**MEASURING THE EFFECTIVENESS OF
EDUCATIONAL INSTRUMENTS IN FACILITATING
ENVIRONMENTALLY RESPONSIBLE BEHAVIOUR
IN AGRICULTURE:**

**THE CANADA-ONTARIO
ENVIRONMENTAL FARM PLAN PROGRAM**

by

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Abstract

Measuring the Effectiveness of Educational Instruments in Facilitating Environmentally Responsible Behaviour in Agriculture: The Canada-Ontario Environmental Farm Plan Program

Master of Applied Science, 2006

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This research evaluates the effectiveness of Ontario's voluntary Environmental Farm Plan (EFP) program's educational instruments by applying the Theory of Planned Behaviour and measuring environmental awareness. Despite being billed as an educational and environmental awareness program, the educational elements of the EFP program have not previously been evaluated in relation to their ability to foster environmental behaviours. A survey was conducted before and after the EFP workshops to measure any change in farmers' environmental awareness or intentions to implement beneficial management practices. Findings suggest an overall increase in participants' behavioural intentions and awareness, though there are opportunities to strengthen the underlying constructs of these measures to help ensure these positive outcomes are sustained beyond workshop participation. This research identifies the strengths and weaknesses of the EFP program's educational instruments and provides insight into the psychological constructs influencing farmers' participation in the program and their intentions to implement conservation measures.

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List of Acronyms

AAFC – Agriculture and Agri-Food Canada

BMP – Beneficial Management Practice

EFP – Environmental Farm Plan

OEFC – Ontario Environmental Farm Coalition

OMAFRA – Ontario Ministry of Agriculture, Food and Rural Affairs

OSCIA – Ontario Soil and Crop Improvement Association

TPB – Theory of Planned Behaviour

TRA – Theory of Reasoned Action

Chapter One: Introduction

The intensification of agricultural operations in the second part of the twentieth century has succeeded in increasing agricultural yields, but has been accompanied by substantial negative consequences for the environment. Environmental problems associated with loss and fragmentation of natural habitats, soil degradation, aquifer depletion, air pollution, and reductions in surface and ground water quality increasingly require the attention of farm managers and policy makers. However, agricultural pollution control presents considerable challenges, largely because of the diffuse nature of agricultural pollutants and the complex environmental fate processes of agricultural by-products (Ritter and Shirmohammadi, 2001; Ribaud and Horan, 1999).

For instance, since the majority of agricultural pollutants originate from non-point sources, it is difficult to directly observe or monitor the pollutant contributions from any individual farm. While on-farm environmental degradation can be detrimental to farm operations, these impacts are generally more visible and more promptly addressed by farm managers who may recognize the eventual private costs of inaction (Weersink et al., 1998). Therefore, greater concerns are often associated with off-farm impacts, which are reflective of the cumulative impact of agricultural pollutants in combination with other non-point source pollutants over a relatively large geographic area (Ribaud and Horan, 1999; Merrington et al., 2002). Given that these environmental damages occur off-site and over fairly long timescales, and that it is not always possible to attribute pollution to agricultural sources (Shortle et al., 2001), there are often few tangible incentives for individual farmers to minimize their environmental impacts (Weersink et al., 1998).

Furthermore, the interface between agriculture and the environment is extremely complex and site-specific. Pollution loads from agricultural land will depend on a variety of factors including, type of operation, crop or livestock type, crop rotation schedule, technology, irrigation practices, drainage, soil type and climate, for example (Novotny, 2003). Thus, a specific management practice may be environmentally benign on one farm, but may present significant environmental concerns on another. These site and case

specific considerations make it difficult to make generalizations regarding the environmental impact of the agricultural sector, or to identify universally appropriate measures for controlling agricultural pollution at the farm level.

1.1 Environmental Policy for Agriculture

The complexities of the agri-environment interface, together with economic and systemic realities associated with the agricultural sector, pose substantial challenges for environmental management and policy making (Novotny, 2003). Policy makers must choose from a variety of policy instruments with the aim of establishing the most appropriate means for overcoming these challenges. For the purposes of this paper, the policy “tool kit” can be broadly distinguished as regulatory and voluntary measures, with voluntary approaches including instruments such as economic incentives and information. These four instrument categories are summarized in Table 1.1. It is worth noting that this categorization may not be agreed to by all. In particular, it is possible to argue that extensive economic incentives reduce the voluntary nature of such programs. However, the distinction in this paper rests on mandatory or regulatory approaches versus those where individuals can freely choose whether to participate in a program.

Without attempting to provide a complete discussion of issues relating to regulatory approaches, Claassen et al. (2001) note that, if properly enforced, regulatory measures are perhaps the most effective tools in terms of achieving specific environmental goals. However, the authors also point out that regulatory measures are inflexible and often not cost-effective, since they do not account for site-specific considerations. The diffuse, non-point source nature of agricultural pollution also presents challenges regarding the efficient and cost-effective monitoring and enforcement of regulatory measures (Weersink, et al., 1998). Moreover, regulatory approaches can have negative repercussions on long-term attitudes and behaviours, and the effectiveness of regulation often depends on the willingness of the target group to be regulated (McKenzie-Mohr and Smith, 1999).

Table 1.1. Broad Categories of Environmental Policy Tools

Policy Instrument	Definition	Examples
Regulation	Regulatory (“command and control”) tools <i>require action</i> through legislation. Regulatory measures are more difficult to implement for non-point source pollution, but may be appropriate in some instances.	Quotas for nutrient/pesticide application; mandatory nutrient or waste management plans; banning specific chemicals; etc.
Voluntary	Voluntary approaches aim <i>to facilitate behaviour change by encouraging action</i> that is environmentally favourable, but commercially viable (i.e. to be adopted voluntarily actions should not impose significant net cost on those targeted)	Industry codes of conduct; best management practices; quality assurance schemes; industry specified pollution or environmental management standards; agreements with government, environmental NGOs or other natural resource-related group to meet specific discharge targets; etc.
Voluntary - Economic	Economic tools <i>provide a financial incentive to change behaviours</i> by altering the marginal cost of an activity, resulting in the adoption of a less environmentally damaging practice.	Environmental taxes; cost-share incentive programs; charges or levies; deposit-refund schemes; subsidy payments; tradable discharge permits; etc.
Voluntary - Information	Information measures aim <i>to raise awareness and facilitate behaviour changes</i> by encouraging greater understanding of input and product values. Includes educational approaches and technical assistance.	Information dissemination; on-farm advice; training; demonstration projects; facilitating information exchange; etc.

Source: OXERA Consulting Ltd, 2003; Claassen et al., 2001; Harrison, 2002.

Increasingly in Canada and other OECD countries, regulatory agri-environmental controls are being replaced, or at least supplemented by, moral suasion or other voluntary policy measures to encourage conservation behaviours among farmers (Luzar and Diagne, 1999; Weersink et al., 1998; Coote and Gregorich, 2000). The flexibility and relative ease of implementation associated with voluntary approaches have made them attractive to policy makers and groups targeted for regulatory action. These voluntary approaches are also seen to offer promise in terms of raising producers’ awareness of environmental issues and encouraging behaviours that facilitate environmental action beyond regulatory compliance (Prakash, 2002). However, to date, these types of agri-environment programs have met with limited environmental improvements, leaving them open to scepticism and questions regarding their ability to effectively meet environmental objectives (Weersink et al., 1998; Shortle and Abler, 2001; Young and Karkoski, 2000).

One of the most consistent conclusions from the literature on voluntary environmental approaches is that there is a clear need for greater research to assess their environmental outcomes (Harrison, 2002; Dietz, 2002). In particular, little is known about the ability of these measures to address problems associated with non-point source pollution, such as that commonly associated with agricultural operations (Dietz, 2002). Greater monitoring of voluntary environmental programs is also needed, but program novelty, insufficient data, weak evaluation methods, lack of credibility and self-selection make monitoring efforts more difficult (Harrison, 2002; Ribaud, 1998).

In addition to the evaluation of short-term environmental outcomes of these voluntary programs, it is necessary to assess their likely long-term environmental impacts. The literature suggests that there is great potential for voluntary programs to foster significant cultural and behavioural changes, particularly when these programs include a substantial educational component. For example, properly framed educational interventions can indirectly influence social norms and political behaviour (Cave, 1998; Gardner and Stern, 1996). These “softer” impacts may, in fact, exceed any direct positive impacts associated with the short term actions supported by the program (Dietz and Stern, 2002b).

In terms of the specific voluntary policy tools, Horan and Shortle (2001) present findings from recent empirical studies which confirm that, in most cases, economic instruments can generally achieve agricultural pollution reductions at a lower cost than regulatory, or mandatory policy instruments. In his review of US Department of Agriculture programs, Ribaud (1998) also concludes that financial incentives are essential for overcoming constraints on the implementation of beneficial management practices (BMPs) such as increased risk and inexperience, for example. However, other authors are more cautious about the application of financial incentives to meet environmental goals (DeYoung, 1993; Deci and Ryan, 1985). Section 2.2.1 provides a more detailed discussion of these potential limitations.

Furthermore, several authors have highlighted the limited impact that voluntary environmental education and informational campaigns have had on environmental

behaviours when they are presented as isolated agri-environmental policy tools (Gardner and Stern, 1996; Ribaudo and Horan, 1999). However, these authors also point to the necessity of informing farmers of new practices and clarifying misinformation about a new practice or about the impact of agriculture on environmental quality. In essence, information and educational instruments are perhaps an insufficient, but necessary, component of programs aimed at influencing agri-environmental behaviours.

There is little consensus regarding the most appropriate policy approaches for addressing agricultural pollution; the challenge is to identify the most appropriate mix of policy tools to effectively and efficiently overcome internal and external barriers to action and meet identified environmental objectives (Merrington et al., 2002; Gardner and Stern, 1996). In fact, policy measures to address specific environmental issues often employ different tools from the various categories to present an effective “policy package” (Dietz and Stern, 2002a).

1.2 Environmental Farm Planning in Ontario

Ontario’s Environmental Farm Plan (EFP) initiative represents a voluntary approach to agri-environmental management. This program, which originated in Ontario’s farming community in the early 1990s, employs both informational and economic policy instruments to assist producers in learning about, and taking action against, the negative environmental impacts associated with their farm operations. Modelled after the US “Farm-a-Syst” program (Castelnuovo, 1999), the original EFP initiative in Ontario was designed and administered by the Ontario Farm Environment Coalition in partnership with the provincial and federal governments (providing financial and technical assistance).

Farmers participating in the program attended educational workshops, completed a confidential environmental risk assessment of their farm operation using worksheets provided by the program, and identified site-appropriate beneficial management practices (BMPs) for mitigating environmental impacts. A small economic incentive (\$1500) was

available to assist farmers in implementing BMPs (A. Graham, EFP Program Manager, OSCIA, personal communication, March, 21, 2005). The program has experienced high participation rates. In addition, its unique educational, participatory and risk-based approach to environmental management has been recognized internationally, receiving the State of the Lakes Ecosystem Conference Award in 2000 (OMAFRA, 2005). The Ontario EFP initiative ran until the spring of 2004 when funding ran out and negotiations were underway for the new Canada-Ontario EFP program that is currently operational.

1.2.1 A National Approach to Environmental Farm Planning

Agriculture and Agri-Food Canada (AAFC) has recently adopted the EFP concept and is now promoting the use of environmental farm planning to help meet the environmental objectives of its Agricultural Policy Framework (AAFC, 2006). In April 2005, Ontario signed an agreement with AAFC for a new generation of farm planning in the province, in which funding will continue until March 31, 2008 (OMAFRA, 2005). Like the original program in Ontario, the Ontario Soil and Crop Improvement Association (OSCIA) continues to deliver the new Canada-Ontario program on behalf of the Ontario Farm Environment Coalition. While the new Canada-Ontario program is largely based on the previous Ontario EFP programs, there are some new elements that could potentially influence the level of farmer participation and the extent of long-term environmental improvements.

The Canada-Ontario EFP process is outlined in figure 1.1. The program involves participation in two introductory workshops and the completion of an individualized farm action plan. See Appendix A for an example agenda for the two workshops. During the first workshop, producers assess their farms' soils in terms of the soils' tendency to offset or increase environmental risks. At this stage, they are also instructed on how to undertake the farm review. In the intervening time between the two workshops, farmers use the worksheets in the EFP workbook to review and identify potential environmental risks on their farms. Corresponding infosheets are also available to assist farmers in completing the worksheets and action plans (OMAFRA, 2005). A list of the worksheets

included in the workbook and an example worksheet are included in Appendix B. Robinson (2005) provides a thorough description regarding the design and steps required to complete the worksheets.

Ontario Farm Environmental Coalition et al., 2004:4 (used with permission).

Figure 1.1. The Environmental Farm Plan Process incorporates educational instruments (workshop component), participatory learning through the completion of an individualized action plan, review by a peer review panel and implementation of identified mitigation measures or BMPs.

During the second workshop, farmers are introduced to potential solutions to the environmental risks they identified during the farm scan, and are provided assistance in developing their farm action plan (Ontario Farm Environmental Coalition et al., 2004). The workbook urges producers to focus on the high-risk aspects of their operations and those issues that are most important with respect to family health and safety, legal obligations and the health and safety of the community environment (OEFC et al., 2004). The first page of the form for recording the farmers' action plan is also included in Appendix B.

Once complete, the farm action plans are confidentially reviewed by a peer review committee, which is generally comprised of three locally-appointed farmers who have experience in agri-environmental issues and who receive regular training through OSCIA (A. Graham, personal communication, April 19, 2006). The review panel ensures priorities in the action plan appropriately reflect the environmental farm scan and will suggest ways to strengthen the action plan if necessary. Once the EFP is deemed appropriate, farmers are eligible to access the cost-share incentives available to assist in BMP implementation (OMAFRA, 2005).

In the original Ontario EFP program, the financial incentive for implementing BMPs amounted to only \$1500 per project. Under the new Canada-Ontario agreement, farmers who have completed an EFP that has been approved by a peer review panel are eligible for a total of \$45,000 (\$30,000 through the Canada-Ontario Farm Stewardship Program and Greencover Canada combined, and an additional \$15,000 through the Canada-Ontario Water Supply Expansion Program) within the four-year program timeframe (Ontario Farm Environmental Coalition et al., 2005). There are specific funding caps for the various BMP categories eligible for cost-share. The new generation also employs a graduated cost-sharing approach, offering a 30% cost-share for initiatives with greater on-farm benefits and a 50% cost-share for initiatives having greater off-farm benefits (AAFC, 2003; Ontario Farm Environmental Coalition et al., 2005).

Technical support is provided through the workshops and through various materials and resource information available to participants (A. Graham, personal communication, April 19, 2006). There is considerable assistance available to farmers for the technical completion of the EFP worksheets and the development of action plans. This assistance is in the form of technical infosheets that accompany each of the worksheets and guidance from the regional EFP program representatives and OMAFRA staff during the workshops. While the program does not directly incorporate technical assistance for on-farm BMP implementation, a considerable effort is made to inform producers of assistance available through other agencies (e.g., OMAFRA, conservation authorities, municipalities, consultants and commodity organizations). Recognizing that on-farm

assistance could provide substantial benefits to the program, OSCIA is piloting an agreement with Conservation Ontario where \$500 will be provided to a conservation authority that contributes expertise to the completion of a Greencover Canada project (one of the funding sources for the EFP) (A. Graham, personal communication, April 19, 2006).

Perhaps the most significantly different component of the Canada-Ontario program is the requirement for a provincial-level environmental scan. All provinces with a joint federal EFP program are expected to develop such a scan, which aims to: 1) identify high priority regional risks; 2) develop consensus between governmental, industry and non-governmental partners on regional risks; 3) encourage coordination among partner agencies; and 4) identify BMPs that could be targeted for priority funding through incentive programs (AAFC, 2003). The provincial scan approach offers promise in terms of improving the cost-effectiveness of the program and strengthening monitoring and reporting efforts. In Ontario, The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) is taking the lead to develop a scan; however, as of April 2006, no draft had been circulated to OSCIA for input and no information was available on the approach for developing the scan (A. Graham, personal communication, April 19, 2006).

Agriculture and Agri-Food Canada has either established agreements or is in negotiation with the other provinces and Yukon Territory for a joint federal-provincial/territorial EFP program (AAFC, 2005). These programs are all based on the same general premise as the Canada-Ontario program, but incorporate different elements and/or approaches as negotiated between AAFC and each province or territory. As with all government programs, but particularly given the general scepticism associated with voluntary approaches, there is a need to evaluate program results and identify strengths and weaknesses. A new generation of environmental farm planning is expected to be implemented in 2008 (M. Harland, AAFC, personal communication, February 17, 2005). As such, AAFC is eager to identify ways to strengthen the approach to inform future generations of the program.

1.2.2 Assessing Program Effectiveness

According to OSCIA's data, past generations of the program have been very successful in encouraging farmer participation. By the end of the previous program (Spring 2004), over 27,000 farmers had participated in EFP workshops since the program's inception (OSCIA, 2004a; OSCIA, 2004b). Approximately 17,500 farm plans were reviewed through the peer review process and approximately 11,600 claims were made under the incentive program. Furthermore, total project costs under the program amounted to approximately \$60,463,700, reflecting a 3:1 (farmer : government) cost-share.

These statistics are an impressive indication of the program's ability to attract farmer participation and leverage funds for environmental improvements. However, the discrepancy between the number of farmers participating in initial workshops and the number of claims for BMP implementation incentives points to the challenges of sustaining voluntary participation and raises concerns regarding the program's ability to result in long-term, environmentally positive behaviours. In survey results of past participants, Smithers and Furman (2003) found that approximately 40% of those who participated in the workshops did not complete the entire process. Among other indicators of advanced participation, this earlier review looked at the participants' motivations for initial participation and found that those who entered the program with more intrinsic motivations were associated with greater degrees of participation. Smithers and Furman's work raises some questions with respect to the program's ability to retain participants who may not possess a significant personal commitment to the environment prior to entering the program.

It is important to note that there are likely external reasons why farmers opted against full participation in the past EFP generation. For instance, concerns around confidentiality could have prevented the farmer from going through the peer review process (Smithers and Furman, 2003). In addition, the financial support that was initially available may not have provided enough incentive for farmers to participate fully (A. Graham, personal communication, March 21, 2005). However, farmers may have implemented BMPs on

their own accord, or through other cost-share programs offered by other agencies such as municipal governments or conservation authorities (T. Ryan, Grand River Conservation Authority, personal communication, March 3, 2005). Consequently, existing data collected on BMP implementation by OSCIA may not be a complete reflection of the extent of conservation activity that resulted from the program.

In addition to Smithers and Furman's (2003) work, several studies have explored the drivers and barriers associated with participation in the EFP program. These studies have identified other barriers to full program participation, which largely revolve around technical and financial limitations (VanOsch, 1997; Fitzgibbon, 2000a; Holmes, 1998). Concerns about confidentiality/trust of government and a perceived lack of urgency or lack of personal priority were also identified as barriers to participation and/or BMP implementation (Fitzgibbon, 2000a; Klupfel, 1998, Holmes, 1998).

Other studies have been undertaken to evaluate or report on the EFP program outcomes. However, the confidential nature of the program and limited data collection and monitoring under previous generations of the program present challenges for outcome analysis. Most findings currently relate more to program *outputs* rather than *outcomes*. Robinson (2005) provides a thorough analysis of the program data to 2002, summarizing findings such as the number of farm acres affected by the EFP program, participation by commodity group and the frequency of undertaken activities based on worksheet categories, for example. Fitzgibbon et al. (2000a) also undertook research in an attempt to quantify the extent of environmental action that resulted from the completion of farm plans. In survey results from this study, 41% of respondents indicated that the EFP had prevented an environmental peril associated with their operations, 51.4% indicated they had revisited and/or updated their plan and 62.2% had taken actions that went beyond their plan. The authors concluded that these and other indicators included in the survey suggested the EFP was having a "tremendous effect on the agricultural environment" (2000a:14).

In an effort to provide further insight into the program's environmental impact, FitzGibbon et al. (2000b) applied a systematic, pathways approach to map the likely impact of the program. They indicated that farmers tend to act relatively equally in the five identified focus areas (farm productivity and profitability, aquifer degradation, surface water degradation, farm health and safety, and air pollution). However, at deeper levels of analysis the authors found some differentiation. The study suggested that farmers were more likely to implement actions that related to soil and erosion, water quality, water consumption, well contamination and surface water degradation, and less likely to implement actions related to chemical storage and handling, fire hazards and odour control.

A commonly identified strength of the program is its ability to increase farmers' awareness of environmental issues (FitzGibbon et al., 2000a; Klupfel, 2000; OSCIA-OFEC, 1999). In fact, the program is referred to as a "voluntary environmental education and awareness program" (OMAFRA, 2005:1). However, to date, there have been no efforts to measure awareness change or assess the value of the educational component, although other researchers have identified this element as a research need (OCSIA, 1999; Rudy, 2003).

1.3. Research Approach

As previously suggested in the background on environmental policy measures, the increasing application of voluntary programs like the EFP initiative presents numerous challenges for policy makers – challenges largely related to the management of human beings rather than the management of environmental resources. With these challenges in mind, substantial efforts are needed to better understand environmental behaviours and the underlying psychological constructs that inform decisions to participate in voluntary programs and to carry out actions that will improve environmental quality. This increased understanding would help ensure that voluntary programs are designed to have the greatest possible impact on environmental improvements while ensuring public expenditures to meet environmental objectives are cost-effective.

The Canada-Ontario EFP program presents an interesting opportunity to investigate some of these issues. The EFP concept has been operational in Ontario for approximately thirteen years, providing ample time for the program to be well recognized within the agricultural community and for some of the initial challenges of voluntary program start-up to be overcome. While program uptake has been substantial, the discrepancy between the number of participants who attended the initial EFP workshops and those who completed the entire program raises some concerns about the program's environmental impact (Smithers and Furman, 2003). Among other indicators of advanced participation, Smithers and Furman (2003) found that farmers possessing greater internal motivations to participate were more likely to complete all phases of the program, thus demonstrating behaviours conducive to improved environmental management. These findings are supported by the environmental psychology literature, which suggests voluntary programs will have greater long-term success if participants are more intrinsically motivated to take environmental action (DeYoung, 1993; Dwyer et al., 1993; Geller, 2002).

These findings are interesting in light of the higher financial incentives accompanying the new Canada-Ontario program, which will likely increase farmers' external motivation to participate in the program and to implement the BMPs they identify in their action plans. Since the new generation of the program is only in its first year, it is unclear how these additional incentives will influence initial and sustained program participation or the likelihood of lasting environmentally responsible behaviours beyond the life of the program. However, based on the environmental psychology literature that cautions against over-reliance on external motivations in voluntary programs (Geller, 2002; DeYoung, 1993; Dwyer et al., 1993), one can speculate that there may be an even greater need for the educational component to build an internal commitment to help encourage more complete participation in the program, and thus help ensure it delivers the intended, long-term environmental benefits. The question, then, is how to encourage greater participation and long-term behaviour change from producers who are potentially more extrinsically motivated? Are there lessons from the fields of environmental psychology and environmental education that could be better incorporated into workshop materials

and approaches to strengthen the informational and educational instruments employed by the EFP program?

In investigating these questions, this research contributes to program evaluation efforts by determining the value of the introductory workshops of the EFP program in terms of their ability to raise farmer awareness of environmental issues and foster internal motivations for behavioural change. Participants, researchers and administrators often cite “raising awareness” as one of the key values of the program (FitzGibbon et al., 2000a; Klupfel, 2000; OSCIA-OFEC, 1999). However, to date, there has been no significant attempt to measure changes in environmental awareness and to determine whether increased awareness is likely to translate into more environmentally favourable behaviours over the long-term.

In addition to measuring awareness change, the research measures the effectiveness of the EFP workshops based on their ability to strengthen participants’ intentions towards BMP implementation. Using Ajzen’s (1985) Theory of Planned Behaviour (TPB) as a theoretical framework, the research assesses the change in workshop participants’ attitudes, perceptions of subjective norm and perceptions of personal control over BMP implementation as measured before and after the workshop component. Applying this psychological theory in this context provides theoretical insight and opportunities for developing more effective educational programming. The application of the TPB also provides a measure of producers’ intentions to implement BMPs following their participation in the workshops. This measure is important as it provides an opportunity to speculate on the program’s potential environmental impact if a discrepancy between participation in the workshop and completion of the entire EFP program persists.

1.4 Research Purpose and Objectives

The overall purpose of the research is to investigate whether the EFP educational component improves the likelihood of environmentally positive behaviours as they relate to on-farm management. As indicated in the contextual material presented above and in

the literature review, this is an important question that has not been previously answered, and that can provide insight into the potential impact of this voluntary environmental policy instrument.

To reach this overall goal, the paper focuses on five research objectives:

- 1) Provide insight into the appropriateness and/or sufficiency of the Theory of Planned Behaviour model as a tool for assessing farmers' environmental behaviours or behavioural intentions;
- 2) Determine the value of the EFP's educational component in relation to its ability to influence behavioural intentions and raise environmental awareness;
- 3) Identify the strengths and weaknesses of the EFP workshops in relation to their influence on behavioural intentions and environmental awareness;
- 4) Determine how participants' perceptions of the new incentive framework of the Canada-Ontario EFP program may affect program participation and BMP implementation; and
- 5) Contribute to program monitoring and evaluation by providing a framework to assess the program's educational component in terms of its ability to raise environmental awareness and facilitate environmentally positive behaviours.

These objectives were identified following a review of the literature, which revealed a need to better understand farmer motivations to participate and to better demonstrate the environmental outcomes of the EFP program (Smithers and Furman, 2003; Fitzgibbon et al., 2004). The focus on the program's educational instruments, specifically the initial workshops, stems from its position in the program as the first opportunity to engage participants and influence attitudes and perceptions that are conducive to further program participation and sustained, environmentally positive behaviours. The literature also

suggested a need to assess the effectiveness of the educational components (Rudy, 2003) and to measure the program's impact on environmental awareness (OSCIA-OFEC, 1999).

As outlined in Chapter Three, the study's methodological limitations mean the results apply directly to the EFP workshops in the six Ontario Counties included in the research. The findings provide some insight into the EFP workshops held throughout Ontario in a more preliminary manner.

1.5 Paper Outline

A review of the relevant literature follows this introductory section, providing the necessary background and context for the research. Chapter Three presents the methodological approach for the research and Chapters Four through Seven present the results from the data analysis and a discussion on the findings. Chapter Four describes the survey population and discusses the findings from descriptive statistical analyses conducted on the dataset. Chapter Five investigates the appropriateness and sufficiency of the TPB as a tool for measuring farmer behaviours and behavioural intentions in this context, and Chapter Six describes the change in awareness and intentions from before to after the EFP workshops. Chapter Seven comments on the new Canada-Ontario EFP program as it relates to the environmental policy, environmental education and environmental psychology fields. In particular, findings on participants' perceptions of the new economic incentive framework are discussed. Finally, the concluding chapter (Chapter Eight) summarizes the research findings in relation to the stated objectives and presents recommendations for the EFP program and for future research.

Regarding the research scope, it is important to note what is and is not included in the research framework. The research provides a baseline of participants' attitudes and perceptions as they enter the program, and assesses the change in attitudes and perspectives that can be measured following the workshop. It provides insight into the likelihood of environmentally responsible behaviours following workshop participation

and presents a tool that can be adapted and applied in the future to monitor how behavioural intentions and motivations are affected at different stages of the program. By measuring the various indicators of behaviour change (as per the TPB), and several variables relating to environmental awareness, the research is able to explain the underlying foundations of EFP participants' behavioural intentions and to identify the strengths and weaknesses of the EFP workshops in terms of their ability to create the foundations necessary for sustained environmental action.

The research does not offer a comprehensive evaluation of the program. Rather, it aims to supplement more direct monitoring and evaluation efforts that are needed to better identify and communicate the environmental outcomes of the EFP program.

Furthermore, the research is not a comparison of voluntary versus regulatory approaches to agricultural environmental management, but rather focuses on the relative effectiveness of the EFP program as a voluntary policy instrument. Finally, the research does not present a comprehensive assessment of actual behaviour change resulting from program participation. Instead, it speculates on the likelihood that producers will engage in environmentally positive behaviours based on their participation in the first component of the program, namely the EFP workshops. In the future, it may be possible to use these research findings to inform the validity of behavioural predictions and actual behavioural change.

Chapter Two: Voluntary Environmental Policy Instruments and Environmentally Responsible Behaviour in Agriculture

The scholarly context for this research is derived from three fields within the broader framework of environmental management. These fields include environmental law and policy, environmental and behavioural psychology, as well as environmental education. Environmental and behavioural psychology is particularly pertinent to the research at hand as it provides the theoretical framework for meeting the research objectives. However, the background from all three of these fields provides the context for examining the effectiveness of the Canada-Ontario Environmental Farm Plan program in relation to its ability to enhance environmentally positive behaviours through education, and in relation to its consequent contribution to improved environmental quality. This chapter builds on the contextual information presented in the introduction and outlines the literature in these three fields as it relates to the present research.

