

A SURVEY OF FARMER PERSPECTIVES ON THE PEI ALUS PROGRAM

Van Lantz, Toni Anderson, and Libby Johnston
Faculty of Forestry and Environmental Management
University of New Brunswick

Research Project Number: **PR-02-2012**

Final Report
November, 2012



Abstract

The government of PEI is the first to implement a province-wide Alternative Land Use Services (ALUS) program in Canada. This voluntary program, which began in 2008, pays annual financial incentives to farmers to implement beneficial management practices (BMPs) on their privately owned land designed to conserve and protect key environmental assets. The goal of this research is to assess the program from the farmer's perspective, and provide recommendations for further development. Surveys were mailed to all PEI ALUS program members (400) and a sample of non-members (400). Data collected from respondents included information on the land they manage; their involvement (or non-involvement) in the ALUS and other conservation programs; and their perspectives on the operation, goals, and future of the ALUS program in the province. Response rates to the surveys were 51% and 31% for members and non-members, respectively. Findings indicated that the PEI ALUS program has performed well from the farmer's perspective and has been effective at increasing BMPs on the agricultural landbase. Farmers provided a number of suggestions related to operation, goals, BMPs covered, payment rates, and others to help improve the program in the future.

Table of Contents

Abstract.....	i
1. Introduction	1
2. Background	2
2.1 ALUS Program Concept and Pilots	2
2.2 ALUS on PEI	3
3. Methods.....	6
3.1 Data collection procedures	6
3.2 Survey Design.....	6
<i>Member Version</i>	6
<i>Non-Member Version</i>	7
<i>Both Versions</i>	7
3.3 Analysis of survey data.....	8
4. Results.....	9
4.1 Response rates and distribution across PEI	9
4.2 Landowner characteristics	9
4.3 Landowner adoption of <i>BMPs</i>	12
<i>Member Adoption of BMPs</i>	12
<i>Non-Member Adoption of BMPs</i>	14
<i>Landowner characteristics associated with adoption of BMPs</i>	15
4.4 Member involvement with the PEI ALUS program	17
4.5 Member satisfaction with the PEI ALUS program.....	18
<i>Program operation</i>	18
<i>Program goals</i>	21
4.6 Non-Member perspectives on the PEI ALUS program.....	24
4.7 Member & Non-Member perspectives on new elements in the PEI ALUS program.....	25
5. Discussion.....	26
6. Acknowledgements.....	29
7. References	30

1. Introduction

Growing public awareness of the deteriorating environmental quality of agricultural landscapes on Prince Edward Island (PEI) has led to increased demand for the protection of environmental goods (EG&S) and services on the island. EG&S can be defined as the positive environmental benefits derived from healthy ecosystems, including wildlife biodiversity and clean air (IISD 2010). Landowners are in a position to adopt practices on their privately owned property which can protect or enhance vital ecological processes. While these environmental services provide benefits to the public as a whole, they come at a direct cost to the producer.

Environmental regulations have been enforced throughout Canada and around the world to help protect environmental goods and services; however there has been criticism over the long-term effectiveness of the regulatory approach to protecting the environment. More recently financial incentives have become a popular alternative for protecting the environment in Canada. The Alternative Land-Use Services (ALUS) program is one such incentive-based approach for the conservation and protection of environmental assets on privately-owned land (Keystone Agriculture Producers 2011). The program pays annual financial incentives to farmers to implement beneficial (or better/best) management practices (BMPs) on their land designed to conserve and protect key environmental assets. While a number of ALUS project pilots have been implemented over the past 10 years, the government of PEI is the first government to implement ALUS as a province-wide program beginning in 2008. Under the program, agricultural producers receive annual payments for supplying a range of EG&S that provide environmental benefits to the public.

The purpose of this report is to assess the PEI ALUS program and provide recommendations for further development. In particular, the current study is focused on three related objectives:

1. Understand who is, and who is not, involved in the program (demographic, farm type, etc. characteristics)
2. Assess member satisfaction with the program, identify areas that could be improved, and understand what could increase member involvement.
3. Assess non-member attitudes toward the program, examine why they are not involved, and understand what would encourage them to become involved.

The next section of this report begins with an overview of the ALUS program concept and then provides details about the program on PEI. The third section outlines the methodology for data collection and analysis. The key survey results are presented in Section 4. The report concludes with a discussion of the main findings and recommendations for further development of the ALUS program on PEI.

2. Background

2.1 ALUS Program Concept and Pilots

The ALUS program is an incentive-based EG&S program initially developed by Manitoba's Keystone Agricultural Producers. The ALUS concept recognizes that farmers are in a position to supply EG&S on their land that provide environmental benefits to the public. It also recognizes that there is a cost to implementing these services (through adoption of BMPs) that is borne by the farmer. The payments under the ALUS program help offset (or compensate the farmer for) some, or all, of these costs. Farmers tend to be in favour of the ALUS program because it allows them to be environmental stewards on their land without compromising their ability to remain competitive in the marketplace (Keystone Agricultural Producers 2011).

A number of ALUS pilot projects have been implemented in Canada over the past 10 years to test the concept. The first ALUS pilot project, launched in the regional municipality of Blanchard Manitoba in November 2005, was designed to test the feasibility of the ALUS concept in local communities (Keystone Agricultural Producers 2011). The three year, \$1.8 million dollar pilot project supported farmers in their efforts to maintain existing wetlands and riparian and natural areas, and to provide for permanent cover on fragile cultivated lands. Funding came from the federal and provincial governments as well as some private contributors. Under the program, farmers were paid \$5 per acre for managed grazing areas; \$15 per acre for taking natural areas, riparian areas and wetlands out of agricultural production; and \$25 per acre for ecologically sensitive lands. The project was deemed a success, with over 20,000 eligible acres being enrolled by 160 landowners in the first year.

A second ALUS pilot project was initiated in Norfolk County, Ontario, through a 2004 proposal developed by the Norfolk Federation of Agriculture (Norfolk ALUS Project 2009). A public opinion survey distributed in 2005 provided information on resident perceptions and awareness of environmental issues, as well as their level of support for a program that would pay

farmers to produce environmental benefits on their land (Greenslade and Bailey 2006). The three-year pilot project which raised over \$1.3 million dollars in funding was launched in September 2007. The main areas targeted for ecological service delivery included wetlands, uplands, riparian zones, and wildlife enhancement. In March 2011 the W. Garfield Weston Foundation announced a \$1.5 million three-year donation to the Norfolk ALUS project. The pilot phase of the program came to an end in March 2011, at which point the program moved into the second phase which is to expand and establish ALUS as a permanent program in Norfolk County.

A third ALUS pilot project was initiated in the County of Vermilion River, Alberta, in 2010 (The Western Producer, 2011). The program pays farmers and ranchers on a per-acre basis (based on the rental rates for land in their area) to create shelterbelts, natural grasses and wetlands. It is funded by private individuals and conservation groups, with in-kind and equipment support provided by the county government. Thus far, projects on over 1,000 acres have been implemented.

