GEORGE MORRIS CENTRE

Canada's Independent Agri-Food Think Tank

Ecological Goods and Services: Estimating Program Uptake and the Nature of Costs/Benefits in Agro-Manitoba

FINAL REPORT

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EXECUTIVE SUMMARY

The Canadian agriculture and agri-food industry operates in close connection with the surrounding environment (Lefebvre et al., 2005). The sustainability of the sector depends on its ability to co-exist with the natural environment.

Beneficial management practices (BMPs) are a key driving force for the protection of the environment under the current Agricultural Policy Framework (APF) in Canada. However, in recent years, a new concept of environmental management, referred to as ecological goods and services (EG&S) or simply 'ecosystem services', has emerged. The Millennium Ecosystem Assessment (2005) defines ecosystem services as the benefits that people obtain from ecosystems. Examples of these services include food and water provision, climate and flood regulation, cultural services, and supporting services such as photosynthesis and soil formation. The human species, while buffered against environmental changes by culture and technology, is fundamentally dependent on the flow of ecosystem services.

Farmers and ranchers, as land managers, have the opportunity to adopt effective or promising responses that conserve or sustainably enhance the direct supply of ecosystem services provided by their lands (as recommended in the Millennium Ecosystem Assessment, 2005). In Canada, pilot projects that reward farmers and ranchers for ongoing practices specifically aimed at maintaining or enhancing the natural capital on their farms that provide direct ecosystem services are in progress (Norfolk Federation of Agriculture, 2007; Keystone Agricultural Producers, 2007).

There is growing recognition among producers, governments, and other stakeholders that EG&S are vital to Canada's economic and social well-being (Wildlife Habitat Canada, 2006). Therefore, adaptive institutions need to be developed to ensure that the contributions to human well-being provided by ecosystem services can be sustained and enhanced. Systems of payment for ecosystem services can be one effective element in these institutions (Costanza, 2007).

Manitoba Agriculture, Food and Rural Initiatives (MAFRI) was interested in evaluating the costs and benefits of implementing a potential EG&S program across Agro-Manitoba. This research represents a response to that interest.

The specific objectives of this project were:

- To determine the nature and extent of EG&S qualifying lands throughout Manitoba and across various agri-environmental regions.
- To describe the potential environmental and other benefits from an EG&S program and the main environmental practices involved.
- To estimate program expenses for low, medium and high adoption rates on EG&S qualifying lands.
- To estimate the value of environmental and other benefits resulting from low, medium and high adoption rates on EG&S qualifying lands.
- To develop an analytical framework that compares the costs and benefits of various scenarios.
- To recommend an approach for staging the introduction of an EG&S program in Agro-Manitoba based on cost/benefit parameters.

To meet the objectives of the study, the following procedures were undertaken. First, a review of the concept of EG&S and the relationship between ecosystem services and the environmental and human benefits generated was conducted. Second, telephone interviews, an online survey, and a focus group were conducted with local stakeholders in Manitoba in order to ensure stakeholder involvement in the design of a potential EG&S program. Once program design scenarios were determined, geographical information systems (GIS) analysis was used to estimate the number of acres that would be eligible for the potential EG&S program in Manitoba. Given the results of the GIS analysis, the costs and benefits of the potential program were estimated using dollar values transferred from the literature and other sources. These costs and benefits were calculated as net present values as well as benefit-cost ratios under various scenarios. Finally, conclusions and recommendations stemming from the research were identified.

The following sections summarize the results of various elements of the research.

Literature Review

The literature review focused on the environmental and human benefits arising from the increased adoption of EG&S practices and provision of ecosystem services by farmers. In particular, the literature review explored the benefits of maintaining or enhancing wetlands, riparian buffers, natural areas and ecologically sensitive lands.

Many environmental and human benefits accrue from the existence of wetlands (Gabor et al., 2001). In their review of the literature, van Diggelen et al. (2006) listed the following environmental benefits of wetlands: the enhancement of biodiversity, carbon storage, water purification, water holding capacity and the provision of natural resources including game, fish, reed and wood (van Diggelen et al., 2006).

The environmental and human benefits of buffer strips, which include riparian buffers or zones along watercourses, include: reduction of soil loss due to wind and water erosion; removal of fertilizers and pesticides; the removal of pathogens from field runoff; reduction of the movement of pollutants overland to streams; increase of biodiversity of flora and fauna; and provision of wildlife corridors (Conestoga-Rovers & Associates, 2006; Hickey and Doran, 2004; Lovell and Sullivan, 2006). It was also noted that it is very difficult to make predictions about the effectiveness of a buffer under site-specific conditions (Hickey and Doran, 2004). Hickey and Doran (2004) concluded that buffers 30 to 100 m in width are most effective but there is not enough information available regarding the effectiveness of buffers in the 1 to 10 m width range.

Information presented by Di and Cameron (2002) suggested that maintaining or enhancing natural areas that include forest and grasslands could provide an environmental benefit related to the control of nitrate leaching and a human benefit related to water purification.

Research conducted by McMaster and Davis (2001) examined the impact of the Permanent Cover Program that was established on marginal cultivated lands with high erosion risk in the Prairie Provinces in the 1990s. The research showed that permanent cover locations enhanced grassland bird species richness.

Overall, there are many environmental and human benefits associated with preserving and enhancing EG&S and natural capital.

Interviews

The main purpose of the interviews and online survey was to gain an understanding of the environmental and farm issues that are prevalent in various regions of Manitoba, as well as to solicit feedback on potential EG&S program design. A total of 15 telephone interviews and 5 additional online surveys were completed.

Overall, the respondents mentioned riparian areas, wetlands, lakes and escarpments as key environmentally sensitive areas. Respondents felt that water quality and quantity was the top environmental concern in Manitoba, followed by concern about soil quality.

The majority of the respondents stated that environmental management practices to maintain the physical landscape including riparian areas, wetlands, natural areas, and wildlife habitat were currently in place; however, adoption of these practices was low.

When asked to identify the types of environmental management practices that they would like to see eligible for EG&S payments in their local area, respondents mentioned wetlands and riparian areas most frequently.

With respect to the potential design of an EG&S program in Manitoba, most respondents agreed with a provincially based program with flexibility for accommodating a bundle of local management practices specific to particular areas. For the most part, environmentally sensitive areas were the desired target. However, a few respondents disagreed with targeting in any form and suggested a uniform program across the province. Long term continuous payments were observed as the general preference among the respondents. Common responses regarding eligibility criteria included that individuals must be owners of the land to be eligible and that higher preference should be given to agricultural landowners as well as high risk or sensitive lands.

Focus Group

This section outlines the key insights from the focus group discussion that took place at the Winnipeg Winter Club in Winnipeg, Manitoba on November 27th, 2007. Overall, 41 stakeholders participated in the workshop.

The stakeholders identified the following objectives and criteria when considering potential EG&S program design in Manitoba:

- Program should have sustainable long term funding
- Program should have an education and communication component
- Program should be adaptive and flexible
- Program should be measurable, accountable and multi-functional
- Program should be compatible with rural culture
- Program should have public support
- Program should achieve healthy functioning watersheds
- Program should achieve sustainable agriculture
- Other important considerations include landowner acceptability and the impact on landowner decision making and behaviour.

The focus group participants confirmed that every stakeholder has a role to play within the development of the potential EG&S program and that the magnitude of the role depends on the stakeholder.

During the focus group, the following types of land were viewed as eligible for a potential EG&S program:

- Riparian Areas
- Wetlands
- Upland Natural Areas
- Fragile Lands

Within these categories, the participants felt that lands should be targeted based on largest potential environmental benefit from program participation.

In terms of eligible practices, the participants felt that all practices that maintain, rehabilitate and enhance the environment (and, hence, EG&S) should be eligible for the potential program. They also suggested that the Alternative Land Use Services (ALUS) pilot project appears to be encompassing.

Overall, stakeholders suggested a provincial program that has a targeted approach based on regional issues.

With respect to payment structure, stakeholders identified various options including:

- Opportunity cost plus incentives for key areas (e.g., sensitive or high risk)
- Bidding system
- Multifunctional market based program
- Annual long term payments
- Based on environmental outcomes (e.g. benefit indexing)
- Premiums for longer term contracts

In terms of eligibility criteria, the participants felt that the program should be voluntary and be available to landowners only. They felt that historical stewardship should be eligible if focused on maintenance and on-going delivery of environmental benefits. In addition, the participants suggested contract lengths ranging from 3-10 years.

In terms of potential adoption of an EG&S program by landowners, the participants felt that adoption could range from 30-70% and, overall, they anticipated high uptake.

The focus group participants also identified a number of shortcomings and risks that need to be taken into account when considering an EG&S program including:

- Uncertainty about level of funding
- Perception of landowners
- Public perception/public relations
- Uncertainty in terms of program design based on sound science and market realities
- Difficulties in choosing target regions
- Administrative costs
- Competition among neighbours with bidding process
- Design impacted by budget

<u>Proposed EG&S Program Design</u>

Based on the information collected in the interviews and focus group, the research team developed an EG&S program design for use in the cost-benefit analysis. The main points are as follows:

Eligibility Criteria

For this analysis, we assumed that participation would be voluntary and that only agricultural landowners would be eligible to participate in the program.[1]

Eligible Land

- Wetlands
    - All sizes of wetlands were deemed eligible for this program.
- Natural Uplands
    - Any upland maintained with native grassland, bushes and trees, or any combination thereof.
        - Note that fallow land is not eligible for the potential program.
- Ecologically Sensitive Lands
    - Land subject to severe water erosion, wind erosion, flooding, salinity, runoff or leaching (ALUS Technical Advisory Committee, 2006).
        - Land classes 4, 5, 6 and 7 were assumed to be eligible under the ecologically sensitive land service.
- Riparian areas were modelled as part of eligible lands within the sensitivity analysis but not within the original cost-benefit analysis. This is due to the fact that given impending riparian zone buffer regulations in Manitoba, there may not be a need for EG&S payments for some types of buffers.

Eligible Practices

All practices that maintain, rehabilitate and enhance the environment and ultimately produce EG&S were given consideration for this program. After detailed discussions with both the focus group participants and the interviewees, it was determined that practices eligible for the ALUS pilot project in Manitoba seemed reasonable (i.e. no agricultural use; haying permitted; controlled grazing permitted).

Level of Payments

Because of a lack of consensus among stakeholders, a scenario approach was developed to assess various ways to approach payment level determination. The scenarios are all based on continuous annual payments. The scenarios included:

- Payments based on rental rates for marginal and productive land (proxy for opportunity costs)
- Payments based on crop revenues and expenses for marginal and productive land (proxy for opportunity costs)
- Payments based on the ALUS pilot project (assuming no agricultural use payment levels).

Contract Length

A number of suggestions were offered in the interviews and focus group for the length of contracts for the provision of EG&S in Manitoba, ranging anywhere from 3 to 10 years. Since

[1] Note that, due to data restrictions, the number of eligible acres for wetlands and natural uplands encompass all of the areas of wetlands and natural uplands on private lands in rural Manitoba (rather than only land owned by agricultural landowners). The number of eligible acres for ecologically sensitive lands and riparian areas reflect only agricultural and forage crop land.

there was no consensus on the contract length, three scenarios were evaluated using 3, 6 and 10 year contracts.

Adoption Rates

Using the results of the interviews and focus group as a guide, four scenarios representing various levels of adoption of eligible acres were determined. Specifically, the total acres of eligible land were adjusted by 30%, 50% and 70% to estimate total program costs and benefits for various levels of participation in the program (i.e., adoption rates for eligible land). A 100% adoption rate was also used.

GIS Analysis

The number of eligible acres in Agro-Manitoba for the types of eligible land was estimated using GIS analysis to be:

Wetlands = 1,417,922 acres
Natural uplands = 9,079,354 acres
Ecologically sensitive lands = 1,517,713 acres
3 m buffers = 10,176 acres
10 m buffers = 45,827 acres
25 m buffers = 136,536 acres
50 m buffers = 340,438 acres

Note that the numbers for wetlands and natural uplands encompass all of the areas of wetlands and natural uplands on private lands in rural Manitoba (rather than only land owned by agricultural landowners). The numbers for ecologically sensitive lands and buffer strips reflect only agricultural and forage crop land.

Cost-Benefit Analysis

Methods

Specific values were transferred from the literature to represent the various costs and benefits of the potential EG&S program. These values are described in detail in sections 6.2.1 and 6.2.2.

A cost-benefit analysis model was developed to quantify the present values of net benefits for 36 scenarios. For each payment scenario, net benefits were calculated by subtracting the present value of costs (payment + administrative + start-up) from the present value of benefits (environment, recreation and government). The 36 scenarios are combinations of three payment types (ALUS, rental rates, crop budgets), three contract lengths (3, 6 and 10 years) and four adoption rates (100%, 70%, 50% and 30%), as shown in Table E.1. The 36 scenarios were repeated for an alternative benefit discounting scenario, yielding a total of 72 net benefit values of the proposed EG&S program in Manitoba.

Table E.1 Summary Table of Modeled Scenarios

Payment Scenario		**ALUS**			**Rental Rate**			**Crop Model**		
Adoption Rate	*Contract Length:*	*3*	*6*	*10*	*3*	*6*	*10*	*3*	*6*	*10*
1										
0.7										
0.5										
0.3										

The two benefit discounting scenarios that were conducted both used a discount rate of 4%. In the first scenario, the three types of benefits (i.e., environmental, recreation and government on a per acre basis) were discounted in annuity[2] under the assumption that annual benefits would accrue at the end of each year for the length of the contract. These discounted per acre benefits were then multiplied by the number of eligible acres of each land type, resulting in the present value of total benefits for each land type. This scenario assumes that agricultural producers do not maintain any of the ecological goods or services on their land beyond the completion of their contracts under an EG&S program.

The second scenario involved discounting the environmental and recreational benefits (per acre) in perpetuity[3] and the government benefits (per acre) in annuity (as before). This scenario assumes that maintained or established EG&S under the program would provide benefits beyond the contract length, i.e., agricultural producers would maintain EG&S on their land (e.g., do not revert land into agriculture, drain wetlands, destroy buffers); however, the benefits to government would cease when the contracts ended as any administrative savings (i.e., benefits) would no longer be applicable. Again, in this scenario, the discounted per acre benefits were then multiplied by the number of eligible acres of each land type to determine the present value of total benefits for each land type.

A sensitivity analysis was conducted to determine how the results changed when key values (assumptions and inputs) within the model changed. The first sensitivity analysis involved the benefit value of wetlands. The value for wetlands was adjusted to account for a lower value from the literature. A second sensitivity analysis was conducted on the crop prices used to determine the crop model-based payment scenario.[4] A third sensitivity analysis involved lowering the administration costs as a percentage of program costs. Finally, the sensitivity analysis included eligible acres for riparian areas as part of program costs and benefits.

Results of the Original Cost-Benefit Analysis

The results of the original cost-benefit analysis (i.e. without sensitivity analysis) are presented in Tables E.2 and E.3. Table E.2 presents the results for the various scenarios based on the assumption that all benefits are discounted in annuity. Table E.3 presents the results for the various scenarios based on the assumption that the environmental and recreational benefits are discounted in perpetuity and that the government benefits (i.e. savings) are discounted in annuity.

[2] Annuity: equal, fixed amount received (or paid) each year for a number of years (Boardman et al., 2006)
[3] Perpetuity: an annuity that continues indefinitely (Boardman et al, 2006).
[4] The spreadsheets used in this research can also be adjusted to change net income per acre for the purposes of the crop model payment scenario. Given the high nature of crop prices at the time of this research, lowering net income per acre may be an effective tool for accounting for lower crop prices.

Table E.2 Present Value of Net Benefits of an EG&S Program in Manitoba – All Benefits Discounted in Annuity (in million $)

Payment Scenario		**ALUS**			**Rental Rate**			**Crop Model**		
Adoption Rate	*Contract Length:*	*3*	*6*	*10*	*3*	*6*	*10*	*3*	*6*	*10*
1	PVB	10,811	20,423	31,599	10,811	20,423	31,599	10,811	20,423	31,599
	PVC	1,117	1,672	2,316	2,305	3,448	4,777	1,531	2,291	3,174
	NPV	**9,694**	**18,751**	**29,282**	**8,507**	**16,975**	**26,821**	**9,280**	**18,132**	**28,425**
0.7	PVB	7,568	14,296	22,119	7,568	14,296	22,119	7,568	14,296	22,119
	PVC	782	1,170	1,622	1,613	2,414	3,344	1,072	1,603	2,222
	NPV	**6,786**	**13,126**	**20,498**	**5,955**	**11,882**	**18,775**	**6,496**	**12,692**	**19,897**
0.5	PVB	5,406	10,211	15,799	5,406	10,211	15,799	5,406	10,211	15,799
	PVC	559	836	1,158	1,152	1,724	2,389	766	1,145	1,587
	NPV	**4,847**	**9,375**	**14,641**	**4,253**	**8,487**	**13,411**	**4,640**	**9,066**	**14,212**
0.3	PVB	3,243	6,127	9,480	3,243	6,127	9,480	3,243	6,127	9,480
	PVC	335	502	695	691	1,034	1,433	459	687	952
	NPV	**2,908**	**5,625**	**8,785**	**2,552**	**5,092**	**8,046**	**2,784**	**5,440**	**8,527**
Benefits/Cost (all adoption rates)		**10**	**12**	**14**	**5**	**6**	**7**	**7**	**9**	**10**

Min **2,552**

Max **29,282**

Average **11,519**

Table E.3 Present Value of Net Benefits of an EG&S Program in Manitoba – Environmental and Recreational Benefits Discounted in Perpetuity (in million $)

Payment Scenario		**ALUS**			**Rental Rate**			**Crop Model**		
Adoption Rate	*Contract Length:*	*3*	*6*	*10*	*3*	*6*	*10*	*3*	*6*	*10*
1	PVB	97,008	97,051	97,101	97,008	97,051	97,101	97,008	97,051	97,101
	PVC	1,117	1,672	2,316	2,305	3,448	4,777	1,531	2,291	3,174
	NPV	**95,891**	**95,379**	**94,785**	**94,704**	**93,603**	**92,324**	**95,477**	**94,760**	**93,927**
0.7	PVB	67,906	67,936	67,971	67,906	67,936	67,971	67,906	67,936	67,971
	PVC	782	1,170	1,622	1,613	2,414	3,344	1,072	1,603	2,222
	NPV	**67,123**	**66,766**	**66,349**	**66,292**	**65,522**	**64,627**	**66,834**	**66,332**	**65,749**
0.5	PVB	48,504	48,526	48,551	48,504	48,526	48,551	48,504	48,526	48,551
	PVC	559	836	1,158	1,152	1,724	2,389	766	1,145	1,587
	NPV	**47,945**	**47,690**	**47,392**	**47,352**	**46,802**	**46,162**	**47,738**	**47,380**	**46,964**
0.3	PVB	29,102	29,115	29,130	29,102	29,115	29,130	29,102	29,115	29,130
	PVC	335	502	695	691	1,034	1,433	459	687	952
	NPV	**28,767**	**28,614**	**28,435**	**28,411**	**28,081**	**27,697**	**28,643**	**28,428**	**28,178**
Benefits/Costs (all adoption rates)		**87**	**58**	**42**	**42**	**28**	**20**	**63**	**42**	**31**

Min **27,697**

Max **95,891**

Average **59,087**

The following are the key observations stemming from the original cost-benefit analysis results:

- The present values of net benefits of an EG&S program are much higher when environmental and recreational benefits are discounted in perpetuity instead of in annuity. This is an obvious result since the perpetuity scenario assumes environmental and recreational benefits accrue beyond the length of the contract, whereas the annuity scenario only measures benefits for the length of the contract.
- The highest present value of net benefits stem from the 100 percent adoption, ALUS payment scenario (for both the annuity and perpetuity benefit discounting scenarios). These net benefits amount to $29,282 million (environment and recreational benefits discounted in annuity) and $95,891 million (environmental and recreational benefits discounted in perpetuity) and benefit-cost ratios of 14 and 87, respectively.
    - When benefits are discounted in annuity, a 10 year contract yields the highest net benefit.
    - When benefits are discounted in perpetuity, a 3 year contact yields the highest net benefit.
- The lowest present value of net benefits stem from the rental rate payment scenario (for both the annuity and perpetuity benefit discounting scenarios). These net benefits amount to $2,552 million (environment and recreational benefits discounted in annuity) and $27,697 million (environmental and recreational benefits discounted in perpetuity).
    - Both lowest present values of net benefits are under the rental rate payment scenarios with a 30 percent adoption rate.
    - When benefits are discounted in annuity, a 3 year contract yields the lowest net benefits. The benefit-cost ratio in this case is 5.
    - When benefits are discounted in perpetuity, a 10 year contract yields the lowest net benefits. The benefit-cost ratio in this case is 20.
- The average present values of net benefits for all adoption rates, contract lengths and payment scenarios are $11,519 million and $59,087 million, when benefits are discounted in annuity and perpetuity, respectively. If both benefit discounting scenarios are considered, the average present value of net benefits is $35,303 million.

Results of the Sensitivity Analysis

The following table (Table E.4) compares the original cost-benefit analysis results to those of the sensitivity analyses. The table shows the average present value of net benefits and the highest (maximum) present value of net benefits. As discussed previously, the maximums always occur in the case where benefits are discounted in perpetuity. The table also shows the average of the maximums for the annuity and perpetuity-discounted benefit cases (a more realistic result, since, as mentioned previously, some farmers are likely to allow benefits to accrue beyond the length of the contract while others are not). In addition, the percentage change in the average maximums in the sensitivity analyses are compared with the original analysis average maximums. Finally, the table shows the conditions (payment scenario, contract length and adoption rate) that yield the maximum present value of net benefits in each cost-benefit analysis scenario.

As the table shows, the administrative cost and riparian land sensitivity analyses yield only small differences in the results as compared to the original cost-benefit analysis (CBA). However, the decrease in wetland value has a significant impact on the original results.

Table E.4 Comparison of Cost-Benefit Analysis and Sensitivity Analysis Results

CBA scenario	Original CBA	Wetland Value	Admin Cost	Riparian Lands
Average NPV* (million $)	35,303	1,247	35,409	35,268 (50 m) to 35,302 (3 m)
Max NPV** (million $)	95,891	6,187	95,950	95,896 (3 m) to 96,068 (50 m)
Max NPV Scenario	ALUS, 3 year contract, 100% adoption	ALUS, 3-year contract, 100% adoption	ALUS, 3-year contract, 100% adoption	ALUS, 3-year contract, 100% adoption
Max Benefit/Cost Ratio (annuity; perpetuity)	14; 87	1.08; 6.54	14.75; 91.71	13.60; 86.53

*Average of all present values of net benefits (both benefit-discounting scenarios)
**Highest present value of net benefits (always under the perpetuity benefit discounting scenario)

Conclusions

Taking into account the net present values as well as the sensitivity analysis, we make the following conclusions regarding EG&S programming in Manitoba.

In terms of the payment structure of a potential EG&S program, this research found that ALUS payment levels yield the highest present values of net benefits (and benefit-cost ratios) in all of the scenarios analyzed. Similarly, a 100% adoption rate yields the highest net benefits; as such, potential programming should not be limited in terms of acreage, but would likely be limited in terms of cost.

Contract length is a more complex variable. The cost-benefit analysis results indicate that a 10-year contract (longest contract option) is preferable when benefits are discounted in annuity. When benefits are discounted in perpetuity, a 3-year contract (shortest contract option) is preferable. We concluded that shorter contract lengths yield the highest net benefits when benefits are discounted in perpetuity because the benefits are not dependent on contract length in this case (i.e. benefits are the same for all contract lengths). On the other hand, payments increase as contract length increases (since payments are in annuity) resulting in net benefits declining with contract length.

However, when both benefit discounting scenarios are considered (i.e., the average of the two benefit discounting scenarios), net benefits increase with contract length. The average of the two scenarios is a realistic assumption since, in reality, some landowners may allow the benefits to accrue beyond the length of program contracts, whereas others may not. Therefore, based on the net benefits, we recommend that a relatively long, 10-year contract length be used in potential EG&S program design.

Within the original cost-benefit analysis, all of the scenarios yield a large positive net benefit from the adoption of a potential EG&S program. The highest present value of net benefits of an EG&S program would result from an ALUS payment, 100% adoption rate, 10-year contract scenario. Under this scenario, the maximum present value of net benefits is between $29,282 million (benefits discounted in annuity) and $94,785 million (benefits discounted in perpetuity).

The lowest present value of net benefits would result from the rental rate, 30% adoption, 3-year contract scenario. Again, in this case, rental rate payments and a 30% adoption rate come out

at the bottom whether benefits are discounted in annuity or perpetuity. Under this scenario, the present value of net benefits ranges from $2,552 million to $28,411 million.

The large positive net benefits from the adoption of a potential EG&S program resulting from the original cost benefit analysis are primarily due to the high dollar value that has been used to estimate the benefits of wetlands (specifically, the benefits of wetlands are valued at $2,555/acre).

Within the sensitivity analysis, the value of wetland benefits is lowered to $25.78/acre. This change significantly affects the results of the research. Using the lower value for wetlands, many of the scenarios within the annuity assumption yield negative present values of net benefits due to the fact that the costs now outweigh the benefits. Note that under the perpetuity assumption, net benefits remain positive.

Considering that the wetland value is uncertain, it is important to note the results stemming from the decreased wetland value sensitivity analysis. As with the original cost-benefit analysis, the results indicate that ALUS payments and a 100% adoption rate yield the highest present value of net benefits in this sensitivity analysis scenario. However, the preferable contract length is different in this analysis than in the original analysis; a 3-year contract length yields the highest present value of net benefits.

Under the ALUS, 100% adoption, 3-year contract length scenario, the maximum present value of net benefits, as determined by this sensitivity analysis (i.e. with a lower wetland value), is between $-258 million (benefits discounted in annuity) and $6,187 million (benefits discounted in perpetuity). Therefore, the range is significantly different than that resulting from the original analysis, and, as a matter of fact, there is potential for net losses from an EG&S program under this scenario. **Therefore, the results of the research are highly dependent on the value placed on the benefits of wetlands.**

When considering EG&S program design, there are many other considerations that must be taken into account, as suggested within the stakeholder consultations. The considerations include:

- Level of funding and any uncertainties surrounding funding
- Landowner perceptions
- Public perceptions and relations
- Uncertainty in terms of program design with respect to science and market realities
- Difficulties in selecting areas to target for potential EG&S program delivery
- Administrative costs
- Program delivery

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AAFC	Agriculture and Agri-Food Canada
ALUS	Alternative Land Use Services
APF	Agricultural Policy Framework
BMP	Beneficial Management Practice
CAIS	Canadian Agricultural Income Stabilization
CBA	Cost-Benefit Analysis
CRP	Conservation Reserve Program
CWB	Canadian Wheat Board
DFA	Designated Forage Areas
DFAIT	Department of Foreign Affairs and International Trade Canada
EG&S	Ecological Goods and Services
FSA	Farm Service Agency
GIS	Geographical Information Systems
MAFRI	Manitoba Agriculture, Food and Rural Initiatives
MASC	Manitoba Agricultural Services Corporation
METB	Marginal Excess Tax Burden
MLI	Manitoba Land Initiative
NPV	Net Present Value
NRCS	Natural Resources Conservation Services
OECD	Organisation for Economic Co-operation and Development
WCE	Winnipeg Commodity Exchange
WTO	World Trade Organization

1.0 Introduction

The Canadian agriculture and agri-food industry operates in close connection with the surrounding environment (Lefebvre et al., 2005). The sustainability of the sector depends on its ability to co-exist with the natural environment. Under the current Agricultural Policy Framework (APF), the Environment Pillar was designed to meet three major objectives: achieve meaningful and measurable improvements in soil, water and air quality and the agriculture industry's impact on biodiversity; research and develop new on-farm beneficial management practices; and make environmental information available for better land use planning and management and provide the tools to support on-farm action (AAFC, 2008).

As demonstrated by the three objectives described above, beneficial management practices (BMPs) are a key driving force for the protection of the environment under the current APF. In Canada, a BMP is a voluntary agricultural management practice and is typically used to mitigate environmental risk posed by a farm (AAFC, 2007a). However, in more recent years, a new concept of environmental management, referred to as ecological goods and services (EG&S) or simply 'ecosystem services', has emerged. The Millennium Ecosystem Assessment (2005) defines ecosystem services as the benefits people obtain from ecosystems. Examples of these services include food and water provision, climate and flood regulation, cultural services, and supporting services such as photosynthesis and soil formation. The human species, while buffered against environmental changes by culture and technology, is fundamentally dependent on the flow of ecosystem services.

Many ecosystem services are traditionally viewed as "free" benefits to society or as "public goods" (e.g., wildlife habitat and diversity, watershed services, pollination, carbon storage, and clean air). For many of these services, there is a high cost for replication outside the natural environment. However, lacking a formal market, these natural assets are traditionally absent from society's analyses of worth, and their critical contributions are often overlooked in public, corporate, and individual decision-making (Millennium Ecosystem Assessment, 2005). However, Costanza (2007) suggests that ecosystem services and the natural capital assets that produce them represent a significant contribution to sustainable human well-being which is larger than the contribution of marketed goods and services. Costanza et al. (1997) estimated the economic value of the world's ecosystem services and natural capital at US$33 trillion per year, about 1.8 times the annual global gross national product (GNP) at the time.

Farmers and ranchers, as land managers, have the opportunity to adopt effective or promising responses that conserve or sustainably enhance the direct supply of ecosystems services provided by their lands (as recommended in the Millennium Ecosystem Assessment, 2005). In Canada, pilot projects that reward farmers and ranchers for ongoing practices that are specifically aimed at maintaining or enhancing the natural capital on their farms that provide direct ecosystem services are in progress (Norfolk Federation of Agriculture, 2007; Keystone Agricultural Producers, 2007). As part of the Alternative Land Use Services (ALUS) pilot project in the Rural Municipality of Blanshard, Manitoba, landowners enrol eligible acres of wetlands, riparian areas, ecologically sensitive lands and natural areas in a three year commitment to protect and enhance these areas. In turn, landowners receive continuous annual payments.

There is growing recognition among producers, governments, and other stakeholders that EG&S are vital to Canada's economic and social well-being (Wildlife Habitat Canada, 2006). Therefore, adaptive institutions need to be developed to ensure that the contributions to human well-being provided by ecosystem services can be sustained and enhanced. Systems of

payment for ecosystem services can be one effective element in these institutions (Costanza, 2007).

Manitoba Agriculture, Food and Rural Initiatives (MAFRI) was interested in evaluating the costs and benefits of implementing an EG&S program across Agro-Manitoba. This project is in response to that interest.

1.1 Purpose and Objectives

The purpose of this project was to evaluate the costs and benefits of a potential EG&S program with consideration to the various agri-environmental regions of Agro-Manitoba.

The specific objectives of this project were:

- To determine the nature and extent of EG&S qualifying lands throughout Manitoba and across various agri-environmental regions.
- To describe the potential environmental and other benefits from an EG&S program and the main environmental practices involved.
- To estimate program expenses for low, medium and high adoption rates on EG&S qualifying lands.
- To estimate the value of environmental and other benefits resulting from low, medium and high adoption rates on EG&S qualifying lands.
- To develop an analytical framework that compares the costs and benefits of various scenarios.
- To recommend an approach for staging the introduction of an EG&S program in Agro-Manitoba based on cost/benefit parameters.

1.2 Report Outline

To respond to the purpose and objectives outlined above, the research was broken into seven sections:

- Section 1.0 Introduction
- Section 2.0 Literature Review
- Section 3.0 Methods and Approach
- Section 4.0 Program Design
- Section 5.0 GIS Analysis and Results
- Section 6.0 Cost-Benefit Analysis
- Section 7.0 Conclusions and Recommendations

Section 1.0 of the report introduces the research. Section 2.0 provides an overview of the literature pertaining to environmental and human benefits arising from EG&S. Section 3.0 describes the methods for this research. Section 4.0 outlines the proposed design of the potential EG&S program in Manitoba, given the feedback received from stakeholder consultations. Section 5.0 presents the results of the GIS analysis which estimated the number of acres that would be eligible for the potential EG&S program in Manitoba. Section 6.0 presents the cost-benefit analysis of the potential program. Section 7.0 outlines the conclusions and recommendations stemming from the research.

