that a landowner has owned their property was obtained from question 3 of the survey. This question provides six choices which reflect a range of dates when they first purchased property in the region. It is important to note that survey data for this question was coded such that longer ownership is associated with lower coding scores. This needs to be considered when interpreting the results for this variable. This question generates ordinal data which can be processed as interval data.

f. Reliance on Income from Agriculture

The reliance of the landowner on farm receipts as a proportion of overall income was obtained from question 32 of the survey. This question provided the respondent a choice of six options ranging from 0 % to 100 %. The data from the question is ordinal but the data may also be analysed as interval data as the selection made

does provide an indication of the magnitude of the landowner's reliance on agricultural income relative to the other choices provided.

g. Debt Level

The debt level of landowners was obtained from the answer provided to question 34 of the survey. This question provided respondents with a choice of four options ranging from "debt free" to "high" debt load and the data from this question can be analysed as ordinal or interval data.

h. Conservation Ethic Index

An index of a landowner's conservation ethic was constructed by analysing the data from portions of questions 7 and 13 of the survey. The information used and the weight of the information, is outlined in Table 8. The data obtained is interval. It is noted that the order of responses in questions 7 and 13 in the original survey were set up such that low numbers were associated with more conservation oriented behaviour. To construct the index in a way that higher numbers reflected more conservation oriented behaviour, the scores assigned to the answers for question 7 and 13 were reversed. Cases where one or more of the answers to the questions that make up the Conservation Ethic Index score were either left blank, or the respondent provided a "Don't Know" response, were not given an Ethic Index score.

Table 8: Information Used to Construct Conservation Ethic Index						
		Value Applied				
Q #	Content of Question					
	Response	1	2	3	4	5
7	People own land for many different reasons. How important are each of the following reasons to you?					
7-5	For recreation (hunting, fishing, walking etc.)	4	3	2	1	0
7-7	For the sake of our future generations	4	3	2	1	0
7-8	To preserve ecosystems	8	6	4	2	0
13	As a landowner, I have the responsibility to:					
13-1	Be a good steward of my land and to maintain it in good condition for future generations	4	3	2	1	0
13-2	Leave the land in a better condition than when I acquired it	4	3	2	1	0
13-3	Take into account the values of society at large when making decisions about my land	4	3	2	1	0

Responses for Question 7	**Responses for Question 13**
1. Very Important	1. Strongly agree
2. Important	2. Agree
3. Neither Important or Unimportant	3. Neither agree or disagree
4. Of Little Important	4. Disagree
5. Un-important	5. Strongly Disagree

7. Results

i. Summary of Information from Overall Survey Data

The survey was distributed to approximately 18,100 households and 3,227 responses were received. Details on the overall survey response rate, the distribution of surveys sent, and responses received between the two watersheds are included in Table 6 in the previous section. A total of 57.5 % of the returned surveys originate from the Grand River watershed and the remaining 42.5 % were from the Upper Thames watershed. The distribution of all survey respondents by County is shown in Figure 6. The age distribution of all respondents is shown in Figure 7. Out of the 3,227 total surveys returned, there were 3,115 valid survey responses for age. The minimum age reported was 17 and the maximum age reported was 92. The mean age for all respondents is

56.4 and the standard deviation for age is 13.7. A total of 3,181 respondents provided their gender and of this total, 70.1 % were male and 29.9 % female.

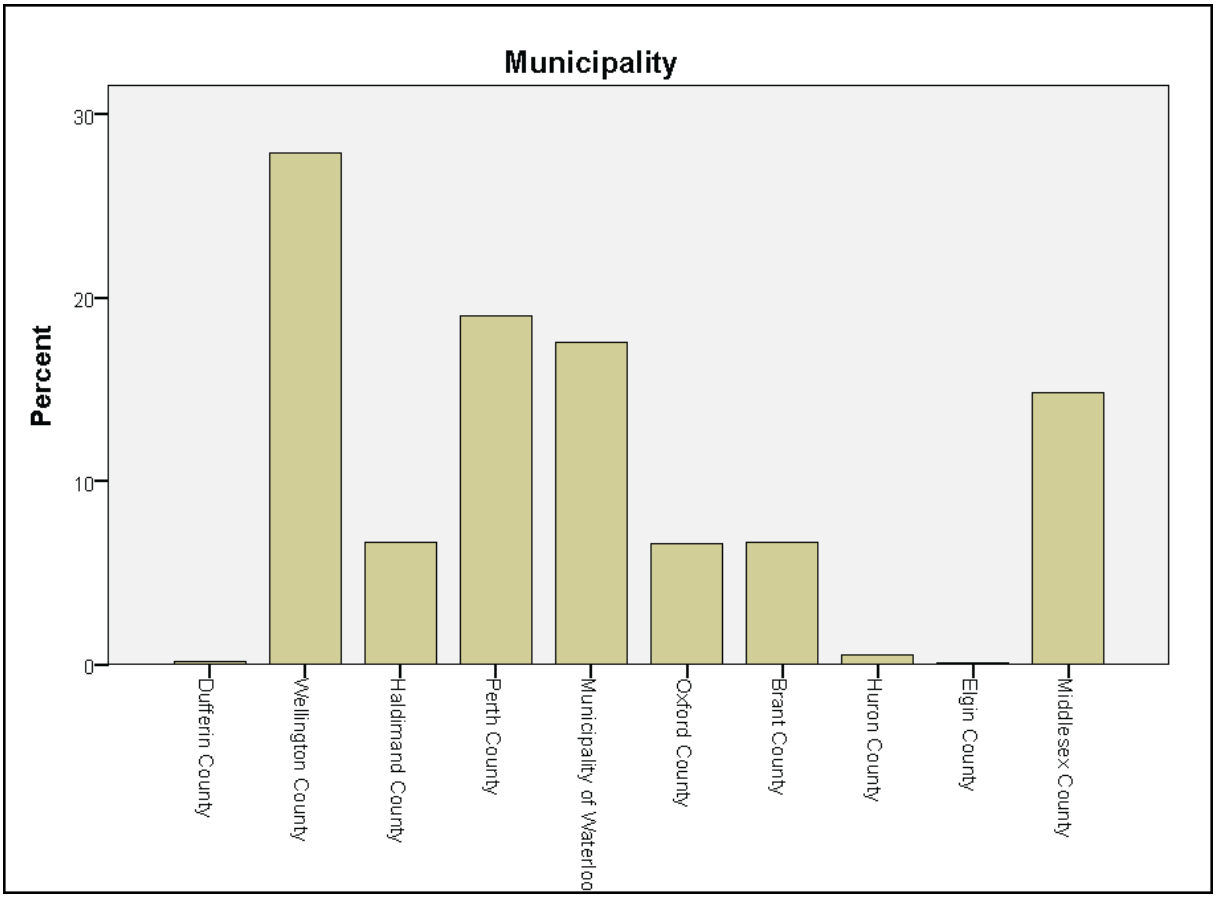

Figure 6: Distribution of All Survey Respondents by County

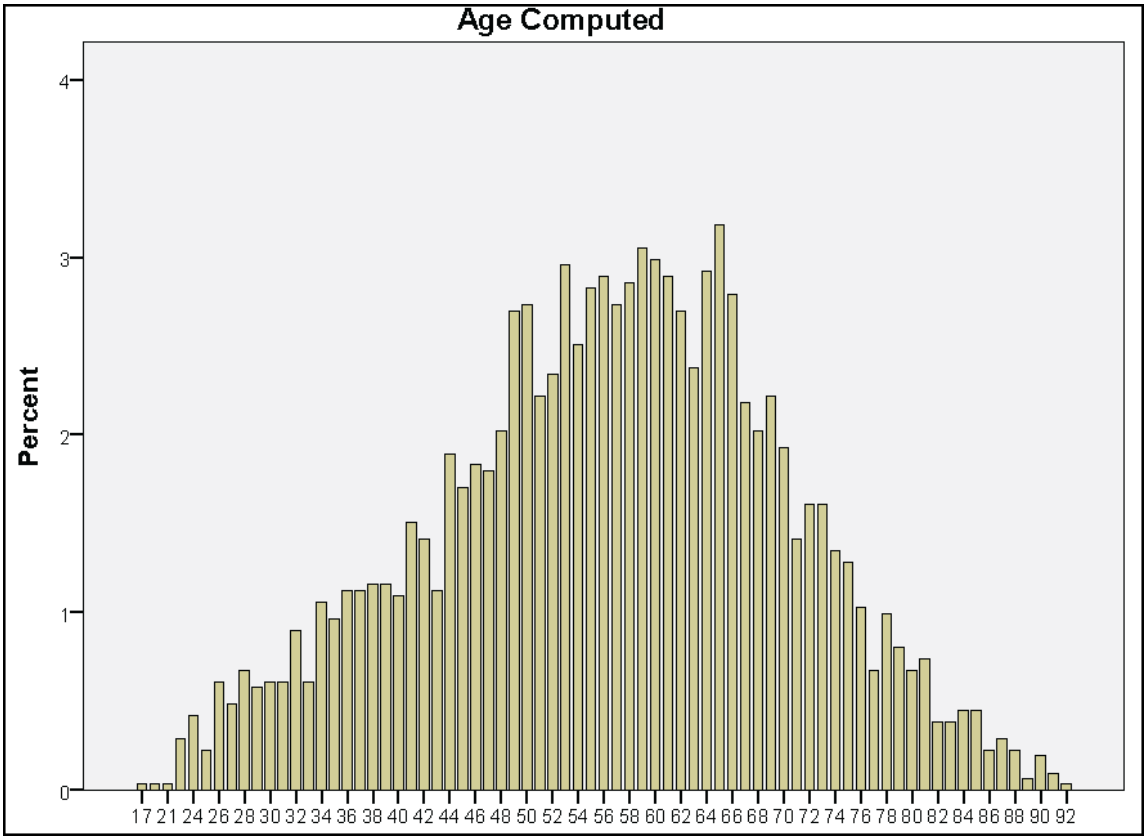

Figure 7: Distribution of All Survey Respondents by Age
N = 3,115, Min = 17, Max = 92, Mean = 56.4 and SD = 13.7

All 3,227 respondents provided a response for property size. The mean property size for all respondents is 96.0 acres and the standard deviation is 180.4 acres. Figure 8 is the total area of property for various size ranges from all respondents and Figure 9 provides a total number of properties that are reported for the various size bands in the full survey. It is noted that the total area of land represented by all survey respondents from the Grand River survey represents 9.6 % of the Grand River watershed area. The total area of land represented by all survey respondents from the Upper Thames survey represents 17.5 % of the land area of the Upper Thames watershed. Figure 10 shows the distribution of highest education attained for all survey respondents. Figure 11

shows the Conservation Ethic Index Scores for all survey respondents. A complete summary of survey results for all respondents is provided in Appendix E.

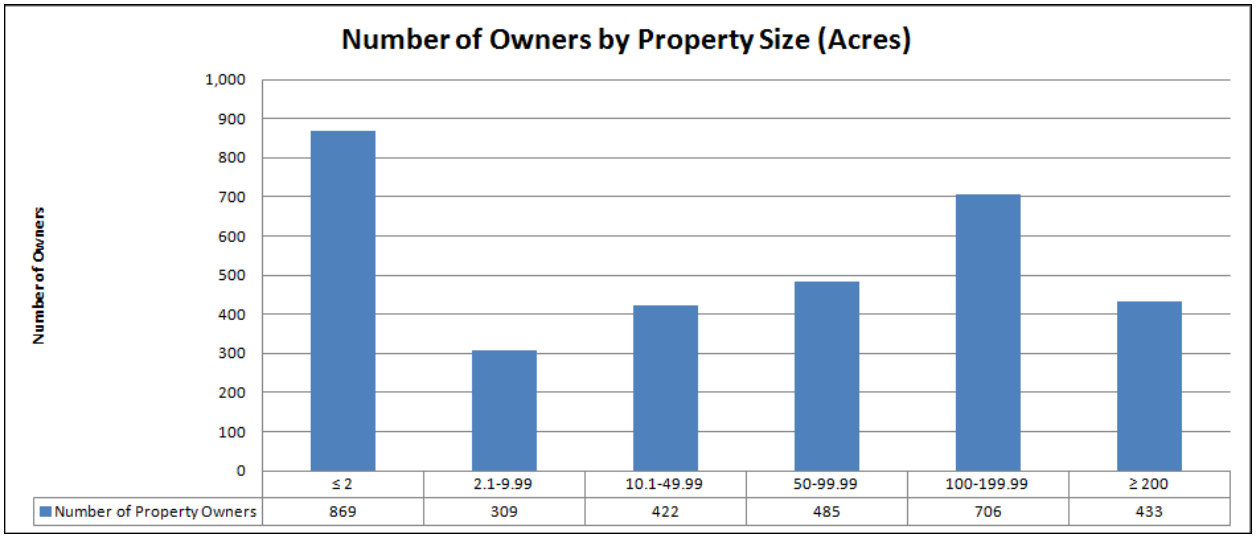

Figure 8: Total Number of Owners by Property Size for All Respondents

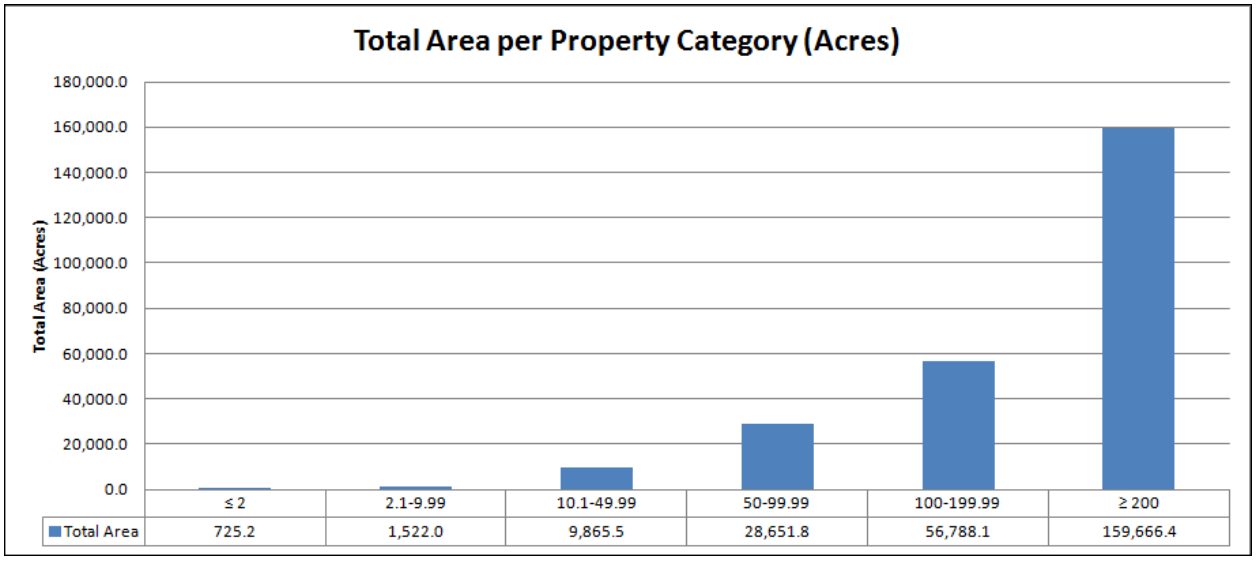

Figure 9: Total Area per Property Category for All Respondents

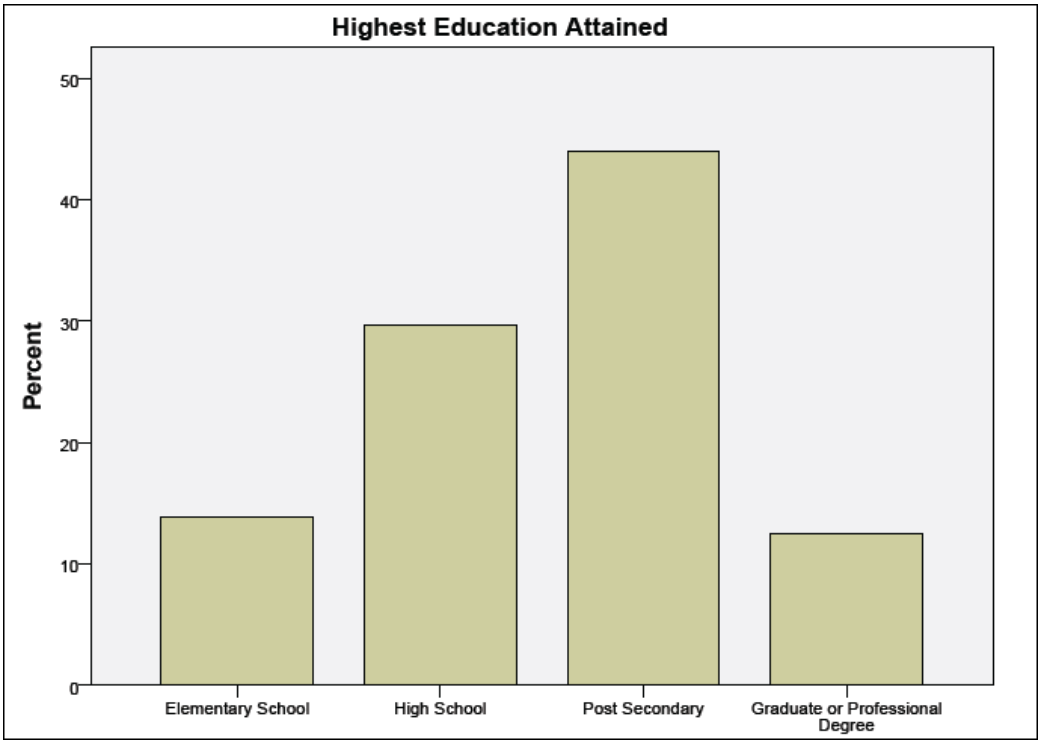

Figure 10: Distribution of Highest Education Achieved for all Respondents

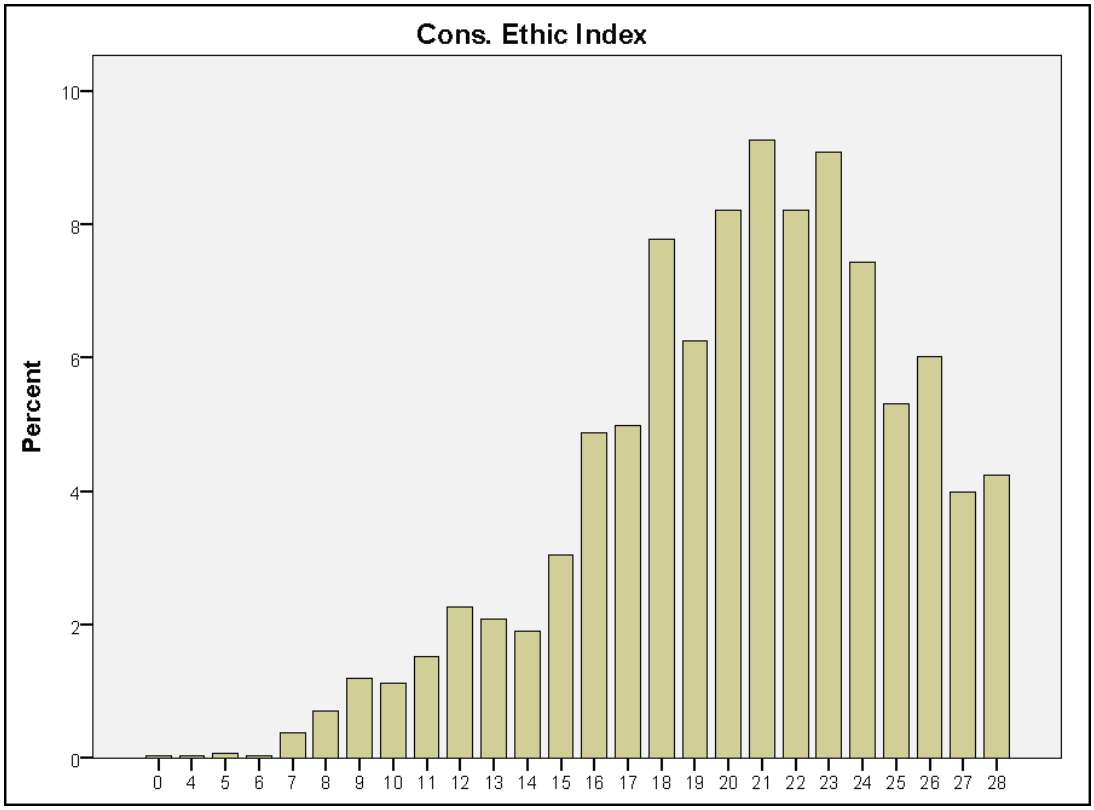

Figure 11: Distribution of Conservation Ethic Index Scores for All Respondents N=2690, Min = 1, Max = 28, Mean = 20.4 and SD = 4.7

Two maps showing the geographic distribution of Conservation Ethic Index Scores for all survey respondents are included in Appendix E. The first map shows the distribution of average Conservation Ethic Index scores by County and the second map shows the distribution of the average scores by Forward Sortation Area (FSA). The FSA is the first portion of the Postal Code and this information was provided by survey respondents. Counties and FSAs with less than five cases were removed from this analysis. The Conservation Ethic Index scores for each case were joined to their corresponding polygon feature classes (County and FSA) and symbolized by value to show higher average values in a darker shade. The joint Grand River and Upper Thames watershed boundary was buffered by two km to clip the FSA boundaries. The maps show that there is some geographic variation in Conservation Ethic Index scores and this information may be useful to local organizations that provide conservation and stewardship services.

ii. Summary of Survey Information for Farmers

For the purposes of this study, a farmer is identified as a landowner that reports owning 100 or more acres of land and reports that at least 50 % of their income comes from farming. A total of 626 survey respondents meet this description and 53.2 % completed a Grand River survey and 46.8 % completed an Upper Thames survey. Of the 620 farm respondents that provided their gender, 85.3 % are male and 14.7 % are female.

The distribution of property sizes for farm respondents is shown in Figure 12.

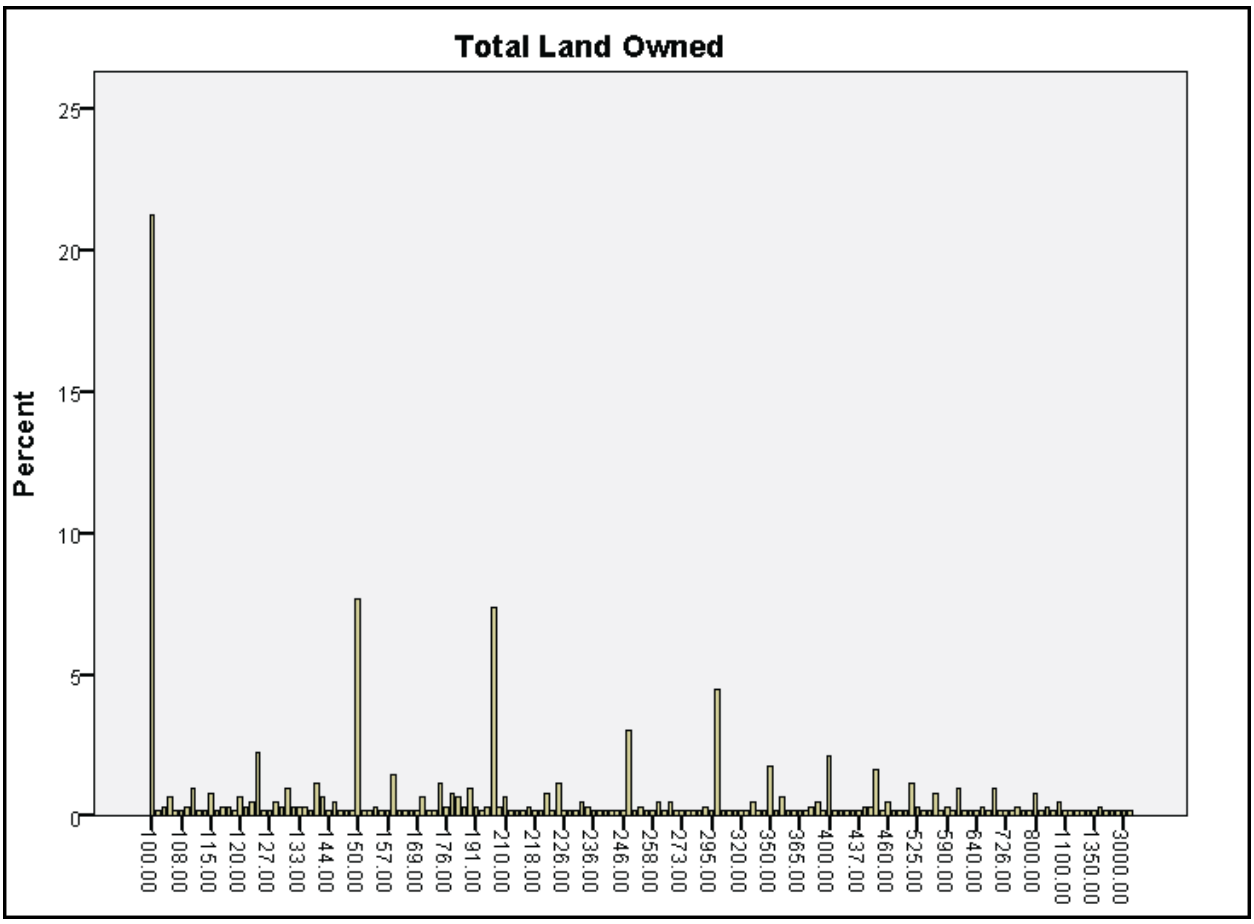

Figure 12: Distribution of Property Size for All Survey Respondents (N = 626) Min = 100 acres, Max = 3,050 acres, Mean = 268.1 acres & SD = 281.7

The distribution of farm respondent replies to the question of highest education attained is shown in Figure 13. The highest education attained data was further analysed by breaking the farm respondents into three age groups. The distributions for farmers less than 40 years of age, farmers 40 – 59 years old and farmers 60 + years old are shown in Figures 14, 15 and 16. These figures illustrate a rather unusual finding from the survey that more than 50 % of farmers that are less than 40 years old report elementary school as their highest level of education attained. This is an unexpected finding and is contrary to the result reported by Lamba et al. (2009) that there was a significant

negative correlation between education and age in a study of southern Ontario farmers.