2.1 Voluntary Agri-Environment Policy

There is a variety of literature aimed at evaluating and deriving lessons from voluntary programs designed to reduce the environmental effects of agriculture. These programs can range from efforts to encourage the adoption of BMPs, to schemes to increase wildlife habitat or remove land from cultivation, for example. Direct comparison with other jurisdictions is not always appropriate given the different political, economic and social characteristics that affect these types of programs. However, some general lessons can be derived from experiences in other jurisdictions.

In a review of US Department of Agriculture programs for agricultural non-point source pollution, Ribaud (1998) presents a summary of the conditions through which voluntary, watershed-based water quality programs have the best opportunity to succeed (Table 2.1). Among other findings, Ribaud highlights the importance of targeting efforts to watersheds where agriculture is a primary source of pollution, and ensuring that farmers recognize agricultural contributions to environmental degradation and the need for

environmental action by the agricultural community. Many of Ribaudó's findings are also supported by Gale et al. (1993) in their evaluation of the U.S. Rural Clean Water Program.

Table 2.1. Conditions for Successful Voluntary Agricultural Programs

Targeting	Cost effectiveness is enhanced in programs that target efforts in watersheds where agriculture is the primary source of water quality concerns and to critical areas within watersheds.
Farmers see need	Program uptake and success is greater where farmers recognize that agriculture is a key contributor to local or on-farm pollution.
Local research on economic/physical performance	Local research on the economic and environmental performance of various BMPs is required to overcome farmer scepticism (farmers often sceptical of national standards).
Generate returns	Programs have greater long-term success when environmental solutions result in profitable returns (to ensure practices continue once financial incentives end)
Flexibility of cost-share	Cost-share approaches to BMP adoption are more successful and efficient than fixed rate approaches or those offering a limited list of supported practices
Coordinated educational, technical and financial assistance	Even though all farmers will not require the full spectrum of assistance, educational, technical and financial assistance should be available in a coordinated fashion
Water quality monitoring	Water quality monitoring and project evaluation is required to assess the cost-effectiveness of alternatives and help target efforts (can also employ watershed modelling and tracking of changes in management techniques)
Need long-term focus	Programs to improve water quality must have a long term focus to account for the time-lags between pollution cause and effects in agriculture.
Interaction with non-agricultural agencies and local business	Stakeholder involvement in program planning will minimize conflicts and may provide additional resources.
Maintain threat of regulation	The threat of future regulatory action can help maintain farmer interest in voluntary programs.

Adapted from Ribaudó, 1998.

In another study, Morris and Potter (1995) review and comment on the UK's agriculture-related voluntary conservation schemes. They point to the promising level of farmer enrolment in programs that offer economic incentives to encourage specific conservation behaviours, but note that this high level of participation does not necessarily translate into long-term environmental achievements. The authors conclude that the variation in the *quality* of farmers' engagement and in the degree of commitment and alignment with the broader (long term) objectives of the programs threaten their environmental success. Morris and Potter (1995:61) suggest an important, but perhaps less tangible, objective of these schemes should be to "bring about a shift in the attitudes of farmers . . . which will

outlast the schemes themselves and to establish conservation as a legitimate use of land and resources.”

Other authors indicate that programs aiming to encourage the adoption of agricultural BMPs have often met limited success, since measures are likely to be adopted only if they are relatively inexpensive (Young and Karkoski, 2000). Uri (1999) points to several typical impediments to the voluntary adoption of BMPs including a lack of information, short term planning horizons, inadequate technical or managerial skills and inaccessible technical and financial support. In another study, D’Arcy and Frost (2001) review several limitations of voluntary BMP programs in the UK, indicating the lack of technical detail in BMP guidelines and the lack of statutory back up as major impediments to success.

Furthermore, other authors highlight the need for farmers to understand and believe there is a need for their intervention (Novotny, 2003; Gale et al., 1993), and to be aware of both the economic and environmental rationale for BMP implementation (Vining and Ebreo, 2002; DeYoung, 1993; Ribaud and Horan, 1999). Consequently, effective communication strategies are required to reduce the uncertainty around non-point source pollution at the local level, and to emphasize both the short and long term economic and environmental implications of using BMPs. Finally, Beedell and Rehman (2000) also point to problems relating to farmer recruitment into such voluntary programs. They found farmers that were most in need of technical advice and financial support were the least likely to become engaged in voluntary programs offering this type of assistance.

Further challenges are presented by the often broad application of voluntary public programs aimed at encouraging specific behaviours. For instance, in the case of voluntary agricultural BMP programs, the entire agricultural community in the jurisdiction is generally targeted. However, there is no expectation that any one individual will participate in the program (Harrison, 2002). Consequently, achieving an adequate level of participation is a challenging, yet essential, component of voluntary programs. To encourage voluntary participation, agri-environment policy makers must have a thorough understanding of farmers’ current attitudes and behaviours with regards

to the environment (Beedell and Rehman, 1999). These attitudes and behaviours will likely vary by geographic region, commodity sector, farm size and farm type (e.g. commercial vs. subsistence), and will have a significant influence on the degree to which new programs are accepted by the agricultural community.

In a review of private sector participation in voluntary environmental programs Dietz (2002) outlines the internal organizational issues and the external factors which are often important determinants of voluntary participation. While the agricultural industry has some peculiarities that prevent it from being directly compared with other private sector industries, issues such as: prevailing culture and routines; available expertise and capital; existing and anticipated regulation; industry structure; and the perceived interests of suppliers, consumers and competitors are certain to factor into decisions regarding farmers' voluntary participation in environmental programs. Ribaudo and Horan (1999) contend that producers' farm management decisions are driven by a desire to maximize private benefits, but these benefits may reflect personal health, a healthy environment or utility maximization in addition to purely monetary benefits.

Further insight into the barriers and motivations for participation can be found in research exploring the psychological factors affecting individual behaviour (section 2.2). These internal factors can potentially be influenced by targeted policy interventions, particularly those that employ educational or informational policy tools (Gardner and Stern, 1996).

2.2 Environmental and Behavioural Psychology

There is a growing body of literature relating human behaviour to the environment in general. However, the focus of this existing literature is largely on more urban issues such as energy conservation and solid waste reduction. Less attention has been paid specifically to farmer motivations and behaviours in terms of participating in agri-environment schemes and adopting conservation practices (Smithers and Furman, 2003; Nickerson, 2003). Of the agricultural research that has been conducted using a

“behavioural approach”, several studies have recently been criticized by Burton (2004) for their lack of consistency with socio-psychological theory.

Burton (2004) refers to Morris and Potter’s (1995:55) definition of the “behavioural approach” as an actor-oriented, quantitative methodology focusing “on the motives, values and attitudes that determine the decision-making processes of individual farmers”. A literature base for farmer behaviours and responses to policy initiatives has begun to be established using this behavioural approach (see section 2.2.5). However, Burton notes that weaknesses stemming from these studies’ methodological divergence from mainstream behavioural science have reduced the importance and value of this research tool in the rural studies field. He further suggests there is a practical argument for quantitative behavioural studies to satisfy policy-makers’ desire for repeatable and standardized methodologies for measuring policy effectiveness. Thus, Burton’s proposed solution is to realign agricultural behavioural studies with theoretical advances in behavioural science, which have moved beyond simply considering attitudes as the primary predictive force of human behaviour.

2.2.1 Attitudes, Intentions and Behaviours

Studies attempting to link attitudes and behaviour remain murky in many regards, largely as a result of the numerous other internal and external factors that are suspected to affect individual decision-making and behaviour (Nickerson, 2003). Research has generally found that an individual’s environmental knowledge or concern and their environmental behaviour are at best weakly correlated (Moore et al., 1994). However, other researchers point to methodological explanations for some of these findings.

In the late 1960s, attitude, as a useful and relevant theoretical construct of behaviour, was nearly abandoned when a series of studies resulted in ambiguous and conflicting findings regarding the relationship between attitude and behaviour (see Ajzen and Fishbein, 2005 for a review). The construct was revived through Fishbein and Ajzen’s (1975) Theory of Reasoned Action (TRA). The TRA provided a framework for predicting behaviours that

are under volitional control using attitudes toward the behaviour and perception of social pressure (subjective norm) as theoretical constructs. In the development of the theory, Fishbein and Ajzen stressed the importance of methodological considerations, which strengthen the relevance of attitude as a construct of behaviour. For instance, they note that measured attitudes and behaviours must reflect the same level of specificity; that is, it is not appropriate to use general attitudes about the environment to predict the performance of a specific environmental behaviour. In addition, Fishbein and Ajzen stressed that behaviours, behavioural intentions and their predictor variables must have corresponding operational definitions in terms of the target, action, context and time elements (see methodology section 3.6.1 for more detail).

Attitude has, therefore, re-emerged as an important focus in interventions aimed at strengthening existing positive behaviours or altering negative behaviours. While positive attitudes towards the environment are not necessarily sufficient to result in specific behaviours, it is generally agreed that any short-term changes to behaviour will not persist much beyond the life of a targeted intervention unless individuals possess corresponding positive attitudes and internal motivations to carry out a specific behaviour (Dwyer et al., 1993; DeYoung, 1993).

An alternative to changing behaviours indirectly through attitudes is to change behaviour directly. Such approaches would include, for example, the provision of substantial financial incentives or technical support to implement environmentally friendly technology. The use of such direct measures is based on a theory that attitudes can be both a cause and consequence of behaviour (Geller, 1992). Furthermore, Newhouse (1990) claims that there is greater correlation between attitudes and behaviours when the attitudes have been formed through direct experiences. In general, the consensus in this regard appears to be that attitudes are likely both a cause and consequence of behaviour and that it is best to target both depending on the circumstance (Nickerson, 2003).

The role financial incentives play in affecting attitudes receives substantial attention in the environmental psychology literature. In essence, the question is whether financial

incentives over-emphasize external motivations to participate in programs and follow environmentally beneficial practices, rather than fostering the internal motivations that are necessary for sustained, environmentally responsible behaviours (DeYoung, 1993; Deci and Ryan, 1985; Geller, 2002). Financial incentives can be instrumental in overcoming external barriers to environmental behaviours by providing positive reinforcement and changing the perceived consequences of behaviour (Bell et al., 2001). However, as noted by Gardner and Stern (1996), determinants of short and long-term behaviour are not necessarily the same. For instance, financial incentives may be sufficient to encourage behaviour in the short-term, but may not be a sufficient tool to ensure behaviours are carried out in the future in the absence of such incentives.

Luzar and Diagne (1999) note that the effectiveness of a program in influencing behaviours depends on its application of the “right” incentive. Furthermore, other authors contend that it is important for incentives to reflect the “minimal justification principle” from social psychology (Festinger, 1957; Festinger and Carlsmith, 1959 as cited in Lynne et al., 1995). This principle suggests that excessive incentives can be seen as coercive and can erode individuals’ perceptions of internal control. Consequently, financial rewards should be just sufficient to initiate action to prevent any perceived threat to personal freedom and to help ensure behaviours are sustained beyond the life of the intervention (Geller, 2002).

2.2.2 The Theory of Planned Behaviour

There are several theoretical and methodological perspectives on conservation behaviour in the environmental psychology literature. Some are derived purely from the environmental psychology field, while others are “borrowed” from social psychology (Vining and Ebreo, 2002; Gifford, 2002). One such theory from social psychology is Ajzen’s (1985) Theory of Planned Behaviour (TPB). The TPB is promoted as a potentially appropriate conceptual framework for rural studies in Burton’s (2004) critique of past ‘behavioural approaches’ in agricultural research. According to Staats (2003:171), the TPB is “one of the most influential theories on attitude-behaviour

relations". In areas such as recycling and transportation choice, for example, the theory has made important contributions in environment-behaviour research as further discussed below.

The TPB builds on Fishbein and Ajzen's (1975) Theory of Reasoned Action (TRA) by adding a variable for perceived behavioural control, which allows the model to account for factors that may be beyond an individual's volitional control, such as time, money, skill, etc. (Ajzen, 1991). Perceived behavioural control measures individuals' impressions regarding their capability to perform a behaviour, their perception of whether they have the necessary resources, and their beliefs about whether they can overcome any potential obstacles to behavioural performance (Ajzen, 2002a). Thus, unlike the original TRA, the TPB recognizes that behavioural performance can be heavily influenced by the degree of an individual's control over external obstacles and/or their personal deficiencies related to behavioural performance (Ajzen, 1985).

The TPB aims to both predict and explain behaviour (Ajzen, 1991). According to the theory, behavioural intentions (as strong predictors of actual behaviour) are determined by: 1) attitudes towards the behaviour; 2) social or perceived subjective norms; and 3) perceptions of behavioural control (Ajzen, 1985). Figure 2.1 depicts the theoretical elements of the TPB. Underlying each of the predictive variables are salient beliefs regarding the behaviour (behavioural beliefs), societal expectations (normative beliefs) and the degree of control held over the behaviour (control beliefs), respectively. If the measure of perceived behavioural control is a realistic representation of actual control, together with measures of intention, perceived behavioural control can predict the likelihood of a successful attempt to carry out a behaviour (Ajzen, 1985). For simplicity, feedback loops have not been included in the model, even though the theory recognizes that behaviours can influence the beliefs underlying the theoretical constructs (attitudes, subjective norms and perceived behavioural control) (Beck and Ajzen, 1991).

Both the TRA and the TPB assume that an intention to perform (or not) a specific behaviour is the immediate determinant of whether the action is carried out (Ajzen,

Figure 2.1: The Theory of Planned Behaviour (adapted from Ajzen, 1991). Behavioural intentions are formed by a person's attitude toward the behaviour, their perceptions of social norms and their perceived behavioural control. Behaviours are a direct result of intentions to perform the behaviour and the actual control an individual has over performing the behaviour.

1985). However, not all intentions are executed, and intentions can change with time. In general, the TRA and the TPB expect intentions to present a good representation of actual behaviour when the methodological constructs are adhered to (see TPB methodology in section 3.6.1). In addition, behavioural intentions are most accurate when they are measured directly prior to behavioural performance.

The proximity of measured intention to the performance of the behaviour is theoretically important since the stability of intentions is affected by time. Ajzen (1985) notes that beliefs about the attractions and repulsions of a given behaviour can change as the performance of the behaviour draws nearer. In other words, beliefs regarding the negative features of a behaviour may become more salient, reversing an intention to perform the behaviour if the perceived costs outweigh the perceived benefits. Time can also affect the stability of intentions indirectly by allowing an opportunity for an

individual to accumulate new information which can affect his or her beliefs regarding the behaviour, societal norms or their personal control.

With this in mind, it is theoretically best if behavioural intentions are measured directly prior to the opportunity to perform a behaviour. However, this is often infeasible, and, for practical reasons, intentions are often measured well before behavioural performance (Staats, 2003; Ajzen, 1985). As a general rule, longer range predictions may reduce the accuracy of the intention measure, but findings are considered more stable if data are aggregated over a larger population (as opposed to being measured on an individual basis) (Ajzen, 1985). Furthermore, intentions can vary in strength. Ajzen (1985) indicates that very strong (highly polarized) intentions are unlikely to be affected by new information and are more likely to accurately predict behaviour.

The theory is generally well supported by empirical evidence, although there are still some theoretical weaknesses that continue to be investigated by the theory's author and others (Ajzen, 1991; Ajzen, 2002a; Conner and Armitage, 1999). Some researchers challenge the underlying assumption of the TRA and TPB that human behaviours are rational (Kollmuss and Agyeman, 2002); however, this is a foundational issue of debate within the behavioural psychology literature. A complete discussion of the theory's limitations is beyond the scope of this paper; however, these issues have been considered during research design and, where appropriate, will be addressed during the discussion of research results. Ajzen (1991, 2002) provides a good overview and discussion of some of the challenges to the theory.

Meta-analyses on the TRA and the TPB conducted by Sutton (1998:1317) demonstrate that the models generally explain 40% to 50% of the variance in intention and 19% to 38% of the variance in behaviour. While these values may appear low, Sutton (1998) indicates that the models perform well in relation to the effect sizes that are typically associated with the behavioural sciences. While best results are found when the theory is applied under optimal theoretical conditions, even when optimal conditions are not

feasible in practice, Staats (2003) points to the theory's ability to stand up against these shortcomings and to contribute to improved understanding of behavioural constructs.

One of the greatest questions posed in the literature pertains to the theory's sufficiency. The TPB assumes that the model accounts for all potential influences on behaviour, either directly or indirectly through the variable constructs (Staats, 2003; Ajzen, 1991). Some authors have questioned the distinctions between the three predictor variables (see Miniard and Cohen, 1981), but Ajzen (1991) counters that the variables are three distinct concepts that are recognized as such in social and behavioural theories. A more important question, as recognized by Ajzen (1991) is whether additional variables can be added to the model as distinct constructs. Commonly investigated additional variables include personal norms or moral obligation (Beck and Ajzen, 1991; Harland et al., 1999; Lam, 1999; Conner and Armitage, 1998), past behaviour and habit (Conner and Armitage, 1998), as well as self-identity (Sparks and Shepherd, 1992; Conner and Armitage, 1998). Ajzen (1991) maintains that the appropriate variables may be situation and/or behaviour specific, and that additional research is necessary before any definitive statements can be made regarding the sufficiency of the TPB.

Several studies have investigated the effectiveness of various behavioural interventions using the TPB as a theoretical framework. Staats (2003) notes that applying the TPB to interventions can help identify influential factors and the underlying beliefs that are determining these factors. Hence, the TPB can be used to develop interventions that are targeted on specific variables and include approaches and content aimed at influencing specific beliefs (Sutton, 1998). According to Ajzen (n.d.), as long as there is room for improvement in any of the predictors (as demonstrated through the application of the theory) it is reasonable to target an intervention on those variables. He also suggests it may be more beneficial to target an intervention on the variables that account for the greatest variance in intention and/or behaviour.

While application of the TPB can be beneficial in designing or evaluating interventions, Staats (2003) cautions against being overly optimistic regarding the ability of

interventions to influence underlying belief structures. Other authors would likely agree with this cautionary advice, particularly with regards to attitude, given the complexities involved in influencing the underlying cognitions that affect beliefs and attitudes (Erwin, 2001; Eagly and Chaiken, 1993).

The TPB has more commonly been applied in health research, but several studies have used the theory to predict and explain behaviours relating to the environment (Corbett, 2002). Environmental behaviours that have been investigated using the theory have included recycling (Boldero, 1995; Terry et al., 1999; Cheung et al., 1999; Chu and Chiu, 2003), transportation choice (Bamberg and Schmidt, 1998), water use and conservation (Lam, 1999), green consumerism (Sparks and Shepherd, 1992), and the adoption of conservation technology (Lynne et al., 1995). With the exception of a few studies, the majority of environmental problems investigated using the TPB have been of a more urban nature, focused on the behaviours of urban populations (Corbett, 2002).

2.2.3 Environmental Degradation and Human Behaviour

There has been relatively little attention paid to the effects of human behaviour on environmental quality within the environmental psychology field. However, this research area has been expanding as awareness grows regarding the human behaviour elements of many local and global environmental issues (Nickerson, 2003). In reviewing the environmental psychology literature, the importance of attitude and the other TPB variables in affecting human behaviours towards the environment figure prominently.

The influence of attitudes is sufficiently covered in section 2.2.1. In relation to social or subjective norm, the environmental psychology literature presents a slightly different perspective. In the TPB, subjective norm focuses on an individual's perception of whether important others expect or want him or her to perform a specific behaviour. On the other hand, the environmental psychology literature indicates that behaviours are influenced by what an individual perceives others to be doing (Nickerson, 2003). In other words, the environmental psychology theory stresses the importance of shared

social values and the importance of behaviours being accepted, expected and valued in the community to the point that behaviours receive continuous, reinforcing social rewards (Nickerson, 2003:113; McKenzie-Mohr and Smith, 1999).

Regarding behavioural control, there is close congruence between the TPB and the environmental psychology literature, which stresses the importance of personal control or choice, perceptions of self-efficacy or personal capability, as well as perceptions regarding the costs or ease associated with the behaviour (Nickerson, 2003; Guagnano et al., 1995). In general, if the behaviour is perceived to be difficult to carry out, individuals are unlikely to undertake the activity (Gardner and Stern, 1996). In addition, Nickerson (2003) notes that the strength of barriers to action (as captured under the TPB's perceived behavioural control variable) have a heavy influence on the relationship between attitude and behaviour. Even very strong pro-environment attitudes will have little effect if a behaviour is associated with onerous external or internal barriers (Gardner and Stern, 1996).

Beyond the TPB variables, the environmental psychology literature also identifies several perceptions or beliefs that are commonly associated with the performance of environmental behaviours. For example, pro-environment behaviours are more likely when an individual views the targeted environmental problem as legitimate and when they perceive that their individual efforts can have an impact (Guagnano et al., 1995; Bell, 2001). In addition, pro-environment behaviour is more likely if the touted alternatives to replace environmentally detrimental behaviours are not viewed as infringing on personal freedoms or comfort (Nickerson, 2003). Other theories regarding pro-environment behaviour and the role of moral obligation (Corraliza and Berenguer, 2000; Geller, 1995; Harland et al., 1999) and emotion (Smith et al., 1994; Aronson, 1980 as cited in Vining and Ebreo, 2002) have also received attention in the literature.

Furthermore, Vining and Ebreo (2002) point to Janz and Becker's (1984) Health Behaviour Model as providing a useful framework for conservation behaviour. In this model, behaviour is influenced by the perceived threat of a problem (which is a reflection

of a perception regarding the likelihood and severity of a negative outcome) and the perceived outcome expectancy. The outcome expectancy reflects a perception regarding the likelihood that a specific behaviour will prevent the negative outcome, weighed against the costs and barriers associated with the behaviour. Thus, beyond the TPB variables, the environmental psychology literature provides insight into potentially influencing factors specific to, or at least relevant to, the environmental management context.

2.2.4 Environmental Behaviours and the Social Dilemma

Another area of environmental psychology considers human behaviour in relation to commons resources. The term “social dilemma” was coined by Dawes (1980) to encompass issues relating to the commons dilemma and the social trap. Gifford (2002) describes the commons dilemma as the conflict that exists between the certain, greater benefits of acting in the self-interest and the uncertain benefits, or certain costs, of acting in the best interest of the community. He defines the social trap as the tendency for individuals to ignore the long-term costs associated with activities having immediate rewards. Thus, the social dilemma is defined by: 1) the greater reward received by an individual acting in their self-interest; and 2) the overall greater benefit to the group if individuals act in the public interest (Dawes, 1980).

Much of the early work relating to the commons dilemma focused on Garrett Hardin’s (1968) assertion that humans are egoistic by nature, in that they will act in their self-interest at the expense of group or collective welfare when it comes to managing commons resources. In general, environmental psychologists have not fully accepted Hardin’s conclusions. Rather, environmental psychologists believe human behaviour in the common resource situation remains an empirical question; namely, under what conditions will humans behave in the best interest of the collective (Gifford, 2002)? As summarized in Gifford (2002), the literature identifies four categories that influence cooperative behaviour in relation to common resources: 1) the nature of the resource (e.g. its importance to the participants and the degree of certainty regarding its depletion); 2)

the individual participant's characteristics (e.g. the degree of social uncertainty or confidence in how others in the group will act); 3) the characteristics of the individual as part of a group (e.g. group identity, perceptions of equality); and 4) the structure of the dilemma itself (e.g. rewards/punishments, degree of communication).

For the purposes of this paper, this basic understanding of the concept helps put the discussion of farmer behaviour in the context of environmental management. A more thorough review of social dilemma theories is beyond the scope of the paper, but can be found, for example, in texts by Gifford (2002) and Cave (1998).

2.2.5 Environmental Behaviour Research and Agriculture

A number of studies have investigated the factors affecting farmer behaviours in relation to the environment. While some have perhaps focused too heavily on attitudes, as criticized by Burton (2004), several have attempted to find more comprehensive measures of behaviours, and a few have applied socio-psychological theories as postulated by Burton (2004).

For example, Fishbein and Ajzen's (1975) TRA was applied by Luzar and Diagne (1999) to assess the impact of attitudes on farmer participation in a voluntary, incentive based, wetland conservation program. The TRA was also used by Lynne and Rola (1988) to investigate farmers' soil conservation actions. In a later study, Lynne et al. (1995) expanded their work, applying the TPB to help explain strawberry farmers' use of conservation technology. This study found that the TPB, together with a variable measuring financial capability resulted in a significant explanation in the variance of the behaviour. In an additional study by Corbett (2002), the TPB was applied to investigate participant motivations in a riparian improvement program. Corbett concluded that the TPB becomes less accurate as the monetary commitment for a behaviour increases. While this finding of Corbett's is worthy of further research, aspects of the applied methodology are questionable in relation to the guidance provided by Ajzen (1988) relating to the proper application of the TPB.

In a series of studies in the United Kingdom, Beedell and Rehman (1996, 1999, 2000) used the TPB as the theoretical framework for analyzing the difference in underlying beliefs between farmers, farming members of an agricultural conservation group, and more mainstream conservationists. In their pilot interviews, Beedell and Rehman identified moral obligation as a potentially important variable in farmer behaviours and thus added a measure of moral obligation to the TPB as applied to their work. In their final study, Beedell and Rehman (2000) concluded that socio-psychological models, while having some limitations, provide an appropriate framework for assessing farmer behaviours.

As previously mentioned in the discussion of agri-environmental policy tools (section 1.1), and as evident in the studies mentioned above, farmers will experience both internal and external barriers to environmentally responsible behaviours. One of the most common approaches for addressing internal barriers is to employ informational and educational campaigns to improve farmer's awareness of environmental issues. However, Gardner and Stern (1996) caution that overcoming internal barriers through education requires careful design based on psychological principles. These approaches are discussed in the following section.

2.3 Environmental Education and Communication: Overcoming Internal Barriers to Action

A lack of information, resulting in ignorance and/or misinformation can present a significant internal barrier to environmental action (Gardner and Stern, 1996). As a result, educational programs have become an important element of many initiatives geared towards influencing environmental behaviours. There is some variation in the definition of "environmental education" in the literature (Disinger, 1983). The body of research that focuses on the role of environmental education in facilitating responsible environmental behaviours is most relevant to the present study. It is also important to note that there are a variety of tools under the education umbrella, which can be considered individually: information, communication, education and capacity building

(Fien et al., 2001). However, for the purposes of this paper, these concepts will be considered collectively, in that they all have the objective of providing the necessary precursors for environmentally responsible behaviours.

2.3.1 Environmental Education and Behaviour Change

Too frequently, interventions aimed at influencing environmental behaviours have been based on collective wisdom rather than the psychological principles underlying effective communication (Gotch and Hall, 2004). In addition, environmental education programs have too often focused on general knowledge and awareness (Hungerford and Volk, 1990; Leeming et al., 1993; Sia, 1985/1986), and have reflected simplistic, linear models that suggest information provision will lead to attitude change and subsequent changes in behaviour. These simplistic models have been largely discounted (Vining and Ebreo, 2002; Hungerford and Volk, 1990; Cullen, 2001) and more recent research has focused on identifying the variables that lead to responsible environmental behaviours.

Several authors provide a thorough discussion of various models for influencing environmental behaviours (Hines et al., 1986/1987; Hungerford and Volk, 1990; Marcinkowski, 2001; Sia et al., 1985/1986; Sivek and Hungerford, 1989/1990; Volk and McBeth, 2001; and Zelezny, 2001). Of particular interest in the context of the present research is Hines et al.'s (1986/1987) model for Responsible Environment Behaviour. The model suggests behaviours and behavioural intentions are a function of cognitive factors (knowledge of environmental issues; knowledge of action strategies and action skills), personality factors (attitude, internal locus of control and personal responsibility) and situational factors (economic considerations, social influences and opportunities to act). Comparing Hines et al.'s (1986/1987) findings with those of the other studies referenced above, Ramsey and Hungerford (2002:152) summarize the findings of the literature. They list the variables that have been found to be associated with responsible environmental behaviours as: 1) environmental sensitivity (i.e. comfort in or empathy towards nature); 2) knowledge of ecological concepts; 3) knowledge of environmental problems and issues; 4) skills to identify, analyze, investigate and evaluate environmental

problems and solutions; 5) beliefs and values; 6) knowledge of strategies for environmental action; 7) skills for applying environmental action strategies; and 8) internal locus of control (i.e. a belief that personal action can result in or contribute to desired outcomes). While these variables can provide a starting point for designing environmental education programs, the interrelationships between these variables are not well understood, and it remains unclear which variable or variables are more influential in facilitating environmental behaviours (Hines et al., 1986/1987). Furthermore, the complexities of human behaviour may make it impossible to capture all variables within a single framework (Kollmuss and Agyeman, 2002).

