THESIS

Barriers and Benefits to Wetland Conservation in Agricultural Nova Scotia

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Contents

1.0 Introduction

1.1 Rationale

The aim of this research is to better understand the factors that encourage or prevent individuals and groups from being good stewards of their land, and conserving natural heritage features in the landscape. More specifically, this study focuses on the barriers and benefits to implementing the use of buffer zones around wetlands and watercourses in agricultural Nova Scotia.

In February 2010 the N.S. government released a draft copy of the Nova Scotia Wetland Conservation Policy for consultation with the public and industry. The policy has five main objectives, they are 1) manage human activities around wetlands to achieve no loss of Wetlands of Special Significance and no net loss of all other wetlands, 2) promote stewardship and securement of wetlands, 3) promote long-term net gain of wetland area and function, 4) encourage the use of buffers around wetlands adjacent to development and 5) align the policy with those of P.E.I. and N.B where practical. Comments made by community members and stakeholders during the consultation period were evaluated and used to revise the draft. There was a wide range of opinion about what would comprise an effective wetland policy for Nova Scotia, with many contradictory perspectives from various industry sectors and community groups, including housing developers, farmers, the forestry industry and environmental groups (Brazner 2010 pers. comm.). The policy has not yet been given final approval from government.

Historic wetland distribution is poorly documented across the province and the Nova Scotia wetland inventory contains many inaccuracies, which creates challenges for effectively implementing a policy that is based on preventing net loss of wetland.

Nova Scotia Environment (NSE) is very interested in getting this policy approved because the current policy is much more limited in scope. It does not explicitly have a goal of preventing net loss and does not provide special protection for wetlands of special significance. It also does not emphasize restoration of wetland types that have suffered high historic losses and has no provisions related to buffers adjacent to wetlands. Buffers are perimeters of land around wetlands and watercourses that are left in a natural condition to promote the health of the wetland or watercourse.

Strong legislation paired with a guiding policy is crucial to the success of conservation programs within the province. It is anticipated that a revised wetland conservation policy will provide considerable improvement in wetland management and protection in Nova Scotia.

It has been estimated that over 50% of salt marshes province-wide have been lost to conversion and development (Mackinnon and Scott 1984). Losses of freshwater wetlands are also thought to be high, but historic loss of freshwater wetlands has not been well-studied in Nova Scotia. Wetland conservation in Nova Scotia has been less effective than in many other jurisdictions in the U.S., Europe and in some other Canadian provinces. Both New Brunswick (New Brunswick Wetlands Conservation Policy) and Prince Edward Island (A Wetland Conservation Policy for Prince Edward Island) have comprehensive wetland policies that have "no net loss" of wetland as a primary objective. The draft policy for wetland conservation in Nova Scotia would, in many ways, align Nova Scotia policy with the primary policy objectives in NB and PEI. It would also protect wetlands of ecological significance[1] from any destruction and encourage the use of buffers as a protection tool for wetlands.

[1] Wetlands of ecological significance are defined as wetlands having local, regional, provincial, national or international significance as define by provincial identification process. These lands include wetlands that have experienced high levels of historic loss (salt marshes), exist on

It is important that the provincial government protects the wetlands of Nova Scotia because they provide a wide variety of important ecological functions. Wetlands provide habitat for many species, they filter and decontaminate our water and are of cultural and aesthetic value (Williams 1996). The ecosystem goods and services that wetlands provide are often not taken into consideration in financial markets but are valuable to human society. It has been estimated that the function of wetlands would be worth over 10 trillion USD/year (Costanza 1997). It would cost Nova Scotians greatly if the province lost these goods and services to wetland conversion. For example, the Geologic Society of Canada recognized that areas with salt marshes are less negatively affected by hurricanes and winter storms. It is estimated that salt marshes in Nova Scotia provide 400 million CND worth of ecosystem goods and services to communities every year (Wilson 2000).

It is apparent that wetlands in Nova Scotia have a high economic value. If the province intends to protect this resource on behalf of all Nova Scotians it is important that effective wetland policy be implemented. However, as stated in the proposed wetland policy, "effective wetland conservation and preventing net loss is unlikely to be achieved through policy alone and acknowledges the critical role of voluntary stewardship by Nova Scotians in the success of any wetland conservation efforts in the province". This suggests that the government understands if it wants to successfully conserve wetlands in the province, it cannot simply force the proposed wetland policy on the public and industries like agriculture and forestry without first overcoming resistance and gaining voluntary support. Therefore, it is important to find the root of the public and industrial resistance to implementing the proposed wetland policy. Through my research, I

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provincial parks and other protected areas and where *species at risk* live, amongst other factors (Government of Nova Scotia, 2010).

will analyze important benefits and key barriers limiting behaviours that provide wetland conservation through the lens of community-based social marketing (CBSM).

Social marketing is the use of marketing techniques to encourage behaviours or changes in behaviour to the benefit of society. McKenzie-Mohr *et al.* (1999), founder of the CBSM approach, lays out a framework for designing and analyzing the effectiveness of social marketing campaigns.

My research will mirror the first steps of the CBSM framework and identify the benefits and barriers to the use of buffers as a wetland protection tool within the context of agricultural applications within Nova Scotia. The research was focused on the use of buffers around wetlands and watercourses to provide a more in depth look at one aspect of wetland conservation, rather than attempting a broad overview of the whole concept. It is hoped that the relatively in-depth look at the use of buffers will reflect the barriers and benefits to wetland conservation in general in Nova Scotia.

It is important that regulators understand where forms of resistance are coming from to minimize the risk of misallocating resources to programs that are not reaching their full potential of effectiveness. Finding out what barriers exist for farmers that prevent the use of buffers around wetlands could provide valuable insight into what government could do to encourage this practice - one of the primary objectives of the proposed Nova Scotia Wetland Conservation Policy. The CBSM theory employed in this study should be applicable to the study of other agricultural conservation issues where there is community or industry resistance to potential policy implementation. This study will also contribute baseline data that will be useful in future comparisons with other studies.

2.0 Literature Review

2.1 Overview

The objective of this literature review is to identify research related to influencing wetland conservation behavior. These types of behaviours vary greatly across geographic area. In highly agricultural areas drainage ditches may be one of the last places where wetland ecosystems are found, increasing their significance and priority for conservation. Searches for literature were performed on Google Scholar in the English language. Peer reviewed sources of research were preferred but there is a large amount of government produced material that should not be ignored and therefore the searches were not limited to primary resources. There was no delimitation regarding date for the literature searches performed. Although most of the literature is relatively recent, some important historical perspective was provided by sources from the 1970's. Search terms used were "wetland", "conservation", "behavio(u)r", "agriculture", "social", "learning", "barriers" "buffers" and "benefits".

2.2 History of wetlands and agriculture

Wetlands were once regarded as areas with little value, where development for human purposes was under utilized. Wetlands were considered landscapes of no use and sanctuaries for pests and diseases (Williams 1996). These perceptions led to government incentives that encouraged draining and cultivation of wetlands to transform them into economically profitable lands (Wiebe 1997). This view of wetlands has since diminished and has been replaced by the more modern notion that wetlands are positive natural heritage features. Governments are also beginning to recognize wetlands as valuable habitats (Mitsch and Gosselink 2000). Government policy, such as the "Swampbuster" provisions, was a major turning point that slowed the destruction of wetlands in the USA. Under this program farmers are given government subsidies

if they manage wetlands responsibly (Heimlich 1998). Slowly, societies are becoming aware that wetlands hold intrinsic as well as economic benefit and, if preserved, often become more valuable than if they are drained or converted to other land, such as agricultural land.

2.3 Importance of Wetlands

Wetlands are valuable to society because they perform functions that humans depend on. These are functions are called ecosystem services (Williams 1996, Mitsch and Gosselink 2000, Costanza 1997, Kohn 1994, Zedler 2003, Zedler). The benefits provided by these services include flood abatement, water filtration and habitat that supports biodiversity (Zedler 2003). Wetland benefits also include less tangible services, such as the cultural significance of a salt marsh, or the natural beauty provided by a bog land. When Costanza *et al.* (1997) examined 17 ecosystem services across 16 global biomes, they concluded that the services and natural capital were worth 33 trillion dollars per year (USD-1997). They attributed 40% of this value to services and natural capital found within wetlands, or the equivalent of 13.3 trillion dollars worldwide. This is comparable to the total annual gross national product of 18 trillion/year in the US? (Costanza et al. 1997)..