A fourth ALUS pilot project was initiated in four rural municipalities in Saskatchewan in December 2011 (Delta Waterfowl 2011). These pilots are set to begin in 2012 and will focus on protecting wetlands, improving riparian areas and enhancing native grasses. Incentives will include cost sharing and/or annual payment based on local land rates.

A forthcoming ALUS pilot is underway in the Ontario Municipality of Bayham, with funding provided by the W. Garfield Weston Foundation, the Ontario Trillium Foundation and the Municipality of Bayham (Tillsonburg News 2012). The program will aim to restore marginal farmlands in the area and will help increase biodiversity, reduce and control soil erosion, improve water quality and enhance wildlife habitat. Other Ontario pilots are planned for Grey Bruce Counties and Caledon (Better Farming 2012).

2.2 ALUS on PEI

In 2007, as interest was growing in the ALUS concept across Canada, two watershed associations in PEI submitted a proposal to Agriculture and Agri-food Canada to implement a two-year EG&S pilot project in the Souris and Founds river watersheds. The objective of the pilot was to evaluate the effectiveness of an incentive based approach for the provision of environmental goods and services on private lands (essentially an ALUS program). Over the two years, more than \$100,000 was paid to landowners for providing a host of BMPs that were

thought to help achieve the program goals. BMPs that increased the most over the two years included creation of grassed headlands, enhanced stream or wetland buffers, nutrient management trials, spring plowing, pesticide risk reduction, among others (Lantz et al. 2009).

The success of the PEI EG&S pilot influenced the PEI Government to adopt the province-wide ALUS Program in 2008 (Souris and Area Branch of the PEI Wildlife Federation 2008). The goals of the PEI ALUS program are to empower farmers in conservation and increase the supply of ecological goods and services across the province, and improve land management by: reducing soil erosion; improving water quality; improve and increase wildlife habitat; and reducing the impacts of climate change (Government of PEI 2012). Six activities designed to address these goals are eligible for payment. The practices and associated payments are shown in Table 1. The payment rates under the provincial program are the same as those used in the EG&S pilot project.

Table 1. PEI ALUS practices and payment rates

Practices	Payment Rates
Establishment of native trees in buffer zones	\$185/ha/year
Retiring sensitive land by expanding buffer zones	\$185/ha/year
Retiring sensitive land by establishing non-regulated grassed headlands	\$185/ha/year
Retiring sensitive land by retiring high-sloped land	\$100/ha/year
Taking land out of production to establish soil conservation structures	\$250/ha/year
Maintaining livestock fences adjacent to watercourses & wetlands	\$0.30/metre/year

The PEI ALUS program runs from 2008 to 2013. Therefore, landowners who signed in 2008 entered into a 5-year contract while those who signed in subsequent years enter into shorter contract lengths. All contracts will be reviewed upon expiry in 2013.

The ALUS Program is administered by the Department of Environment, Labour, and Justice and the PEI Department of Agriculture and Forestry. Local watershed groups and other stakeholders are encouraged to get involved in the program and promote awareness within the community. The provincial government receives feedback on the program from three separate committees, notably the External Committee (composed of non-governmental representatives from all sectors of the economy), the Internal Committee (consists of federal and provincial level government representatives), and the Implementation Committee (coordinates delivery of the

program and consists of the PEI Department of Fisheries and Aquaculture, the PEI Department of Environment, Labour, and Justice, and the PEI Department of Agriculture and Forestry).

Enrollment in the PEI ALUS program has increased annually for all six practices eligible for payment in the first three years of the program (Table 2). As displayed, the largest area (ha) of land enrolled in the program for each of the three years has been “Retiring High-Sloped Land”. The lowest level of enrollment in 2009-10 and 2010-11 was “Tree Planting”. The number of members enrolled in the program as of 2010-11 were 400.

Table 2. PEI ALUS practices and uptake

Practice	Hectares per year ^a			
	2008-2009	2009-2010	2010-2011	<i>Target 2010-11</i>
Tree planting	29	108	222	<i>1000</i>
Expanding buffer zones	59	175	478	<i>1000</i>
Grassed headlands	7	273	451	<i>200</i>
Retiring high-sloped land	261	477	1,142	<i>1,930</i>
Soil conservation structures	56	485	757	<i>600</i>
TOTAL hectares	409	1,477	3,050	<i>4,730</i>
Maintaining livestock fences adjacent to water/wetlands	0	104,287 m	210,062 m	-

^a Unless otherwise specified.

Program administrators provided target levels of uptake for each practice for 2010-11, based on what they thought could be achieved through the program (Table 2). Uptake for tree planting, expanding buffer zones, and retiring high-sloped land were well below their targets. On the other hand, uptake for grassed headlands was more than double its targeted level. Soil conservation structure uptake was also larger than targeted.

Annual program expenditures have increased in line with uptake in practices over the three years of the program (Table 3). A significant increase in enrollment from 2008-09 (the first year of the program) to 2009-10, led to a five-fold increase in payments.

Table 3. PEI ALUS practices and program expenditures

Practice	ALUS Program Expenditures		
	2008-2009	2009-2010	2010-2011
Tree planting	\$5,236	\$19,906	\$41,070
Expanding buffer zones	\$10,915	\$32,431	\$88,430
Grassed headlands	\$1,314	\$50,524	\$83,435
Retiring high-sloped land	\$26,120	\$47,720	\$114,200
Soil conservation structures	\$13,875	\$121,213	\$189,250
Maintaining livestock fences adjacent to water/wetlands (m)	\$0	\$31,286	\$63,019
TOTAL	\$57,459	\$303,079	\$579,404

3. Methods

3.1 Data collection procedures

Farmer perspectives on the PEI ALUS program were elicited through mail surveys sent to each of the 400 landowners participating in the ALUS program (referred to as members) in PEI, and a random sample of 400 landowners not involved with the program (referred to as non-members). Mailing addresses for members and non-members were obtained by the PEI Department of Agriculture and Forestry. Landowners were mailed a copy of the survey along with a cover letter which stated the purpose of the survey and its voluntary and anonymous nature. One week after mailing the survey, recipients were sent a postcard reminding them to complete the survey if they had not already done so. Three weeks after the initial mailing of the member and non-member surveys, non-respondents were mailed a second copy of the survey.

3.2 Survey Design

Both member and non-member survey versions began with a section on the respondents' land on PEI, including questions on the amount of land they own and/or lease, when they first obtained land on the island, and in what county their land is located.

Member Version

In the second section of the member survey, respondents' were asked a series of questions on their involvement in PEI ALUS, including what motivated them to participate in the program and how their land management behaviour has changed since becoming involved in PEI ALUS. The third section of the member survey was designed to elicit member's satisfaction with

the operation of the program. Respondents were asked to rate their level of agreement on a six-point (likert) scale of statements that related to the operation of the program. The questions addressed the receipt of payments, opportunities to provide feedback, the role of their local contact, and the level of administration involved.

In the fourth section, members were asked their opinion on the current ALUS program structure, including the goals of the program and the activities made available for compensation. Specifically, they were asked whether they were satisfied with the current program goals and if not, what goals should be added or removed from the program. Additionally, they were asked to indicate whether they were satisfied with the current levels of payment and if not, what they would change them to. This was an open-ended question directed toward eliciting member's willingness-to-accept compensation for each practice (based on the amount of compensation they felt should be offered to compensate them for the construction, maintenance, inefficiency, foregone opportunity, or any other such costs associated with the practice).