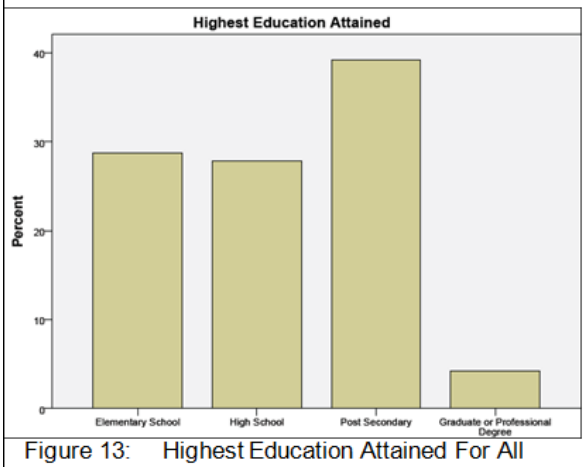

Figure 13: Highest Education Attained For All Farm Respondents

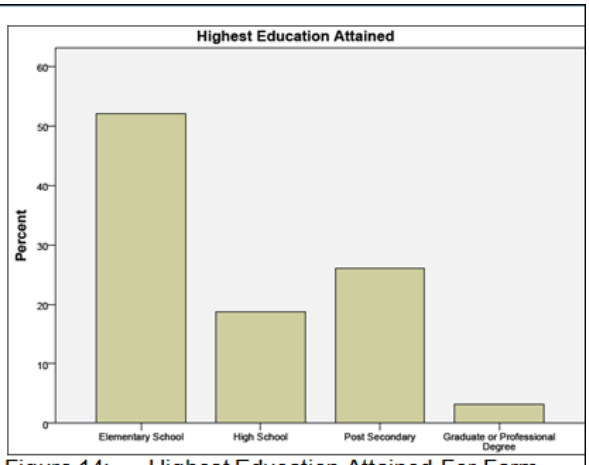

Figure 14: Highest Education Attained For Farm Respondents Less Than 40 Yrs (N = 96)

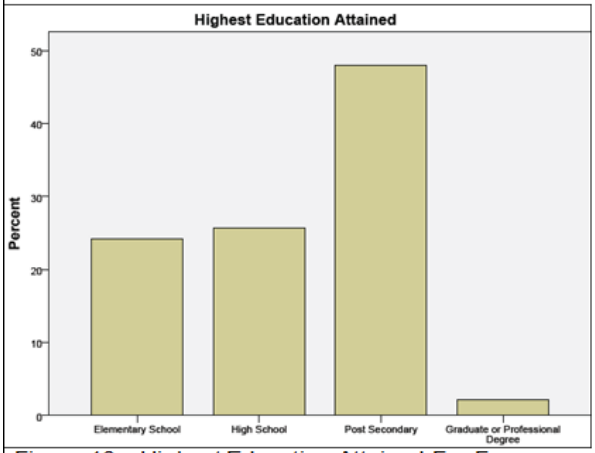

Figure 16: Highest Education Attained For Farm Respondents 40 – 59 Yrs (N= 273)

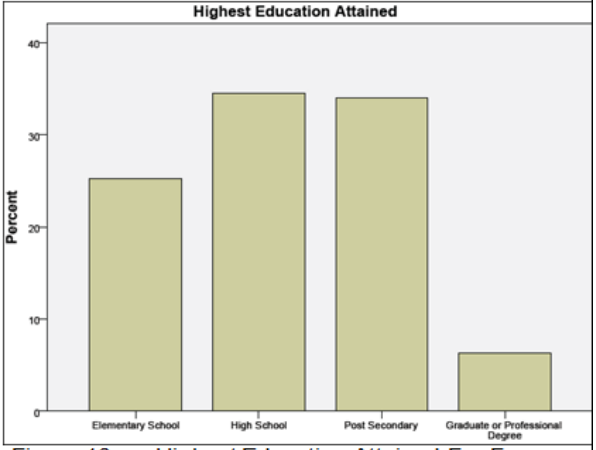

Figure 16: Highest Education Attained For Farm Respondents 60 + Yrs Old (N = 206)

Figure 17 shows a distribution of Conservation Ethic Index Scores for farm respondents. The distribution, mean and standard deviation of the farm Conservation Ethic Index scores is similar to the scores reported for all respondents in Figure 11.

A complete summary of the characteristics of Farm respondents is included in Appendix F. The complete summary includes information on the dependent variable, all of the

independent variables and other data from the survey. A complete summary of all survey respondents is included in Appendix G.

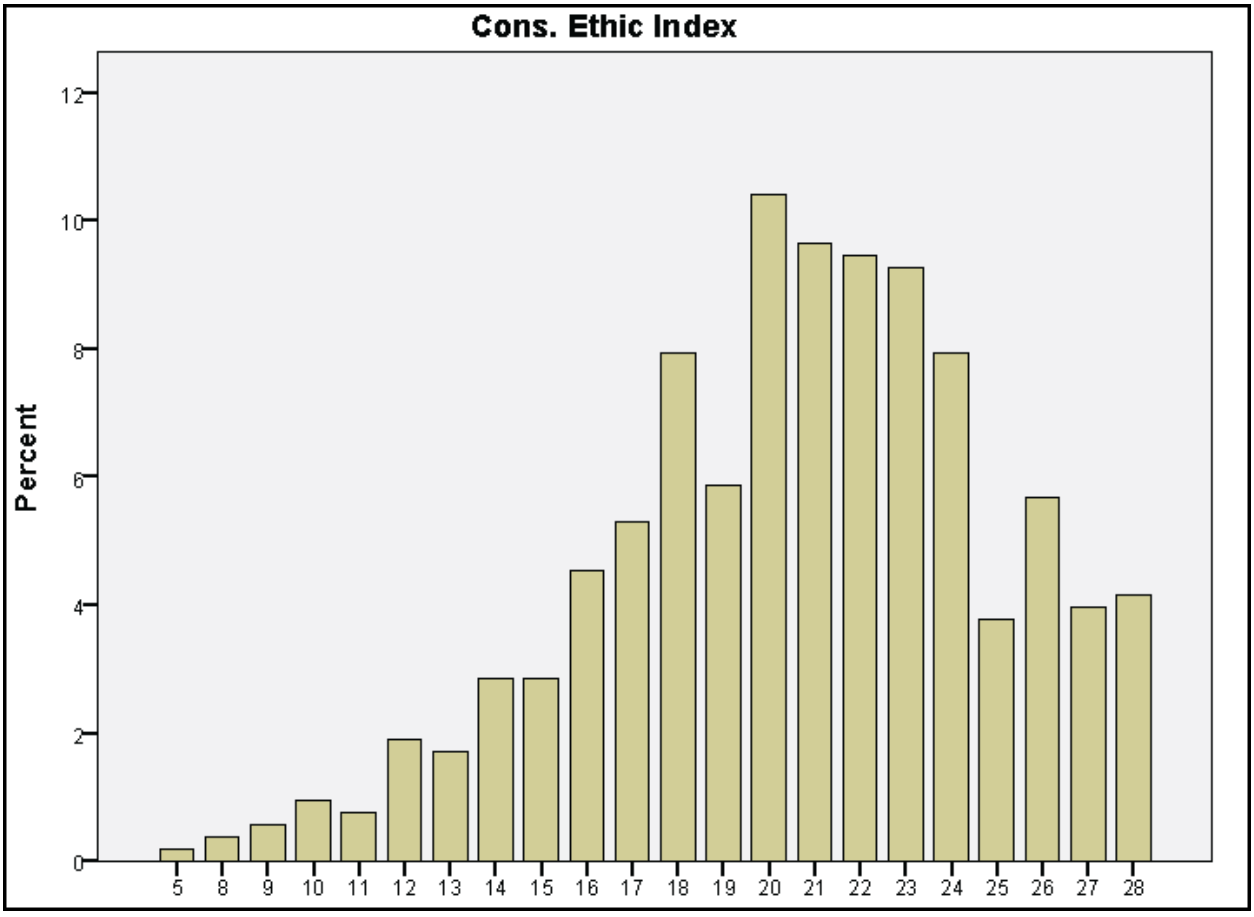

Figure 17: Distribution of Ethic Index Scores for Farm Respondents (N = 529) Min = 5, Max = 28, Mean = 20.6 and SD = 4.3

iii. Bivariate Statistics for Farm Respondents

A bivariate correlation was performed using IBM SPSS Statistics 21. The correlation was run for farm respondents (N=626) and included the dependent variable and the eight independent variables. It is noted that for the purposes of this correlation and the multiple regression analysis discussed in the next section, the data for the dependent variable is arranged as the "net change in conservation lands since 2006." The net

change is computed from the net increase and net decrease information provided by respondents and it can be a positive or negative value. It would be possible to set the research up in such a way that the increase in conservation lands and the decrease in conservation lands could be treated as two separate dependent variables. This approach was considered but not implemented in this study. It is anticipated that the variables will act consistently, positively or negatively, and symmetrically. It is also noted that some cases may report an equal net increase and net decrease since 2006 and using the single net change variable approach leads to these cases being treated as no net change. An approach using two dependent variables would report these cases as both increases and decreases. Finally, it is noted that in order to isolate the differences in those cases that report a net increase and those cases that report a net decrease, the cases that did not have a net change in either direction were treated as "missing" values for the correlation and regression analyses. This approach significantly lowers the number of cases that are included in the analyses but it does put more focus on those cases that report a change.

The output from IBM SPSS 21 is shown in Table 9. Significant relationships are flagged and the Pearson Correlation value indicates the strength of the relationship.

Table 9: Bivariate Correlation Output from IBM SPSS 21 for Farm Respondents Independent Variables & Dependent Variable (Net Conservation Land Chg)

		Total Land Owned	Land First Obtained	Highest Education Attained	Household Income	Reliance on Farm Income	Debt Load	Cons. Ethic Index	Conserv Land Net Chg	Age Computed
Total Land Owned	Pearson Cor.	1	-.166**	.219**	.114**	.185**	.020	-.012	.289**	.070
	Sig.		.000	.000	.007	.000	.617	.776	.004	.086
	N	626	618	617	567	626	607	529	99	607
Land First Obtained	Pearson Cor.	-.166**	1	-.117**	-.001	.049	.452**	-.066	.080	-.696**
	Sig.	.000		.004	.986	.222	.000	.130	.431	.000
	N	618	618	609	559	618	600	522	98	600
Highest Education Attained	Pearson Cor.	.219**	-.117**	1	.050	-.002	-.065	.089*	.018	.068
	Sig.	.000	.004		.238	.966	.111	.042	.863	.094
	N	617	609	617	562	617	598	524	98	601
Household Income	Pearson Cor.	.114**	-.001	.050	1	.166**	-.018	-.083	.069	-.053
	Sig.	.007	.986	.238		.000	.675	.069	.509	.211
	N	567	559	562	567	567	557	484	93	553
Reliance on Farm Income	Pearson Cor.	.185**	.049	-.002	.166**	1	.117**	-.066	.172	-.114**
	Sig.	.000	.222	.966	.000		.004	.131	.089	.005
	N	626	618	617	567	626	607	529	99	607
Debt Load	Pearson Cor.	.020	.452**	-.065	-.018	.117**	1	-.112*	.083	-.523**
	Sig.	.617	.000	.111	.675	.004		.011	.414	.000
	N	607	600	598	557	607	607	513	98	590
Ethic Index	Pearson Cor.	-.012	-.066	.089*	-.083	-.066	-.112*	1	.184	.047
	Sig.	.776	.130	.042	.069	.131	.011		.085	.284
	N	529	522	524	484	529	513	529	89	513
Conserv Land Net Chg	Pearson Cor.	.289**	.080	.018	.069	.172	.083	.184	1	-.021
	Sig.	.004	.431	.863	.509	.089	.414	.085		.840
	N	99	98	98	93	99	98	89	99	97
Age Computed	Pearson Cor.	.070	-.696**	.068	-.053	-.114**	-.523**	.047	-.021	1
	Sig.	.086	.000	.094	.211	.005	.000	.284	.840	
	N	607	600	601	553	607	590	513	97	607

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The output from the bivariate correlation indicates that there is a significant negative correlation between age and land first obtained and this relationship is relatively strong.

This relationship is expected as older farmers would tend to have owned their land for a longer period of time. The significant negative correlation between age and debt load is also an expected finding. This is also a relatively strong relationship and it would be expected that older farmers would tend to have less debt and that younger farmers would tend to have a higher debt load. A significant positive relationship between land first obtained and debt load is reported and this relationship is relatively strong. This is also an expected relationship as farmers who have owned their land longer would be expected to have less debt. A significant positive correlation is also found between highest education attained and total land owned meaning that farmers reporting a higher level of education are associated with larger property sizes. This relationship is of moderate strength and it is logical given that a higher level of education attained would presumably provide a farmer with the training necessary to operate a larger farm enterprise. It is somewhat surprising that no significant relationship is found between education level and household income. A positive relationship would have been anticipated. A weak positive significant relationship is found between reliance on farm income and total land owned. This relationship would be expected as farmers with more land would logically obtain more income from farming.

One significant relationship was found related to the dependent variable. Net change in conservation land is positively correlated with total land owned and the relationship is of moderate strength. This positive correlation is consistent with the hypothesis that farmers with more land would be expected to exhibit more conservation oriented behaviour as they would tend to have the land base needed and the financial and

equipment resources available to them to establish conservation lands. An expected positive relationship between net change in conservation land and highest education attained is not found. A positive significant relationship between highest level of education attained and the Conservation Ethic Index is found but it is extremely weak. A negative significant relationship between debt load and the Conservation Ethic Index is also found and it is weak.

The strong correlations that are found are generally expected relationships related to age and financial planning time horizons. The positive relationship between property size and net conservation land is an interesting finding that was hypothesized. The significant correlations between highest level of education attained and the Conservation Ethic Index (positive) and debt load and the Conservation Ethic Index (negative) are relationships that were anticipated. Although these correlations are weak, they do provide an indication that there are relationships. A number of other anticipated relationships were not found in the bivariate correlation.

iv. Multivariate Analysis of Farm Respondents

Multiple regression allows for the examination of the independent effect of multiple variables. The process essentially isolates the effect of each variable while holding all others constant. A linear regression analysis was performed on the cases meeting the definition of a farmer using IBM SPSS 21. The dependent variable for this analysis was

the net change in conservation lands and the eight independent variables were included in the regression. The outputs from IBM SPSS are included in Table 10.

Table 10: Linear Multiple Regression Outputs from IBM SPSS 21
Farm Respondents: Net Conservation Land Chg as Dependent Variable

Model Summary[a]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.520[a]	.270	.189	58.68587	.270	3.333	8	72	.003

a. Predictors: (Constant), Age Computed, Cons. Ethic Index, Household Income, Reliance on Farm Income, Highest Education Attained, Total Land Owned, Debt Load, Land First Obtained

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	91844.845	8	11480.606	3.333	.003[b]
	Residual	247970.291	72	3444.032		
	Total	339815.136	80			

a. Dependent Variable: Conserv Land Net Chg

b. Predictors: (Constant), Age Computed, Cons. Ethic Index, Household Income, Reliance on Farm Income, Highest Education Attained, Total Land Owned, Debt Load, Land First Obtained

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-241.848	99.291		-2.436	.017
	Total Land Owned	.105	.027	.467	3.967	.000
	Land First Obtained	16.573	6.716	.407	2.468	.016
	Highest Education Attained	-4.649	8.248	-.060	-.564	.575
	Household Income	-.818	5.404	-.017	-.151	.880
	Reliance on Farm Income	9.309	9.458	.104	.984	.328
	Debt Load	7.530	9.252	.100	.814	.418
	Cons. Ethic Index	2.209	1.621	.144	1.363	.177
	Age Computed	1.219	.818	.247	1.491	.140

a. Dependent Variable: Conserv Land Net Chg

The model output indicates that there is a significant positive relationship at α = 0.01 between total land owned and net change in conservation land meaning that farmers who have more acreage establish more conservation lands. There is also a significant positive relationship at α = 0.05 between land first obtained and net change in conservation land meaning that farmers who have owned their land longer establish more conservation lands. The adjusted R Square value of 0.189 indicates that these are weak to moderate strength relationships.

The finding that there is a significant positive relationship between amount of land owned and establishment of conservation lands is consistent with the hypothesis that was developed for this independent variable. As a result, the null hypothesis is disproven. The finding that there is a positive correlation between land first obtained and net change in conservation land is also consistent with the hypothesis that was established for this research and this null hypothesis is also disproven. It is important to note that the data for this variable was coded to provide longer tenure with lower scores. This reverse coding needs to be considered when interpreting the data and therefore, the positive correlation that is recorded for this variable, is consistent with the hypothesis that farmers who have owned land longer will exhibit more conservation oriented behaviour.

The significance reported in the Coefficients table portion of the output (Table 10) is based on a Two -Tailed T Test. If a One-Tailed T Test was used, a positive correlation

between age and net conservation land would be significant at α = 0.07 and a positive correlation between Conservation Ethic Index score and net conservation land would be significant at α = 0.09. This finding for age suggests that older farmers are more conservation oriented and while this finding is contrary to the hypothesis that was developed for this variable, it is consistent with the direction that is reported by some of the studies that were reviewed in the literature. The One-Tailed T Test finding that Conservation Ethic Index score is positively correlated with conservation behaviour is consistent with the hypothesis that was developed.

The linear regression does not confirm significant relationships for any of the other independent variables and therefore, the remaining null hypotheses are not disproven.

To further assess the potential relationships in the data, a linear regression model was run with the Conservation Ethic as the Dependent Variable. The output from this model is included in Table 11. The output indicates that there is a significant relationship between land first obtained and Conservation Ethic Index but the R Square value is very low indicating a very weak relationship.

Table 11: Linear Multiple Regression Outputs from IBM SPSS 21
Farm Respondents: Net Conservation Land Chg as Dependent Variable

Model Summary[a]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.344[a]	.119	.021	4.213	.119	1.211	8	72	.305

a. Predictors: (Constant), Conserv Land Net Chg, Age Computed, Household Income, Reliance on Farm Income, Highest Education Attained, Total Land Owned, Debt Load, Land First Obtained

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	171.993	8	21.499	1.211	.305[b]
	Residual	1278.032	72	17.750		
	Total	1450.025	80			

a. Dependent Variable: Cons. Ethic Index

b. Predictors: (Constant), Conserv Land Net Chg, Age Computed, Household Income, Reliance on Farm Income, Highest Education Attained, Total Land Owned, Debt Load, Land First Obtained

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	28.540	6.610		4.318	.000
	Total Land Owned	.000	.002	-.011	-.075	.941
	Land First Obtained	-1.107	.485	-.416	-2.283	.025
	Highest Education Attained	.264	.593	.052	.446	.657
	Household Income	-.328	.386	-.104	-.851	.398
	Reliance on Farm Income	.274	.683	.047	.401	.690
	Debt Load	-.038	.667	-.008	-.057	.954
	Age Computed	-.102	.058	-.317	-1.752	.084
	Conserv Land Net Chg	.011	.008	.174	1.363	.177

a. Dependent Variable: Cons. Ethic Index

8. Generalizations and Implications

As noted in the previous section, this study found that two of the eight independent variables were significantly correlated with the net conservation land dependent variable using a One-Tailed T Test. Based on the literature, it was hypothesized that the size of the property owned would be positively correlated with conservation behaviour. The bivariate correlation conducted in this study found a significant positive relationship between property size and the establishment of conservation lands. A significant positive correlation was also found in the linear regression. The meta-analyses completed by Prokopy et al. (2008) and Knowler and Bradshaw (2007) both found that when a significant relationship between property size and BMP adoption is found, the direction of the relationship is usually positive. It must be noted that the analysis in this study focused on farmers who owned more than 100 acres of land and based on this definition, a 100 acre farm is the smallest property size in the analysis. The distribution of farm property sizes shows that there are many large properties in the farm sample (N=626) and this study has shown that the farmers with larger land holdings tend to be more conservation oriented. This finding reinforces the conclusion of Ghazalian (2009) that the actions of a few farmers on their large properties can have a greater impact than the actions of many farmers on their small properties. This is not to suggest that extension programs should ignore smaller landowners however, if the goal of a conservation program is to maximize the amount of land that is converted, program implementers may expect to have greater success by targeting farmers with large land holdings. A review of the property size and property owners information included in Tables 8 and Table 9 reinforces this point. Tables 8 and Table 9 show that the 433

respondents who report owning 200 or more acres of land account for 62.1 % of the total land represented in the survey. An additional 706 respondents report owning more than 100 acres of land and less than 200 acres of land. These two groups of landowners account for 35.3 % of the survey respondents but they control 84.2 % of the land owned by all respondents.

The analysis completed in this study also indicates that there is a significant positive relationship between length ownership and net conservation land since 2006. This finding that farmers who have owned their land for a longer period of time tend to be more conservation minded is consistent with the hypothesis that was developed from the literature. It is important to note however that the literature review found very few studies that considered length of ownership as a variable and those studies that did consider this variable, operationalized the concept in differing ways. This finding suggests that farmers who have owned their land for a longer period of time have more of a sense of pride of ownership and stewardship for the resources of their property. The finding that farmers who have owned their land longer is positively correlated with conservation behaviour is contrary to the finding that was reported by Raymond and Brown (2011) based on research in Australia. This may perhaps be explained by cultural differences or it may be explained by differences in farmers' attitudes about the various resources that are part of a farm unit. The finding that length of ownership is correlated to conservation behaviour is an interesting addition to the theory about adoption behaviour and perhaps future studies can explore this relationship further. The positive relationship that has been found in this study may also be of assistance to

organizations that currently implement stewardship programs as this finding may inform decisions about how to target efforts.

This study did not find a significant relationship between highest level of education attained and conservation behaviour. Based on a review of the literature, a significant positive relationship was hypothesized. The failure to find a significant relationship for the education variable is not a surprising finding given the results of the meta-analyses completed by Prokopy et al. (2008) and Knowler and Bradshaw (2007). The study did identify an unusual trend in the data which is highlighted in Tables 13 to 16. The study found that more than 50 % of farmers who are younger than 40 years of age report elementary school as their highest level of education attained. This finding is not consistent with the trend for all farmers or the trend for all survey respondents. This finding is also contrary to the finding that was reported by Lamba et al. (2009) for research involving southern Ontario farmers. This anomaly in the data may explain why the hypothesized relationship between education and conservation behaviour was not found and this unusually low level of education reported for young farmers could be further pursued in future research as it may have a significant impact on extension service delivery in the study area.

This study hypothesized that younger farmers would exhibit more conservation oriented behaviour. The review of the literature identified mixed results for the age variable and it is not surprising that no relationship was found in this study when a Two-Tailed T Test

was used to set the level of significance. As noted in the literature review, there are compelling arguments for both a positive correlation between age and conservation behaviour and a negative correlation between age and conservation behaviour. It is possible that that the explanations found in the literature that support positive correlations and negative correlations are both occurring in the area of this survey and that the net effect of these conflicting forces contributes to the failure to find a correlation. When a One-Tailed T-Test is used, it is found that there is a significant positive correlation between age and conservation behaviour at $\alpha = 0.07$. This is a lower test for significance than was used for this study but this finding does suggest that the direction of the relationship is positive rather than the negative direction that was hypothesized. While this finding does not meet the threshold for significance that was set for this study, it is somewhat concerning that the data suggests that younger farmers are less conservation oriented and finding does warrant consideration by organizations that are involved in conservation extension.

The changing economic landscape of agriculture in southern Ontario is an important part of the frame for this study. The study considered three economic related variables and based on the literature review and the changing economic conditions of the study area, research hypotheses were developed. In the case of total household income, it was hypothesized that farmers who have higher household income will exhibit more conservation oriented behaviour. This study did not find a significant relationship for the total household income variable. This finding is not surprising considering the results of the meta-analysis completed by Prokopy et al. (2008) which reports that 109 of the 156

models that considered income reported that there was no significant relationship. This study also considered farm income as part of a farmer's overall income as a variable that may explain conservation behaviour. Based on the literature review, it was hypothesized that farmers who have a higher reliance on farm receipts for their income will be less conservation oriented. This study did not find a significant relationship and based on the results of the Prokopy et al. (2008) and Knowler and Bradshaw (2007) meta-analyses, a finding of no relationship is not surprising. Finally, this study considered debt load as a factor that may explain conservation behaviour. A limited number of studies were found in the literature review that could assist with establishing a hypothesis for this variable. Based on these limited studies and the review of changing economic conditions of agriculture in the study area, it was hypothesized that farmers who have a higher debt load will be less conservation oriented. The bivariate correlation conducted for this study did find a significant relationship between debt load and Conservation Ethic Index score however the relationship was of low strength. Even with its low strength, this relationship does provide some indication to conservation practitioners about potential risks and opportunities for their conservation land protection and enhancement activities.

Given the higher commodity prices that have been experienced in recent years and the significant increase in land prices that has been documented for the study area, it is somewhat surprising that strong significant relationships were not found for any of the three economic variables that were considered in this study. It is possible that it will take more time for the impact of the shifting economic conditions to have an influence

on the conservation behaviour of farmers. This theory however, contradicts the concerns of various resource management professionals that are documented by Roulston (2013). Given these contradicting observations, it is appropriate to consider whether there are other explanations for the lack of significant correlations found in this study. One possibility that must be considered is the effect of non-response bias. With an overall survey response rate of 18 %, it is important to consider if the landowners who responded to this survey are somewhat representative of the landowners in the study watersheds. More is offered on this concern later in this section.

The final variable that was explored in this study is a Conservation Ethic Index score. The index was constructed from questions included in the surveys that dealt with stewardship and ecology. It was hypothesized that farmers who have a higher Conservation Ethic Index score will exhibit more conservation oriented behaviour. The literature review found several examples where conservation attitudes and general environmental awareness were studied as factors that may explain BMP adoption. The meta-analyses completed by Prokopy et al. (2008) and Knowler and Bradshaw (2007) found that environmental attitudes have been considered in a number of studies and that when a significant relationship is found, it is always a positive correlation. This study did not find a strong significant relationship between Conservation Ethic Index score and conservation behaviour. The meta-analyses did find that it is common for no relationship to be found for this variable. It is however still surprising that a strong significant relationship was not found for the general population of this survey (N=3,227) or the farm respondents (N=626).

As noted earlier in this section, the overall response rate for this survey was 18 %. Based on the literature reviewed, an 18 % response rate is to be expected for an untargeted survey with a farm audience (Trenholm et al., 2012, Paudel, 2008). While the response rate is in the anticipated range, the fact remains that 82 % of the landowners who received the survey did not respond. The potential impact of the landowners who did not respond must be considered when reviewing the findings of this study.

Given the content of the survey and the cultural, economic and regulatory landscape of the study area, there is a potential for a non-response bias in the study results. For example it would be logical that landowners who had established conservation lands would be more enthusiastic about reporting their activities in a survey than those landowners who had removed conservation lands. Also, the survey was sent to landowners in an envelope with the local conservation authority logo on it and this may have influenced the choice of recipients to even open the envelope. The survey return envelope was addressed to the local conservation authority and given that the UTRCA and GRCA are involved in regulatory enforcement activities, respondents may have hesitated to report conservation land removal activities. This type of landowner is likely under-represented in the survey data. Those landowners who have worked with the GRCA or the UTRCA on past stewardship activities may have been more willing to complete the survey and these landowners may be over-represented in the survey data.

The different levels of participation by different types of landowners is a threat to the validity of the study results and this must be considered by the reader.

Habron (2004) considered the potential for non-response bias in a study involving Oregon farmers. In an effort to determine the characteristics of the non-respondents and the potential implications for the study results, the study team contacted 24 non-respondents for follow up interviews. This study would benefit from a similar follow-up approach to assess if there is a non-response bias and if a bias is found, to attempt to determine the magnitude of the bias.

The meta-analyses by Prokopy et al. (2008) and Knowler and Bradshaw (2007) both highlight the wide range of BMPs that can be implemented by landowners and they note that the potential factors that may explain adoption may be influenced by the type of BMP that is considered. It must be noted that this study only considered eight variables for explanation while the meta-analyses referenced identified 37 variables that could be explored. The unexplained variation in the results of this study may be explained by variables not considered in this study.