2.4 Current Conservation Efforts

Current conservation efforts to retain wetlands in agricultural landscapes are either failing or not working well enough. Most plans to curb wetland loss and destruction are met with opposition, especially in wetlands on agricultural land where the attitude is often that it is inappropriate to harm food production in efforts to protect the environment (Ruhl 2002). Environmental protection and wetland retention are, in the end, measures that ensure food safety, but this connection is not generally made by the public or policy makers when it comes to

agriculture (Ruhl 2002). Food safety is increased because wetlands provide protection from flooding and drought, both of which are threats to agricultural yields.

Even where legislation guiding the conservation of wetlands is in place, there is still incremental wetland loss (Walters and Shrubsole 2005) for several reasons. Some wetland boundaries are not effectively delineated and therefore are not effectively protected, but there is also an important difference between policies of the government and attitudes on the ground related to wetland conservation (Walters and Shrubsole 2005, Pearsell and Mulamoottil 1994). This leads to conflict between public interests and private landowners, with governments seen as imposing on private interest. This conflict increases the difficulty of implementing wetland stewardship programs on agricultural lands (private property).

Public opinion is important to policy makers because widespread opposition can lead to policy rejection. It is therefore important to approach the subject of government policy on private lands with caution. Public opinion of agriculture often differs from other industries. EPA Administrator Christine Whitman expressed this attitude when she said, “we can’t harm food production to implement environmental protection” When discussing agricultural policy in the USA (Ruhl 2002). To demonstrate the fallacy of this thinking, Ruhl proposed changing “food production” to “nuclear power production” or “medical industry profits” and substituting “environmental protection” to “public safety protection” or “patient care protection” respectively in the Whitman quote above. The resulting statements are shocking and in Ruhl’s opinion much less agreeable than the original. Ruhl uses this “word game” to question why so many exceptions are made for the agricultural sector. Right or wrong, if public opinion is typically aligned with agriculture it will be important for policy makers and those trying to influence wetland management on agricultural lands to proceed with sensitivity.

Due to the constraints and sensitivities of industries, conservation measures must take into consideration the effects they will have on these industries, the jobs they create, the wealth they generate and the right they have to operate (Kohn 1994). The agriculture sector is of particular importance because; as it converts natural wetland areas to other uses the ecological functions performed by these lands are reduced (Woltemade 2000, Howarth 2002). Due to the critical importance of these functions, there is widespread scientific consensus that wetlands need to be conserved at healthy levels to maintain benefits to humans.

Typically the main beneficiary to conservation actions is the general public because the benefits of things like clean air, purified water and increased songbirds diversity extend well beyond the life boundaries of the person who conserves the land (Kohn 1994). This poses a challenge to understanding the logic of conservation behavior, because the opportunity cost of conserving wetlands to the farmer is greater than the individual benefit received from conservation i.e. it may be perceived as not worth conserving because the personal gains are so low (Kohn 1994). For example, if a farmer in King's County is cultivating 100 ha of their land for the production of feed corn, it would hypothetically be worth $22 000 dollars per season at $220/ha. If they were able to transform another 10 ha of wetland into corn producing crop land they would gain another $2 200 dollars per season (this is a high estimate considering converted wetlands are usually less productive than high lands). This wetland, if left in its natural state may be worth much more, say $6000 dollars per hectare per year. However because the benefits produced by the wetland are non-excludible i.e. they cannot be "bottled" and privately sold the benefits are shared among the people of the province. This means that benefits to the individual farmer would only be $6 000 divided by the amount of people who benefit from the services of the wetland (e.g., all the people that live in that watershed) resulting in only a small financial

incentive for the farmer to maintain the natural state of their wetland. In general, free market economic regulations have failed to adequately provide a full cost accounting for natural capital features such as wetlands (Stern and Britain 2006).

Neo-classical economics and free market systems based on supply and demand and the calculation of gross domestic product (GDP) all contradict prudent (sustainable) ecological policy. Supply and demand encourages producers (farmers for instance) to make as much profit as possible. It encourages producers to ignore damage done to ecosystems by not including this damage in the price of the goods. Calculations for GDP don't take into consideration many of the damages caused by agriculture, for instance the value a bushel of wheat is added to the GDP but the cost of lost topsoil lost or polluted waterways associated with this production is not subtracted from the GDP. This leaves a false sense of progress (based on increasing GDP) when our natural environment and ability to generate wealth (e.g. sustainable production of wheat) is actually in a steep decline. It has been shown that people making rational economic decisions can lead to the depletion of resources and a lower overall efficiency in simple ecological systems such as the amount of animals grazing on a public pasture (Hardin 1968). This is known as the "tragedy of the commons". The phenomenon noted by Hardin, has also been seen in Alberta, where unmanaged livestock grazing has lead to overuse and degraded riparian areas (Fitch and Adams 1998). Acting independently, ranchers (farmers, shepherds etc.) will often over-use the land and degrade it without noticing because, the benefits forgone by not conserving are so small ([dollars/ha]/beneficiaries).

With so many failures and problems arising from free market control of ecosystems within the context of agriculture we cannot depend on the market alone to regulate behaviours surrounding conservation measures. Government payments have typically been made to farmers

who choose to manage their land responsibly, but this is a costly and difficult process to implement. These types of transfer payments to farmers are sometimes much appreciated by farmers in exchange for their cooperation in conservation programs, but are hard to implement effectively because farms and the land on which they lie are so variable. Some lands are very valuable in an ecological sense (e.g. wetland) while other areas are very valuable for agriculture operations (e.g. nutrient rich crop land), the difficultly of placing a value on these differing lands has been a criticism of the current system of transfer payments (Burgess et al. 2000). Evidence suggests that we cannot depend on market processes and government payments alone to encourage conservationist behavior (Kohn 1994, Burgess et al. 2000). A new system of encouraging conservation behavior must be developed because budgets are limited and payments will not always be possible, so conservationists must find ways to encourage changes in land-use management practices through stewardship (Walters and Shrubsole 2005).

There are a number of different ideas for ways to achieve positive behavioural change in relation to wetland management, but none are well-tested. There is still significant debate over which approaches are most effective and feasible. Two main schools of thought exist on the issue: 1) that government regulation and financial incentives are the solution to conservation program implementation and 2) that education and stewardship behavior should be the main focus.

Conservation by through government regulations and free market processes are becoming less and less popular due to supposed inefficiency (Walters and Shrubsole 2005, Stern and Britain 2006, Ison 2007). These mechanisms are often mismanaged and hard to implement fairly. At best, farmers are compensated according to general assumptions where some land is over-valued and some is undervalued; in the worst case scenario, farmers are paid to pollute because

so little environmental protection is asked of them (Ruhl 2002). Increasingly, efforts towards sustainable water resource use (e.g. wetland conservation) are being focused toward more complex networks, involving cooperation between the stakeholders involved (e.g. Walters and Shrubsole 2005, Stern and Britain 2006, Ison 2007). Involving all stakeholders in the policy development process can result in widely accepted government policy or self-regulation through agricultural associations. Whatever the outcome, it appears to be beneficial to have cooperation and input by all stakeholders, including; farmers, regulators, public servants, politicians and the general public.

Social learning is one theory that has been applied to conservation behavior. Social learning is a concept of intense stakeholder involvement and heuristic learning; it has proved successful in a number of European case studies (Steyaert 2007, Olsson 2004). Heuristic learning is experienced-based learning, where discussion, sharing and trial and error methods lead to efficient conclusions on policy directives. This learning can be a powerful bonding tool for stakeholders and allows for common interests to drive progress and cooperation. Decisions that come from a shared appreciation of the issues between stakeholders are likely to have a longer lasting impact (Callon *et al.*, 2001 as found in Steyaert 2007). Any processes that are likely to result in long-term behavioural change for improved wetland management are likely to have a lasting impacting on conservation behavior. As a result, multi-stakeholder platforms for decision-making are now the dominant policy for agriculture-environment interactions in France (Steyaert 2007).