Non-Member Version

The non-member survey was designed to learn about the respondents' current land management behaviour and their perspectives on conservations program on PEI, including ALUS. In the second section respondents' are asked about conservation practices they had either implemented in the past or are currently implementing on their land and whether or not they received cost-share support for them.

The third and fourth sections were devoted to PEI ALUS and other land conservation programs on PEI, respectively. Respondents' were asked about their familiarity with, and views on, the programs, as well as why they had (not) participated in conservation programs in the past and what might convince them to become involved in ALUS in the future.

Both Versions

All respondents' were presented with some information on reverse auctions and asked whether they would support it as an alternate method of payment. Both versions concluded with questions on the respondents' personal views on a range of environmental issues and how they felt land should be managed, as well as some standard demographic questions.

3.3 Analysis of survey data

Responses were first analysed by calculating frequency distributions for each category of response. To provide further insight into landowner characteristics associated with: (i) membership in the PEI ALUS program; and (ii) adoption of specific BMPs, we conducted a number of Logistic regression analyses. Details of the variables used in the regressions are presented in Table 4.

Table 4. Description of variables used in logistic regression analyses

Variables	Description
Dependent Variables:	
Membership in PEI ALUS ^a	Dummy variable (1=member; 0=non-member)
Individual BMPs ^b	Dummy variable (1=member; 0=non-member)
Independent Variables:	
Land Area Farmed	# of hectares
# Land Parcels:	
Purchased	Categorical variable (1=0-1 parcels; 2=2-5 parcels; 3=6-15 parcels; 4=16-30 parcels; 5=31-45 parcels; 6=46+ parcels)
Rented	Categorical variable (same as above for purchased parcels)
County:	
Queen	Dummy Variable (1=Queens; 0=Prince)
Kings	Dummy Variable (1=Kings; 0=Prince)
Farm Type:	
Potato	Dummy Variable (1=Potato; 0=other)
Livestock	Dummy Variable (1=Livestock; 0=other)
Grain/Oilseed	Dummy Variable (1=Grain/Oilseed; 0=other)
Veg/Fruit	Dummy Variable (1=Veg/Fruit; 0=other)
Demographics:	
Male	Dummy Variable (1=Male; 0= Female)
Age 56+	Dummy Variable (1=Age 56+; 0= otherwise)
Grew up rural	Dummy Variable (1=Grew up Rural; 0= otherwise)
Education	Dummy Variable (1=>Highschool; 0=otherwise)
Income	Dummy Variable (1=>\$50,000; 0= otherwise)
Membership in associations:	
Environmental	Dummy Variable (1=member; 0=non-member)
Hunt/Fish	Dummy Variable (1=member; 0=non-member)
ATV/Snow	Dummy Variable (1=member; 0=non-member)
Farm	Dummy Variable (1=member; 0=non-member)
Land	Dummy Variable (1=member; 0=non-member)
Forest	Dummy Variable (1=member; 0=non-member)
Agree with BMP reverse auction	Dummy Variable (1=Agree or strongly agree; 0=otherwise)
Agree with higher payment rates for BMPs in sensitive areas	Dummy Variable (1=Agree or strongly agree; 0=otherwise)

^a This variable was first used as a dependent variable, and then as an independent variable to examine its influence on the implementation of individual BMPs.

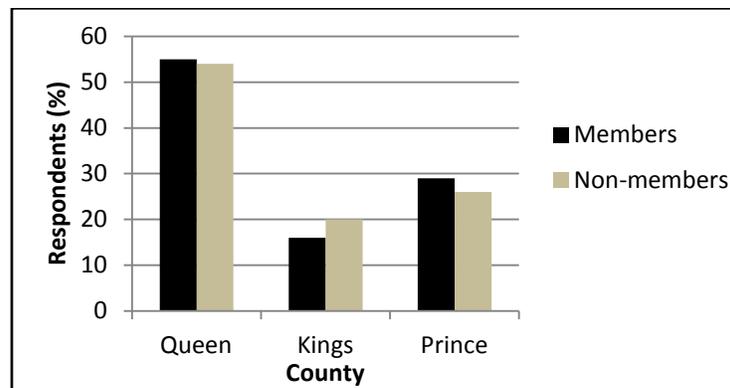
^b Individual BMPs include: Tree planting (in buffers); Expanded buffers; High slope land retirement; Soil conservation structures; Headlands; Fencing (maintaining fencing adjacent to wetlands & waterways); Cover crops; Spring plowing; Hedgerows; Manure mgmt; Nutrient mgmt; and Pest risk mgmt.

4. Results

4.1 Response rates and distribution across PEI

Of the 400 surveys mailed to members of the ALUS program, 204 were returned completed, yielding a 51% response rate. Of the 400 surveys mailed to non-members, 125 were returned completed, yielding a 31% response rate. The percentage breakdown of responses by County was similar among members and non-members, with slightly more than 50% of responses from Queen County (Figure 1).

Figure 1. Question: In what County do you own or lease land?



4.2 Landowner characteristics

A number of land-use differences were observed when comparing member and non-member respondents. For instance, members tended to own or rent relatively more parcels (Table 5) and more acres (Table 6) of land relative to non-members. Indeed, the amount of acreage was almost twice as large for members compared to non-members.

Table 5. Question: How many individual parcels of land do you own/rent on PEI?

	Member		Non-Member	
	Land owned (%)	Land rented (%)	Land owned (%)	Land rented (%)
0-1 parcels	8	43	20	68
2-5 parcels	40	30	52	22
6-15 parcels	35	19	24	7
16-30 parcels	10	5	2	1
31-45 parcels	3	2	1	1
> than 45 parcels	4	1	1	1
Total	100	100	100	100

Table 6. Question: What is the total area of land you own/lease on PEI (in acres)?

	Member	Non-Member
Min	12	0.06
Max	1800	600
Mean	493	211

There was, however, relatively little difference between the two groups in terms of when they obtained their land (Table 7). Most landowners surveyed were not new owners, and had obtained their land before 1990.

Table 7. Question: When did you first obtain land on PEI?

	Member (%)	Non-Member (%)
Before the 1970's	37	30
1970-1980	27	23
1981-1990	21	21
1991-2000	9	17
2001-2011	6	9
Total	100	100

There were larger differences between member and non-member respondents when looking at the type of farm they own (Table 8). Members tended to be largely potato farmers, but others included grains and oil seeds, and livestock. Non-members on the other hand were split between being vegetable or fruit producers, and livestock producers, with 16% of these respondents indicating “other”.

Table 8. Question: What is the main product you produce?

	Member (%)	Non-Member (%)
Potatoes	35	6
Dairy	12	14
Hogs	1	0
Beef	14	20
Grains and oilseeds	16	8
Vegetables & fruit crops	3	21
Other	8	16
Not applicable	11	15
Total	100	100

There were relatively small differences between member and non-member respondents when looking at socio-demographic statistics (Table 9). Respondents tended to be middle aged men. A slightly larger percentage of members grew up rural, had greater than post-secondary education, and had income more than \$50,000, when compared to non-members.