Another approach for investigating the effectiveness of an educational program in terms of its impact on environmental behaviours would be to consider the program's content within the framework presented by Hungerford et al.'s (1980) "Goals for Curriculum Development in Environmental Education". While perhaps geared towards more formal environmental education, the four goals present the "levels" of environmental awareness and knowledge necessary to influence behaviour. As summarized in Cullen (2001:39), the goal levels are as followed: 1) The Ecological Foundations Level, where learners gain a degree of ecological knowledge that facilitates ecologically sound decision-making; 2) The Conceptual Awareness Level: Issues and Values, where learners become aware of the impact of individual and collective actions on the environment; 3) The [Issue] Investigation and Evaluation Level, where learners develop knowledge and skills to investigate environmental issues and evaluate alternatives; and 4) The Action Skills Level: Training and Application, where learners develop skills to take environmental action.

2.3.2 Effective Environmental Communication

In addition to the elements raised in section 2.3.1, the effectiveness of environmental education and communication initiatives can be strengthened through an initiative's structure and design, its messaging, and its incorporation of techniques to bridge the gap between intention and behaviour. Many of these recommendations in the environmental

education literature are found in the environmental psychology and policy fields as well. In particular, an emerging field, Community Based Social Marketing, aims to incorporate many of these elements into a single framework for guiding interventions aimed at influencing specific behaviours (McKenzie-Mohr and Smith, 1999).

In terms of structure, Gardner and Stern (1996) and Stern (2002) highlight the importance of using interpersonal forms of communication delivery, preferably using locally known and trusted community groups. Gardner and Stern (1996) indicate it is necessary for the source of the information to be perceived as credible, and for there to be opportunities for learners to validate the information they receive. The literature also suggests it is important to use multiple channels to disseminate information, and to incorporate effective techniques such as behaviour modelling, live and/or video demonstrations and hands-on activities, all geared specifically to the target audience (Cave, 1998; Gardner and Stern, 1996; Gifford, 2002; Stern, 2002).

In terms of messaging, the content of environmental communication and education programs must be sufficiently personalized, and be based on the learners' current level of knowledge and attitudes and their interests (Gardner and Stern, 1996; Gifford, 2002; Stern, 2002). This is not to say that educational programs need to be individualized; but they should be targeted towards different groupings or types of people within the target audience (Stern, 2002).

Messages should be appropriately framed in terms of what is at stake at being lost, rather than what can be gained, as individuals are more responsive to losing something than they are to the prospect of gaining something (Cave, 1998). Consequently, educational programs should accurately emphasize the severity of the environmental problem, the necessity of immediate action and the dangers or costs of failing to take pro-environment action. However, these messages must be accompanied by information on specific actions that can be taken to avoid these dangers in order to maintain (or instil) a sense of personal control (Cave, 1998; Stern, 2002). Gardner and Stern (1996) further stress that is important to frame messages in a manner that emphasizes the achievement of desirable

goals, rather than creating a perception of personal sacrifice. It is also imperative that these messages accurately reflect the state of the environment and the likely impact of positive behaviours on environmental improvements (Nickerson, 2003).

As previously indicated, educational initiatives have minimal effect on the situational barriers that can prevent people from acting on their intentions to behave in an environmentally responsible manner (Gardner and Stern, 1996). However, efforts to overcome “behavioural inertia” can be built into programs to remind and encourage individuals to follow through with the intentions developed through educational activities (Gardner and Stern, 1996:85). Commonly cited approaches include the use of reminders or prompts, which are timely and specific (Cave, 1998; Gardner and Stern, 1996), and the application of a public commitment to behave in accordance with behavioural intentions (Cave, 1998; Gardner and Stern, 1996; Gollwitzer, 1999).

Chapter Three: Methodology

As outlined in the Introduction, the overall purpose of this research is to determine whether the EFP educational component improves the likelihood of environmentally positive behaviours as they relate to on-farm management. The approach and data requirements for fulfilling this research goal were established following a review of the theoretical literature as presented in Chapter Two, as well as existing empirical research relating to environmental farm management and the Ontario EFP program. The literature review led to the selection of a theoretical framework through which the effectiveness of the EFP workshops could be assessed. It also identified current assumptions and gaps relating to farmer participation in voluntary environmental programs and these programs' environmental impact. A survey was developed to explore the linkages between the theory and the EFP reality, and to test current assumptions about farmers' environmental behaviour. Interviews of professionals involved in the EFP program and a basic curriculum review were also undertaken to ensure a broader understanding of the EFP approach in Ontario. This section describes the study methodology in terms of the applied approach, research instruments and data analysis.

3.1 Research Approach

While several studies have been previously conducted on the Ontario EFP program, none provided a relevant dataset for this research. In addition, the lack of systematic data collection and reporting requirements under previous generations of the Ontario EFP program made primary research necessary (A. Graham, EFP Program Manager, OSCIA, personal communication, March 21, 2005). The research focus on psychological constructs and farmers' perceptions lent itself to survey or interview research instruments.

In conversations with staff at the Ontario Soil and Crop Improvement Association (OSCIA), the organization responsible for the program's delivery, mail-out surveys were ruled out as several previous researchers had encountered difficulties with response rates

(A. Graham, personal communication, March 21, 2005). The strict confidentiality aspects of the program also presented challenges for conducting mail out surveys or farmer interviews. Since the research focused on the program's educational component, the workshops were identified as an appropriate setting for conducting the surveys. It is important to note that for the purposes of the survey research, the EFP educational component is defined as the two EFP workshops and the informal, participatory learning that occurs through the completion of the EFP worksheets during the intervening time between the two sessions. The development of the action plan could also be considered an educational element, as could the technical assistance made available through the program.

This approach to conduct the surveys at the workshops presented some limitations in terms of the applicability of the research to the broader farming population, but was considered the least intrusive approach and the approach most likely to produce results in the given timeframe. A "before-and-after" approach was adopted to take measurements as farmers entered, and then completed, the educational component of the EFP program. While this is an accepted research approach for measuring the impact of an intervention, it is important to recognize some limitations when interpreting results. For instance, it is typical for before-and-after tests to show improvements; however, some studies that have included follow-up elements to assess responses several months after the intervention have found a return to baseline levels (Leeming et al. 1993). The present research does not include a follow-up study given time constraints.

3.2 Data Requirements

The data requirements for the research objectives were identified through preliminary discussions with OSCIA staff and through the literature review of past EFP studies and theories relating to environmental policy, environmental psychology, and environmental education. The following paragraphs outline the data requirements based on the research objectives that were first presented in section 1.4.

To investigate the formation of farmers' behavioural intentions to implement BMPs on their farms and to assess the degree of change in intentions from before to after the workshop component, both surveys elicited farmers' attitudes, subjective norms, and perceptions of control over the implementation of BMPs. These elements are required to apply the Theory of Planned Behaviour (TPB), which provided the theoretical framework for investigating farmer behaviour. The construct of this theory and its application to the research are discussed in detail in section 2.2.2. To further test the sufficiency of this model in explaining farmer intentions in this context, questions measuring participants' personal norms or perceptions of moral obligation were also included in the surveys.

The measures of environmental awareness were selected through a broader review of the environmental psychology literature, and from lessons derived from research into the effectiveness of voluntary agri-environmental schemes. Care was taken to measure elements of environmental awareness that the literature linked to environmental behaviours. In this way, the environmental awareness variables reflected the type of awareness that is likely to result in environmental behaviours rather than simply general environmental knowledge or awareness. Thus, nine questions measuring participants' perceptions of these awareness factors were included in both surveys to provide an overall measure of awareness and to allow the change in this awareness to be measured from before to after the EFP's educational component. It is important to note that the index used in this study does not claim to present a complete measure of environmental awareness, but rather aims to provide some general insight into these select awareness elements that are believed to have some influence on environmental behaviours.

3.3 Study Scope and Population

The surveys were administered at fourteen EFP workshops (each consisting of a full day, separated by approximately one week) held in Carleton, Dundas, Grenville, Lanark, Middlesex and Elgin Counties between late-October 2005 and mid-February 2006.

OSCIA selected these counties to be part of the study based largely on the willingness of the two program representatives to participate in the research. This approach was

necessary because the research required the support of OSCIA and the workshop facilitators.

The survey respondents were all participants at the EFP workshops and they were given the choice of completing the questionnaires. This use of a “convenience sample” presents some limitations relating to self-selection and representativeness, as the choice to participate in the EFP workshops and complete the survey may reflect certain attitudes or tendencies that could influence the results. In addition, the keenness of the program representatives in these counties to participate in the research may reflect personal characteristics that influence their approach to workshop facilitation. Thus, results may be different in other counties where workshops are run by other program representatives. The results can present general insight into the program’s workshop component, but caution should be used in directly applying the results to workshops in other counties. The results are also not reflective of the Ontario farming population on the whole since the surveys were completed by a subset of the farming population who had all self-selected to participate in the EFP workshops.

3.4 Questionnaire Design

As previously described, the EFP education component consists of two introductory day-long workshops conducted one to two weeks apart. Two self-administered questionnaires were developed to measure participants’ responses before and after the program’s educational component. The two questionnaires were linked by a 4-digit code provided by the participant, a measure that reflects the program’s strict confidentiality policy and the need to ensure participants’ anonymity.

The questionnaires were developed during the summer of 2005, and underwent several revisions following reviews by OSCIA administrators, workshop facilitators and a farmer before being submitted to Ryerson’s Ethics Review Board in September 2005. The first three sets of workshops in October 2005 were run as pilots. Following these initial workshops several questions were removed to reduce the questionnaire length. For

instance, open-ended questions aimed at providing deeper insight into the belief constructs of the TPB and questions relating to general environmental knowledge were removed. This additional information would have been useful, but given time constraints and early feedback from participants regarding their frustration with the length, these items were removed to strengthen the questionnaire on the whole.

There were four parts to the questionnaires (Appendix C). Both questionnaires included measures relating to the TPB and environmental awareness. In addition, the first questionnaire included several demographic questions and the second questionnaire included measures of the participants' perceptions of the new financial incentives, and of the financial costs of BMP implementation. Participants were encouraged to provide additional comments and both surveys included space for this purpose.

There was no systematic order to the questions and care was taken to rearrange question order and layout to reduce issues associated with the "memory" or "carry over effect". The "carry over effect" can be a problem with before-and-after data collection designs, where responses to the second treatment can be influenced by participants' responses or impressions during the first treatment (Gravetter and Wallnau, 1988).

In addition, the survey questions were designed paying close attention to general principles of good questionnaire design. Given that the questionnaires were largely self-administered, efforts were taken to ensure the questionnaire employed clear, self-explanatory, and largely closed answer questions of similar format (Fowler, 2002; Buckingham and Saunders, 2004). Special attention was paid to ensuring the questions "worked" for the target population (given the agricultural context and realities associated with some participants having English as a second language), and the number of questions was reduced to help ensure active participation in the entire survey (Marans, 1987; Fowler, 2002).

Regarding question reliability and validity, the internal consistency of items aimed at measuring the same underlying constructs was measured and results are reported in

section 3.7.2. Time and logistical constraints prevented any opportunity to conduct test-retest reliability study of the surveys, thus the validity of the questions in terms of response consistency over time has not been established.

3.5 Survey Administration by OSCIA Staff

The program's policy for confidentiality and the realities of incorporating the surveys into the workshop agendas made it necessary for the questionnaires to be administered by the program representatives for the respective counties. As such, prior to each workshop, the facilitators were provided with a package that included the requested number of questionnaires, consent forms for the participants (which were kept by OSCIA), and "Notes for the Survey Administrator", which provided some guidance to the program representatives regarding the consent form and questions that might have been raised by participants. These accompanying documents (Appendix D) aimed to facilitate consistency in questionnaire administration since the primary researcher was entirely "hands off" during this component of the research. Instructions on the questionnaires also provided basic definitions and directions for completing the surveys.

3.6 Question Formation: The Theory of Planned Behaviour

The survey questions aimed at measuring the variables of the TPB closely followed guidelines found in the literature. While there is no standard format for a TPB questionnaire, there are specific underlying rules that must be adhered to in order to obtain results that most accurately explain the theory (Ajzen, 2002b). The most pertinent methodological issues relating to the application of the TPB and the development of TPB questionnaires are outlined in the following sections.

3.6.1 TPB Methodological Considerations

In developing an appropriate TPB questionnaire, it is important that the behavioural measure be defined with respect to a specific "Target" and a specific "Action", all within

a given “Context” and “Timeframe” (Ajzen and Fishbein, 1975). In addition to these elements, the following methodological principles, as outlined by Ajzen and Fishbein (1980) and Ajzen (1988, 2002b), were taken into account during question design.

Principle of Compatibility – The principle of compatibility requires that all constructs of the model (attitude, subjective norm, perceived behavioural control and intention) be defined in the same terms (i.e. by the TACT elements explained above) as the behaviour. The items measuring the TPB variables were all carefully designed with this principle in mind. The behavioural target was “beneficial management practices”, the action was “implementing”, the context was “your farm operation” and the timeframe was “within the coming year”.

Specificity and Generality – It is possible to measure both specific and more general behaviours using the TPB. However, the principle of compatibility applies in this case as well, and all measures in the questionnaire must share the same level of specificity. For example, it is not appropriate to measure intentions to implement agricultural beneficial management practices and attitudes towards implementing vegetative buffer strips in the same TPB questionnaire.

Internal Consistency – More than one question is needed to assess each variable. For appropriate design (reliability), the items must demonstrate high internal consistency with each other to ensure the items are measuring the same construct. Consequently, each construct variable was associated with 3 or 4 items and internal consistency tests were applied to measure reliability (section 3.7.2).

3.6.2 Direct vs. Indirect Measures of TPB Constructs

The TPB construct variables (attitudes, subjective norm and perceived behavioural control) can be measured directly, with respondents judging each variable against a set scale, or indirectly, by measuring corresponding (underlying) beliefs and evaluative outcomes (Ajzen, 1988).

The current study uses direct measures of the construct variables in an effort to reduce complexity and limit the length of the questionnaire. It was expected that the direct approach would increase the likelihood of questionnaire response (shorter length) and lessen the necessity for structured elicitation studies for questionnaire design. It would also leave room to include some additional questions to assess other aspects regarding the workshops' effectiveness (i.e. the awareness component).

3.6.3 TPB Question Format

The question format employs 5-point bipolar adjective scales (i.e. pairs of opposites). This differs from the 7-point scale applied in most TPB studies; however, Ajzen (n.d.) notes that a 7-point scale is not mandatory. A 5-point scale was deemed better suited for the given context to decrease complexity and frustration in the target group. Efforts were taken to carefully develop questions with bipolar adjectives that adequately reflected the agricultural and program context. Adjectives at the higher end of the scale reflected stronger intentions, attitudes, subjective norms and perceptions and behavioural control.

Counter to the methodological advice in the literature (Ajzen, 2002b), an elicitation study was not conducted to design the questions because of time and logistical constraints. Instead, questions were designed to measure behavioural intentions, attitudes, subjective norm, perceived behavioural control and moral obligation based on the literature review of previous studies attempting to identify drivers and barriers to participation in the EFP, and the more general literature on farmer participation in voluntary environmental programs. These elements were reviewed by members of the OSCIA and workshop facilitators prior to survey administration in an attempt to establish question relevance and appropriateness in the given context. While these efforts were taken to ensure the appropriateness of the questions, the failure to conduct an elicitation study could result in an underestimation of the construct's predictive validity (Ajzen, 2002b).

3.7 Analysis of Results

In the months from late October 2005 to mid-February 2006, sixteen workshops were held in the study counties. Of these, three workshops were used to pilot the surveys (and the data were not included in the dataset), and in two instances the workshop facilitator decided not to conduct the surveys for reasons relating to difficulties with the tone of the group or lack of workshop administration support (A. Ross, EFP Program Representative, personal communication, March 16, 2006). Consequently, data were collected and analyzed from eleven workshops.

The workshops were each comprised of approximately 10-25 participants, and there was a very low degree of non-response. A total of 127 valid surveys were retrieved, and only a handful of workshop participants opted not to complete the surveys (M. May and A. Ross, EFP Program Representatives, personal communication October 2005 – February 2006). Quantification of the response rate is not possible without access to the confidential list of workshop participants. Any difference in the number of workshop participants and the number of valid surveys is largely attributed to absences in the first or second workshop, since both a pre and post-workshop survey was required for a workshop participant to be included in the dataset. Absences are not uncommon as sometimes workshop participation is shared between individuals, or a participant may attend the first workshop, but then attend a second workshop offered later in the year, for example.

In general, the quality and thoroughness of the responses were quite high. There were a few cases where participants skipped whole pages and some participants appeared to opt against completing the questions measuring demographic attributes. The data were collected and entered into an SPSS database using the variables as defined in Appendix E. Any missing data were entered as such and a review of the missing data detected no patterns in terms of the cases with missing data and the corresponding behavioural intentions, for example. Given this result, no further action was taken with respect to

missing data. In the SPSS analysis, missing data were excluded in a pair-wise or analysis-by-analysis manner (Norusis, 2005).

3.7.1 A Note on Statistical Analysis Assumptions

The majority of the data analysis applied parametric statistical tests including Pearson's product-moment test for correlation, multiple regression and difference of means tests (independent and paired samples t-tests and one-way analysis of variance between groups). These tests are associated with a number of assumptions that were considered before their application and that need to be recalled during the interpretation of results.

First, the applied tests assume continuous, interval level data. Some authors suggest data obtained from a 5-point scale is more clearly ordinal level data. These authors view the possible responses as categorical rather than continuous because the intervals between each point on the scale are not necessarily equal (Buckingham and Saunders, 2004). Others, however, make the distinction between the variable being measured and the instrument used to collect the measurement (Russo, 2003; Gravetter and Wallnau, 1988). In this respect it is argued that it is appropriate to consider the variables being measured in this research as continuous variables in that there are infinite possible responses that are only limited by the accuracy and precision afforded by the measuring instrument (i.e. the five-point scale). However, in interpreting the data, the limitations imposed by the measuring instrument must be respected.

Second, preliminary analysis revealed that the data were not normally distributed, which is another assumption underlying the applied statistical tests. Given the nature of questions typically included in social science research, it is not uncommon for social science data to be skewed (Pallant, 2001), and since the survey participants all self-selected to participate in an environmentally focused program, the lack of normality is not surprising. In the case of the t-tests, the technique is generally robust to violations of the normality assumption, particularly in samples greater than thirty (Gravetter and

Wallnau, 1988). The robustness of multiple regression to this violation is less certain, but is believed to increase with greater sample sizes (Tabachnick and Fidell, 2001:74).

Application of the corresponding non-parametric techniques was considered. However, given the lower power of these techniques, the detection of correlations would likely have been more difficult (Cone and Foster, 1993; Pallant, 2001). Mathematically transforming the data to reflect a normal distribution, as advocated by Tabachnick and Fidell (2001) was also considered but rejected as an appropriate option in this case. Transforming the data is not a universally accepted practice (Tabachnick and Fidell, 2001; Pallant, 2001) and the transformation would have greatly increased the difficulty of interpretation. In addition, since this research does not aim to infer results to the broader farming population (whose responses to these types of questions would likely reflect a more normal distribution), the parametric statistics are acceptable in this instance. That said, it is important to recognize that failing to meet this assumption may weaken the findings.

A further assumption common to the selected techniques is “independence of observations”, in that each observation or measurement in the study must not be influenced by the others (Stevens, 1996). Given the study design of this research (i.e. collecting responses in a classroom or group setting), it is possible that the survey participants were influenced by others in the workshop. To help account for this potential violation, when interpreting the results, those demonstrating a less stringent alpha value (i.e. $p < .05$ rather than $p < .01$) should perhaps be considered suspect (Stevens, 1996). Section 3.7.3, describing the multiple regression methods, includes some additional discussion of the assumptions specific to that statistical test.

3.7.2 Data Preparation

Several steps were taken to prepare the data prior to analysis. An alpha reliability coefficient was derived for each set of items measuring the separate TPB variables to determine their internal consistency, and thus the reliability of the TPB survey questions. The literature indicates Cronbach's alpha coefficients should be at or above 0.7 to

properly demonstrate internal consistency, though lower values are sometimes used, particularly in exploratory research (Pallant, 2001; Garson, 1999). Alpha values were calculated for the TPB variables on both sets of questionnaires and the averaged values were considered to guide interpretation (which was deemed appropriate since the questions were the same). The *Intention*, *Attitude* and *Moral Obligation* variables had alpha values at or above 0.7, but the measures for *Subjective Norm* and *Perceived Behavioural Control* were slightly lower. The analysis indicated that removing the first item of perceived behavioural control (measuring the degree to which participants had sole decision-making authority on their farm) and the third item of subjective norm (measuring participant's perceptions of societal expectations) would substantially improve the alpha value for these variables.

Since Cronbach alpha values can be lower when used to assess the internal consistency of scales with a small number of items (Pallant, 2001:85), the above findings were verified by analyzing the practical and statistical significance of the inter-item correlations of the scale items. Statistical significance was confirmed ($p < .01$) and the correlations were moderate to high considering typical values in behavioural sciences (Cohen, 1988). The pattern of inter-item correlations supported the findings of the Cronbach's alpha analysis. The values derived from the internal consistency analysis are presented in Appendix F. Given the exploratory nature of the research, the calculated reliabilities are acceptable. Scales for the TPB variables were developed using all the original survey question items for the *Intention*, *Attitude* and *Moral Obligation* variables and with items 2, 3 and 4 for *Perceived Behavioural Control* and items 1 and 2 for *Subjective Norm*. The average score of each set of items was taken to derive an overall score for each TPB variable as the literature directed (Francis et al., 2004).

In addition to calculating TPB variable scores, an environmental awareness index (*Awareness Index*) and an index for financial costs (*Financial Cost Index*) were also derived. Nine items (*Implementation Knowledge*, *Maintenance Knowledge*, *Environmental Improvements*, *Environmental Urgency*, *Agricultural Contribution*, *Health Impact*, *Social Certainty*, *Farm Impact* and *Personal Responsibility*) were

summed to form the *Awareness Index* which ranged from 9 to 45, with lower scores indicating lower environmental awareness and lower probability of environmentally responsible behaviours and vice-versa. Three variables (*Profit Impact*, *Management Options* and *Financial Constraints*) were summed to form the *Financial Cost Index*, which ranged from 3 to 15 with lower values indicating greater perceptions of financial obstacles and less chance of BMP implementation. Note that some scale items were reversed before being added to the indices so that the higher scores all reflected a greater likelihood of environmental behaviour (in the case of the *Awareness Index*) or a lesser likelihood that financial issues would pose as an obstacle to BMP implementation (in the case of the *Financial Cost Index*). The questions corresponding to these index variables are found in Appendix E.

For the indices, there was no concern regarding the inter-item consistency of the index variables, since the measures were not designed to reflect a single underlying construct (as was the case with the TPB variables). Rather, the indices summarize a number of different but related indicators believed to influence the index measures (i.e. environmental awareness and financial cost considerations). Thus, rather than measuring internal consistency using Cronbach's Alpha as for the TPB variables, a correlation matrix was analyzed to ensure some correlation between the individual items and the overall index score. These matrices are presented in (Appendix G). The statistical and practical correlations between the individual items and the index were determined to ensure it was appropriate to include each of the awareness questions in the index. Statistical significance was determined at $p < .01$ and at least a moderate practical significance was verified. While appropriate for this preliminary investigation, it is important to note that simply summing the individual scores implies each variable equally contributes to the index value (Buckingham and Saunders, 2004). However, the low inter-item consistencies and the variety of correlation strengths demonstrate the relatively rudimentary nature of the index, and these limitations should be kept in mind when interpreting results.

3.7.3 Data Analysis

To meet the research objectives, data analyses using correlation, multiple regression and difference of means statistics were required. Linear multiple regression was used to test the sufficiency of the TPB. The analysis aimed to identify the extent to which the theory constructs can explain the variance in behavioural intention and to determine whether the addition of the *Moral Obligation* variable could improve the degree of explanation regarding the variation in intention. In addition, the relative contribution of the variables in terms of their explanation of intention could be identified by inspecting the standardized regression coefficients. The data from the second (post-workshop) questionnaire were used for this analysis since the participants' intentions once they had experienced the workshops were of greater interest.

Before conducting the analysis, the assumptions for multiple regression (beyond those already discussed in section 3.7.1) were considered. The study's sample size was considered sufficient using guidelines provided by Stevens (1996:72), who suggests fifteen cases for each predictor variable in the equation, and by Tabachnick and Fidell's (1996:132) formula where $N > 50 + 8m$ (where m is equal to the number of independent variables). Applying both these measures indicates the study population size of 127 is well beyond the minimum requirements for regression sample size, which should help alleviate the impact of the skewed distribution of the variable scores (see section 3.7.1).

The correlation matrix for all TPB variables, the *Awareness Index* and the *Financial Cost Index* was also reviewed (Table 5.1, page 72). There were statistically ($p < .01$) and practically significant correlations between intention and the other variables except for the *Financial Cost Index*. This analysis confirmed that the data met the assumption relating to singularity and the absence of multicollinearity as required for multiple regression analyses (Tabachnick and Fidell, 2001:82).

Hierarchical regressions were performed on the various theory constructs, with intention as the dependent variable. In the first step, just the components of the Theory of

Reasoned Action (TRA) were measured (*Attitude* and *Subjective Norm*). The second step measured the TPB components (adding *Perceived Behavioural Control* to *Attitude* and *Subjective Norm*) to test the ability of the TPB to provide a greater degree of explanation beyond the original TRA model. The third step added a measure of *Moral Obligation* to determine whether this additional variable resulted in a statistically significant improvement in the explanation of *Intention*.

The changes in behavioural intentions and environmental awareness from before to after the workshops were measured to gain insight into the influence of the EFP educational component. The differences in the TPB predictor variables and the constructs of the awareness index were also measured to gain a deeper understanding of the change, and to identify the strengths and weaknesses of the EFP workshops. Each of these investigations employed a paired-samples t-test using the variables measured at time 1 (questionnaire 1) and time 2 (questionnaire 2) to identify the degree and direction of change.

Finally, using data from the second questionnaire (post workshop), one-way between-group analysis of variance tests were conducted to determine any differences in the TPB, environmental awareness, financial costs or financial incentive variables based on the collected demographic variables (age, education, income, past-use and county).

Chapter Four: Describing the Survey Population

This chapter describes the preliminary review of the data in relation to respondents' behavioural intentions, degree of environmental awareness, and their impressions of financial costs associated with BMP implementation. The demographic data are also analyzed to describe this population and to investigate any relationship between demographic factors and participants' responses. The results of this analysis and a discussion of these results are presented in the following sections.

4.1 Results

Of the 127 survey participants, 12 were from Carleton County, 19 from Dundas, 10 from Grenville, 14 from Lanark, 43 from Middlesex and 29 from Elgin. Grouped by EFP program representative, 56.7% of the participants are from the Middlesex-Elgin region and 43.3% from the Carleton, Dundas, Grenville and Lanark Counties. A summary of the demographic results relating to age, education, income, past BMP use and farm commodity are provided in Table 4.1. Of particular note is the relatively high education levels of participants and the higher participation of farmers recording incomes in the \$30,000-\$49,999 and greater than \$70,000 categories. In addition, workshop participation was greatest from the field crops, mixed (crops/livestock) and dairy commodity groups.

Other analyses using descriptive statistics provided insight into participants' intentions to implement BMPs on their farm in the upcoming year, their degree of environmental awareness and their perceptions of the financial costs posed by the implementation of BMPs. These results are summarized in Table 4.2. As measured on a 5-point scale, there was an increase in mean intentions from 3.77 (SD .84) to 4.10 (SD .74). Mean environmental awareness, as measured by the *Awareness Index* variable (on a scale of 9-45), also increased from 28.02 (SD 4.86) to 29.89 (SD 4.69) from before to after the workshop component. The financial costs variables were only measured after the second

workshop. The mean *Financial Cost Index* value (as measured on a scale of 3-15) was 9.09 (SD 2.45).