Actor network theory (ANT) is another theory that has proven to be useful in the conservation of wetlands. This is because it allows the issue to be viewed from different perspectives by different actors (Burgess et al. 2000). ANT allows stakeholders involved in the

conservation of wetlands to focus on the network that brings the actors together, which is often the hardest obstacle to surmount (Burgess et al. 2000, Law 1992). Focusing on the network that brings actors (stakeholders) together, largely accomplishes the same result as social learning; it strengthens the bonds between stakeholders and encourages cooperation. Outside of a group situation people are highly unlikely to take leadership and go out of their way to conserve the natural areas they own (especially if the costs are prohibitive as they often are in wetland conservation). ANT has lead to positive outcomes in Pevensey Levels, an agricultural area of England where wetland degradation was an issue (Burgess et al. 2000). Pevensey Levels is a large estuary containing salt marsh, fresh water marsh and nationally rare species. It is classified as a Site of Special Scientific Interest (SSSI) and is overlain by a network of ditches that facilitate the removal of surface water creating appropriate conditions for grazing livestock. Necessary maintenance of the ditch system was threatening the ecological function of the area. Burgess *et al.* showed that it was possible to achieve positive behavioural change that fostered conservation and stewardship within the agricultural community around Pevensey Levels.

Research about the interactions between common agricultural practices and wetland conservation is overdue. Wetlands have been converted and modified by humans for a variety of reasons even though are one of the most modified ecosystems (Costanza 1997, Williams 1996). If wetland loss is not curtailed, human society runs the great risk of losing many of the ecosystem goods and services that wetlands provide.

Inducing behavioural change towards wetland conservation must be adaptive and able to fit the extremely variable and unique issues that face individual communities. The theories that best fit this description are based on social learning and involve all stakeholders equitably (Steyaert 2007, Burgess et al. 2000, Ison 2007, Olsson 2004).

Environmental psychologist from St. Thomas University in Fredericton N.B. Doug McKenzie-Mohr (1999) has developed a theoretical framework for fostering sustainable behaviour. This framework called "community-based social marketing" (CBSM) could be extremely valuable in encouraging social learning and behaviour modifications of wetland stakeholders in Canada. CBSM sets out the steps that must be taken in order to foster sustainable behavior. It is a general model but specifically designed to encourage behaviours that are environmentally-friendly. The model is quite similar to social learning and actor network theory in that it involves cooperation of all stakeholders. Stakeholder participation and water resource protection has been achieved recently in Canada with some success. In Alberta, the "Cows and Fish" program educates, informs and encourages stewardship in the agricultural community, with specific focus on cattle ranching activities (Alberta Riparian Habitat Management Society, 2010). People choose to do things that have high benefits and relatively small barriers (McKenzie-Mohr et al. 1999). This is a feature that McKenzie-Mohr claims applies to all conservation situations. It will be important to analyze the barriers to wetland protection and to educate about the associated benefits to make progress towards wetland conservation in Nova Scotia. This research is an exploratory project to see if community-based social marketing can be applied to better understand what is needed to advance wetland conservation in Nova Scotia.

3.0 Methods

The research in this study is primarily qualitative research and aims to answer questions about how and why things occur. The problem of wetland conservation will be approached through interpretive methods. It is important to understand, not just what particular behaviours are among farmers in relation to wetland conservation or degradation, but how the people

responsible for these actions define themselves in the world (e.g. as stewards of the land, as dependants on the land). With the interpretive approach assumptions about whether a behaviour is appropriate or inappropriate are dependent on the societal factors that have influenced one's perceptions. These perceptions will change across societies and time, so a key study goal is to understand these perceptions. The research in this study is positivist in nature, where the goal is to understand the world in a way that allows one to make predictions and test hypotheses. The research is addressing complex systems that are based on more than just a single experience or even one person's experience. To gain a holistic view of the systems driving behaviours regarding wetland conservation, information must be gathered that is reliable and representative of the people it is intending to characterize. The methods are designed to provide a reliable representation of wetland conservation behaviour in Nova Scotia.

Respondents were regarded as informants because they were explicitly involved in the research process. Informants were aware that they were taking part in a study and the purpose of the study. The informants helped researchers get a perspective that could only be provided by people that are directly involved in the farming industry in Nova Scotia.

3.1 Geographic Area of study

Agricultural lands in Nova Scotia are spread throughout the province but exist in higher concentrations where soils are particularly suitable for farming. The Annapolis Valley is the most famous agricultural center in Nova Scotia and home to the highest number of farms. King's County contains 17% of all the farms in Nova Scotia with over 580 in operation (Nova Scotia Federation of Agriculture 2001-1). Digby County has the least farms with only 2% of the provincial total (NSFA 2001-2). Concentrations of certain crop and commodity types are also found across the province. Fruit farms are concentrated in King's county, while mink operations

make up the majority of farms in Digby County (NSFA 2001-1, NSFA 2001-2). There were no delimitations placed on geographic area in the study, except for provincial boundaries, because a random sample of farms provided a suitable cross-section of geography and commodity. Because the random sample was generated from a list of Nova Scotian farms it was assumed that all returned surveys were from within the province.

3.2 Sampling

The study employed limited use of a "gatekeeper", a person that is already somewhat familiar with the targeted group and issues associated with the study. The gatekeeper acted as an ambassador to potential respondents and created a network of respondents. The study's gatekeeper, Mr. Reg Newell is the Stewardship Coordinator working for Nova Scotia Department of Natural Resources. Mr. Newell is knowledgeable about on-farm practices in Nova Scotia and was able to suggest many potential informants from experience in the field. This experience was derived from completing biodiversity surveys on farmlands around the province and compiling this information into reports on the health of biodiversity on the farm. Mr. Newell was also useful as a source of local knowledge. Through connections made by the gatekeeper, four respondents participated in the study via emailed surveys.

Mr. Newell also suggested using the Nova Scotia Federation of Agriculture as the main contact. The Federation has about 2500 members across the province and provides them with a series of direct and indirect benefits (NSFA 2008). The NSFA was used as the primary contact because it has the largest database of farmer contact information and provided a way to contact a relatively large, representative group of farmers in the province. The membership of the NSFA represents almost 70% of the farms in Nova Scotia.

To achieve representativeness, a random sample of 500 farmers was selected from the NSFA members database. Addresses were kept confidential to protect the privacy of the members. It was assumed that the membership of the NSFA was representative of the total farming population in Nova Scotia. No evidence surfaced during the study that suggested otherwise. Optional personal questions were included in the survey to allow demographic characteristization of the respondents[2]. Age, size of farm and whether or not their primary income was from farming were included in the survey for comparison to provincial averages from long-form census data to check for representativeness. It was assumed that to achieve any sort of representativeness and saturation at least 50 responses (10% of the total population in the NSFA database) would be required.

If response rates were below the targeted 10%, recruitment efforts would be shifted to newsletters (from agricultural associations, commodity groups etc), newsprint and further social networking through contacts made by Mr. Reg Newell.

3.3 Mode of data collection

To gain a representative view of wetland conservation issues in agricultural Nova Scotia, questionnaires were utilized (see Appendix II). Questionnaires are a suitable sampling method for this application, because they can be sent out to anyone with a mailing address and to many people for relatively low cost. It was important to the success of the study that the response rate be at or above the required 10% which is an average for Canadian mailed surveys (McKenzie-Mohr 1999). To boost response rates the survey completion process were made as simple and attractive as possible. For example:

- Stamped and addressed return envelope was included with each mailed survey

[2] Although these questions were optional the response rate was nearly 100%, higher than some of the non optional questions.

- All envelopes were personally addressed
- The survey was confined to a single page front and back
- Coercion was not used
- Anonymity was guaranteed for all participants
- Purpose of the study was explicitly explained
- A short description of the researcher was given including age, degree program and a photo
- A statement saying no financial gain would come from the research was included

These efforts were taken to ensure a high response rate and allow the survey to be completed solely through the contacts at the NSFA which was the most representative way with the least amount of bias.

The language used in the survey was designed to encompass a large window of interpretation. For instance, instead of 'wetlands', these areas were referred to as "bogs, marshes and swamps". "Rivers and streams" was used instead of 'watercourses'. In the rest of this report the language is used interchangeably. For the purpose of simplification, the matrix of statements (section A of the survey- Appendix II) regarding the use of "uncultivated, ungrazed and unlogged areas near" wetlands and watercourses will be referred to as "environmental statements". "Sources" of information and influence will refer to section E of the survey where respondents were asked "where they got their information regarding farming practices" and "what influenced their decisions regarding farming practices".