Table 9. Selected demographics

	Member	Non-Member
% male	93%	94%
Average age	53 yrs	55 yrs
% Grew up rural	92%	88%
% > Post-secondary education	44%	38%
Income more than \$50,000	55%	47%

A slightly larger percentage of members were also engaged in environmental and producer groups, when compared to non-members (Table 10).

Table 10. Question: Are you a member of any of the following types of organizations or associations? (check all that apply)

	Members (%)	Non-Members (%)
Environmental/conservation	19	15
Hunting/fishing	7	11
Landowner	10	9
ATV/snowmobile	52	47
Farm commodity producer	38	26
Forestry producer	7	3

A systematic analysis of landowner characteristics associated with the likelihood of ALUS membership was conducted using logistic regression analysis (Table 11). Findings indicated that respondents with higher annual incomes and larger acreage owned or rented were significantly (i.e., with confidence level > 90%) more likely to be ALUS members. On the other hand, respondents who lived in Kings County, were vegetable or fruit farmers, were male, and believed that higher payment rates are needed for the implementation of BMPs on sensitive land were significantly less likely to be members.

Table 11. Logistic regression analysis of landowner characteristics associated with membership in the PEI ALUS program (member =1; non-member=0)

Explanatory Variables		Coefficient
Constant		8.786
Land Area Farmed		0.002*
# Land Parcels:	Purchased	0.133
	Rented	-0.043
County:	Queen	0.501
	Kings	-1.096*
Farm Type:	Potato	0.752
	Livestock	-0.671
	Grain/Oilseed	1.060
	Veg/Fruit	-2.703***
Demographics:	Male	-2.945**
	Age 56+	-0.465
	Grew up rural	0.032
	Education	0.284
	Income	0.305*
Membership in associations:	Environmental	0.050
	Hunt/Fish	-0.525
	ATV/Snow	-0.196
	Farm	-0.208
	Land	-0.305
	Forest	0.402
Agree with BMP reverse auction		0.172
Agree with higher payment rates for BMPs in sensitive areas		-1.390***

^a ***, **, and * indicate 99%, 95%, and 90% levels of confidence, respectively.

4.3 Landowner adoption of *BMPs*

Member Adoption of BMPs

Member adoption of BMPs has increased over the past 10 years (Table 12). The BMPs that have increased the most include expanded buffer zones and high sloped land retirement. Soil conservation structures and the construction of fences were the BMPs that have increased the least amount over the 10 year period.

Table 12. Member Question: What ALUS practices have you implemented before (up to 10 yrs prior) and after you became a PEI ALUS member?

Practice	Before		After		Uptake (% change)	
	# of Members	Total acres ^a	# of Members	Total acres ^a	# of Members	Total acres
Tree planting	34	145	58	225	71	55
Expanded buffer zones	41	189	89	584	117	209
Headlands	42	196	68	544	62	178
High-sloped land retirement	33	143	81	521	145	264
Soil conservation structures	52	675	64	861	23	28
Maintaining livestock fences adjacent to water/wetlands	37	21682 m	44	26646 m	19	23

^a Unless otherwise specified.

Members of the ALUS program have also increased some BMPs that are not currently in the program (Table 13). Some of these include spring plowing which has taken a 41% increase and hedgerows which has taken a 56% increase, although the total number of members implementing this practice is still low at 28. Nutrient management has also increased since the ALUS program has been carried out.

Table 13. Member Question: What other (non-ALUS practices) have you implemented before (up to 10 yrs prior) and after you became a PEI ALUS member?

	Before		After		Uptake (% change)	
	# of Members	Total acres	# of Members	Total acres	# of Members	Total acres
Spring Plowing	44	1651	62	2746	41	66
Fall cover crop or mulch	49	1595	57	1944	16	22
Hedgerows	18	181	28	274	56	51
Nutrient management	39	4467	52	6337	33	42
Improved manure storage & handling	13	627	19	1091	46	74
Pesticide risk reduction	21	2452	25	2892	19	18

Non-Member Adoption of BMPs

Non-member participation was relatively low for BMP adoption (Table 14). Only 34 non-members indicated they've invested in hedgerows, followed closely by non-members investing in livestock fences, and spring plowing. Surprisingly, even though 34 non-members have invested in hedgerows, only seven have received funding from a cost-share program to do so. The lowest rate of participation involved investing in soil conservation structures (10 non-members), but five had been funded by a cost-share program. Other BMPs that non-members are investing in but are not receiving cost-share funding for are spring plows, increased buffer zones, retirement of high-sloped land, and pesticide risk reduction.

Table 14. Non-member Question: Have you ever implemented any of the following practices? If so, what was the area and did you receive cost-share for the practice?

Practice	A	B ^a	C	D	E	F
	Implemented practice		Area of land		Received cost-share support	
	# of Non-members	% of sample (n=128)	# of Non-members	Area (ha) ^b	# of Non-members	% of sample (E/A)
Tree planting	23	18	12	40	9	39
Expanded buffer zones	23	18	13	51	1	4
Headlands	24	19	16	70	4	17
High-sloped land retirement	11	9	5	12	1	9
Soil conservation structures	10	8	8	110	5	50
Maintaining livestock fences adjacent to water/wetlands	32	25	23	8687m	17	53
Spring Plowing	26	20	19	648	0	0
Fall cover crop or mulch	21	16	16	617	3	14
Hedgerows	34	27	20	187	7	21
Nutrient management	22	17	15	706	2	9
Improved manure storage and handling	19	15	8	296	13	68
Pesticide risk reduction	15	12	5	146	1	7

^a Percentages in column B account for non-response cases

^b Unless otherwise specified.

Overall knowledge of cost-share programs is limited for non-members. About 50 percent of non-members are aware of the Enhanced Environment Farm Plan, and the Island Nature Trust. Knowledge of other PEI cost-share programs are much lower (Table 15).

Table 15. Non-Member knowledge of, and participation in, PEI cost-share programs

	Familiar with Program		Participated in Program	
	n	% of sample (n=128)	n	% (column 4/2)
Enhanced Environmental Farm Plan Program	57	52	40	70
Environmental Property Tax Credit Program	15	14	2	14
Canada-PEI Agriculture Stewardship Program	21	20	10	48
Island Nature Trust	53	50	4	8
Other	7	6	7	100

Note: “No Response” cases not included in percentages above

Lack of awareness tends to be the main reason for non-participation in conservation programs. Large amounts of paperwork, and too low of financial incentives can also be contributing factors (Table 16). Respondents indicated that “not trusting the funding organization” did not play a major role in their decision to not participate, and there was no underlying belief that these programs do not aid in environmental protection.