2.0 Literature Review

This section provides a description of EG&S and reviews the environmental benefits arising from the increased adoption of EG&S practices and provision of ecosystem services which are expected to result from the potential EG&S program in Manitoba. Section 2.1 introduces the EG&S concept and provides an overview of ecosystem services in the global perspective, including the various definitions used, the components of EG&S, and the link between these components and human well-being, as described in the literature. Section 2.2 describes the connection between EG&S, natural capital and agriculture with a focus on the role of beneficial management practices to this relationship. Section 2.3 is a description of the benefits from maintaining or enhancing natural ecosystems in agricultural landscapes, as identified in the literature. This section focuses on the review of scientific literature that describes the relationship between ecosystem services and the related environmental and human benefits generated. Section 2.4 presents a summary of the literature review.

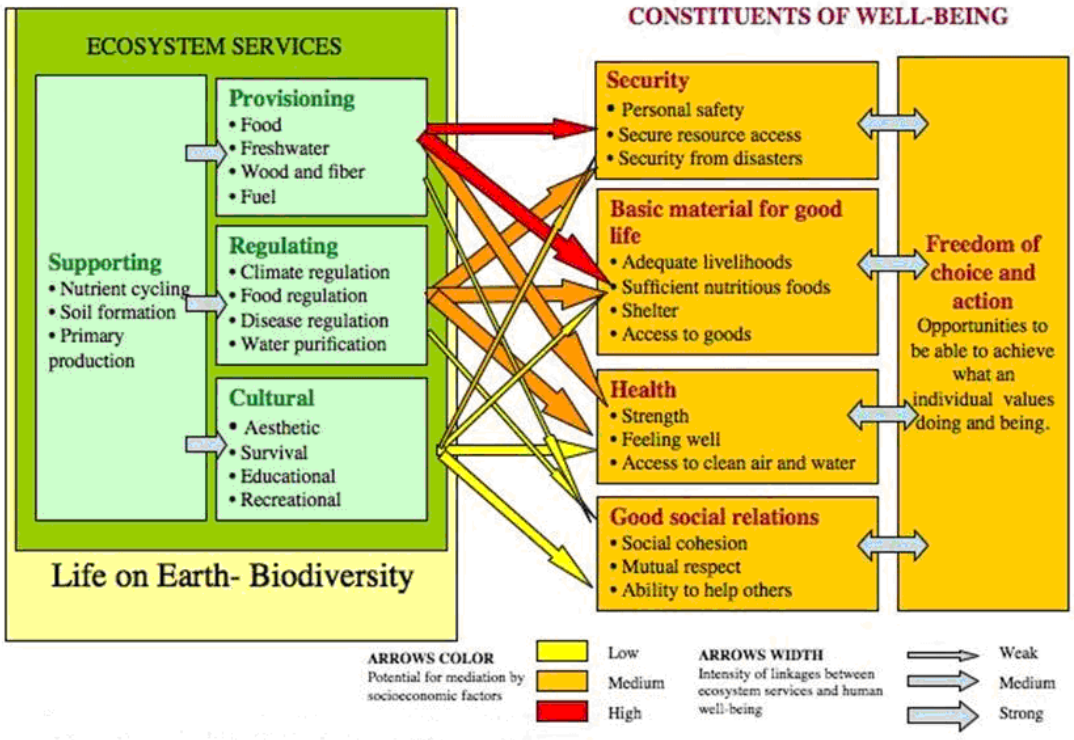
2.1 Introduction to EG&S

EG&S are variously referred to as ecosystem services, environmental services and natural capital (Gagnon et al., 2005).

The Millennium Ecosystem Assessment[5] (2005) defines ecosystem services as the benefits people obtain from ecosystems. These include provisioning services such as food, water, timber, and fibre; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling (Millennium Ecosystem Assessment, 2005). The human species is fundamentally dependent on the flow of ecosystem services; hence, the importance of these services in a policy context (Millennium Ecosystem Assessment, 2005; Whitten et al., 2003). Figure 2.1 illustrates the complicated linkages between ecosystem services and human well-being.

[5] *The Millennium Ecosystem Assessment (MA) was conducted under the auspices of the United Nations, with the secretariat coordinated by the United Nations Environment Programme, and it was governed by a multistakeholder board that included representatives of international institutions, governments, business, NGOs, and indigenous peoples. The objective of the MA was to assess the consequences of ecosystem change for human well-being and to establish the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contributions to human well-being.* Excerpt from *Ecosystems and Human Well-Being: Synthes*is (Millennium Ecosystem Assessment, 2005).

Figure 2.1 Linkages Between Ecosystem Services and Human Well-being



Source: (Millennium Ecosystem Assessment, 2005)

The following excerpt (adapted from Box 2.1: Ecosystem Services (Millennium Ecosystem Assessment, 2005)) explains the scope of each service.

Provisioning Services - These are the products obtained from ecosystems, including:

- *Food.* This includes the vast range of food products derived from plants, animals, and microbes.
- *Fiber.* Materials included here are wood, jute, cotton, hemp, silk, and wool.
- *Fuel.* Wood, dung, and other biological materials serve as sources of energy.
- *Genetic resources.* This includes the genes and genetic information used for animal and plant breeding and biotechnology.
- *Biochemicals, natural medicines, and pharmaceuticals.* Many medicines, biocides, food additives such as alginates, and biological materials are derived from ecosystems.
- *Ornamental resources.* Animal and plant products, such as skins, shells, and flowers, are used as ornaments, and whole plants are used for landscaping and ornaments.
- *Fresh water.* People obtain fresh water from ecosystems and thus the supply of fresh water can be considered a provisioning service. Fresh water in rivers is also a source of energy. Because water is required for other life to exist, however, it could also be considered a supporting service.

Regulating Services - These are the benefits obtained from the regulation of ecosystem processes, including:

- *Air quality regulation.* Ecosystems both contribute chemicals to and extract chemicals from the atmosphere, influencing many aspects of air quality.
- *Climate regulation.* Ecosystems influence climate both locally and globally. At a local scale, for example, changes in land cover can affect both temperature and precipitation. At the global scale, ecosystems play an important role in climate by either sequestering or emitting greenhouse gases.
- *Water regulation.* The timing and magnitude of runoff, flooding, and aquifer recharge can be strongly influenced by changes in land cover, including, in particular, alterations that change the water storage potential of the system, such as the conversion of wetlands or the replacement of forests with croplands or croplands with urban areas.
- *Erosion regulation.* Vegetative cover plays an important role in soil retention and the prevention of landslides.
- *Water purification and waste treatment.* Ecosystems can be a source of impurities (for instance, in fresh water) but also can help filter out and decompose organic wastes introduced into inland waters and coastal and marine ecosystems and can assimilate and detoxify compounds through soil and subsoil processes.
- *Disease regulation.* Changes in ecosystems can directly change the abundance of human pathogens, such as cholera, and can alter the abundance of disease vectors, such as mosquitoes.
- *Pest regulation.* Ecosystem changes affect the prevalence of crop and livestock pests and diseases.
- *Pollination.* Ecosystem changes affect the distribution, abundance, and effectiveness of pollinators.
- *Natural hazard regulation.* The presence of coastal ecosystems such as mangroves and coral reefs can reduce the damage caused by hurricanes or large waves.

Cultural Services - These are the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences, including:

- *Cultural diversity.* The diversity of ecosystems is one factor influencing the diversity of cultures.
- *Spiritual and religious values.* Many religions attach spiritual and religious values to ecosystems or their components.
- *Knowledge systems* (traditional and formal). Ecosystems influence the types of knowledge systems developed by different cultures.
- *Educational values.* Ecosystems and their components and processes provide the basis for both formal and informal education in many societies.
- *Inspiration.* Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture, and advertising.
- *Aesthetic values.* Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for parks, scenic drives, and the selection of housing locations.
- *Social relations.* Ecosystems influence the types of social relations that are established in particular cultures. Fishing societies, for example, differ in many respects in their social relations from nomadic herding or agricultural societies.
- *Sense of place.* Many people value the “sense of place” that is associated with recognized features of their environment, including aspects of the ecosystem.

- *Cultural heritage values.* Many societies place high value on the maintenance of either historically important landscapes ("cultural landscapes") or culturally significant species.
- *Recreation and ecotourism.* People often choose where to spend their leisure time based in part on the characteristics of the natural or cultivated landscapes in a particular area.

Supporting Services - Supporting services are those that are necessary for the production of all other ecosystem services. They differ from provisioning, regulating, and cultural services in that their impacts on people are often indirect or occur over a very long time, whereas changes in the other categories have relatively direct and short-term impacts on people. (Some services, like erosion regulation, can be categorized as both a supporting and a regulating service, depending on the time scale and immediacy of their impact on people.) These services include:

- *Soil Formation.* Because many provisioning services depend on soil fertility, the rate of soil formation influences human well-being in many ways.
- *Photosynthesis*. Photosynthesis produces oxygen necessary for most living organisms.
- *Primary production*. The assimilation or accumulation of energy and nutrients by organisms.
- *Nutrient cycling.* Approximately 20 nutrients essential for life, including nitrogen and phosphorus, cycle through ecosystems and are maintained at different concentrations in different parts of ecosystems.
- *Water cycling*. Water cycles through ecosystems and is essential for living organisms.

The United Nations Millennium Ecosystem Assessment reviewed 74 response[6] options for ecosystem services, integrated ecosystem management, conservation and sustainable use of biodiversity, and climate change. Many of these options hold significant promise for conserving or sustainably enhancing the supply of ecosystem services (Millennium Ecosystem Assessment, 2005).

Natural capital is a variation of the concept of EG&S. In literature, natural capital includes: natural resources capital (e.g., minerals, forests, water), ecosystems and environmental capital (e.g., wetland, forest and riparian ecosystems) and land (i.e., the space humans use) (Olewiler, 2004). Natural capital represents both the list of assets and the amounts or stocks of these assets that are present locally. Natural capital is lost, or is depreciated, mainly due to conversion of lands to other human uses, for example, homes, roads, food production (Olewiler, 2004). Therefore, although the concept of the stock of environmental assets is the focus of the natural capital definition, natural capital can be regarded as equivalent to EG&S. Both constitute natural assets that can be of value to humans. The concepts of natural capital and

[6] A response is considered to be **effective** when its assessment indicates that it has enhanced the particular ecosystem service (or, in the case of biodiversity, its conservation and sustainable use) and contributed to human well-being without significant harm to other ecosystem services or harmful impacts to other groups of people. A response is considered **promising** either if it does not have a long track record to assess but appears likely to succeed or if there are known means of modifying the response so that it can become effective. A response is considered **problematic** if its historical use indicates either that it has not met the goals related to service enhancement (or conservation and sustainable use of biodiversity) or that it has caused significant harm to other ecosystem services (Millennium Ecosystem Assessment, 2005).

EG&S can also be related by considering natural capital as a source (or "capital") for the provision of EG&S.

2.2 Ecosystem Services, Natural Capital and Agriculture

Farmers and ranchers, as land managers, have the opportunity to adopt effective or promising responses that conserve or sustainably enhance the direct supply of ecosystems services provided by their lands (as recommended in the Millennium Ecosystem Assessment, 2005). They can do this by maintaining or enhancing the wetlands, riparian buffers, natural areas and ecologically sensitive lands (i.e., the natural capital) they own. The responses that farmers and ranchers use to achieve these outcomes are identified as beneficial management practices (BMPs) (Gagnon et al., 2005; Millennium Ecosystem Assessment, 2005).

A beneficial management practice (BMP) is defined as any agricultural management practice that: ensures the long-term health and sustainability of land-related resources used for agricultural production; positively impacts the long-term economic and environmental viability of the agricultural industry; and minimizes negative impacts and risk to the environment (AAFC, 2007a). Gagnon (2005), however, suggests that those BMPs related to the provision of ecosystem services should be essentially beneficial to the environment; a practice should enhance positive impacts rather than limit negative impacts on the environment.

2.2.1 Selected Practices

In Canada, there are well-established funding programs aimed at encouraging the adoption and use of a wide variety of BMPs (AAFC, 2007a; Ontario Soil and Crop Improvement Association, 2006). In Manitoba, the Canada-Manitoba Farm Stewardship Program provides farmers and ranchers with access to funding to help them adopt, but not necessarily maintain, effective or promising BMPs that conserve or sustainably enhance the direct supply of ecosystems services provided by wetlands, riparian buffers, natural areas or ecologically sensitive lands that may or could exist on their lands. The following table (Table 2.1) outlines four examples of BMPs that are: a) funded by the Canada-Manitoba Farm Stewardship Program, b) provide a direct supply of ecosystem services, and also, as suggested by Gagnon (2005), c) enhance the positive impacts rather than limit the negative impacts of agriculture on the environment.

Table 2.1 Selected BMPs Providing Ecosystem Services

BMP No.	BMP Category	Category of Ecosystem Service To Humans*	BMP Description: List of Ecosystem Services Providing Human Benefit
10	Riparian area management	Provisioning service: food	Produces forage; provides shelter for wildlife, livestock, and fish
		Regulating service: erosion regulation	Builds and maintains banks and shorelines
		Supporting service: primary production and nutrient cycling	Protects aquatic life
		Regulating service: water purification and waste treatment	Maintains the quality of surface water

BMP No.	BMP Category	Category of Ecosystem Service To Humans*	BMP Description: List of Ecosystem Services Providing Human Benefit
		Supporting service: primary production and nutrient cycling	Ensures the riparian areas serve as islands and corridors for biodiversity
13	Land management for soils at risk	Regulating service: erosion regulation	Minimizes erosion and salinization in critical areas on agricultural land
21	Enhancing wildlife habitat and biodiversity	Supporting service: primary production and nutrient cycling	Increases wildlife habitat
		Supporting service: primary production and nutrient cycling	Restores native biodiversity
		Regulating service: climate regulation	Reduces greenhouse gases through sequestration of atmospheric carbon
17	Nutrient Recovery from Waste Water	Regulating service: water regulation; and water purification and waste treatment	Constructed wetlands prevent contamination that may be released into surface waters
Ref.	(AAFC, 2007a)	Developed by Cordner Science based on the (Millennium Ecosystem Assessment, 2005)	(AAFC, 2007a)

* some services may fit more than one category

The literature search did not produce lists of detailed field-level practices that were specifically identified or described in the context of maintaining or enhancing the direct provision of ecosystem services within agricultural landscapes. However, a review of descriptions of relevant BMP practices provided in the Canadian Environmental Farm Plan and US Natural Resources Conservation Service (NRCS) programs indicated that these objectives could be met if many of these practices were adopted (AAFC, 2007a; Ontario Farm Environmental Coalition, 2004; USDA, 2007a).

It is recognized that existing BMP programs provide support and funding on a cost-share basis for adoption or implementation of practices by farmers or ranchers. The costs of maintaining or enhancing a practice are not necessarily covered in these programs. In Canada, pilot projects that reward farmers and ranchers for ongoing practices that are specifically aimed at maintaining or enhancing the natural capital on their farms that provides direct ecosystem services are in progress (Norfolk Federation of Agriculture, 2007; Keystone Agricultural Producers, 2007).

The Alternative Land Use Services (ALUS) pilot project in the Rural Municipality of Blanshard, Manitoba includes the following practices. The project is described in greater detail in Appendix A.

Wetlands[7]

a) Maintenance of wetlands with no agricultural use
   - Leave in natural state
   - No burning, draining, filling or clearing

b) Maintenance and or enhancement of wetlands with haying permitted
   - No burning, draining, filling or clearing
   - Haying permitted between July 15th and August 31st inclusive.

c) Maintenance and/or enhancement of wetland areas with controlled grazing permitted
   - Minimum 75% ground cover surrounding wetland areas
   - Continuous season long grazing is not permitted (no grazing before July 1st)
   - Less than 15% of the total shoreline has evidence of pugging*, rutting* and or hummocking*
   - Maintain average minimum height for grasses 10-15 centimetres (4-6 inches)
   - Adequate off-site watering system required at a minimum 15 metres (50 feet) setback from water source

Riparian Buffers

a) Maintenance of riparian cover to obtain an adequate buffer zone with no agricultural use
   - Leave in natural state
   - No burning, breaking or clearing

b) Maintenance and/or enhancement of riparian cover to obtain an adequate buffer zone with haying/mowing permitted
   - No burning, breaking or clearing
   - Riparian buffer could be rejuvenated by overseeding (chemical burn off excluded)

c) Maintenance and/or enhancement of riparian areas with controlled grazing permitted
   - Minimum 75% ground cover surrounding wetland areas
   - Continuous season long grazing is not permitted (no grazing before July 1st)
   - Less than 15 % of the total shoreline has evidence of pugging, rutting and or hummocking
   - Maintain average minimum height for grasses 10-15 cm (4-6 inches)
   - Adequate off-site watering system required at a minimum 15 metre (50 feet) setback from water source

Ecologically Sensitive Land

a) Maintenance for ecologically sensitive lands taken of out of annual production and put into perennial cover, with no agricultural use
   - No burning or breaking

b) Maintenance and/or enhancement for ecologically sensitive lands taken out of annual production and put into perennial cover with haying permitted
   - No burning or breaking
   - Lands could be rejuvenated by overseeding (chemical burn off excluded)

c) Maintenance and/or enhancement for ecologically sensitive lands taken out of annual production and put into perennial cover, grazing permitted
   - No burning or breaking
   - Lands could be rejuvenated by overseeding (chemical burn off excluded)
   - Minimum 75% ground cover surrounding wetland areas
   - Continuous season long grazing is not permitted (no grazing before July 1st)

[7] Note that under ALUS, all isolated wetlands and wetland complexes including associated uplands are eligible under wetland services. The ratio of permanent cover upland areas (to be established) to wetlands may not exceed 5 to 1. Source: (ALUS Technical Advisory Committee, 2006).

- Less than 15% of the total shoreline has evidence of pugging, rutting and or hummocking
- Maintain average minimum height for grasses 10-15 cm (4-6 inches)
- Adequate off-site watering system required at a minimum 15 metre (50 feet) setback from water source

Natural Areas

a) Maintenance of wooded natural areas with no agricultural use:
- No burning, clearing or breaking

b) Maintenance of grassland natural areas with no agricultural use:
- No breaking
- Prescribed burning permitted or chemical control of woody species

c) Maintenance and/or enhancement of grassland natural areas with haying permitted

d) Maintenance and/or enhancement of wooded natural areas under an approved woodlot management plan

e) Maintenance and/or enhancement of wooded natural areas with controlled grazing permitted
- Minimum 75% ground cover surrounding wetland areas
- Continuous season long grazing is not permitted (no grazing before July 1st)
- Less than 15 % of the total shoreline has evidence of pugging, rutting and or hummocking
- Maintain average minimum height for grasses of 10-15 cm (4-6 inches)
- Adequate off-site watering system required at a minimum 15 metre (50 feet) setback from water source

f) Maintenance and/or enhancement of grassland natural areas with controlled grazing permitted
- Minimum 75% ground cover surrounding wetland areas
- Continuous season long grazing is not permitted (no grazing before July 1st)
- Less than 15 % of the total shoreline has evidence of pugging*, rutting* and or hummocking*
- Maintain average minimum height for grasses of 10-15 cm (4-6 inches)
- Adequate off-site watering system required at a minimum 15 metre (50 feet) setback from water source

(ALUS Technical Advisory Committee, 2006)

In Norfolk County, Ontario, the current ALUS pilot project only targets priority watersheds for grassed buffers and the development of 3-5 more demonstration farms due to funding limitations (Norfolk Federation of Agriculture, 2007). The original concept promoted the targeting of environmentally sensitive lands for stewardship. It was anticipated that fragile or marginal lands would be retired from cultivation or farmed in a different manner to benefit the environment, as identified by the landowner through the Environmental Farm Planning process (Norfolk Federation of Agriculture, 2007).

2.3 Environmental and Human Benefits from Maintaining or Enhancing Natural Capital in Agricultural Landscapes

The four types of natural capital identified in the Manitoba ALUS pilot project i.e. wetlands, riparian buffers, natural areas and ecologically sensitive lands, were also of primary interest in this project. A review of the literature yielded a significant number of references with key words related to ‘wetlands’ and ‘riparian buffers’ and very few references with key words related to ‘natural uplands,’ ‘fragile lands’ or ‘ecologically sensitive lands’. The reader is reminded,

however, that the ecosystem services provided by these land types are not mutually exclusive and much of the following discussion is applicable to all.

Wetlands and riparian buffers represent the transition from land to water. There are two zones of contact between land and water: the riparian zone and the hyporheic zone. The riparian zone is the boundary between land and water and includes the banks of the stream and adjacent vegetation (Giller and Malmqvist, 1998). The riparian zone provides land-based inputs to the stream system such as organic matter from leaf litter. Vegetative cover in the riparian zone, which causes shading over the waters, affects temperature and light levels in the water. The riparian zone can be very effective in controlling bank erosion and sediment loading to streams (Giller and Malmqvist, 1998). The hyporheic zone is the area of water-saturated sediments beneath and beside a watercourse. Ground water and surface water meet in this zone either as an upwelling or downwelling of water (Burton Jr and Pitt, 2002; Meyer et al., 2003). The high level of contact between water and soil creates an environment where many physical, chemical and biological functions of headwaters occur. This zone can provide essential habitat and shelter for a variety of plants and animals. It can affect how contaminants are held, removed or transported in the system. Nutrients and carbon are cycled in the hyporheic zone and food web links between primary producers, prey and predators are established (Burton Jr and Pitt, 2002). Together the riparian and hyporheic zones within wetlands and riparian buffers are particularly important in providing humans with regulating ecosystem services including food regulation and water purification; and supporting ecosystem services including photosynthesis, primary production, nutrient cycling and water cycling (see section 2.2) (Millennium Ecosystem Assessment, 2005).

Many environmental and human benefits accrue from the existence of wetlands (Gabor et al., 2001). From a water management and human benefit perspective, wetlands store and release surface water, recharge local and regional groundwater supplies, reduce peak floodwater flows, de-synchronize flood peaks, and prevent erosion. Wetlands act as nutrient sinks (as shown in Table 2.2) accumulating organic matter, retaining nutrients in buried sediments, converting inorganic nutrients to organic biomass, promoting sedimentation of solids, and maximizing water-soil contact which influences microbial processing of nutrients and other material. These environmental benefits translate into human benefits, which are represented by provisioning services including food, fibre and fuel; regulating services including water purification; and supporting services including photosynthesis, primary production and nutrient cycling (see section 2.2) (Millennium Ecosystem Assessment, 2005). In their review of the literature, Gabor et al. (2001) noted that wetland vegetation slows the flow and speed of water, which increases the retention time of the water and the settling out of sediment in the wetland. The amount and location of the wetlands in the landscape are important for reducing sediment loads to water courses. From a human perspective, a reduction in sediment loads, for example, provides a cultural ecosystem service by enhancing the characteristics of the natural landscape (i.e. clear water not laden with sediment) and encouraging recreation and ecotourism (see section 2.2) (Millennium Ecosystem Assessment, 2005).

In general, pesticides in surface and ground water are metabolized rapidly when they enter wetlands because the wetlands present conditions that promote the breakdown of pesticides by biological, physical and chemical processes (Gabor et al., 2001). This regulating service i.e., water purification and waste treatment, provided by wetlands helps to protect the quality of water used by humans (see section 2.2) (Millennium Ecosystem Assessment, 2005).

Table 2.2 Range of Percent Retention for Nitrogen, Phosphorus, Sediment, Coliforms and Pesticides in Wetlands

Parameter	% Retention
Nitrogen – Nitrate	up to 80
Nitrogen – Ammonium	up to 95
Phosphorus	up to 92
Sediment	up to 70
Coliforms (Constructed Wetlands)	up to 90
Pesticides	<1 day - several months[1]

[1] Time for residues to decrease by 50%

Source: (Gabor et al., 2001)

In their review of the literature, van Diggelen et al. (2006) listed the environmental benefits of wetlands as including the enhancement of biodiversity, carbon storage, water purification, water holding capacity and the provision of natural resources including game, fish, reed and wood (van Diggelen et al., 2006). Many of these environmental benefits also may be categorized as human benefits e.g., provisioning services that provide products such as food (game, fish), fibre (reed) and wood; regulating services such as climate regulation (carbon storage), water purification, water regulation (water holding capacity); and supporting services such as primary production (enhancement of biodiversity) (see section 2.2) (Millennium Ecosystem Assessment, 2005).

The terms riparian buffers, vegetative buffer strips and buffer strips may be considered synonymous (Hickey and Doran, 2004). Hickey and Doran (2004) defined a buffer strip as: *any strip of vegetation between a river, stream or creek and an adjacent upland land use activity, that is maintained for the purposes of protecting or improving water quality, or enhancing the movement of wildlife among habitat patches.* Research on buffers has been conducted by a number of individuals (Borin et al., 2004; Dosskey, 2001; Hickey and Doran, 2004; Vought et al., 1995).

The environmental and human benefits of buffer strips, which include riparian buffers or zones along watercourses, are listed in Table 2.3:

Table 2.3 Environmental and Human Benefits of Buffer Strips

No.	Environmental Benefit	Category of Ecosystem Service To Humans*	Example Of Actual Ecosystem Service Providing Human Benefit
1	Reduction of soil loss due to wind and water erosion;	Regulating service: erosion regulation; Cultural service: recreation and ecotourism	Retained soil maintains productivity for food production; Clear watercourses encourage swimming and boating
2	Removal of fertilizers (nitrogen, phosphorus) and pesticides (depending on the unique mobility and soil binding properties of each compound) from field runoff;	Regulating service: water purification and waste treatment	Maintains water quality for human use

No.	Environmental Benefit	Category of Ecosystem Service To Humans*	Example Of Actual Ecosystem Service Providing Human Benefit
3	Increase of biodiversity of flora and fauna;	Supporting service: primary production and nutrient cycling	Indirect benefit to humans when energy and nutrients are cycled through or stored in a variety of organisms
4	Provision or enhancement of habitat for terrestrial and aquatic species	Cultural services: educational values, aesthetic values, recreation and ecotourism	Natural areas are used for educational purposes (school trips) and leisure (camping, hiking, fishing)
5	Provision of corridors that connect wildlife habitats and allow the safe movement between fragmented patches of natural areas	Supporting service: primary production and nutrient cycling	Indirect benefit to humans when populations are maintained so that energy and nutrients are cycled through or stored in a variety of organisms
Ref.	(Lovell and Sullivan, 2006)	(Millennium Ecosystem Assessment, 2005)	

* some services may fit more than one category
Notes:
- The first column is based on the environmental benefits listed in Lovell and Sulllivan, 2006.
- The second column is based on categorization of ecosystem services by the research team based on the services outlined in the Millennium Ecosystem Assessment.
- The third column includes examples suggested by the research team. Note that these examples do not come from the literature.

An additional environmental benefit of buffer strips includes the removal of pathogens from field runoff (Conestoga-Rovers & Associates, 2006). Also, buffer strips can reduce the movement of pollutants overland to streams but due to the variability in findings, it is very difficult to make predictions about the effectiveness of a buffer under site-specific conditions (Hickey and Doran, 2004). Hickey and Doran (2004) concluded that buffers 30 to 100 m in width are most effective but there is not enough information available regarding the effectiveness of buffers in the 1 to 10 m width range. Several authors, however, have compiled tables indicating the effectiveness of buffer strips in removing soil, sediment, nutrients, pesticides and pathogens from field runoff that enters the buffer strip as influent and leaves the buffer strip as effluent (Dosskey, 2001) (Dosskey, 2002) (Hickey and Doran, 2004) (USDA-NRCS, 2000).

Di and Cameron (2002) reviewed nitrate leaching in temperate agroecosystems. They determined that nitrate leaching is a normal occurrence in agricultural production systems. Their comparisons of the data showed that leaching is least likely to occur under forested conditions and most likely to occur under vegetable production. The order of systems was as follows: forest < cut grassland < grazed pastures, arable cropping < ploughing of pastures < vegetables. The amount of leaching was dependant on soil, climate, forms of N applied, and post-harvest management (Di and Cameron, 2002). This information suggested that maintaining or enhancing natural areas that include forest and grasslands could provide an environmental benefit related to the control of nitrate leaching and a human benefit related to water purification.

The most appropriate indicators of fish community condition across large geographic scales were shown to be physicochemistry and riparian condition rather than land use within the same area (Meador and Goldstein, 2003). The results of the research support the enhancement of riparian buffers, especially in agricultural and urban areas, to restore fish communities.

McMaster and Davis (2001) examined the impact of the Permanent Cover Program that was established on marginal cultivated lands with high erosion risk in the Prairie Provinces in the 1990s. Permanent cover locations were used for hay or pasture but not used for cropland. The research showed that the program enhanced grassland bird species richness and nine of the 10 common species occurred more frequently in permanent cover locations (McMaster and Davis, 2001).

Reynolds et al. (2006) discussed the decline in duck nest success that coincided with the increase in cultivated lands in the United States and Canada. Waterfowl require grassland cover to exist and its preservation has long been a priority of wildlife managers. In the United States, the Conservation Reserve Program (CRP) and the Swampbuster (wetlands conservation) provision of the Food Security Act (1985) demonstrate the recognition of the environmental benefits these programs would achieve by reducing soil erosion, reducing crop surpluses and improving wildlife habitat (Reynolds et al., 2006).

2.4 Summary of the Literature

This section presented a literature review of EG&S, including the environmental benefits arising from the increased adoption of EG&S practices and provision of ecosystem services which are expected to result from the potential EG&S program in Manitoba.

EG&S are variously referred to as ecosystem services, environmental services and natural capital (Gagnon et al., 2005). The Millennium Ecosystem Assessment (2005) defines ecosystem services as the benefits people obtain from ecosystems. These include provisioning services such as food, water, timber, and fibre; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling (Millennium Ecosystem Assessment, 2005).

Natural capital is a variation of the concept of EG&S. In literature, natural capital includes: natural resources capital (e.g., minerals, forests, water), ecosystems and environmental capital (e.g., wetland, forest and riparian ecosystems) and land (i.e., the space humans use) (Olewiler, 2004).

Farmers and ranchers, as land managers, have the opportunity to adopt effective or promising responses that conserve or sustainably enhance the direct supply of ecosystems services provided by their lands (as recommended in the Millennium Ecosystem Assessment, 2005). They can do this by maintaining or enhancing the wetlands, riparian buffers, natural areas and ecologically sensitive lands (i.e., the natural capital) they own. The responses that farmers and ranchers use to achieve these outcomes are identified as beneficial management practices (BMPs) (Gagnon et al., 2005; Millennium Ecosystem Assessment, 2005).

It is recognized that existing BMP programs provide support and funding on a cost-share basis for adoption or implementation of practices by farmers or ranchers. The costs of maintaining or enhancing a practice are not necessarily covered in these programs. In Canada, pilot projects that reward farmers and ranchers for ongoing practices that are specifically aimed at maintaining or enhancing the natural capital on their farms that provides direct ecosystem services are in progress (Norfolk Federation of Agriculture, 2007; Keystone Agricultural Producers, 2007). The Alternative Land Use Services (ALUS) pilot project in the Rural Municipality of Blanshard, Manitoba identifies four types of natural capital identified: wetlands, riparian buffers, natural areas and ecologically sensitive lands.

Wetlands and riparian buffers represent the transition from land to water. Many environmental and human benefits accrue from the existence of wetlands (Gabor et al., 2001). In their review of the literature, van Diggelen et al. (2006) listed the environmental benefits of wetlands as including the enhancement of biodiversity, carbon storage, water purification, water holding capacity and the provision of natural resources including game, fish, reed and wood (van Diggelen et al., 2006).

The environmental and human benefits of buffer strips, which include riparian buffers or zones along watercourses, include (Conestoga-Rovers & Associates, 2006; Hickey and Doran, 2004; Lovell and Sullivan, 2006): reduction of soil loss due to wind and water erosion; removal of fertilizers and pesticides; the removal of pathogens from field runoff; reduction of the movement of pollutants overland to streams; increase of biodiversity of flora and fauna; and provision of wildlife corridors. It was also noted that it is very difficult to make predictions about the effectiveness of a buffer under site-specific conditions (Hickey and Doran, 2004). Hickey and Doran (2004) concluded that buffers 30 to 100 m in width are most effective but there is not enough information available regarding the effectiveness of buffers in the 1 to 10 m width range.

Information presented by Di and Cameron (2002) suggested that maintaining or enhancing natural areas that include forest and grasslands could provide an environmental benefit related to the control of nitrate leaching and a human benefit related to water purification.

Research conducted by McMaster and Davis (2001) examined the impact of the Permanent Cover Program that was established on marginal cultivated lands with high erosion risk in the Prairie Provinces in the 1990s. The research showed that permanent cover locations enhanced grassland bird species richness.