Table 4.1. Demographic Summary

	Category	Frequency	Valid Percent*	Cumulative Percent
Age (N=125)	< 30	13	10.4	10.4
	30 - 40	31	24.8	35.2
	41 - 50	45	36.0	71.2
	> 51	36	28.8	100.0
Education (N=125)	Did not complete high school	8	6.4	6.4
	Completed high school	25	20.0	26.4
	Completed college/technical program	63	50.4	76.8
	Completed bachelors degree	24	19.2	96.0
	Completed masters/doctoral degree	5	4.0	100.0
Income (N=113)	< \$30,000	23	20.4	20.4
	\$30,000 - \$49,999	34	30.1	50.4
	\$50,000 - \$70,000	19	16.8	67.3
	> \$70,000	37	32.7	100.0
Past use (N=124)	Never applied BMPs	16	12.9	12.9
	Applied 1 or 2 BMPs	42	33.9	46.8
	Applied several BMPs; others relevant	62	50.0	96.8
	All relevant BMPs applied	4	3.2	100.0
Commodity (N=123)	Beef	11	8.7	--
	Field crops	22	17.3	--
	Pork	4	3.1	--
	Mixed (crops/livestock)	36	28.3	--
	Fruit and vegetable	5	3.9	--
	Dairy	27	21.3	--
	Poultry	7	5.5	--
	Other	11	8.7	--

*valid percent is recalculated based on N

To gain greater insight into the dispersion of participants' responses regarding behavioural intentions, environmental awareness and financial costs, the percentage of participants responding in the top two and bottom two scale items was investigated (Table 4.2). Recall from the methodology sections 3.6.3 and 3.7.2 that higher scale items indicate stronger intentions to implement BMPs, greater environmental awareness and fewer concerns regarding financial costs. For both *Intention* and the *Awareness Index*, participants' responses shifted towards the higher end of the scale following the second

workshop; however, in the case of environmental awareness, a significant proportion (26.4%) of the respondents continued to have lower measures of environmental awareness. Analyses on the statistical and practical significance of these changes are calculated in sections 6.1 and 6.2. The dispersion information for the *Financial Costs Index* indicates a fairly even split in the respondents between the lower (40.7%) and higher (38.2%) ends of the scales.

Table 4.2. Descriptive Summary of Participants' Behavioural Intentions and Environmental Awareness

	Intention to Implement BMPs in the Coming Year	Environmental Awareness*	Financial Costs*
Mean: incoming participants	3.77 (SD 0.84)	28.02 (SD 4.86)	--
Mean: outgoing participants	4.10 (SD 0.74)	29.89 (SD 4.69)	9.09 (SD 2.45)
Dispersion: incoming participants	Scores < 3: 11% Scores = 3: 14.2% Scores > 3: 74%	Scores < 27: 34.9% Scores = 27: 5.6% Scores > 27: 59.6%	--
Dispersion: outgoing participants	Scores < 3: 5.6% Scores = 3: 7.9% Scores > 3: 86.4%	Scores < 27: 26.4% Scores = 27: 5.8% Scores > 27: 67.8%	Scores < 9: 40.7% Scores = 9: 21.1% Scores > 9: 38.2%

* The environmental Awareness Index is comprised of 9 variables measuring awareness factors with demonstrated links to environmentally responsible behaviour. The possible range of the index is 9-45, with values closest to 45 indicating a greater degree of environmental awareness and greater likelihood of environmentally responsible behaviours. The Financial Costs Index is comprised of 3 variables, with a possible range of 3-15. Values closest to 15 indicate fewer financial concerns and, therefore, a greater likelihood of environmentally responsible behaviours.

A similar analysis was conducted on the individual TPB variables, those variables that comprise the *Awareness Index* and the variables included in the *Financial Costs Index*. Regarding the TPB variables (Table 4.3), of particular note are the high percentages of participants in the top end of the attitude scales (91.2% following the second workshop). All TPB variables demonstrated a very low percentage of respondents in the bottom scale items; however, a relatively larger percentage was found for *Moral Obligation* (15.2% after the second workshop).

Table 4.3. TPB Variables: Descriptive Summary

	Attitudes	Subjective Norm	Perceived Behavioural Control	Moral Obligation
Mean: incoming participants	3.89 (SD 0.68)	3.82 (SD 0.71)	3.62 (SD 0.79)	3.53 (SD 0.82)
Mean: outgoing participants	4.08 (SD 0.67)	3.91 (SD 0.82)	3.77 (SD 0.69)	3.73 (SD 0.81)
Dispersion: incoming participants				
Scores < 3	8.7%	4.8%	11.9%	19.7%
Scores = 3	4.8%	16.9%	10.3%	12.6%
Scores > 3	86.5%	78.2%	77.9%	67.8%
Dispersion: outgoing participants				
Scores < 3	4.0%	6.4%	7.2%	15.2%
Scores = 3	4.8%	22.4%	9.6%	10.4%
Scores > 3	91.2%	71.2%	83.2%	74.4%

Of the environmental awareness variables (Table 4.4), the percentage of respondents in the top scale items jumped significantly from before to after the workshops for *Environmental Urgency* (from 34.1% to 41.3%), *Health Impact* (from 23.65 to 34.1%), *Social Certainty* (from 22% to 42.1%) and *Farm Impact* (from 23.6% to 38.1%). The analyses on the statistical and practical significance of these changes are presented in sections 6.1 and 6.2.

In terms of the financial costs variables (Table 4.5), approximately 51% of the respondents selected scale items suggesting the implementation of BMPs would not restrict their farm's future management options. However, approximately 34% selected the lower scale items indicating that the implementation of BMPs would have a negative impact on their farm profitability, and approximately 51% selected scale items indicating that the implementation of BMPs would place an unacceptable financial constraint on their farm operations.

Table 4.4. Awareness Index Variables: Descriptive Summary

	Mean: incoming participants	Mean: outgoing participants	Dispersion: incoming participants			Dispersion: outgoing participants		
			< 3	= 3	> 3	< 3	= 3	> 3
KNOWI	3.21 (SD 1.21)	3.36 (SD 1.08)	27.6%	26.8%	45.7%	22.2%	23.0%	54.7%
KNOWM	3.50 (SD 1.10)	3.38 (SD 1.08)	16.5%	26.8%	56.7%	18.1%	30.7%	51.2%
ENVIMP	3.80 (SD 1.02)	3.88 (SD .96)	11.8%	20.5%	67.7%	9.5%	19.0%	71.5%
URGENC	3.00 (SD 1.19)	3.23 (SD 1.08)	35.7%	30.2%	34.1%	23.8%	34.9%	41.3%
AGCONT	2.33 (SD 1.13)	2.46 (SD 1.03)	61.4%	21.3%	17.3%	53.2%	31.7%	15.1%
HEALTH	2.57 (SD 1.27)	3.02 (SD 1.15)	50.4%	26.0%	23.6%	29.4%	36.5%	34.1%
SOC	2.77 (SD 1.07)	3.36 (SD 1.02)	35.4%	42.5%	22.0%	18.3%	39.7%	42.1%
FARM	2.82 (SD 1.06)	3.19 (SD .99)	36.2%	40.2%	23.6%	21.4%	40.5%	38.1%
RESP	4.17 (SD 0.92)	4.06 (SD 0.92)	6.3%	11.8%	81.9%	4.7%	19.7%	75.6%

Note Appendix E outlines the variable label descriptions.

Table 4.5. Financial Cost Index Variables: Descriptive Summary

	Mean:	Dispersion:
	outgoing participants	outgoing participants
Profit Impact	3.10 (SD 1.27)	Scores < 3: 33.6% Scores = 3: 28.8% Scores > 3: 27.6%
Management Options	3.41 (SD 1.06)	Scores < 3: 20.6% Scores = 3: 28.6% Scores > 3: 50.8%
Financial Constraint	2.59 (SD .96)	Scores < 3: 50.8% Scores = 3: 34.7% Scores > 3: 14.5%

To determine whether demographic factors (age, education, income, past-use, commodity and county) had an influence on participants' responses, one-way analysis of variance between-groups tests were conducted to identify any differences in the TPB variables, the *Awareness Index*, or the *Financial Cost Index*. The only statistically significant difference was found in the responses of participants based on income. A Tukey post-hoc test indicated significant differences between participants in the lowest income

category (< \$30,000) and the highest category (> \$70,000) in their responses for both intention and perceived behavioural control. In both instances, respondents in the lowest income category reported lower measures. A further statistically significant distinction was evident between the lowest income category (< \$30,000) and the second lowest income category (\$30,000 – \$49,000) in their responses for intention, attitude, subjective norm, perceived behavioural control and moral obligation. In each case, the responses from participants in the lowest income category were lower than those in the second lowest category.

While only the differences mentioned above were statistically significant, the means plots generated by the SPSS analysis revealed a common pattern for intention, attitude, subjective norm and perceived behavioural control based on income category. The lowest means for all variables were recorded in the lowest income category, and the highest means for all variables were found in the second lowest income category (except for perceived behavioural control, where the mean recorded for the highest income category is slightly higher).

4.2 Demographic Influence on Intentions and Awareness

The differences in intention and awareness responses based on demographic variables are statistically insignificant (with the exception of income). This finding is not entirely surprising based on the current understanding of the role of demographic factors in environmental awareness or behaviours as presented in the literature. It is not uncommon for studies to publish conflicting results on the linkages between demographics and environmental awareness or behaviour from situation to situation. Hines et al. (1986/87) discusses the tenuous relationship between environmental awareness and demographic factors such as income, education, age and gender and indicates that there are no, to only slight or weak, associations that can generally be found in reviewing the literature. Regarding the Theory of Planned Behaviour (TPB), it is generally assumed that demographic variables are reflected in the underlying beliefs that inform the theory

constructs (Ajzen, 1985), thus one would not expect to see distinct differences for the TPB variables by demographic group.

However, the analysis did reveal a pattern regarding participants' responses to the TPB variables and their reported income categories. This finding could reflect methodological limitations regarding the construct of the TPB questions (i.e. no elicitation study), or potentially it reflects the particular importance of income and cost to this target audience (Corbett, 2002; Rhodes et al., 2002). Lynne and Rola (1988) reported findings suggesting that farmers with higher incomes tended to have weaker environmental attitudes. This relationship between income and attitude is more complex in the current research, in that the lowest recorded attitudes towards the behaviour were from those farmers in the lowest income category, followed by the second highest, then the highest category. The second lowest income category reported the highest attitudes towards BMP implementation.

If research is conducted in the future to explore the underlying beliefs of participants' attitudes, subjective norms and perceived behavioural control, greater insight could be gained regarding the influence of income on these variables. In the meantime, there are two possible explanations to consider. First, farms generating less income are generally smaller scale operations associated with fewer environmental concerns. In this circumstance, environmental problems are likely less visible and therefore, respondents may not feel there is sufficient need for such actions. Second, the responses may be largely reflective of the financial resources that are available to implement BMPs. This possibility points to the particular pertinence of the perceived behavioural control variable and participants' perceptions of their ability to overcome financial obstacles associated with BMP implementation.

The research shows the greatest participation from farmers in the two income categories that experience the highest pro-behaviour attitudes and intentions (i.e. Table 4.1 shows approximately 66% of participants have incomes in the \$30,000 – \$49,000 and greater than \$70,000 categories). Therefore, if workshops are comprised of more farmers from

the other income categories, this research suggests additional efforts may be needed to strengthen positive attitudes and beliefs regarding the positive effects of BMP implementation.

4.3 Strong Intentions and the Likelihood of BMP Implementation

Table 4.2 clearly displays respondents' strong intentions to implement BMPs on their farms in the coming year and an increase in these intentions from before to after workshop participation. The nature and significance of this change will be discussed in greater detail in section 6.1. However, regardless of any change, the high measures of behavioural intention warrant further discussion.

Recall that under the TPB, behaviours are determined by an individual's intention to perform the behaviour and their actual control over behavioural performance (Figure 2.1, page 27). In this respect, to the extent that variables have been measured in line with the theory's methodological principles, and that perceptions of behavioural control approximate reality, behavioural performance can theoretically be predicted from measures of *Intention* and *Perceived Behavioural Control* (Ajzen, 1985). While it would be tempting to use the high *Intention* and relatively high *Perceived Behavioural Control* measures from this study to suggest a high likelihood that BMPs will be implemented, some cautions are necessary.

For instance, it is widely accepted that behavioural intentions affect actions, but that people do not always follow through on all their intentions (Ajzen, 1985). In fact, it is common to see a willingness to perform a behaviour that is not followed through, but it is uncommon to see evidence of the opposite pattern occurring (Ajzen, 2005). This reality suggests that intentions may be overestimated when people are specifically asked in a questionnaire whether they intend to carry out an action (Staats, 2003). Sutton (1998) provides a thorough review of the largely methodological reasons why intentions do not always translate into behaviours when using the TPB model. Two of the most important reasons relating to the present research are discussed in greater detail here.

First, in order for intentions to accurately predict behaviour, intentions must remain stable over time (Ajzen, 1985, 1991). In particular, if there is a large interval between when the intentions are measured and when the behaviour is performed, there is a possibility that the effects of time itself, or the addition of new information, will influence and potentially change an individual's intention to perform a behaviour. For instance, since these measures were taken following the second workshop and the behaviour is not likely to be performed until after a farmer has completed his or her action plan and had it reviewed by the peer review committee (figure 1.1, page 7), a significant amount of time will pass during which the producer is likely to gain more information regarding the costs and benefits of implementing BMPs. It is not uncommon for the negative features of performing a behaviour to become more salient as an individual gets closer to an opportunity to perform the behaviour (Ajzen, 1985). Therefore, the question of intention in this context may be quite hypothetical. In fact, responses may be affected by a "hypothetical bias", where the measures of intention may reflect more socially desirable responses rather than true intentions to implement BMPs (Ajzen et al., 2004; Ajzen, 2005; Sutton, 1998).

Second, given the non-volitional nature of the behaviour under investigation (implementing BMPs), predicting behaviours from intentions also requires consideration of perceived behavioural control. Consequently, it is not appropriate to consider intentions as a single, direct determinant of behaviour in this case. In order for measures of perceived behavioural control to combine with intentions and provide an accurate prediction of behaviour, the measure of control must also remain stable over time and must closely approximate the individual's actual control over the behaviour (Ajzen, 1991). The measure of perceived behavioural control is in fact a measure of an individual's confidence in their ability to perform a behaviour, and in general, as perceived behavioural control increases, so does the effort expended to perform the behaviour (Ajzen, 1991).

Therefore, perceived behavioural control is an important measure in itself in terms of providing insight into the degree to which individuals will pursue behavioural performance. However, the degree to which perceived behavioural control reflects the reality of actual control will determine whether formed intentions will be carried out. In this investigation, it is uncertain whether the *Perceived Behavioural Control* variable is reflecting the reality of farmers' actual control over the implementation of BMPs. Measured *Perceived Behavioural Control* was only weakly correlated with other variables believed to have an influence on actual control (*Implementation Knowledge*, *Maintenance Knowledge*, *Only Decision Maker* and the *Financial Costs Index*) (Table 5.4, page 74). This finding suggests that farmers' perceptions of control may not have been adequately reflecting these other control issues at the time the measure was taken following the second workshop. It is possible that these control issues may become more salient as the opportunity to perform the behaviour gets closer, thus changing (and possibly lowering) the measurement of perceived behavioural control.

Given this discussion, the measured behavioural intentions should not be directly interpreted as likely behavioural performance. Since the relative importance of intentions and behavioural control varies between behaviours and situations (Ajzen, 1991), it is not possible to determine at this point whether the farmers' strong behavioural intentions or the possible lack of congruence between perceived and actual behavioural control will have greater relevance for the measure of behavioural performance.

If intentions are found to be sufficiently important, there is some reason to suspect that the farmers involved in this study will follow through with a relatively high level of behavioural performance. For instance, respondents' intentions may be less likely to be reversed prior to an opportunity to implement BMPs since their intentions are highly polarized, and thus unlikely to be offset through the addition of new information (Ajzen, 1985). Furthermore, the high measures of attitude towards BMP implementation may reflect a stronger cognitive basis for the recorded behavioural intentions and thus make intentions more stable over time (Ajzen, 2005; Staats, 2003). While these results suggest some positive correlation between current intentions and future behaviours, the impact of

behavioural control must be carefully considered, as even the strongest intentions will not overcome situational barriers that are beyond the individual's control (Gardner and Stern, 1996).

Given the particular significance of costs as a barrier to action for this target group (VanOsch, 1997; Holmes, 1998; Fitzgibbon, 2000a; Robinson, 2005), one would expect that if the financial incentives under the program are perceived as sufficient, there may be a much stronger likelihood that BMPs will be implemented. Section 7.4 provides a discussion of the respondents' perceptions of the incentives' sufficiency.

4.4 Strong Attitudes towards BMP Implementation

The results also demonstrate the EFP workshop participants' strong positive attitudes towards the implementation of BMPs both before and after the workshop component. Section 6.1 discusses the significance of any change in these measures from before to after the workshops; however, like the *Intention* variable, the *Attitude* measures warrant some additional discussion.

Staats (2003) suggested that strong attitudes toward a behaviour will generally result in higher, and often more stable, behavioural intentions. However, Ajzen (2005) and others (Geller, 1992; Newhouse, 1990) distinguish between the type of information on which attitudes are formed as having important implications for the actual strength and stability of attitudes over time. According to these authors, attitudes will be stronger (and therefore more salient and accessible when it comes time to perform the behaviour), when they are formed through direct experience or interaction with the behavioural object (i.e., BMPs). They explain that perceptions of the nature and consequences of a behaviour are more accurate when they are formed through direct experience, and therefore are less susceptible to change through the passage of time or introduction of new information.

This theory suggests that the 50% of workshop participants who have substantial previous experience implementing BMPs (Table 4.1) may have more stable attitudes (and therefore, more stable intentions) than those who have not implemented many BMPs in the past and whose attitudes were likely formed through less direct, perhaps second-hand, information. It is possible that the EFP program's participatory approach might help facilitate stronger attitudes by creating first-hand knowledge of agri-environment impacts and the consequences of BMP implementation; however, at the stage under investigation in this study, one should expect that a proportion of these high attitude measures are in fact not as strong as they initially appear, and may weaken if the participants have misjudged the difficulty or value of BMP implementation, or their interest in the behaviour, for example (Ajzen, 2005).

Furthermore, the strong attitudes towards BMP implementation should also be considered in light of some literature that suggests farmers' environmental attitudes may be overestimated if they are only compared to others within the farming community (Carr and Tait, 1990; Beedell and Rehman, 1996, 1999). These studies investigated the underlying determinants of seemingly similar environmental attitudes of farmers and conservationists in the United Kingdom and found significant divergence in the beliefs informing the attitudes of these two groups. For instance, Beedell and Rehman (1999) found that farmers had a more "creative" than "preservative" view of conservation. These findings are also supported by research referenced in Gifford (2002), where farmers were found to have a more anthropocentric outlook, viewing natural resources as important more for their human, rather than environmental, value. A future investigation into belief constructs and/or the types of BMPs implemented could help determine whether this distinction is important in this context, perhaps being reflected in the nature of BMPs implemented or other farm management decisions.

As a final note on the *Attitude* variable, the high values may also reflect the general nature of the behaviour under investigation. In order to make sure the behaviour was relevant to all farmers, the survey measured intentions to implement BMPs in general. It would not have been appropriate to ask about a single type of BMP, since it would likely

not have had relevance to all farm operations. However, in applying this more general behaviour, it is possible that the measures of *Attitude* (and possibly *Intention*) are somewhat inflated since they reflect perceptions of a group of management practices, not necessarily specific practices that would be associated with their own set of salient beliefs.

These caveats on the high recorded attitudes of workshop participants are not meant to minimize the gravity of these high attitudes, but to suggest that some caution is required in interpreting the results. The issues raised in this discussion are likely not substantial enough to suggest actual attitudes are drastically reduced from these measures. On the other hand, the seemingly high measures do not necessarily suggest there is no room for improvement in strengthening farmers' attitudes towards conservation behaviours.

4.5 Moderate Environmental Awareness

In comparison to the TPB responses, measures for the *Awareness Index* and its variables are generally lower and less homogenous, and demonstrate greater variation in the degree of change between the first and second workshops. As indicated in the methodology (section 3.2), it is important to note that the measures for environmental awareness are actually measures of perceptions that are believed to support environmentally responsible behaviour. As such, this research does not measure a general state of environmental knowledge or awareness, but rather awareness that increases the likelihood of environmental action. Furthermore, several of the variables in the index are related to respondents' perceptions of the state of the environment in their region. This research has not included any element to determine the accuracy of these perceptions.

One might assume, however, that if the respondents' perceptions of environmental quality in their region were an accurate reflection of the local situation, there would be fairly strong consensus on their responses to the awareness questions if the data were grouped by county. However, there were no significant differences detected between the counties. All of the mean *Awareness Index* values ranged from approximately 27 to 31 (with similar standard deviations as were seen for the aggregate data). Furthermore, for

the five variables in the index specifically aimed at eliciting regional perspectives, the county-grouped data continued to demonstrate a fairly wide range of responses. These discrepancies are also evident in reviewing the open-ended questions asking participants to list the most important environmental concerns in their region. Although respondents appeared quite aware of a variety of environmental issues and their potential sources, there was no clear pattern demonstrating group consensus on the most important regional environmental issues. These findings appear to suggest that farmers' responses to the regional environmental awareness questions do not necessarily reflect the reality of the regional situation. Efforts to enhance farmers' understanding of the true situation may be necessary to enhance the likelihood of positive environmental behaviours, especially in regions where agricultural sources are considered to be an important source of environmental degradation.

With this in mind, the more moderate means for the awareness variables and the index itself (i.e. slightly over the mid-point of the scale in most cases by the end of the second workshop), suggest participants' prevailing perceptions regarding the state of the environment and their ability to influence environmental quality may be creating internal obstacles to action. While in no way comprehensive, the awareness variables begin to explore some of the underlying beliefs that one would expect to influence a farmer's decision to implement BMPs; thus, these lower measures support the above discussion that the high *Intention* and *Attitude* measures may be somewhat exaggerated.

The particularly low measures for *Agricultural Contribution* warrant additional discussion. Participants were asked to indicate the extent to which agriculture contributed to environmental degradation in their region. The mean response remained quite low (2.46) at the end of the second workshop, with only 15.1% selecting scale items indicating a relatively high agricultural contribution. Again, there is no attempt made in this research to determine whether this is an accurate perception. Rather, the point is that this perception could be an important obstacle to action as farmers may feel less responsible for environmental problems as a group and less empowered to influence environmental quality through their personal actions (Ribaud, 1998).

These perceptions regarding the limited influence of agriculture on regional environmental quality were also made evident through the open-ended questions asking participants to identify the greatest environmental concerns in their region and the causes of these concerns. Environmental concerns associated with urban sources figured prominently in producers' open-ended responses regarding the most important regional environmental issues and their causes. This contention between rural and urban sources of pollution is pervasive and is not likely to be addressed completely through the EFP workshops. One approach to addressing comments or frustrations regarding urban pollution sources during the workshops is to emphasize how proud the farm community is that rural environmental issues are being addressed proactively (A. Ross, personal communication, April 21, 2006). This appears to be an appropriate approach, as the emphasis should be on what individuals can do to minimize their impact rather than placing blame elsewhere.

Given the importance of farmers' perceptions of agricultural contributions to environmental problems in relation to encouraging environmental action, it may be necessary to investigate additional means to demonstrate agricultural and individual contributions, particularly in watersheds where agriculture does indeed play a significant role. Ribaudo and Horan (1999) note that a common shortcoming of many agri-environment programs is their failure to convince producers of their role in environmental protection. Tindell and O'Connor (1987, as cited in Gifford, 2002) suggest that educational programs aimed at curbing environmental degradation should incorporate the concept of the social dilemma (as discussed in section 2.2.4). They found that greater cooperation and personal action to prevent environmental damage was associated with a stronger understanding of the issues underlying the commons resource dilemma. This kind of awareness could go a long way in bridging the rural-urban divide and placing the focus for environmental management at the regional scale.

4.6 Moderate to High Financial Costs

As measured by the *Financial Cost Index*, it appears that participants feel BMP implementation is associated with moderate financial costs. Investigating the individual variables provides greater insight into where participants perceive greater financial limitations. There appear to be fewer concerns about the possibility that BMPs would restrict the options available for future agricultural operations, and fairly evenly distributed perceptions regarding the likelihood that BMPs would have a negative impact on farm profitability. The greatest consensus among these three variables demonstrated the perception that BMP implementation would place an unacceptable financial constraint on farm operations (even with existing cost-share support). This finding is particularly concerning in the context of whether behavioural intentions will translate into the actual implementation of BMPs, since cost has been identified as a significant barrier to action for farmers participating in the EFP program (Van Osch, 1997; Robinson, 2005).

These findings suggest the need for more effective communication on the likely economic repercussions of BMPs and perhaps further research to determine whether these perceptions are founded in reality. The moderately high perceptions of financial costs associated with BMPs have implications for determining the sufficiency and appropriateness of the economic incentives offered through the program. These issues are discussed in greater detail in section 7.4.

Chapter Five: Determining the Sufficiency of the Theory of Planned Behaviour

One of the most common questions posed in the Theory of Planned Behaviour (TPB) literature pertains to the theory's sufficiency. Specifically, Ajzen (1991) concedes that it may be possible to identify additional variables that can provide a distinct contribution to variance in behaviours or behavioural intentions beyond that explained by the existing theoretical constructs. In addition, environmental behaviours are not all influenced by the same factors (Gifford, 2000), and the extent to which the predictor variables are able to explain intentional or behavioural variance will vary from situation to situation (Ajzen, 1991). Hence, specific investigations to determine the appropriateness and the sufficiency of the TPB are required in each behavioural context. The present research investigates the extent to which the TPB can explain the variance in farmers' intentions to implement BMPs on their farms in the coming year. It also includes a measure of moral obligation, to determine whether farmers' personal norms provide any additional unique explanation for the variance in intention beyond the established TPB construct variables. The following sections present the results of the data analysis, followed by a discussion of these findings.

5.1 Results

Before performing any analysis, the correlations between *Intention* and all the variables hypothesized to have a relationship with farmers' intentions were analysed using Pearson's product-moment correlation. The correlation matrix is presented in Table 5.1. The matrix shows a relatively high degree of practical correlation between the dependent variable (*Intention*) and the TPB predictor variables, and a more moderate correlation between *Intention* and *Moral Obligation*. There is also a statistically significant, medium strength correlation between *Intention* and the *Awareness Index*, but no significant correlation between *Intention* and the *Financial Costs Index*.

Table 5.1. Correlation Coefficients among Variables

	INT	ATT	SN	PBC	MO	AIndex	FCIndex
Intention (INT)	1						
Attitude (ATT)	.640*	1					
Subjective Norm (SN)	.635*	.611*	1				
Perceived Behavioural Control (PBC)	.622*	.486*	.489*	1			
Moral Obligation (MO)	.424*	.587*	.556*	.320*	1		
Awareness Index (AIndex)	.413*	.542*	.355*	.320*	.403*	1	
Financial Costs Index (FCIndex)	.166	.282*	.071	.288*	-.009	.068	1

* sig. 0.01 (2-tailed)

To test the sufficiency of the TPB, a hierarchical regression was performed. The variables of Fishbein and Ajzen's (1975) Theory of Reasoned Action (TRA) were entered on the first step (*Attitude* and *Subjective Norm*). The TPB variables (*Attitude*, *Subjective Norm* and *Perceived Behavioural Control*) were entered on the second step to test any additional explanation of the TPB beyond Fishbein and Ajzen's original behavioural model. The TPB plus a measure of *Moral Obligation* was entered on the third step to measure whether this additional variable could increase the explanation of behavioural intention beyond the TPB constructs. The results of this analysis are presented in Table 5.2.

Table 5.2. Hierarchical Regression Analysis for Intention: Testing the TPB and the Addition of Moral Obligation

	R	R ²	Adjusted R ²	R ² Change	Sig. F Change
Step 1: TRA ^a	.711	.505	.497	.505	.000
Step 2: TPB ^b	.764	.584	.573	.079	.000
Step 3: TPB + MO ^c	.764	.584	.570	.001	.668

^a predictor variables: attitude, subjective norm

^b predictor variables: attitude, subjective norm, perceived behavioural control

^c predictor variables: attitude, subjective norm, perceived behavioural control, moral obligation

The TRA performed well, explaining 49.7% of the variance in intention (using adjusted R² values to account for possible overestimation). The addition of *Perceived Behavioural Control* in the TPB resulted in a statistically and practically significant

increase in explanation, with a total of 57.3% of the variance being explained by the theory. The addition of the *Moral Obligation* variable did not improve the explanation for variance in *Intention*.

Table 5.3 presents the regression coefficients for the TPB variables, indicating the relative weights or importance of the predictor variables in relation to the explanation of *Intention*. All three TPB predictor variables make a statistically significant ($p < .01$) contribution to the explanation of the variance in intention. While quite close in their relative contributions, with the highest standardized regression coefficient (Beta = 0.334), *Perceived Behavioural Control* makes the greatest unique contribution to the explanation of the variance in *Intention* over the other TPB constructs.

Table 5.3. TPB Regression Coefficients

	Standardized Regression Coefficient (Beta)	Significance
Attitude	.302	.000
Subjective Norm	.288	.000
Perceived Behavioural Control	.334	.000

The relationship between *Perceived Behavioural Control* and other variables with clear linkages to personal control were explored in greater detail using Pearson's product-moment correlation. The variables collected on the second questionnaire were used for this analysis, and the correlation coefficients are presented in Table 5.4. Of interest are the statistically significant (either $p < .01$ or $p < .05$), but relatively low practical significance of the correlation between *Perceived Behavioural Control* and other variables that one would expect to affect farmers' perception of personal control; namely, whether the respondent is the only decision-maker on the farm (*Only Decision Maker*); their perception of personal knowledge regarding BMP implementation (*Implementation Knowledge*) and maintenance (*Maintenance Knowledge*); and their perceptions of the financial implications of BMP implementation (*Financial Costs Index*).