Table 16. Non-Member reasons for not participating in non-ALUS conservation practices

	Non-members (%)
Lack of awareness	43
Financial incentives are too low	15
Too much paperwork	20
I don't trust the funding agency/organization	5
I don't think it will benefit the environment	6
Other	8

Landowner characteristics associated with adoption of BMPs

To help shed some light on the effectiveness of the ALUS program in encouraging landowners to adopt BMPs, an ALUS membership dummy variable and other explanatory variables were regressed on the likelihood of implementing BMPs covered and not covered under the PEI ALUS program. For almost all BMPs covered under the program (with the exception of Headlands), ALUS membership was found to significantly increase the likelihood of implementing the practice (Table 17). Other notable factors that consistently increased the likelihood of a landowner adopting most BMPs included in the ALUS program were: (i) if they more recently obtained their land; (ii) if they were a member of an environment association; and (iii) if they had relatively high incomes.

Table 17. Logistic regression analysis of landowner characteristics associated with adoption of BMPs included in the PEI ALUS program

Explanatory Variables		Tree Planting in Buffers	Expanded Buffers	High Slope Land Retirement	Soil Conservation Structures	Headlands	Fencing
Constant		-1.305	-4.235***	-4.147**	-4.297**	-2.794*	-3.42*
ALUS member		1.028**	1.608***	2.564***	1.402***	0.718	0.991*
Land area		-0.0003	-0.0002	0.0003	0.0002	0.0003	-0.002**
Land obtained		0.082	0.188	0.519***	0.293*	0.429***	0.385**
County:	Queen	-0.070	0.164	1.030**	0.132	0.082	0.372
	Kings	-0.161	-0.200	-0.316	-0.358	-0.043	-0.372
Farm Type:	Potato	-0.090	0.649	1.319**	1.103*	0.949*	-0.066
	Livestock	0.610	-0.221	0.562	-0.635	-0.223	2.498***
	Grain/Oilseed	1.257**	-0.109	0.737	-0.682	-0.315	1.384**
	Veg/Fruit	0.562	-1.543*	-0.514	-0.391	-1.098	-19.654
Demographics:	Male	-1.581**	0.543	-1.151	-0.374	-0.575	-0.867
	Age 56+	0.457	-0.104	-0.207	-0.604	-0.375	-1.204**
	Grew up rural	-0.654	0.394	-0.971	1.129	0.210	0.980
	Education	0.180	0.160	0.141	-0.113	-0.0291	0.179
	Income	0.291**	0.312**	0.031	0.285*	0.046	-0.044
Association Membership:	Environment	1.149***	0.847*	-0.248	0.658	0.985**	0.916*
	Hunt/Fish	-0.355	0.259	-0.208	1.002	-0.162	-0.804
	ATV/snow	0.488	1.462*	3.171***	-0.318	0.320	0.112
	Farm	0.0165	0.172	-0.327	0.560	-0.025	0.649
	Landowner	-0.652*	0.228	0.072	-0.776*	0.588	-0.135
	Forestry	-0.386	0.096	0.388	-0.666	-0.172	-2.501**

Note: ***, **, and * indicate 99%, 95%, and 90% levels of confidence, respectively.

Additional logistic analyses for BMPs not covered under the PEI ALUS program uncovered some interesting findings (Table 18). Here, ALUS membership was not found to systematically affect the likelihood of adopting these BMPs. Notable factors that tend to increase the likelihood of a landowner adopting these BMPs were: (i) if they more recently obtained their land; (ii) if they were a potato producer; (iii) if they grew up rural; and (iv) if they were a member of an environment association.

Table 18. Logistic regression analysis of landowner characteristics associated with adoption of BMPs not included in the PEI ALUS program

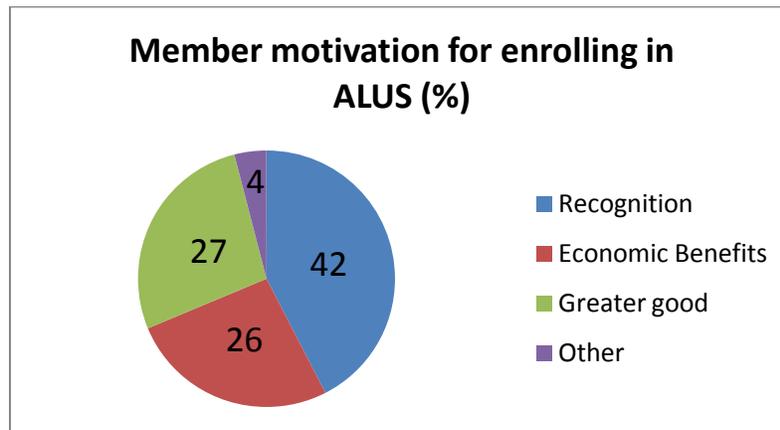
Explanatory Variables		Cover Crops	Spring Plowing	Hedge-rows	Manure Mgmt	Nutrient Mgmt	Pest Risk Mgmt
Constant		-3.350**	-3.603**	0.691	-5.190***	-7.381***	-4.590***
ALUS member		-0.098	-0.011	0.082	0.366	0.420	1.407**
Land area		0.0002	0.0007**	-0.0001	-0.0002	0.0001	0.0004
Land obtained		0.457**	-0.117	0.112	0.195	0.425**	0.449**
County	Queen	0.592	0.214	-0.616	-0.245	0.673	0.030
	Kings	-0.729	-1.391**	-0.913	-0.549	-0.228	-0.672
Farm Type	Potato	1.879***	0.905	-1.158*	-0.826	1.668**	1.650**
	Livestock	0.273	0.365	-0.569	1.155**	0.495	0.673
	Grain/Oilseed	1.447**	1.418**	0.167	0.067	0.776	0.241
	Veg/Fruit	0.701	-0.285	0.432	-1.536	0.783	3.190***
Demographics	Male	0.258	0.741	-0.520	1.282	-1.223	-1.419*
	Age 56+	-0.899**	0.178	-0.698	-0.440	-0.724	-0.080
	Grew up rural	0.251	2.097**	-0.720	1.967*	2.151**	0.328
	Education	-0.189	0.270	-0.152	-0.135	0.605**	0.017
	Income	0.0161	-0.306*	0.126	0.178	0.384**	0.010
Association Membership	Environment	0.830*	1.269***	1.201***	0.611	0.855*	0.618
	Hunt/Fish	0.562	-0.984	-1.691**	-0.534	-0.579	-1.183
	ATV/snow	1.393**	0.959	0.512	-0.222	0.758	0.193
	Farm	-0.023	0.345	0.253	0.511	1.297***	0.775*
	Landowner	-0.717*	-0.777*	-0.436	-0.335	-0.369	0.129
	Forestry	0.177	0.787	0.516	0.548	-0.648	-0.005

Note: ***, **, and * indicate 99%, 95%, and 90% levels of confidence, respectively.