This study focuses on the choice of landowners to remove or to establish wetlands, trees, watercourse buffers, fence lines, wind breaks, shrub land meadows and open drainage systems. These areas may provide some production benefit for farmers but

they have a more direct habitat and water quality benefit which would be realized by society as a whole. Soil conservation measures such as contour plowing and minimum tillage provide more of a production benefit and farmers may view these types of BMPs in economic terms more so than in conservation terms. Any consideration of BMP adoption and any interpretation of the results of this study should take into account the type of BMP involved.

Finally, it is important to reiterate the importance of local context in the review of the results of this study. Several authors highlight the importance of local conditions, the activities of local governmental and non-governmental organizations and the function of local information networks when attempting to explain conservation behaviour (Ahnström et al., 2009, Ghazalian, 2009, Prokopy et al., 2008, Knowler and Bradshaw, 2007). This study provides information about farmers in the Grand River and Upper Thames river watersheds that may assist practitioners and agencies in planning and implementing conservation activities. The study findings may be applicable to other jurisdictions which have similar circumstances in terms of general landscape characteristics, agricultural history, economic pressures and the policy environment but the limitations of the applicability of this study due to sampling methodology and local context must be kept in mind.

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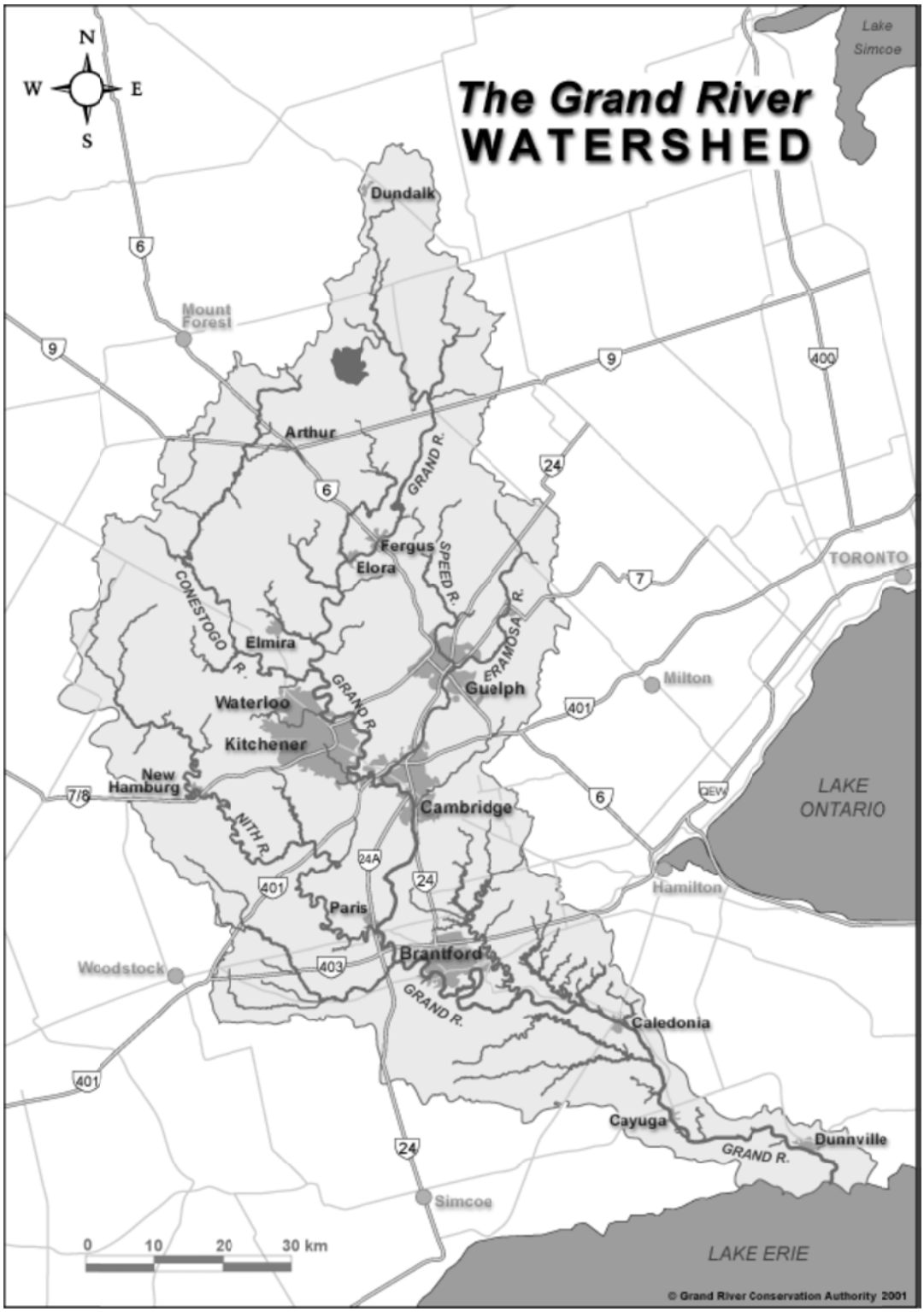
10. Appendices

Appendix A: Upper Thames Watershed Study Area

Appendix B: Grand River Watershed Study Area

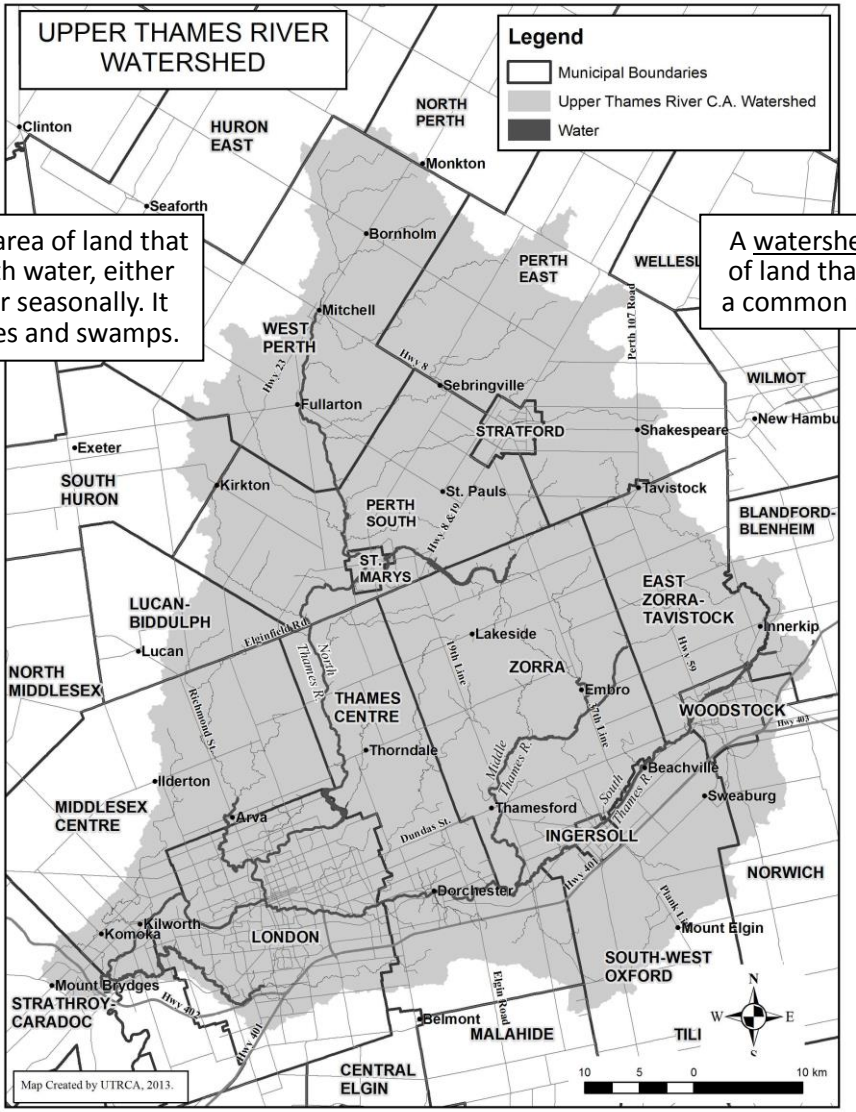


Appendix C: Farmer Survey for the Upper Thames River Watershed

Survey of Farmer Views on Wetland Enhancement and Restoration in & near the Upper Thames River Watershed

A <u>wetland</u> is an area of land that is saturated with water, either permanently or seasonally. It includes marshes and swamps.

A <u>watershed</u> is an area of land that drains into a common river system.



When you have completed this survey, please place it in the postage-paid envelope provided in your survey package and drop it off in the mail. Thank you!

Section 1: Your Land

1. Which county do you live in? *Please check **one** box only.*

☐ Huron County ☐ Middlesex County
☐ Oxford County ☐ Perth County
☐ Elgin County ☐ Other (Please specify): _____

2. What is the total area of land that you own inside and outside the Upper Thames River watershed (if needed, consult the map on the back of the cover letter)?
Please indicate the number of acres in the spaces provided.

Inside: _____ Acres
Outside: _____ Acres

3. When did you first obtain land in the region? *Please check **one** box only.*

☐ Before 1970 ☐ 1981-1990 ☐ 2001-2006 ☐ Not Applicable
☐ 1970-1980 ☐ 1991-2000 ☐ 2007-2013

4. What is the primary use of the land you own? *Please check **one** box only.*

☐ Agriculture ☐ Residence
☐ Forestry ☐ Other: _____

5. If you generated income from your land over the past 5 years, is it from any of the following? *Please check **all** boxes that apply.*

☐ Farming ☐ Leasing land for recreation ☐ Not applicable
☐ Forestry ☐ Leasing land for farming or forestry ☐ Other: _____
☐ Leasing land for hunting ☐ Development/sale of your land _____

6. What will likely happen to your land after you retire? *Please check **one** box only.*

☐ Sell ☐ Give to land trust ☐ Have not started planning for retirement
☐ Give to family ☐ Don't know ☐ Other: _____

7. People own land for many different reasons. How important are each of the following reasons to you? *For each reason, please check the box that corresponds with your answer.*

	Very important	Important	Neither important or unimportant	Of little importance	Un-important	Don't know
To make a living (farm, forest, or other income)	☐	☐	☐	☐	☐	☐
To complement my income	☐	☐	☐	☐	☐	☐
As an investment for future gain	☐	☐	☐	☐	☐	☐
As a location for my permanent residence	☐	☐	☐	☐	☐	☐
For recreation (hunting, fishing, walking, etc.)	☐	☐	☐	☐	☐	☐
To maintain a family legacy	☐	☐	☐	☐	☐	☐
For the sake of our future generations	☐	☐	☐	☐	☐	☐
To preserve ecosystems	☐	☐	☐	☐	☐	☐

8. Which of the following features do you have on your land?
*Please check **all** boxes that apply.*

☐ Crop ☐ Pasture ☐ Meadows
☐ Orchard ☐ Forests ☐ Other: _____

9a. Do you have wetlands on your land?

☐ Yes ➡ *If yes, please continue with question **9b***
☐ No ➡ *If no, please skip to question **10***

9b. Did you create, or have you enhanced, any of these wetlands? *Check **all** boxes that apply.*

☐ Created them ☐ Enhanced them ☐ No

9c. If you created or enhanced any wetlands on your land, please explain what you did and how it was funded. *If you answered 'No' to question **9b** please skip to question **10**.*

_____

_____

_____

Section 2: Your Land Management

10. How many acres of your land are currently left untilled or dedicated to other land cover types, and how have these areas changed since 2006?

Please indicate your answers using the spaces provided below. For any specific land cover type that does not apply to your situation, please leave the associated space blank.

Land cover type	# of acres now	Change since 2006	
		Increase (acres)	Decrease (acres)
Land left untilled	_____	_____	_____
Fence line	_____	_____	_____
Wind break	_____	_____	_____
Trees	_____	_____	_____
Shrub land meadow	_____	_____	_____
Ditch	_____	_____	_____
Wet area / Wetland	_____	_____	_____
Other conservation measure: _____	_____	_____	_____
_____			

11. Have you ever received financial incentives or cost-share payments from any of the following programs for implementing conservation measures on your land?

*Please check **all** boxes that apply.*

- ☐ Stewardship Program offered by the local Conservation Authority
- ☐ Environmental Farm Plan
- ☐ I have not received financial assistance from any program
- ☐ Ducks Unlimited Wetland Retention or Restoration Programs
- ☐ Other: _____
  _____

12. To what extent do you agree or disagree with each of the following statements about your landowner rights?

For each statement, please check the box that corresponds with your answer.

As a landowner, I have the **right** to…	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
…restrict others' access to my land	☐	☐	☐	☐	☐	☐
…transfer ownership of my land to others without restriction	☐	☐	☐	☐	☐	☐
…do whatever I want with my land without regard for others	☐	☐	☐	☐	☐	☐
…do anything with my land as long as my actions do not infringe upon neighbours' rights	☐	☐	☐	☐	☐	☐
…do anything with my land as long as my actions do not conflict with the interests and values of the local community	☐	☐	☐	☐	☐	☐

13. To what extent do you agree or disagree with each of the following statements about your landowner responsibilities?

For each statement, please check the box that corresponds with your answer.

As a landowner, I have the **responsibility** to…	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
… be a good steward of my land and to maintain it in a good condition for future generations	☐	☐	☐	☐	☐	☐
… leave the land in a better condition than when I acquired it	☐	☐	☐	☐	☐	☐
… take into account the values and interests of society at large when making decisions about my land	☐	☐	☐	☐	☐	☐

Section 3: Wetland Management

Information: Wetland Benefits

Wetlands in your area provide a number of benefits to the community, including:

- ***Water quality:*** Wetlands help purify water.
- ***Flood, drought, and erosion control:*** Wetlands help control flooding and erosion, as well as reduce the impacts of drought.
- ***Wildlife habitat:*** Wetlands provide habitat for native and/or endangered plant and wildlife species (both on land and in water).
- ***Carbon storage:*** Wetlands store carbon helping to slow climate change.
- ***Recreation and education:*** Wetlands provide recreational and educational opportunities.

14. How <u>important</u> are the following wetland benefits in your area to you?
*Please check **<u>one</u>** box per item.*

	Very important	Somewhat important	Not important	No opinion
Water quality	☐	☐	☐	☐
Flood, drought, and erosion control	☐	☐	☐	☐
Wildlife habitat	☐	☐	☐	☐
Carbon storage	☐	☐	☐	☐
Recreation and education	☐	☐	☐	☐

15. How would you describe the <u>current state</u> of wetlands in your area?
*Please check **<u>one</u>** box per item.*

	Excellent	Good	Fair	Marginal	Don't know
Quantity (amount) of wetlands	☐	☐	☐	☐	☐
Quality (health) of wetlands	☐	☐	☐	☐	☐
Accessibility to view wetlands	☐	☐	☐	☐	☐

Information: Decline in Wetland Area

- The area of wetlands in and around the Upper Thames River watershed has declined significantly over the past century, largely due to human activities such as expansion of urban areas, agriculture, and industrial developments.
- While the rate of wetland loss has recently slowed, the area and/or quality of wetlands in your region still declines each year, resulting in further loss of wetland benefits.
- Landowners can help reverse the declining trend by enhancing existing wetlands and restoring previously drained ones on the land they manage.

16. In your opinion, what would motivate landowners in your region to participate in wetland enhancement and restoration activities on their land?
For each incentive, please check the box that corresponds with your answer.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Don't know
Public recognition (e.g., signage on property, stewardship banquets and awards, etc.)	☐	☐	☐	☐	☐	☐
Concern over loss of wetlands in this region	☐	☐	☐	☐	☐	☐
More information on how the decline in wetland area affects them personally	☐	☐	☐	☐	☐	☐
Access to technical assistance and information	☐	☐	☐	☐	☐	☐
If neighbours undertook this type of practice	☐	☐	☐	☐	☐	☐
A one-time payment to offset initial cost of enhancement or restoration	☐	☐	☐	☐	☐	☐
A small annual payment to acknowledge their environmental service provision to society and to help cover loss of revenue	☐	☐	☐	☐	☐	☐
Other (please specify): _____	☐	☐	☐	☐	☐	☐

Section 4: Incentives for Enhancing & Restoring Wetlands

Suppose that in an effort to enhance and restore wetlands within and adjacent to the Upper Thames River watershed, the government offered a voluntary program that provided incentives (e.g., payments, public recognition) to landowners to set aside some of their lands. This land could be (i) converted to meadow or trees to help retain nearby wetlands; or (ii) converted directly into wetlands if appropriate.

PROGRAM CONDITIONS:

Participating landowners would:

- Sign a 5-year contract to enroll some of their land and receive annual payments (to help compensate for lost income & acknowledge provision of an environmental service to society).
- Have the opportunity to renew the contract, or transfer/terminate it if the land is sold.
- Enroll land that is in addition to existing commitments under government or non-government programs and legal requirements.
- Have a say in what type of land conversion activities are implemented (i.e. whether to convert land to meadow, trees, or wetlands). All capital/material costs would be paid for by the government (on top of any financial incentive to you).

We would now like to ask you to evaluate several program options.

On each of the next few pages, you'll be presented with a set of 2 voluntary programs considered by the government. We ask you to choose between PROGRAM A, PROGRAM B, or NO PROGRAM.

PROGRAM CHARACTERISTICS:

Each program is described by the following range of PROGRAM CHARACTERISTICS:

Type of land to be converted	➡ land can be Productive or Marginal (i.e., less fertile) farmland
Conversion activity	➡ land can be converted to Meadow, Trees, or Wetland
Number of acres	➡ area converted can be 1, 3, or 5 acres
Public recognition	➡ can be Yes or No, depending on whether or not **signage** on property, stewardship **banquets**, & **awards** are provided.
Annual payments to you	➡ can be $50 to $550 per acre per year (to help compensate you for any lost income and to acknowledge your provision of an environmental service to society).

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.

SET 1:

17a. If the following program options were the only ones available to you, which one would you choose?

Please check the box that corresponds with your answer.

PROGRAM CHARACTERISTICS	PROGRAM A	PROGRAM B	NO PROGRAM
Type of land to be converted	Marginal	Marginal	---
Conversion activity	Wetland	Meadow	---
Number of acres	5 acres	3 acres	---
Public recognition	Yes	No	---
Annual payments to you	$450/acre	$450/acre	$0/acre
Please choose only one →	☐	☐	☐

17b. On a scale 1 to 10, how certain are you about the program choice you made above?

*Please circle the number that best represents your answer if **1 equals not at all certain** and **10 equals very certain**.*

1	2	3	4	5	6	7	8	9	10
Not at all certain				Somewhat certain					Very certain

SET 2:

18a. If the following program options were the only ones available to you, which one would you choose?

Please check the box that corresponds with your answer.

Program Characteristics	Program A	Program B	No Program
Type of land to be converted	Productive	Marginal	---
Conversion activity	Trees	Trees	---
Number of acres	3 acres	5 acres	---
Public recognition	Yes	No	---
Annual payments to you	$250/acre	$150/acre	$0/acre
Please choose only one →	☐	☐	☐

18b. On a scale 1 to 10, how certain are you about the program choice you made above?

*Please circle the number that best represents your answer if **1 equals not at all certain** and **10 equals very certain**.*

1	2	3	4	5	6	7	8	9	10
Not at all certain				Somewhat certain					Very certain

SET 3:

19a. If the following program options were the only ones available to you, which one would you choose?

Please check the box that corresponds with your answer.

PROGRAM CHARACTERISTICS	PROGRAM A	PROGRAM B	NO PROGRAM
Type of land to be converted	Productive	Marginal	---
Conversion activity	Meadow	Wetland	---
Number of acres	1 acre	1 acre	---
Public recognition	Yes	No	---
Annual payments to you	$150/acre	$550/acre	$0/acre
Please choose only one →	☐	☐	☐

19b. On a scale 1 to 10, how certain are you about the program choice you made above?

*Please circle the number that best represents your answer if **1 equals not at all certain** and **10 equals very certain**.*

1	2	3	4	5	6	7	8	9	10
Not at all certain				Somewhat certain					Very certain

SET 4:

20a. If the following program options were the only ones available to you, which one would you choose?

Please check the box that corresponds with your answer.

Program Characteristics	Program A	Program B	No Program
Type of land to be converted	Marginal	Productive	---
Conversion activity	Trees	Meadow	---
Number of acres	1 acre	3 acres	---
Public recognition	No	Yes	---
Annual payments to you	$350/acre	$50/acre	$0/acre
Please choose only one →	☐	☐	☐

20b. On a scale 1 to 10, how certain are you about the program choice you made above?

*Please circle the number that best represents your answer if **1 equals not at all certain** and **10 equals very certain**.*

1	2	3	4	5	6	7	8	9	10
Not at all certain				Somewhat certain					Very certain

SET 5:

21a. If the following program options were the only ones available to you, which one would you choose?

Please check the box that corresponds with your answer.

PROGRAM CHARACTERISTICS	PROGRAM A	PROGRAM B	NO PROGRAM
Type of land to be converted	Marginal	Marginal	---
Conversion activity	Meadow	Trees	---
Number of acres	5 acres	5 acres	---
Public recognition	No	Yes	---
Annual payments to you	$50/acre	$350/acre	$0/acre
Please choose only one →	☐	☐	☐

21b. On a scale 1 to 10, how certain are you about the program choice you made above?

*Please circle the number that best represents your answer if **1 equals not at all certain** and **10 equals very certain**.*

1	2	3	4	5	6	7	8	9	10
Not at all certain				Somewhat certain					Very certain

SET 6:

22a. If the following program options were the only ones available to you, which one would you choose?

Please check the box that corresponds with your answer.

Program Characteristics	Program A	Program B	No Program
Type of land to be converted	Productive	Productive	---
Conversion activity	Wetland	Wetland	---
Number of acres	3 acres	1 acre	---
Public recognition	No	Yes	---
Annual payments to you	$550/acre	$250/acre	$0/acre
Please choose only one →	☐	☐	☐

22b. On a scale 1 to 10, how certain are you about the program choice you made above?

*Please circle the number that best represents your answer if **1 equals not at all certain** and **10 equals very certain**.*

1	2	3	4	5	6	7	8	9	10
Not at all certain				Somewhat certain					Very certain

23. If you chose "NO PROGRAM" for any of the previous sets, please check the box that best explains why you chose this option. *Please check **one** box only.*

"The annual payments were too low"	☐
"I believe these projects would lower my property value"	☐
"The amount of land involved was too large"	☐
"The amount of land involved was too small"	☐
"I do not think retaining or restoring wetlands is an important issue"	☐
"The 5-year contract length was too restrictive"	☐
"I don't trust the government"	☐
Other: _____	☐

24. If you chose either "PROGRAM A" or "PROGRAM B" for any of the previous sets, please check the box that best explains why you chose this option.

*Please check **one** box only.*

"The annual payments were the main reason for my choices"	☐
"We should restore wetlands regardless of the payment levels"	☐
"The public recognition of my conservation effort was the main reason for my choices"	☐
"It's equally important to provide payments and recognition to landowners who restore wetlands in my area"	☐
Other: _____	☐

25. If you chose either "PROGRAM A" or "PROGRAM B" for any of the previous sets, please check the box that indicates your preferred renewable contract length.

*Please check **one** box only.*

☐ 1 year ☐ 10 years ☐ 20 years
☐ 5 years ☐ 15 years ☐ More than 20 years

Section 5: Your Personal Characteristics

26. What is your gender?

☐ Female ☐ Male

27. In what year were you born? _____

28. What is the highest level of education that you have completed?
*Please check **one** box only.*

☐ Elementary school ☐ Post-secondary (diploma or bachelor's degree)
☐ High school ☐ Graduate or professional degree (e.g. law, MD, masters, or PhD)

29. Which of the following best describes your present employment status?
*Please check **one** box only*.

☐ Working full time ☐ Retired ☐ Student
☐ Working part time ☐ Unemployed

30. Are you a member of any of the following types or organizations or associations?
*Please check **all** boxes that apply.*

☐ Environmental/conservation ☐ Farmer
☐ Hunting/fishing ☐ Woodlot
☐ ATV/snowmobile ☐ Other: _____

31. What is your best estimate of your total household income (before taxes) over the past 12 months? *Please check **one** box only.*

☐ Less than $10,000 ☐ $30,000 to $49,999 ☐ $75,000 to $99,999
☐ $10,000 to $29,999 ☐ $50,000 to $74,999 ☐ More than $100,000

32. What percentage of your household income is from on-farm sources (i.e. crop / livestock)?

☐ 0 % ☐ 1 to 24 % ☐ 25 to 49 % ☐ 50 to 74 % ☐ 75 to 99 % ☐ 100 %

33. What is your postal code and rural route number (example: RR 1)?

Postal Code: _____ Route Number: _____

34. How would you describe your household's debt load? *Please check **one** box only.*

☐ Debt free ☐ Low ☐ Moderate ☐ High

End of Survey. Thank You!

Please place the completed survey in the postage-paid envelope and drop it off in the mail.

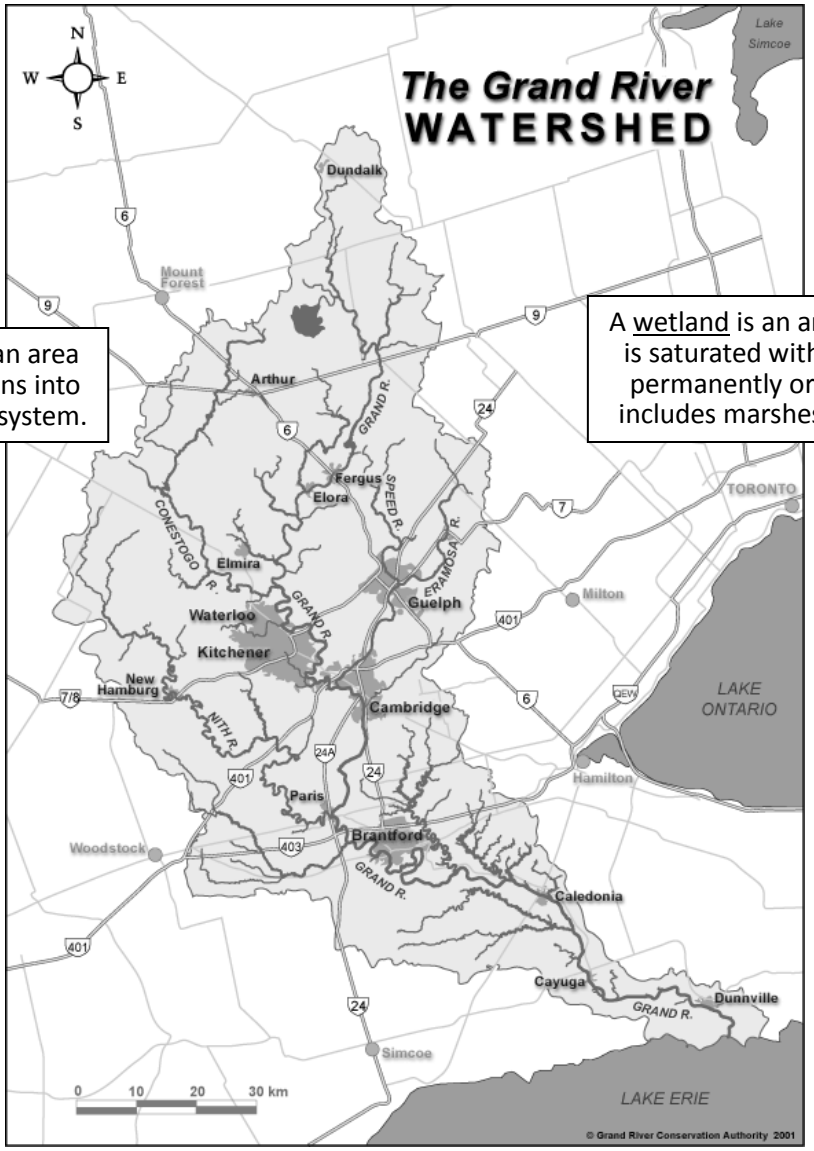
To be entered into the draw for one of three $100 Visa gift cards, please fill out the ballot at the bottom of the cover letter, detach, and return it with your completed survey.