Overall, there are many environmental and human benefits associated with preserving and enhancing EG&S and natural capital.

3.0 Methods and Approach

Section 3.0 describes the research methods used for this project. Section 3.1 describes the methods used to ensure stakeholder involvement in the design of a potential EG&S program in Manitoba. Section 3.2 describes the GIS analysis used to identify lands in Manitoba that may be eligible for a potential EG&S program. Section 3.3 provides a brief overview of the steps required to conduct a cost-benefit analysis.

3.1 Stakeholder Involvement in Program Design

In order to gain an "on the ground" understanding of what environmental practices are already in place in Manitoba and stakeholder opinions and perspective for the design of an EG&S program, our research team conducted telephone interviews, an online survey and a focus group with stakeholders in Manitoba. The results of these consultations were used to determine the design of the potential EG&S program for the cost-benefit analysis.

This section provides a brief overview of the methods used and a summary of the results for the consultations. More detailed information on the methods for the consultations can be found in Appendix B.

3.1.1 Telephone Interviews and Online Survey

The main purpose of the interviews and online survey was to gain an understanding of the environmental and farm issues that are prevalent in various regions of Manitoba, as well as to solicit feedback on potential EG&S program design.

Methods

A list of stakeholders was developed using the George Morris Centre database. This list was provided by MAFRI to ensure that the sample represented a broad spectrum of stakeholders. Targeted stakeholders included: producers, producer associations and program representatives (including the ALUS program), government (program administrators, scientists and GO Teams), non-government organizations, conservation districts and academics. It was determined that individuals that had an in-depth understanding of the landscape were the most appropriate stakeholders to participate in the interview phase of the research, while the remaining stakeholders on the list would be invited to the focus group. A few key stakeholders participated in both the interviews and focus group.

The interview questionnaire was developed by the research team and then approved by the MAFRI project team. The following types of information were collected during the interviews (refer to Appendix B.1.1 for the complete questionnaire):

- Introduction
  - How the respondent was involved with EG&S
- Land Classification
  - Familiarity with physical land characteristics
  - Environmentally sensitive areas within the respondent's municipality
  - Other data that may be of value to the research
- Land Management
  - Main environmental concerns and top three environmental issues
  - Current use and effectiveness of environmental management practices in the respondent's rural municipality

- EG&S and Potential Programming
    - Management practices currently in use that contribute EG&S within the respondent's municipality, including estimated adoption rate (% acres)
    - Types of EG&S management practices the respondent would like to see eligible within an EG&S program, including the respondent's perceptions of cost of establishment (low, moderate and high), ease of establishment (hard, moderate and easy) and environmental effectiveness (low, moderate and high)
        - The management practices identified were also ranked by preference
    - Suggested payment types for use in a provincial EG&S program
    - Whether the respondent agreed or disagreed with a series of statements regarding EG&S.
    - Preferred approach for a provincial EG&S program and the perceived level of adoption that would occur given the program described.

Fifteen interviews were completed by telephone. Individuals were initially contacted by telephone or email to request their participation in the survey via a telephone interview. During this initial contact, the potential participant was given some background on the research, a date and time for the telephone interview was established and the participant was sent the survey questions via email. This allowed participants to read over the questions ensuring that they understood and could gather their thoughts on the topics presented.
All of the telephone interviews were recorded using Microsoft OneNote software which enabled the researches to capture all information provided by participants.

In addition to the telephone interviews, the survey was posted on Zoomerang[8], an online survey program (the online interview questionnaire included the same questions as the telephone interview questionnaire included in Appendix B). This allowed the researchers to send the survey to other stakeholders, particularly conservation districts, which were otherwise not able to complete the survey by telephone. All the telephone interview results were transcribed into the Zoomerang program to allow for analysis of the results.

By November 30th, 2007 a total of 15 telephone interviews and 5 additional online surveys had been completed, for a total response of 20 interviews.

3.1.2 Focus Group

The focus group workshop took place at the Winnipeg Winter Club in Winnipeg, Manitoba on November 27th, 2007. The stakeholders who were invited to the focus group were known in the industry to be 'solution seekers' and had a keen interest in program design for a provincial EG&S program. Targeted stakeholders included: producer associations, program representatives (including the ALUS pilot project), government (program administrators and GO Team members), non-government organizations and academics.

Methods

An invitation (refer to Appendix B.2.1) to the brainstorming workshop was sent to 47 stakeholders in total (including the MAFRI project team) on November 5th, 2007. Of the invited stakeholders, 41 registered to attend the workshop (including the project team). As such, the response rate for this workshop was quite high. However, it should be noted that a number of

[8] Refer to http://www.zoomerang.com/recipient/survey-intro.zgi?p=WEB2276PKQA9PP

the invited stakeholders requested that other colleagues participate in the workshop as well. Despite this, it was clear that there was an overwhelming interest in the workshop topic.

The focus group was facilitated by team members Cher Brethour and Jane Sadler Richards and included an opening presentation (refer to Appendix B.2.2 for a description of the opening presentation), as well as breakout sessions. The breakout sessions were intended to solicit feedback on the following characteristics of a potential EG&S program in Manitoba (refer to Appendix B.2.3 for the worksheets used in the breakout sessions):

- Objectives of an EG&S Program
- Stakeholder roles
- Land eligible
- Eligibility criteria
- Preferred approach to program design
- Adoption rates
- Shortcomings

For a more detailed description of the focus group methods, refer to Appendix B.2.2)

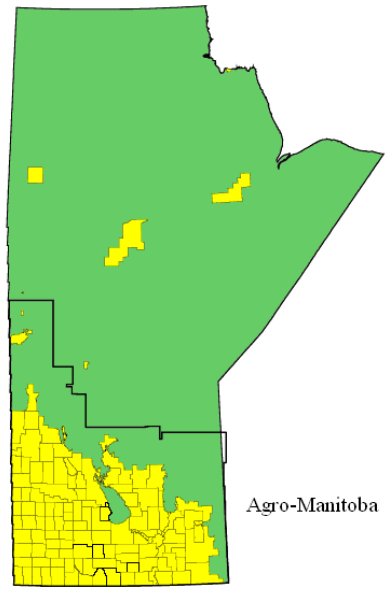
3.2 GIS Analysis

The purpose of the Geographical Information Systems (GIS) component of the research was to estimate the nature and extent of agricultural lands that could qualify for a potential EG&S program in Manitoba.

The ArcView GIS program was used to generate the data required for this analysis using the raw data files, which were largely obtained from the Manitoba Land Initiative website (described below). ArcView is a software package designed to visualize and analyze geographic data.

Manitoba extends 1,225 kilometres from the United States border to the Nunavut. The total area of the province is approximately 161 million acres with the land area amounting to approximately 135 million acres (Education Canada Network, 2008; Wahl, 2007). For this research, the GIS analysis focused on Agro-Manitoba, the most populated and settled portion of the province (Manitoba Conservation, 2007). The majority of the municipalities within the province are located in Agro-Manitoba, as shown in Figure 3.1.

Figure 3.1 Agro-Manitoba



Sources: (Government of Manitoba, 2007; Wahl, 2007)

The GIS analysis estimated the number of acres in Agro-Manitoba that would be eligible for EG&S payments under each of the four types of eligible land: riparian areas, wetlands, natural uplands[9], and ecologically sensitive lands. These eligible land types were based on the program design scenarios discussed in section 4.0. The number of acres was used to estimate the total costs and benefits associated with a potential EG&S program. Therefore, the focus of the GIS work was on acreage calculations and analysis, not on map creation.

The GIS acreage calculations and analysis were transferred to Excel for use in the cost-benefit analysis. However, MAFRI was given the GIS data layers and shape files to review/recreate the analysis in the future.

Assumptions and Methods

The specific assumptions and methods used for the GIS analysis are described in the following bullets.

- GIS data was retrieved from the Manitoba Land Initiative (MLI) website (Government of Manitoba, 2007). Additional data was also obtained from Manitoba Conservation. The information collected included:
    - Base map of the province
    - Map of Agro-Manitoba
    - Municipalities
    - Land use/land cover classifications (e.g. agriculture, forest, marsh, roads/trails)[10]
    - Designated drain watercourses

[9] MAFRI suggested the use of the terminology "Natural Uplands" in order to distinguish between all natural areas (e.g. wetlands, riparian areas) and uplands (i.e. woodland and grasses).

[10] The land use and land cover data used in this analysis is based on 2001 satellite imagery data. Although newer data exists, it was not in usable format for this analysis. Updating this research with the newer satellite imagery data represents an opportunity to enhance this research in the future.

  - Soil class data
  - Section grids and quarter section grids
  - Crown lands
  - Other protected or public lands (described below)
- The Base Map consisted of Agro-Manitoba.
- The following areas were cut out of the GIS analysis since the research team assumed that they were already protected or public lands:
  - Wildlife Management Areas
  - Wildlife Refuges
  - Special Conservation Areas
  - Protected Areas
  - Parks (both federal and provincial)
  - Conservation Lands
  - Crown Lands
  - Road allowances (based on section grids and quarter section grids)
- The land use classification data was particularly relevant to the GIS work. The land use data is based on 2001 satellite imagery and includes the following land use classes (legend shown in colour).

- From the above land use classes, the following areas were cut out of the GIS analysis because they were deemed not relevant for this analysis:
  - Treed Rock
  - Cultural (includes cities, towns, communities and facilities like golf courses, shopping centres, airports, etc.)
  - Bare rock/sand/gravel
  - Roads/Trails
- The research team amalgamated the following land use classes into one general category entitled ‘Forest’ to make the analysis simpler:
  - Deciduous Forest
  - Mixedwood Forest
  - Conifer Forest
  - Burns (i.e. Wildfire Areas)
  - Open Deciduous Forest
  - Forest Cutblocks
- Similarly, the research team amalgamated the following land use classes into one general category entitled ‘Wetlands’ to make the analysis simpler:

  - Marsh/Fens
  - Bogs
- In summary, the research team used the following land use classes within the GIS work (given the amalgamations and deletions):
  - Agriculture
  - Forest
  - Water
  - Grassland
  - Wetlands
  - Forage Crops

To estimate the number of eligible acres under the land types, the following methodology was used.

- Ecologically Sensitive Lands[11]
  - Land classes 4, 5, 6 and 7 were assumed to be eligible under the ecologically sensitive land service.[12]
  - While soil mapping may not be accurate or consistent between areas of the province, it will provide a rough idea of the total area of sensitive lands.
  - The research team used the soil land class data to calculate the number of acres of agricultural lands (in either the agriculture or forage land classes) that consisted of classes 4, 5, 6 and 7 at the Agro-Manitoba level.
- Wetlands[13]
  - The research team calculated the acreage of wetlands in Agro-Manitoba using the land use classification data (amalgamated under 'Wetlands').
  - There was no maximum size for the wetland.
  - Unfortunately, given the nature of the land use classification data, it is not possible to determine which wetlands are on agricultural land since land is either classified as one land use class or another (land cannot be mapped as agricultural and as a wetland at the same time). As such, the eligible acres for wetlands represent the number of eligible acres of wetlands within private rural land in Agro-Manitoba rather than within private agricultural land in Agro-Manitoba.
- Natural Uplands
  - Natural uplands are any uplands maintained with native grassland, bushes and trees, or any combination thereof. For the purposes of this research, we have estimated the number of acres of natural uplands based on the 'Forest' and 'Grassland' land use classifications.
  - Unfortunately, given the nature of the land use classification data, it is not possible to determine which natural uplands are on agricultural land since land is

[11] Ecologically sensitive lands are subject to severe water erosion, wind erosion, flooding, salinity, runoff or leaching. Source: ALUS Draft Technical Standards, 2006.

[12] Class 4 soils are marginal for sustained arable agriculture and should be in permanent forage production. Class 5 soils are suitable only for improved permanent pasture. Class 6 soils are capable only for native pasture use. Class 7 soils are incapable of use for arable agriculture or permanent pasture. Note: organic soils were not included as part of ecologically sensitive lands. Source: (MAFRI, 2008b).

[13] Wetlands refer to land areas on farms that hold spring-season, semi-permanent or permanent water. These include bogs, marshes and swamps and have saturated soil conditions over a long enough period of time during the year to maintain water-loving vegetation (such as rushes, cattails, sedges and other forbs) and wildlife habitat. Source: ALUS Draft Technical Standards, 2006.

either classified as one land use class or another (land cannot be mapped as agricultural and as a natural upland at the same time).

Eligible lands for riparian areas were modelled for the purposes of the sensitivity analysis. The methodology used to determine eligible lands for riparian areas is described below.

- Riparian Areas[14]
    - The research team created buffers on each side of all watercourses in Agro-Manitoba using the designated drain watercourses GIS data layer[15] on the MLI website. This includes buffers on all streams that have a Modified Strahler[16] order of 1 or higher and all designated provincial drains. The data set also includes features such as intermittent streams, ditches, culverts (roadway, railway) and the research team made specific decisions regarding the inclusion/exclusion of buffers alongside these features. In particular:
        - Buffers were included alongside ditches since ditches could represent potential habitat. While ditches are not high quality habitat due to road salt, etc., they are still habitat and they do provide a corridor for wildlife travel.
        - The research team also included buffers alongside intermittent streams which tend to be in-field water pools that have water for part of the year. This is due to the fact that these streams are true headwaters and quite important from a water perspective.
        - Culverts under roads and railways (even driveways) do not need protection and therefore were not mapped with riparian areas.
    - The research team used scenarios for buffer width including 3m, 10m, 25m and 50m.
    - The research team determined which buffers fell on agricultural land (in either the agriculture or forage land classes).

Data Issues and Caveats

The following list identifies some of the issues encountered with the GIS data and relevant caveats to the analysis.

- The land use data is based on 2001 satellite imagery.[17] Therefore, land uses may have changed since that time. Although newer data exist, it was not in usable format for this analysis. Updating this research with the newer satellite imagery data represents an opportunity to enhance this research in the future.
- The resolution of the satellite imagery is based on 30 m pixels (i.e. 30 m by 30 m square). For the land use class data, this level of resolution means that it is not possible

[14] A riparian area is an area of land adjacent to a stream, river, lake or wetland that contains natural vegetation that, due to the presence of water, is distinctly different from the vegetation of adjacent upland areas. Source: ALUS Draft Technical Standards, 2006.
[15] Note that the drain data contains over 100 data files.
[16] Strahler's stream ordering system is based on stream/tributary relationships. The uppermost channels in a drainage network (i.e., headwater channels with no upstream tributaries) are designated as first-order streams down to their first juncture with another stream. A second-order stream is formed below the juncture of two first-order channels. Third-order streams are created when two second-order channels join, and so on. Source: US EPA, 2008.
[17] The satellite imagery is obtained by the Government of Manitoba. Contact the Remote Sensing Centre for more information.

to see smaller features within the 30 m block of land. The 30 m block is categorized by the predominant land use (e.g. forage) and if there is another smaller feature within the block (e.g. small wetland), it is ignored.

- To remove road allowances for public and private lands from the analysis, the boundaries of the section grids for Agro-Manitoba were used as a proxy since GIS files showing the actual road allowances are not available. By removing the boundaries of the section grids, the research team effectively cut out the road allowances.[18] However, this methodology only approximates the actual road allowances and is therefore not completely accurate. According to the Tax Assessment Branch, this approximation would be relatively accurate in Southwest Manitoba but could be inaccurate in North and East Manitoba (Ross, personal communication, 2008). Note that, since the focus of this research is on Agro-Manitoba, some of the error in North and East Manitoba would be eliminated.
- Another issue encountered with the section grids was that there are areas of Agro-Manitoba for which data are missing (i.e. the section grids are not completed). According to Manitoba Conservation, the data for these areas were never collected (Sobkowich, personal communication, 2008). The research team had to manually cut out data in these areas.
- Public lands (i.e. crown lands) were removed from the analysis. It is important to note that the crown land data used within the GIS component are currently being updated and some areas may not have been completed.
- To determine ecologically sensitive lands, soil classes were used. However, the GIS data of the soil classes had several weaknesses that must be acknowledged. First, soils information was not available in GIS format for the land use class area of Cedar Lake. Second, soils data for the land use class area of Lac du bonnet would not combine with the modified land use data. Finally, there were blank polygons within some of the soils data and therefore, for some regions of the province[19], total acreage calculated with the soils data was less than total acreage calculated based on the land use data. As a result, the soils data likely underestimates acreages in certain areas of the province.
- When considering the number of eligible acres of riparian buffers, it is important to note the potential for overlap with the ecologically sensitive land categories. If agricultural or forage crop land was both beside a watercourse and classified as soil classes 4-7, there is the potential for overlap (i.e. double counting) within the estimates for eligible acres. However, given that the riparian areas were considered only for the sensitivity analysis, the main results of the research were not affected by this caveat.

Other Considerations

It is also important to recognize other considerations with respect to the mapping and data collection components of the potential EG&S program in Manitoba.

When establishing and implementing a potential EG&S program in Manitoba, there are two primary steps with respect to mapping and data collection in determining eligible acres.

1. The first step is to estimate the number of acres that would be eligible under the four land types (wetlands, natural uplands, riparian areas and ecologically sensitive lands) at a regional or provincial level.

[18] The road allowance is 30 m between the sections.
[19] In particular, it appears as though there is missing soils data in the land use areas of Dauphin, Gypsumville, Riverton, Swan River, Winnipeg and Woodridge.

2. The second step is to actually create/view maps at the individual farm level in order to show the producer what acres are eligible and have him/her choose which acres he/she would like to enroll. There are two options for creating/viewing these maps: digitized air photos or satellite imagery.

The first step described above has been the focus of this analysis. The important points to note about this step include:

- The GIS data required to determine eligible acres have a number of issues and caveats as described above.
- In terms of transferability of the GIS analysis to other regions, it is expected that there will be some transferability based on the model function in the most recent version of ArcView.[20] Under the model builder, base files can be inserted and the analysis functions and queries can be saved. The current analysis focused on Agro-Manitoba as the region of interest. If one was interested in determining eligible lands in a new region such as a specific rural municipality, it is possible to re-use the analysis functions and queries developed for Agro-Manitoba, but the insertion of new base files for the rural municipality would be required. It is worth noting that there may be problems within this process.
- In deciding to examine other locations in more detail, it is important to consider the amount of mapping data required, the limitations of the GIS data currently available and the time, financial resources and computing capacity required.

The second step may be a future research initiative if an EG&S program is established in Manitoba. There are two options for creating and viewing maps: satellite imagery or digitized air photos. The relevant considerations for each are described below.

<u>GIS analysis using satellite imagery</u>

- Even when GIS maps are created at the municipality level, it is not practical to see individual farms due to the scale of the GIS files.
- Also, as discussed above, the resolution of the satellite imagery (30 m pixels) for the land use classes means that it is not possible to see smaller features within the 30 m block of land. At the same time, the advantage of the land use satellite imagery is that professionals have determined the land uses which may be more accurate than a visual interpretation of air photos (discussed below).

<u>Digitized air photos</u>

- The ALUS pilot project in the Rural Municipality of Blanshard used GIS analysis to determine eligible acres in the municipality and air photos in order to determine eligible acres for individual farms. The air photos used were taken over Blanshard in 2005. The photos were in colour, included 62 cm resolution and were digitized. This allowed the program administrators to determine where the eligible acres were by examining the photos. The photos were trusted by farmers who could easily look at their farm and determine the acres that they wanted enrolled. These air photos were highly accurate but had high procurement and administration costs (Hamm, personal communication, 2007).
- Unfortunately, for the province of Manitoba, the last air photos were taken in the mid 1990s. These photos are available in black and white at 2 m resolution. Therefore, in order for the province to use air photos as part of a potential EG&S program, it would be necessary to collect and purchase new digitized air photos. This process is very costly

[20] This project used version 9.3 of the software.

but there may be reasons to collect air photos other than simply an EG&S program. Note that timing of the air photos is important in order to be able to accurately identify land features (Hamm, personal communication, 2007).

Another less accurate method for determining eligible acres on individual farms would be to have the producer identify eligible acres and then use verification/auditing to confirm. It would also be possible to use information on enrolled acres in production insurance to cross check the eligible areas with enrolled acres and total acres. This is a much less expensive option but definitely not as accurate as either satellite imagery or air photos.

The choice of methodology to determine eligible acres at the individual farm level depends on the acceptable level of accuracy and the costs and benefits of this accuracy.

3.3 Cost-Benefit Analysis

According to Prest and Turvey (1965), cost-benefit analysis is a systematic approach of assessing the desirability of projects or policies. In this research, the cost-benefit analysis involved identifying the costs and benefits of the potential EG&S program and attaching a dollar value to each cost and benefit. Theoretically, the decision regarding whether to adopt the EG&S program depends on whether the program is predicted to generate net benefits to society in comparison to the status quo.

The cost-benefit analysis involved the following steps, which are discussed in detail in the following sections.

1. Select the alternatives to be considered
2. Determine the benefits and costs to be considered
3. List the potential impacts and select the measurement indicators
4. Assign dollar values to all impacts
5. Discount for time to determine present values
6. Sum: Add up the benefits and costs to determine the net benefits
7. Perform sensitivity analysis
8. Recommend the alternative with the largest net social benefits.

4.0 Program Design

This section outlines the program design and scenarios for the evaluation of a potential EG&S program in Manitoba. The program design and scenarios used for the cost-benefit analysis are based on the outcomes of the telephone interviews, online surveys and focus group with stakeholders in Manitoba.

Section 4.1 provides a summary of the results of the consultations with stakeholders as background for the EG&S program design that was used in the cost-benefit analysis described in section 4.2.

4.1 Summary of the Results of the Stakeholder Consultations

4.1.1 Summary of the Results of the Telephone Interviews and Online Survey

The results of the interviews provided information on environmental concerns, current land management practices, the provision of EG&S, and potential EG&S program design in Manitoba.

Overall, the respondents mentioned riparian areas, wetlands, lakes and escarpments as key environmentally sensitive areas. Respondents felt that water quality and quantity was the top environmental concern in Manitoba, followed by concern about soil quality.

The majority of the respondents stated that environmental management practices to maintain the physical landscape including riparian areas, wetlands, natural areas, and wildlife habitat were currently in place; however adoption of these practices was low. Reasons cited for low adoption included lack of economic justification and, in some cases, a lack of proper government support measures. A few respondents also highlighted the need for changing farmers' perceptions and awareness of the practices.

When asked to identify the types of environmental management practices that they would like to see eligible for EG&S payments in their local area, respondents mentioned wetlands and riparian areas most frequently.

With respect to the potential design of an EG&S program in Manitoba, most respondents agreed with a provincially based program with flexibility for accommodating a bundle of local management practices specific to particular areas. For the most part, environmentally sensitive areas were the desired target. However, a few respondents disagreed with targeting in any form and suggested a uniform program across the province. Long term continuous payments were observed as the general preference among the respondents. A minor fraction of the interviewees expressed interest in eco-service auctioning and tradable permits. A small percentage of respondents preferred one time, lump sum payments as well. Common responses regarding eligibility criteria included that individuals must be owners of the land to be eligible and that higher preference should be given to agricultural landowners as well as high risk or sensitive lands.

For a more detailed description of the interview results, refer to Appendix B.1.2.

4.1.2 Summary of the Results of the Focus Group

The key insights from the focus group discussion are presented below in the following format (which corresponds with the focus group brainstorming session discussion): 1) objectives of an EG&S program; 2) stakeholder roles; 3) eligible lands; 4) eligible practices; 5) preferred program approach; 6) payment structure; 7) eligibility criteria; 8) adoption rates; and 9) shortcomings.

1. Objectives/Criteria for Consideration for Program Design:
    a. Program should have sustainable long term funding
    b. Program should have an education and communication component
    c. Program should be adaptive and flexible
    d. Program should be measurable, accountable and multi-functional
    e. Program should be compatible with rural culture
    f. Program should have public support
    g. Program should achieve healthy functioning watersheds
    h. Program should achieve sustainable agriculture
        i. Land owner acceptability
        ii. Program should impact land owner decision making and behaviour
2. Stakeholders:
    a. Confirmation that every stakeholder has a role
    b. Magnitude of role depends on stakeholder
3. Eligible Lands:
    a. Riparian
    b. Wetlands
    c. Upland Natural Areas
    d. Fragile Lands
        i. But within these categories it “depends”
            1. Regional perspective or perhaps a watershed based approach
    e. Lands should be targeted based on largest potential environmental benefit from program participation (“low hanging fruit”; “biggest bang for your buck”)
4. Eligible Practices
    a. All practices that maintain, rehabilitate and enhance the environment (and, hence, EG&S) should be eligible
    b. ALUS appears to be encompassing (wetlands, riparian areas, upland natural areas and fragile lands)
5. Targeted regions
    a. Provincial program that has a targeted approach based on regional issues
6. Payment structure
    a. Opportunity cost plus incentives for key areas (e.g., sensitive or high risk)
    b. Bidding system
    c. Multifunctional market based program
    d. Annual long term payments
    e. Based on environmental outcomes
        i. Benefit indexing
    f. Premiums for longer term contracts
7. Eligibility criteria
    a. Voluntary
    b. Land owners only
    c. 3-10 year contracts
    d. Historical stewardship eligible
        i. If focused on maintenance and on-going delivery of environmental benefit

8. Estimated Adoption
    a. 30-70%, with caveats
    b. High uptake anticipated
9. A number of short comings and risks will need to be taken into account:
    a. Uncertainty about level of funding
    b. Perception of landowners
    c. Public perception/public relations
    d. Uncertainty in terms of program design based on sound science and market realities (science not there for decision-making)
    e. Difficulties in choosing target regions
    f. Administrative costs
    g. Competition among neighbours with bidding process
    h. Design impacted by budget

For a more detailed description of the focus group results, refer to Appendices B.2.4 (general) and B.2.5 (results by group).

4.2 Proposed EG&S Program Design for the Cost-Benefit Analysis

Given the information collected in the interviews and focus group, the research team developed an EG&S program design for use in the cost-benefit analysis, which is described in the following sections.

Eligibility Criteria

For this analysis, we assumed that participation would be voluntary and that only agricultural landowners would be eligible to participate in the program.[21] Since the program is about the provision of EG&S (and not risk reduction), historical stewardship was considered eligible for the program to ensure that all lands recognized for the production of EG&S remain as EG&S lands. Note that payments were not retroactive.

Eligible Land

The following lands were deemed eligible for a provincial EG&S program:

- Wetlands
    - Land areas on farms that hold spring-season, semi-permanent or permanent water. These include bogs, fens, marshes and swamps and have saturated soil conditions over a long enough period of time during the year to maintain water-loving vegetation (such as rushes, cattails, sedges and other forbs) and wildlife habitat (ALUS Technical Advisory Committee, 2006).
        - All sizes of wetlands were deemed eligible for this program.
- Natural Uplands
    - Any upland maintained with native grassland, bushes and trees, or any combination thereof. [22]
        - Note that fallow land is not eligible for the potential program.

[21] Note that, due to data restrictions, the number of eligible acres for wetlands and natural uplands encompass all of the areas of wetlands and natural uplands on private lands in rural Manitoba (rather than only land owned by agricultural landowners). The number of eligible acres for ecologically sensitive lands and riparian areas reflect only agricultural and forage crop land.

[22] Under ALUS, natural uplands are lands that have not been cultivated for 20 years or more excluding wetlands and riparian areas (ALUS Technical Advisory Committee, 2006).

- Ecologically Sensitive Lands
    - Land subject to severe water erosion, wind erosion, flooding, salinity, runoff or leaching (ALUS Technical Advisory Committee, 2006).
        - Land classes 4, 5, 6 and 7 were assumed to be eligible under the ecologically sensitive land service.

Riparian areas were modeled as part of eligible lands within the sensitivity analysis. This is due to the fact that given impending riparian zone buffer regulations under *the Water Protection Act*, they may not be a need for EG&S payments for some types of buffers. While the details of the regulations are not yet known with certainty, we have elected to present the results with the inclusion of eligible acres for riparian areas as a sensitivity analysis rather than as part of the main results. The following bullets define riparian areas for the purposes of the sensitivity analysis.

- Riparian Areas and Buffers
    - An area of land adjacent to a stream, river, lake or wetland that contains natural vegetation that, due to the presence of water, is distinctly different from the vegetation of adjacent upland areas (ALUS Technical Advisory Committee, 2006).
    - A riparian buffer includes the riparian area plus areas of perennial cover that extend beyond the riparian area. A riparian buffer is an area of land developed or conserved to reduce erosion, intercept contaminants and provide wildlife habitat along the side of a watercourse or waterbody. The area is often left in undisturbed or permanent vegetation.
    - Buffer widths of 3m, 10m, 25m and 50m were assessed for this analysis.

This program was designed from a provincial perspective. However, it should be noted that a targeted approach based on regional issues was highlighted throughout the interviews and focus group as the most appropriate approach for program design. Despite this suggestion, due to budget and time limitations, the scope of the project had to be limited to a provincial analysis.

Eligible Practices

All practices that maintain, rehabilitate and enhance the environment and ultimately produce EG&S were given consideration for this program. After detailed discussions with both the focus group participants and the interviewees, it was determined that practices eligible for the ALUS pilot project in Manitoba seemed reasonable. These practices included maintenance and enhancement of wetlands, riparian areas, natural uplands and ecologically sensitive lands with either:

- No agricultural use
- Haying permitted
- Controlled grazing permitted

More detailed descriptions of these practices were provided in Section 2.2.1.

For the most part, there appeared to be consensus from the focus group and interviews on the first three factors identified above (i.e., eligibility criteria, eligible land, and eligible practices). However, there were a number of variations with respect to the other suggested criteria (i.e., level of payments, contract length and adoption rates). In these cases, we used multiple scenarios representing the range of responses in the cost-benefit analysis, as described below.

Level of Payments

Because of the lack of consensus, a scenario approach was developed to assess various ways to approach payments. The scenarios are all based on continuous annual payments. The scenarios included:

- Payments based on rental rates for marginal and productive land (proxy for opportunity costs)
- Payments based on crop revenues and expenses for marginal and productive land (proxy for opportunity costs)
- Payments based on the ALUS pilot project (assuming no agricultural use payment levels).

A more detailed description of the above payment scenarios is included in Section 6.

The George Morris Centre also came up with two other potential payment scenarios, based on the US Conservation Reserve Program, which were not modelled for the purposes of this analysis. These two scenarios are described in Appendix C.

Contract Length

A number of suggestions were offered in the interviews and focus group for the length of contracts for the provision of EG&S in Manitoba, ranging anywhere from 3 to 10 years. Since there was no consensus on the contract length, three scenarios were evaluated using 3, 6 and 10 year contracts. Three was selected as the minimum number of years to meet WTO requirements, 6 year contracts represented a mid-point and a 10 year contract scenario was used to reflect the US Conservation Reserve Program approach.

Adoption Rates of EG&S Practices on Eligible Land

Using the results of the interviews and focus group as a guide, three scenarios representing various levels of adoption of eligible acres were determined. Specifically, the total acres of eligible land were adjusted by 30%, 50% and 70% to estimate total program costs and benefits for various levels of participation in the program (i.e., adoption rates for eligible land).

Other Considerations

There are two other points to consider when designing an EG&S program for Manitoba. First, what characteristics are necessary for a program to be considered an EG&S program? Second, what characteristics are necessary for a program to fall within the WTO green box requirements?

In terms of EG&S program criteria, in 2005, the Québec Ministère de l'Agriculture, des Pêcheries et de l'Alimentation conducted a detailed analysis of remuneration for EG&S produced by agriculture (Gagnon et al., 2005). The research proposes that, to be considered remuneration for EG&S, payment programs must meet the two main criteria and at least one of the secondary criteria listed below:

- Main criteria
    - Payments are made to the producer of the ecological good or service;
    - Payments are for the production of a well defined ecological good or service.
- Secondary criteria
    - Payments are on-going;

- Payments are made under a contract resulting in the long-term provision of an ecological good or service;
- Payments exceed the initial cost incurred and thus provide a form of production incentive;
- The ecological good or service is the object of a transaction between the producer and another stakeholder for whom the good or service is useful.

The proposed design of the potential EG&S program in Manitoba within this research meets the above criteria. These criteria are interesting to consider as a potential EG&S program for Manitoba is discussed in the future.