4.4 Member involvement with the PEI ALUS program

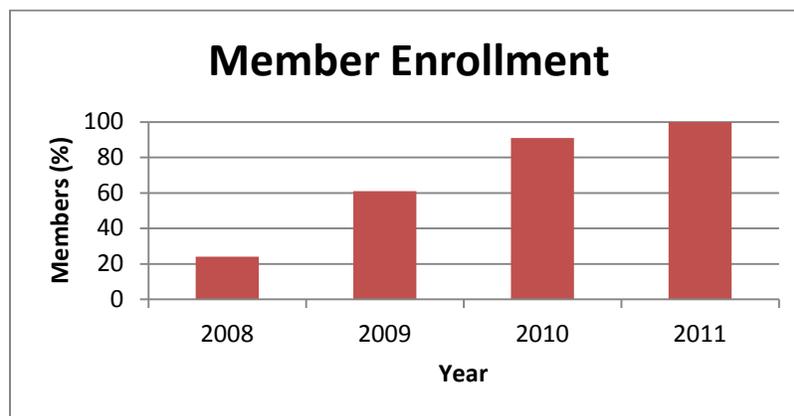
Members indicated a number of reasons for why they became involved in the ALUS program (Figure 2). Over 70% indicated that they did so for either the recognition of their efforts to protect the environment, or for the greater good of society at large. Economic benefits were only considered by 26% as being the main motivating factor.

Figure 2. Member Question: What is your primary motive for participating in the ALUS program (total=100%)



Member enrollment has continued to climb since the program was introduced in 2008 (Figure 3). This is consistent with the historical expenditure trends on the program (Table 3), indicating that as more farmers become members, program expenditures have increased.

Figure 3. Member Question: What years have you participated in ALUS as a member?



4.5 Member satisfaction with the PEI ALUS program

Program operation

Members largely agreed (i.e., agreed or strongly agreed) that the development and delivery of the program was transparent, that the amount of paperwork needed to enrol in the program was acceptable, that payments had been received on time, and that the performance of the program contacts/advisors was acceptable (Table 19). However, a fewer number of members

(around 50%) agreed that they had been given opportunities to participate in discussions related to the program, that they were encouraged to provide comments about it, and that there was program information and updates available to them.

Table 19. Member level of agreement with statements on the operation of the PEI ALUS program

	Members (%)					
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't know
The development and delivery of the ALUS program has been transparent	15	61	15	3	2	3
I have been given opportunities to participate in discussions related to the ALUS program	13	41	32	7	5	4
I am encouraged to provide comments & feedback on the ALUS program	11	45	32	6	3	4
ALUS program information and updates are made available to me	7	49	24	12	4	5
ALUS payments to me have been received on time	21	63	7	3	2	4
I am satisfied with the level of administration (paperwork) involved in the ALUS application process	15	65	12	3	2	3
I am satisfied with the performance of the ALUS program contacts/advisors	26	52	18	2	2	3

Members also largely agreed that having familiar contacts for the program to succeed was important, that the program had encouraged them to implement more practices that improve the environment, that the program contract was acceptable, that they intended to renew their contract in 2013, and that they would recommend becoming a member of the program to other landowners (Table 20). However, a fewer number of members (around 50%) felt that owners of non-agricultural lands should be eligible for ALUS program payments.

A large majority of members agreed that the PEI government would renew the ALUS program in 2013 (Table 21). However, most believed that a longer financial commitment should be made to fund the program. Perspectives were split over the issue of whether or not the government needs more personnel to effectively monitor ALUS, with a majority of members either having no opinion or indicating neutrality with regard to this issue.

Table 20. Member level of agreement with statements on the operation of the PEI ALUS program

	Members (%)					
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't know
Having familiar contacts is important for the success of the ALUS program	27	61	9	2	0	2
ALUS has encouraged me to implement more practices that benefit the environment on my property	17	47	23	8	2	4
I am satisfied with the ALUS contract that landowners are given	15	51	19	8	3	2
I intend on renewing my ALUS program agreement in 2013	28	54	7	1	0	11
I would recommend becoming a member of the ALUS program to other landowners	27	59	11	0	1	2
Owners of non-agricultural lands (e.g., woodlots, etc.) should be eligible for ALUS program payments	18	33	27	9	6	7

Table 21. Member level of agreement with statements on the future of the ALUS program

	Members (%)					
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't know
I think the PEI government will renew the ALUS program in 2013	28	51	9	1	1	9
A longer financial commitment should be made to fund ALUS	36	56	5	1	0	3
The government needs more personnel to effectively monitor ALUS	6	16	39	20	5	13

A number of members (31%) indicated that they would discontinue one or more of their adopted BMPs if funding was revoked and the program was not renewed. Of these landowners, 18% stated they would stop investing in expanding buffer zones, and 12% indicated they would take high sloped land out of retirement (Table 22).

Table 22. Member Question: Which ALUS practices would you discontinue if the program wasn't renewed? (check all that apply)

ALUS Practice	Members (%)
Buffer zone tree planting	6
Expanded buffer zones	18
Non-regulated grassed headlands	8
High-sloped land retirement	12
Soil conservation structures	3
Livestock fences adjacent to water/wetlands	6

Program goals

When asked what goals (if any) should be excluded from the program, only 12% of respondents indicated that at least one goal should be removed. Of these 12%, most (10%) believed the goal regarding climate change mitigation should be excluded, while some (7%) also suggested excluding improving and increasing wildlife habitat.

Table 23. Member Question: What goals should be excluded from the program? (check all that apply)

	# of Members	% of Member responses (n=209)
Improve water quality	10	5
Reduce soil erosion and siltation of watercourses & wetlands	10	5
Improve and increase wildlife habitat	15	7
Reduce the impacts of climate change	20	10

Note: 12% of members felt that one or more goals should be removed from the program.

When asked what goals (if any) should be added to the program, most respondents (73%) felt at least one goal should be added. At the top of the list was improved pest control, followed by increased pollination of crops, improved flood and drought control, and improved waste management and treatment (Table 24). No respondents felt improved landscape views or improved air quality was an important goal to have.

Table 24. Member Question: What goals should be added to the program? (check all that apply)

	# of Members	% of Member responses (n=213)
Improve pest control	99	47
Increase pollination of crops/natural vegetation	74	35
Improve flood/drought control	70	33
Improve waste treatment	61	21
Landscape views	0	0
Air quality	0	0

Note: 73% of members felt that one or more goals should be added.

Almost one half of the members thought that at least one program payment should be modified in some way (Table 25). Thirty five percent of respondents believed the payment for retiring high sloped land should be changed, and 30% believed payment should be changed for expanded buffer zones.

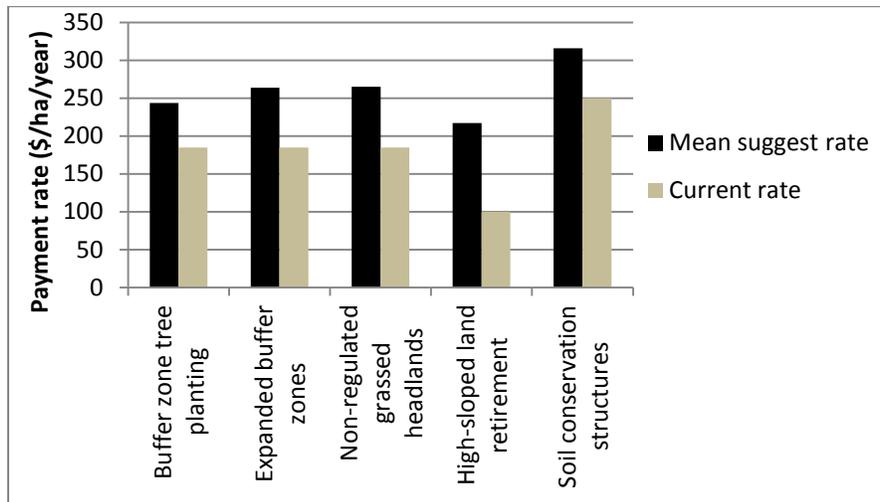
Table 25. Member Question: Do you think any ALUS practice payment level should be changed?