3.4 Data Analysis

Due to the highly qualitative nature of the study, quantitative data analysis was challenging. Personal cultural influences and opinions were managed by process of bracketing. Bracketing is the recognition of biases that are inherent in the opinions of the researcher due to experience (or lack thereof) with the subject matter. If beliefs of the researcher are not accounted for, conclusions may be biased. In an effort to mitigate influence, a diary of personal beliefs and thoughts regarding the subject of the study were kept by the researcher.

Responses, such as which commodity (beef, grain, fruit, dairy etc.) a farmer indicated as their primary commodity, were coded numerically in order of their appearance when reading the surveys. Answers in "other" and "why" categories such as other sources of information or why unworked areas were left near wetlands were similarly coded.

Responses were standardized when possible, using questions that could be rated with scales such as the Likert scale. Likert scale responses were easy to compile and synthesize because respondents choices are limited to specific categories (see Appendix II section A).

Final response data was analyzed for saturation. Saturation is achieved when responses that are returned reiterate what has already been discovered from previously returned surveys. It was assumed that if the surveys being returned are similar to those that have already been returned that a sufficient variety of perspectives have been obtained. Representativeness is also crucial to obtaining reliable results. If the study is perfectly representative, the proportion of each demographic in the study respondents will match perfectly to the proportion of that demographic in the whole population. Information from Statistics Canada from the long-form census including age and farm size was compared to the survey response averages. Results from the national survey that are close to the provincial averages suggested a representative sample without major

biases. Although this information doesn't speak for the opinions that the sample farmers may have it does suggest that there is no inherent bias favouring one demographic over another.

Compiled data was analyzed with basic statistical software (Minitab 15 and Microsoft Excel) to identify the overall opinions and thoughts of the respondents. Likert scale responses were summarized by calculating a mean average along with a standard deviation. This expressed how much the respondents agreed with the statement and how much variation there was amongst the group. Likert scale responses such as agreement with environmental statements were analyzed using Spearman's Correlations. Spearman's Correlations were used due to the ordinal nature of Likert scale responses. This correlation is also useful because the data is non-parametric, therefore rendering a Pearson's Correlation inaccurate. The survey responses were correlated with sources of information and sources of influence. The agreement levels from survey data were also correlated with use of buffers around wetland and use of buffers around rivers and streams. The signs of the correlations were flipped to provide a clearer relationship between sources of information and influence and agreement on Likert scale (because 6=strongly disagree a positive correlation does not express increasing agreement with use of information source or influence). Confidence values such as P-values were calculated on a t-table according to the calculation:

$$t = r\sqrt{\frac{n-2}{1-r^2}}$$

Questions involving yes or no answers (Bernoulli trials) were assigned 'dummy' variables (1=yes, 0=no) and were averaged to express binomial distribution or a probability of a respondent answering positively.

Chi-squared analysis was run on sources of information and sources of influence from the survey to check for significant (α=0.05) differences between them.

3.4 Ethical Approval

To ensure the utmost of respect for the respondents was maintained, ethical approval was obtained from the Department of Environmental Science according to the guidelines set out by The Office of Research Ethics at Dalhousie University. Application for ethical approval was submitted with intentions of the project, a description of methods, risks of the project, potential benefits of the project and informed consent process (Appendix I).

4.0 Results

In certain cases in the results and analysis section a confidence level of α=0.10 is used. Although the conventional level of α=0.05 would have been ideal and given greater confidence in the results, this study was an exploratory and therefore it is assumed that any results with a confidence level of α=0.10 are real trends and not solely based on chance. There has been little research done in this area of study in Nova Scotia so adoption of a more liberal alpha level was appropriate.

4.1 Descriptive Statistics

Of the 500 surveys initially mailed out, 3 were returned as undeliverable due to incomplete addresses. One hundred eleven completed surveys were returned giving a response rate of 22.3%. The average age of the respondents was 55-59 years. Age of respondents was heavily skewed towards the over 50 category. There were very few (8) respondents under the age of 40 and no respondent was younger than 30.

Farming was the primary income for exactly half of the respondents who responded (n=110). The mean and median size of farm was 130.95 ha and 101.17 ha respectively[3] (n=101).

The most common commodities sold by respondents were dairy and beef but more rare commodities were also represented including grapes, horses, goats, landscape plants and maple products (grouped as "other" in figure 1).

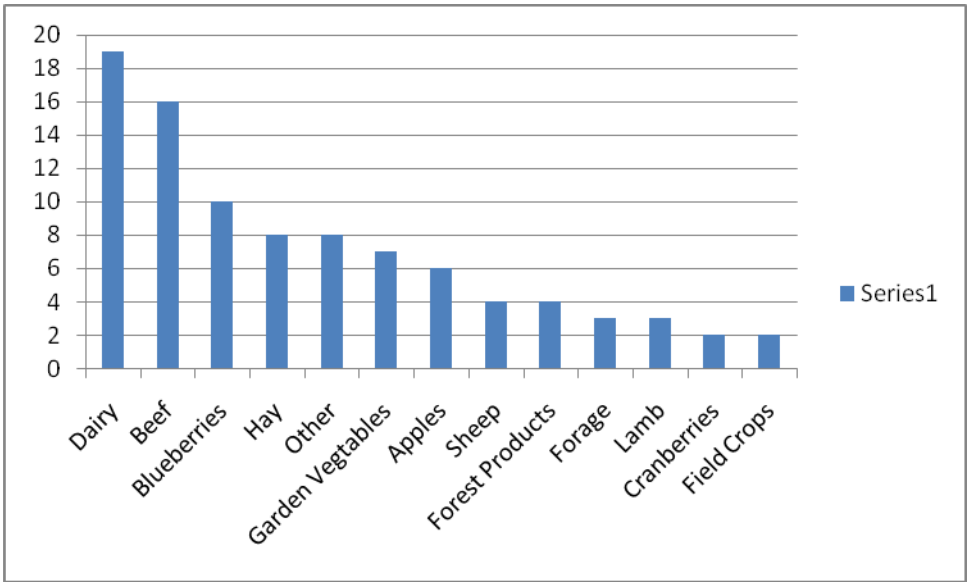

Figure 1. Commodities produced by respondents and how many respondents reporting them as their primary product.

The most common sources of information about farming were "farming publications" and "agricultural associations" with 70 and 71 respondents indicating them as sources of information (Figure 2). Of those who indicated that "farming publications" were a major source of information there was a wide variety of publications mentioned. Most other categories of information sources were also cited fairly heavily by respondents, but the source that was

[3] Respondents were asked to convey the size of their farms in acreage because it is a more commonly used unit than hectares. Area in hectares was calculated from acreage.

selected least was “family” (n=36). In the comments section related to this question common responses (n=9) included “experience” and “common sense”.

When asked “what influences your decisions about farming practices” the results were very similar, although in almost every category the positive response rate was lower (Figure 2). Farming publications and agricultural associations were the most common responses but it was neighbours and not family that had the fewest responses (n=31). Experience was indicated as an influential factor in decision-making by 15 respondents and economic factors were mentioned by another 9 respondents. Two respondents mentioned that Environmental Farm Plans (EFP’s) influenced that decision. The EFP program is run by the Nova Scotia Federation of Agriculture with support from the provincial and federal government and is meant to help farmers assess environmental risk on their farms.

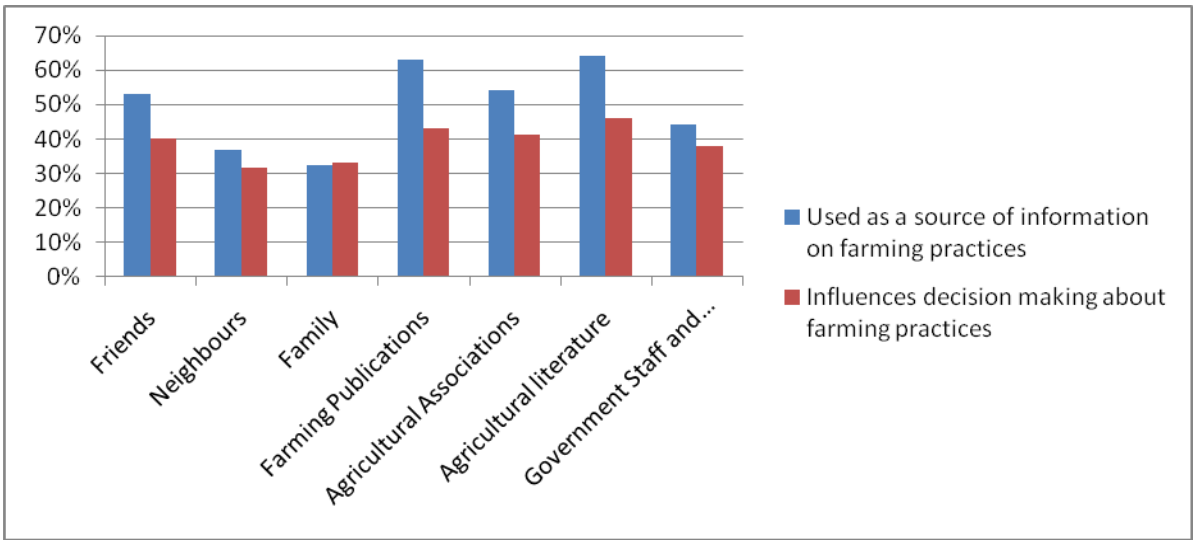

Figure 2. Percentage of positive responses from survey results showing commonly used “sources of information about farming practices” and “factors that influence decision-making about farming practices”.