Green Box subsidies are permitted by the World Trade Organization (WTO) without financial limits (WTO, 2002). MAFRI wishes to ensure that any potential EG&S program implemented in Manitoba meets the definition of a Green Box subsidy in order to prepare for the future. Annex 2 of the Agriculture Agreement of the WTO defines Green Box subsidies (WTO, 2007). Agriculture and Agri-Food Canada (AAFC) and the Department of Foreign Affairs and International Trade Canada (DFAIT) interpret the WTO agreements and make the final decision on the notification of Canada's programs. At this point, without input from AAFC and DFAIT, it is unclear whether the EG&S program design modelled for this analysis will fall within the WTO Green Box subsidies or not. However, this is an important consideration for the future.

5.0 GIS Analysis and Results

Using the GIS data collected from the Manitoba Land Initiative website as well as additional data obtained from Manitoba Conservation, GIS analysis was used to estimate the number of acres eligible for a potential EG&S program within Agro-Manitoba. The number of eligible acres[23] in Agro-Manitoba for wetlands, natural uplands and ecologically sensitive lands has been estimated using GIS analysis as follows:

Wetlands = 1,417,922 acres
Natural uplands = 9,079,354 acres
Ecologically sensitive lands = 1,517,713 acres

For the sensitivity analysis, the following estimates for the number of eligible acres of riparian areas were used:

Table 5.1 Estimated Eligible Acres of Riparian Areas by Buffer Width

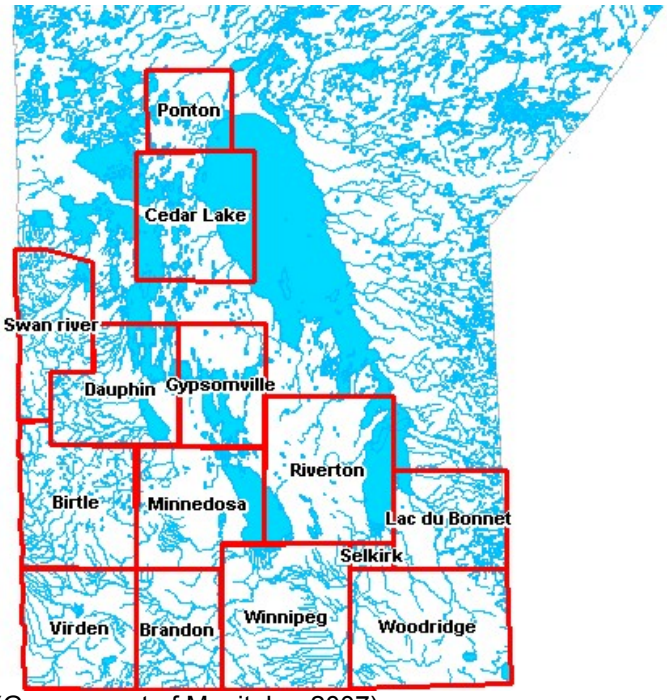
Buffer Width	Eligible Acres
3 m	10,176
10 m	45,827
25 m	136,536
50 m	340,438

Note that the numbers for wetlands and natural uplands encompass all of the areas of wetlands and natural uplands on private lands in rural Manitoba (rather than only land owned by agricultural landowners). The numbers for ecologically sensitive lands and riparian areas reflect only agricultural and forage crop land.

Within the land use class data, there are 13 areas within the province as shown in the following figure.

[23] Eligible acres reflect acres which are classified as belonging to the desired land type (e.g. wetlands, ecologically sensitive lands, natural uplands and riparian areas) in Agro-Manitoba and, hence, may be eligible for a potential EG&S program. In addition, other factors have been taken into consideration in order to determine eligible acres as described in section 3.2. For example, public lands would not be eligible for an EG&S program.

Figure 5.1 Land Use/Land Cover Areas Available for Manitoba



Source: (Government of Manitoba, 2007).

Given the areas of land use data, it is possible to breakdown eligible acres of wetlands, natural uplands and ecologically sensitive lands into each of the areas as shown in Table 5.2. Table 5.3 presents similar information for riparian areas by buffer width.

Table 5.2 Eligible Acres for Wetlands, Natural Uplands and Ecologically Sensitive Lands by Land Use/Land Cover Area

	Acres		
	Wetlands	**Natural Uplands**	**Ecologically Sensitive Lands**
Birtle	190,268	840,422	162,381
Brandon	77,298	706,701	207,155
Cedar Lake	63,653	68,721	n/a
Dauphin	134,043	1,047,139	107,645
Gypsumville	97,735	524,932	38,063
Lac du bonnet	93,879	187,146	n/a
Minnedosa	90,264	946,243	192,588
Riverton	189,273	1,089,663	166,655
Selkirk	630	81,664	5,367
Swan River	143,370	1,069,467	89,978
Virden	40,505	731,155	287,805
Winnipeg	24,734	659,039	200,292
Woodridge	272,269	1,127,062	59,783
Total for Agro-Manitoba	**1,417,922**	**9,079,354**	**1,517,713**

Table 5.3 Eligible Acres for Riparian Areas by Land Use/Land Cover Area by Buffer Width

	Eligible Acres of Riparian Areas			
	3 m	**10 m**	**25 m**	**50 m**
Birtle	790.3	3,405.4	9,855.0	26,530.3
Brandon	827.1	3,459.6	9,603.4	24,163.1
Cedar Lake				
Dauphin	889.5	3,598.5	9,538.7	23,032.7
Gypsumville	3.6	15.3	45.6	159.8
Lac du Bonnet	168.4	1,174.6	3,391.3	9,405.1
Minnedosa	957.1	4,591.1	12,456.0	31,342.6
Riverton	203.8	1,370.5	3,588.9	8,659.2
Selkirk	99.6	712.6	2,081.1	4,990.4
Swan River	1,173.8	5,831.6	13,987.2	30,482.4
Virden	1,541.5	6,563.1	17,006.2	39,559.3
Winnipeg	2,892.8	11,278.7	43,583.0	110,148.3
Woodridge	628.9	3,825.8	11,399.3	31,964.6
Total for Agro-Manitoba	10,176.3	45,826.7	136,535.8	340,437.7

6.0 Cost-Benefit Analysis

Section 6.0 provides a description of the background, assumptions and the results stemming from the cost-benefit analysis conducted to evaluate the proposed EG&S program for Manitoba. Specifically, Section 6.1 provides the background context for the cost-benefit analysis. Section 6.2 identifies the specific values transferred from the literature to represent the various costs and benefits of the proposed program in the model. Section 6.3 provides a detailed description of the economic model and the assumptions made to conduct the cost-benefit analysis. The section concludes with the results of the cost-benefit analysis (section 6.4).

6.1 Background for the Cost-Benefit Analysis

This research examines the costs and benefits of the proposed EG&S program if it were established in Agro-Manitoba. The costs and benefits are discussed in comparison to the status quo (the current situation in Agro-Manitoba where an EG&S program is not in place).

Determining the Scope

Cost-benefit analysis can be performed from a global, national, provincial or local perspective. For the purposes of this research, the cost-benefit analysis was conducted at the provincial level, or more specifically for Agro-Manitoba.

6.2 Identifying and Valuing the Benefits and Costs

To discuss the various benefits and costs anticipated from an EG&S program, this section has been divided as follows: Section 6.2.1 discusses the benefits and Section 6.2.2 discusses the costs included for evaluation in the model and the specific values transferred from the literature. Section 6.2.3 provides a detailed discussion of the other potential impacts that may occur from the introduction of an EG&S program, but which could not be estimated in the model.

6.2.1 Benefits

The following is a brief description and justification of the dollar values assigned to the benefits of the potential EG&S program in Manitoba for the cost-benefit analysis. Given that the generation of new quantitative data on the value of environmental improvements from an EG&S program in Manitoba was beyond the scope of this research, the value of benefits provided by the EG&S program were assessed using a literature review and benefit transfer methodology[24], where possible.

We derived the value of benefits associated with eligible land in Manitoba based on a case study[25] by Belcher et al. (2001), as described by Olewiler (2004). Olewiler presented final natural capital values estimated by Belcher et al. (2001) for the Upper Assiniboine River Basin,

[24] Benefit transfer can be defined as the transfer of existing estimates of non-market values to a new study which is different from the study for which the values were originally estimated (Boyle and Bergstrom, 1992). The site for which the original estimates were obtained is referred to as the study site while the site under consideration for a new policy is termed the policy site (Desvousges et al., 1992). The estimated benefits are transferred from the study site to the policy site (Desvousges et al., 1992).

[25] As background, in 2001, there were 5,800 farms located in the Upper Assiniboine River Basin, cultivating a total of 1,024,814 hectares. Lease rates for land located in the Basin ranged from $28 to $52 per hectare. The top three agricultural outputs from the Basin included annual crops, livestock and forage production.

which is located in east-central Saskatchewan and western Manitoba. The geographic location of the estimated environmental benefits (i.e. the Upper Assiniboine River Basin) lends itself to a more accurate benefit transfer of these values to our analysis in Manitoba. In addition, the environmental risks[26] of the Upper Assiniboine River Basin are similar to those in the province of Manitoba, making the transfer of environmental benefits from the preservation of natural capital and the provision of EG&S even more relevant. The gross and net benefits (per hectare) to society of protecting natural areas or converting tilled land in the Upper Assiniboine River Basin from Olewiler's research are shown in Table 6.1 (high, low and best estimates are included).

Table 6.1 Net Value of Conserving Natural Capital in the Upper Assiniboine River Basin, $/Hectare/Year, 2001

Benefits	High	Best Estimate	Low
	2001 Dollars		
	C$/Hectare/Year		
Saved government payments	19.25	*12.83*	6.42
Saved crop insurance premiums	5.27	*3.51*	1.76
Improved water quality – decreased sediment	9.34	*4.62*	1.34
Water-based recreation	1.37	*0.91*	0.46
Reduced wind erosion	4.01	*2.67*	1.34
Reduction in GHG emissions	14.07	*9.38*	4.69
Carbon sequestration	29.40	*19.60*	9.80
Increased wildlife hunting	19.11	*10.71*	5.36
Wildlife - non-consumptive use	6.45	*4.16*	2.08
Gross benefits	**$108.25**	***$68.39***	**$33.23**
Program administration costs	(1.04)	*(2.08)*	(3.12)
Wildlife depredation compensation	(0.32)	*(0.64)*	(0.96)
Net Benefits	**$106.89**	***$65.67***	**$29.15**

Note: Numbers may not add due to rounding (but are reflective of original source)
Source: Olewiler (2004).

For our analysis, we used Olewiler's best estimates (from Table 6.1) as the base for the benefits for natural uplands, ecologically sensitive areas and riparian areas, but made the following modifications:

- Converted the numbers to 2008 Canadian dollars per acre per year[27]
- Removed saved government payments (discussed in section 6.2.3)
- Removed program administration costs (because they are accounted for in our cost scenarios)

Therefore, the estimated value of benefits for natural uplands, sensitive areas and riparian areas is outlined in Table 6.2.

[26] Over time, many trees have been cleared from land in the Upper Assiniboine River Basin, as well as wetlands drained. Several of the problems caused by this degradation of natural capital include loss of wetland and riparian habitat, increased flooding danger, soil erosion and declining water quality. This is of special concern to the communities of Brandon and Portage la Prairie, whose drinking water comes from the Assiniboine River (Olewiler, 2004).

[27] Converted using: 1 ha = 2.471 acres; converted from 2001 to 2008 dollars using Bank of Canada Inflation Calculator (Bank of Canada, 2008).

Table 6.2 Value of Benefits for Natural Uplands, Sensitive Areas and Riparian Areas

Benefits (Costs)	Best Estimate (2008 CDN $/acre/year)
Saved crop insurance premiums*	1.65
Improved water quality – decreased sediment	2.17
Water-based recreation	0.43
Reduced wind erosion	1.25
Reduction in GHG emissions	4.40
Carbon sequestration	9.20
Increased wildlife hunting	5.03
Wildlife- non-consumptive use	1.95
Gross environmental benefits**	**24.43**
Gross benefits	**26.08**
Wildlife depredation compensation***	-0.30
Net Benefits	**25.78**

*Non-environmental benefits
** George Morris Centre addition.
***Cost, but included here to determine net environmental benefits.
Source: Adapted from Olewiler, 2004.

Quantification of wetland benefits in the literature indicates that wetlands are valued higher than the other types of land discussed here. Therefore, to increase the accuracy of the analysis, we used a separate benefit value for wetlands. Olewiler (2004) states that a number of studies have valued the goods and services generated by one hectare of wetlands per year. The estimates range from $5,792/hectare/year to $24,330/hectare/year (2003 estimates). When converted to 2008 dollars per acre, the value of wetlands ranges from 2008 $2,555/acre/year to 2008 $10,732/acre/year. For the purposes of this analysis, we have assumed that the environmental benefits produced by a wetland are valued at $2,555/acre/year and have included lower estimates as part of the sensitivity analysis.

6.2.2 Costs

The anticipated costs of the EG&S program include:

- Program payments to agricultural landowners;
- Program design and development costs (i.e. start-up costs)
- Program administration costs

Each of these costs is examined in the following sections.

Program Payments

Several cost scenarios for program payments were used in the analysis. The scenarios were all based on continuous annual payments including:

- Scenario 1: Payments based on rental rates for marginal and productive land (proxy for opportunity costs)
- Scenario 2: Payments based on crop budget revenues and expenses for marginal and productive land (proxy for opportunity costs)

- Scenario 3: Payments based on the ALUS pilot project (assuming no agricultural use payment levels).

The four types of land eligible for the potential EG&S program include riparian areas, natural uplands, ecologically sensitive areas and wetlands. In terms of agricultural productivity, two of the eligible lands under the potential EG&S program may be classified as marginal lands. In particular, ecologically sensitive lands are based on soil classes 4, 5, 6 and 7 which, by definition, include land that is subject to erosion, leaching, etc. Natural uplands include lands maintained with native grasslands, shrubs, and trees and are also assumed to be marginal in nature.

In contrast, riparian areas and wetlands can be quite productive. Wetlands are productive with drainage and riparian areas can be productive with clearing.

Therefore, for the purposes of this analysis, the opportunity costs (both rental rates and crop budgets) are based on marginal productivity for ecologically sensitive lands and natural uplands and are based on high productivity for wetlands and riparian areas.

Scenario 1: Payments Based on Rental Rates

A current estimate for rental rates on productive and marginal lands in Manitoba were provided by MAFRI. It was estimated that productive land has a current rental rate of $60/acre, while marginal land has a rental rate of $30/acre (Park, personal communication, 2008). These values are reflective of the high commodity prices in the current 2008 market. Rental rates are expected to increase if commodity prices continue to rise (Park, personal communication, 2008).

Table 6.3 Estimated Rental Rates Used in the Analysis for Marginal and Productive Land in Manitoba, 2008

Land Type	Rental Rate ($/acre)
Productive	$60
Marginal	$30

Source: (Park, personal communication, 2008).

Scenario 2: Payments Based on Crop Budgets

Agricultural land can be used to produce many different commodities and products including cash crops, livestock, greenhouse vegetables, etc. The value of this production (income generated) represents an opportunity cost to the farmer if land use is restricted under an EG&S program. The value of production arising from the use of the agricultural land can be examined using models of the revenues and costs associated with producing the relevant crops.

To measure the value of production, representative farm models were developed using 2007 or 2008 crop budgets obtained from Manitoba Agriculture, Food and Rural Initiatives (MAFRI, 2008a). A few adjustments were made based on advice from MAFRI staff. Most notably, fuel prices in the Crop Production Costs model were increased by $2.00/acre for each crop and the input cost of fuel for the Alfalfa Hay model was set at $1.15/litre (up from $0.81/litre). The crop budgets provide estimates of the variable costs and fixed costs for individual crops on a per acre basis. Estimates for revenues and net income were then included in the models based on 10 year average yields (Wilcox, 2008) and 2007-2008 prices.

Crop Rotations

Various crop rotations were used in building the crop models to represent a typical farm in Manitoba. Consultation with MAFRI established that the use of a rotation previously used in George Morris Centre research (Brethour et al., 2007) was an appropriate rotation to use for the more productive lands in Western Manitoba. This rotation consisted of barley, canola, red spring wheat and peas at 20%, 30%, 40% and 10% respectively (Brown-Livingston, personal communication, 2008; Park, personal communication, 2008) for each of the crops. It was noted; however, that this rotation would not be appropriate for regions further east where soybean production occurs. Therefore, a crop model was also developed based on a typical rotation on productive land in eastern Manitoba, which included oats, canola, red spring wheat, and soybeans again with a ratio of 20%, 30%, 40% and 10% respectively (Park, personal communication, 2008). Upon the estimation of net income from these two rotations, it was determined that the net incomes were extremely close, with the Western Manitoba model generating just slightly higher returns. For simplicity purposes, the remainder of the analysis for productive lands was based on the Western Manitoba crop model.

It was assumed for marginal land that forage production would be included in the rotation and, in consultation with MAFRI staff, a typical rotation on marginal land was considered as red spring wheat, canola and alfalfa with the respective ratios at 25%, 25% and 50%. It was assumed that alfalfa would be produced for multiple years and would therefore represent a larger portion of the land (i.e., 50% of the rotation).

Yield Estimation

In order to distinguish between productive and marginal land, data from the Manitoba Agricultural Services Corporation's (MASC) crop insurance program was used to calculate the average yield from the different land types (i.e., productive and marginal).

MASC bases crop insurance on a land productivity index.[28] The index consists of 10 soil classes "A-J", with "A" being the most productive and "J" being the least productive of the soils. In addition to the soil classes, MASC has established risk areas.[29] Yield records are maintained by risk area and soil class and a 10 year average is the "probable yield" upon which MASC bases crop insurance.

To establish an estimate of yield for each of the field crops used in the models, the average probable yield across all risk areas for soil classes A-D was used as a proxy for yields on productive land, while the average probable yield across all risk areas for soil classes H-J was considered used as a proxy for yields on marginal land. This assumption was made in consultation with MASC staff (Wilcox, 2008).

[28] This index was developed with collaboration between the Manitoba Department of Agriculture, the Department of Soil Science at the University of Manitoba and the Manitoba Soil Survey. This project began in the 1930s and initially major soil types in the province (benchmark soils) were selected and the long term (35 years) average wheat, oats, and barley yields were obtained for each soil from the Dominion Bureau of Statistics, the Sandford-Evans Statistical Service, and the Veterans' Land Act Administration. The benchmark soils were then placed in one of ten classes (A - J) with the soils having the highest yields being classed as "A" and the lowest yielding soils being classed as "J". The characteristics of all other soils mapped by the Soil Survey were then studied and compared to these benchmark soils were placed in the appropriate productivity classes.

[29] There are 15 risk areas - values ranging from 1-16 (no risk area for 13). For maps refer to Appendix D.

Alfalfa Yields

Data for alfalfa yields and insurance are not based on the soil productivity index (i.e., the "A-J" classification). Instead, the province is divided into designated forage areas (DFA) and yield data is collected for each of these areas. In order to establish which of these areas were marginal land, a map from MASC which indicated the distribution of "I" and "J" soils throughout the province was used in conjunction with a map which illustrated the boundaries of the various DFAs[30] to estimate which DFAs were generally marginal lands (i.e., high levels of "I" and "J" soils). It was these marginal land DFAs that were used in calculating an average alfalfa yield on marginal land.[31] It is important to note that this methodology is simply an approximation of which DFAs were marginal and is therefore subject to a certain level of error.

Yields for productive and marginal land for the various crops are summarized in Table 6.4 and Table 6.5, respectively.

Table 6.4 Crop Yields on Productive Land, 10 year average (1996-2007)

Commodity*	Yield (bu/acre)**
Barley	63.05
Canola	31.37
Wheat	41.69
Peas	36.09

* Based on Western Manitoba crop rotation.
** Based on yields for land with soil classes "A-D" from 15 risk areas in the province.
Source: (Wilcox, 2008).

Table 6.5 Crop Yields on Marginal Land, 10 year average (1996-2007)

Commodity*	Yield	Notes
Wheat	29.11 bu/acre	Based on yields for land with soil classes "H", "I" and "J" from 15 risk areas in the province.
Canola	22.01 bu/acre	Based on yields for land with soil classes "H", "I" and "J" from 15 risk areas in the province.
Alfalfa	3,778 lbs/acre	Based on selected designated forage areas which were generally marginal lands (i.e., high levels of "I" and "J" soils)

* Based on typical rotation for marginal land.
Source: (Wilcox, 2008).

Prices

The commodity prices that were used in the crop rotation models to establish revenues were the 2007-08 prices. These prices reflect the most recent commodity prices and include prices to mid April 2008. Prices and data sources for the various crops are summarized in the table below.

[30] For maps, refer to Appendix D.
[31] The DFAs selected included # 1, 10, 21, 23, 24, 26, 27, 38, 39, 43 and 44.

Table 6.6 Sources for Commodity Prices

Commodity	Price ($/t)	Price ($/bu)	Source	Notes
Wheat		10.26	CWB	Latest 2007/08 Pool Return Outlook (March 2008)
Barley	188.09	4.10	AAFC[32]	Saskatoon elevator price, Winnipeg no longer being monitored by AAFC
Canola	479.09	10.87	WCE	Saskatoon Par-Region Data
Peas	260.77	7.10	AAFC	Saskatoon elevator price
Oats	185.70	2.86	AAFC	Saskatoon elevator price
Soybeans	368.27	10.02	MAFRI-Manitoba Markets	From MAFRI website
Alfalfa		0.041 **$/lbs**	MAFRI-Friesen, G., Forage Specialist.	Personal Communication

Summary

Table 6.7 and 6.8 present the revenues and costs for the crops used within the models on a per acre basis. Then, the representative crop rotations are assigned to these revenues and costs to determine overall net income on a per acre basis. The Western Manitoba crop model was used to model the net income per acre for productive land within Manitoba and the marginal land crop model was used to model net income per acre for marginal land in Manitoba.

[32] Data from AAFC is sent to the George Morris Centre on a weekly basis.

Table 6.7 Western Manitoba Crop Model

Revenue	*Barley* $/acre	*Canola* $/acre	*Wheat* $/acre	*Peas* $/acre
Crop Yield (bu/acre)	63.05	31.37	41.69	36.09
Estimated Price ($/bu)	4.10	10.87	10.26	7.10
Expected Crop Revenue	**258.21**	**340.86**	**427.74**	**256.17**
A. Operating Costs				
Seed & Treatment	18.00	33.95	18.28	34.38
Fertilizer	42.93	52.35	45.03	23.55
Herbicide	23.00	26.00	23.00	24.50
Fungicide	6.25	26.50	7.75	16.50
Insecticide	0.00	0.00	0.00	0.00
Fuel	17.00	17.00	17.00	17.00
Machinery Operating	10.00	10.00	10.00	10.50
Crop Insurance	5.11	10.02	5.97	8.76
Other Costs	7.50	7.50	7.50	8.00
Land Taxes	4.80	4.80	4.80	4.80
Interest on Operating	4.37	6.11	4.53	4.81
Total Operating	**138.96**	**194.23**	**143.86**	**152.80**
B. Fixed Costs				
Land Investment Costs	25.00	25.00	25.00	25.00
Machinery Depreciation	25.00	25.00	25.00	25.00
Machinery Investment	10.00	10.00	10.00	10.00
Storage Costs	3.77	3.77	3.77	3.77
Total Fixed	**63.77**	**63.77**	**63.77**	**63.77**
C. Labour	**17.25**	**17.25**	**17.25**	**19.25**
Total Costs	**219.98**	**275.25**	**224.88**	**235.82**

Revenue	*Barley* *20%*	*Canola* *30%*	*Wheat* *40%*	*Peas* *10%*	Total $/acre
Crop Yield (bu/acre)	-	-	-	-	
Estimated Price ($/bu)	-	-	-	-	
Expected Crop Revenue	**51.64**	**102.26**	**171.09**	**25.62**	**350.61**
A. Operating Costs					
Seed & Treatment	3.60	10.19	7.31	3.44	
Fertilizer	8.59	15.71	18.01	2.36	
Herbicide	4.60	7.80	9.20	2.45	
Fungicide	1.25	7.95	3.10	1.65	
Insecticide	0.00	0.00	0.00	0.00	
Fuel	3.40	5.10	6.80	1.70	
Machinery Operating	2.00	3.00	4.00	1.05	
Crop Insurance	1.02	3.01	2.39	0.88	
Other Costs	1.50	2.25	3.00	0.80	
Land Taxes	0.96	1.44	1.92	0.48	
Interest on Operating	0.87	1.83	1.81	0.48	
Total Operating	**27.79**	**58.27**	**57.54**	**15.28**	
B. Fixed Costs					
Land Investment Costs	5.00	7.50	10.00	2.50	
Machinery Depreciation	5.00	7.50	10.00	2.50	
Machinery Investment	2.00	3.00	4.00	1.00	
Storage Costs	0.75	1.13	1.51	0.38	
Total Fixed	**12.75**	**19.13**	**25.51**	**6.38**	
C. Labour	**3.45**	**5.18**	**6.90**	**1.93**	
Total Costs	**44.00**	**82.58**	**89.95**	**23.58**	**240.10**
Net Income					**110.51**

Table 6.8 Marginal Land Crop Model

	Wheat $/acre	*Canola* $/acre
Crop Yield (bu/acre)	29.11	22.01
Estimated Price ($/bu)	10.26	10.87
Expected Crop Revenue	**298.69**	**239.13**
A. Operating Costs		
Seed & Treatment	18.28	33.95
Fertilizer	45.03	52.35
Herbicide	23.00	26.00
Fungicide	7.75	26.50
Insecticide	0.00	0.00
Fuel	17.00	17.00
Machinery Operating	10.00	10.00
Crop Insurance	5.97	10.02
Other Costs	7.50	7.50
Land Taxes	4.80	4.80
Drying Costs	0.00	0.00
Interest on Operating	4.53	6.11
Total Operating	**143.86**	**194.23**
B. Fixed Costs		
Land Investment Costs	25.00	25.00
Machinery Depreciation	25.00	25.00
Machinery Investment	10.00	10.00
Storage Costs	3.77	3.77
Total Fixed	**63.77**	**63.77**
C. Labour	**17.25**	**17.25**
Total Costs	**224.88**	**275.25**

	Alfalfa $/acre
Crop Yield (lbs/acre)	3,778
Estimated Price ($/lb)	0.041
Expected Crop Revenue	**154.89**
A. Operating Costs	
Establishment Cost	24.67
Seed (included in establishment)	-
Fertilizer	25.60
Herbicide	0.00
Field Fuel Costs	17.01
Moving Costs	12.50
Repairs & Maintenance	3.50
Crop Insurance	7.91
Land Taxes	4.80
Miscellaneous	6.00
Sub-total Operating Cost	101.99
Interest on Operating	2.80
Total Operating	**104.79**
B. Fixed Costs	
Depreciation	
Machinery	14.50
Storage	1.50
Investment	
Land	21.00
Machinery	3.19
Storage	0.60
Total Fixed Costs	**40.79**
C. Labour	**7.20**
Total Cost of Production	**152.78**

Table 6.8 Marginal Land Crop Model (continued…)

	Wheat 25%	*Canola* 25%	*Alfalfa* 50%	*Total* $/acre
Expected Crop Revenue	**74.67**	**59.78**	**77.45**	**211.90**
Total Operating Costs	35.97	48.56	52.39	136.92
Total Fixed Costs	15.94	15.94	20.40	52.28
Labour	4.31	4.31	3.60	12.22
Total Cost of Production	**56.22**	**68.81**	**76.39**	**201.42**
Net Income				**10.48**

Scenario 3: Payments Based on ALUS Program Payment Levels

Scenario 3 was based on the payment schedule outlined in the ALUS program. Table 6.9 outlines the payment levels under the ALUS pilot project in the Rural Municipality of Blanshard, Manitoba.

Table 6.9 ALUS Pilot Project Payment Levels

Service	No Agricultural Use ($/acre/yr)	Haying ($/acre/yr)	Grazing ($/acre/yr)
Wetland	15	7.50	5
Riparian	15	7.50	5
Natural	15	7.50	5
Ecologically Sensitive	25	10	5

Source: (ALUS Technical Advisory Committee, 2006).

For this analysis, the "no agricultural use" levels of ALUS payments were used (i.e., haying and grazing payments were not considered as cost scenarios). This assumption was made for two reasons. First, the no agricultural use payment levels are the highest of the three options. Therefore, these levels reflect the maximum potential costs associated with program payments by the government and funding partners. Second, in the Rural Municipality of Blanshard pilot project, the majority of enrolled acres were classified as no agricultural use rather than haying or grazing (Grant and Mann, 2007). Therefore, these payment levels would likely comprise the majority of payments in a similar program, such as that proposed for Manitoba.

It is also important to note that under the ALUS pilot project, up to 100% of eligible acres under the wetland, natural area and riparian area services can be enrolled. However, a maximum of 20% of the ecologically sensitive land within a landowner's land base is eligible for payment. For this analysis, 100% of ecologically sensitive land was considered eligible for payments, in order to model the maximum potential costs associated with the potential EG&S program.

Start-Up Costs

Generally, policy related transactions costs can be divided into four stages of costs: policy design and policy delivery when beneficiaries are identified; claims processed and support paid; monitoring and control; and evaluation to determine if the policy fulfilled its objectives (OECD, 2007a). Some of these costs fall under start-up costs, for example, policy design and initial policy delivery, while the remaining costs can be categorized as administration costs of the

program. The following is a brief overview of start-up costs for the ALUS pilot project in Manitoba, the National Farm Stewardship Program/Greencover Canada Program and the US Conservation Reserve Program (CRP). Administration costs associated with these programs are discussed in the following section. These values are a reference point in the estimation of the costs for a potential Manitoba EG&S program for use in the cost-benefit analysis.

Start-up costs for the ALUS pilot project in the Rural Municipality of Blanshard included development expenditures in the amount of 67% of first and second year payments to producers. As the program expands, these development expenditures are shared among more producers, resulting in start-up costs representing a smaller percentage of payment costs (Grant and Mann, 2007).

Agriculture and Agri-Food Canada (AAFC) delivers a large number of agri-environmental programs. Unfortunately, AAFC did not track start-up costs separately from administration for these programs (e.g. National Farm Stewardship Program and Greencover Canada). The programs typically had higher administration costs early in the program (accounting for, at least in part, start-up costs) (Sharpe, personal communication, 2008).

The Conservation Reserve Program (CRP) is administered by the Farm Service Agency (FSA) and the Natural Resources Conservation Services (NRCS) in the United States. The costs of developing and administering the program fall between these two organizations. Both agencies had substantial start-up costs in the first year that CRP operated (1986). Start-up costs represented 87% of payments for NRCS and 23% of payments for FSA (OECD, 2007a).

For this analysis, the start-up costs under the ALUS pilot project were used as a proxy for the development expenditures that would be associated with a potential EG&S program in Manitoba.

Administration Costs

In the first year of the ALUS Pilot Program in Blanshard, operational expenditures were 22% of producer payments of $294,206. Producer payments for the second year were expected to be approximately $306,485 and operational expenditures were 15% of this payment amount (Grant and Mann, 2007).

Agriculture and Agri-Food Canada manages and delivers a large number of programs through their Client Service Centre including the National Farm Stewardship Program and Greencover Canada. Unfortunately, the Client Service Centre does not track the administrative expenditures by individual program and therefore it is not possible to identify how much is spent on an individual program. However, when third party delivery agents are used for program delivery, National Farm Stewardship Program administration costs are capped at 15% of program expenditures and Greencover Canada administration costs are capped at 10% of program expenditures. As such, these percentages represent the maximum potential administrative costs related to these programs, respectively (Sharpe, personal communication, 2008).

In the initial years of CRP (1986-1996), NRCS technical assistance costs were 3% per dollar of expenditure.[33] In succeeding years (1997-2002), technical assistance costs decreased to 1%

[33] Note that CRP technical assistance and administration costs are stated as a % of expenditures, whereas ALUS operational costs are stated as a % of program payments.

per dollar of expenditure. FSA administration costs were equal in the initial and succeeding years at 4% per dollar of expenditure (OECD, 2007b). Recent estimates indicate that each contract under the CRP costs about US$60 per year, which translates into approximately 2% of program costs (Barbarika, personal communication, 2008).

On a per acre basis, NRCS technical assistance costs were US$23.21 per acre initially and US$5.33 per acre in succeeding years. FSA administrative costs were US$27.11 per acre initially and US$13.97 per acre in succeeding years (OECD, 2007b).

This brief overview of administrative costs of several environmental programs indicates that the US CRP estimates are very low compared to estimated costs of Canadian programs. Since the proposed EG&S program is in Manitoba, the Canadian estimates are more applicable for this analysis. To ensure that the maximum potential costs of the program are taken into consideration in the analysis, a 15% administrative cost, as a percentage of payments, was used to represent administrative costs of the proposed EG&S program in Agro-Manitoba.