Table 5.4. Correlation Matrix among Behavioural Control Variables

	Perceived Behavioural Control	Only Decision Maker	Implementation Knowledge	Maintenance Knowledge	Financial Considerations Index
PBC	1				
ONLY	.272*	1			
KNOWI	.210**	.274*	1		
KNOWM	.220**	.228*	.673*	1	
FCINDEX	.288*	-.101	.119	.066	1

* sig. .01 (2-tailed)
** sig. .05 (2-tailed)

5.2 Explaining the Variance in Intention

The findings from this component of the research suggest that the TPB can explain a significant degree of the variance in behavioural intentions. The results suggest that the TPB may not be completely sufficient in explaining farmers' intentions or behaviours in this context, but that the theory can present a useful starting point for investigating some of the underlying foundations of farmers' environmental behaviours in the EFP context. This conclusion is also supported by Beedell and Rehman (2000), in their investigation into farmers' conservation behaviours in the United Kingdom.

In the context of behavioural science research, explaining 57.3% of the variance in behavioural intentions is quite reasonable (Sutton, 1998). The percentage of variance in intention explained by the TPB in this study is slightly higher than the average range found for other TPB-based studies. In a meta-analysis of such studies Sutton (1998) indicates that, on average, the TPB generally explains between 40% and 50% of the variance in intention. The discrepancy between this average value and the study results is quite small, and could be partly explained by methodological limitations (e.g. no elicitation study to inform the TPB questions) or the simple fact that each behaviour and context will result in a different degree of explanation using the TPB.

5.3 Explaining the Contribution of the TPB Variables

Of special interest in this study is the relative strength of the TRA to the TPB. The hierarchical regression revealed the substantial influence of attitudes and subjective

norms as demonstrated through the strong performance of the TRA model, which explained 49.7% of the variance in farmers' intentions. In addition, despite being fairly equally correlated with intention and highly correlated with each other, the TPB regression coefficients reveal that both *Subjective Norm* and *Attitude* also make substantial, unique contributions to farmers' intentions to implement BMPs on their farms.

As indicated in the results, the TPB, through the addition of the *Perceived Behavioural Control* variable, added almost 8% to the explanation in intentions beyond that explained by the TRA. While this is a significant contribution, which is not out of line with what can be found for other behaviours in the literature, this finding is not intuitive with what one would expect considering the potentially important internal and external constraints on BMP implementation (e.g. technical know-how, decision-making control, financial resources). Given these commonly cited barriers of BMP implementation in Ontario (VanOsch, 1997; Fitzgibbon, 2000a; Holmes, 1998), one might expect BMP implementation to be associated with greater non-volitional elements that would make the TRA less effective at explaining behavioural intentions.

There are three possible explanations for this finding. First, Corbett (2002) concludes that the high importance of cost to this audience suggests standard conceptions of perceived behavioural control may not be appropriate for measuring the financial considerations associated with farmers' decisions to adopt conservation behaviours. Initially, the results from the present study appear to support Corbett's assertion, particularly given the relatively weak correlation between the *Perceived Behavioural Control* variable and the *Financial Costs Index* (Table 5.4). While it is likely that a combination of social psychological and economic concepts and models could improve the understanding of farmers' environmental behaviours (as advocated by Lynne et al., 1988), Corbett's conclusions may also be premature since her methodology did not closely follow the recommended TPB construct principles (section 3.6.1).

There are also possible methodological explanations for the limited additional explanation in variance provided by the TPB in the present study. For instance, it is possible that a TPB-based study using indirect measures of control, or one based on full elicitation and pilot studies, might employ a more accurate and sufficient measure of perceived behavioural control for this audience. Furthermore, Ajzen (2002) discusses the distinction between self-efficacy and controllability elements of behavioural control (i.e. beliefs about the ease or difficulty of the behaviour and the extent to which the behavioural performance is determined by the actor, respectively). In the present study, items measuring both self-efficacy and controllability were included in the overall measure of perceived behavioural control. However, one of the items measuring controllability (i.e. the degree to which the decision to implement BMPs was entirely up to the respondent) was removed from the overall variable score because of limited internal consistency with the other items (section 3.7.2). As such, *Perceived Behavioural Control* may be more accurately assessing self-efficacy elements of the construct and less accurately reflecting controllability issues associated with BMP implementation.

Third, the relatively small additional contribution of *Perceived Behavioural Control* may be related to the relatively large temporal distance between the point where the measure of control was taken (i.e. at the end of the second workshop) and the opportunity to implement BMPs through the program following peer review. The repercussions of more distal measures of the TPB constructs are discussed in detail in section 4.3. Specific to perceived behavioural control, when measures are not taken proximally, the internal and external barriers to action can be less salient than they would be if the measure was taken closer to the opportunity to carry out the behaviour (Ajzen, 1985). In the case of this more distal measure of intentions, the TRA holds the bulk of the explanation in intention since control issues may not be sufficiently salient.

If the second survey was conducted once the farmer had completed the action plan (i.e. at greater proximity to the behavioural opportunity), the beliefs regarding personal control may be more salient and may be better reflected in the measures for intention and perceived behavioural control. Under these circumstances, the *Perceived Behavioural*

Control variable would likely approximate actual control more closely. If this were the case, it is possible that the TPB would provide greater additional explanation in *Intention* beyond that provided by the TRA since the non-volitional aspects of the behaviour would be more salient. This more accurate reflection of perceived behavioural control in intentions and the greater degree to which PBC would approximate actual control would also allow for a more accurate prediction of BMP implementation behaviours.

5.4 Explaining Moral Obligation

Several studies have concluded that measures of moral obligation or personal norms can provide a unique contribution to the explanation of behaviour or behavioural intentions and can improve the TPB model (Staats, 2003; Beck and Ajzen, 1991; Conner and Armitage, 1998). Moral obligation can only represent a measure distinct from attitudes and subjective norms in situations where moral issues are salient. Personal norms must also be activated so the consequences of a behaviour, and responsibility for these behavioural consequences, are internalized (Beck and Ajzen, 1991; Harland et al., 1999). The first study to investigate the role of moral obligation and the TPB for environmental behaviours was conducted by Harland et al. (1999). The authors concluded that moral obligation significantly improved the model, but noted that their study had focused on a sample that was particularly involved in environmental issues. In a study investigating the underlying beliefs of farmers in the United Kingdom, Beedell and Rehman (1996) identified farmers' moral obligation to conserve as an important factor in affecting their intentions for environmental behaviours. Thus, the present study included measures of moral obligation to determine whether this variable could improve the understanding of farmer behaviours in the EFP context.

The failure of *Moral Obligation* to provide an improvement in the explanation of *Intention* may reflect methodological limitations if questions measuring moral obligation were not sufficiently exact to allow moral obligation to be distinguished from the other TPB constructs (Conner and Armitage, 1998). Elicitation studies and additional focus groups to pilot the survey wording would likely have improved the selection of moral

obligation questions. Another possible explanation for the finding is that farmers' personal norms to implement BMPs may not be sufficiently activated in this context to provide a unique contribution beyond that which is already captured by farmers' attitudes and subjective norms. In Schwartz's Norm Activation Model (1977 as cited in Harland et al., 1999), the extent to which behavioural consequences and personal responsibility for those consequences are internalized affects the development of the internal values that create personal norms or the moral obligation to carry out behaviours accordingly.

While this research did not set out to explore the foundations of moral obligation directly, the data presented in Table 4.4 (page 58) provide some support for this assertion that the foundations for personal norm development are not sufficiently in place among this audience in this particular context. The *Health Impact (HEALTH)* and *Farm Impact (FARM)* variables measured farmers' perceptions of the consequences of regional environmental degradation on human health and the long term viability of their farm operation, respectively. Following the second workshop, only 34.1% of respondents perceived strong negative consequences (i.e. responding in the top two scale items) for human health and 38.1% perceived strong negative consequences for farm viability. These findings suggest the consequences of environmental degradation are not perceived as a substantial threat by the majority of participating farmers.

The other antecedent for the development of personal norms is the attribution of these consequences to the self. In the present study, the variables measuring farmers' perceptions of the regional contribution of agriculture (*AGCONT*) to environmental degradation and personal responsibility (*RESP*) to protect natural resources for future generations provide some indication of the degree to which participants may feel personally responsible for environmental degradation and thus any negatively perceived consequences. The measures for *Personal Responsibility* were quite high following the second workshop, with 75.6% of the surveyed population responding in the top two scale items indicating feelings of strong personal responsibility to ensure natural resources are maintained for future generations. On the other hand, the lower measures for the *Agricultural Contribution* variable suggest participants did not feel environmental

degradation in their region was caused by agricultural sources. Following the workshops, 53.2% of respondents selected scale items indicating agriculture played a relatively small role in regional environmental degradation.

5.5 Lessons for the EFP Workshops

The results from this analysis present several lessons for encouraging the adoption of agricultural BMPs through the EFP workshops. First, it is possible to target interventions using the relative weights, or importance, of the TPB variables as a guide. For instance, the results revealed that *Perceived Behavioural Control* provided the greatest unique contribution to the explanation in *Intention* variance. This would suggest that efforts aimed at improving participants' perception of their control on BMP implementation would have the greatest potential for strengthening behavioural intentions. Efforts to enhance perceived behavioural control during the workshops should focus on internal self-efficacy and personal control elements of the construct, since educational interventions have the greatest potential to influence internal control factors (Gardner and Stern, 1996). As indicated previously, self efficacy refers to an individuals' perception of their personal ability to carry out a behaviour (Ajzen, 2002a), so efforts to provide individuals with greater knowledge and technical support for BMP implementation and maintenance would be an obvious starting point for increasing perceived behavioural control within the educational component. Since these elements are already a significant component of the workshops (A. Ross and M. May, EFP Program Representatives, personal communication, April 20, 2006), perhaps it would be more effective to consider the way messages are framed or presented to the audience to have a greater impact in this area (see section 2.3.2). In addition, further research into the underlying beliefs of farmers' perceptions of behavioural control could also identify opportunities to strengthen this variable through the workshop component (as discussed in section 6.4).

While Ajzen (n.d.b) recognizes the opportunity to target interventions based on the estimated weights of the TPB variables, he cautions that any intervention targeted on a specific variable will change the relative weights, so it may be more prudent to frame

interventions using any variable that demonstrates room for improvement. The relatively close measures of the unique contributions of *Attitude*, *Subjective Norm* and *Perceived Behavioural Control* suggest efforts to strengthen all these variables would increase intentions. Since *Perceived Behavioural Control* demonstrated the lowest mean values (both before and after the workshops), it continues to appear appropriate to focus additional efforts on this variable. Even though there appears to be less room for improvement in *Attitude* and *Subjective Norm*, there is some research to suggest that *Attitude* may be somewhat exaggerated (see discussion section 4.4). There may also be an opportunity to further tap into the strong social networks and any group identity that may be felt by the population. In Chapter Six, the degree of change in the TPB variables as measured from before to after the workshop component is discussed, providing further insight into areas where the educational aspects of the EFP program could place additional emphasis.

Finally, in this behavioural context, moral obligation did not appear to play a role beyond what was already captured by the TPB constructs. However, moral obligation or personal norms can play an essential role in encouraging environmentally responsible behaviours in some contexts (Corraliza and Berenguer, 2000; Geller, 1995; Vining and Ebreo, 2002). According to the Norm Activation Theory (Schwartz, 1977, as cited in Harland et al., 1999), interventions aimed at strengthening a particular behaviour should aim to activate the preconditions for norm internalization, which include increased awareness of behavioural consequences and increased ascription of responsibility for those consequences on the self. While there was a statistically significant and relatively moderate increase in *Moral Obligation* scores from before to after the workshop, there may be additional opportunities to strengthen personal norms through the EFP workshops by targeting some of the underlying constructs as discussed in section 5.4.

Chapter Six: Measuring Change in Behavioural Intentions and Environmental Awareness

Having confirmed that the TPB is an appropriate starting point for investigating the underlying constructs of farmers' behavioural intentions in Chapter Five, this chapter measures the change in the TPB variables from before to after the workshops to assess the influence of the EFP workshops on farmers' intentions to implement BMPs. The research also quantifies the influence of the workshops on environmental awareness, particularly as it relates to the type of knowledge and perceptions that are related to environmentally responsible behaviours. This element of the research reflects the fact that there has been no systematic attempt to measure the program's impact on environmental awareness even though the EFP program is billed as a "voluntary environmental education and awareness program" (OMAFRA, 2005:1). The following sections present the results and a discussion of the study findings.

6.1 Results: Behavioural Intentions

To assess the degree of change in behavioural intention from before to after the EFP workshop, a paired-samples t-test was performed on the *Intention* scores from the first and second questionnaires. The results are summarized in Table 6.1. There was a statistically significant ($p < .01$) increase in intention scores measured from before to after the workshops as the mean increased from 3.77 (SD .84) in the first questionnaire to 4.10 (SD .74) in the second questionnaire. This change represents an increase of .34 on a 5-point scale.

A paired-samples t-test was also performed on the individual predictor variables of the TPB to determine the difference in *Attitude*, *Subjective Norm* and *Perceived Behavioural Control* scores between the two questionnaires. The results are presented in Table 6.1. There was a statistically significant (at least $p < .05$) increase in both *Attitude* (3.89 to 4.08) and *Perceived Behavioural Control* (3.62 to 3.77) from before to after the workshops. The increase in *Attitude* (0.19 on a 5-point scale) was slightly larger than the

increase in *Perceived Behavioural Control* (0.16). However, there was no statistically significant change in *Subjective Norm* scores.

Table 6.1. Change in Intention and TPB Variables

	Mean	SD	t	df	Sig. (2-tailed)
Intention	-0.34	0.85	-4.42	125	.000
Q1INT	3.77	0.84			
Q2INT	4.10	0.74			
Attitude	-0.19	0.60	-3.54	123	.001
Q1ATT	3.89	0.68			
Q2ATT	4.08	0.67			
Subjective Norm	-0.11	0.82	-1.49	121	.140
Q1SN	3.81	0.72			
Q2SN	3.92	0.82			
Perceived Behavioural Control	-0.16	0.72	-2.42	123	.017
Q1PBC	3.62	0.79			
Q2PBC	3.77	0.69			

*Q1/Q2 refers to questionnaire one and questionnaire two, respectively.

6.2 Results: Environmental Awareness

As in the investigations measuring the change in behavioural intentions, a paired-samples t-test was conducted to determine the change in the *Awareness Index* between the first and second questionnaires. These results are presented in Table 6.2. The mean *Awareness Index* increased by 1.88 from 28.02 (SD .49) before the workshop to 29.89 (SD.47) after the workshop. Recall that the possible range for the *Awareness Index* is 9 - 45. This difference represents a statistically significant change ($p < .01$) from before to after the workshops.

The results for the paired-samples t-tests conducted on the individual awareness variables are also presented in Table 6.2. In this investigation, the only variables that demonstrated a statistically significant change were: *Environmental Urgency* ($p < .05$), *Health Impacts* ($p < .01$), *Social Certainty* ($p < .01$) and *Farm Impacts* ($p < .01$). The results indicate the greatest improvements in *Social Certainty* (increased by .59), followed by *Health*

Impacts (increased by .46), *Farm Impacts* (increased by .38) and *Environmental Urgency* (increased by .22).

Table 6.2. Change in Awareness Index and Awareness Variables

	Mean	SD	t	df	Sig. (2-tailed)
Awareness Index	-1.88	4.39	-4.68	119	.000
Q1AIndex	28.02	0.49			
Q2AIndex	29.89	0.47			
Knowledge-Implementation	-0.13	1.22	-1.17	125	.245
Q1KnowI	3.23	1.19			
Q2KnowI	3.36	1.08			
Knowledge-Maintenance	0.12	1.22	1.09	126	.277
Q1KnowM	3.50	1.10			
Q2KnowM	3.38	1.08			
Environmental Improvements	-0.06	1.00	-.71	125	.478
Q1EnvImp	3.82	1.01			
Q2EnvImp	3.88	0.96			
Environmental Urgency	-0.22	1.21	-2.07	124	.041
Q1Urgenc	3.01	1.20			
Q2Urgenc	3.23	1.08			
Agricultural Contribution	-0.13	1.16	-1.25	125	.221
Q1AgCont	2.33	1.13			
Q2AgCont	2.46	1.03			
Health Impacts	-0.46	1.22	-4.22	125	.000
Q1Health	2.56	1.26			
Q2Health	3.02	1.15			
Social Certainty	-0.59	1.39	-4.73	125	.000
Q1Soc	2.77	1.08			
Q2Soc	3.36	1.02			
Farm Impacts	-0.38	1.15	-3.71	125	.000
Q1Farm	2.81	1.06			
Q2Farm	3.19	0.99			
Personal Responsibility	0.10	1.02	1.13	126	.261
Q1Resp	4.17	0.92			
Q2Resp	4.06	0.92			

**Q1/Q2 refers to questionnaire one and questionnaire two, respectively.*

6.3 Methodological Considerations for Measuring Workshop Impact

Before interpreting these results, it is important to recall some limitations presented by the methodological approach. Some general limitations are discussed in Chapter Two; however, the items deemed most pertinent to this investigation are highlighted here.

First, while the pre-test, post-test survey format is an accepted approach, it is important to

note the limitations of this method. For instance, survey participants can be influenced by their responses to the pre-test survey (Gravetter and Wallnau, 1988), and there is a tendency for post-test measures to reflect higher responses which may not be sustained over time (Gardner and Stern, 1996; Leeming et al., 1993). This research does not involve any long-term measure of change to test whether the improvements recorded in Tables 6.1 and 6.2 are sustained into the future.

Second, a statistical change in the measures from before to after the workshop does not imply that the workshop *caused* the change. There is significant intervening time between the two surveys, during which participants are not only exposed to the formal educational component of the program, but they also complete the personal learning experience of conducting the farm-level risk assessment. Therefore, the measured change could be attributed to either of these educational elements or any number of factors that could intervene in the interval between the two surveys. In addition, for reasons related to limited time and opportunity, this research did not include a control group, which could have helped distinguish between the effect of the workshop and other potential influences.

Third, the t-test statistic holds the “independence of observation” assumption, which is potentially violated in this research given that the surveys were conducted in a group setting. While this can be a problem, concerns regarding the effects of the group setting are reduced given the more stringent alpha values detected in this investigation (Stevens, 1996). To account for some of the other potential limitations, it may be pertinent to hold small or even moderate magnitude changes suspect in terms of their sustainability beyond the end of the workshops.

6.4 Impact of the EFP Educational Component on Behavioural Intentions

Since past research suggests participation in the EFP program is particularly strong during the workshop component, one of the aims of this research is to determine whether participation in the EFP workshop alone significantly enhances the likelihood of farmers

implementing BMPs. As discussed in section 4.3, strong intentions and a high degree of actual control over the behaviour are both necessary for behavioural intentions to translate into action. To a large extent, the correspondence of perceived behavioural control and actual control is beyond the influence of the workshops. Therefore, the greatest opportunity for the workshops to enhance the likelihood of BMP implementation is to strengthen behavioural intentions. The increase in the *Intention* measurements likely speaks to some strength in the educational element of the program and suggests the EFP workshops make a contribution in improving the likelihood of farmers adopting BMPs. It is important to recall, however, that strong behavioural intentions do not necessarily translate into actual behaviour (as discussed in section 4.3).

It is also important to consider the practical nature of this change in relation to its measurement on a 5-point scale. For instance, in the case of *Intention* (Table 6.1), is an increase of .34 on a five point scale sufficient to ensure the change in intentions is sustained into the future (given the discussion on methodological limitations above)? The answer to this question is quite subjective, but the question is raised to ensure the practical significance of this change is considered when interpreting these results on the statistically significant findings.

While the change in *Intention* is relatively large in comparison to the other TPB variables, there is room for improvement by targeting the individual construct variables believed to influence behavioural intentions under the TPB. The more moderate change in attitudes (an increase of 0.19) is arguably less surprising given the challenges and complexity of influencing people's behavioural beliefs and attitudes (Geller, 2002; Erwin, 2001; Eagly and Chaiken, 1993). It may also appear that there is not a lot of room for improving this variable, given the high scores that were measured. However, as discussed in section 4.4, it is possible that the recorded attitudes are less stable (i.e. based on less direct experience), or that they are based on beliefs that may or may not be consistent with the conservation efforts promoted by the program.

Attitude may become an increasingly important variable to monitor and influence during the workshops if the program begins to engage farmers who are strongly motivated by the higher financial incentives and thus, may hold weaker internal motivations to complete the program and implement BMPs (see discussion on incentives, section 7.4). If this situation materializes, the ability of the educational component to inspire the attitudinal foundation for a long-term commitment to environmentally responsible farm management will become increasingly important.

The very minimal, and statistically insignificant, change in *Subjective Norm* scores suggests that the workshop component is not influencing this TPB construct to any great degree. Currently, the workshop participants are encouraged to share their experiences with BMPs and other environmental issues during the workshops (A. Ross and M. May, EFP Program Representatives, personal communication, April 21, 2006), but it may be that a more targeted effort to increase participants' perceptions of socially accepted and encouraged environmental behaviours could have a greater influence on this variable, and thus on behavioural intentions.

Similarly, the smaller magnitude change in the *Perceived Behavioural Control* variable (an increase of 0.16) suggests there is a need to improve participants' confidence in their ability to implement BMPs during the educational component. Additional justification for focusing on perceived behavioural control is provided by the fact that this variable has the lowest mean score among the TPB variables, yet makes the greatest unique contribution to behavioural intentions (see sections 5.3 and 5.5).

Greater opportunities for increasing the influence of the workshop component on the TPB constructs could be identified through further investigations into the beliefs and evaluations underlying farmers' attitudes, subjective norms and perceived behavioural control. Applying the TPB using an indirect approach (as opposed to the direct approach applied in this research) could provide significant insight into the underlying beliefs of these behavioural constructs. Ajzen (1991) notes that by identifying beliefs, it is possible

to determine the unique factors that will prompt a specific behaviour among different segments of a targeted population.

Once these beliefs are identified, it is easier to construct appropriate communication messages to influence these beliefs in a way that will facilitate stronger attitudes, subjective norms or perceived behavioural control. For example, investigating the underlying beliefs associated with farmers' attitudes could identify which beliefs are most influential in determining positive or negative attitudes towards agricultural BMPs, thus allowing messages to be properly framed to demonstrate the positive outcomes of BMP implementation that matter most to farmers. Furthermore, an investigation into the belief structure of subjective norms could identify the most important referent groups for the audience, whose position or experience with BMPs could then be incorporated into workshop materials, content or messaging, for example. Finally, a better understanding of the beliefs underlying perceptions of behavioural control could provide important guidance for overcoming internal barriers to action in the workshops and for gaining additional insight into situational barriers that may need to be addressed through other elements of the program. In short, identifying the beliefs that encourage and discourage the implementation of BMPs could allow the workshop messaging to be more personalized and relevant to participants, an important characteristic of effective educational tools (Nickerson, 2003).

6.5 Impact of the EFP Educational Component on Environmental Awareness

As in the case of behavioural intentions, the before and after measures of environmental awareness, as combined in the *Awareness Index* variable, revealed a statistically significant change in participants' environmental awareness. While these findings do not confirm that the workshop *caused* these changes, it appears that the workshops may be having some positive influence by strengthening the type of environmental awareness that is believed to support environmentally positive behaviours. However, there is room for improvement, since the mean *Awareness Index* score only increased by 1.88 on a scale ranging from 9 to 45 (to compare this value with the change in *Intention*, if the

Awareness Index was on a 5-point scale, this change would be .21). In addition, the index score remains quite moderate following the workshop, and the change appears to be largely attributed to just a few variables.

The greatest change recorded among the awareness variables was the *Social Certainty* variable, which assessed whether participants felt others who were responsible for environmental degradation in their region were taking action to reduce their impact on the environment. This is an important perception for encouraging environmental behaviour, particularly in a non-point source or commons resource situation (Wade-Benzoni et al., 1996 as cited in Gifford, 2002). Given the wording of the question, it is not clear whether respondents gained an impression that others in the agricultural community were taking action to reduce their impact, or whether the impression extended to the broader community. Workshop materials that facilitate an impression of positive environmental actions by both the agricultural and broader communities are likely to have a positive influence on farmer behaviours, either by strengthening social norms or strictly improving social certainty. These concepts are linked to recommendations in the environmental psychology literature to use educational programs to improve an appreciation for the commons resource dilemma and to increase communication about what others are doing to encourage people to act in the group interest (Gifford, 2002; Schultz, 2002).

A relatively moderate to high change was recorded for *Health Impacts* (an increase of 0.46) and *Farm Impacts* (an increase of 0.38). These variables measured participants' perspectives of the impact that regional environmental degradation could have on human health or the long-term viability of their farm operation, respectively. Both these variables provide a proxy measure of participants' impression of the legitimacy and likely consequences of regional environmental degradation. Higher measures for both these variables would suggest a greater likelihood of BMP implementation since a greater perceived threat or negative consequence, combined with an expectation that the negative outcome will occur, is often associated with actions to prevent the threat (Janz and Becker, 1984 as cited in Vining and Ebreo, 2002). Further efforts to ensure participants'

perceptions accurately reflect the reality in regions facing high environmental degradation could improve the likelihood of BMP adoption where it is needed most.

The smaller change found for the *Environmental Urgency* variable (an increase of 0.22) suggests there may be room for improvement in influencing perceptions where environmental threats are indeed “soon” and “certain”, thus encouraging more immediate action (Geller, 2002; Nickerson, 2003). Other awareness variables that did not demonstrate a statistically significant change include the variables measuring perceptions of technical knowledge (*Implementation Knowledge* and *Maintenance Knowledge*), agricultural contribution to regional environmental degradation (*Agricultural Contribution*), personal responsibility (*Personal Responsibility*) and personal impact on environmental improvements (*Environmental Improvements*). Technical knowledge regarding BMP implementation and maintenance is related to measures of personal control and is important for providing individuals with the skills to implement behavioural intentions and action strategies (Ajzen, 1985; Gifford, 2002). A perception that personal actions can result in environmental improvements (*Environmental Improvements*) is also related to measures of personal control and self-efficacy and can be an important motivating factor for environmentally responsible behaviour (Nickerson, 2003; Gifford, 2002). The importance of *Agricultural Contribution* and *Personal Responsibility* in affecting environmental behaviours has already been discussed in section 5.4.

In sum, there remains significant opportunity for improving the likelihood of BMP implementation by targeting some of the weaker perceptions that are likely to act as internal obstacles to environmentally positive action. However, some caution is necessary in interpreting these results. Since the *Awareness Index* includes regionally specific variables, an optimal range for the index needs to be determined on a regional basis. That is, a very high *Awareness Index* is desirable in a region where there are significant environmental concerns that can affect or be affected by agricultural operations. However, in a region that has fewer environmental issues, an optimal *Awareness Index* measure may be more moderate. Thus, the goal is not necessarily to

maximize the measure, but to make perceptions as accurate as possible. It may be that in some cases, perceptions are currently too high and more accurate perceptions would potentially decrease the likelihood of BMP implementation. While this may seem counter to the program's objectives, it is important in the long term to ensure that environmental perceptions and expectations of behavioural consequences are realistic. Overestimating the importance of implementing BMPs can result in long-term resistance to environmentally responsible behaviour if their adoption does not result in the expected outcomes (Nickerson, 2003).

Chapter Seven: Commenting on the New Canada-Ontario EFP Program

This research has focused on the EFP's educational policy instruments, and has suggested that the workshop component helps strengthen farmers' intentions to implement BMPs on their farms and heighten their environmental awareness by influencing perceptions associated with environmentally responsible behaviour. This evaluation of the EFP's educational policy instruments is useful for determining the possible environmental outcomes for EFP participants who only complete the workshop phase of the program, and for generally assessing the effectiveness of this program component. However, it is important to recognize that the EFP workshops are just one component of an overall policy package that employs a voluntary approach and incorporates other educational and economic policy tools. Furthermore, educational tools are often more effective if they are used in combination with other policy tools (Cave, 1998; Ribaud and Horan, 1999; Stern, 2002). Given this reality, the program is likely to be more effective in influencing environmentally positive behaviours if farmers participate in the entire program, and are thus exposed to all program elements. This chapter discusses the research findings in the context of the entire EFP policy package.

Given the adoption of the EFP concept by AAFC and the promotion of the approach in other regions of Canada, the research investigates the theoretical strengths and weaknesses of the current approach in Ontario with the aim of providing some insight into future programming decisions in Ontario or other Canadian provinces or territories. To meet this objective, the program's strengths and weaknesses are discussed in relation to its correlation with the theoretical literature in the environmental policy, environmental psychology and environmental education fields.