Chi-squared analysis showed a significant (α=0.05) difference in the way respondents used “friends” (χ^2= 4.075, P=0.044) , “farming publications” (χ^2=8.756, P=0.003) and “agricultural associations” (χ^2=7.279, P=0.007) as sources of information and as sources of

behavioural influence in their farming practices. All other factors showed no significant difference between the patterns of use as information and as a source of influence.

Over three quarters (77%) of respondents indicated their property contained wetland. On average these areas took up 9.26% of the total farm area. Over a quarter (27%) of respondents indicated that a portion of their farm has been drained or infilled to create more arable land. Among those respondents, the median drained or infilled area represented 5% of their farm land. Rivers and streams were present on 81% of respondents' farms. Of the respondents with rivers and streams on their farms 93% left unworked areas near the rivers or streams. Size of buffer was not reported. Out of the respondents whose farms contained wetlands, 84% left unworked areas near the wetlands. Respondents with both wetlands and watercourses on their property were almost ten percentage points (94.5%>84.9%) more likely to leave buffers areas near the watercourses as they were to leave buffers near their wetlands. This difference was nearly statistically significant (χ^2= 3.641, p = 0.056).

When asked why respondents did or didn't leave buffer zones around wetlands and watercourses there were many answers. Written responses to 'why respondents did or didn't leave buffer zones around wetlands and watercourses' were categorized, so they could be grouped together and analyzed. The most common responses were that the land was too difficult to cultivate around wetlands and that leaving buffers around rivers prevented erosion (figure 3). Stewardship was also a leading reason why respondents used buffer areas around both wetlands and watercourses.

The survey also included a question asking "*why not*" to those respondents who didn't use buffers but the response rate to this question was extremely low. Fewer than 20% of respondents didn't use buffers around wetlands and watercourses and only a handful of those

farmers reported why they didn't use buffers. There were not enough responses associated with this question to compile the data in a meaningful way.

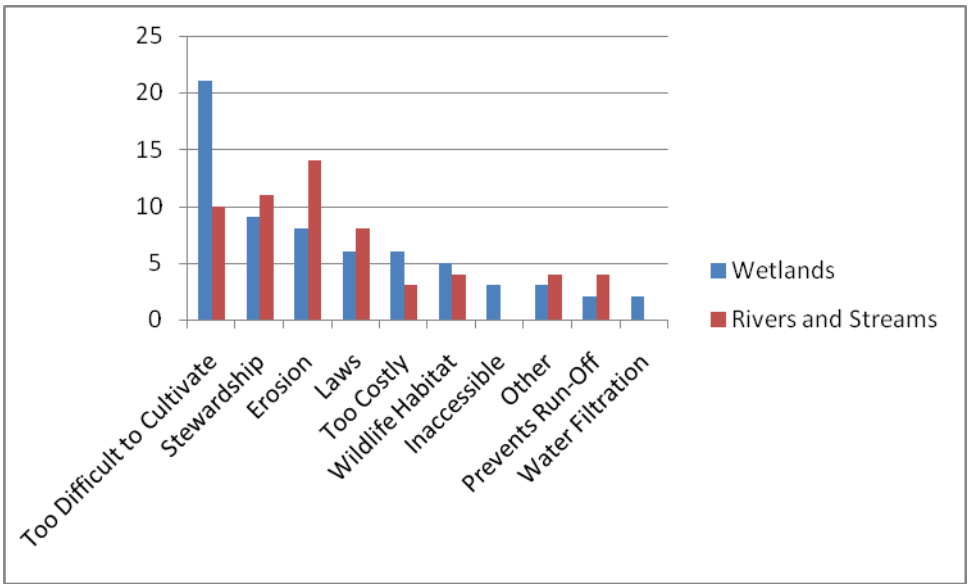

Figure 3. Categorized reasons that respondents used buffer zones around wetlands and rivers and streams.

Respondents were asked how much they agreed with a set of four statements regarding rivers and streams and another set of four regarding wetlands (section A of "Farmer Questionnaire"- Appendix II). The statement respondents agreed with most was that leaving unworked areas around watercourses prevented erosion. The statements they agreed with least were related to flooding near both wetlands and watercourses (table 1). Overall, respondents agreed with the statements more in regards to rivers and streams than they did in regards to wetlands ($P<0.000$) (table 1).

Table 1. Mean agreement (1= strongly agree, 6=strongly disagree) with each statement and standard deviation for statements related to wetlands and rivers and streams with results closer to 1 representing a higher level of agreement.

Leaving uncultivated/unlogged/ungrazed areas…	Wetlands		Rivers and Steams	
	Mean	Standard Dev.	Mean	Standard Dev.
…Prevents erosion	2.316	1.635	1.892	1.493
…prevents flooding	2.816	1.778	2.68	1.711
…purifies water	2.06	1.427	1.949	1.297
…is good for the environment and wildlife	1.99	1.418	1.902	1.338

The *pattern* of responses were very similar in all cases with 1 (strongly agree) being the most popular answer (figure 4).

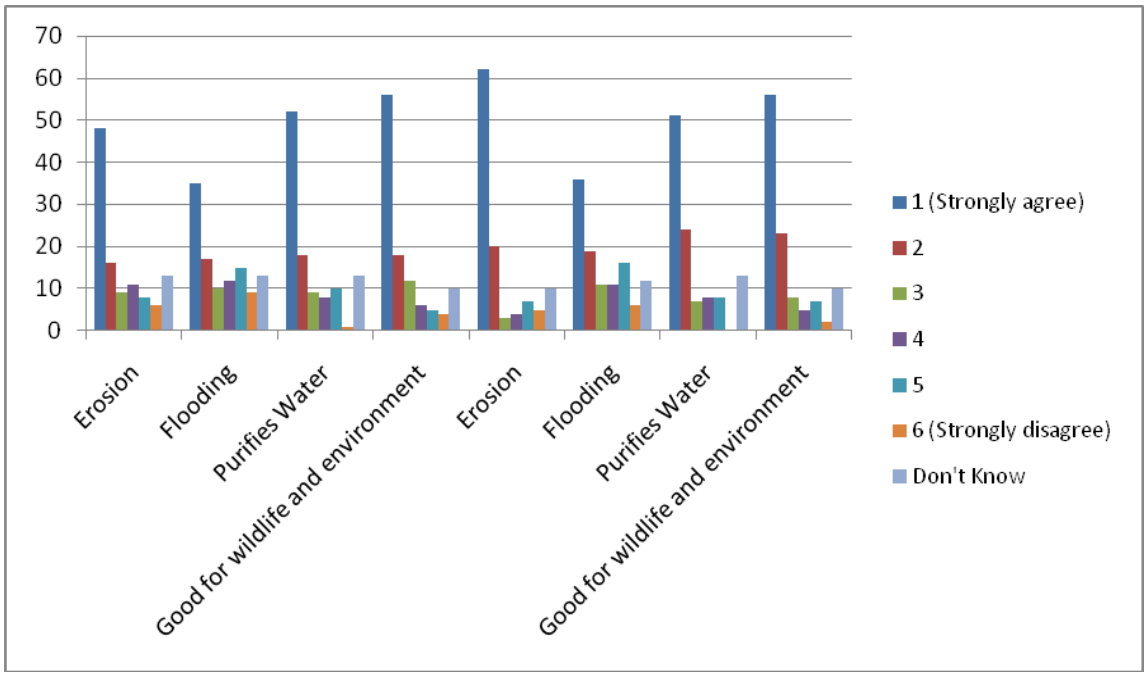

Figure 4. Agreement levels by percentage of respondents to four statements regarding wetland buffer use and buffer use around streams and rivers.