6.2.3 Other Impacts

This section provides an overview of other impacts that may occur from the development of an EG&S program. Due to difficulties placing values on these impacts, they have not been quantified for the purposes of this analysis. Therefore, they are discussed below as potential impacts, but not used in the estimation of the overall costs and benefits of a potential EG&S program. These impacts include:

- Changes in land values
- Impacts on farm income
- Impacts on government program payments
- Municipal and regional cost savings
- Marginal excess tax burden
- Equity

Changes in Land Values

The literature suggests that the effect of EG&S programs on land value is mixed. According to Tyrchniewicz and Tyrchniewicz (2007), government programs that promote 'permanent preservation' of potential agricultural lands for EG&S may tend to increase land values. Moreover, Nickerson and Lynch (2001) evaluated the effect of permanent preservation programs in Maryland and found that such programs may not necessarily decrease farmland prices. Other studies indicated that land used for permanent conservation programs may have lower value than unpreserved land (Blakely, 1991; Taff, 2004). Taff (2004) indicated that preserved lands under the CRP program may be sold for 19% less than unrestricted lands.

Impacts on Farm Income

Royer and Gouin (2007) evaluated the effect of an EG&S program on farm income for three different countries: France, Belgium and Switzerland. Switzerland has explicit farm programs that offer ecological direct payments that give incentives to farmers for preserving their lands for ecological purposes. Ecological direct payments accounted for 14% of the total farm income in 2003 (Royer and Gouin, 2007). In France and Belgium, EG&S programs are embedded in broader agricultural programs. For instance, in France, EG&S programs are part of the environmental component of the Farmland Management Contracts (FMCs), which encourage farmers to produce positive externalities. The Farm Management Contracts program accounted

for 18 to 20% of the total family farm income in France in 2001, with programs targeted towards EG&S contributing less than these values. Similarly in Belgium, EG&S programs are embedded in agri-environmental methods. Even though no quantitative estimation was done due to data limitations, it is expected that payments from agri-environmental methods significantly affects farm income particularly for those on disadvantaged lands (Royer and Gouin, 2007).

An evaluation of the ALUS pilot project in the Rural Municipality of Blanshard, Manitoba indicates that the 2006 ALUS payments were between 10 and 15% of the earned farm gross margin[34] in the municipality. As well, the majority of farmers surveyed as part of the pilot project felt that the receipt of payments for the provision of EG&S would make their farms more financially sustainable.

Impacts on Government Program Payments

This section discusses the potential effects of an EG&S program on government payments for income stabilization, particularly Canadian Agricultural Income Stabilization (CAIS) payments. Note that as of the 2007 program year, CAIS is being replaced by AgriStability and AgriInvest.

It is still uncertain whether and when EG&S program payments would be considered agricultural income, and, thus, whether benefits from decreased government spending on CAIS would be accrued if an EG&S program were implemented in Manitoba. In terms of CAIS payment eligibility, EG&S program payments could be defined as 1) regular allowable farming income (included in both program and reference years); 2) "other program payment" (included in the program year but not the reference years); or 3) non-allowable income (not included).

The decision regarding how EG&S payments will be defined under CAIS (i.e., regular allowable farming income, other program payment, or non-allowable income) may depend on the types of EG&S activities undertaken under an EG&S program (i.e., land taken out of production, land converted from cultivated to permanent forage, maintenance of land providing EG&S). Table 6.10 summarizes the three categories of EG&S program activities, the applicable payment definition options under CAIS, and the corresponding consequences in terms of government spending.

Table 6.10 Consideration of EG&S Program Payments Under CAIS and Consequent Decreases in Government Spending

EG&S Activity	Applicable EG&S Payment Definition under CAIS	Effect on Government CAIS Spending
Land taken out of production	Non-allowable income	None
Land converted from cultivated to permanent forage	Non-allowable income	None
Maintenance of land providing EG&S (two options)	Farming income	Initially, lower CAIS spending (until reference year includes EG&S payments)
	Non-allowable income	None

As Table 6.6 shows, in most cases, the implementation of an EG&S program will not have an impact on government CAIS spending. However, some benefit in terms of decreased

[34] Gross margin is the difference between gross income and variable costs.

government spending could be derived from the enrolment of land providing EG&S, when EG&S program payments are made for maintenance of the land only. In this case, to avoid income distortions, the EG&S payment could be considered farming income, and both the reference year and program year income would be included to calculate CAIS payments. The consequence of this scenario would be that CAIS spending would decrease initially, as EG&S payments would not be included in reference years in the initiation of the program. However, this decrease is only short-term since EG&S payments would be included in reference years after the initiation of the program. Furthermore, there are arguments, in terms of payment definition options, for both the farming income and non-allowable income definitions to be used for this EG&S activity. As such, EG&S program payments for the maintenance of land could also be defined as non-allowable income, in which case there is no effect on government CAIS spending, and thus there would be no benefit derived from decreased government spending.

Municipal and Regional Cost Savings

Natural capital assets, such as riparian buffers, wetlands and natural areas, which provide EG&S reduce the amount of water flow that can potentially cause damage to municipal amenities like drainage, water supply, bridges and roads (Tyrchniewicz and Tyrchniewicz, 2007). Wetlands and natural areas reduce public expenditures by filtering water resources, lowering water treatment cost, thereby improving domestic water and preventing flood risk from drainage blocking caused by soil sediment (Ducks Unlimited, 2006; NRTEE, 2003; as cited in Tyrchniewicz and Tyrchniewicz, 2007). The amount of public expenditure saved depends on the extent to which EG&S reduces these adverse effects on social infrastructure. It also depends on the location of the EG&S relative to the social infrastructure of interest. The National Round Table on the Environment and the Economy (NRTEE) suggested that these benefits, although not yet quantified, could amount to at least $1 per acre savings in public expenditures (NRTEE, 2003 as cited in Tyrchniewicz and Tyrchniewicz, 2007).

Marginal Excess Tax Burden

According to Boardman et al. (2006), "a project that is funded through additional taxes will generally increase deadweight loss[35]." Since an EG&S program in Manitoba would be funded (partially or fully) through taxpayer dollars, another factor that may impact the net benefits of a potential EG&S program is the deadweight loss resulting from raising an additional dollar of tax revenue, referred to as the Marginal Excess Tax Burden (METB) (Boardman et al., 2006). The METB is considered within a CBA as a percentage of additional tax revenues required for the government to fund the project. This percentage is then added to the costs of the project as follows: (1 + METB) x ΔGR, where ΔGR (change in government revenue) represents the project costs absorbed by the government (i.e., government expenditure on the EG&S program).

Since the METB is not considered in the CBA, total program costs may be underestimated. The extent of this underestimation depends on the METB, which ranges depending on which tax transfers are considered. For example, when all taxes (sales, income and property taxes) are considered, the METB (in the US) ranges from US$0.33-$0.46 per dollar of government

[35] When tax revenue is transferred from consumers to the government, some of the resulting costs to consumers are offset by an identical benefit to the government. However, the transfer also imposes an additional cost to consumers (loss in consumer surplus), which is the cost of the tax itself. This cost is referred to, in this context, as a deadweight loss which results from "the distortion in economic behaviour from the competitive equilibrium. The tax causes some consumers to purchase less output than they would in the absence of the tax" (Boardman et al., 2006).

revenue/expenditure (Boardman et al., 2006). However, when just sales tax transfers is considered, the METB ranges from US$0.11 to $0.39 per dollar of government revenue/expenditure (Boardman et al., 2006). The METB also varies depending on the level of government affected by the project (e.g., Boardman suggests that a METB of $0.40/dollar of revenue/expenditure should be considered for federal US projects and a METB of $0.17/dollar of revenue/expenditure should be considered for US local government projects) (Boardman et al., 2006).

The marginal excess tax burden in Manitoba depends on the tax transfers which are considered and hence is not quantified in our analysis.

Equity

Another impact that may result from a potential EG&S program includes distributional inequities that may be created between farm and non-farm landowners given that is expected that only agricultural landowners will be eligible for payments under the potential EG&S program.

6.3 Modelling the Costs and Benefits to Calculate Net Benefits

The following is a description of the cost-benefit analysis model development and structure, including a description of the modeled scenarios, discounting of costs and benefits, the calculation of net benefits, and proposed sensitivity analysis.

Modeled Scenarios

The model was developed to quantify present values of net benefits (discounted benefits-discounted costs) for 36 scenarios. The 36 scenarios are combinations of three payment types (ALUS, rental rates, crop budgets), three contract lengths (3, 6 and 10 years) and four adoption rates, i.e., program participation rates (100%, 70%, 50% and 30%). The 36 scenarios were repeated for an alternative benefit discounting scenario (as described below), yielding a total of 72 net benefit values of the proposed EG&S program in Manitoba. Table 6.11 provides a summary of the modeled scenarios. These scenarios apply to both the annuity and perpetuity discounting options.

Table 6.11 Summary Table of Modeled Scenarios

Payment Scenario		**ALUS**			**Rental Rate**			**Crop Model**		
Adoption Rate	*Contract Length:*	*3*	*6*	*10*	*3*	*6*	*10*	*3*	*6*	*10*
1										
0.7										
0.5										
0.3										

Discounted Benefits

In the model, benefits were based on the benefit transfer of estimates from the literature. The value of benefits for each of the four land types are distinct in the model to allow for changes in benefit values for particular land types. Therefore, if better data should become available or alternative scenarios are considered, the model can easily be updated.

Two benefit discounting scenarios were conducted, both using a discount rate of 4%. In the first scenario, the three types of benefits (i.e., environmental, recreation and government on a per acre basis) were discounted in annuity[36] under the assumption that annual benefits would accrue at the end of each year for the length of the contract. These discounted per acre benefits were then multiplied by the number of eligible acres (as determined by the GIS analysis in Section 5.0) of each land type, resulting in the present value of total benefits for each land type. This scenario assumes that agricultural producers do not maintain any of the ecological goods or services on their land beyond the completion of their contracts under an EG&S program.

The second scenario involved discounting the environmental and recreational benefits (per acre) in perpetuity[37] and the government benefits (per acre) in annuity (as before). This scenario assumes that maintained or established EG&S under the program would provide benefits beyond the contract length, i.e., agricultural producers would maintain EG&S on their land (e.g., do not revert land into agriculture, drain wetlands, destroy buffers); however, the benefits to government would cease when the contracts ended as any administrative savings (i.e., benefits) would no longer be applicable. Again, in this scenario, the discounted per acre benefits were then multiplied by the number of eligible acres of each land type (from GIS analysis) to determine the present value of total benefits for each land type.

The first discounting scenario likely underestimates the environmental and recreational benefits stemming from an EG&S program, while the second scenario may overestimate these benefits. In reality, it is likely that some agricultural producers will maintain all or some of the EG&S on their land beyond the length of the contract, while others will not. However, these two scenarios, representing the two extremes in benefits of an EG&S program, were chosen for the analysis since any middle-ground scenario would require an arbitrary decision on the lifespan of particular EG&S benefits. Since there are a variety of EG&S corresponding to the four land types analyzed, choosing a lifespan for accrued benefits is not possible.

Saved government and insurance spending benefits (i.e., saved payments) would only accrue for the length of the contract regardless of the scenario. For both discounting scenarios, all discounted benefits (environmental, government and recreational) were summed to determine the present value of total benefits of an EG&S program in Manitoba.

Discounted Costs

All three payment scenarios (ALUS, rental rate, crop budgets) were discounted in the same way. First, the annual per acre payments for each type of land were discounted in annuity (i.e., payments were made at the end of each year for the length of the contract) to determine the present value of payments for the contract period. Second, the present values of per acre payments for each type of land were multiplied by the number of corresponding eligible acres in Manitoba, as determined by the GIS analysis (e.g., discounted per acre wetland payment x number of eligible wetland acres in Manitoba). The result of this calculation was the present value of payments (for the given contract length) for all eligible land for each land type. These total payments were summed to determine the total present value of payments for all eligible land (i.e., for all land types).

[36] Annuity: equal, fixed amount received (or paid) each year for a number of years (Boardman et al., 2006)
[37] Perpetuity: an annuity that continues indefinitely (Boardman et al, 2006).

Administrative costs for each payment scenario (ALUS, rental rates, crop models) were calculated using the total present value of payments for all eligible land, as they were assumed as a percentage of these payments. Start-up costs for each payment scenario were calculated under the assumption that these represent a proportion of the present value of the first two years of the program. As such, to determine these costs, two years of annual payments under each payment scenario were discounted in annuity and multiplied by the proportion representing start-up costs to determine total start-up costs under each payment scenario.

Finally, the discounted total payments, administrative costs and start-up costs were summed to determine the present value of total costs of a proposed EG&S program in Manitoba under the three payment scenarios.

Determination of Net Benefits

For each payment scenario, net benefits were calculated by subtracting the present value of costs (payment + administrative + start-up) from the present value of benefits (environment, recreation and government). This calculation was done for each combination of contract length and adoption rate and for both benefit discounting scenarios.

Sensitivity Analysis

The following is an overview of the sensitivity analysis conducted for the cost-benefit analysis model and potential considerations for further sensitivity analysis.

To perform the sensitivity analysis, key values (assumptions and inputs) within the model were changed to determine how the results changed. The focus of the sensitivity analysis was on values and assumptions that may be uncertain or that may drive the results of the analysis (i.e., significantly impact the resulting net benefits, as compared to other inputs into the model). Note that, since many scenarios were considered within the model design, sensitivity analysis was not necessary for some of the key assumptions in the model (i.e., contract length, adoption rates, payment scenario, benefit discounting).

The first sensitivity analysis involved the benefit value of wetlands. The value for wetlands was adjusted to account for a lower value from the literature.

A second sensitivity analysis was conducted on the crop prices used to determine the crop model-based payment scenario in a proposed EG&S program.

A third sensitivity analysis involved lowering the administration costs as a percentage of program costs.

Finally, the sensitivity analysis included the inclusion of eligible acres for riparian areas as part of program costs and benefits. The original cost-benefit analysis results are presented based on the exclusion of eligible acres for riparian areas. This is due to the fact that given impending riparian zone buffer regulations under *the Water Protection Act*, they may not be a need for EG&S payments for some types of buffers. While the details of the regulations are not yet known with certainty, we have elected to present the results with the inclusion of eligible acres for riparian areas as a sensitivity analysis rather than as part of the main results. Within this sensitivity analysis, there is variation in the outcomes based on buffer strip width.

The results of the various sensitivity analyses conducted are discussed in Section 6.4 below.

Considerations for Future Sensitivity Analysis

The model was developed to include flexibility within the primary values and assumptions that may potentially affect the cost-benefit analysis results. The following are model inputs for which the values may be easily changed to perform further sensitivity analysis. Note that these inputs are listed in the "Important Values" Sheet in the model and require changes only within that sheet to generate new results, as the values are linked to the rest of the model.

- Discount rate
- Contract length (the model currently includes three contract length scenarios)
- Adoption rate (the model currently includes four adoption rate scenarios)
- Start-up costs (as a percentage of payments)
- Administrative costs (as a percentage of payments)
- Number of eligible acres of each type of land
- Net income within the crop model-based payment scenario
- Farm gate prices within the crop model-based payment scenario (note that prices are linked to net income within the model so only one of these needs to be changed for sensitivity analysis; both are included to increase flexibility in conducting a sensitivity analysis).

6.4 Results of the Cost-Benefit Analysis

6.4.1 Results Based on Eligible Acres of Ecologically Sensitive Areas, Natural Uplands and Wetlands (Excluding Riparian Areas)

Tables 6.12 and 6.13 show the final results of the cost-benefit analysis of alternative EG&S programs for Manitoba. The tables show the present values of costs, benefits and net benefits of an EG&S program for each combination of contract length and adoption rate and for each payment scenario analyzed. Table 6.12 shows the results for the scenario where all benefits were discounted in annuity, whereas Table 6.13 shows the results for the scenario where environmental and recreational benefits were discounted in perpetuity (government benefits still discounted in annuity).

The following are the key observations stemming from the results:

- The present values of net benefits of an EG&S program are much higher when environmental and recreational benefits are discounted in perpetuity instead of in annuity. This is an obvious result since the perpetuity scenario assumes environmental and recreational benefits accrue beyond the length of the contract, whereas the annuity scenario only measures benefits for the length of the contract.
- The highest present value of net benefits stem from the 100 percent adoption, ALUS payment scenario (for both the annuity and perpetuity benefit discounting scenarios). These net benefits amount to $29,282 million (environment and recreational benefits discounted in annuity) and $95,891 million (environmental and recreational benefits discounted in perpetuity) and benefit-cost ratios of 14 and 87, respectively.
    - When benefits are discounted in annuity, a 10 year contract yields the highest net benefit.
    - When benefits are discounted in perpetuity, a 3 year contact yields the highest net benefit.
- The lowest present value of net benefits stem from the rental rate payment scenario (for both the annuity and perpetuity benefit discounting scenarios). These net benefits

amount to $2,552 million (environment and recreational benefits discounted in annuity) and $27,697 million (environmental and recreational benefits discounted in perpetuity).
    - Both lowest present values of net benefits are under the rental rate payment scenarios with a 30 percent adoption rate.
    - When benefits are discounted in annuity, a 3 year contract yields the lowest net benefits. The benefit-cost ratio in this case is 5.
    - When benefits are discounted in perpetuity, a 10 year contract yields the lowest net benefits. The benefit-cost ratio in this case is 20.
- The average present values of net benefits for all adoption rates, contract lengths and payment scenarios are $11,519 million and $59,087 million, when benefits are discounted in annuity and perpetuity, respectively. If both benefit discounting scenarios are considered, the average present value of net benefits is $35,303 million.

Table 6.12 Present Value of Net Benefits of an EG&S Program in Manitoba – All Benefits Discounted in Annuity (in million $)

Payment Scenario		ALUS			Rental Rate			Crop Model		
Adoption Rate	*Contract Length:*	*3*	*6*	*10*	*3*	*6*	*10*	*3*	*6*	*10*
1	PVB	10,811	20,423	31,599	10,811	20,423	31,599	10,811	20,423	31,599
	PVC	1,117	1,672	2,316	2,305	3,448	4,777	1,531	2,291	3,174
	NPV	**9,694**	**18,751**	**29,282**	**8,507**	**16,975**	**26,821**	**9,280**	**18,132**	**28,425**
0.7	PVB	7,568	14,296	22,119	7,568	14,296	22,119	7,568	14,296	22,119
	PVC	782	1,170	1,622	1,613	2,414	3,344	1,072	1,603	2,222
	NPV	**6,786**	**13,126**	**20,498**	**5,955**	**11,882**	**18,775**	**6,496**	**12,692**	**19,897**
0.5	PVB	5,406	10,211	15,799	5,406	10,211	15,799	5,406	10,211	15,799
	PVC	559	836	1,158	1,152	1,724	2,389	766	1,145	1,587
	NPV	**4,847**	**9,375**	**14,641**	**4,253**	**8,487**	**13,411**	**4,640**	**9,066**	**14,212**
0.3	PVB	3,243	6,127	9,480	3,243	6,127	9,480	3,243	6,127	9,480
	PVC	335	502	695	691	1,034	1,433	459	687	952
	NPV	**2,908**	**5,625**	**8,785**	**2,552**	**5,092**	**8,046**	**2,784**	**5,440**	**8,527**
Benefits/Costs (all adoption rates)		**10**	**12**	**14**	**5**	**6**	**7**	**7**	**9**	**10**

Min **2,552**

Max **29,282**

Average **11,519**

Table 6.13 Present Value of Net Benefits of an EG&S Program in Manitoba – Environmental and Recreational Benefits Discounted in Perpetuity (in million $)

Payment Scenario		ALUS			Rental Rate			Crop Model		
Adoption Rate	*Contract Length:*	*3*	*6*	*10*	*3*	*6*	*10*	*3*	*6*	*10*
1	PVB	97,008	97,051	97,101	97,008	97,051	97,101	97,008	97,051	97,101
	PVC	1,117	1,672	2,316	2,305	3,448	4,777	1,531	2,291	3,174
	NPV	**95,891**	**95,379**	**94,785**	**94,704**	**93,603**	**92,324**	**95,477**	**94,760**	**93,927**
0.7	PVB	67,906	67,936	67,971	67,906	67,936	67,971	67,906	67,936	67,971
	PVC	782	1,170	1,622	1,613	2,414	3,344	1,072	1,603	2,222
	NPV	**67,123**	**66,766**	**66,349**	**66,292**	**65,522**	**64,627**	**66,834**	**66,332**	**65,749**
0.5	PVB	48,504	48,526	48,551	48,504	48,526	48,551	48,504	48,526	48,551
	PVC	559	836	1,158	1,152	1,724	2,389	766	1,145	1,587
	NPV	**47,945**	**47,690**	**47,392**	**47,352**	**46,802**	**46,162**	**47,738**	**47,380**	**46,964**
0.3	PVB	29,102	29,115	29,130	29,102	29,115	29,130	29,102	29,115	29,130
	PVC	335	502	695	691	1,034	1,433	459	687	952
	NPV	**28,767**	**28,614**	**28,435**	**28,411**	**28,081**	**27,697**	**28,643**	**28,428**	**28,178**
Benefits/Costs (all adoption rates)		**87**	**58**	**42**	**42**	**28**	**20**	**63**	**42**	**31**

Min **27,697**

Max **95,891**

Average **59,087**

Table 6.14 presents additional fundamental analysis of the cost-benefit analysis results. This analysis yields averages of present values of net benefits by each type of variable (i.e., payment scenario, contract length and adoption rate) holding all other variables constant. The purpose of this analysis is to demonstrate the potential net benefits of an EG&S program when certain program specifications are set and others are unknown (e.g., if a payment scenario and contract length were chosen, but adoption rates were unknown). This analysis is shown for each of the benefit discounting scenarios (benefits discounted in annuity and perpetuity) and also when both scenarios are taken into account (i.e., the average of the two benefit discounting scenarios, which is a realistic assumption since, as discussed previously, in reality, some landowners may allow benefits to accrue beyond the lengths of a program contract, whereas others may not).

Table 6.14 Average Present Values of Net Benefits by Variable (in million $)

	Environmental and Recreational Benefits Discounted in:		
Average by:	**Annuity**	**Perpetuity**	**Both**
Payment scenario (all adoption rates and contract lengths)			
ALUS	12,026	59,595	35,811
Rental Rate	10,896	58,465	34,681
Crop Model	11,633	59,201	35,417
Contract length (all payment scenarios and adoption rates)			
3	5,725	59,598	32,662
6	11,220	59,113	35,167
10	17,610	58,549	38,080
Adoption rate (all contract lengths and payment scenarios)			
1	18,430	94,539	56,484
0.7	12,901	66,177	39,539
0.5	9,215	47,269	28,242
0.3	5,529	28,362	16,945

Table 6.14 yields the following key observations:

- Of the three payment scenarios, ALUS payments yield the highest net benefits, followed by crop model payments and rental rate payments.
- When benefits are discounted in annuity, net benefits increase as contract length increases. On the other hand, when benefits are discounted in perpetuity, the opposite is true (net benefits decrease as contract length increases). This is because in perpetuity, benefits are not dependent on contract length (i.e. benefits are the same for all contract lengths). On the other hand, payments increase as contract length increases (since payments are in annuity) resulting in net benefits declining with contract length.
    - When both benefit discounting scenarios are considered, net benefits increase with contract length.
- In all cases, a higher adoption rate is more beneficial (in terms of environmental, recreational and government spending impacts) than it is costly.

6.4.2 Sensitivity Analysis

Since many scenarios are already considered in the primary cost-benefit analysis, we conducted sensitivity analysis for variables that 1) may have significant impact on the net benefit values and/or 2) are volatile. The four variables include the wetland value used to determine benefits of an EG&S program, the prices used in the crop model payment scenarios, the level of administration costs, and the inclusion of eligible acres for riparian areas.

Change in Wetland Value

For the first analysis, we decreased the wetland value from the high estimate ($2,555/acre) in the literature to the same value as the other three types of land ($25.78/acre). The purpose of this analysis is to determine how sensitive the cost-benefit analysis results are to the assigned wetland value.

Tables 6.15 and 6.16 show the new present values of net benefits of an EG&S program in Manitoba when the lower wetland value is used in the analysis. As is evident from the table, net benefits of an EG&S program are extremely sensitive to this change in wetland value. As a matter of fact, most program scenarios now result in net costs when benefits are discounted in annuity (when benefits are discounted in perpetuity, all scenarios still result in positive net benefits).

The following are key results when the lower wetland value is used in the analysis:

- The maximum net benefits are $196 million (benefits discounted in annuity) and $6,187 million (benefits discounted in perpetuity) and maximum benefit-cost ratios are 1.08 and 6.54, respectively.
    - As with the original analysis, both of these are under the ALUS scenario.
    - Again, as with the original analysis, when benefits are discounted in annuity, a 10 year contract length yields the highest benefits. When benefits are discounted in perpetuity, a 3 year contract length yields the highest net benefits. When the average present value of net benefits is found (both annuity and perpetuity) and all other variables are held constant, a shorter contract length yields higher net benefits (different from original cost-benefit analysis).
    - As with the original analysis, a 100% adoption rate yields the highest net benefits.
- The minimum net benefits are -$2,265 million (benefits discounted in annuity) and $790 million (benefits discounted in perpetuity) and benefit-cost ratios of 0.53 and 1.55.
    - As with the original analysis, when benefits are discounted in perpetuity, the 10-year contract, rental rate payment and 30% adoption scenario yields the lowest net benefits.
    - However, interestingly, unlike with the original analysis, when benefits are discounted in annuity, a 10-year, 100% adoption rental rate payment scenario yields the lowest net benefits (in the original analysis, a 3 year contract length, 30% adoption rental rate payment scenario yielded the lowest net benefits). This is due to the fact that with lower wetland values, costs are driving the results of the model. Therefore, the higher cost option (i.e. longer contract length and higher adoption rate) results in the lowest net benefits.
- The average present values of net benefits for all adoption rates, contract lengths and payment scenarios are -$531 million and $3,026 million, when benefits are discounted in annuity and perpetuity, respectively. If both benefit discounting scenarios are considered, the average present value of net benefits is $1,247 million.

Table 6.15 Present Value of Net Benefits of an EG&S Program in Manitoba – All Benefits Discounted in Annuity (in million $) – Wetland Value Sensitivity Analysis

Payment Scenario		ALUS			Rental Rate			Crop Model		
Adoption Rate	*Contract Length:*	*3*	*6*	*10*	*3*	*6*	*10*	*3*	*6*	*10*
1	PVB	860	1,624	2,512	860	1,624	2,512	860	1,624	2,512
	PVC	1,117	1,672	2,316	2,305	3,448	4,777	1,531	2,291	3,174
	NPV	**-258**	**-48**	**196**	**-1,445**	**-1,824**	**-2,265**	**-671**	**-667**	**-662**
0.7	PVB	602	1,137	1,759	602	1,137	1,759	602	1,137	1,759
	PVC	782	1,170	1,622	1,613	2,414	3,344	1,072	1,603	2,222
	NPV	**-180**	**-34**	**137**	**-1,011**	**-1,277**	**-1,585**	**-470**	**-467**	**-463**
0.5	PVB	430	812	1,256	430	812	1,256	430	812	1,256
	PVC	559	836	1,158	1,152	1,724	2,389	766	1,145	1,587
	NPV	**-129**	**-24**	**98**	**-722**	**-912**	**-1,132**	**-336**	**-333**	**-331**
0.3	PVB	258	487	754	258	487	754	258	487	754
	PVC	335	502	695	691	1,034	1,433	459	687	952
	NPV	**-77**	**-14**	**59**	**-433**	**-547**	**-679**	**-201**	**-200**	**-198**
Benefits/Costs (all adoption rates)		**0.77**	**0.97**	**1.08**	**0.37**	**0.47**	**0.53**	**0.56**	**0.71**	**0.79**

Min **-2,265**

Max **196**

Average **-531**

Table 6.16 Present Value of Net Benefits of an EG&S Program in Manitoba – Environmental and Recreational Benefits Discounted in Perpetuity (in million $) – Wetland Value Sensitivity Analysis

Payment Scenario		ALUS			Rental Rate			Crop Model		
Adoption Rate	*Contract Length:*	*3*	*6*	*10*	*3*	*6*	*10*	*3*	*6*	*10*
1	PVB	7,304	7,353	7,410	7,304	7,353	7,410	7,304	7,353	7,410
	PVC	1,117	1,672	2,316	2,305	3,448	4,777	1,531	2,291	3,174
	NPV	**6,187**	**5,681**	**5,093**	**5,000**	**3,905**	**2,632**	**5,773**	**5,062**	**4,236**
0.7	PVB	5,113	5,147	5,187	5,113	5,147	5,187	5,113	5,147	5,187
	PVC	782	1,170	1,622	1,613	2,414	3,344	1,072	1,603	2,222
	NPV	**4,331**	**3,977**	**3,565**	**3,500**	**2,734**	**1,843**	**4,041**	**3,544**	**2,965**
0.5	PVB	3,652	3,676	3,705	3,652	3,676	3,705	3,652	3,676	3,705
	PVC	559	836	1,158	1,152	1,724	2,389	766	1,145	1,587
	NPV	**3,093**	**2,841**	**2,547**	**2,500**	**1,953**	**1,316**	**2,886**	**2,531**	**2,118**
0.3	PVB	2,191	2,206	2,223	2,191	2,206	2,223	2,191	2,206	2,223
	PVC	335	502	695	691	1,034	1,433	459	687	952
	NPV	**1,856**	**1,704**	**1,528**	**1,500**	**1,172**	**790**	**1,732**	**1,519**	**1,271**
Benefits/Costs (all adoption rates)		**6.54**	**4.40**	**3.20**	**3.17**	**2.13**	**1.55**	**4.77**	**3.21**	**2.33**

Min **790**

Max **6,187**

Average **3,026**

Change in Crop Prices

Although we conducted a sensitivity analysis by replacing 2007/2008 crop prices in the models used for the crop model payment scenario with the average crop prices for the last three years, the analysis was not conducive to interpretation. The reason for the lack of results is that average prices for the last three years (and, similarly, 2006/2007 prices, or prices for any particular year after 2004 and prior to 2007/2008) yield negative net farm incomes given the current costs of production (i.e., they are too low to result in farm profits). As such, program payments based on these net incomes would be negative, which results in this payment scenario being immaterial in the cost-benefit analysis, and in the determination of an EG&S program structure. Since crop prices have no effect on other components of the cost-benefit analysis (e.g., the net benefits under the ALUS or rental rate payment scenarios), the results for scenarios other than the crop model scenario are identical to those in the original analysis.

The spreadsheets used for the cost benefit analysis can also be adjusted to change net income per acre for the purposes of the crop model payment scenario. Given the high nature of crop prices at the time of this research, lowering net income per acre may be an effective tool for accounting for lower crop prices.

Change in Administration Costs

Since administration costs of an EG&S program are uncertain, we conducted a sensitivity analysis to determine the impacts of potential changes. In the original cost-benefit analysis, we based administration costs on ALUS pilot project administration costs, which are very high in comparison to administration costs for the CRP program in the US. Therefore, for the sensitivity analysis, we replaced the assumed 15% administration costs (based on ALUS) with an estimate of US CRP administration costs in the initial and succeeding years: 4%.[38] This low percentage represents, in our opinion, the best possible case for administrative cost-efficiency, whereas the original analysis considered a less optimistic (but likely more realistic) assumption.

Table 6.17 shows the minimum, maximum and average present values of net benefits and minimum and maximum benefit-cost ratios under the lower administration cost scenario. The results are not significantly different from the results of the original cost-benefit analysis. Thus, we conclude that administrative cost-efficiency may have little impact on the net benefits of an EG&S program.

Table 6.17 Minimum, Maximum and Average Present Values of Net Benefits – Low Administration Costs Sensitivity Analysis (in million $)

	Benefits discounted in:		Average of Annuity and Perpetuity NPVs
	Annuity	Perpetuity	
Minimum NPV*	2,589	27,805	15,197
Maximum NPV	29,457	95,950	62,703
Average NPV	11,625	59,194	35,409
Minimum B/C	4.96	21.98	N/A
Maximum B/C	14.75	91.71	N/A

*NPV=Present Value of Net Benefits

[38] Note that administration costs in recent years are estimated to be even lower at 2% of program costs. However, for the purposes of this analysis, we assumed that administration costs in the initial years of the CRP program would be more representative since the EG&S program would be in early stages as well.