ALUS Practice	# of Members	% of Member responses (n=203)
Buffer zone tree planting	32	16
Expanded buffer zones	60	30
Non-regulated grassed headlands	45	22
High-sloped land retirement	71	35
Soil conservation structures	37	18
Livestock fences adjacent to water/wetlands	47	23

Note: 49% of members (n=97) think at least one program payment level should be changed.

Most of those respondents indicating that payment rates should be changed suggested higher amounts (see Figure 4). The most out-of-line payment rates were thought to be high-sloped land retirement and maintaining livestock fences adjacent to watercourses and wetlands, which members on average thought should be increased by more than 100% of the current payment rates. Payment rates for other practices such as buffer zone tree planting, expanded buffer zones, non-regulated grassed headlands, and soil conservation structures should be increased in the range of 30-40% on average according to members.

Figure 4. Member Question: What should the payment rates be for ALUS practices to cover the cost of implementation?



Note: The average suggested payment rate indicated by members for maintaining livestock fences adjacent to watercourses and wetlands is \$0.62 per meter per year, up from the current \$0.30 per meter.

Members also indicated they would like to see other BMPs added into the program such as fall cover crops, and spring plowing (Table 26).

Table 26. Member Question: Do you think any of the following practices should be added to the ALUS program? And, if so, what do you think the payment should be?

Practices	Practice should be added:		Payment rate:	
	# of Members	% of Member responses (n=204)	# of Members	Member Mean Payment Rate (\$/ha/year)
Spring plowing	92	45	62	70
Fall cover crop	101	50	67	89
Land utilized by hedgerows	71	35	41	177
Mulching	61	30	41	125
Nutrient management	66	32	35	105
Conservation tillage	61	30	31	92
Remove land prone to flooding	58	28	37	167
Improved manure storage & handling	54	27	27	121
Pesticide risk reduction	65	32	27	107

Note: 78% of members (n=159) think that at least one of the practices should be added to the program.

4.6 Non-Member perspectives on the PEI ALUS program

Non-members indicated a number of reasons for why they have not become ALUS members (Table 27). A total of 45% indicated that lack of awareness was the main reason why they had not become members. Interestingly, only 11% indicated that financial incentives were too low to participate, and only 9% indicated that paperwork was too onerous. These paperwork and financial incentive response percentages were slightly lower compared to when non-members were asked about other conservation programs. This indicates that non-members may believe ALUS has less paperwork and better financial incentives compared to other conservation programs on the island.

Table 27. Non-member Question: What is the main reason why you have not participated in PEI ALUS program?

	Non-members (%)
Lack of awareness	45
Financial incentives are too low	11
Too much paperwork	9
I don't trust the government	4
I don't think it will benefit the environment	1
Other	25
No reply	5

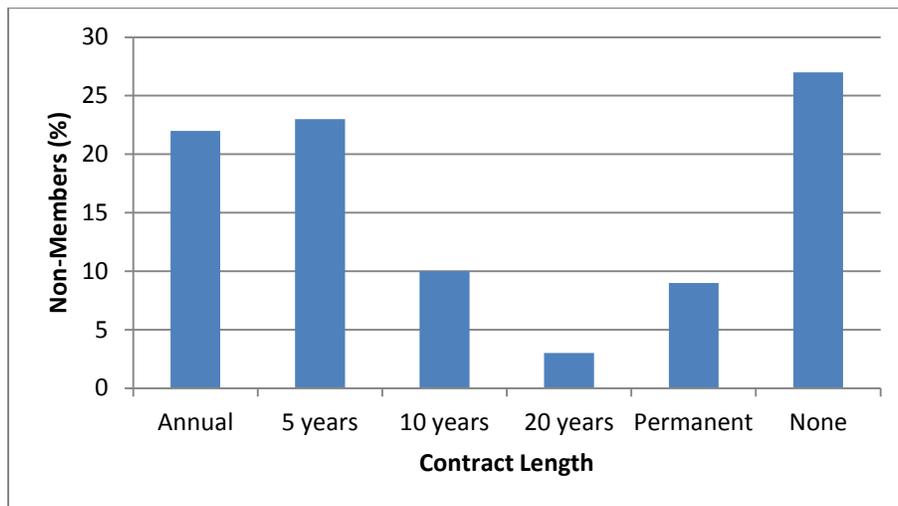
When asked “*what would convince you to become involved in the PEI ALUS program*”, 47% of respondents indicated increased financial incentives (Table 28). This response was followed closely by having pride in being a good steward, and having higher prices for agriculture commodities produced with sound environmental management practices, respectively.

Contract length was also a factor for non-members influencing their decision to participate in the ALUS program in the future. Respondents indicated they would be more likely to participate in the program if there was no contract, an annual contract, or a five year contract compared to a 10 or 20 year contract (Figure 5).

Table 28. Non-member Question: What would convince you to become involved in the PEI ALUS program? (check all that apply)

	Non-members (%)
Increased financial incentives	47
Pride in being a steward of your land	39
If the government set requirements for environmental farm plans	10
More information on the impacts of farming practices on the environment	15
New or improved technology for crops and/or livestock	11
Better access to technical assistance and extension services	21
If my neighbours undertook these kinds of practices	9
Higher prices for agricultural commodities produced with sound environmental management practices	37

Figure 5. Non-member Question: What contract length would you require in order to consider being involved in the ALUS program?



4.7 Member & Non-Member perspectives on new elements in the PEI ALUS program

When asked whether they would be willing to participate in a reverse auction (after a brief description of what it would involve was provided), few members (6%) or non-members (12%) replied in the affirmative (Table 29).

Table 29. Question: Would you be willing to participate in a reverse auction for implementing an ALUS practice if it was offered?

	Member (%)	Non-Member (%)
Yes	6	12
No	46	46
Unsure	48	42

A slightly smaller number of members (38%) compared to non-members (43%) indicated that they would be in favour of higher ALUS payment rates for practices in areas that were more environmentally sensitive.

Table 30. Question: Are you in favour of higher ALUS payment rates for practices in areas that are more environmentally sensitive?

	Member (%)	Non-Member (%)
Yes	38	43
No	31	19
Unsure	31	38

5. Discussion

The findings of this study provide important information to policy-makers with regard to the success of the PEI ALUS program to-date, and about its future development. In terms of program success to-date, program members indicated that their BMP adoption has substantially increased since the program began in 2008. Specifically, their responses indicated that BMPs covered under the program have increased in the range of 23% for livestock fences to 264% for high-sloped land retirement. Further statistical analysis of responses indicated that ALUS members were more likely to have adopted BMPs covered under the ALUS program than non-members (with the exception of Headlands). This finding provides some evidence of program effectiveness.