A more in-depth investigation is conducted into the new incentive framework under the Canada-Ontario EFP Program. There was some uncertainty as to how these changes would be perceived and accepted by Ontario farmers. Thus, the survey aimed to measure the impact of the higher cost-share incentives on program participation, as well as

participants' impressions of the sufficiency and fairness of the targeted incentives. In particular, the research aimed to investigate how these perceptions may influence program participation, BMP implementation and the program's long-term environmental outcomes. The results from this investigation into the incentive framework are presented in section 7.1, followed by a discussion on various program components, namely the voluntary nature of the program, the educational and economic policy tools and the new provincial scanning element.

7.1 Results: Economic Incentives

Table 7.1 presents a summary of the results regarding the impact of incentives on participants' motivations for participation, and their perceptions of the cost-share incentives' sufficiency and fairness. On the 5-point scale, the participants' mean response regarding the degree to which the economic incentives had influenced their decision to participate in the program (ranging from "heavily" to "not at all") was 1.63 (SD .83). This value indicates that in general, the promise of cost-share dollars influenced decisions to participate quite heavily. To gain additional insight into the spread of responses, the percentages of responses in the two bottom and two top scale items were calculated. This investigation revealed that 86.5% of the participants chose lower items on the scale (closer to "heavily"), while only 3.2% selected higher scale items (closer to "not at all").

In determining whether participants viewed the available incentives as either "insufficient" (bottom end of the 5-point scale) or "excessive" (top end of the scale), the mean response was 2.49 (SD 1.06), revealing a fairly moderate response to this question, but a fairly significant dispersion in the responses. Approximately 47% of respondents selected items closer to "insufficient" incentives and 16% selected items closer to "excessive". Participants' responses to a question on the fairness of the targeted incentives were also quite moderate but fairly dispersed, with a mean response of 3.17 (SD 1.23). Approximately 27% of participants selected items at the lower end of the scale, indicating a perception that providing higher incentives for BMPs with greater off-

farm benefits was unfair. However, a greater percentage of respondents (approximately 38%) selected the higher scale items demonstrating a perception that the incentive targeting was fair. These results are also summarized in Table 7.1 and greater discussion on the incentive framework is presented in section 7.4.

Table 7.1. Summary of Participants' Perceptions of the EFP Incentive Framework

	Economically Motivated Participation	Incentive Sufficiency	Fairness of Targeted Incentives
Mean Response	1.63 (SD 0.83)	2.49 (SD 1.06)	3.17 (SD 1.23)
Scores < 3	86.5%	47.2%	27.4%
Scores = 3	10.3%	36.8%	34.7%
Scores > 3	3.2%	16%	37.9%

7.2 EFP Educational Instruments and Effective Environmental Education

In addition to the promising results regarding increased behavioural intentions and awareness following the workshop component (Chapter Six), the programs' educational tools (i.e. both the workshops and technical assistance) also seem quite strong in relation to guidance provided by the environmental education theory. Without a full review of the workshop curriculum and greater investigation into the nature of available (and accessed) technical assistance, it is difficult to determine the extent to which the EFP program influences these environmental education goals. That said, some speculation regarding the correspondence between the EFP's educational tools and the environmental education literature is possible and helps to suggest areas where additional emphasis may be warranted.

For instance, when compared to research on the necessary elements for environmentally responsible behaviour (and thus the target areas for environmental education programs presented in section 2.3.1), it appears likely that the EFP program makes a contribution in four of the eight elements identified by Ramsey and Hungerford (2002). The background information provided in the workshops and EFP workbooks likely play a role in increasing farmers' knowledge of the environmental problems and issues related to

agricultural operations. In addition, the process of completing the worksheets and developing an action plan likely helps farmers develop the skills to identify, analyze, investigate and evaluate environmental problems and solutions, as well as to gain knowledge of action strategies (i.e. site-appropriate BMPs). Finally, the technical assistance provided and advertised through the program likely helps farmers develop the skills for carrying out the action strategies (i.e. implementing the BMPs).

The EFP educational elements also appear to reflect some of the elements identified in Hungerford et al.'s (1980) "Goals for Curriculum Development in Environmental Education". Of the four levels of environmental awareness and knowledge needed to influence behaviour according to this theory, the EFP educational tools appear to correspond with levels three (develop the knowledge and skills to investigate environmental issues and evaluate alternatives) and four (develop skills for action). The program's educational tools appear less reflective of the more foundational goals of the theory. These foundational elements include: developing ecological knowledge for ecologically sound decision-making (level 1) and; understanding the impact of individual and collective action on the environment (level 2). Certainly, some elements of these two curriculum goals are incorporated through the workbook and other support materials. However, additional efforts may be warranted in this regard, given the persistent scepticism regarding the ability of this voluntary program to meet environmental goals, and this research's findings regarding participants' perceptions of the impact of their individual and collective action (section 6.5), for example.

While it would be challenging to comprehensively address all four levels of the educational goals in a two day workshop, it may be necessary to incorporate materials addressing the more foundational elements of this recommended curriculum framework to ensure that the farm risk assessment, action plan and BMP implementation reflect sound ecological principles and an understanding of the repercussions of individual and collective actions in the regional environment.

Finally, the environmental education literature presents several recommendations for strengthening the effectiveness of communication efforts through the structure of educational interventions and appropriate messaging (outlined in section 2.3.2). It is difficult to comment extensively on the extent to which these “best practices” are incorporated into the workshop delivery, since this research did not incorporate any direct observation/evaluation of the workshops. That said, it is clear the workshops already reflect many of these good practices for effective communication, such as using an interpersonal format and having messages delivered by a locally known and trusted organization, for example. A systematic review of the workshop delivery and its correspondence with the best practices outlined in the communication literature could help identify opportunities to strengthen the weaker variables identified through this research.

7.3 EFP’s Voluntary, Confidential Approach

There are many advantages to voluntary environmental programs, and it is clear that these types of programs are highly favoured by the agricultural community (Robinson, 2005). This sentiment was evident as several survey respondents provided unprompted comments regarding their concern about additional environmental regulation. This frustration with (either real or perceived) over-regulation suggests there could be considerable backlash against additional regulatory requirements, which can be seen as a threat to personal choice and freedom (Geller, 2002). These negative perceptions could taint farmers’ attitudes against environmental management in general, thus potentially reducing voluntary participation and BMP implementation. However, at least a threat of environmental regulation is often cited as an important driver of farmers’ voluntary participation in environmental programs (Ribaud, 1998). By distinguishing between regulatory requirements and best management practices, the workbook provides considerable support to farmers aiming to meet regulatory requirements, yet also encourages action beyond regulatory compliance.

The confidential nature of the program has also proven to be a considerable program strength and important motivating factor for initial participation (Klupfel, 2000; Furman, 1997). Concerns that the confidentiality of the completed farm plans will not be maintained has also been identified as a major barrier for more complete participation in the program such as the peer review and application for financial support (Smithers and Furman, 2003). Thus, program administrators take the issue of confidentiality extremely seriously, aiming to assure farmers that their EFP will not be shared or used against them in possible conflicts with regulatory agencies, for example (A. Graham, EFP Program Manager, personal communication, March 21, 2005).

Despite these quite tangible advantages of the EFP's approach, the voluntary and confidential nature of the program also creates scepticism regarding the effectiveness and sufficiency of the program to address environmental concerns. First, the self-assessment and self-auditing approach creates a lack of transparency and suspicion that environmental issues may not be adequately addressed (Dietz, 2002; Prakash, 2002). For instance, Smithers and Furman (2003) found that 55% of surveyed farmers did not subject their entire farm operation to the EFP risk assessment. This shortcoming leads to speculation that the self-identification and prioritization of issues may result in uneven or limited progress towards addressing regional environmental concerns (Smithers and Furman, 2003).

One approach to minimize scepticism on the quality of the EFPs while maintaining the plans' confidentiality is found in British Columbia's EFP program, where EFP planning advisors provide one-on-one assistance in the completion of worksheets and development of action plans. According to N. Holbek (EFP Coordinator, B.C. Agricultural Council, personal communication, April 25, 2006), the planners' responsibilities include an on-site "walkabout" to confirm that the worksheets have been completed properly and that the action priority lists are appropriate given existing on-site conditions. Both the planner and the farmer sign off on the action plan.

The potential benefits of the B.C. approach in terms of reducing scepticism and ensuring accurate action plans need to be weighed against the value of the Ontario approach in facilitating participatory learning and likely helping to create stronger foundations for sustained environmentally responsible behaviours among the agricultural community (though this assertion remains a question for empirical research). While not encouraged, there is a possibility that the planners in B.C. will play a more “consulting role” in that, rather than simply assisting the producer in the completion of their plan, the planner will complete it *for* the farmer. In this respect, opportunities to improve environmental awareness and build internal motivations for environmental actions may be weakened. However, if planners played a more complementary role, the one-on-one approach could result in even greater opportunities to affect internal motivations, as one-on-one communication from a trusted and credible source is believed to have the greatest impact on actual behaviours and underlying attitudes (Geller, 2002; Gale et al., 1993).

It is possible to argue that it is more important to get the BMPs in place than to be concerned with longer term attitudes and actions in environmental management. This argument is potentially sound in situations where simpler, one-off measures or structural BMPs are implemented. However, in instances where more repetitive or managerial BMPs are needed, or where structural BMPs will require regular maintenance, this argument carries less weight. Additional investigations are necessary to determine whether there are considerable differences in the quality of EFPs produced by farmers in Ontario and those produced by farmers and planners in B.C. An empirical investigation comparing the long-term effects of Ontario’s self driven approach and B.C.’s planner approach could also provide important information for future programming decisions in both these jurisdictions.

The historically limited performance monitoring and reporting has also called the sufficiency and effectiveness of the Ontario EFP program into question. The new Canada-Ontario EFP program is associated with new requirements in this regard which were not included in this research since they were still being established at the outset of this investigation. Past efforts to quantify the impact of the EFP program have relied on

output rather than outcome level results, and several authors have recognized the need for improved performance monitoring efforts (Rudy, 2003; OSCIA-OFEC, 1999; Smithers and Furman, 2003). While outputs can sometimes act as useful proxy indicators, measures of activity are not necessarily synonymous with environmental improvements, particularly given the physical and biological complexities of the agri-environmental interface and the necessity of site-specific solutions for environmental protection (Novotny, 2003; Mostaghimi et al., 2001; Hilliard et al., 2002).

Ribaudo (1998) stresses the importance of water quality monitoring and watershed modelling to measure the cost-effectiveness of the program and help target efforts where they are most needed. It remains to be seen whether the new monitoring and reporting approach required under the new Canada-Ontario program will sufficiently coordinate monitoring efforts at the farm, delivery agent, and provincial and federal government levels to provide a framework that can adequately inform program development and communicate results to funding agencies, program participants, the rest of the agricultural community and the public.

The voluntary approach also presents challenges regarding program uptake, since the effectiveness of the program ultimately depends on the willingness of farmers to participate in all phases of the program. At first review, the results from the investigation into the TPB constructs seem to support scepticism that voluntary programs only attract individuals that were already interested in or motivated to take action. In fact, it has been suggested that voluntary agri-environmental programs are unlikely to reach those in the farming population who are most in need of assistance in making environmental improvements (Beedell and Rehman, 2000). While this study can not prove or disprove this statement, the measure of participants' past use of BMPs (section 4.1) provides some insight. For instance, 47% of the workshop participants indicated they had never or only minimally used BMPs. These results suggest that the EFP workshops in these counties attracted a significant number of farmers who did not have a lot of previous experience with environmental protection on their farms.

7.4 EFP Economic Incentives

Economic incentives have become an increasingly common element of many agri-environmental policy schemes (Merrington et al., 2002; Claassen et al., 2001; Shortle and Abler, 2001). While some researchers and program administrators are confident in the role of economic incentives in encouraging environmental behaviours (D'Arcy et al., 1998; Young and Karkoski, 2000), others are more cautious, particularly of the long-term repercussions of such approaches (DeYoung, 1993; Kohn, 1993 (as cited in Geller, 2002); Lynne et al., 1995). Several authors point to the need to identify the “right” incentive, both in terms of the *type* of incentive (e.g. economic, social, market-based), and in the case of financial incentives, the right *amount* of incentive (Deci and Ryan, 1985; Gardner and Stern, 1996; Luzar and Diagne, 1999).

The first investigation undertaken in this research regarding the new incentives available under the Canada-Ontario EFP program aimed to determine the extent to which the promise of cost-share dollars influenced program participation. It is clear the financial incentives are having a strong influence on program participation under this new generation of the program, since 86.5% of the workshop participants selecting items near the end of the scale indicating the incentives figured heavily in decisions to participate. On the surface, these results seem to confirm speculation that the “low hanging fruit” (i.e. farmers who were more interested and concerned about environmental issues and less about the financial implications of BMP implementation) were reached during previous program generations, and that the promise of higher cost share dollars are beginning to attract a broader population in the farming community. However, some caution is required in interpreting these results.

For instance, the survey did not include any other questions on motivations to participate, so the financial motivations can not be compared or weighed against other possible motivating factors such as concern for the environment, lack of technical knowledge, wanting to learn about the environment, for example. That said, the very strong response also suggests some difference from participants in previous generations of the program

who appeared to be heavily motivated by factors other than the available (albeit much lower) economic incentives (Furman, 1997). The strong response also raises some concerns when one considers these findings in light of the environmental psychology literature, which suggests strong economic or external motivations to participate in voluntary environmental programs can reduce the likelihood that behaviours will be sustained beyond the life of the program (DeYoung, 1993; Geller, 2002; Dwyer et al., 1993).

While not a direct measure of internal motivation, the strong measures of attitude toward BMP implementation (section 4.4) are a promising indication that perhaps the new generation of EFP participants hold some strong internal motivations towards environmental protection in addition to the external motivation provided by the higher cost-share incentives. Exploring the underlying belief structure of these attitudes (as discussed in section 6.4), could provide greater insight into the relationship and balance of internal and external motivating forces for this audience.

To investigate whether the current cost-share incentive is at the optimum level for encouraging BMP implementation, participants were asked whether the available cost-share dollars were insufficient or excessive to encourage BMP implementation (as measured on a 5-point scale). The question aimed to assess whether the cost-share component reflected social psychology's "minimal justification principle" (Festinger, 1957; Festinger and Carlsmith, 1959), in which program incentives should be sufficient to initiate action, but not so high as to eliminate the need for any internal justification for action (Geller, 2002:527). In this context, an optimal result would have been for the majority of responses to fall in the middle of the scale, as high responses at either extreme of the scale would indicate that the incentives were either insufficient to initiate action or too excessive. Excessive incentives present a concern since they can have a negative effect on behaviour by increasing the perception of external control infringing on personal freedoms (Geller, 2002), and by eroding any existing internal motivations to improve environmental management practices (Deci and Ryan, 1985).

In fact, the mean response of 2.49, suggests the cost share may be close to reflecting the minimal justification principle. If taken in combination with results on participants' motivations to participate, it appears that the incentives are effective at initiating involvement in the program, and the relatively moderate finding regarding sufficiency should react favourably with the strong attitudes and intentions recorded at the end of the workshop to provide an initial impetus for farmers to implement the BMPs identified in their action plans.

These results suggest the current incentive framework may be approaching the minimal justification principle, and any move to either increase or decrease the cost-share formula should be preceded by formative research into the potential implications of such action. Increasing incentives further is likely to encourage even greater participation and implementation of BMPs and result in important short-term environmental gains; however, the longer term implications of providing higher incentives could be more tenuous. For instance, if the larger incentives can not be sustained over a long time period, the short-term use of higher incentives might discourage participation or action once these incentives are no longer available (Geller, 2002). In this case, producers may feel entitled to these higher rewards and harbour resentment against their being repealed, having an overall negative impact on behavioural attitudes and intentions, and reducing motivations to make environmental improvements in the absence of such financial support.

Geller (2002) speculates that financial incentives could perhaps facilitate lasting behaviour change if they remain in place long enough for the positive consequences of the behaviour to become more visible. In this way, incentives are used to initiate and sustain behaviour until other non-economic incentives for the behaviour are established (e.g. social approval and norms, public recognition, economic markets and feedback on environmental improvements).

Higher incentives may be justified in specific regions where there is a recognized urgency for environmental protection measures and where there are clear linkages

between the environmental problems in a region and the likely environmental improvements associated with specific agricultural BMPs. The higher incentives are particularly justified if the environmental issues can be addressed through relatively straight forward, structural BMPs that require a “one-off” effort and minimal maintenance over the long-term (D. McKenzie-Mohr, PhD. Personal Communication, April 20, 2006). Under these conditions, the need for an internalized commitment to environmental improvement is less important.

The recently announced Oak Ridges Moraine Environmental Enhancement Program, a partnership between the Oak Ridges Moraine Foundation, Conservation Ontario and OSCIA, presents such an approach. This program builds on the cost-share incentives available under the EFP program, so a total of 90% cost-share is available for activities falling within nine of the EFP program’s BMP categories (Oak Ridges Moraine Foundation, 2006). In this approach, the high cost-share formula appears justified. It provides greater incentive for farmers to implement the BMPs that are believed will have the greatest positive impact on the moraine environment, thus enhancing the cost-effectiveness of BMP implementation in terms of meeting short-term regional environmental objectives.

As a final point on the issue of incentive sufficiency, it is important to consider the spread of responses, rather than just the mean to gain greater insight into whether the current cost-share approach is optimal. Just under half of the participants responded in the lower end of the scale indicating they felt the cost-share incentives were insufficient to encourage them to implement BMPs in the coming year. These results suggest there may be some room to increase the cost-share amounts. However, approximately 37% feel the incentives are appropriate and 16% already perceive the incentives as at least slightly excessive. Thus, rather than risking the erosion of internal motivations by increasing the available cost-share dollars, it may also be useful to investigate other types of economic and non-economic incentives that could be incorporated into the program. Given the diversity of the participants’ incomes (section 4.2) and the wide variety in responses regarding their perceptions of financial costs (as measured through the *Financial Costs*

Index, section 4.5), it may be that other types of economic incentives (e.g., tax benefits), or non-economic incentives (e.g., avoiding prosecution, realizing cost-savings, public recognition, better on-farm environmental quality) could provide additional motivation to implement action plans. Additional emphasis on the non-economic incentives during the workshops could perhaps help shift the focus away from cost elements and reduce any over-reliance on the economic incentives provided by the program.

One example of applying a non-economic incentive is the current provision of signs for producers who have completed their EFP. These signs can be displayed at participating farms, helping to create social diffusion of the program and serve as a prompt to the farmer to implement their EFP action plan and manage their land in an environmentally sustainable manner (see discussion of social diffusion and prompts in texts by McKenzie-Mohr and Smith, 1999; Gardner and Stern, 1996). In British Columbia, EFP signs are not provided until the producer has completed the regulatory requirements identified in their action plan (N. Holbeck, personal communication, April 25, 2006). This approach may be more effective in gaining public support for the program in that the sign demonstrates the farm is operating in a manner that meets environmental regulatory requirements at a minimum. Thus, the sign is associated with farms that have taken steps to improve environmental management, rather than just completing the farm scan. This more clear association with environmental improvements could help strengthen public acceptance of the program and create further social and market-based incentives.

Another aim of the research into the new incentive framework was to determine participants' perceptions of the new approach to provide higher cost-share incentives for BMPs that are associated with greater off-farm environmental improvements. The results reflect a lack of consensus among participants regarding the fairness of this approach. Only 38% of the participants responded in the higher end of the scale suggesting they felt the approach was fair. While this is a good proportion of the survey population, a perception of unfairness (held by 27% who responded near the lower end of the scale) or even a more moderate response on the scale (35%), could reflect a lack of understanding or appreciation for efforts to address environmental issues at the regional level.

These less favourable perceptions could also reflect, or create, frustration with the approach, which could have repercussions on participants' overall attitude toward the program. Consequently, these findings suggest there is a need for the workshop component to more effectively communicate the justification, or relevance, for on- and off-farm targeting and a more regional approach to environmental management. It is possible that additional targeting is likely in the future, either through initiatives like the one signed with the Oak Ridges Moraine Foundation, or as perhaps eventually required through the provincial scanning process (section 7.5). Thus, it is imperative that producers see the relevance of this approach to avoid negative attitudes and frustrations about not having access to higher cost-share incentives available in other regions.

7.5 Theoretical Strengths of the EFP Provincial Scan

The provincial-level environmental scan required under the Canada-Ontario program (described in section 1.2.1) presents a potentially important addition to EFP programming in Ontario. However, one year after the new agreement was signed, a provincial scan has not been drafted by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) or circulated to stakeholders for comment (A. Graham, personal communication, April 19, 2006). It is disappointing that the provincial scanning process does not appear to be playing a more prominent role in the program, particularly given the substantial theoretical strengths of the concept. For instance, if developed to a sufficient degree of detail and in line with the federal vision for the provincial scan (AAFC, 2003), the provincial scanning component provides the opportunity to: 1) identify and communicate regional risk areas to producers; 2) target funding to regions most vulnerable to agricultural sources of pollution; 3) establish a baseline for performance monitoring; and 4) provide additional assurance regarding the ability of the program to result in tangible environmental outcomes.

In encouraging environmentally responsible behaviours, several authors point to the need for actors to understand the legitimacy of environmental problems (Guagnano et al., 1995), the nature and threat posed by environmental degradation (Hines et al. 1986/1987;

Ramsey and Hungerford, 2002; Janz and Becker, 1984 as cited in Vining and Ebreo, 2002) and the nature of the personal, or sectoral, contribution to environmental problems and solutions (Ribaud, 1998; Nickerson, 2003; Gifford, 2002). The importance of ensuring actors have an accurate understanding of the likely outcomes of their actions and of receiving feedback regarding the consequences of their environmental behaviour are also often cited in the environmental psychology literature as being important for strengthening the likelihood of long-term environmentally responsible behaviour (Vining and Ebreo, 2002; Nickerson, 2003).

A properly developed scan, whose content is effectively incorporated into the workshop curriculum, could greatly facilitate the communication of these influencing factors. For instance, as discussed in section 6.5, there were no statistically significant changes in farmers' perceptions of their individual conservation efforts on the environmental quality of the region, or on the contribution of agriculture to regional environmental problems. Stronger communication of these concepts during the workshops, based on the results of an informed provincial scanning process, could potentially raise mean perceptions of these awareness items, thus increasing the likelihood of environmental action.

In his review of US Department of Agriculture's environmental programs, Ribaud (1998:6) highlights the improved cost-effectiveness of programs that were targeted to watersheds where agriculture was the principal source of water quality concerns, and to critical risk areas within the watershed. In theory, the scan could facilitate this targeting, thus helping to ensure and/or demonstrate the cost-effectiveness of the program. Since producers in all counties are not evenly participating in the EFP program (A. Graham, personal communication, April 19, 2006), efforts to improve participation rates and cost-share allocations could be coordinated with findings from a provincial scan to focus on those areas where BMP implementation could result in the greatest environmental, social and economic benefits.

While there are intuitive benefits for BMPs to be implemented on any farm operation, efforts should be taken to maximize program uptake in areas where on-farm

improvements have the greatest chance of making regional improvements to ensure the government-funded program is securing the greatest benefits for society. In identified risk areas, local producers could be informed of the particularly high risk during the workshop component. The BMPs that would best contribute to specific pollutant reductions in the region could be highlighted, and farmers could be encouraged to place these actions at higher priority when developing their EFP action plans. It may even be more cost-effective to target additional incentives to these specified actions, as has been done through the Oak Ridges Moraine Environmental Enhancement Program (section 7.4). While this approach would have to be undertaken carefully to avoid program participants feeling coerced or overly controlled by the program, there could also be stronger uptake if farmers felt their individual efforts would have tangible and visible benefits in their region (Nickerson, 2003).

The importance of monitoring has been discussed previously (section 7.3), and the results of any monitoring program can only be effectively measured if some baseline level of environmental quality has been established. The scan not only presents the opportunity to establish this baseline but also to further enhance the quality of program monitoring and reporting efforts. Past research on the Ontario EFP program has highlighted the need to document and assess regional environmental outcomes (Smithers and Furman, 2003). Other authors have highlighted the need to identify ways to convince society that the EFP's voluntary, precautionary approach is the best way to address environmental issues in agriculture (FitzGibbon et al. 2004:173). The scan offers this opportunity to overcome some of the scepticism regarding the ability of the EFP program to result in tangible environmental benefits.

For instance, the development of individual farm plans is reflective of a systems-based approach to environmental management, rather than a performance-based approach. That is, the emphasis is on farm plan development and completion, rather than on meeting specific environmental goals. In systems-based approaches, the environmental objectives are set by the business, or in this case, the producer, which can lead to scepticism as to whether the approach will result in measurable and regionally appropriate environmental

gains (Smithers and Furman, 2003). The addition of the provincial scan element allows a systems-based approach to remain at the farm level (reflecting the realities of confidentiality and monitoring challenges), but ensures a performance-based approach at the regional level to inform individual farm plans, thus improving the program's credibility.

The EFP program has already proven to be an accepted approach to environmental management in the farm community. However, the voluntary and confidential nature of the program leads to questions regarding its environmental outcomes and cost-effectiveness. The scan, if properly developed, presents an opportunity to counter these challenges to the program and establish a framework for overcoming many of the problems that currently plague the majority of voluntary environmental policies, including the EFP program. However, if Ontario's provincial scan is not sufficiently detailed, and developed with adequate involvement of stakeholder agencies, the environmental success of program, or certainly the extent to which its successes can be communicated and verified, will remain limited.

Chapter Eight: Conclusions and Recommendations

Environmental farm planning offers a promising approach to environmental management in agriculture. Despite some of the questions regarding the actual environmental impact of the Ontario EFP program, it is generally regarded as a strong program and has gained acceptance as a planning tool in Canada (FitzGibbon et al. 2004). Some may suggest this acceptance is premature given the current inability to directly measure the environmental effectiveness of the approach; however, there are intuitive benefits associated with the application of BMPs, and the implementation of such a program without full scientific certainty of its likely benefits is in line with the much touted precautionary approach. Furthermore, the EFP approach appears to have overcome several of the challenges associated with voluntary programs, and its site-specific and bottom-up approach to environmental management presents significant promise for making environmental gains. Accordingly, the voluntary EFP program should continue to hold a prominent role in agri-environmental management in Ontario, while ensuring that ongoing efforts are taken to evaluate and continually strengthen the program.

The present research aims to support these efforts to strengthen the program, focusing on an evaluation of its educational component. The research has demonstrated that participation in the workshop component increases the likelihood of BMP implementation, but cautions that the greatest environmental outcomes will likely only be realized if the workshops are experienced in combination with the other policy tools, which together, present a coordinated educational, technical and financial assistance package for participants. This chapter presents a summary of the major conclusions of the research as they relate to the stated research objectives. It also presents recommendations for the current program and future research opportunities.

8.1 Summarizing the Research Objectives and Conclusions

The overall goal of this research was to determine whether the EFP's educational component improves the likelihood of environmentally positive behaviours as they relate

to on-farm environmental management. As stated above, it appears that participation in the EFP workshop does positively influence the likelihood of responsible environmental behaviours. However, the answer to this question was reached following an investigation into five distinct research objectives. These objectives are each reviewed in this section, along with the study conclusions relevant to each.

The first objective was to provide insight into the appropriateness and/or sufficiency of the Theory of Planned Behaviour as a tool for assessing farmer behaviours or behavioural intentions in the EFP context. The investigation determined that the theory provides a statistically and practically significant explanation of the variance in farmers' intentions to implement BMPs. Hence, the TPB provides an appropriate starting point for understanding the foundations of farmers' environmental behaviours in this context. The failure of the *Moral Obligation* variable to provide a unique contribution to the explanation of intentions presents preliminary findings suggesting the underlying beliefs for personal norms are not particularly salient in this context. It therefore appears that moral obligation should not be incorporated into the TPB model for this context.

In this research, the model was used to explain farmers' behavioural intentions rather than to predict their behaviours; however, some speculation is possible based on the research findings. Even though there are other barriers to BMP implementation, the (real or perceived) costs associated with these actions are likely the most significant obstacles. Since approximately 52% of respondents felt the available cost-share incentives were sufficient, it appears that at least half the participants will have sufficient financial support to follow through on their strong behavioural intentions.

The second objective was to determine the value of the EFP's educational component in relation to its ability to influence behavioural intentions and raise environmental awareness. While being careful not to suggest that the workshop *caused* the change, pre- and post-workshop measurements revealed a significant improvement in participants' behavioural intentions and environmental awareness. These findings suggest the educational component has a positive and measurable influence on fostering the

foundations for environmentally responsible behaviour and BMP implementation. However, there is still room for improving these measures by strengthening the underlying constructs of each of the variables. Greater measures of change would help ensure that the increased intentions to implement BMPs and greater environmental awareness are sustained well beyond the workshop component.