4.2 Correlations

Correlations between the agreement levels with each statement and use of buffers were low and ranged from 0.053 to 0.155 (table 2). The signs of the correlation values were switched from negative to positive to give a more intuitive positive correlation between agreement and use of buffers. Naturally the correlation values were negative because 1=strongly agree and 6=strongly disagree. Correlation values were significant (α=0.10) between "use of buffers around rivers and streams" and respondents' agreement levels with statements including, leaving (buffers) prevents erosion, prevents flooding and is good for the environment and wildlife (table 2).

Table 2. Spearman's correlations values between "use of buffers around wetlands" and "agreement with environmental statements regarding wetlands". Table also includes correlation between "use of buffers around rivers and streams" and "agreement with environmental statements regarding rivers and streams". * represents significance at α=0.10. All other values lack significance at α=0.10.

Leaving uncultivated/unlogged/ungrazed areas…	Wetlands	Rivers and Streams
…Prevents erosion	0.121	0.140*
…prevents flooding	0.121	0.135*
…purifies water	0.080	0.053
…is good for the environment and wildlife	0.093	0.155*

Based on correlation analyses, the use of some sources of information and influence were positively correlated (e.g., 'agricultural associations' and 'agricultural literature' (table 3)), while some, like 'friends' and 'neighbours' had negative associations (table 3). Correlation results were generally not strong and ranged from 0.194 to -0.166 (table 3). Results were fairly consistent between sources of information and sources of influence with only 2 factors changing from

positive to negative correlations or vice versa. Correlation results were also consistent (both positive or both negative) between wetlands and watercourses with only "government" showing a change from positive to negative correlation when used as a source of influence as opposed to a source of information.

Table 3. Spearman's correlations associated with source of information or influence and the use of buffers around wetlands and watercourses (* represents results significant at $\alpha \leq 0.10$).

	Source	Use of buffers around wetlands	Use of buffers around rivers and streams
Source of information about farming practices	**Agricultural literature**	**0.109**	**0.057**
	Agricultural associations	**0.126**	**0.064**
	Family	**0.016**	**0.009**
	Farming publications	-0.003	-0.034
	Friends	-0.07	-0.001
	Neighbours	-0.052	-0.037
	Government staff and publications	-0.046	-0.126
Source of influence regarding farming practices	**Agricultural associations**	**0.194* 0.10>P<0.05**	**0.025**
	Agricultural literature	**0.108**	**0.052**
	Farming publications	**0.008**	**0.071**
	Government staff and publications	**0.067**	-0.166
	Family	-0.032	-0.051
	Neighbours	-0.041	-0.071
	Friends	-0.023	-0.157

5.0 Analysis

5.1 Scope

In the analysis section of this paper, relationships and patterns in the data will be explored and explained. The goal of this analysis is to determine what the most significant factors that

encourage the use of buffers are as well as what strongest barriers against the use of buffers are. Any results from the survey that relate to the use of buffers around wetlands or watercourses will shine a light on some of the factors that influence this behaviour. It will also be useful to see what factors influence farmers' perception about the use of buffers. This information gathered from the agreement levels with the four environmental statements will be important to figure out *why* farmers are leaving buffers. Finding the barriers and benefits to buffer use on farms is one of the first steps in the community-based social marketing campaign that could be useful to encourage more positive environmental stewardship on farms in Nova Scotia.

5.2 Response and Demographics

The expected response rate for the study was far exceeded by the actual number of participants in the study. This could be for a number of reasons including; return stamp postage used, and university sponsorship. Return stamp postage (as opposed to business mail) and university sponsorship were shown to have a positive impact on response rates of 6.2% and 8.9% (both statistically significant at $P< 0.01$) respectively in a meta-study of mail surveys (Fox, Crask and Kim 2001). The letter that prefaced the survey was written to appeal to the compassion of the potential respondents (Appendix I). Some of the notes that accompanied completed surveys suggest that this letter may have boosted the response rate as they mentioned that they were not sure whether they should fill out the survey but, hoping it would 'help a young student out', they decided to do so.

Other factors that could have significantly affected response rates include pre-notification by letter and follow-up reminders by post-card (Fox *et al.* 2001). These steps were not possible due to the time and financial constraints of the project. The study analysis includes over 22% of the mailed surveys which is above the average for Canadian mailed surveys (McKenzie-Mohr et

al. 1999). More than this were actually returned (24% or 119 of 497) but the latest surveys could not be analyzed due to time constraints. The 111 farms surveyed represents over 3.3% of the total number of farms in Nova Scotia and there are several factors in the data that suggest the sample is a close representation of the provincial population (Nova Scotia Federation of Agriculture 2001).

The age of the respondents is very consistent with the provincial averages according to long-form census data collected by Statistics Canada in 2006. The average age of respondent farmers was between 55-59 years of age, only slightly lower than the provincial median of 53 years (Statistics Canada 2007-1). This provincial average is also increasing and could, in reality be as high as 55 considering the increase from 51 to 53 seen in a 5 year period between 2001 and 2006. The distribution of ages is also very similar between the provincial population and the respondent sample (see figure 5).

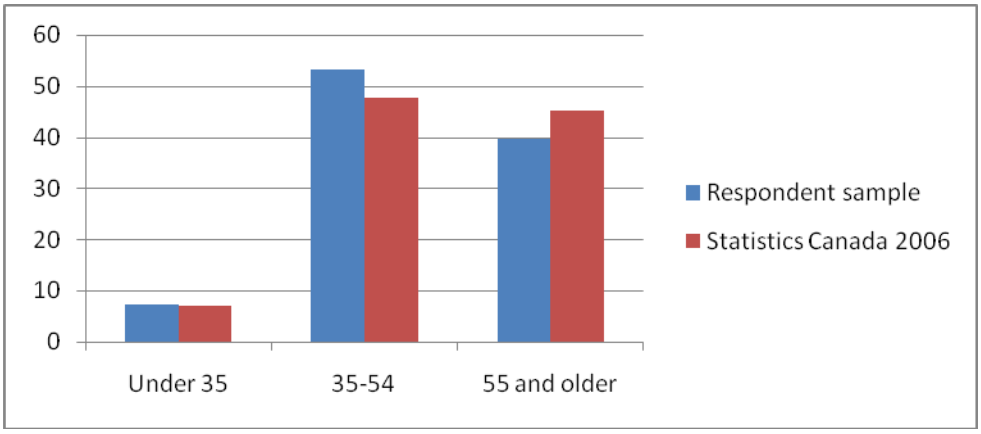

Figure 5. Proportions (percentages) of age categories showing respondent sample and Nova Scotia farmer distribution (Statistics Canada 2007-1).

The average farm size of respondents was also consistent with provincial averages. The provincial mean of 106 ha correlates closely to the surveyed median of 101.17 ha (Statistics Canada 2007-2). One farm reporting a size of 2500 acres had a large influence on the study mean

and therefore the median was used to express the surveyed average. The number of respondent whose primary income is derived from their farm profits was also very close to the provincial average. The split between agricultural primary incomes and non-agricultural primary incomes was exactly 50-50 amongst respondents (n=110) and was 44% agricultural and 56% non-agricultural amongst the provincial population (Statistics Canada 2007-3). This is effectively only a 2% difference and was not significantly different under Chi-squared analysis (χ^2=1.410 P=0.235).

5.3 Sources of Information and Influence

Agricultural associations and farming publications were the most popular responses to what respondents used as sources of information and influence. There is an obvious bias to responses of "agricultural associations" because the survey was distributed through a member list of an agricultural association. "Farming publications" was also a popular answer and this is likely due to the wide distribution of magazines such as "Rural Delivery", "Atlantic Beef" and others. These magazines are readily available and serve as cultural publications amongst groups of farmers. The least popular response was "family". This is probably because "family" is not necessarily a source of expertise unlike agricultural associations and government publications. However, family in actuality is probably a fairly influential factor in the decision making of farmers. Farmers who depend on their production for their income depend on that income to care for their families. In this sense family may be a drive to neglect environmental stewardship in search of higher profits. Contrarily, if the farmer plans on passing down their farm land to the next generation it may drive environmental stewardship.