Interestingly, members also indicated that, since the ALUS program began, they have increased their adoption of BMPs not covered under the program, ranging from 18% for pesticide risk reduction to 74% for improved manure storage and handling. While this result may lead one to speculate that the ALUS program is encouraging members to improve their overall stewardship of the land, further statistical analysis of landowner characteristics associated with

adoption of BMPs did not confirm this outcome at an acceptable level of confidence for all but one BMP (namely, pest risk management).

Members were on average generally satisfied with the operation of the program as a whole. Most intend on renewing their contracts in 2013, should the program be offered. However, there were a number of operational issues highlighted by a majority (or close to a majority) of members that might be considered by the administrators of the program, including:

- Providing more opportunities for members to participate in discussions related to the program.
- Encouraging members to provide comments and feedback about the program.
- Ensuring that members are aware of program information and updates.
- Providing a longer financial commitment to the program.
- Providing more personnel to effectively monitor the program.

Members also had a number of suggestions about how to modify the program goals and BMPs covered under the program. The following suggestions, highlighted by a majority (or close to a majority) of members, might be considered by program administrators:

- Adding improved pest control as a goal in the program.
- Adding fall cover crops and spring plowing as an additional BMP covered under the program.

Regarding non-members, lack of awareness tended to be the most common reason why they have not participated in the program (with 45% of respondents indicating this as the primary reason). Additionally, close to a majority of non-members (47%) indicated that increased financial incentives would convince them to become involved in the program. These findings indicate that program administrators might consider:

- Directing additional efforts toward providing non-members with information about the program.
- Increasing financial incentives to attract non-members into the program.

Finally, when considering a reverse auction or higher payment rates for practices in areas that are more environmentally sensitive under the PEI ALUS program in the future, a majority of members and non-members indicated they would either not be in favour or were uncertain of such new elements. Since a relatively large number of landowners (30-40%) were uncertain

about these elements, more information and discussion would likely have to take place before they would feel comfortable with the concepts.

Overall, this research has found that the PEI ALUS program has performed well from the farmer's perspective and has been effective at increasing BMPs on the agricultural landbase. Farmers have provided a number of suggestions related to operation, goals, BMPs covered, payment rates, and others to help improve the program in the future. Additional considerations discussed in the literature on agri-environmental programs, but not assessed in any detailed manner in this report, may include: (i) assessing the effectiveness of the adopted BMPs at achieving program objectives (i.e., environmental quality monitoring and assessment); (ii) examining the extent to which reverse auctions (and higher payments for practices in areas that are more environmentally sensitive) could increase the cost-effectiveness of the program; and (iii) understanding the extent to which other incentives (such as technical assistance, public recognition, property tax breaks, product price premiums, etc.) could be combined with ALUS payments to encourage further BMP uptake by farmers (Knight 2010; Kenny et al. 2011; Naidoo 2011; Vercaemmen 2011). Such considerations, once combined with farmer's perspectives on the program, would result in a thorough assessment of the program and provide additional input into the most appropriate direction for the program in the future.

6. Acknowledgements

The authors gratefully acknowledge financial support provided by the Linking the Environment and Agriculture Research Network (LEARN) at the University of Alberta, and the Department of Environment, Labour, and Justice on PEI. We would also like to thank the PEI ALUS program coordinator Shawn Hill for all his assistance with this project, and the PEI Department of Agriculture and Forestry for their collaboration.

7. References

- Better Farming (2012). ALUS programs spread north and east. Available at: <http://www.betterfarming.com/online-news/alus-programs-spread-north-and-east-5505> (Accessed: Oct 22, 2012).
- Delta Waterfowl (2011). Saskatchewan Launches New Conservation Program. Available at: <http://www.deltawaterfowl.org/media/deltanews/111208-ALUS.php> (Accessed: December 9, 2011).
- Government of PEI (2012). Prince Edward Island Alternative Land Use Services. Available at: http://www.gov.pe.ca/photos/original/af_alusguide.pdf (Accessed: Oct 10, 2012).
- Greenslade, L., R. Bailey (2006). Alternative Land Use Services (ALUS): A benchmark survey of public opinion on the environment in relation to farming and the quality of life in Norfolk County. Report prepared for the Norfolk Federation of Agriculture and others. Available at: http://www.kap.mb.ca/alus/norfolk_execsummary.pdf (Accessed: September 13, 2011).
- IISD (2010). Analysis of EG&S Policy Options Fostering Adaption of Canadian Farmers to Climate Change and Development of a Decision-making Tool. Available at: http://capi-icpa.ca/pdfs/2011/CAPI_EG&S_English_final.pdf (Accessed: April 5, 2012).
- Kenny, A., S. Elgie, D. Sawyer (2011). Advancing the economics of ecosystems and biodiversity in Canada: a survey of economic instruments for the conservation and protection of biodiversity. Report prepared for Sustainable Prosperity. Available at: <http://www.sustainableprosperity.ca/dl534&display> (Accessed: Nov 1, 2012).
- Keystone Agricultural Producers (2011). Alternative Land Use Services (ALUS): Farmers Growing a Better Environment. Available at: <http://www.kap.mb.ca/alus.htm> (Accessed: April 5, 2012).
- Knight, T. (2010). Enhancing the flow of ecological goods and services to society: key principles for the design of marginal and ecologically significant agricultural land retirement programs in Canada. Report prepared for the Canadian Institute for Environmental Law and Policy. Available at: <http://www.cielap.org/pdf/EnhancingTheFlow.pdf> (Accessed: Nov 1, 2012).
- Lantz, V. et al. (2009). PEI ecological goods and services pilot project. Report prepared for the Souris and Area Branch of the PEI Wildlife Federation. Available at: <http://www.souriswl.ca/FINALE.pdf> (Accessed: Oct 23, 2012).

- Naidoo, R. (2011). Impact evaluation in Canadian agricultural landscapes: scoping the science. Research Report prepared for the Linking Environment & Agricultural Research Network, University of Alberta. Available at:
http://www.learnnetwork.ualberta.ca/en/PublicationsCommunications/~media/learnnetwork/Publications%20and%20Communication/Documents/RP-02-2011_Naidoo-et-al.pdf
(Accessed: Sept 10, 2012).
- Norfolk ALUS Pilot Project (2009). Alternative Land Use Services. Available at:
<http://www.norfolkalus.com> (Accessed: April 5, 2012).
- Souris and Area Branch of the PEI Wildlife Federation (2008). ALUS Program. Available at:
<http://www.souriswl.ca/ALUS.html>.
- The Western Producer (2011). Conservation program moves to Alberta. Available at:
<http://www.producer.com/2011/07/conservation-program-moves-into-alberta/> (Accessed: Sept 10, 2012).
- Tillsonburg News (2012). ALUS program helps farmers, environment. Available at:
<http://www.tillsonburgnews.com/2012/05/14/alus-program-helps-farmers-environment>
(Accessed: Sept 10, 2012).
- Vercammen, J. (2011). Agri-environmental regulations, policies, and programs. Canadian Journal of Agricultural Economics 59: 1-18.