The third objective, to identify the strengths and weaknesses of EFP workshops in relation to their influence on environmental awareness and behavioural intentions, was satisfied by investigating the extent to which the individual TPB and awareness variables changed from before to after the workshops. In terms of the variables affecting behavioural intentions, the investigation found that there was a fairly moderate change in farmers' attitudes from before to after the workshops, but only a very small change in their perceptions of behavioural control and no statistically significant change in subjective norm. These findings suggest there is room for improvement in strengthening all of the TPB variables. Efforts focused on perceived behavioural control may have the greatest chance at influencing intentions since this variable recorded the lowest mean scores and was found to make the greatest unique contribution to the explanation of farmers' intentions in this context. While deemed not to make a unique contribution to intentions in this instance, measures for moral obligation increased moderately. The research suggests there is room for increasing the saliency of personal norms by targeting the underlying beliefs associated with this psychological construct.

Regarding the change in farmers' awareness, it appears the change is largely attributed to four variables in the *Awareness Index* that recorded a statistically significant change. The results demonstrated the greatest change in the perceptions of social certainty (i.e. a belief that others were contributing to environmental solutions), followed by perceptions of the health and farm impacts (i.e. the consequences) of environmental degradation, and only a very small practical change in participants' perceptions of the urgency of environmental issues in their region.

Despite some change, there appears to be room for improvement in all of these environmental awareness variables, and even more so for the other variables in the index that demonstrated no statistically significant change from before to after the workshop. Greater efforts to incorporate workshop content that strengthens participants' technical knowledge of BMPs, encourages a stronger perception of personal responsibility and personal impact on regional environmental quality, and improves understanding of the contribution of agricultural sources to regional pollution, could significantly increase the awareness measures following workshop participation. Since the awareness variables were selected for their linkages with environmental behaviours, efforts to strengthen these awareness factors will likely result in greater environmental action.

The degree of correspondence between the workshops and the theoretical literature on effective environmental education and communication also points to the strength of the educational component and its influence on environmentally responsible behaviours. However, there are some areas for improvement in this regard as well, particularly in ensuring the appropriate foundations are in place to provide greater certainty that producers' have the necessary basis for identifying environmental concerns and prioritizing actions.

The fourth research objective was to determine how participants' perceptions of the new incentive framework of the Canada-Ontario EFP program may affect program participation and BMP implementation. The research found that the financial incentives offered by the program influenced farmers' motivations to participate in the program quite heavily. While these results are promising in terms of increasing participation rates, the paper provides some discussion cautioning against an assumption that greater financial incentives are always beneficial.

The mean response on the sufficiency of the available incentives was just below the middle of the scale, suggesting a fairly moderate perception of sufficiency. There may be some room to increase the incentives; however, the short and long-term objectives of the program need to be carefully considered in light of any move to increase monetary

incentives. There is some concern that higher external incentives erode the possibility for longer-term environmental improvements that could result if participants developed greater internal motivations for environmentally responsible behaviours.

Application of the theoretical literature in this regard suggests higher incentives may be particularly justified if more urgent environmental issues can be addressed through relatively straight forward, structural BMPs that require a “one-off” effort and minimal maintenance over the long-term. However, the range in responses to this question on incentive sufficiency suggests the non-monetary incentives for the implementation of BMPs should be effectively communicated during the workshop component and that other opportunities to incorporate monetary and non-monetary incentives into the program should be explored to create the most appropriate incentives for the majority of Ontario farmers.

With regard to participants’ perceptions of the fairness of the graduated incentives, there was a fairly wide dispersion in the responses. While a significant proportion of the respondents felt it was fair to provide a higher cost-share for activities with greater off-farm impacts, a greater number were either neutral/had no opinion or felt the targeted incentives were not fair. These results suggest greater efforts are needed to communicate the justification and rationale for this approach. More effective communication would likely help foster an appreciation for the need to address environmental issues at a regional level, and prevent perceptions of unfairness that could create negative attitudes towards the program.

Finally, the fifth objective was to contribute to program monitoring and evaluation by providing a framework to assess the program’s educational component in terms of its ability to raise environmental awareness and facilitate environmentally positive behaviours. The application of a TPB questionnaire provides an opportunity to better understand the underlying constructs influencing farmers’ environment behaviours and to target educational tools to strengthen these constructs. Additional efforts to identify the beliefs underlying attitudes, subjective norm and perceived behavioural control could

greatly improve the value of the TPB to inform and evaluate the EFP program's educational content. In addition, if there continues to be a discrepancy between the level of participation in the workshops and subsequent phases of the program, the TPB can provide some insight into the likelihood of BMP implementation arising from incomplete program participation.

That said, the practicality of using TPB questionnaires in routine program monitoring is less certain. To gain the greatest value from the TPB approach, it would be best to apply an indirect form of the TPB, which would require extensive elicitation and pilot studies. An indirect form of the TPB would likely reduce complaints regarding the repetitive nature of the questions (as received from respondents using the direct question format in this research); however, indirect TPB questionnaires are much longer, so it may not be practical to conduct the surveys during the workshop sessions. Thus, while the TPB presents a useful framework for investigating these issues and informing program design, it may be better to use the model in more periodic forms of program monitoring and evaluation.

On the other hand, the awareness variables (with their linkages to environmentally responsible behaviour) could provide a useful addition to regular workshop monitoring and routine evaluation forms. If elicitation studies were conducted to identify the most influential beliefs or determinants of attitudes, subjective norm and perceived behavioural control, these elements could also be incorporated into regular monitoring and evaluation efforts.

8.2 Recommendations for Further Research

This study provides some important preliminary findings into the nature of the psychological constructs believed to influence farmers' environmental behaviours in the EFP context. However, additional research to better account for some of the methodological limitations of the present research and to follow-up on some of the findings could greatly add to these results.

For instance, the applicability of these results to other workshops could be determined by applying a sampling approach. Having farmers who have not participated in the workshops complete the survey could provide a control group to provide greater certainty regarding the influence of the workshops. In addition, follow-up research to determine how well the changed behavioural intentions and awareness measures were sustained beyond workshop participation would provide greater insight into the lasting effects of the program's educational component. Additional follow-up research measuring actual behaviours could help determine how closely behavioural intentions measured during the workshop reflect actual behaviours.

Furthermore, the usefulness of these findings could be enhanced by conducting elicitation studies aimed to identify the influential, salient beliefs underlying farmers' attitudes, subjective norms and perceptions of behavioural control. Once these beliefs have been identified, workshop content and messaging can be evaluated and adapted to have the greatest influence on farmers' behavioural intentions, and thus behaviours.

Regarding the sufficiency of the TPB, it would be worthwhile to conduct research further investigating the role of moral obligation to determine whether the findings in this research are related to methodological limitations or reflect a reality that personal norms are not sufficiently salient to add to the explanation of behavioural intentions in this context. An investigation into TPB sufficiency including variables relating to self-identity would also be worthwhile to determine whether farmers' often cited identity as "stewards" or "guardians" of natural resources provides any additional explanation in their behavioural intentions beyond that captured by the standard TPB variables.

Finally, there are many other research opportunities for investigating the environmental effectiveness of the Ontario EFP approach in general. Particularly, research is needed to explore the legitimacy of concerns associated with the confidential and voluntary nature of the program, particularly the self-identification of issues and prioritization of actions. A useful starting point would be a comparison between Ontario's more self-directed

approach and B.C.'s planner approach to compare the quality of the EFPs and both the short and long-term environmental outcomes associated with the two approaches.

Follow-up research on the implications of the incentive framework is necessary to determine whether the present cost-share formula is sufficient to overcome financial barriers and ensure the adoption of BMPs that will have the most significant impact on environmental quality in both the short and long-term. In addition, research into the effectiveness and adequacy of the new monitoring requirements and of the provincial environmental scan (once developed) will provide important insight into the strength of the program in terms of its ability to overcome scepticism and to result in tangible, necessary and cost-effective environmental outcomes.

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APPENDIX A:

EXAMPLE WORKSHOP AGENDA

EFP Workshop Day 1 Agenda

10:00 – 10:20 am	Welcome, Introduction to EFP Process, Partners (OSCIA)
10:20 – 10:40 am	Introduction to EFP Workbook (OSCIA) <ul style="list-style-type: none">- complete page 10- begin farm sketch
10:40 – 11:20 am	Worksheet 1 – Soil and Site (OMAF) <ul style="list-style-type: none">- identify farmstead and field sites
11:20 – 12:00 pm	Introduction to a Worksheet and the Rating Process (OMAF) <ul style="list-style-type: none">- work through a worksheet(s) – eg. #2,3,5- farmer completes his worksheet(s) as we go- Note – critical as it introduces concepts of site, self-assessment ratings, resource materials, how to complete the process
12:00 – 12:45 pm	Lunch <ul style="list-style-type: none">- opportunity to view materials and resources- videos
12:45 – 1:25 pm	Worksheet with Nutrient Management Focus (OMAF) <ul style="list-style-type: none">- work through a worksheet(s) – eg. #8,9,17- farmer completes his worksheet(s) as we go- provide an overview of current legislation
1:25 - 1:40 pm	Introduction to Action Plan (OSCIA) <ul style="list-style-type: none">- review process for completing action plans- reference materials – BMP books, technical assistance
1:40 – 2:15 pm	Action Plan – Complete an Example (OSCIA) <ul style="list-style-type: none">- examples of actions, compensating factors, monitoring- farmer develops his action plan as we go
2:15 – 2:20 pm	Peer Review Process (OSCIA)
2:20 – 2:50 pm	Introduction To Cost-Share Programs (OSCIA) <ul style="list-style-type: none">- eligibility, applications, process, approvals- COFSP, NMFAP- Greencover, NFWEP- Other Provincial – WHF, etc.- Other local – SNC, RVCA, Ottawa RCWP, etc.
2:50 – 3:00 pm	Evaluations and wrapup (OSCIA)

EFP Workshop Day 2 Agenda

10:00 – 10:15 am	Welcome Back, Introduction, Agenda (OSCIA)
10:15 – 10:30 am	Contingency and Emergency Planning (OMAF)
10:30 – 12:15 pm	Worksheet Review/Action Plan Development (OSCIA, OMAF) <ul style="list-style-type: none">- troubleshoot problems encountered
12:15 – 1:00 pm	Lunch
1:00 – 2:50 pm	Help Session (OSCIA, OMAF) <ul style="list-style-type: none">- individual assistance to complete plans- action plan implementation- cost-share programs- address NMA related questions/concerns- overview of NMS/NMP, approvals, deadlines- assess current & required days of storage – Mstore- NMFAP – more details as needed
2:50 – 3:00 pm	Evaluations and wrapup (OSCIA)
3:00 pm	Action plans submitted, or arrangements made for submission

APPENDIX B:

EFP WORKSHEET LIST, EXAMPLE AND ACTION PLAN OUTLINE

**Note that the Ontario Environmental Farm Plan Workbook materials included in this Appendix are protected by copyright and are included with permission from OSCIA.*

EFP Worksheet List

Worksheet 1 –	Soil and Site Evaluation
Worksheet 2 –	Water Wells
Worksheet 3 –	Pesticide Handling and Storage
Worksheet 4 –	Fertilizer Handling and Storage
Worksheet 5 –	Storage of Petroleum Products
Worksheet 6 –	Disposal of Farm Wastes
Worksheet 7 –	Treatment of Household Wastewater
Worksheet 8 –	On-Farm Storage of Livestock Manure and Other Prescribed Materials
Worksheet 9 –	Livestock Yards and Outdoor Confinement Areas
Worksheet 10 –	Silage Storage
Worksheet 11 –	Milking Centre Washwater
Worksheet 12 –	Nuisances under the Farming and Food Production Protection Act, 1998
Worksheet 13 –	Water Efficiency
Worksheet 14 –	Energy Efficiency
Worksheet 15 –	Soil Management
Worksheet 16 –	Nutrient Management in Growing Crops
Worksheet 17 –	Use and Management of Manure and Other Organic Materials
Worksheet 18 –	Horticultural Production
Worksheet 19 –	Field Crop Management
Worksheet 20 –	Pest Management
Worksheet 21 –	Stream, Ditch and Floodplain Management
Worksheet 22 –	Wetlands and Wildlife Ponds
Worksheet 23 –	Woodlands and Wildlife

Pesticide Handling and Storage

Why should you be concerned?

Pesticides are important for the agricultural industry. They increase farm production and help farmers manage more acres with less work. But pesticides sometimes show up where they're not wanted – in surface and ground water. When ground or surface water is contaminated by pesticides, it cannot be used for human consumption. Pesticide – contaminated water can also harm livestock if consumed and crops through irrigation. When contaminated surface water runs into streams and lakes, it reduces the quality of the water and may harm fish, wildlife and humans. Pesticides must be handled carefully to prevent them from getting into any water source.

Pesticides can be toxic (harmful) to plants, insects, animals and people. They can cause immediate serious health problems (acute toxicity) or long-term health problems (chronic toxicity).

If pesticides enter a water supply because of a spill or backflow accident, it can cause acute health problems. Skin rashes, nausea, eye irritations, or other toxic effects may show up after only a short period of exposure. How serious the effects will be depends on (1) how toxic the pesticide is, and (2) the amount of exposure.

Water testing shows that Ontario's drinking water supplies do not contain high levels of pesticides. What has been found in a few drinking water supplies is very small amounts of pesticide, usually well below tolerance levels set by the government. The concern is

that repeated exposure to even a small amount of a toxic substance over a long period of time could cause chronic health problems. Chronic health problems may not appear for many years.

What can you do?

1. Attend the Ontario Grower Pesticide Safety Course and follow their advice.
2. Handle pesticides carefully, especially during mixing and loading. Make sure everyone knows what to do in case of a pesticide leak or spill.
3. Whenever possible, avoid storing pesticides on your farm. Buy only the amount you need and make sure you have a safe storage area. Dispose of empty pesticide containers and rinsate safely.
4. Use this worksheet to find out how well pesticides are handled and stored on your farm.

Glossary

Pesticide Handling and Storage

Terms you need to know for Worksheet #3

Air gap: An open space between the hose or tap and the water level in the spray tank. The air gap should be at least 6 inches. Leaving an air gap is one way to prevent backflow of pesticide solution into the well or water supply.

Anti-backflow device: A check valve or other mechanical device to prevent liquids from flowing backwards into a water supply system, a well or surface water. Also called an anti-backsiphoning device.

Burning: The controlled use of fire to dispose of paper or cardboard containers.

Smoke from the fire must be directed away from buildings, highways, roads or public outdoor areas and must not affect people or animals. Municipalities may have burning bylaws that prevent such fires or tell how they must be carried out.

Clean up equipment: Includes absorbent material (e.g. sawdust, soil or kitty litter) to soak up spilled liquids, and shovel, broom, empty pails or drum to gather solids and absorbed liquids.

Containment: Impermeable floor and curbs around a chemical storage area or mixing/loading area that prevents the pesticide or spray solution from seeping into the ground in case of a spill or leak.

Contaminate/contamination: Alteration of a material by the introduction of a chemical or other substance so that the material is unfit for a specified use.

Disposal: Getting rid of hazardous material safely. Triple or pressure rinse plastic and metal containers and take them to a pesticide container recycling depot. Take paper and cardboard containers to a municipal landfill.

Emergency plan: A written plan of action to deal with an emergency. The plan should include: location of emergency equipment, emergency telephone numbers, clean up methods and steps to follow in case of a spill or fire.

Exposure: Contact with a gas, liquid or solid. Exposure can happen by swallowing (oral), skin contact (dermal) or breathing in dust or vapour (respiratory).

Immediate use period: Product is received immediately before use. There is no planned delay between the date of receiving and the date when the product is used.

Impermeable: A material that does not absorb liquid or allow liquid to move through it. One example is sealed concrete.

Permeable: A material that absorbs liquid easily or allows liquid to move through it. (e.g. sandy soil.)

Pesticide storage: The legal requirements for a pesticide storage can be found in the *Ontario Pesticides Act*. The Ontario Building Code applies to new and renovated farm buildings with a floor area larger than 108 square feet (10 square meters) constructed after October 1, 1990. (See reference list for more information).

Pressure rinse: One method to properly rinse containers. Spray water under high pressure against all inside surfaces of the container. Add the rinsate to the sprayer tank.

Protective clothing: Clothing that protects the user from getting pesticide on the skin when handling or using pesticides OR cleaning up equipment or spills. Includes: rubber or neoprene boots and gloves, hat, coveralls and other garments.

Respiratory equipment: Includes respiratory devices that protect the user from breathing in pesticide during handling or application of the material or cleanup of a spill.

Rinsate: Waste water from cleaning the inside of a product container or sprayer tank.

Surface water: See glossary, Worksheet #1.

Triple rinse: One way to properly rinse containers. Fill the container 10% full of water, cap and shake the container, then add the rinsate to the sprayer tank. Repeat two more times.

Worksheet#3 Pesticide Handling and Storage

Rating	Best 4	3	2	1	Sites
MIXING AND LOADING PESTICIDES (See Farmstead Sites chart on fold-out for questions 2 and 3)					
1	Mixing/loading area Has a permanent roof and impermeable floor with curb for containment.	Mixing done at site of spray application – site changed frequently, OR temporary plastic lined mixing/loading area with berms for containment.	Regular mixing/loading area has no containment to prevent soil or water contamination.		Your Rating
2	Distance from permanent mixing/loading area to nearest surface water Greater than 150 m (500 ft.)	61-150 m (200-500 ft.)	30-60 m (100-199 ft.)	Less than 30 m (100 ft.)	
Potential for Surface Water Contamination (Table 4 page 16)					
Add +		4	3 or 2	Divide ÷ 2 =	Final Rating Mark at right

If your distance rating is 1 mark your final rating as 1 in the box on the right. For other distance ratings, add the Potential for Surface Water Contamination rating to the Distance Rating and divide by 2. If the answer is a fraction, round up to the next whole number to get your final rating (for example, 2.5 becomes 3).

Bold italic type: These conditions may violate provincial legislation.

A B C D E

Rating **Best 4** **3** **2** **1** Sites

MIXING AND LOADING PESTICIDES (CONTINUED)

3 Distance from permanent mixing/loading area to well	Greater than 90 m (300 ft.)	24-90 m (76-300 ft.) (drilled well)	15-23 m (50-75 ft.)** (drilled well)	Less than 15m (50 ft.) (drilled well)	Your Rating
		47-90 m (151-300 ft.) (bored/dug well)	30-46 m (100-150 ft.)** (bored/dug well)	Less than 30 m (100 ft.) (bored/dug well)

If your distance rating is 1, mark your final rating as 1 in the box on the right. For other distance ratings, add the Potential for Ground Water Contamination rating to the Distance Rating and divide by 2. If the answer is a fraction, round up to the next whole number to get your final rating (for example, 2.5 becomes 3).

4 Backflow prevention on water supply	Separate water tank.	Permanent anti-backflow device installed,	No permanent anti-backflow device installed,	No anti-backflow device,					
		OR permanently fixed 6 inch air gap between the water supply and the sprayer tank.	and air gap of at least 6 inches maintained between the water supply and the sprayer tank.**	and no air gap maintained between the water supply and the sprayer tank.					
5 Sprayer tank filling supervision	Constant.		Frequent.	Seldom or never.					

Rating	Best 4	3	2	1	Sites A B C D E					
MIXING AND LOADING PESTICIDES (CONTINUED)										
6 Disposal of sprayer and container rinsate (rinse water)	Rinsate applied to crops listed on label, and more than 9 m (30 ft.) from surface water, and more than 90 m (300 ft.) from well.	Rinsate applied to crops listed on label, and more than 9 m (30 ft.) from surface water, and 24-90 m (76-300 ft.) (drilled well) 47-90 m (151-300 ft.) (bored/dug well).	Rinsate applied to crops listed on label,** and less than 9 m (30 ft.) from surface water, OR 15-23 m (50-75 ft.)** (drilled well) 30-46 m (100-150 ft.)** (bored/dug well).	Rinsate applied to crops not listed on label, OR dumped at farmstead, OR adjacent to surface water, OR less than 15 m (50 ft.) (drilled well), Less than 30 m (100 ft.) (bored/dug well).	Your Rating	☐	☐	☐	☐	☐
DISPOSAL OF PESTICIDE CONTAINERS										
7 Return, rinsing and disposal	Use of returnable or refillable containers, OR containers triple rinsed or pressure rinsed and taken to a pesticide container recycling depot. Paper or cardboard taken to municipal landfill.	Triple or pressure rinsed containers and empty bags (paper or cardboard) taken to municipal landfill.	Triple or pressure rinsed containers taken to municipal landfill. Paper or cardboard containers burned on farm.**	Improper disposal of unrinsed containers.		☐	☐	☐	☐	
EMERGENCY PLAN										
8 Emergency plan and cleanup equipment for spills	Written emergency plan and spill clean up equipment available.	_____	Emergency plan prepared,	No emergency plan prepared,		☐	☐	☐	☐	
			OR spill clean up equipment available but not both.	and no clean up equipment available.						

[illegible]

Bold italic type: These conditions may violate provincial legislation. **Conditions in column 2 meet or exceed legislation. BMP's in columns 3 and 4 describe stewardship practices that meet or exceed legislation

A B C D E

Rating Best 4 3 2 1 Sites

PESTICIDE STORAGE (CONTINUED) (See Farmstead Sites chart on fold-out for questions 11 and 12)

If your distance rating is 1, mark your final rating as 1 in the box on the right. For other distance ratings, add the Potential for Ground Water Contamination rating to the Distance Rating and divide by 2. If the answer is a fraction, round up to the next whole number to get your final rating (for example, 2.5 becomes 3).

13 Pesticide storage area	Stored in separate free standing building or outdoor cabinet used only for pesticides.	Stored in a designated area of a building with separation walls or in a cabinet within a storage building.	Stored in a designated area(s) of a building with no separation walls,	Stored with or near human or animal food,					
	and storage area may be adjacent to non-food items such as seed, farm equipment.**	and storage area may be adjacent to non-food items such as seed, farm equipment.**	OR stored in residence.						

Best 4

3

2

1

Rating

Best 4

3

2

1

Sites

PESTICIDE STORAGE (CONTINUED)

PESTICIDE STORAGE	Rating					Sites				
	A	B	C	D	E	A	B	C	D	E
14 Spills or leaks containment in storage area	Impermeable floor (e.g. sealed concrete) without cracks, does not allow spills to soak into soil, and curb installed on floor to contain leaks and spills, and no floor drain OR floor drain to acceptable holding tank.	Impermeable floor (e.g. sealed concrete) without cracks, does not allow spills to soak into soil, and no floor drain OR floor drain to acceptable holding tank.	Impermeable floor (e.g. sealed concrete) without cracks, does not allow spills to soak into soil, and no floor drain OR floor drain to acceptable holding tank.	Permeable surface (e.g. wooden floor) has cracks – spills could contaminate wood or soil, and no floor drain OR floor drain to acceptable holding tank.	Permeable surface (e.g. gravel or dirt floor). Spills would contaminate soil, OR has floor drain that leads to tile drain, surface water, etc.	Your Rating				
15 Storage requirements for human safety	Meets all the following requirements for pesticide storage:** (a) locked door – enter only from outdoors (b) warning sign at entrance (c) ventilated to outside (d) respiratory equipment and protective clothing (e) emergency telephone numbers posted (f) only labelled containers	Meets all the following requirements for pesticide storage:** (a) locked door – enter only from outdoors (b) warning sign at entrance (c) ventilated to outside (d) respiratory equipment and protective clothing (e) emergency telephone numbers posted (f) only labelled containers	Meets all the following requirements for pesticide storage:** (a) locked door – enter only from outdoors (b) warning sign at entrance (c) ventilated to outside (d) respiratory equipment and protective clothing (e) emergency telephone numbers posted (f) only labelled containers	Meets all the following requirements for pesticide storage:** (a) locked door – enter only from outdoors (b) warning sign at entrance (c) ventilated to outside (d) respiratory equipment and protective clothing (e) emergency telephone numbers posted (f) only labelled containers	Meets all the following requirements for pesticide storage:** (a) locked door – enter only from outdoors (b) warning sign at entrance (c) ventilated to outside (d) respiratory equipment and protective clothing (e) emergency telephone numbers posted (f) only labelled containers					

*Bold italic type: These conditions may violate provincial legislation. ** Conditions in column 2 meet or exceed legislation. BMPs in columns 3 and 4 describe stewardship practices that meet or exceed legislation.*

Resources List

Pesticide Handling and Storage

For more information...

Ontario Ministry of Agriculture and Food

Agricultural Information Contact Centre at 1-877-424-1300
www.gov.on.ca/OMAF

Factsheets/Leaflets

- Guide to Handling and Applying Herbicide to Protect Water Supplies and Reduce Personal Exposure – Order No. 87-044
- Pesticide Container Rinsing – Order No. 87-057
- Pesticide Contamination of Farm Water Supplies – Order No. 00-099
- Pesticide Handling Facility – Order No. 94-037

Publications

- Best Management Practices series: Pesticide Storage, Handling, and Application (with Agriculture and Agri-Food Canada), Order No. BMPI3

Courses

- Ontario Grower Pesticide Safety Course
 c/o Ridgetown College, University of Guelph, Ridgetown, ON N0P 2C0
 Tel. 1-519-674-1580 or toll-free 1-800-652-8573

Ontario Ministry of Environment

Public Information Centre
 135 St. Clair Ave. West, Toronto, ON M4V 1P5
 Toll-free 1-800-565-4923

Legislation/Acts (available from government bookstores)

- *Pesticides Act*, R.R.O. 1990, Regulation 914, Government of Ontario
- Ontario Building Code, 1997 (Applies to farm buildings larger than 10 square metres in floor area – contact local municipality for details)

At the request of the Ontario Farm Environmental Coalition, consisting of AGCare, Ontario Federation of Agriculture, Christian Farmers' Federation of Ontario and the Ontario Farm Animal Council, the following people contributed to the development of Worksheet #3:

Bob Stone, OMAFRA (chair) • Craig Hunter, OMAFRA • Doug Morrow, MOEE • Helmut Spieser, OMAFRA

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Action Plan

Timetable for addressing area of concern

Area of Concern		Short Term (within 2 yrs.)		Long Term (more than 2 yrs.)	Barriers to Short Term Plan	No Action	Completion Date
		ACTION/Compensating Factor/Monitoring					
Worksheet = _____	<div> <div>Question = _____</div> <div>Site = _____</div> <div>Rating</div> <div>1 2</div> </div>	<div> <div>☐ within 8 mo.</div> <div>☐ within 2 yrs.</div> <div>☐ already being done</div> </div>	<div> <div>☐ 2-5 yrs.</div> <div>☐ 5 + yrs. (reassess)</div> </div>	1. _____ 2. _____	☐ No Action		
Worksheet = _____		<div> <div>☐ within 8 mo.</div> <div>☐ within 2 yrs.</div> <div>☐ already being done</div> </div>	<div> <div>☐ 2-5 yrs.</div> <div>☐ 5 + yrs. (reassess)</div> </div>	1. _____ 2. _____	☐ No Action		
Worksheet = _____		<div> <div>☐ within 8 mo.</div> <div>☐ within 2 yrs.</div> <div>☐ already being done</div> </div>	<div> <div>☐ 2-5 yrs.</div> <div>☐ 5 + yrs. (reassess)</div> </div>	1. _____ 2. _____	☐ No Action		
Worksheet = _____	<div> <div>Question = _____</div> <div>Site = _____</div> <div>Rating</div> <div>1 2</div> </div>	<div> <div>☐ within 8 mo.</div> <div>☐ within 2 yrs.</div> <div>☐ already being done</div> </div>	<div> <div>☐ 2-5 yrs.</div> <div>☐ 5 + yrs. (reassess)</div> </div>	1. _____ 2. _____	☐ No Action		
Worksheet = _____		<div> <div>☐ within 8 mo.</div> <div>☐ within 2 yrs.</div> <div>☐ already being done</div> </div>	<div> <div>☐ 2-5 yrs.</div> <div>☐ 5 + yrs. (reassess)</div> </div>	1. _____ 2. _____	☐ No Action		
Worksheet = _____		<div> <div>☐ within 8 mo.</div> <div>☐ within 2 yrs.</div> <div>☐ already being done</div> </div>	<div> <div>☐ 2-5 yrs.</div> <div>☐ 5 + yrs. (reassess)</div> </div>	1. _____ 2. _____	☐ No Action		

APPENDIX C:
PRE- AND POST- WORKSHOP QUESTIONNAIRES

BMP Opinion Survey
Questionnaire #1 (prior to workshop 1)

Instructions

The survey contains a few open-ended questions, but the majority of questions are posed using a 5-point scale. This scale represents the range of possible answers to the survey questions. Please answer each question by circling the number that best describes your opinion. Only circle one number on a single scale.

For example, given the scale:

Very likely 1 2 3 4 5 Very unlikely

1 = very likely

2 = likely

3 = neither likely or unlikely

4 = unlikely

5 = very unlikely

There are no correct or incorrect answers. We are simply interested in your opinion.