Appendix D: Landowner Survey for the Grand River Watershed

Survey of Farmer Views on Wetland Enhancement and Restoration in & near the Grand River Watershed

A watershed is an area of land that drains into a common river system.

A wetland is an area of land that is saturated with water, either permanently or seasonally. It includes marshes and swamps.



When you have completed this survey, please place it in the postage-paid envelope provided in your survey package and drop it off in the mail. Thank you!

Section 1: Your Land

1. Which county or municipality do you live in? *Please check **one** box only.*

☐ Dufferin County ☐ Regional Municipality of Waterloo
☐ Wellington County ☐ Oxford County
☐ Haldimand County ☐ Brant County
☐ Perth County ☐ Other (Please specify): _____

2. What is the total area of land that you own inside and outside the Grand River watershed (if needed, consult the map on the back of the cover letter)?

Please indicate the number of acres in the spaces provided.

Inside: _____ Acres
Outside: _____ Acres

3. When did you first obtain land in the region? *Please check **one** box only.*

☐ Before 1970 ☐ 1981-1990 ☐ 2001-2006 ☐ Not Applicable
☐ 1970-1980 ☐ 1991-2000 ☐ 2007-2013

4. What is the primary use of the land you own? *Please check **one** box only.*

☐ Agriculture ☐ Residence
☐ Forestry ☐ Other: _____

5. If you generated income from your land over the past 5 years, is it from any of the following? *Please check **all** boxes that apply.*

☐ Farming ☐ Leasing land for recreation ☐ Not applicable
☐ Forestry ☐ Leasing land for farming or forestry ☐ Other: _____
☐ Leasing land for hunting ☐ Development/sale of your land _____

6. What will likely happen to your land after you retire? *Please check **one** box only.*

☐ Sell ☐ Give to land trust ☐ Have not started planning for retirement
☐ Give to family ☐ Don't know ☐ Other: _____

7. People own land for many different reasons. How important are each of the following reasons to you? *For each reason, please check the box that corresponds with your answer.*

	Very important	Important	Neither important or unimportant	Of little importance	Un-important	Don't know
To make a living (farm, forest, or other income)	☐	☐	☐	☐	☐	☐
To complement my income	☐	☐	☐	☐	☐	☐
As an investment for future gain	☐	☐	☐	☐	☐	☐
As a location for my permanent residence	☐	☐	☐	☐	☐	☐
For recreation (hunting, fishing, walking, etc.)	☐	☐	☐	☐	☐	☐
To maintain a family legacy	☐	☐	☐	☐	☐	☐
For the sake of our future generations	☐	☐	☐	☐	☐	☐
To preserve ecosystems	☐	☐	☐	☐	☐	☐

8. Which of the following features do you have on your land?
*Please check **all** boxes that apply.*

☐ Crop ☐ Pasture ☐ Meadows
☐ Orchard ☐ Forests ☐ Other: _____

9a. Do you have wetlands on your land?

☐ Yes ➡ *If yes, please continue with question **9b***
☐ No ➡ *If no, please skip to question **10***

9b. Did you create, or have you enhanced, any of these wetlands? *Check **all** boxes that apply.*

☐ Created them ☐ Enhanced them ☐ No

9c. If you created or enhanced any wetlands on your land, please explain what you did and how it was funded. *If you answered 'No' to question **9b** please skip to question **10**.*

_____

_____

_____

Section 2: Your Land Management

10. How many acres of your land are currently left untilled or dedicated to other land cover types, and how have these areas changed since 2006?

Please indicate your answers using the spaces provided below. For any specific land cover type that does not apply to your situation, please leave the associated space blank.

Land cover type	# of acres now	Change since 2006	
		Increase (acres)	Decrease (acres)
Land left untilled	_____	_____	_____
Fence line	_____	_____	_____
Wind break	_____	_____	_____
Trees	_____	_____	_____
Shrub land meadow	_____	_____	_____
Ditch	_____	_____	_____
Wet area / Wetland	_____	_____	_____
Other conservation measure: _____	_____	_____	_____
_____			

11. Have you ever received financial incentives or cost-share payments from any of the following programs for implementing conservation measures on your land?

*Please check **all** boxes that apply.*

- ☐ Stewardship Program offered by the local Conservation Authority
- ☐ Environmental Farm Plan
- ☐ I have not received financial assistance from any program
- ☐ Ducks Unlimited Wetland Retention or Restoration Programs
- ☐ Other: _____
  _____

12. To what extent do you agree or disagree with each of the following statements about your landowner rights?

For each statement, please check the box that corresponds with your answer.

As a landowner, I have the **right** to…	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
…restrict others' access to my land	☐	☐	☐	☐	☐	☐
…transfer ownership of my land to others without restriction	☐	☐	☐	☐	☐	☐
…do whatever I want with my land without regard for others	☐	☐	☐	☐	☐	☐
…do anything with my land as long as my actions do not infringe upon neighbours' rights	☐	☐	☐	☐	☐	☐
…do anything with my land as long as my actions do not conflict with the interests and values of the local community	☐	☐	☐	☐	☐	☐

13. To what extent do you agree or disagree with each of the following statements about your landowner responsibilities?

For each statement, please check the box that corresponds with your answer.

As a landowner, I have the **responsibility** to…	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
… be a good steward of my land and to maintain it in a good condition for future generations	☐	☐	☐	☐	☐	☐
… leave the land in a better condition than when I acquired it	☐	☐	☐	☐	☐	☐
… take into account the values and interests of society at large when making decisions about my land	☐	☐	☐	☐	☐	☐

Section 3: Wetland Management

Information: Wetland Benefits

Wetlands in your area provide a number of benefits to the community, including:

- ***Water quality:*** Wetlands help purify water.
- ***Flood, drought, and erosion control:*** Wetlands help control flooding and erosion, as well as reduce the impacts of drought.
- ***Wildlife habitat:*** Wetlands provide habitat for native and/or endangered plant and wildlife species (both on land and in water).
- ***Carbon storage:*** Wetlands store carbon helping to slow climate change.
- ***Recreation and education:*** Wetlands provide recreational and educational opportunities.

14. How <u>important</u> are the following wetland benefits in your area to you?
*Please check **<u>one</u>** box per item.*

	Very important	Somewhat important	Not important	No opinion
Water quality	☐	☐	☐	☐
Flood, drought, and erosion control	☐	☐	☐	☐
Wildlife habitat	☐	☐	☐	☐
Carbon storage	☐	☐	☐	☐
Recreation and education	☐	☐	☐	☐

15. How would you describe the <u>current state</u> of wetlands in your area?
*Please check **<u>one</u>** box per item.*

	Excellent	Good	Fair	Marginal	Don't know
Quantity (amount) of wetlands	☐	☐	☐	☐	☐
Quality (health) of wetlands	☐	☐	☐	☐	☐
Accessibility to view wetlands	☐	☐	☐	☐	☐

Information: Decline in Wetland Area

- The area of wetlands in and around the Grand River watershed has declined significantly over the past century, largely due to human activities such as expansion of urban areas, agriculture, and industrial developments.
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For each incentive, please check the box that corresponds with your answer.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Don't know
Public recognition (e.g., signage on property, stewardship banquets and awards, etc.)	☐	☐	☐	☐	☐	☐
Concern over loss of wetlands in this region	☐	☐	☐	☐	☐	☐
More information on how the decline in wetland area affects them personally	☐	☐	☐	☐	☐	☐
Access to technical assistance and information	☐	☐	☐	☐	☐	☐
If neighbours undertook this type of practice	☐	☐	☐	☐	☐	☐
A one-time payment to offset initial cost of enhancement or restoration	☐	☐	☐	☐	☐	☐
A small annual payment to acknowledge their environmental service provision to society and to help cover loss of revenue	☐	☐	☐	☐	☐	☐
Other (please specify): _____	☐	☐	☐	☐	☐	☐

Section 4: Incentives for Enhancing & Restoring Wetlands

Suppose that in an effort to enhance and restore wetlands within and adjacent to the Grand River watershed, the government offered a voluntary program that provided incentives (e.g., payments, public recognition) to landowners to set aside some of their lands. This land could be (i) converted to meadow or trees to help retain nearby wetlands; or (ii) converted directly into wetlands if appropriate.

PROGRAM CONDITIONS:

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- Have the opportunity to renew the contract, or transfer/terminate it if the land is sold.
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Number of acres	➡ area converted can be 1, 3, or 5 acres
Public recognition	➡ can be Yes or No, depending on whether or not **signage** on property, stewardship **banquets**, & **awards** are provided.
Annual payments to you	➡ can be $50 to $550 per acre per year (to help compensate you for any lost income and to acknowledge your provision of an environmental service to society).

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.

SET 1:

17a. If the following program options were the only ones available to you, which one would you choose?

Please check the box that corresponds with your answer.

PROGRAM CHARACTERISTICS	PROGRAM A	PROGRAM B	NO PROGRAM
Type of land to be converted	Marginal	Marginal	---
Conversion activity	Wetland	Meadow	---
Number of acres	5 acres	3 acres	---
Public recognition	Yes	No	---
Annual payments to you	$450/acre	$450/acre	$0/acre
Please choose only one →	☐	☐	☐

17b. On a scale 1 to 10, how certain are you about the program choice you made above?

*Please circle the number that best represents your answer if **1 equals not at all certain** and **10 equals very certain**.*

1	2	3	4	5	6	7	8	9	10
Not at all certain				Somewhat certain					Very certain

SET 2:

18a. If the following program options were the only ones available to you, which one would you choose?

Please check the box that corresponds with your answer.

Program Characteristics	Program A	Program B	No Program
Type of land to be converted	Productive	Marginal	---
Conversion activity	Trees	Trees	---
Number of acres	3 acres	5 acres	---
Public recognition	Yes	No	---
Annual payments to you	$250/acre	$150/acre	$0/acre
Please choose only one →	☐	☐	☐

18b. On a scale 1 to 10, how certain are you about the program choice you made above?

*Please circle the number that best represents your answer if **1 equals not at all certain** and **10 equals very certain**.*

1	2	3	4	5	6	7	8	9	10
Not at all certain				Somewhat certain					Very certain

SET 3:

19a. If the following program options were the only ones available to you, which one would you choose?

Please check the box that corresponds with your answer.

PROGRAM CHARACTERISTICS	PROGRAM A	PROGRAM B	NO PROGRAM
Type of land to be converted	Productive	Marginal	---
Conversion activity	Meadow	Wetland	---
Number of acres	1 acre	1 acre	---
Public recognition	Yes	No	---
Annual payments to you	$150/acre	$550/acre	$0/acre
Please choose only one	☐	☐	☐

19b. On a scale 1 to 10, how certain are you about the program choice you made above?

*Please circle the number that best represents your answer if **1 equals not at all certain** and **10 equals very certain**.*

1	2	3	4	5	6	7	8	9	10
Not at all certain				Somewhat certain					Very certain

SET 4:

20a. If the following program options were the only ones available to you, which one would you choose?

Please check the box that corresponds with your answer.

Program Characteristics	Program A	Program B	No Program
Type of land to be converted	Marginal	Productive	---
Conversion activity	Trees	Meadow	---
Number of acres	1 acre	3 acres	---
Public recognition	No	Yes	---
Annual payments to you	$350/acre	$50/acre	$0/acre
Please choose only one →	☐	☐	☐

20b. On a scale 1 to 10, how certain are you about the program choice you made above?

*Please circle the number that best represents your answer if **1 equals not at all certain** and **10 equals very certain**.*

1	2	3	4	5	6	7	8	9	10
Not at all certain				Somewhat certain					Very certain

SET 5:

21a. If the following program options were the only ones available to you, which one would you choose?

Please check the box that corresponds with your answer.

PROGRAM CHARACTERISTICS	PROGRAM A	PROGRAM B	NO PROGRAM
Type of land to be converted	Marginal	Marginal	---
Conversion activity	Meadow	Trees	---
Number of acres	5 acres	5 acres	---
Public recognition	No	Yes	---
Annual payments to you	$50/acre	$350/acre	$0/acre
Please choose only one →	☐	☐	☐

21b. On a scale 1 to 10, how certain are you about the program choice you made above?

*Please circle the number that best represents your answer if **1 equals not at all certain** and **10 equals very certain**.*

1	2	3	4	5	6	7	8	9	10
Not at all certain				Somewhat certain					Very certain

SET 6:

22a. If the following program options were the only ones available to you, which one would you choose?

Please check the box that corresponds with your answer.

Program Characteristics	Program A	Program B	No Program
Type of land to be converted	Productive	Productive	---
Conversion activity	Wetland	Wetland	---
Number of acres	3 acres	1 acre	---
Public recognition	No	Yes	---
Annual payments to you	$550/acre	$250/acre	$0/acre
Please choose only one →	☐	☐	☐

22b. On a scale 1 to 10, how certain are you about the program choice you made above?

*Please circle the number that best represents your answer if **1 equals not at all certain** and **10 equals very certain**.*

1	2	3	4	5	6	7	8	9	10
Not at all certain				Somewhat certain					Very certain

23. If you chose "NO PROGRAM" for any of the previous sets, please check the box that best explains why you chose this option. *Please check **one** box only.*

"The annual payments were too low"	☐
"I believe these projects would lower my property value"	☐
"The amount of land involved was too large"	☐
"The amount of land involved was too small"	☐
"I do not think retaining or restoring wetlands is an important issue"	☐
"The 5-year contract length was too restrictive"	☐
"I don't trust the government"	☐
Other: _____	☐

24. If you chose either "PROGRAM A" or "PROGRAM B" for any of the previous sets, please check the box that best explains why you chose this option.

*Please check **one** box only.*

"The annual payments were the main reason for my choices"	☐
"We should restore wetlands regardless of the payment levels"	☐
"The public recognition of my conservation effort was the main reason for my choices"	☐
"It's equally important to provide payments and recognition to landowners who restore wetlands in my area"	☐
Other: _____	☐

25. If you chose either "PROGRAM A" or "PROGRAM B" for any of the previous sets, please check the box that indicates your preferred renewable contract length.

*Please check **one** box only.*

☐ 1 year ☐ 10 years ☐ 20 years
☐ 5 years ☐ 15 years ☐ More than 20 years

Section 5: Your Personal Characteristics

26. What is your gender?

☐ Female ☐ Male

27. In what year were you born? _____

28. What is the highest level of education that you have completed?
*Please check **one** box only.*

☐ Elementary school ☐ Post-secondary (diploma or bachelor's degree)
☐ High school ☐ Graduate or professional degree (e.g. law, MD, masters, or PhD)

29. Which of the following best describes your present employment status?
*Please check **one** box only*.

☐ Working full time ☐ Retired ☐ Student
☐ Working part time ☐ Unemployed

30. Are you a member of any of the following types or organizations or associations?
*Please check **all** boxes that apply.*

☐ Environmental/conservation ☐ Farmer
☐ Hunting/fishing ☐ Woodlot
☐ ATV/snowmobile ☐ Other: _____

31. What is your best estimate of your total household income (before taxes) over the past 12 months? *Please check **one** box only.*

☐ Less than $10,000 ☐ $30,000 to $49,999 ☐ $75,000 to $99,999
☐ $10,000 to $29,999 ☐ $50,000 to $74,999 ☐ More than $100,000

32. What percentage of your household income is from on-farm sources (i.e. crop / livestock)?

☐ 0 % ☐ 1 to 24 % ☐ 25 to 49 % ☐ 50 to 74 % ☐ 75 to 99 % ☐ 100 %

33. What is your postal code and rural route number (example: RR 1)?

Postal Code: _____ Route Number: _____

34. How would you describe your household's debt load? *Please check **one** box only.*

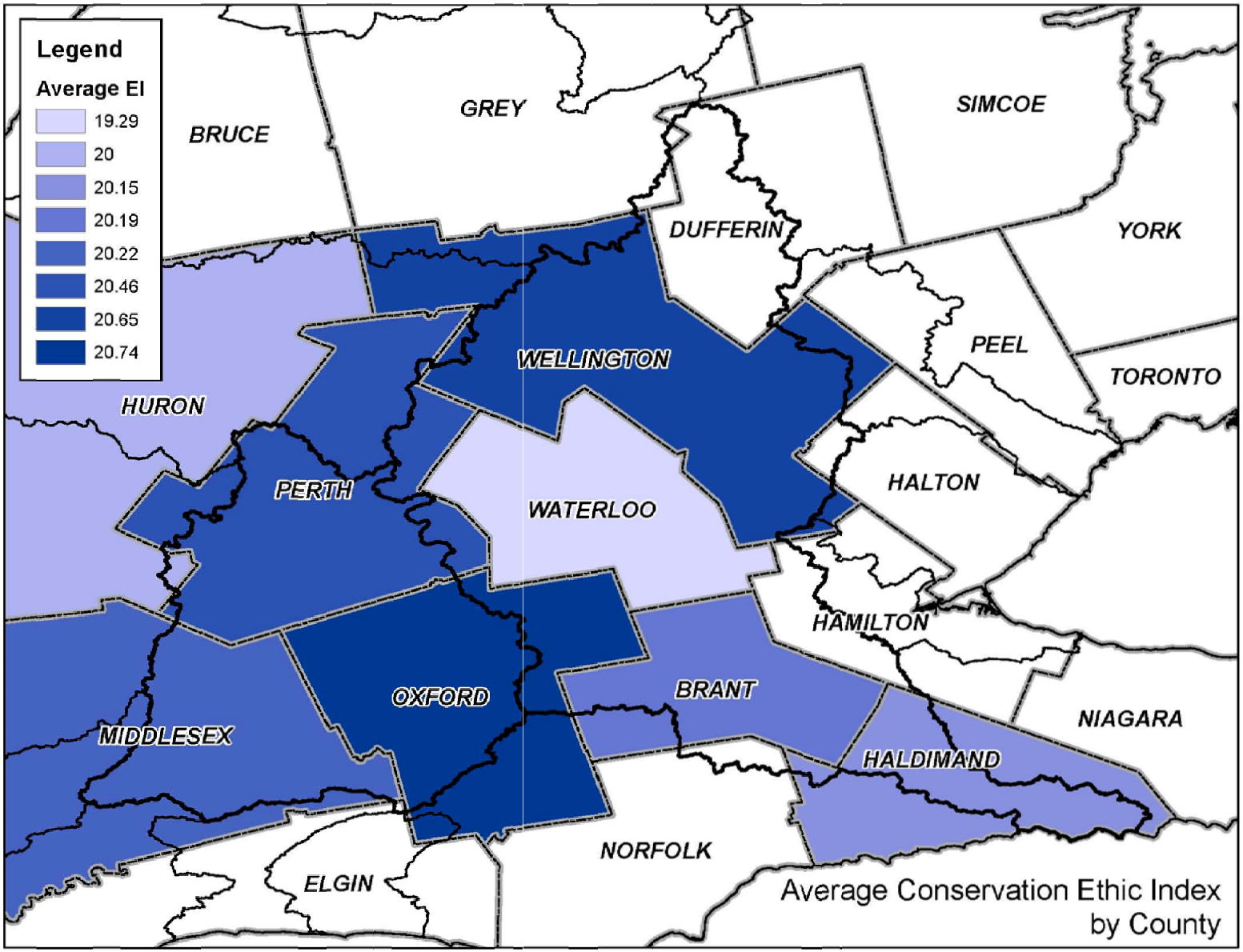
☐ Debt free ☐ Low ☐ Moderate ☐ High

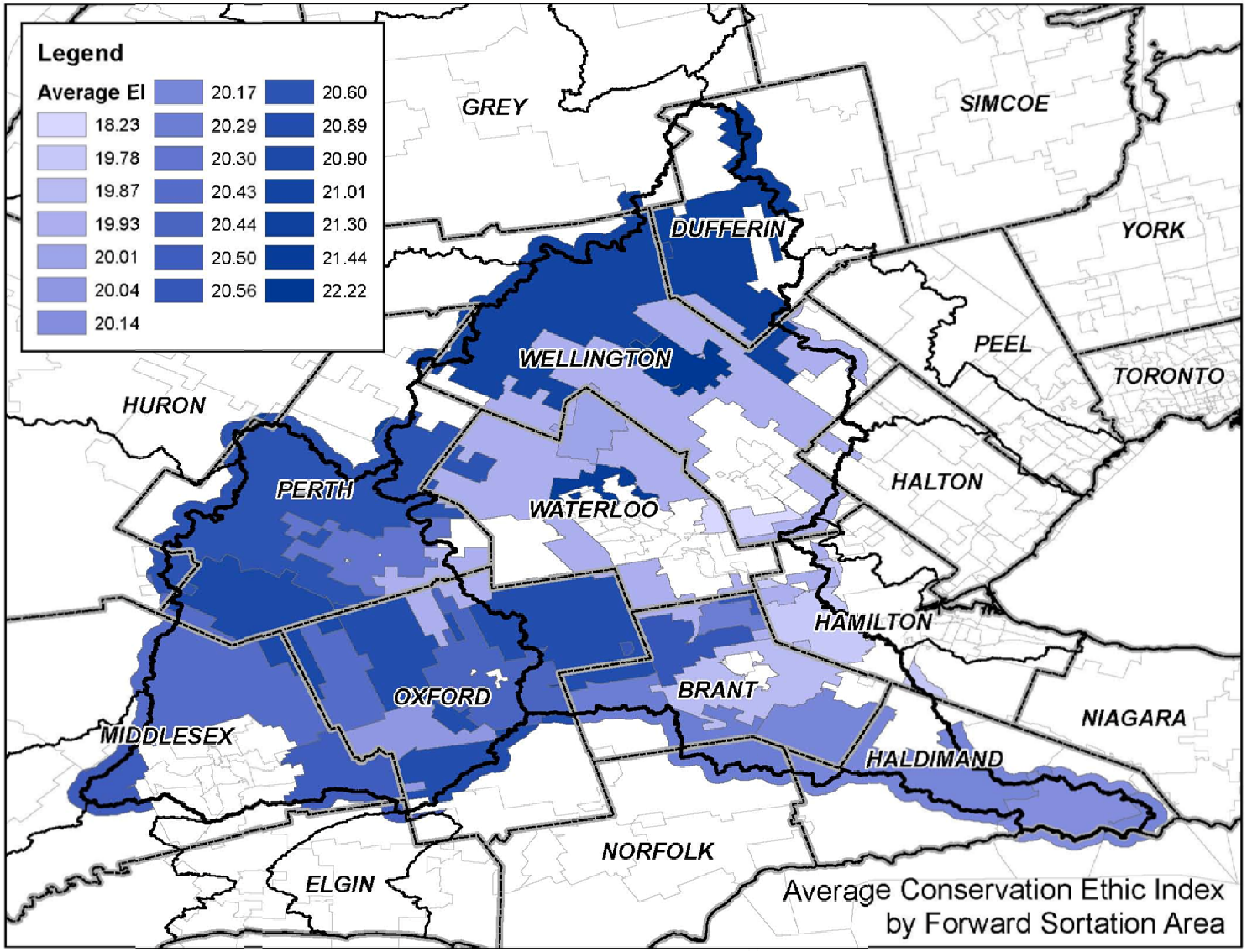
End of Survey. Thank You!

Please place the completed survey in the postage-paid envelope and drop it off in the mail.

To be entered into the draw for one of three $100 Visa gift cards, please fill out the ballot at the bottom of the cover letter, detach, and return it with your completed survey.