Inclusion of Eligible Acres for Riparian Areas

The final sensitivity analysis was conducted by including riparian acres (buffers) in Agro-Manitoba within total land eligible for program payments. As discussed previously, the original cost-benefit analysis excluded eligible acres for riparian areas under the assumption that impending riparian zone buffer regulations under *the Water Protection Act* would make EG&S payments unnecessary for some types of buffers.

Four buffer widths were considered in the sensitivity analysis: 3, 10, 25 and 50 metres (m). As such, four sensitivity analyses were conducted, using each of these buffer widths as a determinant of total eligible riparian acres. This discussion focuses on results using the 10 m buffer in particular.

Tables 6.18 and 6.19 show the present values of net benefits of a Manitoba EG&S program when 10 m buffers on agricultural and forage crop lands are included as eligible acres for program payments.

The following are key results when riparian acres representing 10 m buffers are included in the analysis:

- The maximum net benefits are $29,284 million (benefits discounted in annuity) and $95,915 million (benefits discounted in perpetuity) and benefit-cost ratios of 13.60 and 86.53, respectively.
    - As with the original analysis, both of these are under the ALUS payment scenario.
    - Again, as with the original analysis, when benefits are discounted in annuity, a 10 year contract length yields the highest benefits. When benefits are discounted in perpetuity, a 3 year contract length yields the highest net benefits.
    - As with the original analysis, a 100% adoption rate yields the highest net benefits.
- The minimum net benefits are $2,548 million (benefits discounted in annuity) and $27,696 million (benefits discounted in perpetuity).
    - As with the original analysis, both lowest present values of net benefits are under the rental rate payment scenarios with a 30 percent adoption rate.
    - When benefits are discounted in annuity, a 3 year contract yields the lowest net benefits. The benefit-cost ratio in this case is 4.66.
    - When benefits are discounted in perpetuity, a 10 year contract yields the lowest net benefits. The benefit-cost ratio in this case is 20.19.
- The average present values of net benefits for all adoption rates, contract lengths and payment scenarios are $11,507 million and $59,089 million, when benefits are discounted in annuity and perpetuity, respectively. If both benefit discounting scenarios are considered, the average present value of net benefits is $35,298 million (Table 6.20).

Table 6.18 Present Value of Net Benefits of an EG&S Program in Manitoba – All Benefits Discounted in Annuity (in million $) – Riparian Acres Sensitivity Analysis

Payment Scenario		ALUS			Rental Rate			Crop Model		
Adoption Rate	*Contract Length:*	*3*	*6*	*10*	*3*	*6*	*10*	*3*	*6*	*10*
1	PVB	10,815	20,429	31,608	10,815	20,429	31,608	10,815	20,429	31,608
	PVC	1,121	1,678	2,325	2,320	3,471	4,810	1,560	2,334	3,234
	NPV	**9,693**	**18,751**	**29,284**	**8,494**	**16,957**	**26,798**	**9,255**	**18,095**	**28,374**
0.7	PVB	7,570	14,300	22,126	7,570	14,300	22,126	7,570	14,300	22,126
	PVC	785	1,174	1,627	1,624	2,430	3,367	1,092	1,634	2,264
	NPV	**6,785**	**13,126**	**20,499**	**5,946**	**11,870**	**18,759**	**6,478**	**12,666**	**19,862**
0.5	PVB	5,407	10,214	15,804	5,407	10,214	15,804	5,407	10,214	15,804
	PVC	561	839	1,162	1,160	1,736	2,405	780	1,167	1,617
	NPV	**4,847**	**9,376**	**14,642**	**4,247**	**8,479**	**13,399**	**4,627**	**9,047**	**14,187**
0.3	PVB	3,244	6,129	9,483	3,244	6,129	9,483	3,244	6,129	9,483
	PVC	336	503	697	696	1,041	1,443	468	700	970
	NPV	**2,908**	**5,625**	**8,785**	**2,548**	**5,087**	**8,040**	**2,776**	**5,428**	**8,512**
Benefits/Costs (all adoption rates)		**9.64**	**12.18**	**13.60**	**4.66**	**5.88**	**6.57**	**6.93**	**8.75**	**9.77**

Min **2,548**

Max **29,284**

Average **11,507**

Table 6.19 Present Value of Net Benefits of an EG&S Program in Manitoba – Environmental and Recreational Benefits Discounted in Perpetuity (in million $) – Riparian Acres Sensitivity Analysis

Payment Scenario		ALUS			Rental Rate			Crop Model		
Adoption Rate	*Contract Length:*	*3*	*6*	*10*	*3*	*6*	*10*	*3*	*6*	*10*
1	PVB	97,036	97,079	97,130	97,036	97,079	97,130	97,036	97,079	97,130
	PVC	1,121	1,678	2,325	2,320	3,471	4,810	1,560	2,334	3,234
	NPV	**95,915**	**95,402**	**94,805**	**94,716**	**93,608**	**92,320**	**95,476**	**94,745**	**93,895**
0.7	PVB	67,925	67,955	67,991	67,925	67,955	67,991	67,925	67,955	67,991
	PVC	785	1,174	1,627	1,624	2,430	3,367	1,092	1,634	2,264
	NPV	**67,140**	**66,781**	**66,363**	**66,301**	**65,525**	**64,624**	**66,833**	**66,322**	**65,727**
0.5	PVB	48,518	48,540	48,565	48,518	48,540	48,565	48,518	48,540	48,565
	PVC	561	839	1,162	1,160	1,736	2,405	780	1,167	1,617
	NPV	**47,957**	**47,701**	**47,402**	**47,358**	**46,804**	**46,160**	**47,738**	**47,373**	**46,948**
0.3	PVB	29,111	29,124	29,139	29,111	29,124	29,139	29,111	29,124	29,139
	PVC	336	503	697	696	1,041	1,443	468	700	970
	NPV	**28,774**	**28,620**	**28,441**	**28,415**	**28,082**	**27,696**	**28,643**	**28,424**	**28,169**
Benefits/Costs (all adoption rates)		**86.53**	**57.86**	**41.78**	**41.82**	**27.97**	**20.19**	**62.20**	**41.59**	**30.03**

Min **27,696**

Max **95,915**

Average **59,089**

Table 6.20 summarizes the sensitivity analysis results (new present values of net benefits) in the cases where 3, 10, 25 or 50 m buffers are eligible for program payments, respectively. As Table 6.20 shows, the present values of net benefits do not change significantly based on the width of buffers used to determine eligible acres of riparian land.

As Table 6.20 shows, the maximum present values of net benefits of an EG&S program in Manitoba range from $29,293 million to $29,283 million (annuity) and $96,068 to $95,896 (perpetuity) as buffer width decreases from 50 m to 3 m. The minimum present values of net benefits range from $2,524 million to $2,551 million (annuity) and $27,688 million to $27,697 million (perpetuity) as buffer width decreases. Therefore, the analysis yields a wider range of values of net benefits (lower minimum and higher maximum) as the riparian area considered eligible for program payments increases.

The average present values of net benefits show that when benefits are discounted in annuity, a 3 m buffer yields the highest net benefits, whereas when benefits are discounted in perpetuity, a 50 m buffer yields the highest net benefits. When both benefit-discounting scenarios are considered, the average present value of net benefits is highest in the case where eligible riparian acres are determined based on 3 m buffers. Therefore, the costs of program payments are driving the results in the annuity case and in the case where both benefit-discounting scenarios are considered. On the other hand, when environmental and recreational benefits are discounted in perpetuity, and are therefore much larger, payment costs are not a limiting factor as eligible riparian acres increase.

Table 6.20 Minimum, Maximum and Average Present Values of Net Benefits – Riparian Areas Sensitivity Analysis (in million $)

	Benefits discounted in:		Average of Annuity and Perpetuity NPVs
	Annuity	Perpetuity	
3 m Buffers			
Minimum NPV*	2,551	27,697	15,124
Maximum NPV	29,283	95,896	62,589
Average NPV	11,516	59,087	35,302
10 m Buffers			
Minimum NPV*	2,548	27,696	15,122
Maximum NPV	29,284	95,915	62,599
Average NPV	11,507	59,089	35,298
25 m Buffers			
Minimum NPV*	2,541	27,693	15,117
Maximum NPV	29,287	95,962	62,624
Average NPV	11,484	59,093	35,289
50 m Buffers			
Minimum NPV*	2,524	27,688	15,106
Maximum NPV	29,293	96,068	62,681
Average NPV	11,433	59,102	35,268

*NPV=Present Value of Net Benefits

6.4.3 Summary of Cost-Benefit Analysis and Sensitivity Analysis

The following table (Table 6.21) compares the original cost-benefit analysis results to those of the sensitivity analyses. The table shows the average present value of net benefits and the highest (maximum) present value of net benefits. As discussed previously, the maximums always occur in the case where benefits are discounted in perpetuity. The table also shows the average of the maximums for the annuity and perpetuity-discounted benefit cases (a more realistic result, since, as mentioned previously, some farmers are likely to allow benefits to accrue beyond the length of the contract while others are not). In addition, the percentage change in the average maximums in the sensitivity analyses are compared with the original analysis average maximums. Finally, the table shows the conditions (payment scenario, contract length and adoption rate) that yield the maximum present value of net benefits in each cost-benefit analysis scenario.

As the table shows, the administrative cost and riparian land sensitivity analyses yield only small differences in results as compared to the original cost-benefit analysis. However, the decrease in wetland value has a significant impact on the original results.

Table 6.21 Comparison of Cost-Benefit Analysis and Sensitivity Analysis Results

CBA scenario	Original CBA	Lower Wetland Value	Admin Cost	Riparian Lands
Average NPV* (million $)	35,303	1,247	35,409	35,268 (50 m) to 35,302 (3 m)
Max NPV** (million $)	95,891	6,187	95,950	95,896 (3 m) to 96,068 (50 m)
Max NPV Scenario	ALUS, 3 year contract, 100% adoption	ALUS, 3-year contract, 100% adoption	ALUS, 3-year contract, 100% adoption	ALUS, 3-year contract, 100% adoption
Max benefit/cost ratio (annuity; perpetuity)	14; 87	1.08; 6.54	14.75; 91.71	13.60; 86.53

*Average of all present values of net benefits (both benefit-discounting scenarios)
**Highest present value of net benefits (always under the perpetuity benefit discounting scenario)

7.0 Conclusions and Recommendations

This section presents the conclusions and recommendations stemming from this research.

Taking into account the net present values as well as the sensitivity analysis, we make the following conclusions regarding EG&S programming in Manitoba.

In terms of the payment structure of a potential EG&S program, this research found that Alternative Land Use Services (ALUS) payment levels yield the highest present values of net benefits (and benefit-cost ratios) in all of the scenarios analyzed. Similarly, a 100% adoption rate yields the highest net benefits; as such, potential programming should not be limited in terms of acreage, but would likely be limited in terms of cost.

Contract length is a more complex variable. The cost-benefit analysis results indicate that a 10-year contract (longest contract option) is preferable when benefits are discounted in annuity. When benefits are discounted in perpetuity, a 3-year contract (shortest contract option) is preferable. We concluded that shorter contract lengths yield the highest net benefits when benefits are discounted in perpetuity because the benefits are not dependent on contract length in this case (i.e. benefits are the same for all contract lengths). On the other hand, payments increase as contract length increases (since payments are in annuity) resulting in net benefits declining with contract length.

However, when both benefit discounting scenarios are considered (i.e., the average of the two benefit discounting scenarios), net benefits increase with contract length. The average of the two scenarios is a realistic assumption since, in reality, some landowners may allow the benefits to accrue beyond the length of program contracts, whereas others may not. Therefore, based on the net benefits, we recommend that a relatively long, 10-year contract length be used in potential EG&S program design.

Within the original cost-benefit analysis, all of the scenarios yield a large positive net benefit from the adoption of a potential EG&S program. The highest present value of net benefits of an EG&S program would result from an ALUS payment, 100% adoption rate, 10-year contract scenario. Under this scenario, the maximum present value of net benefits is between $29,282 million (benefits discounted in annuity) and $94,785 million (benefits discounted in perpetuity).

The lowest present value of net benefits would result from the rental rate, 30% adoption, 3-year contract scenario. Again, in this case, rental rate payments and a 30% adoption rate come out at the bottom whether benefits are discounted in annuity or perpetuity. Under this scenario, the present value of net benefits ranges from $2,552 million to $28,411 million.

The large positive net benefits from the adoption of a potential EG&S program resulting from the original cost benefit analysis are primarily due to the high dollar value that has been used to estimate the benefits of wetlands (specifically, the benefits of wetlands are valued at $2,555/acre).

Within the sensitivity analysis, the value of wetland benefits is lowered to $25.78/acre. This change significantly affects the results of the research. Using the lower value for wetlands, many of the scenarios within the annuity assumption yield negative present values of net benefits due to the fact that the costs now outweigh the benefits. Note that under the perpetuity assumption, net benefits remain positive.

Considering that the wetland value is uncertain, it is important to note the results stemming from the decreased wetland value sensitivity analysis. As with the original cost-benefit analysis, the results indicate that ALUS payments and a 100% adoption rate yield the highest present value of net benefits in this sensitivity analysis scenario. However, the preferable contract length is different in this analysis than in the original analysis; a 3-year contract length yields the highest present value of net benefits.

Under the ALUS, 100% adoption, 3-year contract length scenario, the maximum present value of net benefits, as determined by this sensitivity analysis (i.e. with the lower wetland value), is between $-258 million (benefits discounted in annuity) and $6,187 million (benefits discounted in perpetuity). Therefore, the range is significantly different than that resulting from the original analysis, and, as a matter of fact, there is potential for net losses from an EG&S program under this scenario. **Therefore, the results of the research are highly dependent on the value placed on the benefits of wetlands.**

When considering EG&S program design, there are many other considerations that must be taken into account, as suggested within the stakeholder consultations. The considerations include:

- Level of funding and any uncertainties surrounding funding
- Landowner perceptions
- Public perceptions and relations
- Uncertainty in terms of program design with respect to science and market realities
- Difficulties in selecting areas to target for potential EG&S program delivery
- Administrative costs
- Program delivery

Future Research Recommendations

Ideas for future research related to EG&S programming include:

1. Compare this research with a targeted BMP program for specific environmental issues (e.g. intensified manure management program).
2. Examine environmental issues more closely at a watershed level and compare across watersheds (i.e. for improved targeting, design and funding allocations).
3. Conduct a cost-benefit analysis based on local or targeted areas.
4. Additional research on current wetland values in Manitoba would help to improve the estimation of the benefits of a potential EG&S program, which could have significant policy implications.

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APPENDIX A: DESCRIPTION OF OTHER EG&S PROGRAMS

This section outlines eligibility criteria, eligible practices and payments for EG&S programs in Canada and the United States:

- ALUS Pilot Program
- Riparian Tax Credit Program
- US Conservation Reserve Program (CRP)
- US Conservation Security Program (CSP)
- National Farm Stewardship Program (NFSP)
- Greencover Canada Program
- Conservation Easements

ALUS Pilot Program

The Alternative Land Use Services (ALUS) pilot program is a private (farmer) initiative that aims to foster the production of EG&S from privately-owned agricultural land in Canada (Bailey, 2005).

The key principles of ALUS included:

- To secure the greatest interest and uptake from rural landowners and thereby the greatest commitment to the provision of EG&S. Therefore, a key focus was on the acceptability of the project to landowners.
- To support the maintenance and enhancement of environmental assets.

The goals of the pilot project were to determine the acceptability of the ALUS initiative by farmers and rural landowners and to determine the project's feasibility as a locally-driven approach to enhancing EG&S. The three-year pilot project with a budget of $1.9 million was launched in the Rural Municipality of Blanshard (Manitoba) in November 2005. Figure A.1, below, shows the ALUS identification sign and enrolled land within the Blanshard Municipality ALUS program.

Figure A.1 The ALUS Identification Sign (left) and Land Enrolled in the Blanshard Municipality ALUS Program (right)

Note: Photographs taken by Cher Brethour and Jane Sadler Richards on a tour with Steve Hamm, Project Manager of ALUS projects in Blanshard, Manitoba on November 26, 2007.

Eligibility

The pilot project in Blanshard used the following eligibility criteria:

- Only landowners are eligible for payments under ALUS
- Eligible acres are determined by legal land location
- Existing or future participation in stewardship programs will have no impact on eligibility for ALUS funding
- Crown land is not eligible for funding under ALUS
- Up to 100% of eligible acres under wetland, natural area and riparian area services can be enrolled in ALUS. A maximum of 20% of ecologically sensitive land of the landowner's land base is eligible under the ALUS program
- There is no transfer of services under contract unless extenuating circumstances arise; transfer of title or termination of the contract with applicable penalties apply in these circumstances

Under the ALUS project, eligible landowners receive continuous annual payments to maintain and enhance four landscape types which provide ecological goods and services:

- *Wetlands*: Natural features on farms that hold spring-season, semi-permanent or permanent water.
- *Ecologically Sensitive Lands*: Areas that are currently cultivated but are at risk for severe water erosion, wind erosion, flooding, salinity, runoff and leaching.
- *Riparian Areas*: Areas of land adjacent to streams, rivers, lakes or wetlands that contain natural vegetation that due to the presence of water, are distinctly different from the vegetation of adjacent upland areas.
- *Natural Areas*: Lands maintained with native grasslands, shrubs, and trees, or any combination thereof that has not been cultivated in the past 20 years.

Payments

The program provides annual rental payments to cover costs of provision or reimburses forgone income, depending on the practice (Bailey, 2005). Payments are dependent on both which of the four landscapes is being enrolled and the level of agricultural practice being conducted. Table A.1 summarizes the eligible practices under the ALUS pilot program and the associated payment structure.

Table A.1 ALUS Pilot Project Payment Structure

Service	No Agricultural Use ($/acre/year)	Haying ($/acre/year)	Grazing ($/acre/year)	% Enrolment Possible
Wetland	15	7.50	5	100
Riparian	15	7.50	5	100
Natural	15	7.50	5	100
Ecologically Sensitive	25	10	5	20

Source: (ALUS Technical Advisory Committee, 2006).

Riparian Tax Credit Program

The Riparian Tax Credit was initiated by the Manitoba Department of Finance in 2003. Under the Riparian Area Tax Credit, owners of Manitoba farm property may choose to enter into a five-year contract to manage lakeshores, river and stream banks in return for a property tax credit. Proper management of riparian areas provides benefits such as reduced erosion, improved

water quality, reduced greenhouse gas emissions and reduced flood and drought cycle extremes.

Eligibility

Eligible property must border a lake or waterway and either is suitable for cropping or grazing. On committed cropland the owner must maintain a riparian strip that is at least 100 feet wide along a waterway which can only be used for haying. The riparian strip must be maintained with suitable cover which includes native and tame forage, bushes and trees. To be eligible for a tax credit on former grazing land the landowner must enforce a livestock exclusion zone, preventing livestock from both grazing and watering, that is at least 100 feet wide. A permanent fence must be installed to separate grazing livestock from the exclusion zone (Manitoba Government, 2007).

Payments

In the case of former crop land, the owner is entitled to an annual tax credit of ten dollars per acre for five years, equalling a total of $50 per riparian acre. In the case of former grazing land, the owner is also entitled to an annual tax credit of ten dollars per acre for five years if the land is only used for haying and fourteen dollars per acre for five years if there is no agricultural activity on the land (Manitoba Government, 2007).

Two additions were made to the Riparian Tax Credit program for the year 2007, the first, an addition of a 20% tax credit bonus if the riparian area is sloped by 10% or more, and the second, an off-site watering facility credit. Applications for participation in the Riparian Area Tax Credit program for the years 2007 through 2011 were due March 31, 2007. Note that the payments are tax reductions, thus they cannot exceed the property taxes on the farm property and are not to be reported as income on the income tax return (Manitoba Government, 2007).

US Conservation Reserve Program (CRP)

The USDA Conservation Reserve Program (CRP) was established by the Food Security Act of 1985 and began in 1986 with 11 eligible practices. The program was originally thought of as a supply control program that targeted crop land susceptible to erosion, but over time has evolved into primarily an environmental program. Since the Food Security Act of 1985, the CRP has been amended by the Food, Agriculture, Conservation and Trade Act of 1990, the Federal Agriculture Improvement and Reform Act of 1996, the Farm Security and the Farm Security and Rural Investment Act of 2002. It has evolved into the United States' largest private land conservation program.

CRP is a voluntary program administered by USDA's Farm Service Agency in which contracts are formed with agricultural producers to retire highly erodible and other environmentally sensitive cropland and pasture in return for an annual rental payment and cost-share assistance. The long-term contracts of ten to fifteen years enable the conversion of farmland to grass, trees, wildlife cover as well as other conservation uses. The benefits provided by CRP include, but are not limited to, a reduction in soil erosion, enhancement of water quality, expansion of wildlife habitat, carbon sequestration, as well as restoration and maintenance of wetlands.

Although CRP is often referred to as an individual program, there are four variations within the program. Agricultural producers can participate either through the General sign-up of CRP

(which is the largest and best known of the programs) or through the Continuous sign-up of CRP. The continuous sign-up includes two sub-programs; the Conservation Reserve Enhancement Program (CREP) and the Farmable Wetlands Program (USDA-FSA, 2007a).

General sign-up occurs during specific sign-up periods and is based on a competitive bidding process. On the other hand, Continuous CRP is available for producer enrolment on an ongoing basis. However, there are additional criteria that need to be met in order to be eligible for the continuous sign-up. The Conservation Reserve Enhancement Program is a state and federal partnership that is designed to address specific environmental issues. Finally, the Farmable Wetlands Program enrols small non-floodplain wetlands under the provisions of the continuous sign-up program (FAPRI-UMC, 2007).

Eligibility

To be eligible for CRP a producer must have owned or operated the land in question for at least 12 months prior to the close of the CRP sign-up period unless:

- The new owner acquired the land due to the previous owner's death;
- The ownership change occurred due to foreclosure where the owner exercised a timely right or redemption in accordance with state law; or
- The circumstances of the acquisition present adequate assurance to FSA that the new owner did not require the land for the purpose of placing it in CRP.

(USDA, 2007b)

For the land to be eligible it must be either:

- Cropland (including field margins) that is planted or considered planted to an agricultural commodity four of the previous six crop years from 1996 to 2001, and which is physically and legally capable of being planted in a normal manner to an agricultural commodity; or
- Certain marginal pastureland that is enrolled in the Water Bank Program[39] or suitable for use as a riparian buffer or for similar water quality purposes.

(USDA, 2007b)

In addition to the above requirements, cropland must be considered environmentally sensitive to be eligible for the program, and, therefore, it must meet one of the following three criteria:

- Have a weighted average erosion index of eight or higher;
- Be expiring CRP acreage; or
- Be located in a national or state CRP conservation priority area.

(USDA, 2007b)

To decide which Conservation Reserve Program contracts are to be accepted offers are ranked on a competitive basis according to an Environmental Benefits Index (EBI). There are six EBI factors, each having a selection of sub-factors (not listed[40]) that are considered. These are:

- Wildlife habitat benefits;
- Water quality benefits from reduced erosion, runoff, and leaching;
- On-farm benefits from reduced erosion;
- Benefits that will likely endure beyond the contract period;
- Air quality benefits from reduced wind erosion; and
- Cost

[39] Water Bank Program no longer exists; it was rescinded by congress in 2006.
[40] Not listed due to their extensive nature. Details of sub-factors are available from the source (USDA, 2006)

Each of these factors and their sub-factors are graded on a points system (USDA, 2006). Points from the environmental factors are weighed against a cost factor which takes into account the proposed rental rates and whether the applicant proposes cost-sharing (Kirwan et al., 2005).

Applications under the Continuous sign-up are not considered on a competitive basis. However, to be eligible for the Continuous sign-up, the producer and the land must meet all the criteria outlined above (the criteria for General sign-up) and, in addition to this, the land must also be eligible and suitable for any of the conservation practices listed below:

- Riparian buffers;
- Wildlife habitat buffers;
- Wetland buffers;
- Filter strips;
- Wetland restoration;
- Grass waterways;
- Shelterbelts;
- Living snow fences;
- Contour grass strips;
- Salt tolerant vegetation; and
- Shallow water areas for wildlife.

Payments

The rental payments made to agricultural producers who enter CRP contracts are determined by the agricultural rental value of the land including considerations for relative productivity of the soil within each county and the average cash-rent. The maximum rental payment is calculated in advance of enrolment; however, agricultural producers may offer land at a lower rental rate. A maintenance incentive payment of up to five dollars per acre may be paid in addition to the rental payment to give an incentive to perform maintenance obligations. Cost-share assistance is available for participants who establish approved conservation practices to a maximum of 50% of the cost of establishment. CRP participants are also eligible to receive additional money of up to 20% of the annual rental payment in return for continuous sign-up practices.

Annual Rental Payments were expected to be approximately $1,821 million dollars or $49.95 per enrolled acre for 2008 (USDA-FSA, 2007b). However, as of March 2008, the payments per acre were slightly higher while the overall total annual rental was lower, as is shown in the most recent CRP monthly summary presented in the table A.2.

Table A.2 March 2008 Monthly Summary of Conservation Reserve Program Spending

Sign-up Type	Contracts	Farms[41]	Acres	Annual Rental (US$ Million)	Payments (US$/Acres)[42]
General	389,193	253,393	30,676,381	1,354	44.13
Continuous					
Non-CREP	297,976	179,446	2,742,558	245	89.36
CREP	62,151	41,296	1,098,965	139	126.47
Farmable Wetland	11,555	9,200	179,793	21	117.25
Total Continuous	*371,682*	*218,393*	*4,021,316*	*405*	*100.75*
TOTAL	**760,875**	**427,263**	**34,697,697**	**1,759**	**50.69**

Source: (USDA, 2008)

Participation

The latest data (March 2008) from CRP indicates that a total of 427,263 farms have signed 760,875 contracts, which accounts for 34,697,697 acres in over 30 eligible services. The most recent USDA Agricultural Census, 2002, reported a total of 2,128,982 farms and a total of 938,279,056 acres of land in farms (USDA, 2004). The number of farms and acres reported in Table A.1 represent 20% and 3.7% respectively of the most recent census data.

To ensure continued provision of environmental benefits from individuals who were already participating in the CRP, the Farm Services Agency offered extensions of up to 15 years to agricultural producers with contracts that expire between 2007 and 2010; these contracts represent 28 million acres. It is estimated that 80-85% of the expiring contracts will accept the contract extensions (USDA-FSA, 2007a).

US Conservation Security Program (CSP)

The objective of the Conservation Security Program (CSP) is to promote the conservation and improvement of soil, water, air, energy, plant and animal life. In doing so, the program rewards farmers and ranchers by providing payments for maintaining and enhancing natural resources and in addition provides technical assistance in implementing practices that will achieve the objectives of the program. This program is voluntary and is available to tribal and private landowners in a selection of watersheds throughout the USA.

[41] Number of farms cannot be added across sign-up types as farms may participate in multiple sign-up types. "Total" is the actual number of farms involved in CRP.
[42] Approximates FY 2008 payments, before adjustments for haying/grazing, non-compliance, terminations, part-year contracts, and contracts not yet recorded

Eligibility

All working lands within the selected watersheds are eligible to apply for a CSP contract. Working lands include: cropland, grassland, prairie land, improved pasture, range land and forested land that is an incidental part of an agricultural operation (USDA-NRCS, 2007a).

To be eligible, the producer must meet the basic criteria listed here:

- Majority of the land must be within an eligible watershed
- Have control of the land for the life of the contract
- Share in the risk of producing the crop or livestock
- Be in compliance with highly erodible land and wetland conservation provisions within the Food Security Act of 1985.

(Gieseke, 2007; USDA-NRCS, 2005a)

To apply for CSP, a producer must submit a self-assessment describing the conservation practices on his/her operation and supply two years of written records that document the stewardship levels employed within the production system. There is also an application form that needs to accompany the self-assessment and records provided.

The self-assessment makes evident whether the producer is eligible for CSP because the assessment outlines the detailed criteria for the program eligibility. There are a total of 41 questions: 7 general, 18 for cropland and 16 for pasture/rangeland.

After answering the questions, the applicant must fill out a table called the "Benchmark Inventory" which is within the self-assessment document. This benchmark inventory is the foundation of the CSP stewardship plan and provides detailed information as to what production systems are in place, what specific stewardship activities have been conducted and identifies the resource concerns or stewardship opportunities that the applicant would like to address.

Payments

Based on this information, a Natural Resources Conservation Service (NRCS) officer determines which tier fits with the application. There are three tiers of environmental stewardship within the program, each with different caps on the monetary compensation. The definition criteria for entry into each of the tiers, the contract lengths and the payment caps for contracts in each are illustrated in Table A.3 below. The payment caps are for the annual payments given to the producer under the contract (Gieseke, 2007; USDA-NRCS, 2005a). A total of US$503 million was appropriated for the contract payments in 2004-2006 and represented US$2 billion in long-term funding for multi-year contracts (Gieseke, 2007). Contract payments can be given for one or more components which consist of:

1. Annual per acre stewardship payment for the benchmark treatment.
2. A payment for maintaining existing conservation practices; this payment is calculated as a flat rate of 25% of the stewardship payment.
3. Payment to implement a new practice that is identified by the authority as needed within the watershed.
4. A payment for an enhancement. This is an activity or innovation that improves the resource conditions beyond the minimum level of treatment. The activity has measurable results and a list of enhancements is provided by the NRCS officer during the interview stage of application.

(Gieseke, 2007; USDA-NRCS, 2005b)

Table A.3 Conservation Security Program Tier Descriptions

Tier	Criteria	Length of Contract	Contract Caps
I	Producer must have addressed soil quality and water quality to a described minimum level of treatment on part of the agricultural operation prior to acceptance.	5 years	US$20,000
II	Producers must have addressed soil and water quality to the described minimum level of treatment on the entire agricultural operation prior to acceptance AND agree to address an additional resource of concern applicable to their watershed by the end of the contract period.	5-10 years	US$35,000
III	Producer must have addressed all applicable resource concerns to a resource management system level that meets the NRCS Field Office Technical Guide Standards on the entire operation before acceptance AND have riparian zones adequately treated.	5-10 years	US$45,000

Sources: (Gieseke, 2007; USDA-NRCS, 2005a)

Interestingly, a 2006 ruling by the US Internal Revenue Service (IRS) established that payments from the CSP that are cost-share payments are eligible for exclusion from gross income and therefore not taxable; however, payments under the stewardship or enhancement component of the program are not excludable from gross income and, therefore, are taxable (IRS, 2006).

Participation

The first sign-up was offered in only 18 watersheds (there are over 2,000 watersheds in the USA). In subsequent years, the number of watersheds was increased and in total, landowners in 280 watersheds (13% of those in the US) have had the opportunity to sign-up for the CSP. The watersheds were selected based on those which had the greatest potential for improvement in the areas of water quality (surface and groundwater), soil quality and grazing land condition (USDA-NRCS, 2007b). The 19,393 farms with CSP contracts represent 16 million acres within the program (Gieseke, 2007; Howard, personal communication, 2007).

National Farm Stewardship Program[43]

The National Farm Stewardship Program (NFSP) is a federal-provincial-territorial cost-share initiative to support environmental stewardship in agriculture by providing funding for producer adoption of BMPs. The objectives of the program are to help agricultural producers, individually and collectively, take action to reduce identified environmental risks and to improve management of Canada's agricultural land to reduce risks to water and air quality, improve soil productivity and enhance wildlife habitat. By encouraging the use of BMPs, the program endeavours to improve management in areas such as nutrients, riparian areas, erosion control, pests and wildlife habitat.

[43] The federal and provincial governments are working to deliver new programs for farmers through the *Growing Forward* initiative, but while that process continues, existing programs under the Agricultural Policy Framework (APF) will be extended for up to one year, starting April 1, 2008. Source: (OSCIA, 2008).

Producers who have completed an Environmental Farm Plan (EFP) and have received a Statement of Completion certificate are eligible under the NFSP for financial and technical assistance to implement one or more BMPs (AAFC, 2007a). There are 30 BMP categories which are eligible for cost share.[44] Generally, the NFSP will cover 30-50% of eligible costs of approved BMPs. For each category, limits are provided on the funding cost share and total maximum federal funding available through the program (AAFC, 2007a). The total maximum for each farm is $50,000.