Survey design may have influenced respondents to answer in a similar fashion when asked "what sources of information do you use regarding farming practices" and "what

influences your decision about farming practices". Many respondents answered identically to both questions and for some this may be a true representation of how they use these sources of information and how they influence their behaviours. More likely, the questions were unclear to some respondents and therefore the questions were not treated independently. However, significant differences arose between the two questions when asked about "friends", "farming publications" and "agricultural associations". One reason for these differences could be that these sources have particular merit as sources of information or as influential factors but not the other. "Farming publications" elicited interesting responses from the survey. A common Nova Scotia-based farming publication called "Rural Delivery" was referenced as an example in the survey question. Several respondents underlined "Rural Delivery" to highlight the fact that they used the magazine as a source of information, while several others crossed it out or wrote "not" indicating that they didn't use that particular magazine. This represents a strong polarization of respondents who do and don't read this magazine and suggests that there may also be differences between people who simply read it for information and those who use if an influential source. Magazines like "Rural Delivery" are also cultural publications in many respects. They contain community information and general interest stories, many respondents may read them for this reason (source of information) but do not feel that the magazines are influential on their farming practices.

Other factors such as "government staff and publications", "agricultural literature", "family" and "neighbours" did not show significant differences between their use by respondents as sources of information and sources of influence. This could be because of the lack of independence between the two questions. The lack of significant difference could also be a true representation of how respondent use these factors.

5.4 Use of Buffer Zones

Respondents were asked if they used buffers around wetlands and water courses. This was the desired behavior (use of buffers) and the main interest of the survey. Most respondents answered yes to these questions at rates of 93% around rivers and stream and 84% around wetlands. These rates are calculated from respondents who actually had wetlands or watercourses on their property although rates amongst the entire group were similar (rivers and stream=91%, wetlands=84%).

These rates are much higher than expected and would represent very positive environmental stewardship behavior on behalf of the respondents. However, because there was no associated width of buffer within the question in the survey, these figures may be inaccurate. Leaving small buffers around rivers is indeed a very common practice; it can be dangerous and difficult to work this land, so much so that it is often not worth the effort. Leaving a 25 m buffer provides much more environmental benefit including erosion prevention and sedimentation prevention but it is also a greater sacrifice for the farmer. In the survey results these two fundamentally different practices were likely grouped together expressing a very high rate of buffer use.

Instead of a question that asked *if* the respondent used a buffer around rivers or wetlands it should have been three questions asking if the respondent used buffers of three different widths. For instance, 5m, 15m and 30m. This would have allowed for more in-depth analysis and also yielded result regarding the size of buffers used. With such heavily skewed data (so many people responding that they ‘use buffers’) there are limitations to the statistical analysis possible. For instance, as a rule of thumb it is possible to include another control in regression analysis for every 10 “yeses” and 10 “no’s”. With a response rate totaling 111 surveys it would be possible to

control for up to 5 factors if the data was split evenly between yes and no. Unfortunately with data that is skewed, as in the case of this survey, it is not possible to create a meaningful regression model with any predictive power. If the three questions including size of buffer were used instead of the one question, at least one set of data would be more evenly distributed allowing for greater analysis (regression) as well as comparison between the different width question results.

Respondents used buffers around rivers and streams differently than they did around wetlands. Respondents were almost 10 percentage points more likely to use a buffer around their rivers than they were around a wetland amongst respondents with both river and wetlands. This could be because rivers are quickly being accepted as important natural features that deserve protection. This perspective on wetlands is less popular and lagging behind. It is much easier to see destruction of a river (erosion of the banks, siltation, contamination, lack of fish etc.) than it is to see the damage to a wetland. Riparian management strategies have been more focused on rivers and streams than wetlands (e.g. Alberta Habitat Management Society - Cows and Fish program; Foragebeef.ca- Riparian Management) largely for the benefit of fish populations. This is because fish depend on rivers and streams for habitat in spawning season and all year. The significant difference between buffer use around river and wetlands leaves much to be desired regarding buffer use around wetlands but it is also a hopeful message. Respondents agreed more with a set of 4 environmental statements regarding rivers and streams than they did with the same statements regarding wetlands. The agreement captured in three of these questions (leaving buffers around rivers… helps prevent erosion, helps prevent flooding and is good for the environment and wildlife) correlated with some significance (α=0.10) to the use of buffers around rivers and streams. This suggests that programs focused on the health of river riparian

areas are causing the farming community to be more aware of the environmental benefits of healthy river and stream ecosystems and encouraging them to take action. This awareness translated into a significant difference between the percentage of respondents using buffer zones around rivers and streams than around wetlands. If these programs were adapted to encourage more buffer use around wetlands it could potentially close the gap between treatment of watercourses and wetlands. This would have positive environmental implications.

The top reason why respondents used buffers around wetlands was because the land was too difficult to work. This is understandable considering the nature of wetlands. Since this is already an established reason why many farmers don't cultivate right up to the edge of their wetlands it should be reiterated by government and agricultural associations to promote the use of buffer zones. Some of the answers that were compiled into the category of "too difficult to cultivate the land" also involved the limitation of machinery and risk of damage to machinery. These risks could be mentioned along with all the other benefits of leaving buffer zones to further promote their use.

The most commonly expressed reason for using buffers around watercourses was to prevent erosion. Erosion prevention is a commonly cited benefit of leaving a buffer around rivers and suggests that literature including this benefit is having a positive impact. Farmers are well-aware of the erosion control benefits of buffers but perhaps promotion of the lesser understood benefits such as run-off prevention could also increase buffer use. Lesser understood benefits such as run-off prevention were only mentioned by a handful of respondents.

An encouraging result was the relatively high rate of reporting stewardship as a reason to use buffers. No survey answers actually mentioned the word "stewardship" but many perfectly summarized the concept. Answers included "(to leave) the land in good condition for the future".

Stewardship is important because the Nova Scotia Wetland Conservation Policy directly promotes it as one of its core objectives. Stewardship was consistently mentioned as a reason for using buffers between wetlands and watercourses. This could be due to the nature of stewardship and how it is based on taking care of a resource which has an intrinsic value (which is equal between wetlands and watercourses) and not collecting individual benefits (which may vary between wetlands and watercourses).

These reasons *why* respondents used buffer zones on their farms represent the perceived benefits to their use. This information is very useful to encourage current patterns of perceived benefits (erosion control) or improve the perception of other real benefits (run-off prevention).

5.5 Correlations

Correlations between sources of information as well influence, and use of buffer zones on farms is a direct link between the information that is out there and conservation behavior. This information has interesting conservation implications and sheds some light on what is working and what is not working in the effort to encourage conservation of wetlands in Nova Scotia. The correlation values from the survey data were generally low, and were both positive and negative. Positive correlations suggest that the sources of information and influence are being successful in promoting conservation and the use of buffers. Negative correlations suggest the opposite and indicate sources that could be improved.

Sources that produced consistently positive correlations with buffer use included agricultural association and agricultural literature. Both of these sources are consistent and reliable. The message spread by agricultural associations and agricultural literature is ‘pro-conservation’ and encourages responsible stewardship including advocating the use of buffers for healthy riparian areas.

Consistently negative correlations arose from sources such as friends and neighbours. These are sources where personal bias could be present and where advice or information could be unreliable. Inconsistent information can discourage people from taking action, so even if these sources were advocating buffer use in riparian areas the inconsistent advice could prevent action. This hypothesis of reliability leading to positive correlations fits the results well with the exception of "government staff and publications" and "family". Government staff and publications are probably some of the most consistent information sources available however the correlation results were negative. This could be due to chance because the correlation results were not significant to $\alpha=0.10$. Family correlated positively as a source of information and negatively as a source of influence but both results lacked significance so their reliability is in question.

The only significant correlation value ($\alpha=0.10$) between a source and the use of buffers came between agricultural associations (as a source of influence) and use of buffers around wetlands. The positive correlation value of 0.194 suggests that agricultural associations have the strongest positive influence on farmers of all sources (table 3). Agricultural associations in Nova Scotia, such as the Nova Scotia Federation of Agriculture have programs designed to encourage environmental stewardship on farms. These include Environmental Farm Plans (EFPs), and the Environmental Stewardship Contest that awards the best stewards of their land annually. The agricultural associations are made up of members who are farmers themselves. They are voluntary to join and provide many benefits to the farmers. The member structures of the agricultural associations make them an attractive and easy place to gather information. From monthly newsletters to staff just a phone call away agricultural associations in Nova Scotia are a trusted sources of information and because they are farmer run they have a great influence over

the environmental behaviour of the farmers. Advice from agricultural association is possibly more trusted because of the member structure and therefore has a greater influence than other sources.