Appendix E: Maps Showing the Geographic Distribution of Average Conservation Ethic Index Scores


Legend
Average EI
19.29
20
20.15
20.19
20.22
20.46
20.65
20.74
BRUCE
GREY
SIMCOE
DUFFERIN
YORK
PEEL
TORONTO
WELLINGTON
HURON
PERTH
WATERLOO
HALTON
HAMILTON
OXFORD
BRANT
NIAGARA
MIDDLESEX
HALDIMAND
NORFOLK
ELGIN
Average Conservation Ethic Index
by County


Legend
Average EI
18.23
19.78
19.87
19.93
20.01
20.04
20.14
20.17
20.29
20.30
20.43
20.44
20.50
20.56
20.60
20.89
20.90
21.01
21.30
21.44
22.22
GREY
SIMCOE
DUFFERIN
YORK
PEEL
TORONTO
WELLINGTON
HURON
PERTH
WATERLOO
HALTON
HAMILTON
OXFORD
BRANT
NIAGARA
MIDDLESEX
HALDIMAND
NORFOLK
ELGIN
Average Conservation Ethic Index
by Forward Sortation Area

Appendix F: Summary of Survey Results for Farm Respondents

Appendix F: Summary of Survey Results for Farm Respondents

Descriptive Statistics (Farm Respondents)

	N	Minimum	Maximum	Mean	Std. Deviation
Total Land Owned	626	100.00	3050.00	268.0796	281.70908
Age Computed	607	23	91	54.26	13.910
Cons. Ethic Index	529	5	28	20.58	4.293
Conserv Land Increased	69	1.00	370.00	20.9275	57.26341
Conserv Land Decreased	51	1.00	243.00	26.2157	43.30326
Conserv Land Net Chg	99	-243.00	370.00	1.0808	61.37949
Valid N (listwise)	6				

Statistics

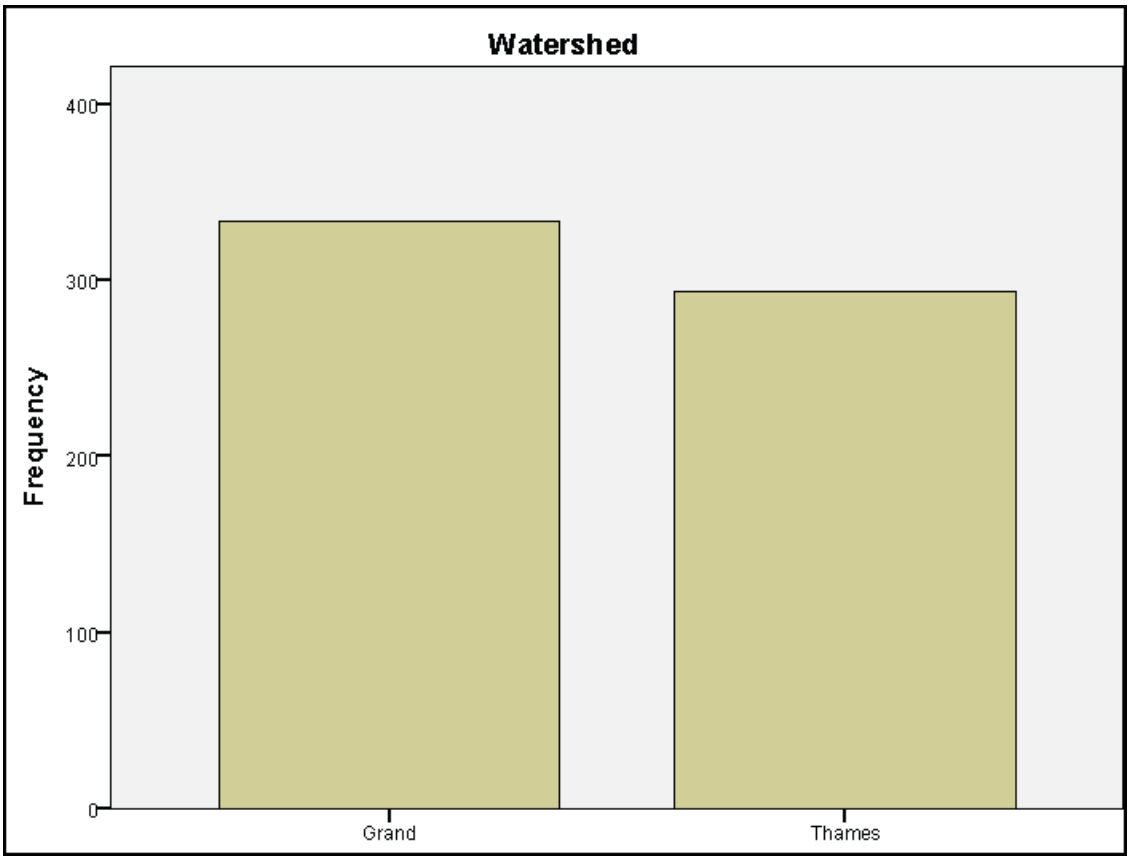
		region Watershed	q1_munic Municipality	q2_areat Total Land Owned	q3_lando Land First Obtained	q26_gend Gender
N	Valid	626	514	626	619	620
	Missing	0	112	0	7	6

		Age Age Computed	q28_educ Highest Education Attained	q31_inco Household Income	q32_onfa Reliance on Farm Income	q34_debt Debt Load
N	Valid	607	617	567	626	607
	Missing	19	9	59	0	19

		ei_total Cons. Ethic Index	q10_incr Conserv Land Increased	q10_decr Conserv Land Decreased	q10_net Conserv Land Net Chg
N	Valid	529	69	51	99
	Missing	97	557	575	527

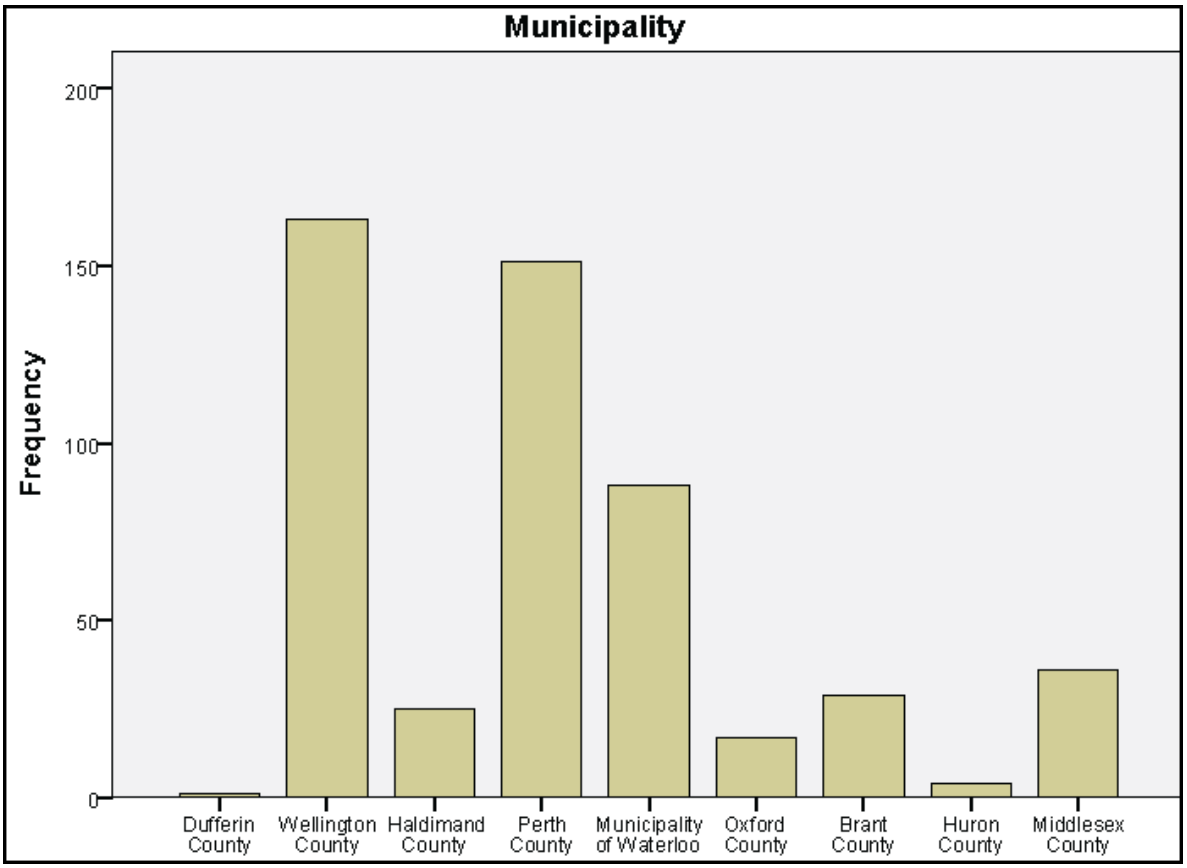
Watershed (Farm Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Grand	333	53.2	53.2	53.2
	Thames	293	46.8	46.8	100.0
	Total	626	100.0	100.0	



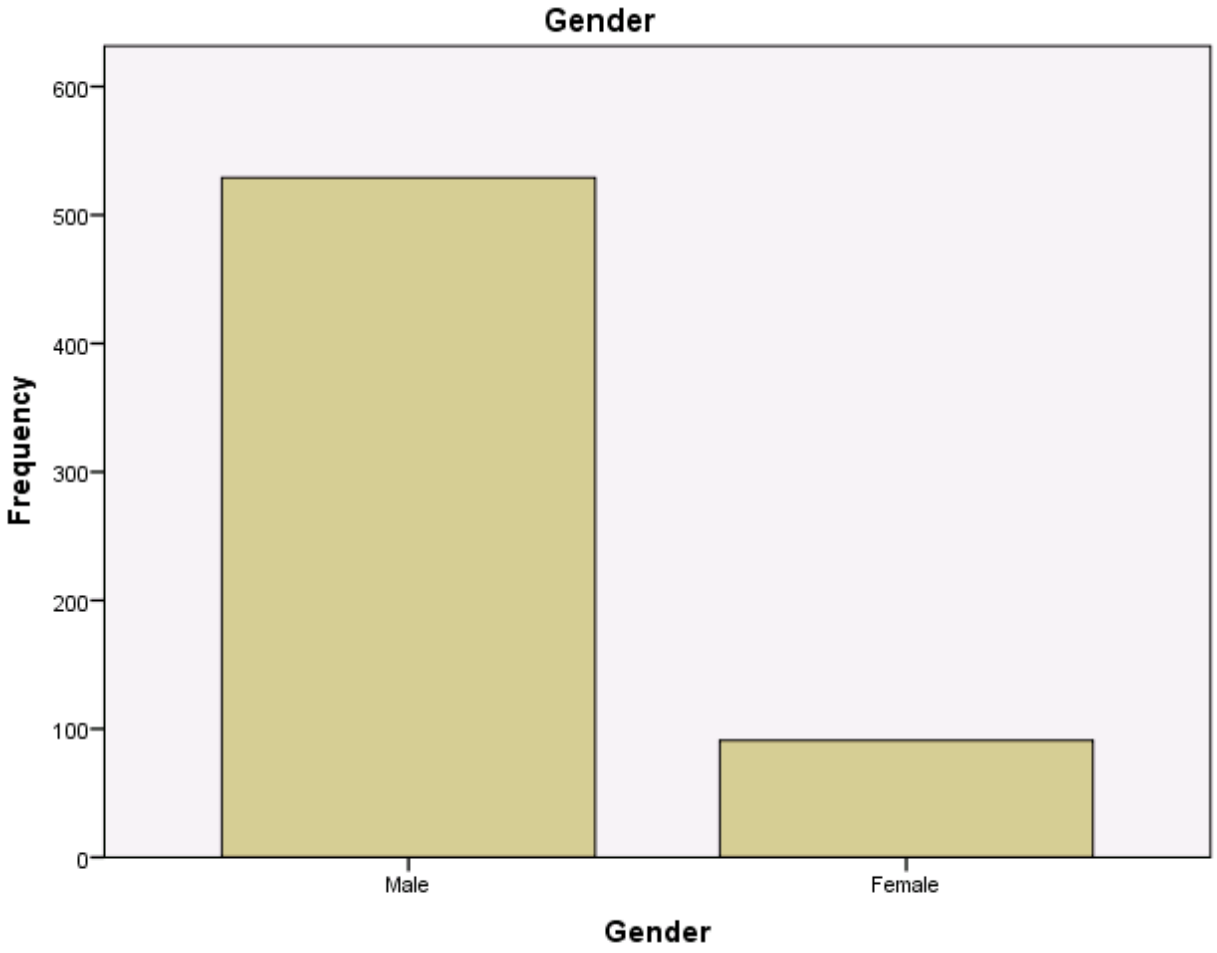
Municipality (Farm Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Dufferin County	1	.2	.2	.2
	2 Wellington County	163	26.0	31.7	31.9
	3 Haldimand County	25	4.0	4.9	36.8
	4 Perth County	151	24.1	29.4	66.1
	5 Municipality of Waterloo	88	14.1	17.1	83.3
	6 Oxford County	17	2.7	3.3	86.6
	7 Brant County	29	4.6	5.6	92.2
	9 Huron County	4	.6	.8	93.0
	11 Middlesex County	36	5.8	7.0	100.0
	Total	514	82.1	100.0	
Missing	8 Other (Grand River)	6	1.0		
	12 Other (Upper Thames)	103	16.5		
	99	3	.5		
	Total	112	17.9		
Total		626	100.0		



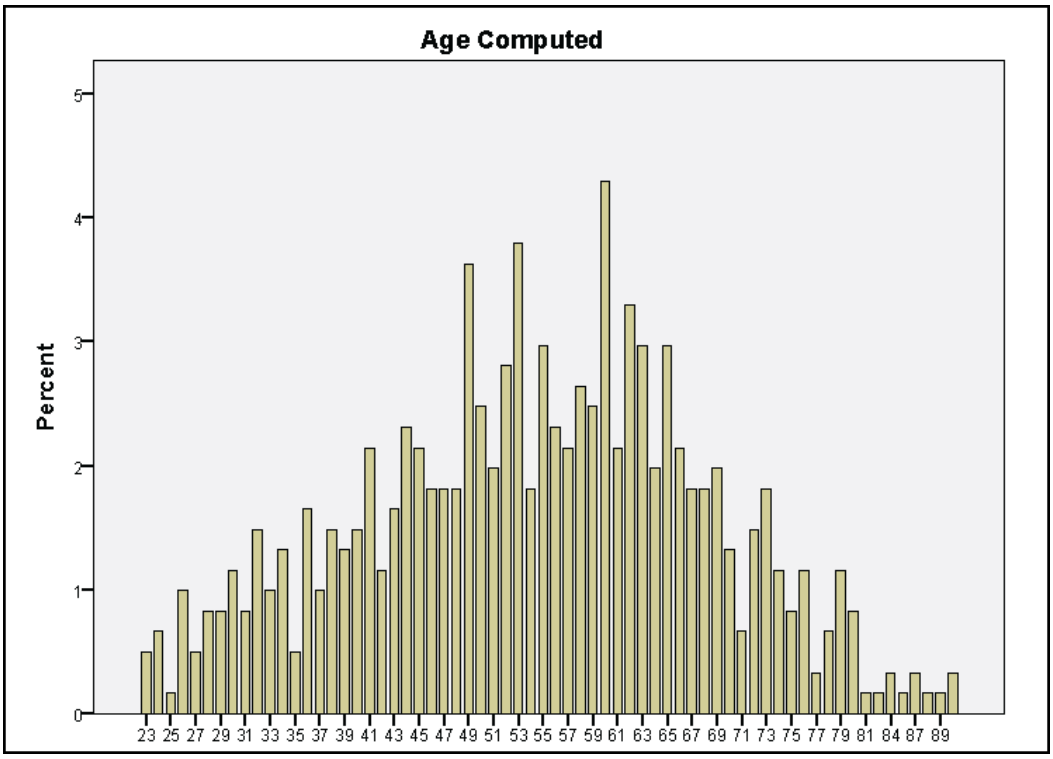
Gender (Farm Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 Male	529	84.5	85.3	85.3
	1 Female	91	14.5	14.7	100.0
	Total	620	99.0	100.0	
Missing	99	6	1.0		
Total		626	100.0		



Age Computed (Farm Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
	Total	607	97.0	100.0	
Missing	System	19	3.0		
Total		626	100.0		



Distribution of Age for Farmers (N = 607)
Min = 23, Max = 91, Mean = 54.3 and SD = 13.9

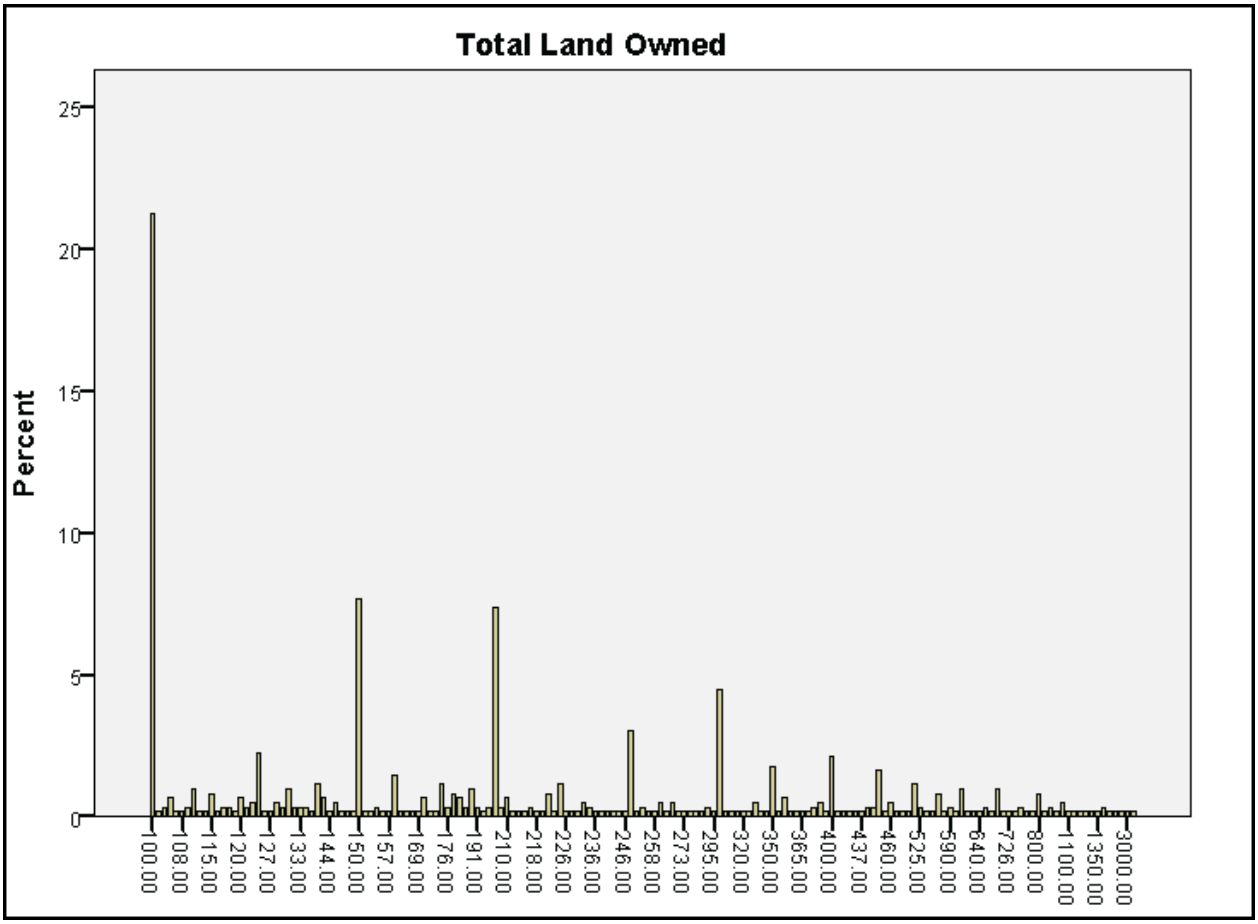
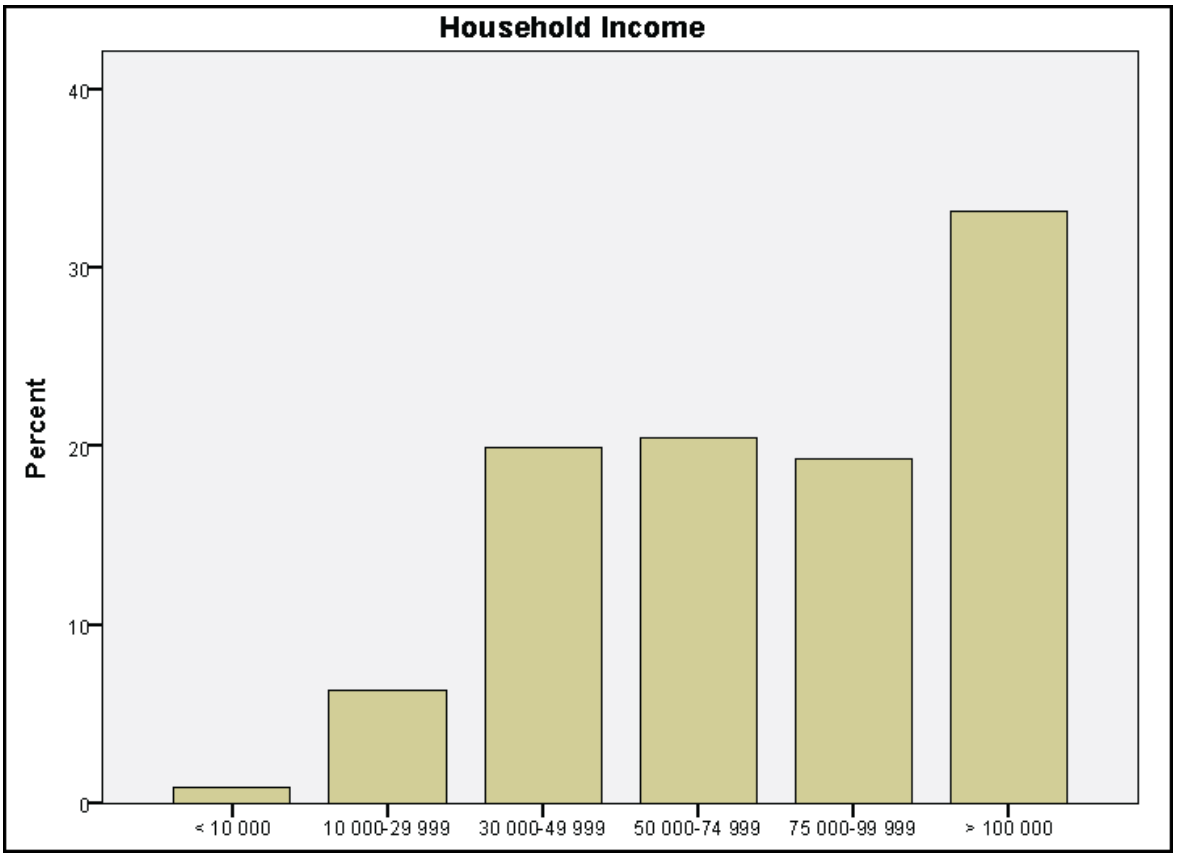


Figure 12: Distribution of Property Size for All Survey Respondents (N = 626)
Min = 100 acres, Max = 3,050 acres, Mean = 268.1 acres & SD = 281.7

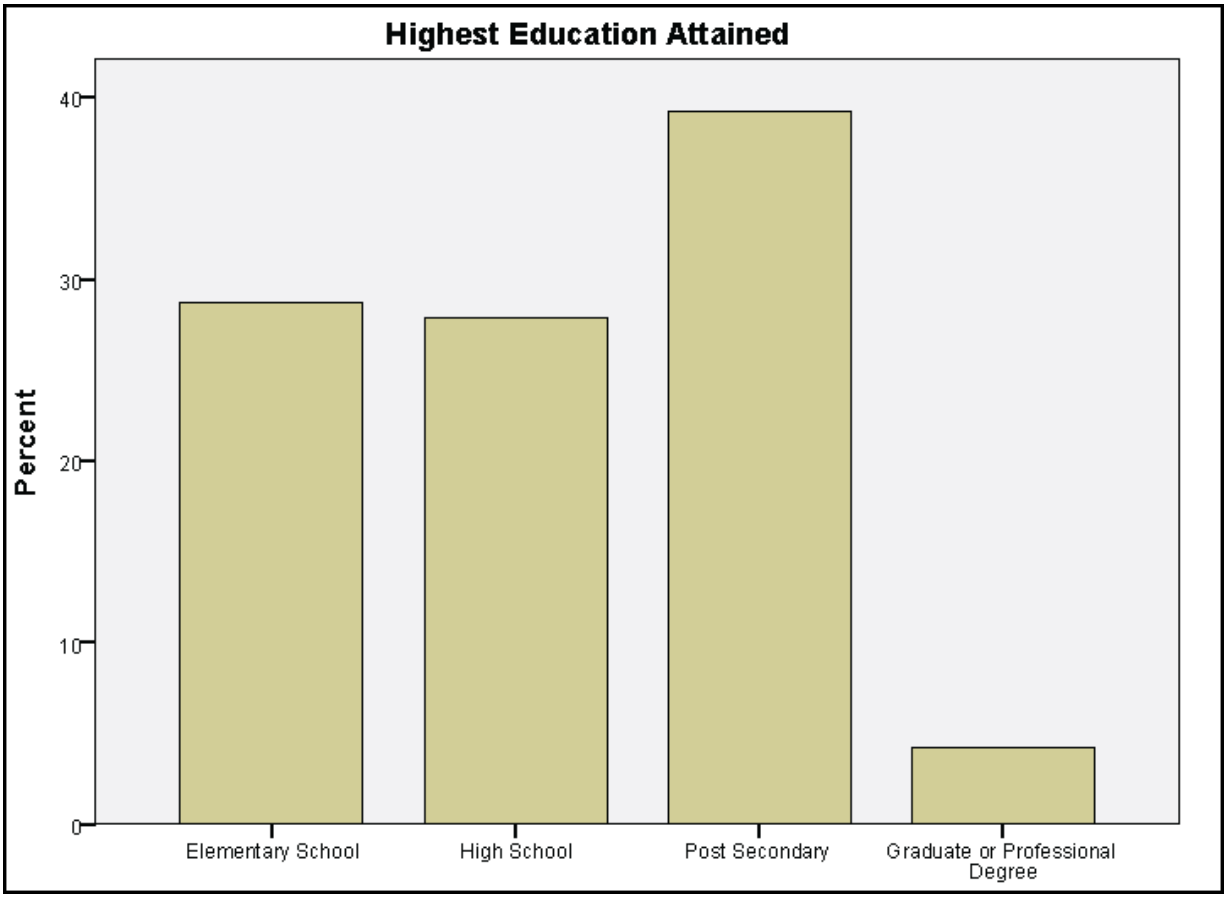
Household Income (Farm Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 < 10 000	5	.8	.9	.9
	2 10 000-29 999	36	5.8	6.3	7.2
	3 30 000-49 999	113	18.1	19.9	27.2
	4 50 000-74 999	116	18.5	20.5	47.6
	5 75 000-99 999	109	17.4	19.2	66.8
	6 > 100 000	188	30.0	33.2	100.0
	Total	567	90.6	100.0	
Missing	99	59	9.4		
Total		626	100.0		



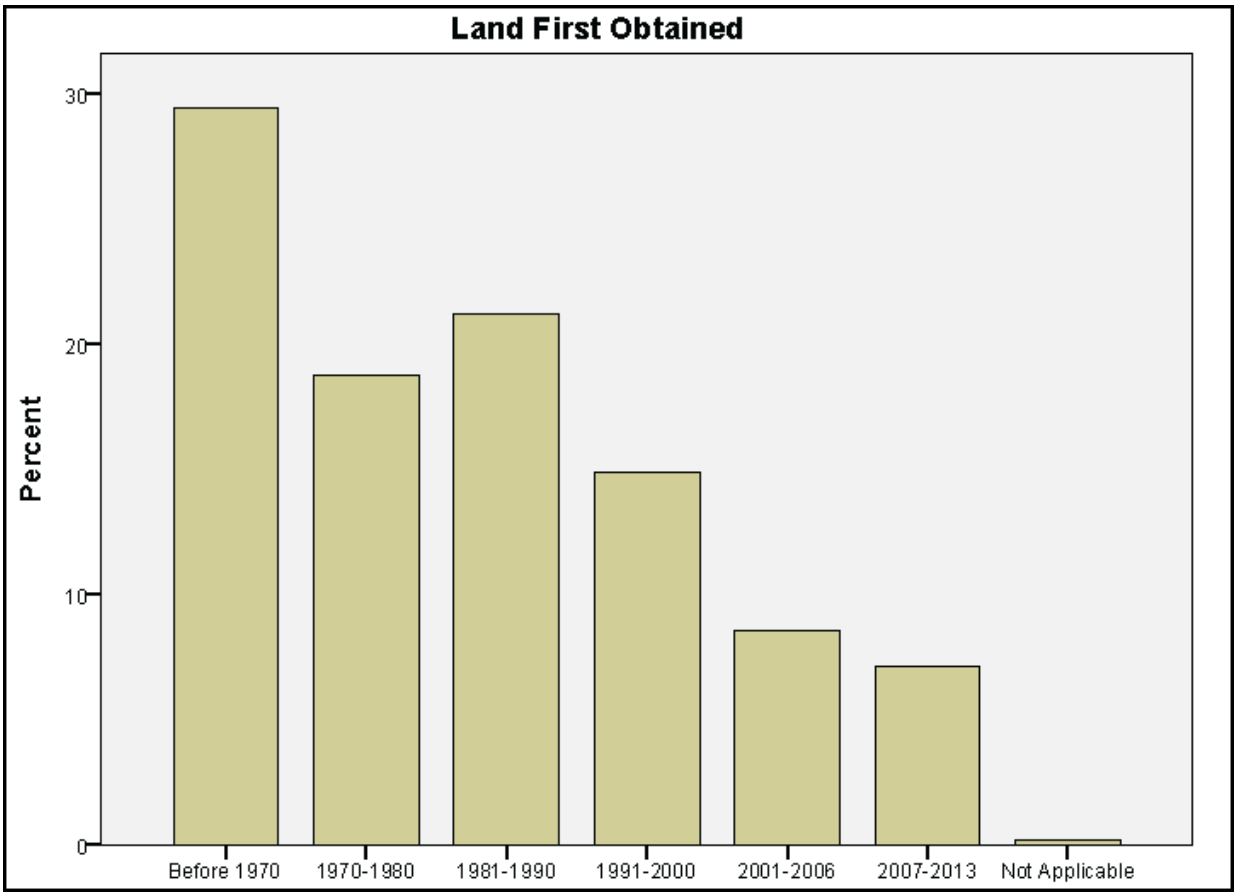
Highest Education Attained (Farm Respondents)