Greencover Canada Program

Greencover Canada was a 110 million dollar initiative by Agriculture and Agri-Food Canada. The program was available over a five year period which ended in the 2007 to 2008 crop year. The program was designed to help producers protect water quality, reduce greenhouse-gas emissions, improve grassland-management practices, as well as enhance biodiversity and wildlife habitat. Greencover Canada focused on four components: land conversion, technical and regional technical assistance, critical areas and shelterbelts (AAFC, 2007b).

The objective of the land conversion component of Greencover Canada was to encourage agricultural producers to convert environmentally sensitive land in their annual crop production to perennial cover. To achieve this objective, Greencover Canada provided funding to offset part of the perennial cover conversion cost in return for an agreement that the agricultural producer would maintain the perennial cover for ten years. Two, one-time payments were received by agricultural producers who choose to convert environmentally sensitive land to perennial cover. If planting tame forage or trees the producer received $20/acre in the first year and $25/acre in the second year, after establishment. If planting a native species the producer received $75/ acre in the first year and $25/acre in the second year, after establishment (AAFC, 2007b).

The technical assistance component of Greencover Canada provided technology transfer tools to encourage beneficial management practices including sustainable use and management of pasture, riparian areas and shelterbelts. Non-profit organizations, incorporated environmental groups, educational institutions, co-operatives, corporations, provincial governments or agencies and provincial Crown corporations were eligible to apply for funding from Greencover Canada to support projects pertaining to beneficial management practices. Up to 100% of project costs could be covered by Greencover Canada for eligible projects. Technical assistance differs from regional technical assistance only in that the scope of the project covers one province rather than several (AAFC, 2007b).

The “critical area” component of Greencover Canada provided funding towards the enhancement of riparian ecosystems through beneficial management practices. All agricultural producers who completed an Environmental Farm Plan, identifying beneficial management practices such as fencing to manage grazing and improve riparian conditions, improve stream crossings, erosion control and buffer establishments, were eligible to apply. The shelterbelt component of the program was similar to the critical area component, only differing in that it emphasized beneficial management practices pertaining to tree and shrub planting on agricultural land. All agricultural producers who completed an Environmental Farm Plan, identifying beneficial management practices such as shelterbelt site preparation, weed control and tree materials, were eligible to apply. Applicants were eligible for up to $30,000 in Federal

[44] Refer to (AAFC, 2007a) for detailed list of BMP categories and cost-share amounts.

funding under the critical area and shelterbelt component of the Greencover Canada program (AAFC, 2007b).

Conservation Easements

Conservation easements are an agreement between the landowner and a conservation organization, for example, Nature Conservancy of Canada and/or Ducks Unlimited Canada. Under the agreement, the landowner voluntarily restricts the development of the land. Whether the landowner can maintain the agricultural productivity of the land and perform specific activities is determined within the agreement. Each agreement is tailored to the individual landowner/situation. Agreements are tied to the title of the land; therefore, future owners of the land are bound by the agreement. Conservation easements may be for a specified time or in perpetuity, again stipulated in the agreement. Easements are used to protect wetlands, forests, prairies, wildlife habitat etc (Ducks Unlimited Canada, 2008; Nature Conservancy Canada, 2006).

The Canadian federal government also provides a taxation benefit called “ecogift”. If the land is donated to the conservation organization and the land is certified as ecologically sensitive the landowner is eligible for a tax credit/deduction based on a “fair market value” of the land. It is calculated by applying a rate of 15.5% to the first $200 of the donor’s total gifts for the year and 29% on the balance. Unlike other charitable gifts there is no maximum (dollar limit) on ecogift donations (Environment Canada, 2007).

Conservation easements are also used in the United States (The Nature Conservancy, 2008). The USDA within the Natural Resource Conservation Service programs also use easements contracts which include payments for the land, or financial assistance in rehabilitation of the land, to a particular state within the Wetland Reserve Program and the Grassland Reserve Program (USDA-NRCS, 2008a; USDA-NRCS, 2008b).

APPENDIX B: STAKEHOLDER INVOLVEMENT

B.1 Telephone Interviews and Online Survey

B.1.1 Interview Questionnaire

Ecological Goods and Services: Estimating Program Uptake and the Nature of Costs and Benefits

Ecological Goods and Services (EG&S) represent the transformation of natural elements into functions useful to human beings and can include such things as soil erosion protection, water and air quality, biodiversity and natural landscapes. The idea of paying farmers for EG&S is receiving national attention. EG&S is an emerging policy tool for the agricultural community to adopt environmental management practices in order to ensure environmental and economic sustainability.

The George Morris Centre has been commissioned by MAFRI to evaluate the costs and benefits of a potential Manitoba Ecological Goods and Services program, while taking into consideration the various agri-environmental regions of Manitoba. To complete this research, it is necessary to understand landscape characteristics and environmental management practices in Manitoba.

Attached is a questionnaire designed to understand the current landscape in your rural municipality/conservation district and the potential for increased environmental management and, thus, ecological goods and services. The George Morris Centre research team would like to obtain your answers to the questions and any comments you care to make by telephone interview. A member of our research team will contact you by telephone or email to determine when you are available for an interview that we expect will take 30-45 minutes of your time. However, if time does not permit an interview, the questions have been designed as a questionnaire that can be completed and returned to us.

You can be assured that all information collected will be held in confidence. For the purpose of data analysis, your questionnaire will be given an identification number, i.e., person or organization names will never be used. No one other than our research staff will see the individual questionnaires.

Please advise us if you feel we should be contacting another individual from your organization.
We thank you in advance for your cooperation.

Sincerely,
Cher Brethour, M.Sc., PMP
Sr. Research Associate – Environment
George Morris Centre

1. Introduction

Name	**Email:**
	Telephone:

1.A. Please identify with a checkmark in the appropriate box(es) how you are involved with ecological goods and services (multiple answers are acceptable):

- ☐ Producer
- ☐ Producer Association
- ☐ Program Representative/Administrator
- ☐ Scientist
- ☐ Government Employee
- ☐ Non-Government Organization
- ☐ Conservation District
- ☐ Academic
- ☐ Other, please specify: _____

For this survey, we use the following definitions:

Natural Capital[45]*: refers to natural resources, such as water and oil, the land which provides space on which to live and work, and the ecosystems that maintain clean water, air and a stable climate. Natural capital is a key input in the production of goods and services in Canada, and is particularly important to the agricultural industry due to the role of land, air, water, soil, and biodiversity in crop and livestock production.*

Ecological goods and services[46] *are defined as components of nature, directly enjoyed, consumed, or used to yield human well-being. Ecological goods and services (EG&S) represent the transformation of natural elements into a function useful to human beings, and can include such things as purification of air and water, maintenance of biodiversity, soil and vegetation generation and renewal, groundwater recharge through wetlands, greenhouse gas mitigation and aesthetically pleasing landscapes.*

Environmentally Sensitive Area[47] *is a type of designation for an agricultural area which needs special protection because of its landscape, wildlife, or historic value. The environmentally sensitive area is vulnerable to a negative environmental impact, such as a flood plain, a wetland or an area designated for plant, fish, and/or animal habitat.*
Environmental Risk[48] *is the chance that human health or the environment will suffer harm as the result of the presence of environmental hazards.*

2. Land Classification

In Manitoba, an Alternate Land Use Services (ALUS) Pilot Program has been established as a three year initiative within the Rural Municipality of Blanshard. This environmental program is voluntary and incentive-based and rewards the positive contributions that agricultural landowners make to soil conservation, clean air and water, and biodiversity through their land management practices. Farmers within the ALUS program receive payments for preserving ecologically sensitive lands, natural areas, riparian areas and wetlands.

[45] Source: http://www.canadianeconomy.gc.ca/english/economy/natural_capital.html
[46] Boyd and Banzhaf (2006)
[47] Source: http://en.wikipedia.org/wiki/Environmentally_Sensitive_Area and http://www.answers.com/topic/environmentally-sensitive-area-1
[48] Source: http://www.smarte.org/smarte/resource/sn-glossary.xml

Similar to ALUS, a provincial EG&S program would be a voluntary initiative aimed at rewarding producers for providing ecological goods and services. In order to estimate the costs and benefits of a provincial EG&S program, it is necessary to understand and classify land that may be eligible for payments. It is our hope that you can help to enhance our understanding of the location of different land uses, environmentally sensitive areas, etc. in order to understand the nature and extent of agricultural lands, or identify shortcomings of the data, for the rural municipalities or conservation districts that you are most familiar with.

2.A The rural municipality(s)/conservation district that you have working familiarity / knowledge with, with respect to land characteristics is/are:

_____

_____

2.B Using an 'X' in the table below, indicate how familiar are you with the physical landscape, the natural capital and the potential for ecological goods and services in your area.

	Very Familiar	Somewhat Familiar	Not Very Familiar	Not at all Familiar
Physical Landscape				
Natural Capital				
Ecological Goods and Services				

2.C To the best of your knowledge, what percentage of land in your rural municipality/conservation district is currently protected through conservation agreements or easements?

Percentage of Land: _____

2.D What are the main environmentally sensitive areas within your rural municipality/conservation district?

_____

_____

2.E Are you aware of physical data or information sources other than the Agricultural Census, Canada-Manitoba Farm Stewardship Program, ALUS and the Manitoba Land Initiative, that could be used to assess and classify the land in your rural municipality/conservation district for ecological goods and services? If yes, please list data and/or source.

_____

_____

3.0 Land Management

The following questions are intended to help us better understand the environmental issues and current land management practices occurring in your rural municipality/conservation district and their effectiveness at addressing environmental concerns.

3.A Thinking of the four main categories of environmental concern, i.e., water, air, soil and biodiversity/natural habitat, please rank the categories using a scoring system of 1 through 4, where 1 represents the most important or greatest concern in your rural municipality/conservation district?

Categories of Environmental Concern	Ranking (1=Greatest Concern)
Water (quality and quantity)	
Air quality	
Soil quality	
Biodiversity/natural habitat	

3.B Given the top two concerns identified above, what are the specific environmental issues facing your rural municipality/conservation district (please describe)? Examples may include ground or surface water contamination, nutrient loading, soil degradation, etc.

#1 Environmental Issue:

_____

_____

#2 Environmental Issue:

_____

_____

#3 Environmental Issue:

_____

_____

3.C The following table is intended to illustrate the current environmental management practices used in your rural municipality/conservation district and their perceived effectiveness at addressing the environmental concerns/issues previously identified. Please fill out the table identifying the applicable management practice as well as the appropriate use and effectiveness rates.

Environmental Management Practice	Use in Rural Municipality/Con District			Effectiveness		
Buffer Strips/filter strips	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐
No Tillage, conservation or minimum tillage	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐
Nutrient Management Planning	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐
Restricted Livestock Access (e.g., fencing, alternative water sources)	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐
Cover crops	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐
Perennial forages/crops	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐
Organic production	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐
Rotational grazing	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐
Other:	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐
Other:	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐
Other:	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐

3.D If you indicated 'low' use for any of the management practices identified in the table above, please indicate why you believe the practice has a low uptake in your rural municipality/conservation district.

_____

_____

3.E Can you think of any other environmental management practices that are not currently being used in your rural municipality/conservation district that would be more effective at addressing the environmental concerns/issues previously identified?

☐ Yes ☐ No

If you responded yes, please describe the practices and why you think they would be more effective:

_____

_____

4.0 Ecological Goods and Services and Potential Programming

For this next section, recall the following definition of ecological goods and services:

Boyd and Banzhaf (2006) define ecosystem services as components of nature, directly enjoyed, consumed, or used to yield human well-being. Ecological goods and services (EG&S) represent the transformation of natural elements into a function useful to human beings, and can include such things as purification of air and water, maintenance of biodiversity, soil and vegetation generation and renewal, groundwater recharge through wetlands, greenhouse gas mitigation and aesthetically pleasing landscapes.

4.A Based on the EG&S definition above, complete the following table to indicate which of the **management practices listed** are **currently in use and therefore contributing ecological goods and services in your rural municipality/conservation district** by specifying 'yes' or 'no' in the table below.

Then indicate your estimate of the current adoption rate (in terms of number of acres) of these EG&S environmental management practices in your rural municipality/conservation district using the following scale: <10%; 10-20%; 20-30%; 30-40%; 40-50% etc.

Finally, indicate whether you would classify the current adoption level as a **low, moderate or high** level of adoption (i.e., we are trying to understand if there is a potential for greater adoption of these practices).

EG&S Practice Currently Being Used in Your Rural Municipality/Conservation District	**Currently in Use Yes or No?**		**Adoption Rate (% of Acres)**	**Do you consider the adoption rate to be low, moderate or high?**		
Maintenance of riparian areas	Yes ☐	No ☐		Low ☐	Moderate ☐	High ☐
Maintenance of wetlands	Yes ☐	No ☐		Low ☐	Moderate ☐	High ☐
Maintenance of natural areas (native grasses, bushes, trees etc)	Yes ☐	No ☐		Low ☐	Moderate ☐	High ☐
Land taken out of annual production	Yes ☐	No ☐		Low ☐	Moderate ☐	High ☐
Carbon sequestration	Yes ☐	No ☐		Low ☐	Moderate ☐	High ☐
Establishment and preservation of wildlife habitat	Yes ☐	No ☐		Low ☐	Moderate ☐	High ☐
Maintenance of property for recreational opportunities such as birding/wildlife watching, photography, hunting, fishing or trails for hiking/cycling/snowmobile/ATV	Yes ☐	No ☐		Low ☐	Moderate ☐	High ☐
Maintenance of property for pleasant landscapes or scenic views	Yes ☐	No ☐		Low ☐	Moderate ☐	High ☐
Other:	Yes ☐	No ☐		Low ☐	Moderate ☐	High ☐

4.B If you indicated 'low' adoption for any of the EG&S practices identified in the table above, please indicate why you believe the practice has a low uptake in your rural municipality/conservation district. In your opinion, could or should this level of uptake be increased?

____

____

4.C Do you think there are more effective management practices that are not currently being used in your area that would have a greater contribution of EG&S?

☐ Yes ☐ No

If so, what environmental management practices would you suggest for use in your area?

____

____

____

4.D In the table below, indicate the **types of environmental management practices** that you would like to see **eligible for EG&S payments in your rural municipality/conservation district**. Then **rate** these practices with respect to their **cost of establishment**, **ease of implementation** and **environmental effectiveness** using a **low, moderate or high** scoring system. Finally, **rank** your top three to five practices that you would like to see receive EG&S payments the most, with 1 representing your most preferred. Examples of EG&S practices are available in question 4A above.

EG&S Management Practice	Cost of Establishment			Ease of Establishment			Environmental Effectiveness			Ranking (1-most preferred; 5-least preferred)
	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	
	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	
	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	
	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	
	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	
	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	
	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	
	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	
	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	Low ☐	Moderate ☐	High ☐	

4.E What type of payment structure would you suggest be used for provincial EG&S program payments (multiple answers are acceptable)?

- ☐ Long term continuous payments
  - o Suggested length of time: _____
- ☐ Payments that cover a percentage of the cost
  - o Suggested percentage: _____
- ☐ Payments that cover more than 100% of the cost plus an additional incentive amount
- ☐ Eco-service Auctions[49]
- ☐ Tradable rights or permits
- ☐ Other(s): _____

Please indicate why you selected the type of payment structure that you did:

_____

_____

4.F Please indicate your level of agreement with the following statements about ecological goods and services programming (**"1" = Strongly Disagree** and **"5" = "Strongly Agree")**

		Strongly Disagree				Strongly Agree
i)	Farmers in my rural area understand what practices provide ecological goods and services	1	2	3	4	5
ii)	Farmers in my rural area are interested in a local EG&S program	1	2	3	4	5
iii)	Farmers in my rural area are interested in a provincial EG&S program	1	2	3	4	5
iv)	A provincial EG&S program should be a universal program, i.e., the same program offered to all municipalities		1	2	3	4	5
v)	An EG&S program should be a targeted program based on priority or high risk areas	1	2	3	4	5	

[49] One example of an eco-service auction is the management of contracts in which the purchaser (either the government or a community group) is able to choose the project which will provide the greatest environmental benefits for the least cost. Landowners present the management they intend to implement and the respective costs. The proposed project is given a score that corresponds to the level of benefit it is expected to provide. Projects with the highest environmental value at the best price obtain the funding.

vi)	An EG&S program should be based on the water quality management zones[50]	1	2	3	4	5
vii)	An EG&S program should be based on soil characteristics or other characteristics of land (e.g., biodiversity)	1	2	3	4	5
viii)	An EG&S program should be based on watershed or sub-watershed boundaries	1	2	3	4	5

4.G Do you have any comments regarding any of the above statements?

_____

_____

4.H Do you think a provincial EG&S program would make a significant contribution toward meeting the needs of Manitoba agricultural producers and society's expectations with respect to the environment?

☐ Yes ☐ No ☐ Undecided

Why or why not?

_____

_____

4.I Given everything that we have discussed in the questionnaire to this point, based on your own opinion, how would you describe your preferred approach for a provincial EG&S program? Please provide specific details regarding target regions, payment structure and eligibility criteria and practices.

Target Regions:

_____

_____

_____

Payment Structure:

_____

_____

_____

[50] Under the *Water Protection Act* in Manitoba, the draft Nutrient Management Regulation suggests six water quality management zones. The zones attempt to define land in the following manner: highly productive, moderately productive, marginally productive and non-productive agricultural lands, as well as land not typically used for agriculture and nutrient buffer zones.

Eligible Criteria: _____

_____

_____

_____

Eligible Practices: _____

_____

_____

_____

Other: _____

_____

4.J What level of adoption of EG&S management practices (in terms of acres) would you estimate would occur if the program you described above was implemented in your rural municipality/conservation district? The province?

Rural Municipality/Conservation District	**Entire Province of Manitoba**
☐ Less than 10%	☐ Less than 10%
☐ 10-20%	☐ 10-20%
☐ 20-30%	☐ 20-30%
☐ 30-40%	☐ 30-40%
☐ 40-50%	☐ 40-50%
☐ 50-60%	☐ 50-60%
☐ 60-70%	☐ 60-70%
☐ 70-80%	☐ 70-80%
☐ 80-90%	☐ 80-90%
☐ 90-100%	☐ 90-100%

4.K Would you anticipate the uptake (given your scenario) as low, moderate or high for your rural municipality/conservation district? The province?

Rural Municipality/Conservation District	**Entire Province of Manitoba**
☐ Low	☐ Low
☐ Moderate	☐ Moderate
☐ High	☐ High

4.L Are there any other comments that you would like to make that were not addressed in this questionnaire?

Letter Requesting Participating in the On-line Survey Questionnaire:

Ecological Goods and Services (EG&S) represent the transformation of natural elements into functions useful to human beings and can include such things as soil erosion protection, water and air quality, biodiversity and natural landscapes. The idea of paying farmers for EG&S is receiving national attention. EG&S is an emerging policy tool for the agricultural community to adopt environmental management practices in order to ensure environmental and economic sustainability.

The George Morris Centre has been commissioned by MAFRI to evaluate the costs and benefits of a potential Manitoba Ecological Goods and Services program, while taking into consideration the various agri-environmental regions of Manitoba. To complete this research, it is necessary to understand landscape characteristics and environmental management practices in Manitoba.

We have designed a questionnaire to understand the current landscape in your rural municipality/conservation district and the potential for increased environmental management and, thus, ecological goods and services. The George Morris Centre research team would like to obtain your answers to the questions and any comments you care to make via an on-line survey questionnaire. The following link will take you directly to the questionnaire: http://www.zoomerang.com/recipient/survey-intro.zgi?p=WEB2276PKQA9PP. We expect the process will take approximately 30 minutes of your time.

You can be assured that all information collected will be held in confidence. For the purpose of data analysis, your questionnaire will be given an identification number, i.e., person or organization names will never be used. No one other than our research staff will see the individual questionnaires.

Please advise us if you feel we should be contacting another individual from your organization.
We thank you in advance for your cooperation.

B.1.2 Results of the Interviews and Online Survey

This section outlines the results of the 15 interviews and 5 Internet responses collected up to and including November 30, 2007.[51]

Overview of Survey Respondents

The survey encompassed all major stakeholders including agricultural producers (4), producer/industry associations (1), program representatives or administrators (2), scientists (1), government employees (7), non-governmental organizations (2) conservation districts (12), land-owners (2) and other categories (3). Note that some respondents identified themselves as belonging to more than one category; hence the total exceeds the total number of completed questionnaires. Unfortunately, there was a lack of academics within the sample of interview respondents. This is an observed limitation of the results.

The working familiarity of the stakeholders with the land characteristics in their respective regions is an important attribute to qualify and also validate the responses. A subtle difference on stakeholders' familiarity with regard to the particular land characteristics i.e., physical landscape, natural capital and ecological goods and services (EG&S) was observed in the preliminary analysis. Most interviewees (70%) were 'very familiar' with the physical landscape characteristics. However, the majority of the respondents interviewed were only 'somewhat familiar' with the characteristics of 'natural capital' and 'EG&S' within their rural regions.

Land Classification - Protected Land and Environmental Concerns

We asked interviewees to indicate what percentage of land was protected through conservation agreements or easements in the rural area with which they were familiar. Responses to this question indicated that the percentage of land protected was generally less than 10%, but in many cases it was below 5%.

When asked to identify the key environmentally sensitive areas, respondents generally identified riparian areas, wetlands, lakes and escarpments. Some respondents provided more specific information on sensitive areas within the areas that they were familiar with. A comprehensive list of the relevant rural municipalities/conservation districts for each respondent and the environmentally sensitive areas identified within those regions is included in Table B.1.

Table B.1 Environmentally Sensitive Areas Identified in the Interviews

Respondent	Rural Municipality/ Conservation Districts	Main Environmentally Sensitive Areas within the Specified Rural Municipalities/Conservation Districts
1	• RMs: Wallace, Pipestone, Sifton, Woodworth, Archie	• Assiniboine River Valley • RM of Sifton includes Oak Lake where there are light sandy soils • RM of Pipestone has aquifer

[51] The following is a link and password to the complete results of the survey. http://www.zoomerang.com/web/SharedResults/SharedResultsPasswordPage.aspx?ID=L2384S3CPJS8 The password is 'jane'; note that the password is case sensitive.

Respondent	Rural Municipality/ Conservation Districts	Main Environmentally Sensitive Areas within the Specified Rural Municipalities/Conservation Districts
2	• Primarily familiar with RM: Portage la Prairie • Also familiar with: South Central - Red River Valley; South-West - dry region; Prairie pot hole country; and Lakes area.	• Buffer strips along rivers and water ways • Saline areas • There are not many pot holes (these are permanent or semi-permanent wetland <2acres in size/) • There are also pot holes which are only wet for a short time in the spring. These are most valuable from a filtration and habitat perspective, but are most often destroyed.
3	• Pembina Valley Conservation District which includes RMs: Stanley, Pembina Louise, Roblin, Lorne and Thompson and the Towns of Pilot Mound, Manitou and Morden and the Villages of Cartwright and Crystal City.	• Riparian areas, wetlands, water reservoirs for drinking water • Aquifer recharge areas
4	• Central Plains area (e.g. Portage, Gladstone).	• Potato land - heavily cultivated and can be sensitive to chemical and fertilizer use. • Lighter texture soil with a major aquifer that is unconsigned.
5	• Cooks Creek Conservation District, includes parts of 5 RMs	• Water Quality • Sensitive areas are aquifers
6	• Primarily familiar with RM of Blanshard • Also familiar with RM of Langford • Also familiar with all 18 CDs	• Riparian areas and wetlands
7	• Whitemud CD	• Riding Mountain Escarpment • Manitoba Escarpment • Minnedosa pot hole region • Big Grass Marsh (20x8 mile marsh) • Assiniboine Delta Aquifer
8	• Agricultural areas of the province	• Natural Areas
9	• RM of Blanshard	• Wetlands - pot hole type topography and risk of being drained • Riparian areas along lakes and creeks. These feed into lake that is the water source for town; therefore there is demand from both wildlife and humans.
10	• RMs: Turtle Mountain, Lorne, Louise, Argyle, Pembina, Strathcona, Riverside, Roblin	• Lakes
11	• North Parkland Region • RMs: Dauphin, Roblin, Ste. Rose du Lac, Ethelbert, Ochre River, Alonsa	• Low lying areas next to lakes - floodplains. When the wind blows, it can blow the water over the land. These lands are crown land but are leased to producers. • Riparian areas; there are a lot of cattle on

Respondent	Rural Municipality/ Conservation Districts	Main Environmentally Sensitive Areas within the Specified Rural Municipalities/Conservation Districts
		these areas.
12	• La Salle Redboine CD • Pembina Valley CD	• Prairie potholes • Wetlands • Escarpment (lake bed and shore of Lake Agassi within two CDs is subject to erosion) and riparian areas along streams are under threat as well.
13	• RMs: MacDonald, Morris, Thompson, Rhineland, Stanley, Headingley, Roland, Dufferin, Grey, Cartier, St. Francois Xavier • CDs: Pembina Valley and La Salle Redboine	• Coleman Creek Watershed • Stephenfield Reservoir • Winkler Aquifer
14	• East-Interlake CD	• Lake Winnipeg • Wetlands • Wildlife management areas • Limestone snake pits: where snakes winter • Carse landscape/sink holes • Oak Hammock Marsh • Some areas with shallow over burden i.e., aquifer is close to the surface therefore contamination can occur.
15	• Lake Manitoba West Watershed • Alonsa CD	• Water Quality in Lake Manitoba • Soil salinity in several areas
16	• RMs: Cornwallis, Elton, Whitehead, Miniota	• Oak Lake Aquifer • Assiniboine Delta Aquifer • Assiniboine Valley slopes • Alex-Gris Marsh • Douglas Marsh • Brandon Hills
17	• Tiger Hills CD	• Pelican Lake, Rock Lake and Swan Lake • Glenboro Marsh • Sandy soil area along Spruce Woods Park
18	• Lake of the Prairies CD which encompasses RMs: Russell, Shell River, Shellmouth-Boulton and Silver Creek	• Wetlands • Riparian areas
19	• Province	• Anywhere there is intensive agriculture
20	• RMs: Archie, Birtle, Ellice, Hamiota, Miniota, Rossburn, Shoal Lake, Wallace and Woodworth	• Riparian areas • Seasonal wetlands

Respondents were asked to rank four environmental concerns in terms of importance: water quality and quantity; air quality; soil quality; and biodiversity/natural habitat. Water quality and quantity was the most common concern to the majority of respondents (90%) with issues such

as loss of wetlands, drainage, salinization, turbidity, surface and ground water contamination due to effluent discharge, nutrient loading and degradation of drinking water all being raised as environmental issues throughout Agro-Manitoba. Soil erosion, land clearing, deforestation and water logging were clearly the major drivers for the concern of soil quality as the second most important environmental concern. Interestingly, biodiversity as the third important concern was mostly intertwined with stakeholders' perceptions towards changing land-use patterns, removal of permanent cover, riparian and wetland degradation and buffer elimination due to commercial cropping. This left air quality as the lowest concern to respondents.

Land Management - Current Beneficial Management Practices

An examination of BMPs currently being practiced looked at both the prevalence and effectiveness of various practices. While the respondents discussed the prevalence of BMPs based on the local regions they were familiar with, most of the insights on BMP use and effectiveness were consistent across the respondents and hence the results are aggregated in this section. No tillage or conservation tillage was identified to be predominantly used in most locations, 35% of respondents indicated that use in terms of acreage was high and 60% felt that use was moderate. This was followed by moderate use of perennial forage crops, i.e., 65% of respondents indicated that use of this practice was moderate. Buffer strips and organic production were considered least practiced in most locations with 90% of respondents revealing that the use of these two practices is low. Other practices highlighted by respondents were shelter belts, green cover (permanent) and mixed species grazing, where uses of these were classified as low or moderate from those who highlighted them.

Analyzing the effectiveness of the BMPs, perennial forages and restricted livestock access were found to most effective. Buffer strips were ranked as highly effective by 50% of respondents and moderately effective by another 45% of respondents. No tillage or conservation tillage was ranked as highly effective by 45% of respondents and moderately effective by another 50%. Nutrient management planning was ranked as highly effective by 55% of respondents and moderately effective by another 40%. Rotational grazing was ranked as highly effective by 58% of respondents and moderately effective by another 37%. Cover cropping was ranked moderately effective by 65% of respondents, followed by organic production which was ranked with low effectiveness by 55% of the stakeholders.

Analysis of the reasons behind the low use of certain BMPs primarily came down to the issue of cost versus economic benefit. For example, the mere existence of buffer-strips was attributed to forced adoption of the practice due to lack of alternative productive use of that land rather than the conscious maintenance of EG&S. The increase in cost associated with various practices (e.g. rotational grazing, restricted access practices, timing of cover crops) was mentioned. Difficulties in infrastructure bottlenecks (i.e., lack of government permission to establish water management and control measures and scale issues with respect to organic farming) were all important reasons for lower adoption of various practices.

The majority of the survey respondents (>70%) agreed that maintenance of the physical landscape including riparian areas, wetlands, natural areas, pleasant landscapes, taking land out of production and maintaining wildlife habitat are all currently in practice, although the majority of respondents indicated that the level of adoption of these practices was low. However, carbon sequestration was identified by most stakeholders as not currently in use at all.

Reasons for low adoption included lack of economic justification for removing land from production (riparian areas), increased economic pressures to leverage more weight on crop enterprise as livestock prices decline (wetlands), increased motivations for profitability as farms become larger and lack of proper government support measures such as payments and tax rebates (e.g. with regard to carbon sequestration). A few responses highlighted the need for changing farmers' perceptions and awareness in these areas.

Improving Environmental Management Practices and the Provision of EG&S

When asked if there were more effective management practices not currently in use in the respondents' area, 10/19 (53%) of respondents said there were, while 9/19 (47%) said there were not. Of those that indicated there were more effective practices that could be implemented, taking marginal lands out of production, encouraging the use of buffer strips, increasing the protection and maintenance of wetlands, and giving payment for these actions were all provided as examples of actions that should be taken. Effective extension of programs such as ALUS with promotions customized to the landowner was considered an essential pre-requisite for successful implementation. Along with education of the landowners, one respondent felt that education of the urban population to illustrate the importance of ecological goods and services provided by agricultural landowners was also important. The respondent was adamant that the majority of the urban population must understand and support an EG&S program for it to succeed.

Respondents were asked to identify the types of environmental management practices that they would like to see eligible for EG&S payments in their local area. Respondents were then asked to rank their suggested practices based on their perceived cost of establishment, ease of establishment and environmental effectiveness. The results are presented in Table B.2 below.

Table B.2 Desired Environmental Management Practices Eligible for EG&S Payments According to Interview Results

EG&S Practice	Cost of Establishment				Ease of Establishment				Environmental Effectiveness			
	L	M	H	*Total*	L	M	H	*Total*	L	M	H	*Total*
Riparian areas	3	**8**	4	*15*	0	**9**	5	*14*	0	2	**12**	*14*
Wetlands	**8**	2	4	*14*	4	4	**6**	*14*	0	1	**12**	*13*
Natural areas	**6**	2	0	*8*	1	1	**5**	*7*	0	2	**5**	*7*
Establishment of grass runways	1	**4**	2	*7*	0	**4**	1	*5*	0	1	**4**	*5*
Water retention/storage measures	0	**4**	2	*6*	2	**5**	0	*7*	0	2	**6**	*8*
Buffer strips	1	**5**	0	*6*	0	**3**	2	*5*	0	**3**	2	*5*
Rotational grazing	1	**3**	1	*5*	1	**2**	0	*3*	0	**2**	1	*3*
Other land management practices	1	2	2	*5*	**3**	2	1	*6*	1	0	**5**	*6*
Perennial forages	2	2	0	*4*	1	1	1	*3*	0	2	2	*4*
Crop residue/native upland/winter wheat practices	**3**	0	1	*4*	1	1	1	*3*	1	**2**	0	*3*
Carbon sequestration	1	1	1	*3*	1	0	**2**	*3*	0	1	**2**	*3*
Habitat improvement	**2**	0	0	*2*		1	1	*2*	0	0	**2**	*2*
Shelterbelts	0	1	1	*2*	1	1	0	*2*	0	1	1	*2*
Gully and erosion control	0	0	**2**	*2*	**2**	0	0	*2*	0	1	1	*2*
Wildlife habitat retention	0	1	1	*2*	0	0	**2**	*2*	0	0	**2**	*2*
Fragile/marginal land retirement	0	1	1	*2*	0	1	1	*2*	0	0	**2**	*2*
Nutrient management	0	**2**	0	*2*	0	**2**	0	*2*	0	**2**	0	*2*
Partner in services between city and rural residents	0	**1**	0	*1*	0	**1**	0	*1*	0	0	**1**	*1*
Reduce residential development	0	**1**	0	*1*	0	0	**1**	*1*	0	0	**1**	*1*
Off-site watering	0	0	**1**	*1*	0	**2**	0	*2*	0	0	**1**	*1*
Education about EG&S	1	0	0	*1*	0	0	**1**	*1*	0	0	**1**	*1*
Organic production	0	0	1	*1*	**1**	0	0	*1*	0	0	**1**	*1*

Respondents suggested that many management practices such as riparian area management, buffer strips, grass runways, rotational grazing and nutrient management can be accomplished by incurring moderate cost. Maintenance of wetlands and natural areas were considered in the category of 'low cost' maintenance and erosion/gully control and off-site watering measures were considered expensive.