6.0 Conclusion

Wetlands are valuable natural habitats in Noav Scotia's landscapes. Nova Scotia is currently the beneficiary of billions of dollars in ecosystem goods and services provided by wetlands. This resource is being depleted through conversion of wetlands to other uses by human activities, costing Nova Scotians $2.3 billion per year in lost ecosystem services (Wilson 2000). Resistance to the provincial plans to implement a comprehensive wetland policy has come from many industry sectors, including agriculture, despite the recognized benefits of wetlands. Acceptance of a comprehensive wetland policy is important to the conservation of wetlands in the province.

Typical methods of government regulation and pay-outs for conservation efforts are underachieving their conservation goals and need to be improved (Fitch and Adams 1998). Successful programs directed at wetland conservation in the agricultural context have been based on social learning and actor network theory (ANT) which involve intense stakeholder involvement and provide meaningful and long-lasting change (e.g. Steyaert P. 2007, Burgess *et al.* 2000, Olsson 2004, Merot 2006). Community-based social marketing (CBSM) is a Canadian developed framework that is based on social learning. As a first step toward implementing a community-based social marketing campaign related to wetland conservation, this study was designed to identify the barriers and benefits to the use of buffers around wetlands and watercourses on farms in Nova Scotia.

Although barriers to buffer use were not expressed clearly through the survey results, benefits were identified. Benefits included erosion prevention around rivers and difficulty of cultivation around wetlands (i.e. the difficulty of cultivation was a barrier to *not* leaving a buffer). These perceived benefits of buffer use could be further promoted to encourage buffer use around wetlands as it is one of the core goals of the proposed Nova Scotia Wetland Conservation Policy. Agreement with four environmental statements also showed that buffers are seen as a good way to reduce erosion, prevent flooding and improve environmental quality for wildlife around watercourses. The agreement with these statements was also positively correlated with the use of buffers in these areas. This shows that farmers' perceptions are important in the promotion of behaviours such as using buffers. If one could improve the perceptions of farmers (i.e. encourage more agreement with the environmental statements) it may be possible to increase the amount of farmers who use buffer zones or even increase the width of the buffer beyond current practices. The survey data suggests that agricultural associations have the most influence on farmers and this influence correlated positively with the use of buffers, suggesting that their current promotion of healthy riparian areas is having some success. Future promotion of healthy riparian areas will be best completed through agricultural associations because the members of the agricultural associations make up the organizations and lead to a culture of trust within the organization.

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8.0 Appendix

8.1 Appendix I

DALHOUSIE UNIVERSITY
Inspiring Minds

Dear NSFA member,

My name is Simon Greenland-Smith, I am a 22 year old undergraduate student at Dalhousie University. I am currently conducting research on the way farmers manage their land in agricultural Nova Scotia. The research is part of my undergraduate degree and I ask for your help and expertise. I am surveying members of the farming community who own or run farms and asking for their opinions about planting, grazing and logging near areas that are usually too wet to farm. I invite you to be a part of my study.

We want to understand how farmers plant, graze and log their land close to water and wet areas, as well as why they make the decisions they do. The results of the study should help us gauge the need to provide advice to farmers on environmentally beneficial planting, grazing and logging practices.

If you would like to participate in this study please complete the informed consent process on the back of this form, which is needed by the university, as well as the survey included and send both items back in the addressed and stamped envelope provided. The informed consent form and the survey should take a combined 15 minutes to complete.

Thank you for your time and if you have any questions please do not hesitate to contact me.

I really appreciate you helping me out with my study.

Thanks again,

Simon Greenland-Smith

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Informed Consent Process

Research objectives
The objective of my research is to better understand the factors that prevent farmers from leaving unmanaged areas around marshes, bogs, and swamps, as well as streams and rivers.

Scope
500 members of the farming community around Nova Scotia have been invited to participate in this study. Each participant has been asked to complete a short survey. Each participant is asked to complete the survey within one week of receiving it with possible follow-up if clarification is required. Participants will not be asked to participate in any further studies related to their participation in this study.

Anonymity and confidentiality
There are no anticipated risks to participants, and participants may withdraw at any time before March 10th, 2011, and have their participant questionnaires destroyed. After this date, a summary of the results are expected to be published in a report. The names of participants will not be utilized or published, but relevant quotations may be accompanied by participant information (type of commodities farmed) and geographic area (e.g. Annapolis Valley apple farmer). I will not state your name in my work or divulge your name to other parties or researchers.

I hereby give consent to:

- ❑ utilize quotations that WILL be accompanied by participant information, farm type and/or geographic area
- ❑ utilize quotations which are NOT to be accompanied by participant information, farm type and/or geographic area
- ❑ NOT utilize quotes at all

For more information please feel free to contact me.

Certification
This research has undergone ethical review at Dalhousie University through the department of Environmental Science, for more information contact Daniel Rainham at dr@dal.ca or 902 494 1286.
I understand the nature and objectives of this study and appreciate the risks and benefits. I understand that my participation is voluntary and that I can end my participation at any time until March 10th 2011.

Date: Signature:

8.2 Appendix II

Farming Practices Survey

Section A

Please complete the boxes in the table below by providing your opinions on each statement. One set of answers applies to marshes bogs and swamps; another to rivers and streams. Circle a selection on a scale from 1 (*strongly agree*) to 6 (*strongly disagree*), or circle DK if you *don't know*.

Leaving uncultivated / ungrazed / unlogged areas…	**Near marshes, bogs and swamps**							**Near rivers and streams**						
	Strongly Agree					**Strongly Disagree**		**Strongly Agree**					**Strongly Disagree**	
…reduces erosion	1	2	3	4	5	6	DK	1	2	3	4	5	6	DK
…reduces flooding	1	2	3	4	5	6	DK	1	2	3	4	5	6	DK
…purifies water	1	2	3	4	5	6	DK	1	2	3	4	5	6	DK
…is good for wildlife and the environment	1	2	3	4	5	6	DK	1	2	3	4	5	6	DK

Section B

Please answer the following questions about your farm.

Approximately what is the size of your farm in acres?

Does your farm contain areas that are usually too wet to farm? These areas are sometimes referred to as bogs, mashes, swamps or wetlands.

❑ Yes. ❑ No.

If yes, what portion (%) of your farm is covered by these areas?

To the best of your knowledge have any of these unfarmable wet areas ever been drained or infilled to provide more farmable land?

❑ Yes. ❑ No.

If yes, what portion of your farm (%) has been drained or infilled to provide more farmable land?

Do you have rivers or streams on or bordering your farm?

❑ Yes. ❑ No.

Section C

Please answer the following section in point form or a couple of words.
Do you leave uncultivated / ungrazed / unlogged areas near wet areas like bogs, marshes and swamps? ❑ Yes. Why? ❑ No. Why not and what would make you more willing?

Do you leave uncultivated / ungrazed / unlogged areas near rivers and streams?
❑ Yes. Why? ❑ No. Why not and what would make you more willing?

Section D
The questions in this section are optional, but the answers will provide information that will significantly improve our ability to make sense of the survey, so we would greatly appreciate any responses you are willing to provide.

What is your approximate age?
18-24 25-29 30-34 35-39 40-44 45-49 50-54 55-59 60-64 65-69 70-74 75+

What is the primary product produced on your farm? (please limit to the top three products produced if there are more than one)

Are the profits from your farm your primary source of income?
❑ Yes. ❑ No.

Section E
Where do you find your information about farming practices?

❑Friends
❑Neighbours
❑Family
❑Farming publications (e.g. Rural Delivery)
❑Agricultural research literature in libraries or on internet
❑Agricultural associations (NSFA etc.)
❑Government staff or publications
❑Other (please provide details)_____

What influences your decisions about farming practices?
❑Friends
❑Neighbours
❑Family
❑Farming publications (e.g. Rural Delivery)
❑Agricultural research literature in libraries or on internet
❑Agricultural associations (NSFA etc.)
❑Government staff or publications
❑Other (please provide details)_____