Some questions may seem similar, but they address different issues. Please read each question carefully before selecting you answer.

You are encouraged to answer all questions. However, you have the right to skip any particular question or stop participation altogether.

Definitions

In this survey, the term beneficial management practices (BMPs) refers to structures or practices that can be implemented to reduce the environmental impact of farm activities. Examples of BMPs include: shelterbelts, fencing to prevent livestock from entering streams, vegetated buffer strips, rotational grazing, conservation tillage, manure storage, improved pest management, water saving devices, erosion control, etc.

The term “my farm” refers to the farm operation that you are affiliated with. Even though this may be a joint operation, please use your own personal opinions to answer the questions.

BMP Opinion Survey
Questionnaire #1 (prior to workshop 1)

PART I

1) In general, I think implementing BMPs on my farm in the next twelve months would be:

Very harmful 1 2 3 4 5 Very beneficial

2) Given the information available to me at this time, I would like to implement BMPs on my farm in the coming year.

Strongly disagree 1 2 3 4 5 Strongly agree

3) The people whose opinions I value would (*discourage/encourage*) me to implement BMPs on my farm in the next 12 months.

Discourage 1 2 3 4 5 Encourage

4) I am the only person who will determine whether or not BMPs are implemented on my farm during this coming year.

Definitely false 1 2 3 4 5 Definitely true

5) Implementing BMPs on my farm in next 12 months would be:

Very personally
troublesome 1 2 3 4 5 Very personally
rewarding

6) I intend to implement BMPs on my farm in the coming year.

Not confident at all 1 2 3 4 5 Very confident

7) Most people who are important to me think I (*should not/should*) implement BMPs on my farm in the coming year.

Should not 1 2 3 4 5 Should

8) Implementing BMPs on my farm in the coming year would be in line with my moral values.

Strongly disagree 1 2 3 4 5 Strongly agree

BMP Opinion Survey
Questionnaire #1 (prior to workshop 1)

9) I am capable of implementing BMPs on my farm within the coming year if I want to.

Strongly disagree 1 2 3 4 5 Strongly agree

10) I feel morally obligated to implement BMPs on my farm in the coming year.

Definitely false 1 2 3 4 5 Definitely true

11) I believe that implementing BMPs on my farm in the coming year would be:

Very frustrating 1 2 3 4 5 Very satisfying

12) I feel that society expects me to implement BMPs on my farm in the coming year.

Certainly not 1 2 3 4 5 Certainly

13) I have control over whether or not BMPs are implemented on my farm in the coming year.

No control 1 2 3 4 5 Complete Control

14) Within the next 12 months, I expect to implement BMPs on my farm.

Definitely will not 1 2 3 4 5 Definitely will

15) Implementing BMPs on my farm in the next 12 months would be:

Very foolish 1 2 3 4 5 Very wise

16) Implementing BMPs on my farm within the coming year would be:

Very difficult 1 2 3 4 5 Very easy

17) I would feel guilty if I did not install BMPs on my farm this coming year.

Very unlikely 1 2 3 4 5 Very likely

BMP Opinion Survey
Questionnaire #1 (prior to workshop 1)

PART II

1) What could be done on your farm to minimize potential environmental damages? (*list up to 5 items; if none occur to you at this time, please write: "none"*)?

1. _____
2. _____
3. _____
4. _____
5. _____

2) Aside from any financial constraints, I have the ability to *implement* BMPs on my farm without receiving additional technical assistance.

Certainly not 1 2 3 4 5 Certainly

3) Aside from any financial constraints, I have the ability to *maintain* BMPs on my farm without receiving additional technical assistance.

Strongly disagree 1 2 3 4 5 Strongly agree

4) I can improve the effectiveness of my conservation efforts by completing an environmental farm plan before implementing any BMPs on my farm.

Definitely false 1 2 3 4 5 Definitely true

The remaining questions in Part II (5 - 13), include the term "region". In this survey, the term "region" refers to your local area at the county or district scale.

5) In the long term, implementing BMPs on my farm will help improve the quality of the environment in my region.

Very unlikely 1 2 3 4 5 Very likely

6) Immediate action is required to fix current environmental problems in my region.

Strongly disagree 1 2 3 4 5 Strongly agree

7) In my estimation, the contribution of agriculture to environmental problems in my region is:

Very large 1 2 3 4 5 Very small

BMP Opinion Survey
Questionnaire #1 (prior to workshop 1)

8) Within my region, what is (are) the greatest environmental concern(s)? *Please list up to 5 items. If none occur to you at this time, please write: "none".*

1. _____
2. _____
3. _____
4. _____
5. _____

9) In relation to the question above (#8), what are the most significant causes of this (these) environmental concern(s)? *Please list up to 5 items. If none occur to you at this time, please write: "none".*

1. _____
2. _____
3. _____
4. _____
5. _____

10) The current level of environmental degradation in my region could have a negative impact on human health.

Completely uncertain 1 2 3 4 5 Completely certain

11) I believe that other individuals or groups that are (at least partially) responsible for environmental degradation in my region are taking action to reduce their impact on the environment.

Strongly disagree 1 2 3 4 5 Strongly agree

12) The current amount of environmental degradation in my region could have a negative impact on the long-term viability of my farming operation.

Completely uncertain 1 2 3 4 5 Completely certain

13) I feel a personal responsibility to ensure my region's natural resources are maintained for future generations.

Strongly disagree 1 2 3 4 5 Strongly agree

BMP Opinion Survey
Questionnaire #1 (prior to workshop 1)

Part III

Recalling that your answers are anonymous and confidential, please select the best answer to the questions below.

1) Please indicate which item best describes the past use of Beneficial Management Practices (BMPs) on your farm.

- ☐ I have never used BMPs on my farm.
- ☐ I have implemented one or two BMPs on my farm.
- ☐ I have implemented several BMPs, but there are others that would be environmentally relevant to my farm operations.
- ☐ I have implemented all environmentally relevant BMPs into my farm operations.

2) Please indicate which category reflects your current age.

- ☐ younger than 30 years old
- ☐ 30 – 40 years old
- ☐ 41 – 50 years old
- ☐ older than 51

3) Which category best describes your annual income?

- ☐ < 30,000
- ☐ 30,000 – 49,999
- ☐ 50,000 – 70,000
- ☐ > 70,000

4) Which item best represents the highest level of education you have completed?

- ☐ Did not complete high school
- ☐ Completed high school
- ☐ Completed college degree and/or technical program
- ☐ Completed a university bachelors degree
- ☐ Completed a university masters or doctoral degree

5) What is the primary commodity of your farming operation?

☐ Beef	☐ Fruit and vegetables
☐ Field crops	☐ Dairy
☐ Pork	☐ Poultry
☐ Mixed (crops/livestock)	☐ Other (<i>please specify</i>) _____

Thank you for your participation in the first part of this research. If you would like to add anything else, please feel free to make comments on the next page.

BMP Opinion Survey
Questionnaire #1 (prior to workshop 1)

Please feel free to make any additional comments:

BMP Opinion Survey
Questionnaire #1 (prior to workshop 1)

BMP Opinion Survey
Questionnaire #2 (following Workshop 2)

Instructions

This survey follows the same format as the first survey you completed. The survey contains a few open-ended questions, but the majority of questions are posed using a 5-point scale. This scale represents the range of possible answers to the survey questions. Please answer each question by circling the number that best describes your opinion. Only circle one number on a single scale.

For example, given the scale:

Very likely 1 2 3 4 5 Very unlikely

1 = very likely

2 = likely

3 = neither likely or unlikely

4 = unlikely

5 = very unlikely

There are no correct or incorrect answers. We are simply interested in your opinion.

Some questions may seem similar, but they address different issues. Please read each question carefully before selecting you answer.

You are encouraged to answer all questions. However, you have the right to skip any particular question or stop participation altogether.

Definitions

In this survey, the term beneficial management practices (BMPs) refers to structures or practices that can be implemented to reduce the environmental impact of farm activities. Examples of BMPs include: shelterbelts, fencing to prevent livestock from entering streams, vegetated buffer strips, rotational grazing, conservation tillage, manure storage, improved pest management, water saving devices, erosion control, etc.

The term “my farm” refers to the farm operation that you are affiliated with. Even though this may be a joint operation, please use your own personal opinions to answer the questions.

BMP Opinion Survey
Questionnaire #2 (following Workshop 2)

PART I

1) I intend to implement BMPs on my farm in the coming year.

Not confident at all 1 2 3 4 5 Very confident

2) Most people who are important to me think I (*should not/should*) implement BMPs on my farm in the coming year.

Should not 1 2 3 4 5 Should

3) I have control over whether or not BMPs are implemented on my farm in the coming year.

No control 1 2 3 4 5 Complete Control

4) I feel morally obligated to implement BMPs on my farm in the coming year.

Definitely false 1 2 3 4 5 Definitely true

5) Within the next 12 months, I expect to implement BMPs on my farm.

Definitely will not 1 2 3 4 5 Definitely will

6) The people whose opinions I value would (*discourage/encourage*) me to implement BMPs on my farm in the next 12 months.

Discourage 1 2 3 4 5 Encourage

7) I believe that implementing BMPs on my farm in the coming year would be:

Very frustrating 1 2 3 4 5 Very satisfying

8) I would feel guilty if I did not install BMPs on my farm this coming year.

Very unlikely 1 2 3 4 5 Very likely

9) Implementing BMPs on my farm in the next 12 months would be:

Very foolish 1 2 3 4 5 Very wise

BMP Opinion Survey
Questionnaire #2 (following Workshop 2)

10) Implementing BMPs on my farm within the coming year would be:

Very difficult 1 2 3 4 5 Very easy

11) Given the information available to me at this time, I would like to implement BMPs on my farm in the coming year.

Strongly disagree 1 2 3 4 5 Strongly agree

12) Implementing BMPs on my farm in the coming year would be in line with my moral values.

Strongly disagree 1 2 3 4 5 Strongly agree

13) I am the only person who will determine whether or not BMPs are implemented on my farm during this coming year.

Definitely false 1 2 3 4 5 Definitely true

14) In general, I think implementing BMPs on my farm in the next twelve months would be:

Very harmful 1 2 3 4 5 Very beneficial

15) I feel that society expects me to implement BMPs on my farm in the coming year.

Certainly not 1 2 3 4 5 Certainly

16) I am capable of implementing BMPs on my farm within the coming year if I want to.

Strongly disagree 1 2 3 4 5 Strongly agree

17) Implementing BMPs on my farm in next 12 months would be:

Very personally
troublesome 1 2 3 4 5 Very personally
rewarding

BMP Opinion Survey
Questionnaire #2 (following Workshop 2)

Part II

1) The promise of cost-sharing dollars has influenced my decision to participate in the Environmental Farm Plan (EFP) program.

Not at all 1 2 3 4 5 Heavily

2) Implementing BMPs on my farm in the coming year would have a negative impact on the long-term profitability of my farm operation.

Very unlikely 1 2 3 4 5 Very likely

3) Given the realities of my farm operation, the cost-share dollars are (*insufficient / excessive*) in terms of encouraging me to adopt BMPs in the next year.

Insufficient 1 2 3 4 5 Excessive

4) I suspect that implementing BMPs on my farm in the coming year would restrict my future farm management options.

Definitely not 1 2 3 4 5 Definitely

5) In my opinion, it is (*very unfair / very fair*) to provide a larger amount of financial support for BMPs that have greater off-farm than on-farm benefits.

Very unfair 1 2 3 4 5 Very fair

6) Implementing BMPs on my farm in the coming year would place an unacceptable financial constraint on my farm operation (even with existing cost-share support).

Strongly disagree 1 2 3 4 5 Strongly agree

PART III

1) I can improve the effectiveness of my conservation efforts by completing an environmental farm plan before implementing any BMPs on my farm.

Definitely false 1 2 3 4 5 Definitely true

BMP Opinion Survey
Questionnaire #2 (following Workshop 2)

2) What could be done on your farm to minimize potential environmental damages? (*list up to 5 items; if none occur to you at this time, please write: "none"*)?

1. _____
2. _____
3. _____
4. _____
5. _____

3) Aside from any financial constraints, I have the ability to *maintain* BMPs on my farm without receiving additional technical assistance.

Strongly disagree 1 2 3 4 5 Strongly agree

4) Aside from any financial constraints, I have the ability to *implement* BMPs on my farm without receiving additional technical assistance.

Certainly not 1 2 3 4 5 Certainly

The remaining questions in Part II (5 - 13), include the term "region". In this survey, the term "region" refers to your local area at the county or district scale.

5) In the long term, implementing BMPs on my farm will help improve the quality of the environment in my region.

Very unlikely 1 2 3 4 5 Very likely

6) Within my region, what is (are) the greatest environmental concern(s)? *Please list up to 5 items. If none occur to you at this time, please write: "none"*.

1. _____
2. _____
3. _____
4. _____
5. _____

7) In relation to the question above (#6), what are the most significant causes of this (these) environmental concern(s)? *Please list up to 5 items. If none occur to you at this time, please write: "none"*.

1. _____
2. _____
3. _____
4. _____
5. _____

BMP Opinion Survey
Questionnaire #2 (following Workshop 2)

8) I feel a personal responsibility to ensure my region's natural resources are maintained for future generations.

Strongly disagree 1 2 3 4 5 Strongly agree

9) I believe that other individuals or groups that are (at least partially) responsible for environmental degradation in my region are taking action to reduce their impact on the environment.

Strongly disagree 1 2 3 4 5 Strongly agree

10) The current amount of environmental degradation in my region could have a negative impact on the long-term viability of my farming operation.

Completely uncertain 1 2 3 4 5 Completely certain

11) Immediate action is required to fix current environmental problems in my region.

Strongly disagree 1 2 3 4 5 Strongly agree

12) In my estimation, the contribution of agriculture to environmental problems in my region is:

Very large 1 2 3 4 5 Very small

13) The current level of environmental degradation in my region could have a negative impact on human health.

Completely uncertain 1 2 3 4 5 Completely certain

Thank you for your participation in the second part of this research. If you would like to add anything else, please feel free to make comments in the space provided.

APPENDIX D:
SURVEY ADMINISTRATION PACKAGE

Survey Administration Package Overview

In addition to this overview sheet, this package contains:

- “Notes for Survey Administrator – Consent Form”
- “Notes for Survey Administrator – Questions”
- consent forms
- Pre-Workshop Questionnaire
- Post-Workshop Questionnaire

* Note that the consent forms and questionnaires are double sided.

The **consent forms** must be provided to the proponent before they participate in the first survey only. This is a requirement of Ryerson’s Ethics Review Board. As indicated on the forms and in the “Notes for Survey Administrator” document, OSCIA will keep these consent forms.

The **“Notes for the Survey Administrator – consent form”** document highlights the main points of the consent form, which should be read out to the workshop participants. It is not a “line for line” repeat of the consent form, but highlights the important elements” (*You could explain that the consent form is structured to meet the ethics review guidelines, but that you will highlight the main elements*).

The **“Notes for the Survey Administrator – questions”** document outlines some potentially common questions that participants may have, along with some guidance to help you answer them. Please try not to interpret the questions for individual participants. If they are frustrated with a question after you have done what you can without interpreting the question for them, just ask them to answer to the best of their ability, but to indicate with a question mark in the margins that they don’t understand the question. They can also make a comment on the back of the questionnaire.

The **questionnaires** are provided. Questionnaire No. 1 is to be completed before the 1st session of the workshop begins. Questionnaire No. 2 is to be completed at the end of the final session of the workshop.

In addition to the consent form, there are **instructions** and **definitions** at the beginning of each questionnaire. Please go through these instructions with the participants. In particular, make sure the participants understand what the survey means by “BMP”. Also, please explain that some of the questions will seem similar and repetitious, but assure them that it is designed this way on purpose, asking them to be persistent and answer all the questions to the best of their ability – there are no wrong answers; we are simply looking for their opinions.

Workshop #2

If a different farm representative attends the second workshop, we will not ask them to participate in the 2nd survey. I will only use questionnaires with matching codes, but please try to make sure it is the same person filling out both questionnaires.

Please take note of any questions/problems participants had answering questions, or that you had in administering the survey.

- Please return questionnaires to me at 77 Wellesley St. East. Suite #41 Toronto, ON M4Y 1H7.
- Please send consent forms to Andy Graham at OSCIA.

Notes for Survey Administrator – Consent Form

The consent form provided to the participants is quite lengthy given the requirements of Ryerson University's Ethics Review Board. The main elements for the participants to understand outlined below. The notes are written from the perspective of you speaking directly to the participants.

The survey aims to gather information on participant's **opinions** of agricultural beneficial management practices (BMPs).

In this survey, the term BMP refers to **structures or practices that can be implemented to reduce the environmental impact of farm activities. Examples of BMPs include: shelterbelts, fencing to prevent livestock from entering streams, vegetated buffer strips, rotational grazing, conservation tillage, manure storage, improved pest management, water saving devices, erosion control, etc.**

You are under no obligation to participate in this survey. Your choice of whether or not to participate will not influence your future relations with OSCIA or the EFP program.

That said, your involvement would greatly facilitate this research. **OSCIA expects that this research will provide important insight that will help strengthen EFP workshops in the future.**

If you decide to participate, you will be asked to complete **two surveys**. One survey is completed at the beginning of *first session* of the EFP workshops. The second survey is completed at the end of the *final session* of the EFP workshops.

The data analysis will be conducted by a graduate student at Ryerson University. Her Contact information is on the consent form if you have any questions after the survey.

Complete confidentiality will be maintained. OSCIA will collect and keep the consent forms. The researcher will not have access to participants' names.

In order to link the two surveys, but to maintain confidentiality, you are asked to place a **4-digit code** on the first page of the questionnaire. (You can use a name of a pet or some other word if you prefer)

- Pick a code you can easily remember so you can use the same code on the second questionnaire that you will complete during the final workshop session. **(Perhaps write it down somewhere)**
- Do not put the code on the consent form. This ensures your questionnaire responses will be **anonymous**.

Only OSCIA and the researcher will have access to the completed questionnaires.

When you have finished, please place your completed questionnaire in one pile and the consent forms in another.

Implementation of Beneficial Management Practices – Opinion Survey Consent Form

You are being asked to participate in a research survey. Before you volunteer, please read the following information and ask as many questions as necessary to understand what you will be asked to do. Approximately 100 participants in Environmental Farm Plan (EFP) workshops are being asked to participate in this study.

The survey aims to gather information on your opinions of agricultural beneficial management practices (BMPs). In this survey, the term BMP refers to structures or practices that can be implemented to reduce the environmental impact of farm activities. Examples of BMPs include: shelterbelts, fencing to prevent livestock from entering streams, vegetated buffer strips, rotational grazing, conservation tillage, manure storage, improved pest management, water saving devices, erosion control, etc.

If you decide to participate, you will be asked to complete two surveys. One survey is completed at the beginning of Day 1 of the EFP workshops. The second survey is completed at the end of Day 2 of the EFP workshops. Each survey is designed to take approximately 10 minutes to fill out. A small number of questions ask you to write a response. A few questions relate to personal information such as age, income, education and farm type. The majority of questions ask you to circle the number on a scale that best reflects your personal opinion. There are no correct or incorrect answers.

None of the questionnaires used in this study are experimental in nature. The only experimental aspect of this study is the gathering of information for the purpose of analysis. The data analysis will be conducted by Hayley Vernon, a graduate student in Ryerson University's Environmental Applied Science and Management program. Ms. Vernon's research will be supervised by Dr. Michal Bardecki in Ryerson's Geography Department.

You are under no obligation to participate in this survey. There are no benefits to you personally, and you will not be paid to participate in this study. That said, your involvement would greatly facilitate this research. The Ontario Soil and Crop Improvement Association (OSICA) expects that this research will provide important insight that will help strengthen EFP workshops in the future. The research findings will be published in a graduate thesis.

Complete confidentiality will be maintained. OSICA will collect and keep these consent forms. The researcher will not have access to participants' names. This is in line with the confidentiality requirements of the EFP program.

In order to link the two surveys, but to maintain confidentiality, you will be asked to place a 4-digit code on the first page of the questionnaire. Pick a code you can easily remember so you can use the same code on the second questionnaire that you will complete during workshop #2. The code will not be linked to this consent form, so your questionnaire responses will be anonymous. Only OSICA and the researcher will have access to the completed questionnaires. The researcher will ensure that the responses are stored in a secure location.

Participation in this study is voluntary. Your choice of whether or not to participate will not influence your future relations with OSICA, the EFP program, or Ryerson University. If you decide to participate, you are encouraged to answer all questions to the best of your ability. That said, you have the right to skip any particular question or stop participation altogether. Please note that you will need to provide your 4-digit code if you wish to withdraw your completed

questionnaire at a later date.

If you have any questions about the research now, please ask. If you have questions later about the research, you may contact:

Hayley Vernon or

Dr. Michal Bardecki
(416) 979-5000 ext 6175

If you have questions regarding your rights as a participant in this study, you may contact the Ryerson University Research Ethics Board for information.

Research Ethics Board
c/o Office of Research Services
Ryerson University
350 Victoria Street
Toronto, ON M5B 2K3
416-979-5042

Your signature below indicates that you have read the information in this agreement and have had a chance to ask any questions you have about the study. Your signature also indicates that you agree to be in the study and have been told that you can change your mind and withdraw your consent to participate at any time. You have been given a copy of this agreement.

You have been told that by signing this consent agreement you are not giving up any of your legal rights.

Name of Participant (please print)

Signature of Participant

Date

Signature of Investigator

Date

Notes for Survey Administrator - Questions

In general, it is best to answer all questions at the beginning. However, if you get questions during the survey, here are some suggested answers. If possible, if one person asks a question, please let the others know as well.

1. Question: “I don’t understand what a BMP is”

- Refer to the definition on the first page of the questionnaire
- Feel free to give some additional examples; perhaps put in the context of the EFP program (i.e. BMPs are the types of projects they can get money for under the EFP program).
- If they really don’t understand, tell them to right on the back of the questionnaire that they don’t know what a BMP is.

2. Question: “How can I answer these questions when I am part of a joint farm operation, and am not the only one responsible for making decisions”

- Refer to the definition on the first page of the questionnaire
- Remind them we are looking for their personal point of view.
- Assure them there is a question included that asks whether they have sole decision making in relation to implementing BMPs (#5 in Part I)

3. Question: “Why are the questions all asking the same thing” (i.e. participants are frustrated with repetition)

- Reassure them that the questions all measure slightly different issues
- Encourage them to bear with it, reading the questions carefully and answering each one individually based on personal feeling/opinion.

4. Question: “What if I don’t know?”

- Indicate that it is ok if they don’t know for sure, but to pick the number that best reflects how they feel right now.

5. Question: “Why is the second questionnaire asking the same questions as the first?”

- Let them know the questionnaires are largely the same since they are trying to measure any differences in opinion following the workshop.
- Urge them to simply read each question and answer it to the best of their abilities based on their personal opinions right now.
- There are some different questions between the two surveys; the questions are also in different orders.

APPENDIX E:

VARIABLE LIST

Research Variables

1. Theory of Planned Behaviour Variables

Variable Label	Variable Abbreviation	Corresponding Survey Questions (Questionnaire 1)*
Intention	INT	2, 6, 14
Attitude	ATT	1, 5, 11, 15
Subjective Norm	SN	3, 7
Perceived Behavioural Control	PBC	9, 13, 16
Moral Obligation	MO	8, 10, 17

** Questions averaged for an overall variable score*

2. Awareness Variables

Variable Label	Variable Name	Corresponding Survey Question
Implementation Knowledge	KNOWI	Aside from any financial constraints, I have the ability to <i>implement</i> BMPs on my farm without receiving additional technical assistance.
Maintenance Knowledge	KNOWM	Aside from any financial constraints, I have the ability to <i>maintain</i> BMPs on my farm without receiving additional technical assistance.
Environmental Improvement	ENVIMP	In the long term, implementing BMPs on my farm will help improve the quality of the environment in my region.
Environmental Urgency	URGENC	Immediate action is required to fix current environmental problems in my region.
Health Impact	HEALTH	The current level of environmental degradation in my region could have a negative impact on human health.
Social Certainty	SOC	I believe that other individuals or groups that are (at least partially) responsible for environmental degradation in my region are taking action to reduce their impact on the environment.
Farm Impact	FARM	The current amount of environmental degradation in my region could have a negative impact on the long-term viability of my farming operation.
Personal Responsibility	RESP	I feel a personal responsibility to ensure my region's natural resources are maintained for future generations.
Awareness Index	AINDEX	Sum of 9 variables

3. Financial Cost Variables

Variable Label	Variable Name	Corresponding Survey Question (Questionnaire 2)
Profit Impact	PROFIT	Implementing BMPs on my farm in the coming year would have a negative impact on the long-term profitability of my farm operation.
Management Options	MANOPS	I suspect that implementing BMPs on my farm in the coming year would restrict my future farm management options.
Financial Constraints	FINCONS	Implementing BMPs on my farm in the coming year would place an unacceptable financial constraint on my farm operation (even with existing cost-share support).
Financial Costs Index	FCINDEX	Sum of 3 variables

4. Incentive Framework

Variable Label	Variable Name	Corresponding Survey Question (Questionnaire 2)
Economic Participation	ECPART	The promise of cost-sharing dollars has influenced my decision to participate in the Environmental Farm Plan (EFP) program. (heavily/not at all)
Incentive Sufficiency	INCSUF	Given the realities of my farm operation, the cost-share dollars are (<i>insufficient</i> / <i>excessive</i>) in terms of encouraging me to adopt BMPs in the next year.
Targeted Incentive	TARGINC	In my opinion, it is (<i>very unfair</i> / <i>very fair</i>) to provide a larger amount of financial support for BMPs that have greater off-farm than on-farm benefits.

APPENDIX F:

INTERNAL CONSISTENCY ANALYSIS

Internal Consistency Analysis

Table 1. TPB Inter-Item Correlations with Cronbach's Alpha Values

Questionnaire 1					Questionnaire 2				
Average Correlations (all items)				Cronbach's Alpha	Average Correlations (all items)				Cronbach's Alpha
	INT1	INT2	INT3			INT1	INT2	INT3	
INT1				.829	INT1				.833
INT2	.590*				INT2	.535*			
INT3	.543*	.725*			INT3	.609*	.616*		
	ATT1	ATT2	ATT3	ATT4		ATT1	ATT2	ATT3	ATT4
ATT1					ATT1				
ATT2	.437*				ATT2	.613*			.866
ATT3	.443*	.434*		.779	ATT3	.544*	.712*		
ATT4	.480*	.532*	.527*		ATT4	.696*	.572*	.622*	
	SN2	SN2	SN3			SN2	SN2	SN3	
SN1				.491	SN1				.635
SN2	.434*				SN2	.538*			
SN3	.239*	.147			SN3	.277*	.292*		
	PBC1	PBC2	PBC3	PBC4		PBC1	PBC2	PBC3	PBC4
PBC1					PBC1				
PBC2	.344*				PBC2	.430*			.593
PBC3	.145	.456*		.599	PBC3	.157	.321*		
PBC4	.116	.391*	.411*		PBC4	.065	.270*	.482*	
	MO1	MO2	MO3			MO1	MO2	MO3	
MO1				.683	MO1				.803
MO2	.314*				MO2	.628*			
MO3	.293*	.616*			MO3	.567*	.601*		

*Sig < .01 (two-tailed)

Table 2. Cronbach's Alpha Values Averaged from Questionnaire 1 and 2

Questionnaire 1 and 2 Averaged Cronbach's Alpha	
Average with all items	Average with dropped items
.831	.831
.823	.823
.563	.650
.596	.656
.743	.743

APPENDIX G:

INDEX CORRELATIONS

Index Development: Correlation Analysis

Awareness

	KNOWI	KNOWM	ENVIMP	URGENC	AGCONT	HEALTH	SOC	FARM	RESP	AINDEX
KNOWI	1									
KNOWM	.673*	1								
ENVIMP	-.008	.133	1							
URGENC	-.061	-.076	.318*	1						
AGCONT	-.028	-.054	.202**	.315*	1					
HEALTH	-.072	-.050	.184**	.528*	.224**	1				
SOC	-.082	-.071	.291*	.055	.077	.112	1			
FARM	-.078	-.053	.430*	.568*	.142	.486*	.184**	1		
RESP	.119	.128	.356*	.133	.151	.076	.233*	.166	1	
AINDEX	.335*	.380*	.628*	.628*	.468*	.574*	.379*	.651*	.492*	1

* sig. $p < .01$ (2-tailed)

**sig. $p < .05$ (2-tailed)

Financial Considerations

	PROFIT	MANOPTS	FINCONST	FCINDEX
PROFIT	1			
MANOPTS	.448*	1		
FINCONST	.325*	.220**	1	
FCINDEX	.826*	.743*	.658*	1

* sig. $p < .01$ (2-tailed)

**sig. $p < .05$ (2-tailed)

③ 26.87 - 100