		Frequency	Percent	Valid Percent	Cumulative %
Valid	1 Elementary School	177	28.3	28.7	28.7
	2 High School	172	27.5	27.9	56.6
	3 Post Secondary	242	38.7	39.2	95.8
	4 Graduate or Professional Degree	26	4.2	4.2	100.0
	Total	617	98.6	100.0	
Missing	99	9	1.4		
Total		626	100.0		



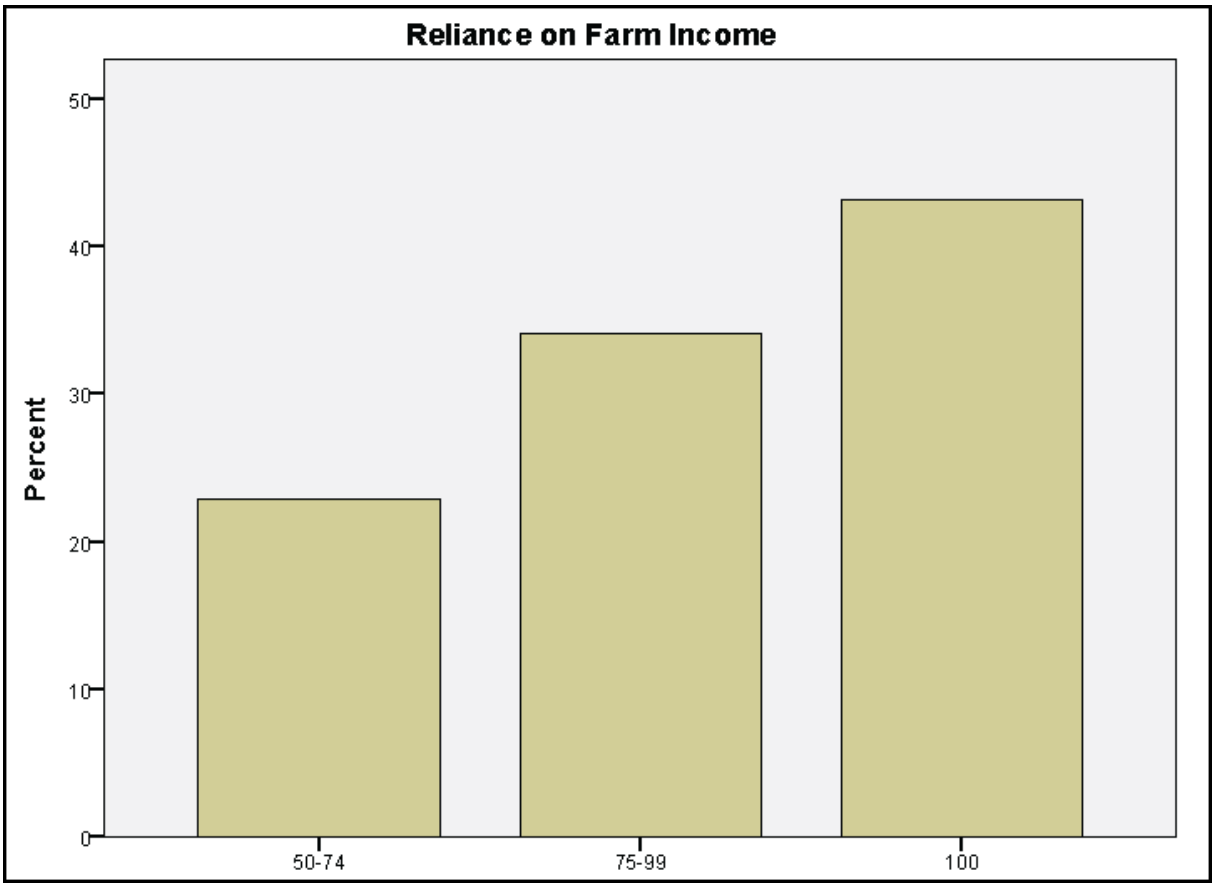
Land First Obtained (Farm Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Before 1970	182	29.1	29.4	29.4
	2 1970-1980	116	18.5	18.7	48.1
	3 1981-1990	131	20.9	21.2	69.3
	4 1991-2000	92	14.7	14.9	84.2
	5 2001-2006	53	8.5	8.6	92.7
	6 2007-2013	44	7.0	7.1	99.8
	7 Not Applicable	1	.2	.2	100.0
	Total	619	98.9	100.0	
Missing	99	7	1.1		
Total		626	100.0		



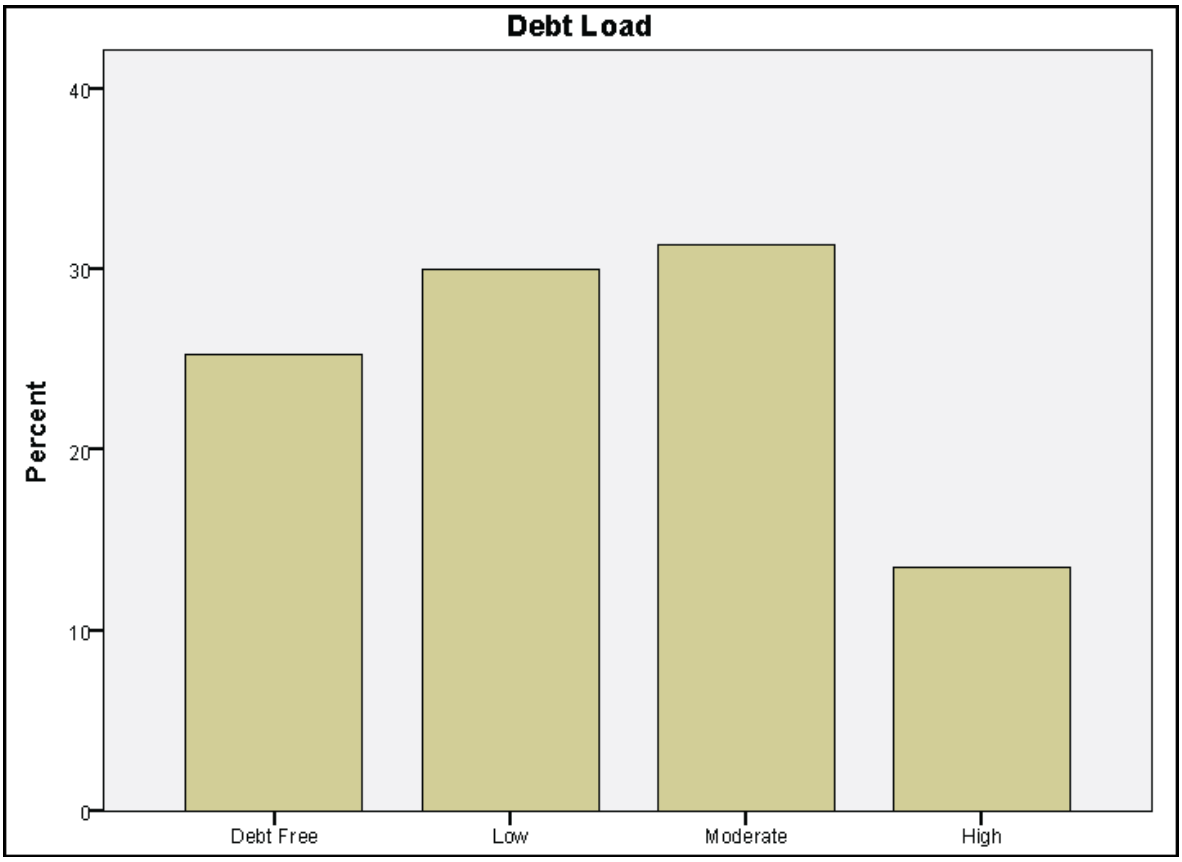
Reliance on Farm Income (Farm Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4 50-74	143	22.8	22.8	22.8
	5 75-99	213	34.0	34.0	56.9
	6 100	270	43.1	43.1	100.0
	Total	626	100.0	100.0	



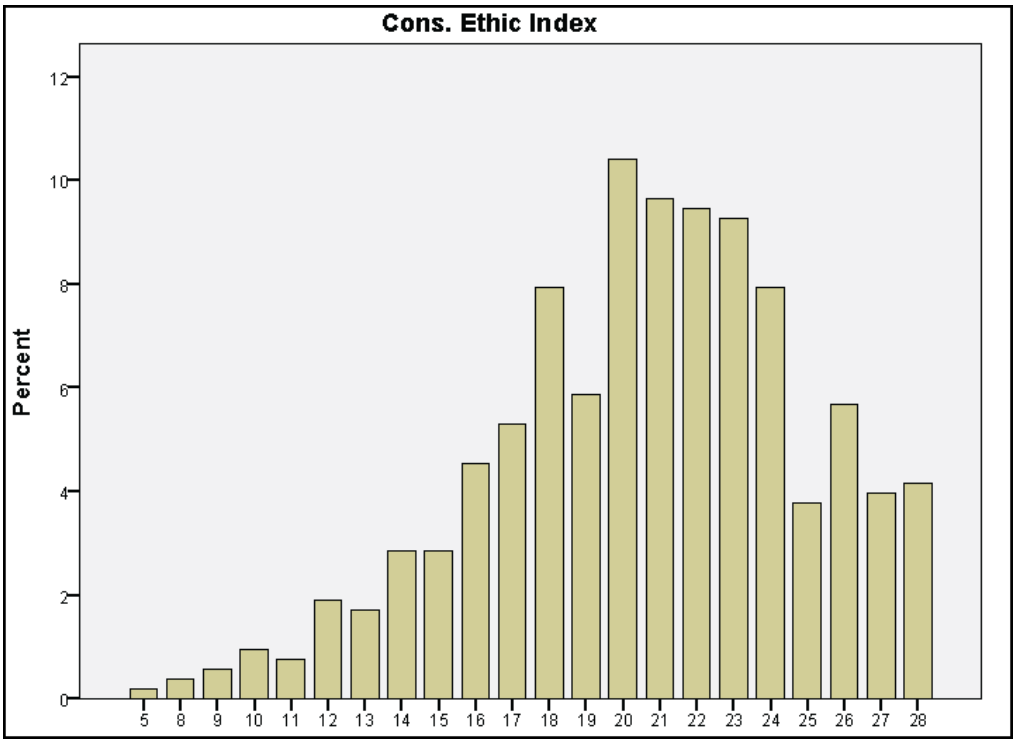
Debt Load (Farm Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Debt Free	153	24.4	25.2	25.2
	2 Low	182	29.1	30.0	55.2
	3 Moderate	190	30.4	31.3	86.5
	4 High	82	13.1	13.5	100.0
	Total	607	97.0	100.0	
Missing	99	19	3.0		
Total		626	100.0		



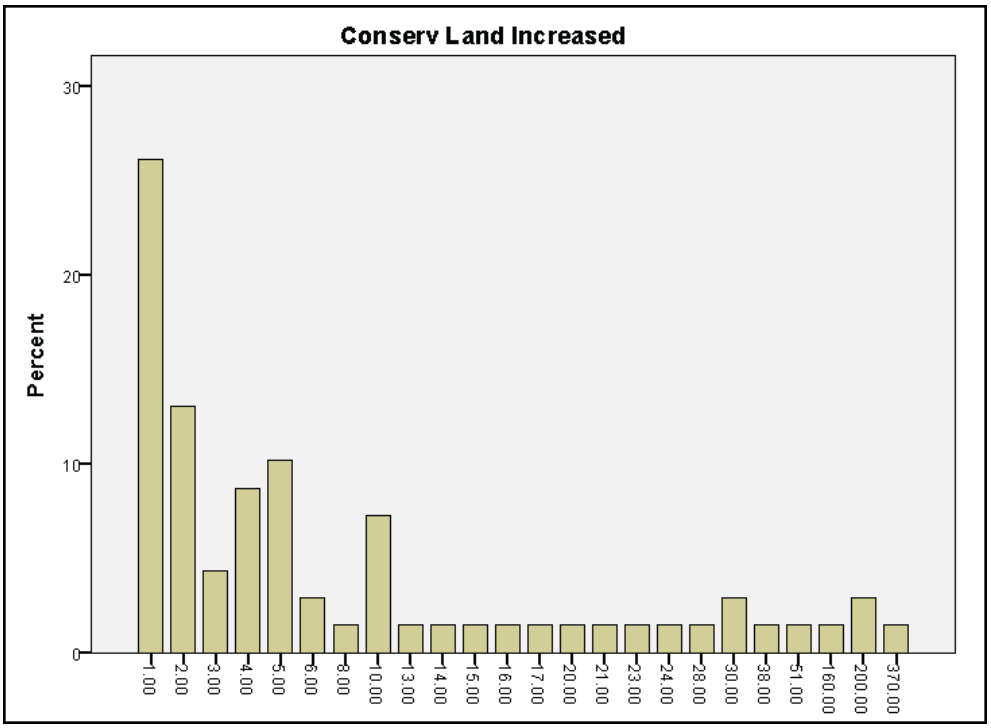
Cons. Ethic Index (Farm Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5	1	.2	.2	.2
	8	2	.3	.4	.6
	9	3	.5	.6	1.1
	10	5	.8	.9	2.1
	11	4	.6	.8	2.8
	12	10	1.6	1.9	4.7
	13	9	1.4	1.7	6.4
	14	15	2.4	2.8	9.3
	15	15	2.4	2.8	12.1
	16	24	3.8	4.5	16.6
	17	28	4.5	5.3	21.9
	18	42	6.7	7.9	29.9
	19	31	5.0	5.9	35.7
	20	55	8.8	10.4	46.1
	21	51	8.1	9.6	55.8
	22	50	8.0	9.5	65.2
	23	49	7.8	9.3	74.5
	24	42	6.7	7.9	82.4
	25	20	3.2	3.8	86.2
	26	30	4.8	5.7	91.9
	27	21	3.4	4.0	95.8
	28	22	3.5	4.2	100.0
	Total	529	84.5	100.0	
Total	Missing	97	15.5		
		626	100.0		



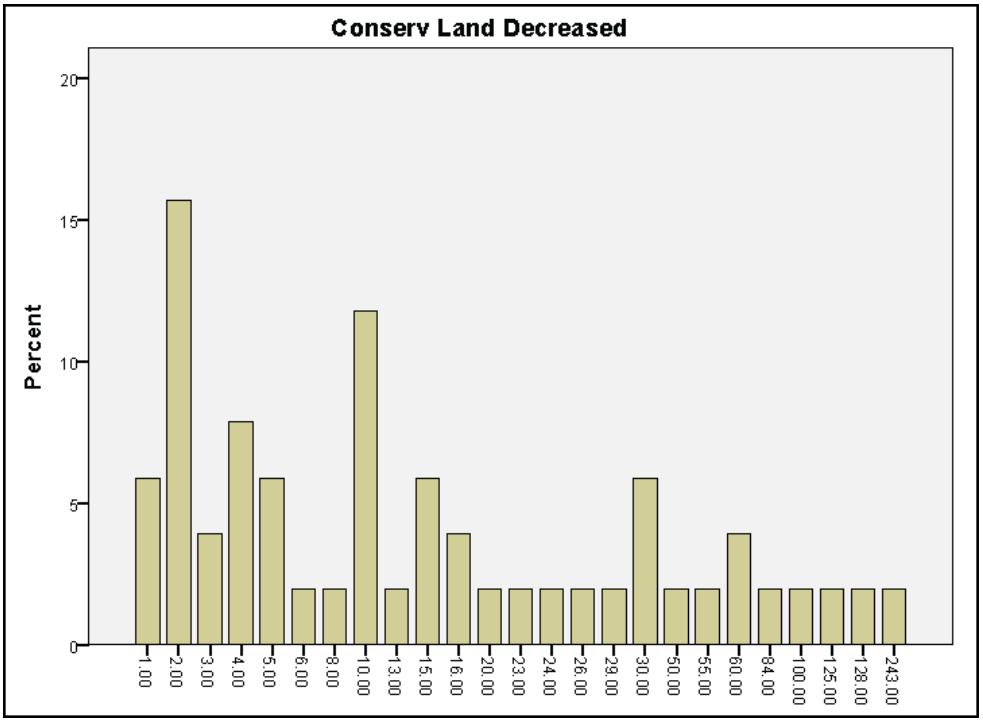
Conserv Land Increased (Farm Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	18	2.9	26.1	26.1
	2.00	9	1.4	13.0	39.1
	3.00	3	.5	4.3	43.5
	4.00	6	1.0	8.7	52.2
	5.00	7	1.1	10.1	62.3
	6.00	2	.3	2.9	65.2
	8.00	1	.2	1.4	66.7
	10.00	5	.8	7.2	73.9
	13.00	1	.2	1.4	75.4
	14.00	1	.2	1.4	76.8
	15.00	1	.2	1.4	78.3
	16.00	1	.2	1.4	79.7
	17.00	1	.2	1.4	81.2
	20.00	1	.2	1.4	82.6
	21.00	1	.2	1.4	84.1
	23.00	1	.2	1.4	85.5
	24.00	1	.2	1.4	87.0
	28.00	1	.2	1.4	88.4
	30.00	2	.3	2.9	91.3
	38.00	1	.2	1.4	92.8
	51.00	1	.2	1.4	94.2
	160.00	1	.2	1.4	95.7
	200.00	2	.3	2.9	98.6
	370.00	1	.2	1.4	100.0
	Total	69	11.0	100.0	
Missing	.00	557	89.0		
Total		626	100.0		



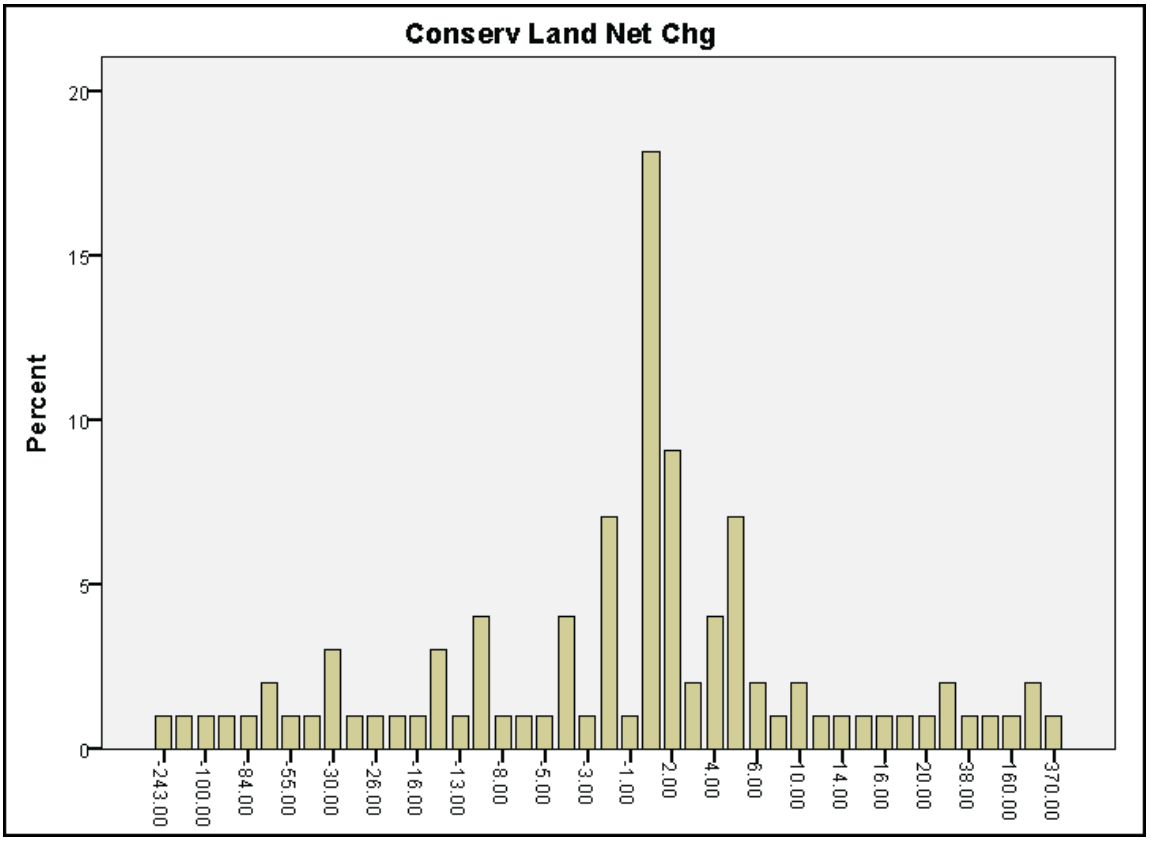
Conserv Land Decreased (Farm Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	3	.5	5.9	5.9
	2.00	8	1.3	15.7	21.6
	3.00	2	.3	3.9	25.5
	4.00	4	.6	7.8	33.3
	5.00	3	.5	5.9	39.2
	6.00	1	.2	2.0	41.2
	8.00	1	.2	2.0	43.1
	10.00	6	1.0	11.8	54.9
	13.00	1	.2	2.0	56.9
	15.00	3	.5	5.9	62.7
	16.00	2	.3	3.9	66.7
	20.00	1	.2	2.0	68.6
	23.00	1	.2	2.0	70.6
	24.00	1	.2	2.0	72.5
	26.00	1	.2	2.0	74.5
	29.00	1	.2	2.0	76.5
	30.00	3	.5	5.9	82.4
	50.00	1	.2	2.0	84.3
	55.00	1	.2	2.0	86.3
	60.00	2	.3	3.9	90.2
	84.00	1	.2	2.0	92.2
	100.00	1	.2	2.0	94.1
	125.00	1	.2	2.0	96.1
	128.00	1	.2	2.0	98.0
	243.00	1	.2	2.0	100.0
	Total	51	8.1	100.0	
Missing	.00	575	91.9		
Total		626	100.0		



Conserv Land Net Chg (Farm Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-243.00	1	.2	1.0	1.0
	-125.00	1	.2	1.0	2.0
	-100.00	1	.2	1.0	3.0
	-90.00	1	.2	1.0	4.0
	-84.00	1	.2	1.0	5.1
	-60.00	2	.3	2.0	7.1
	-55.00	1	.2	1.0	8.1
	-50.00	1	.2	1.0	9.1
	-30.00	3	.5	3.0	12.1
	-29.00	1	.2	1.0	13.1
	-26.00	1	.2	1.0	14.1
	-20.00	1	.2	1.0	15.2
	-16.00	1	.2	1.0	16.2
	-15.00	3	.5	3.0	19.2
	-13.00	1	.2	1.0	20.2
	-10.00	4	.6	4.0	24.2
	-8.00	1	.2	1.0	25.3
	-6.00	1	.2	1.0	26.3
	-5.00	1	.2	1.0	27.3
	-4.00	4	.6	4.0	31.3
	-3.00	1	.2	1.0	32.3
	-2.00	7	1.1	7.1	39.4
	-1.00	1	.2	1.0	40.4
	1.00	18	2.9	18.2	58.6
	2.00	9	1.4	9.1	67.7
	3.00	2	.3	2.0	69.7
	4.00	4	.6	4.0	73.7
	5.00	7	1.1	7.1	80.8
	6.00	2	.3	2.0	82.8
	8.00	1	.2	1.0	83.8
	10.00	2	.3	2.0	85.9
	13.00	1	.2	1.0	86.9
	14.00	1	.2	1.0	87.9
	15.00	1	.2	1.0	88.9
	16.00	1	.2	1.0	89.9
	17.00	1	.2	1.0	90.9
	20.00	1	.2	1.0	91.9
	30.00	2	.3	2.0	93.9
	38.00	1	.2	1.0	94.9
	50.00	1	.2	1.0	96.0
	160.00	1	.2	1.0	97.0
	200.00	2	.3	2.0	99.0
	370.00	1	.2	1.0	100.0
	Total	99	15.8	100.0	
Missing	.00	527	84.2		
Total		626	100.0		


Conserv Land Net Chg
Percent
20
15
10
5
0
-243.00
-100.00
-84.00
-55.00
-30.00
-26.00
-16.00
-13.00
-8.00
-5.00
-3.00
-1.00
2.00
4.00
6.00
10.00
14.00
16.00
20.00
38.00
160.00
370.00

Appendix G: Summary of Survey Results for All Respondents

Appendix G: Summary of Survey Results for All Respondents

Descriptive Statistics (All Respondents)

	N	Minimum	Maximum	Mean	Std. Deviation
Total Land Owned	3227	.00	3151.00	96.0292	180.44761
Age Computed	3115	17	92	56.42	13.748
Cons. Ethic Index	2690	0	28	20.37	4.679
Conserv Land Increased	262	1.00	370.00	14.2252	35.18826
Conserv Land Decreased	130	1.00	243.00	17.5077	32.18701
Conserv Land Net Chg	330	-243.00	370.00	4.4030	38.35474
Valid N (listwise)	19				

Statistics

		region Watershed	q1_munic Municipality	q2_areat Total Land Owned	q3_lando Land First Obtained	q26_gend Gender
N	Valid	3227	2575	3227	3173	3181
	Missing	0	652	0	54	46

Statistics

		Age Age Computed	q28_educ Highest Education Attained	q31_inco Household Income	q32_onfa Reliance on Farm Income	q34_debt Debt Load
N	Valid	3115	3145	2830	3059	3067
	Missing	112	82	397	168	160

Statistics

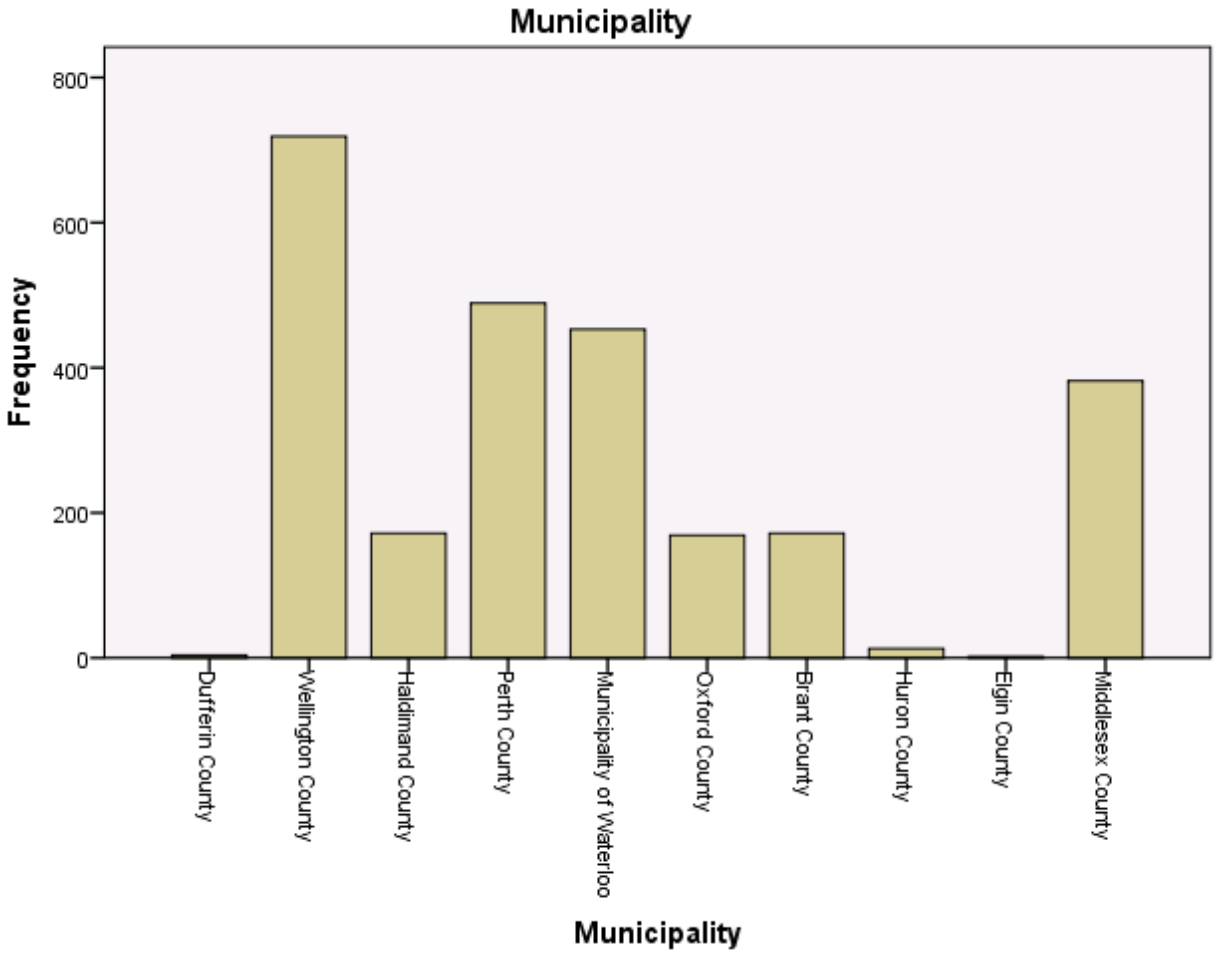
		ei_total Cons. Ethic Index	q10_incr Conserv Land Increased	q10_decr Conserv Land Decreased	q10_net Conserv Land Net Chg
N	Valid	2690	262	130	330
	Missing	537	2965	3097	2897

Watershed (All Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Grand	1855	57.5	57.5	57.5
	Thames	1372	42.5	42.5	100.0
	Total	3227	100.0	100.0	

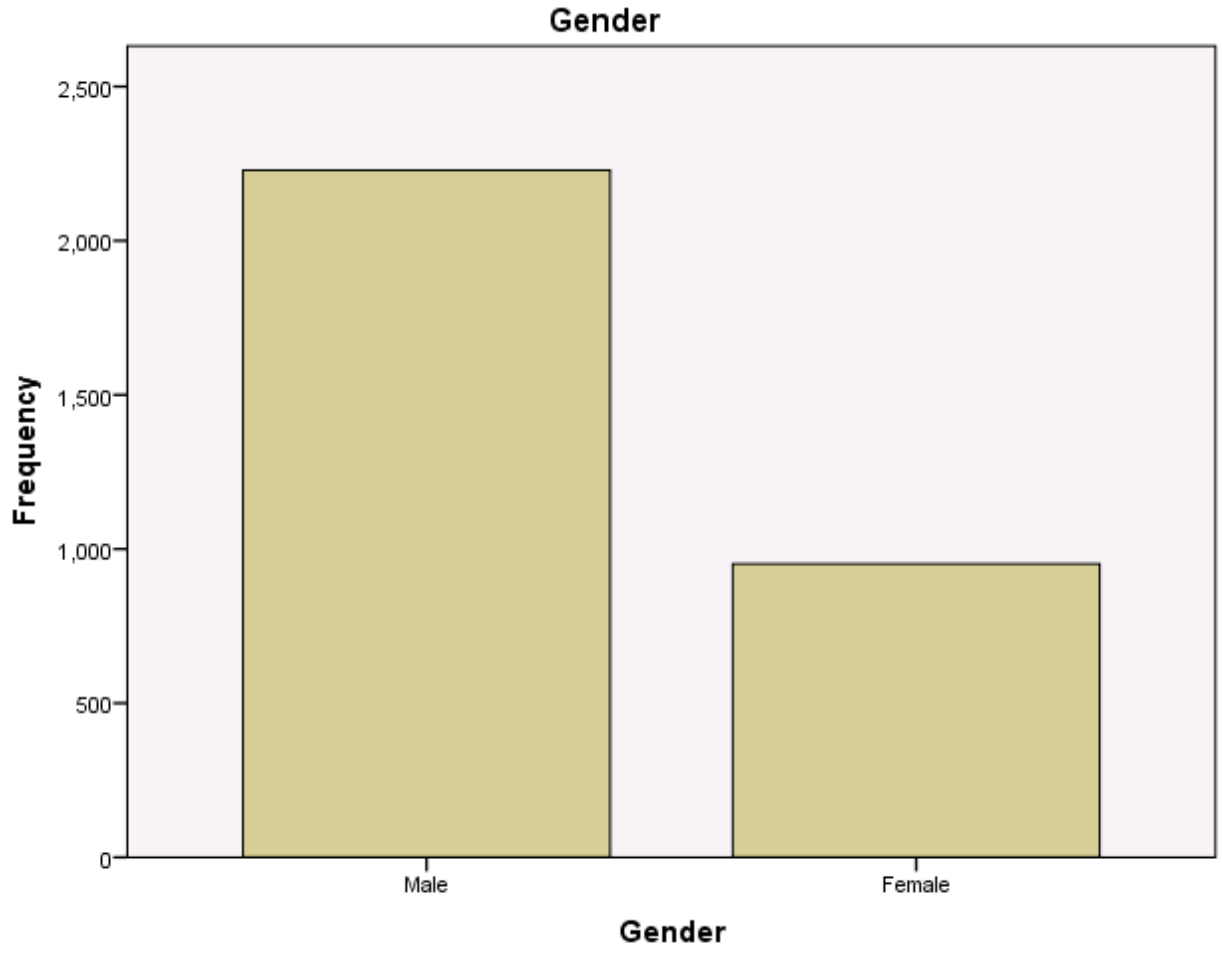
Municipality (All Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Dufferin County	4	.1	.2	.2
	2 Wellington County	719	22.3	27.9	28.1
	3 Haldimand County	172	5.3	6.7	34.8
	4 Perth County	489	15.2	19.0	53.7
	5 Municipality of Waterloo	453	14.0	17.6	71.3
	6 Oxford County	169	5.2	6.6	77.9
	7 Brant County	172	5.3	6.7	84.6
	9 Huron County	13	.4	.5	85.1
	10 Elgin County	2	.1	.1	85.2
	11 Middlesex County	382	11.8	14.8	100.0
	Total	2575	79.8	100.0	
Missing	8 Other (Grand River)	135	4.2		
	12 Other (Upper Thames)	469	14.5		
	99	48	1.5		
	Total	652	20.2		
Total		3227	100.0		



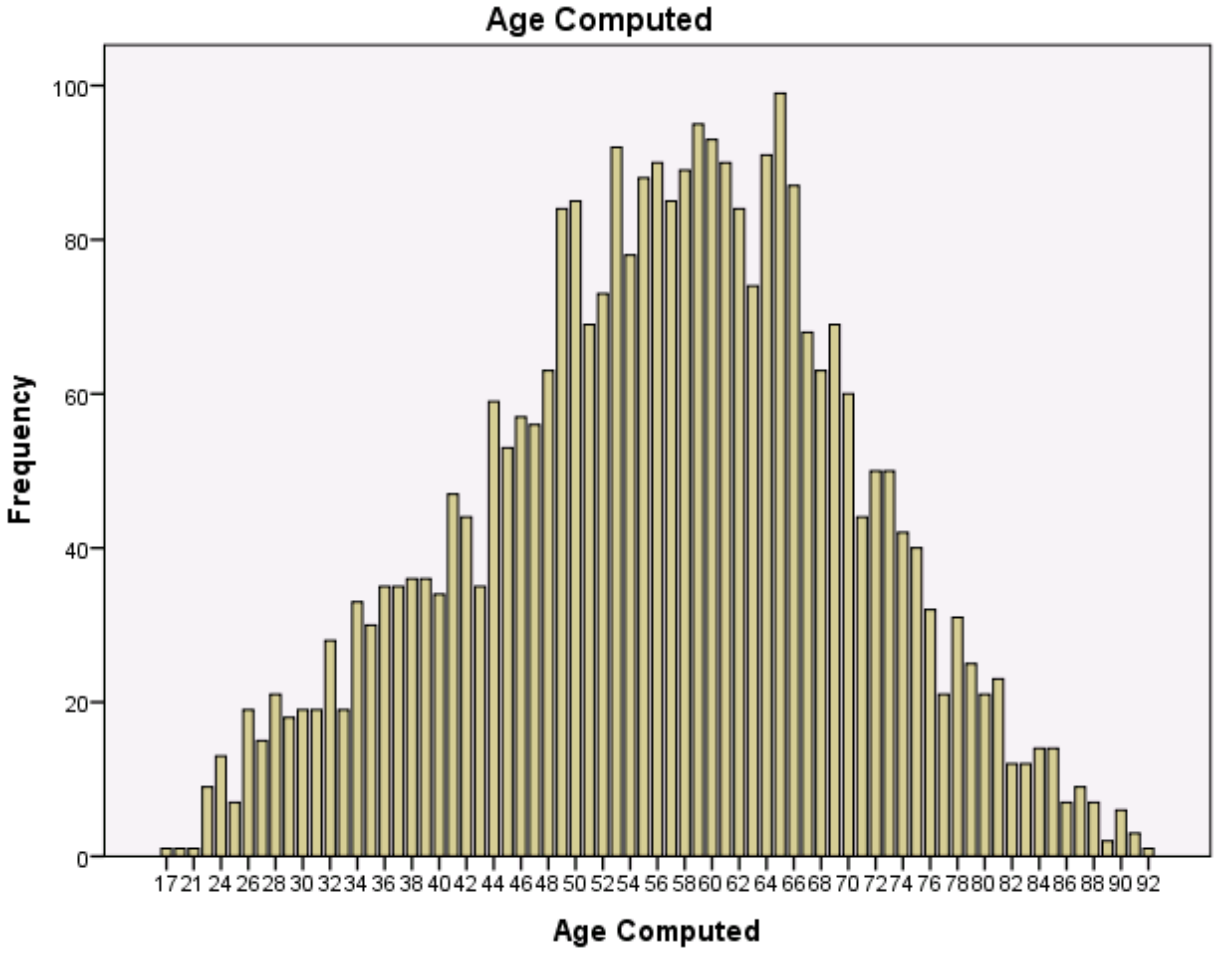
Gender (All Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 Male	2229	69.1	70.1	70.1
	1 Female	952	29.5	29.9	100.0
	Total	3181	98.6	100.0	
Missing	99	45	1.4		
	System	1	.0		
	Total	46	1.4		
Total		3227	100.0		



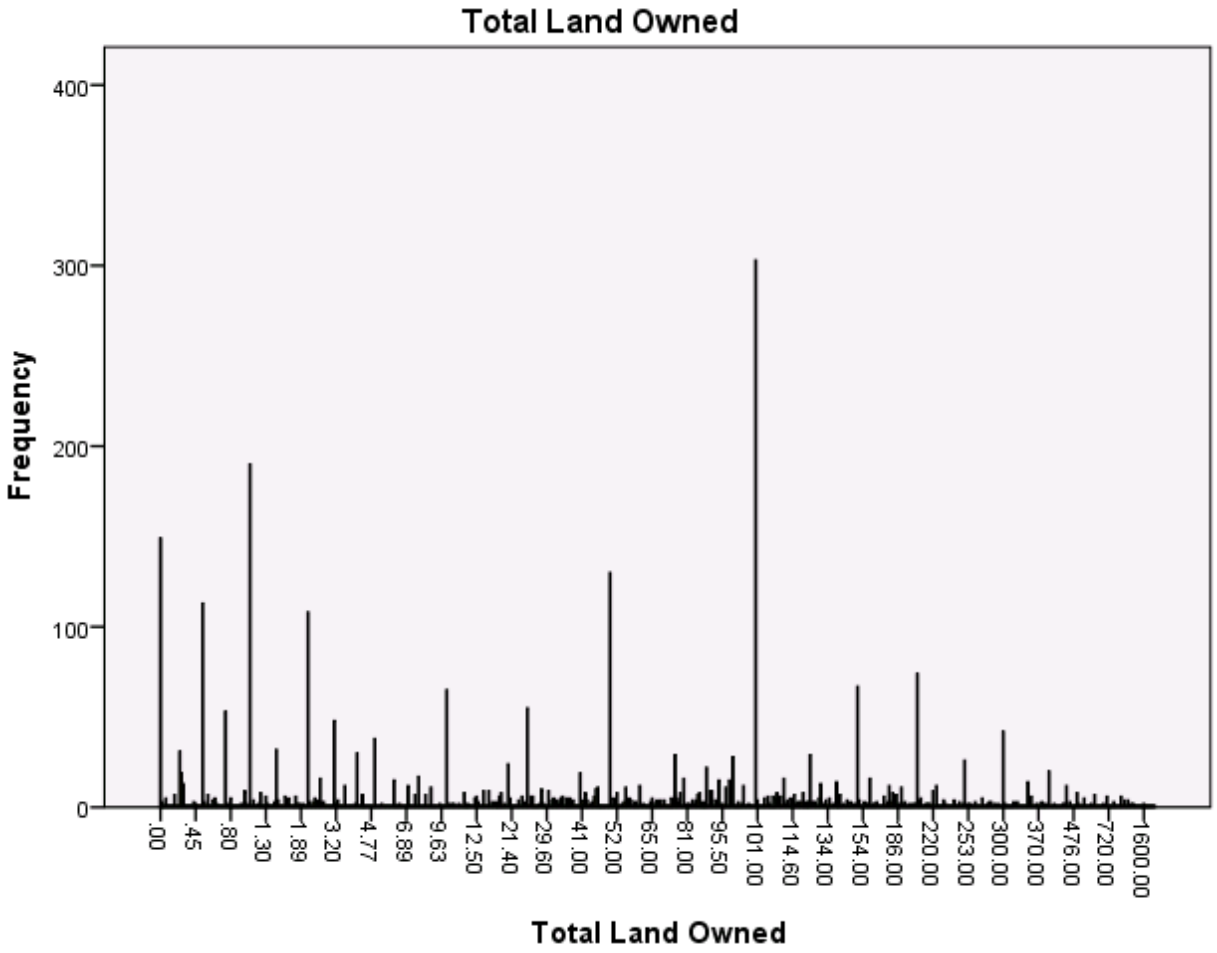
***Age Computed* (All Respondents)**

		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
	Total	*3115*	*96.5*	*100.0*	
Missing	*System*	*112*	*3.5*		
Total		*3227*	*100.0*		



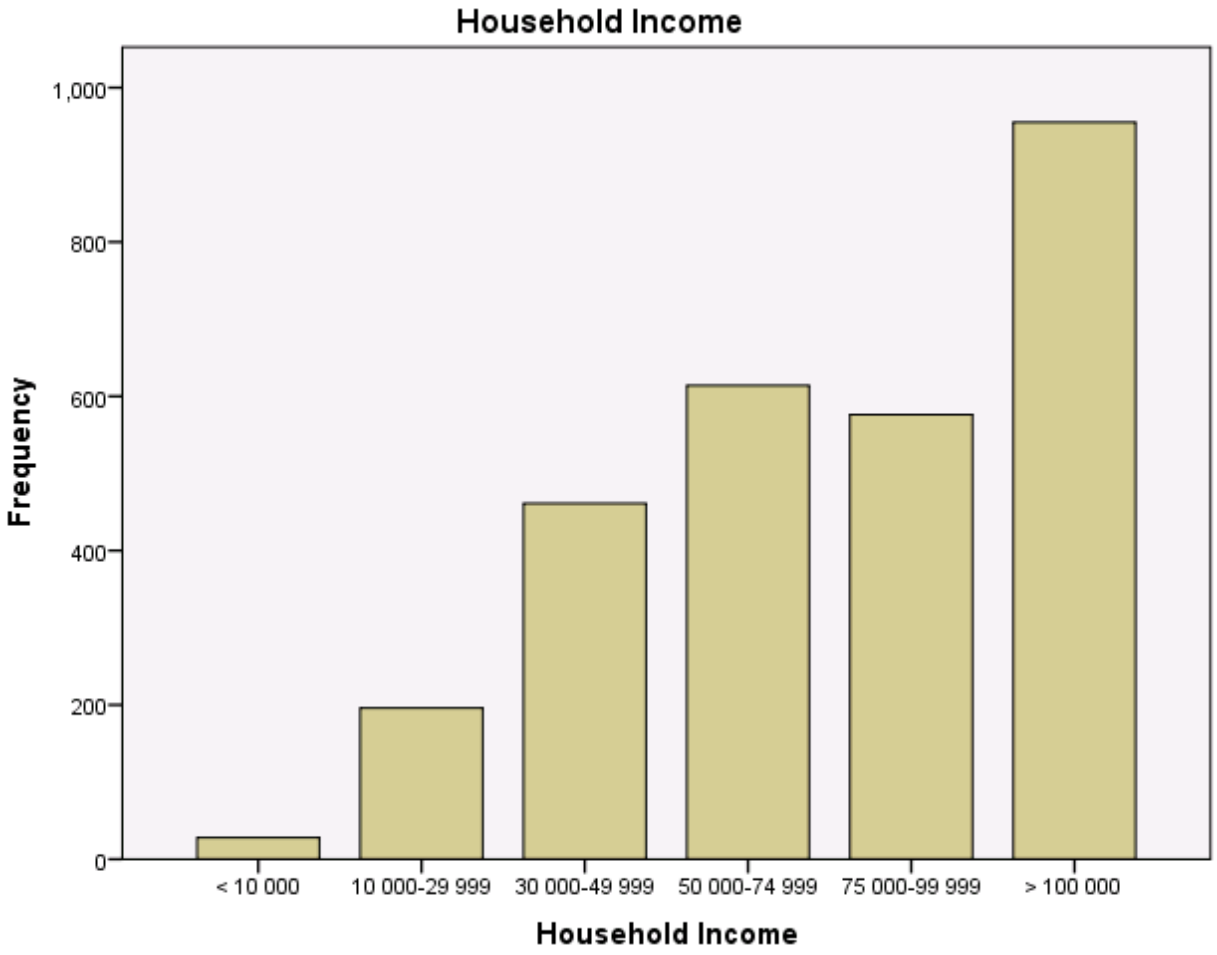
Total Land Owned (All Respondents)

	Frequency	Percent	Valid Percent	Cumulative Percent
Total	3227	100.0	100.0	



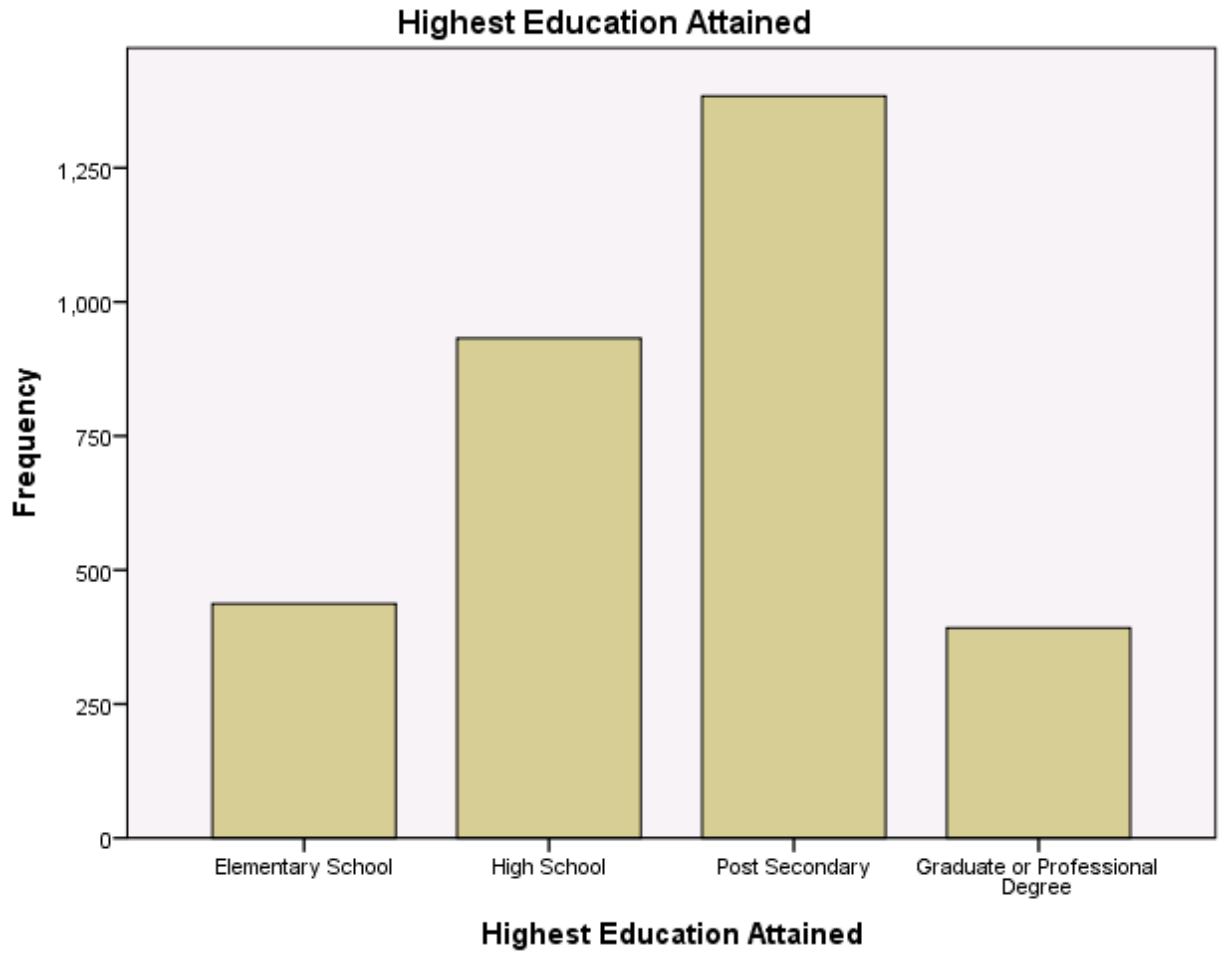
Household Income (All Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 < 10 000	28	.9	1.0	1.0
	2 10 000-29 999	196	6.1	6.9	7.9
	3 30 000-49 999	461	14.3	16.3	24.2
	4 50 000-74 999	614	19.0	21.7	45.9
	5 75 000-99 999	576	17.8	20.4	66.3
	6 > 100 000	955	29.6	33.7	100.0
	Total	2830	87.7	100.0	
Missing	99	396	12.3		
	System	1	.0		
	Total	397	12.3		
Total		3227	100.0		



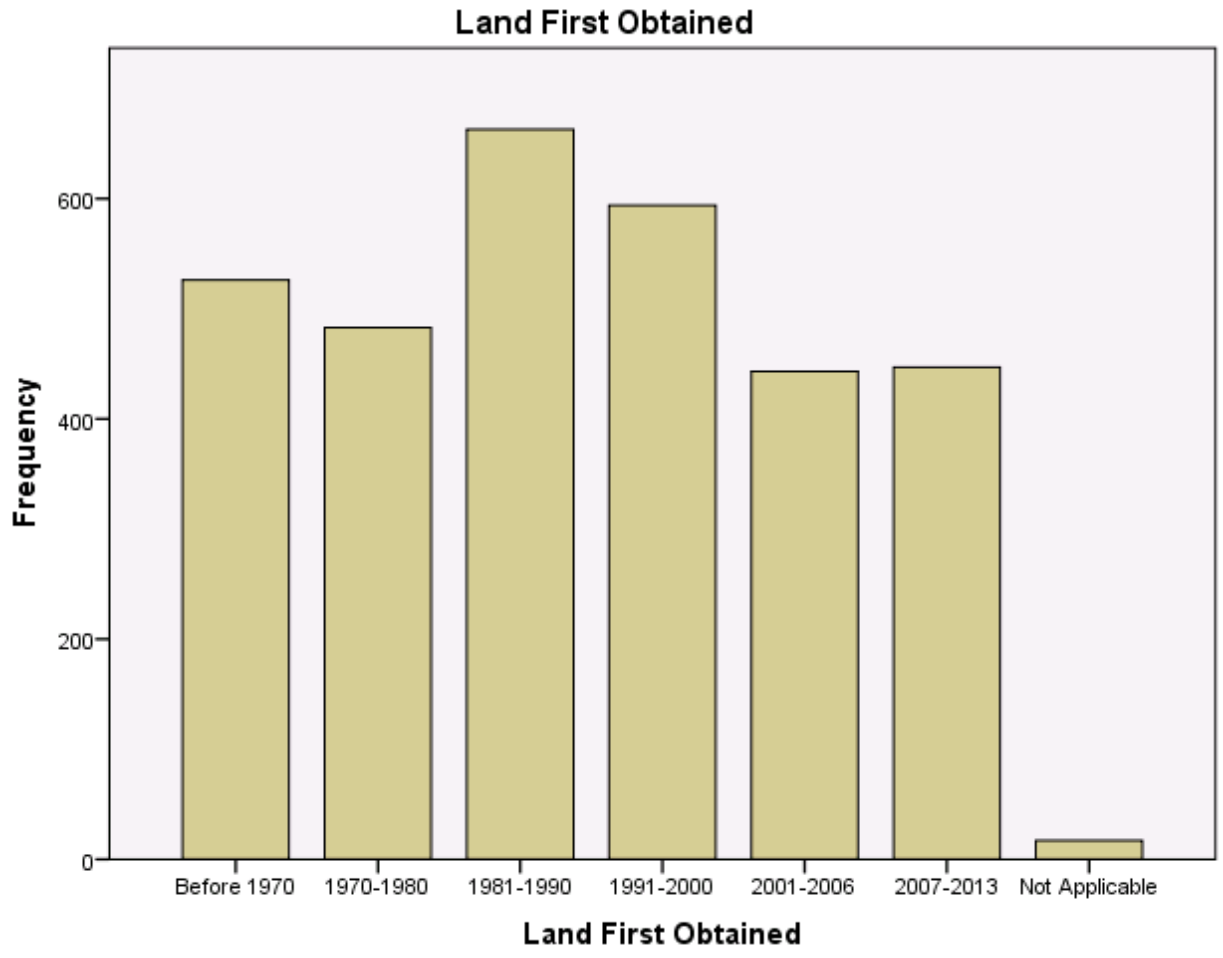
Highest Education Attained (All Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Elementary School	437	13.5	13.9	13.9
	2 High School	932	28.9	29.6	43.5
	3 Post Secondary	1384	42.9	44.0	87.5
	4 Graduate or Professional Degree	392	12.1	12.5	100.0
	Total	3145	97.5	100.0	
Missing	99	81	2.5		
	System	1	.0		
	Total	82	2.5		
Total		3227	100.0		



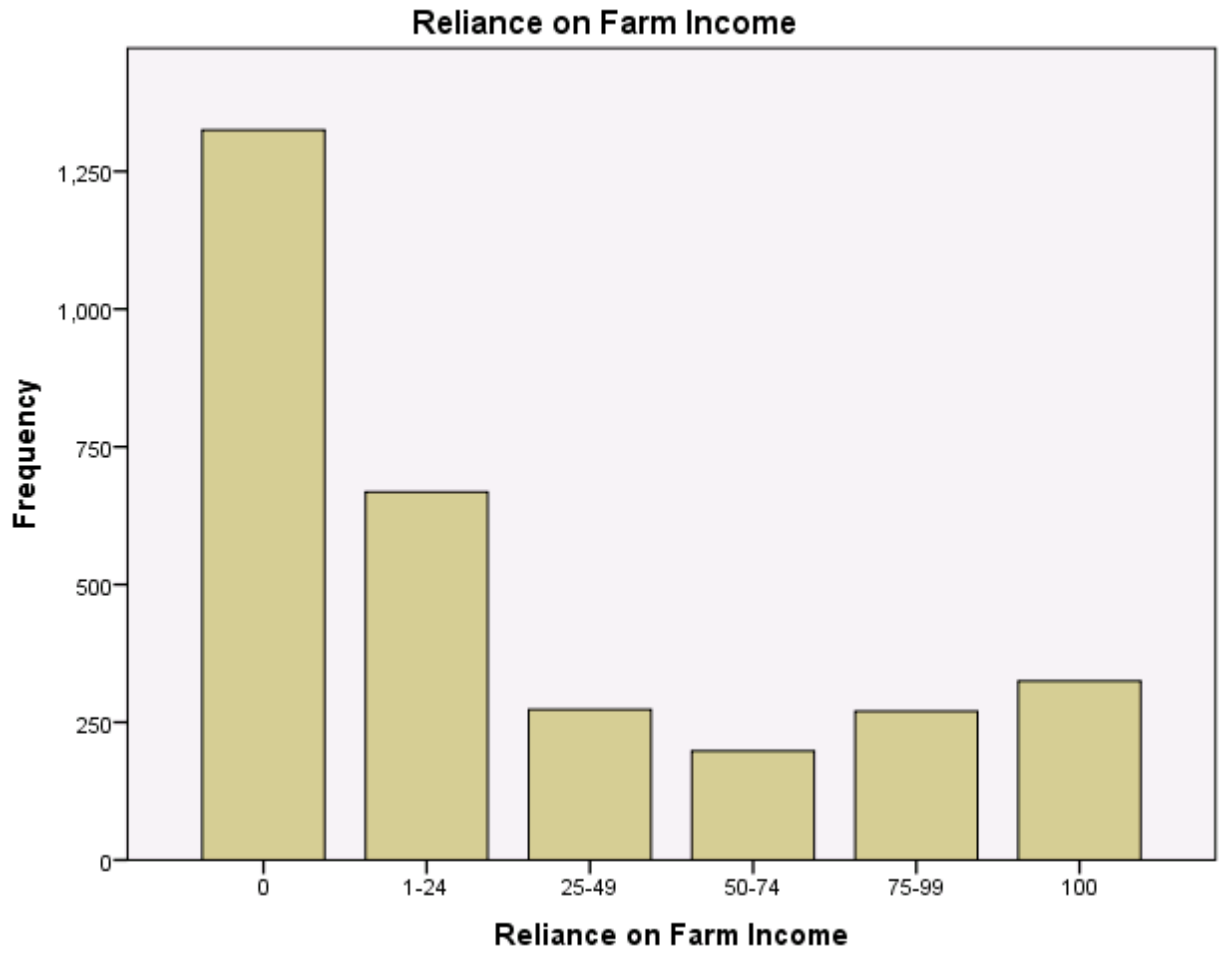
Land First Obtained (All Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Before 1970	526	16.3	16.6	16.6
	2 1970-1980	483	15.0	15.2	31.8
	3 1981-1990	663	20.5	20.9	52.7
	4 1991-2000	594	18.4	18.7	71.4
	5 2001-2006	443	13.7	14.0	85.4
	6 2007-2013	447	13.9	14.1	99.5
	7 Not Applicable	17	.5	.5	100.0
	Total	3173	98.3	100.0	
Missing	99	54	1.7		
Total		3227	100.0		



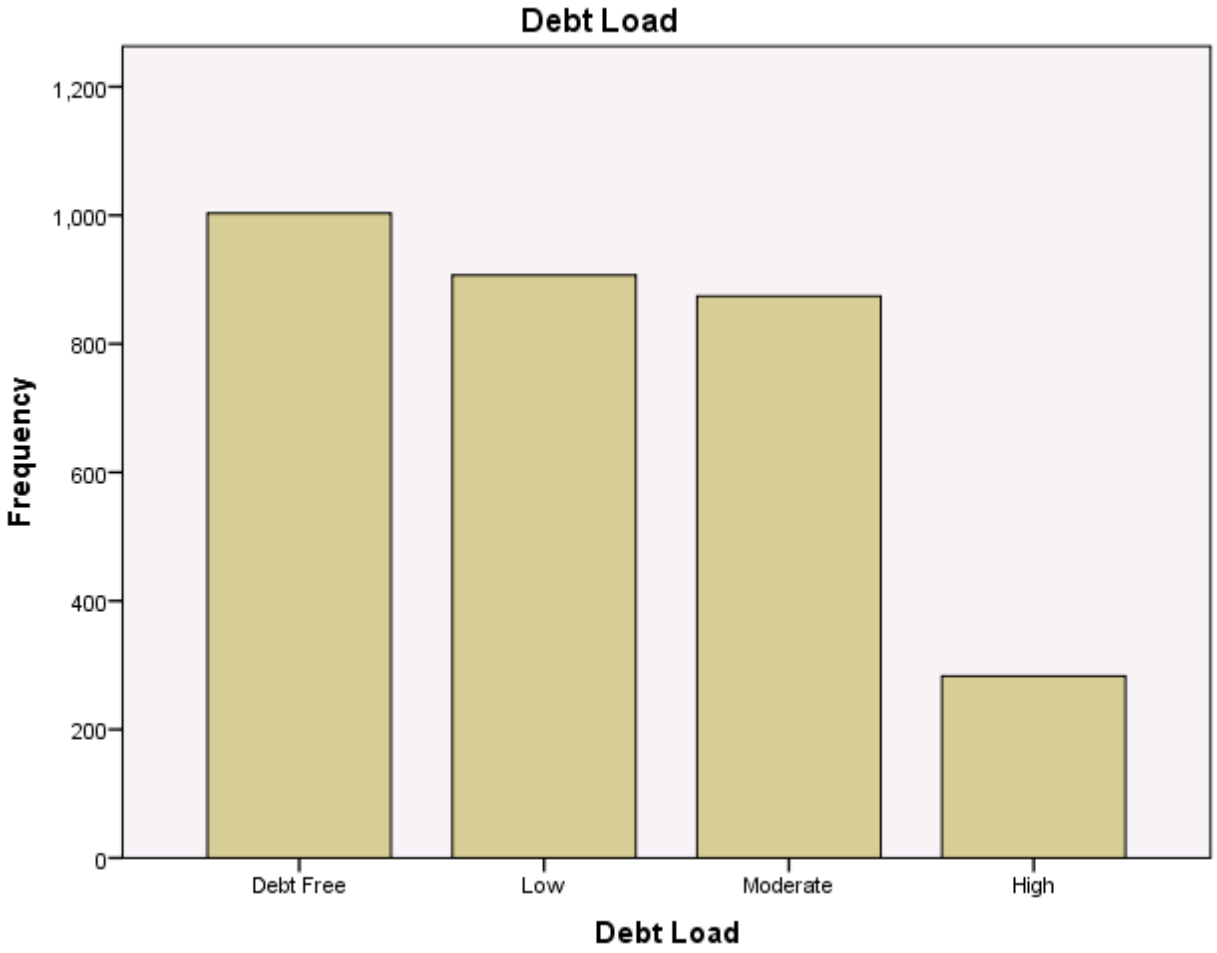
Reliance on Farm Income (All Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 0	1325	41.1	43.3	43.3
	2 1-24	668	20.7	21.8	65.2
	3 25-49	273	8.5	8.9	74.1
	4 50-74	198	6.1	6.5	80.5
	5 75-99	270	8.4	8.8	89.4
	6 100	325	10.1	10.6	100.0
	Total	3059	94.8	100.0	
Missing	99	167	5.2		
	System	1	.0		
	Total	168	5.2		
Total		3227	100.0		



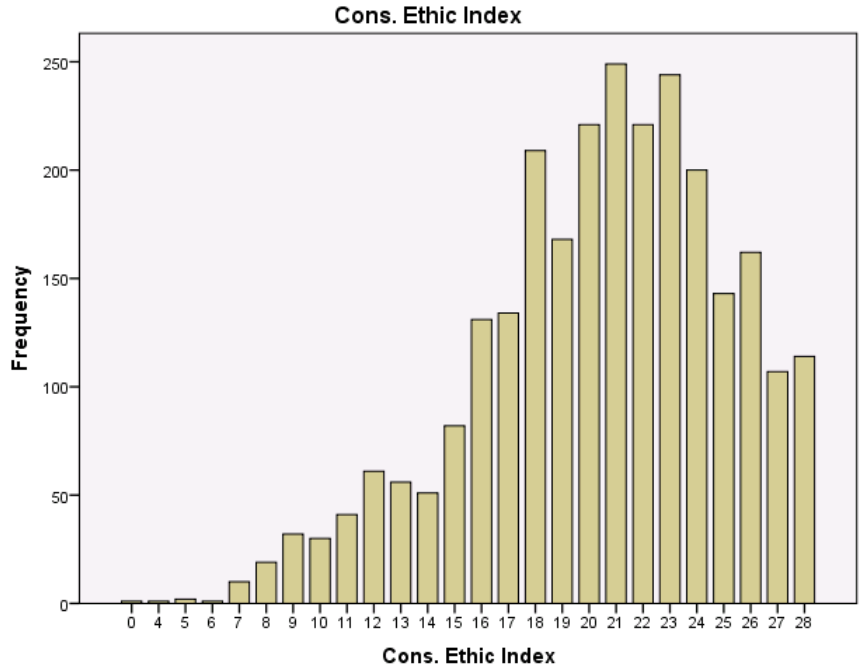
Debt Load (All Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Debt Free	1003	31.1	32.7	32.7
	2 Low	907	28.1	29.6	62.3
	3 Moderate	874	27.1	28.5	90.8
	4 High	283	8.8	9.2	100.0
	Total	3067	95.0	100.0	
Missing	99	159	4.9		
	System	1	.0		
	Total	160	5.0		
Total		3227	100.0		



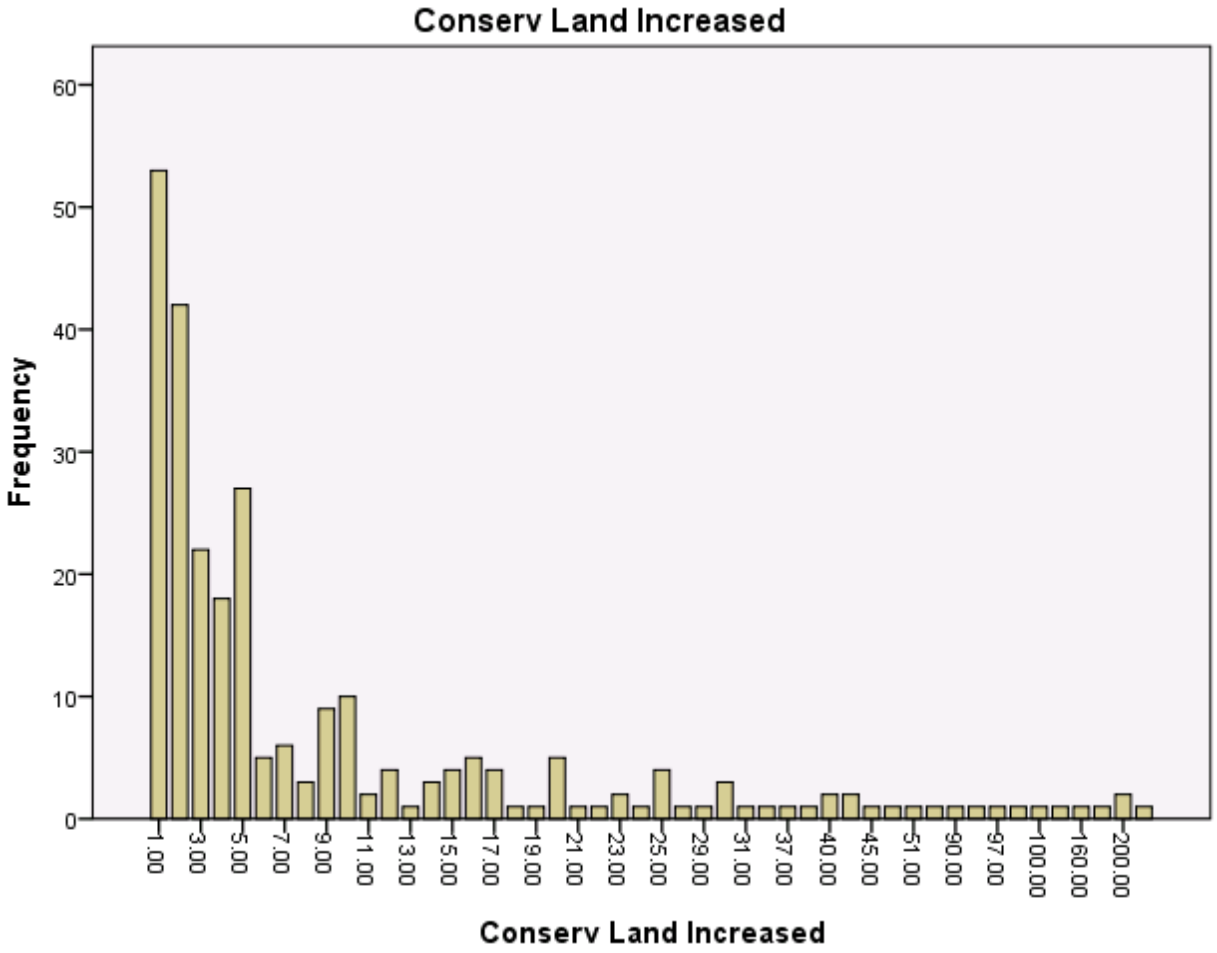
Cons. Ethic Index (All Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1	.0	.0	.0
	4	1	.0	.0	.1
	5	2	.1	.1	.1
	6	1	.0	.0	.2
	7	10	.3	.4	.6
	8	19	.6	.7	1.3
	9	32	1.0	1.2	2.5
	10	30	.9	1.1	3.6
	11	41	1.3	1.5	5.1
	12	61	1.9	2.3	7.4
	13	56	1.7	2.1	9.4
	14	51	1.6	1.9	11.3
	15	82	2.5	3.0	14.4
	16	131	4.1	4.9	19.3
	17	134	4.2	5.0	24.2
	18	209	6.5	7.8	32.0
	19	168	5.2	6.2	38.3
	20	221	6.8	8.2	46.5
	21	249	7.7	9.3	55.7
	22	221	6.8	8.2	63.9
	23	244	7.6	9.1	73.0
	24	200	6.2	7.4	80.4
	25	143	4.4	5.3	85.8
	26	162	5.0	6.0	91.8
	27	107	3.3	4.0	95.8
	28	114	3.5	4.2	100.0
	Total	2690	83.4	100.0	
Total	Total	537	16.6		
		3227	100.0		



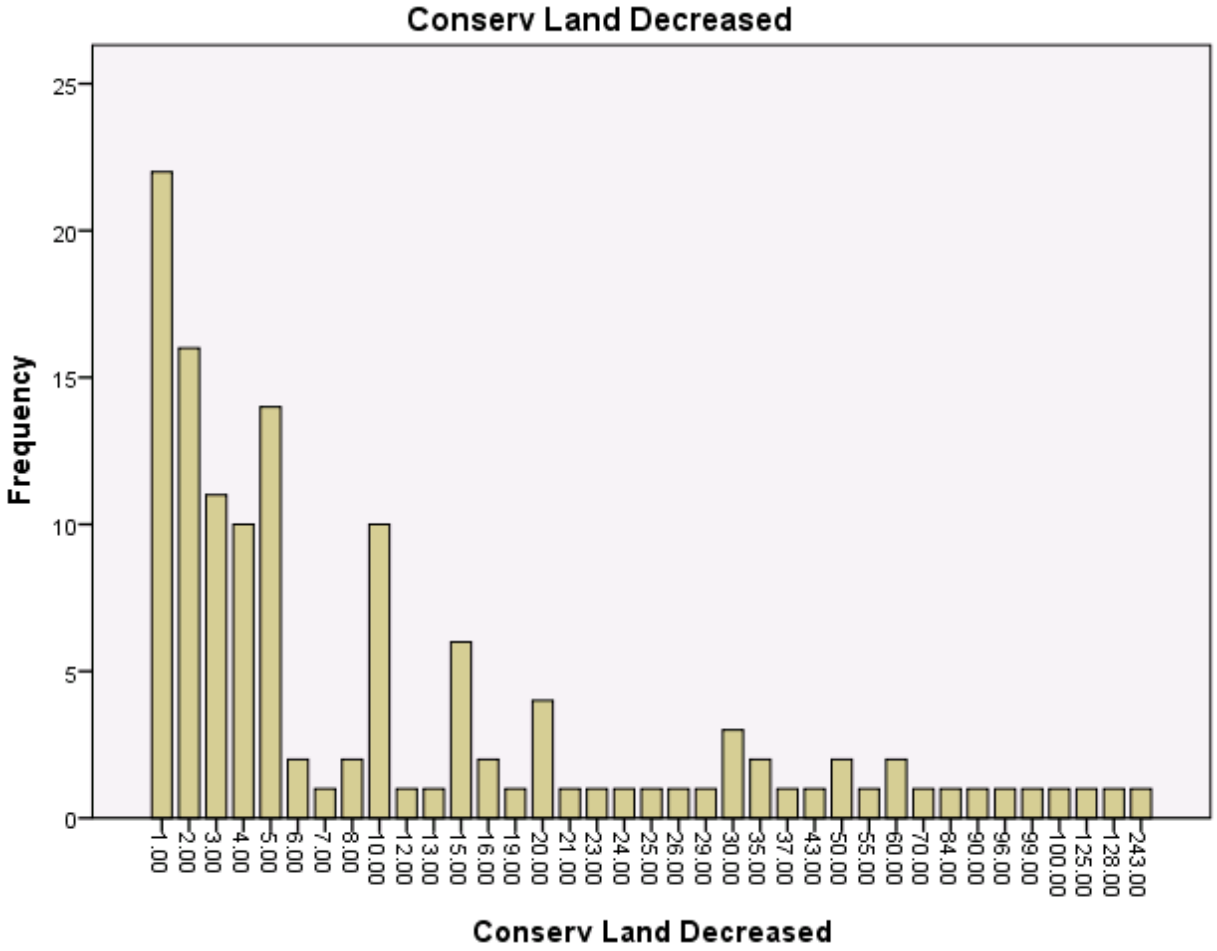
Conserv Land Increased (All Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-99.00	1	.0	.4	.4
	1.00	53	1.6	20.2	20.6
	2.00	42	1.3	16.0	36.6
	3.00	22	.7	8.4	45.0
	4.00	18	.6	6.9	51.9
	5.00	27	.8	10.3	62.2
	6.00	5	.2	1.9	64.1
	7.00	6	.2	2.3	66.4
	8.00	3	.1	1.1	67.6
	9.00	9	.3	3.4	71.0
	10.00	10	.3	3.8	74.8
	11.00	2	.1	.8	75.6
	12.00	4	.1	1.5	77.1
	13.00	1	.0	.4	77.5
	14.00	3	.1	1.1	78.6
	15.00	4	.1	1.5	80.2
	16.00	5	.2	1.9	82.1
	17.00	4	.1	1.5	83.6
	18.00	1	.0	.4	84.0
	19.00	1	.0	.4	84.4
	20.00	5	.2	1.9	86.3
	21.00	1	.0	.4	86.6
	22.00	1	.0	.4	87.0
	23.00	2	.1	.8	87.8
	24.00	1	.0	.4	88.2
	25.00	4	.1	1.5	89.7
	28.00	1	.0	.4	90.1
	29.00	1	.0	.4	90.5
	30.00	3	.1	1.1	91.6
	31.00	1	.0	.4	92.0
	34.00	1	.0	.4	92.4
	37.00	1	.0	.4	92.7
	38.00	1	.0	.4	93.1
	40.00	2	.1	.8	93.9
	44.00	2	.1	.8	94.7
	45.00	1	.0	.4	95.0
	46.00	1	.0	.4	95.4
	51.00	1	.0	.4	95.8
	60.00	1	.0	.4	96.2
	90.00	1	.0	.4	96.6
	96.00	1	.0	.4	96.9
	97.00	1	.0	.4	97.3
	100.00	1	.0	.4	97.7
	108.00	1	.0	.4	98.1
	160.00	1	.0	.4	98.5
	180.00	1	.0	.4	98.9
	200.00	2	.1	.8	99.6
	370.00	1	.0	.4	100.0
	Total	262	8.1	100.0	
Missing	.00	2965	91.9		
Total		3227	100.0		


Conserv Land Increased
Frequency
60
50
40
30
20
10
0
1.00
3.00
5.00
7.00
9.00
11.00
13.00
15.00
17.00
19.00
21.00
23.00
25.00
29.00
31.00
37.00
40.00
45.00
51.00
90.00
97.00
100.00
160.00
200.00
Conserv Land Increased

Conserv Land Decreased (All Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-99.00	1	.0	.8	.8
	-1.00	1	.0	.8	1.5
	1.00	21	.7	16.2	17.7
	2.00	16	.5	12.3	30.0
	3.00	11	.3	8.5	38.5
	4.00	10	.3	7.7	46.2
	5.00	14	.4	10.8	56.9
	6.00	2	.1	1.5	58.5
	7.00	1	.0	.8	59.2
	8.00	2	.1	1.5	60.8
	10.00	10	.3	7.7	68.5
	12.00	1	.0	.8	69.2
	13.00	1	.0	.8	70.0
	15.00	6	.2	4.6	74.6
	16.00	2	.1	1.5	76.2
	19.00	1	.0	.8	76.9
	20.00	4	.1	3.1	80.0
	21.00	1	.0	.8	80.8
	23.00	1	.0	.8	81.5
	24.00	1	.0	.8	82.3
	25.00	1	.0	.8	83.1
	26.00	1	.0	.8	83.8
	29.00	1	.0	.8	84.6
	30.00	3	.1	2.3	86.9
	35.00	2	.1	1.5	88.5
	37.00	1	.0	.8	89.2
	43.00	1	.0	.8	90.0
	50.00	2	.1	1.5	91.5
	55.00	1	.0	.8	92.3
	60.00	2	.1	1.5	93.8
	70.00	1	.0	.8	94.6
	84.00	1	.0	.8	95.4
	90.00	1	.0	.8	96.2
	96.00	1	.0	.8	96.9
	100.00	1	.0	.8	97.7
	125.00	1	.0	.8	98.5
	128.00	1	.0	.8	99.2
	243.00	1	.0	.8	100.0
	Total	130	4.0	100.0	
Missing	.00	3097	96.0		
Total		3227	100.0		



Conserv Land Net Chg (All Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-243.00	1	.0	.3	.3
	-125.00	1	.0	.3	.6
	-100.00	1	.0	.3	.9
	-90.00	1	.0	.3	1.2
	-88.00	1	.0	.3	1.5
	-84.00	1	.0	.3	1.8
	-70.00	1	.0	.3	2.1
	-60.00	2	.1	.6	2.7
	-55.00	1	.0	.3	3.0
	-50.00	2	.1	.6	3.6
	-43.00	1	.0	.3	3.9
	-35.00	2	.1	.6	4.5
	-30.00	3	.1	.9	5.5
	-29.00	1	.0	.3	5.8
	-26.00	1	.0	.3	6.1
	-25.00	1	.0	.3	6.4
	-20.00	3	.1	.9	7.3
	-19.00	1	.0	.3	7.6
	-16.00	1	.0	.3	7.9

Conserv Land Net Chg (All Respondents)

	Frequency	Percent	Valid Percent	Cumulative Percent
-15.00	6	.2	1.8	9.7
-13.00	1	.0	.3	10.0
-12.00	1	.0	.3	10.3
-10.00	7	.2	2.1	12.4
-9.00	1	.0	.3	12.7
-8.00	1	.0	.3	13.0
-6.00	3	.1	.9	13.9
-5.00	6	.2	1.8	15.8
-4.00	6	.2	1.8	17.6
-3.00	9	.3	2.7	20.3
-2.00	13	.4	3.9	24.2
-1.00	17	.5	5.2	29.4
1.00	52	1.6	15.8	45.2
2.00	40	1.2	12.1	57.3
3.00	19	.6	5.8	63.0
4.00	13	.4	3.9	67.0
5.00	22	.7	6.7	73.6
6.00	5	.2	1.5	75.2
7.00	6	.2	1.8	77.0
8.00	2	.1	.6	77.6
9.00	9	.3	2.7	80.3
10.00	6	.2	1.8	82.1
11.00	2	.1	.6	82.7
12.00	4	.1	1.2	83.9
13.00	1	.0	.3	84.2
14.00	3	.1	.9	85.2
15.00	4	.1	1.2	86.4
16.00	5	.2	1.5	87.9
17.00	4	.1	1.2	89.1
18.00	1	.0	.3	89.4
20.00	5	.2	1.5	90.9
22.00	1	.0	.3	91.2
23.00	1	.0	.3	91.5
25.00	4	.1	1.2	92.7
27.00	1	.0	.3	93.0
30.00	3	.1	.9	93.9
31.00	1	.0	.3	94.2
34.00	1	.0	.3	94.5
38.00	1	.0	.3	94.8
40.00	2	.1	.6	95.5
44.00	2	.1	.6	96.1
45.00	1	.0	.3	96.4
46.00	1	.0	.3	96.7
50.00	1	.0	.3	97.0
60.00	1	.0	.3	97.3
77.00	1	.0	.3	97.6
90.00	1	.0	.3	97.9
100.00	1	.0	.3	98.2
108.00	1	.0	.3	98.5
160.00	1	.0	.3	98.8
180.00	1	.0	.3	99.1
200.00	2	.1	.6	99.7

Conserv Land Net Chg (All Respondents)

		Frequency	Percent	Valid Percent	Cumulative Percent
	370.00	1	.0	.3	100.0
	Total	330	10.2	100.0	
Missing	.00	2897	89.8		
Total		3227	100.0