Carbon sequestration, maintenance of natural areas and wetlands, and wildlife habitat retention obtained 'high ease' rankings for maintenance, i.e., they were deemed easy to establish. Establishment of buffer strips, grass runways and riparian areas was considered moderately easy. Water retention measures and rotational grazing were also considered to be moderately easy. Organic production and erosion control measures were considered more difficult to establish.

The awareness of survey respondents to the environmental effectiveness of the environmental management practices was clearly evident. Most interviewees ranked the effectiveness of almost all the management practices as highly effective. Natural areas, riparian areas, wetlands, grass runways and habitat improvement and retention were all considered highly effective. Interestingly, nutrient management was ranked 'moderately effective' by the survey respondents. However, it is important to note that the rankings are based only on individuals who identified the specific practices and chose to rank them since not all interviewees identified all of the practices.

As far as which environmental management practices were most favoured to qualify for EG&S payments, wetlands and riparian areas were mentioned the most often by interview respondents.

Ecological Goods and Services and Potential Programming

Respondents were asked to indicate their level of agreement with a selection of statements, the statements and response rates are given in Table B.3 below. As can be seen from the statements, they were aimed at understanding the level of farmer awareness of practices that provide EG&S and farmer interest in a local or provincial program. In addition, we were attempting to establish respondents' preference for universal programs or targeted programs and what boundary or characteristics (e.g. soil or biodiversity) they felt an EG&S program should be based on.

In terms of EG&S program interest, 45% of interview respondents agreed or strongly agreed that farmers in their area would be interested in a local EG&S program; another 45% of respondents were neutral. There was slightly more interest in a provincial program, i.e., a higher number of respondents agreed or strongly agreed with the statement that "farmers in my local area are interested in a provincial EG&S program". There was a mixed response when respondents were asked whether farmers in the local area understand what practices provide EG&S. A relatively even mixture of responses was also found with regard to the universality of an EG&S program while, a vast majority (90%) agreed or strongly agreed that a program should be targeted to priority or high risk areas.

In response to questions about eligibility and program boundaries, it became apparent that the majority of respondents do not wish to see a program based on water quality management zones, but that a program should be based on characteristics such as soil or biodiversity and by watersheds or sub-watersheds.

Table B.3 Summary of Questionnaire Responses for Question 4F

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Farmers in my rural area understand what practices provide EG&S	15%	25%	30%	25%	5%
Farmers in my rural area are interested in a local EG&S program	5%	5%	45%	20%	25%
Farmers in my rural area are interested in a provincial EG&S program	5%	5%	35%	30%	25%
A provincial EG&S program should be a universal program, i.e. the same program offered to all municipalities	20%	25%	15%	25%	15%
An EG&S program should be a targeted program based on priority or high risk areas	5%	0%	5%	45%	45%
An EG&S program should be based on the water quality management zones	30%	25%	25%	15%	5%
An EG&S program should be based on soil characteristics or other characteristics of land (e.g. biodiversity)	5%	10%	30%	40%	15%
An EG&S program should be based on watershed or sub-watershed boundaries	0%	15%	25%	30%	30%

When asked about their preferred approach for an EG&S program in Manitoba, most respondents appeared to agree with a provincially based program with flexibility for accommodating a bundle of local management practices specific to areas. Environmentally sensitive areas were the desired target for the most part. However, a few respondents disagreed with targeting in any form and suggested a uniform program with broader perspective.

Long term continuous payments were observed as the general preference among the respondents. An even-split among survey respondents on payments that covered only a fraction of cost and payments covering entire cost with incentives was intriguing. A minor fraction of the interviewees expressed interest in eco-service auctioning (3 respondents) and tradable permits (3 respondents). A small percentage of respondents preferred one time, lump sum payments as well.

Common responses regarding eligibility criteria included that individuals must be owners of the land to be eligible and that higher preference should be given to agricultural land owners as well as high risk or sensitive lands. It was noted that all land eligibility criteria should be based on a whole farm perspective to encourage a whole farm approach to managing land.

With respect to eligible practices, many common responses were identified including: maintenance of wetlands, riparian and natural areas, buffer strips, carbon sequestration, habitat protection and taking marginal land out of production. A number of individuals noted that eligible practices should be identified on an environmental risk basis within the regional municipalities.

An interesting suggestion made was to have two sources of funding: the first for the maintenance of existing lands that provide EG&S and new funding for capital expenditures for new management for the provision of EG&S.

Based on the program designed above, there was a vast array of opinions on the level of uptake (in terms of acres) that would occur across the province. The following are the most common responses:

- 26% of the sample indicated an uptake level of 10-20% of acres
- 16% of the sample indicated an uptake level of 30-40% of acres
- 16% of the sample indicated an uptake level of 70-80% of acres

68% of the sample indicated that the levels identified above should be considered a moderate level of uptake.

Summary of the Interview Results

The purpose of the interviews was to gain an understanding of the environmental and farm issues that are prevalent in various regions of Manitoba. The survey encompassed all major stakeholders in Manitoba with the exception of academia. The stakeholders had strong familiarity with the physical characteristics of the regional landscapes in Manitoba and were somewhat familiar with natural capital and ecological goods and services in their areas.

The results of the interviews provided information on environmental concerns, current land management practices, the provision of EG&S, and potential EG&S program design in Manitoba.

Overall, the respondents mentioned riparian areas, wetlands, lakes and escarpments as key environmentally sensitive areas. Respondents felt that water quality and quantity was the top environmental concern in Manitoba, followed by concern about soil quality.

The majority of the respondents stated that environmental management practices to maintain the physical landscape including riparian areas, wetlands, natural areas, and wildlife habitat were currently in place; however adoption of these practices was low. Reasons cited for low adoption included lack of economic justification and, in some cases, a lack of proper government support measures. A few respondents also highlighted the need for changing farmers' perceptions and awareness of the practices.

When asked to identify the types of environmental management practices that they would like to see eligible for EG&S payments in their local area, respondents mentioned wetlands and riparian areas most frequently.

With respect to the potential design of an EG&S program in Manitoba, most respondents agreed with a provincially based program with flexibility for accommodating a bundle of local management practices specific to particular areas. For the most part, environmentally sensitive areas were the desired target. However, a few respondents disagreed with targeting in any form and suggested a uniform program across the province. Long term continuous payments were observed as the general preference among the respondents. A minor fraction of the interviewees expressed interest in eco-service auctioning and tradable permits. A small percentage of respondents preferred one time, lump sum payments as well. Common responses regarding eligibility criteria included that individuals must be owners of the land to be eligible and that higher preference should be given to agricultural landowners as well as high risk or sensitive lands.

B.2 Focus Group

B.2.1 Focus Group Invitation

November 5, 2007

Dear:

Re: Ecological Goods and Services: Estimating Program Uptake and the Nature of Costs and Benefits

The George Morris Centre, in collaboration with Cordner Science, is hosting a **focus group workshop** to examine scenarios regarding the structure of a potential Ecological Goods and Services (EG&S) program in Manitoba.

We are pleased to extend an invitation to you to participate in this focus group. We hope that you will be able to join us on the following date:

November 27, 2007
8:30 AM to 3:30 PM
Winnipeg Winter Club

As you may know, Ecological Goods and Services (EG&S) represent the transformation of natural elements into functions useful to human beings and can include such things as soil erosion protection, water and air quality, biodiversity and natural landscapes. The idea of paying farmers for EG&S is receiving national attention. EG&S is an emerging policy tool for the agricultural community to adopt environmental management practices in order to ensure environmental and economic sustainability.

We are seeking key stakeholders including producers, producer associations, conservation districts, non-government organizations, government and academia to share their information and insight into this very important emerging conservation strategy. The objectives of the workshop will be to achieve consensus amongst stakeholders and to select scenarios that are most relevant for analysis of their respective costs and benefits. Examples of the types of information that may be discussed include:

- Objectives for a potential EG&S program
- Land eligible for participation in the program
  - Reference will be made to current science, and provincial and municipal maps
  - Eligibility criteria
- Proposed levels of payments
- Hypothesized adoption rates of EG&S practices
- Shortcomings of the proposed scenarios

Funding for this project was provided by Manitoba Agriculture, Food and Rural Initiatives. There is no cost to you for participation or meals. The format for the session is outlined in the attached agenda.

Should you have any questions, please feel free to contact me at 519-822-3929 x 207 or by email at cher@georgemorris.org. To R.S.V.P. to this event, please fill out the attached response sheet and return it by **November 15, 2007** via email or fax (to Cher at 519-837-8721). Should you wish to suggest a participant for this important workshop, please include their name and contact information on your response form.

We sincerely hope that you will be able to join us.

Sincerely,

Cher Brethour
Senior Research Associate, Environment
George Morris Centre

Jane Sadler Richards
Principal Scientist
Cordner Science

GEORGE MORRIS CENTRE

Canada's Independent Agri-Food Think Tank

Session Content

- *Opening Presentation – Cher Brethour*
  - Review of background research and project objectives
  - Possible scenarios for Manitoba EG&S program structure
- *Brainstorming Session I – Jane Sadler Richards*
  - Objectives for a potential EG&S program
    - What are the various roles of government, private sector, non-government and society in achieving these objectives?
  - Land eligible for participation in the program
    - Review of current science behind eligible land
    - Review of GIS maps and land classification for eligible lands
    - Discussion of shortcomings of land classifications, including suggestions for modifications
- *Brainstorming Session II – Cher Brethour*
  - Eligibility criteria
    - Environmental management practices
    - Universal or targeted approach and watershed based priorities
  - Proposed levels of payments
    - Cost share requirements to encourage adoption
    - Contract lengths, funding limits, monitoring and enforcement
  - Hypothesized adoption rates of EG&S practices (low, medium and high) based on the above definitions
    - Would increases in producer extension and workshops increase uptake of EG&S practices?
  - Shortcomings of the proposed program scenarios
  - New sources of data and information and key contacts for research
- *Recap of the day/next steps and closing remarks – Cher Brethour*

Fact Sheet

- A fact sheet will be sent to participants prior to the session to provide background information on possible scenarios of an EG&S program in Manitoba.

Schedule of Events

8:00 – 8:30	Continental Breakfast
8:30 – 8:45	Introductions of Attendees
8:45 – 9:45	Opening Presentation
9:45 – 10:00	Break
10:00 - 12:00	Brainstorming Session I
12:00 – 1:00	Lunch
1:00 – 1:15	Recap of Brainstorming Session I
1:15 – 3:15	Brainstorming Session II:
3:15 – 3:30	Recap of the day and closing remarks

B.2.2 Methods

Description of the Workshop

Cher Brethour from the George Morris Centre and Jane Sadler Richards from Cordner Science facilitated the workshop (refer to Table B.4 for the schedule of events). The workshop began with Cher welcoming all the participants to the session and asking them to introduce themselves by stating their name, organization and the reason they were interested in participating in an ecological goods and services workshop.

Table B.4 Brainstorming Workshop Schedule, November 27, 2007

Schedule of Events	
8:00 – 8:30	Continental Breakfast
8:30 – 8:45	Introductions of Attendees
8:45 – 9:45	Opening Presentation
9:45 – 10:00	Break
10:00 - 12:00	Brainstorming Session I
12:00 – 1:00	Lunch
1:00 – 1:15	Recap of Brainstorming Session I
1:15 – 3:15	Brainstorming Session II
3:15 – 3:30	Recap of the day and closing remarks

After introductions, Cher began with the opening presentation[52] (refer to Figure B.1) to provide stakeholders with an understanding of the purpose, the main objectives and methods of the research, as well as background information on ecological goods and services policy options and current management practices in Manitoba. The following is an outline of the opening presentation:

- Purpose and objectives
  - Research
  - Focus Group
- Background on ecological goods and services
  - Definition
  - Various policy options
- Background on Manitoba
  - Statistics on agricultural land
  - Current environmental management
  - Landscape (GIS maps)
- Implications for developing an EG&S program
  - WTO and Green Box Payments
  - Policy questions for program development

In addition, the opening presentation outlined the structure and main goals of the breakout sessions. The following was the outline for the brainstorming sessions:

- Brainstorming Sessions I & II:
  - Objectives of an EG&S Program
  - Stakeholder roles
  - Land eligible

[52] At the participants' request, a copy of the opening presentation slides was distributed to all the workshop attendees.

- Eligibility criteria
- Preferred approach to program design
- Adoption rates
- Shortcomings

Figure B.1 Brainstorming Workshop Opening Presentation, Winnipeg Winter Club, November 27th, 2007

Brainstorming Session I

The five tables in the room were organized such that there was a cross section of various stakeholders at every table (refer to Figure B.2 below). Worksheets (refer to B.2.3) were provided to participants for each of the brainstorming sessions. A MAFRI staff acted as a scribe for each table and a specific individual was selected at each table to act as the spokesperson.

For the first brainstorming session, participants were given 40 minutes to discuss what they would like to see as objectives of a provincial EG&S program. They were also asked to identify the stakeholders and their respective roles within a provincial EG&S program. Twenty minutes was given for group discussion.

In the second part of the first brainstorming session, participants were given 40 minutes to identify eligible land and activities for a provincial EG&S program. Once again, 20 minutes was allotted to group discussion.

Brainstorming Session II

In the second brainstorming session, participants were given 60 minutes to outline their preferred approach for a provincial EG&S program. Within the preferred approach, the participants were asked to respond to the following:

- Target regions
- Payment structure
- Eligibility criteria
- Eligible practices
- Other key points for program design

Twenty minutes was given for group discussion.

In the last segment of the second brainstorming session, participants were asked to identify their estimated level of adoption given the program they described above. In addition, participants were asked to identify any expected shortcomings of their proposed program design and offer any additional information and/or data that could be of use for this research. Ten minutes was given for group discussion.

Figure B.2 Brainstorming Sessions I & II, November 27, 2007

Workshop Closing Remarks

Cher Brethour provided the closing remarks for the day by summarizing all the information that was presented during the workshop. The results of the two brainstorming sessions are presented in Section B.2.4 below and were used to develop the scenarios for program design in the cost-benefit analysis.

B.2.3 Focus Group Worksheets

Brainstorming Session I: Objectives of a Provincial EG&S Program

With the colleagues at your table, please discuss the **objectives** of a provincial EG&S program. Please add more sheets if needed.

To help 'kick start' the discussion, a few ideas related to the ALUS program are listed on the back of this page.

Objective One:

_____

_____

_____

Objective Two:

_____

_____

_____

Objective Three:

Objective Four:

Objective Five:

Other Comments:

During your discussions, you may want to:

- Think about sustainability. What environmental, social and economic objectives should be achieved?
- Think about provincial and federal policy requirements.
- Think about the list and role of potential stakeholders
- Think about existing programs that may provide ideas about objectives and stakeholder roles e.g. ALUS, EFP, National Farm Stewardship Program (NFSP)

For example, a few potential objectives are mentioned in this excerpt from *A Proposal for the Development of an Alternate Land Use Services Pilot Project in the Rural Municipality of Blanshard* August, 2004.

> ALUS, as a policy concept, is intended to deliver environmental benefits, be non-trade distorting, and should be attractive to both rural and urban Canadians. Farmers and ranchers are currently paid to deliver food and fibre from their land and the ALUS suggests that a similar mechanism be established to support the production of public environmental goods from private agricultural land. This mechanism must be "farmer friendly," supportive of rural communities, and should be delivered by agricultural agencies.

Brainstorming Session I: Stakeholder Roles in a Provincial EG&S Program

With the colleagues at your table, please discuss the **Stakeholder Roles** within a provincial EG&S program.

To help 'kick start' the discussion, a few ideas related to the ALUS program are listed on the back of this page.

Other Comments: _____

_____

_____

During your discussions, you may want to:

- Think about sustainability. What environmental, social and economic objectives should be achieved?
- Think about provincial and federal policy requirements.
- Think about the list and role of potential stakeholders
- Think about existing programs that may provide ideas about objectives and stakeholder roles e.g. ALUS, EFP, NSCP

For example, the following stakeholder list and organizational chart were provided in the document *A Proposal for the Development of an Alternate Land Use Services Pilot Project in the Rural Municipality of Blanshard* August, 2004.

PROJECT PARTNERS

ALUS meshes the goals of the conservation, rural and agricultural communities, and thus has gathered a wide range of supporting agencies.

Founders:
Keystone Agricultural Producers
Delta Waterfowl Foundation
Little Saskatchewan River Conservation District
RM of Blanshard

Potential Partners:
Manitoba Crop Insurance Corporation
Mississippi Duck Stamp Foundation
Manitoba Department of Water Stewardship
Manitoba Conservation Districts Association
Manitoba Conservation
Manitoba Agriculture, Food & Rural Initiatives
Masters and PhD students from Delta Waterfowl
Prairie Farm Rehabilitation Administration
Manitoba Habitat Heritage Corporation
Manitoba Cattle Producers Association
Manitoba Pork Council
Department of Fisheries and Oceans
Farm Stewardship Association of Manitoba
Academia (Universities or Colleges)
Nature Conservancy of Canada

Brainstorming Session I: EG&S Lands

With the colleagues at your table, please identify and provide a rationale for the types of lands and the practices that should be eligible within a provincial EG&S program. Please add more sheets if needed.

To help 'kick start' the discussion, a few ideas are listed on the back of this page.

Other Comments: _____

_____

_____

During your discussions, you may want to:

- Which land types, if any, may be best addressed through an EG&S program and which land types, if any, may be best addressed through an agricultural BMP program, and why.
- Which land types, if any, may be readily identified as eligible for an EG&S program using existing databases and programs and which land types, if any, may require additional resources to be adequately identified as eligible for an EG&S program.

For example, four land types were identified as eligible in the document *A Proposal for the Development of an Alternate Land Use Services Pilot Project in the Rural Municipality of Blanshard* August, 2004.

1. **Wetlands** refer to land areas on farms that hold semi-permanent or spring-season water. (Permanent water bodies will not be eligible under the wetland services, but will be eligible under riparian services.)

2. **Riparian areas** include lands along lake edges, watercourses, and intermittent and normally-dry drainage channels.
3. **Fragile lands** are areas on farms that have been cultivated but have major limitations due to slope or soil texture. These lands may be renovated with permanent cover and should be maintained with permanent cover.
4. **Natural areas** are areas that have not been cultivated but may have been used as pasture or woodlot.

Brainstorming Session I: EG&S Practices

Below is a list of EG&S practices; you may use these and/or identify different practices using the blank table provided on the back of this sheet. With the colleagues at your table please **rate** the practices you would like to see in an EG&S program with respect to their **cost of establishment**, **ease of implementation** and **environmental effectiveness** using the scoring system provided in the table. Finally, **rank** your top three to five practices that you would like to see receive EG&S payments the most, with 1 representing your most preferred.

EG&S Management Practice	Cost of Establishment			Ease of Establishment			Environmental Effectiveness			Ranking (1-most preferred; 5-least preferred)
Maintenance of riparian areas	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	
Maintenance of wetlands	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	
Maintenance of natural areas (native grasses, bushes, trees etc)	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	
Land taken out of annual production	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	
Carbon sequestration	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	
Establishment and preservation of wildlife habitat	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	
Maintenance of property for recreational opportunities such as birding/wildlife watching, photography, hunting, fishing or trails for hiking/cycling/snowmobile/ATV	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	
Maintenance of property for pleasant landscapes or scenic views	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	

EG&S Management Practice	Cost of Establishment			Ease of Establishment			Environmental Effectiveness			Ranking (1-most preferred; 5-least preferred)
	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	
	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	
	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	
	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	
	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	
	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	
	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	
	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	
	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	
	Low ☐	Moderate ☐	High ☐	Hard ☐	Moderate ☐	Easy ☐	Low ☐	Moderate ☐	High ☐	

Brainstorming Session II: Preferred Approach for a Provincial EG&S Program

With the colleagues at your table describe the components of a provincial EG&S program, providing specific details regarding target regions, payment structure and eligibility criteria and practices. Using the scale on the back of this sheet indicate the level of adoption of EG&S management practices (in terms of acres) that you estimate would occur if the program you described was implemented for the province.

Target Regions:

Payment Structure:

Eligible Criteria:

Eligible Practices:

Other:

In terms of acres, what percentage of uptake would you estimate across the province if the program was designed and implemented as you described?

Level of uptake (acres)

- ☐ Less than 10%
- ☐ 10-20%
- ☐ 20-30%
- ☐ 30-40%
- ☐ 40-50%
- ☐ 50-60%
- ☐ 60-70%
- ☐ 70-80%
- ☐ 80-90%
- ☐ 90-100%

To give some perspective to the percentage you have given, do you consider this level of uptake to be low, moderate or high?

Relative level of uptake

- ☐ Low
- ☐ Moderate
- ☐ High

Things to keep in mind with respect to Green Box Payments when considering an EG&S program:

- Clearly defined publicly funded government program
  - Cannot involve transfers from consumers
- No price support to producers
- Not linked to production
- Payments limited to extra costs or loss of income involved in complying with program
- Land retirement must be for a minimum of three years
  - Once retired, land cannot be used for alternative agricultural production

B.2.4 Focus Group Results in General

The following sections highlight the results obtained from the focus group workshop. The key insights from the focus group discussion are presented in the following format which corresponds with the focus group brainstorming session discussion:

- Objectives of an EG&S Program
- Stakeholder roles
- Eligible lands
- Eligible practices
- Preferred program approach
- Adoption rates
- Shortcomings
- Summary of focus group discussion

A detailed summary of results by group is presented in the following section (B.2.5).

Program Objectives/Criteria for Consideration in Program Design

The following is a high level summary of what the participants identified as objectives for a provincial EG&S program. Note that some of the information presented in the next paragraph is not necessarily an objective of a program, but rather an intended result or a specific design consideration for a program.

Objectives/criteria for consideration of a provincial EG&S program:

- Program should have sustainable long term funding
- Program should have an education and communication component
- Program should be adaptive and flexible
- Program should be measurable, accountable and multi-functional
- Program should be compatible with rural culture
- Program should have public support
- Program should achieve healthy functioning watersheds
- Program should achieve sustainable agriculture
    - Land owner acceptability
    - Program should impact land owner decision making and behaviour

The following paragraphs are additional points that were made with respect to the list identified above.

Most groups (all but group 2) expressed the need to ensure measurability of outcomes and benefits from the designed EG&S program and the importance of achieving environmental benefits (i.e. improved water quality, biodiversity) through the program. Two groups mentioned that the environmental benefit objective should be in line with climate change considerations. A holistic approach, i.e., an approach that considers the whole farm and all its multifunctional components and flexibility in implementing a mix of long and short term environmental management were recommended by groups 1 and group 5.

Economic viability of the producers and landowners was highlighted as a key issue by two groups (group 1 and group 5) in the program design. For example, group 1 mentioned that 'farmers need to make money'. In addition, group 4 mentioned that economic viability of both the providers and users of the EG&S need to be considered.

Crucial administrative issues such as processing simplicity (i.e. minimal paperwork), implementation efficiency and results monitoring were highlighted by two groups (group 1 and group 4). For example, group 4 mentioned that the program should be simple to deliver, use and understand. Orientation of the program to accommodate regional emphasis was also expressed by group 4.

Stakeholder Roles

This segment of the brainstorming workshop discussed stakeholder roles for a provincial EG&S program. Specifically, the section helped to validate the stakeholders that were identified (refer to brainstorming worksheets in Appendix B.2.2) as having a role to play in a provincial EG&S program. It also became clear that the magnitude of the stakeholder's role is dependent on the specific stakeholder.

The major roles identified by the five groups included: funding, planning, execution, promotion and communication, appraisal (research investigation) and policy development. The most common stakeholders identified among the groups included: government (federal, provincial and municipal), producer groups (except group 3), non-governmental organizations (except group 4) and academic institutions (except groups 1, 4, and 5).

The role of funding was mainly associated with all levels of government. Other funding stakeholders identified in the discussion were NGOs, the general public and in-kind contributions by producers. Program planning/development and other administrative responsibilities were allotted to federal and provincial levels of government and local program delivery was allotted to municipal governments. The participants also identified producer groups and provincial extension groups as having roles in the delivery and execution of the program (i.e., working with landowners to implement program tools).

According to the focus group participants, promotion and communication of the program should be a role undertaken by government, NGOs (identified as important in communication of benefits and outcomes of the program) and commodity groups (identified as important for producer buy-in to program participation). One group stated that all stakeholders should be involved in program communication, including media, government, NGOs, producer groups and the urban public.

The focus group participants designated the program appraisal/research role to government, academia (i.e. universities) and NGOs such as Delta Waterfowl and the George Morris Centre. Finally, the role of policy development was given to the government, whereas political support in policy development (i.e. "nurturing political will") was allotted to producer groups. The aspect of program participation incentives was identified as one important focus of policy development.

Eligible Land Type

The common land-use types identified by the different groups included: riparian areas, fragile lands, marginal lands, upland natural areas and wetlands. These land types, which were designated as eligible for an EG&S program, are presented in Table B.5.

Table B.5 Eligible Land Types as Identified by the Focus Groups

Land Types	Group
Riparian areas, fragile lands, marginal lands, natural lands, wetlands	Group 1
All non broken lands	Group 2
Riparian areas, fragile lands, natural areas, wetlands	Group 3
Riparian areas, natural lands, wetlands	Group 4
Riparian areas/stream areas, wetlands, natural grasslands, natural buffers, native uplands	Group 5

One important point that came out of the land eligibility discussion was that many of the groups felt that the eligibility of land depended on a number of factors. It was identified that a regional perspective or perhaps a watershed based approach would be optimal.

Two key discussion points pertaining to eligible land-use types included the incorporation of individual farm's uniqueness and the often-mentioned overlap between BMPs and EG&S. Group 1 considered utilization of projects associated with BMPs in identifying the eligible land use types. Group 5, however, pointed out that the key differences between BMPs and EG&S need to be highlighted.

One reason given by several groups for why they chose certain land types for program eligibility is that the improvement of these land types represents the "biggest bang for your buck" or the "low hanging fruit."

Eligible Practices

Focus group participants were asked to rank different EG&S practices according to cost of establishment, ease of implementation and environmental effectiveness in order to gauge which practices should be eligible under an EG&S program. Low cost, high ease of implementation and high environmental effectiveness of a practice would reflect the preferred choice in terms of program eligibility.

Unfortunately, participants indicated that ranking practices was difficult because their answers were highly dependent on the situation. As such, the focus group discussion on eligible practices likely does not provide key information about program design. However, one point to make is that participants predominantly categorized riparian areas as having low maintenance cost and high environmental effectiveness.

We captured more valid responses on preferred eligible practices of an EG&S program in the discussion on preferred approach to program design discussed below.

Preferred Approach to Program Design

In order to gauge focus group participants' preferred approach to program design, participants were asked to discuss preferred target regions, payment structure, eligibility criteria and eligible

practices of the program. The considerations identified by participants in choosing preferred target regions were as follows:

- Regions that provide potential for most environmental improvement or benefit ("most bang for buck")
- Environmentally critical regions
- Watershed based regions – source water protection as highest priority
- ALUS lands as guideline (ALUS appears to have exhaustive list)

The points made regarding preferred payment structure included:

- There should be no payment for economically beneficial practices (i.e. rotational grazing)
- Payment should be based on opportunity costs (plus incentives for key areas)
- Payments should be based on land rental rate
- Payments should be based on market value (i.e. bid offer systems)
- Transparency is key in payment structure
- One time payments are not preferable
- Annual payments have high administrative costs
- Contracts should be long-term to ensure long-term provision of EG&S (but payments should be made annually)
- Length of contracts should be 10 years (or bundles of three contracts of three years each or five contracts for two years each etc.)
- There should be a sliding scale and premiums for longer contacts.
- Payment should be provided based on outcome (i.e., according to environmental benefit provided) and should depend on value of land and the type of practices implemented
- Payment should be made after service is provided

In terms of preferred eligibility criteria for an EG&S program, participants' responses varied. One group of participants stated that wetlands, riparian areas, woodlots and sensitive lands should all be eligible for the program. Another group identified those lands that provide a measurable environmental benefit to be suitable for high eligibility and stated that the program design should include an assessment for eligibility based on a pre-existing environmental farm plan or larger watershed plans. Another idea for determining eligibility was an environmental score based on an index combining environmental benefits and bundling of practices. Participants also stated that eligibility should be based on a multifunctionality approach to landownership with a focus on landowners and not necessarily agricultural producers. Finally, there was discussion regarding whether landowners should be rewarded for past environmental stewardship. Participants stated that maintenance of current EG&S should be compensated, noting that the restoration of a wetland represented a BMP, whereas the maintenance of that wetland constituted an EG&S and, as such, should be eligible for program funding.

Participants identified the following practices as those that should be eligible under a preferred EG&S program design:

- Ongoing practices that constitute environmental stewardship (paid on an ongoing basis)
- Practices that have measurable outcomes (i.e. the restoration and maintenance of a marsh)
- Carbon sequestration
- Wetland retention (long-term minimum) and retention ponds
- "Natural" practices
- Run-off management

- Practices focused on retention not restoration (i.e., focus on maintaining environmental benefits that already exist).

Adoption Rates

There were few estimates by participants on percentage of uptake across the province if a preferred EG&S program was designed and implemented. One group of participants indicated a 60 to 70 percent adoption rate (in terms of total eligible acres) and an uptake of 10 to 20 percent of total agricultural acres. Another group estimated a level of uptake in the range of 20 to 40 percent of provincial acres, depending on the location and the eligible land and practices under the program. These groups identified their estimated levels of uptake as relatively high. Finally, another group's estimated uptake ranged from 30 to 70 percent of provincial acres.

Shortcomings

The following potential shortcomings of an EG&S program were identified by focus group participants:

- Uncertainty about level of funding
- Perception of landowners
- Public perception/public relations
- Uncertainty in terms of program design based on sound science and market realities (science not there for decision-making)
- Difficulties in choosing target regions
- Administrative costs
- Competition among neighbours with bidding process
- Design impacted by budget

Summary of the Focus Group Workshop

- Summary of Objectives/Criteria for Consideration for Program Design:
    - Program should have sustainable long term funding
    - Program should have an education and communication component
    - Program should be adaptive and flexible
    - Program should be measurable, accountable and multi-functional
    - Program should be compatible with rural culture
    - Program should have public support
    - Program should achieve healthy functioning watersheds
    - Program should achieve sustainable agriculture
        - Land owner acceptability
        - Program should impact land owner decision making and behaviour
- Stakeholders:
    - Confirmation that every stakeholder has a role
    - Magnitude of role depends on stakeholder
- Eligible Lands:
    - Riparian
    - Wetlands
    - Upland Natural Areas
    - Fragile Lands
        - But within these categories it "depends"
            - Regional perspective or perhaps a watershed based approach

    - Lands should be targeted based on largest potential environmental benefit from program participation ("low hanging fruit"; "biggest bang for your buck")
- Eligible Practices
    - All practices that maintain, rehabilitate and enhance the environment (and, hence, EG&S) should be eligible
    - ALUS appears to be encompassing (wetlands, riparian areas, upland natural areas and fragile lands)
- Targeted regions
    - Provincial program that has a targeted approach based on regional issues
- Payment structure
    - Opportunity cost + incentives for key areas
    - Bidding system
    - Multifunctional market based program
    - Annual long term payments
    - Based on environmental outcomes
        - Benefit indexing
    - Premiums for longer term contracts
- Eligibility criteria
    - Voluntary
    - Land owners
    - 3-10 year contracts
    - Historical stewardship eligible
        - If focused on maintenance and on-going delivery of environmental benefit
- Estimated Adoption
    - 30-70%, with caveats
    - High uptake
- A number of short comings and risks will need to be taken into account:
    - Uncertainty about level of funding
    - Perception of landowners
    - Public perception/public relations
    - Uncertainty in terms of program design based on sound science and market realities (science not there for decision-making)
    - Difficulties in choosing target regions
    - Administrative costs
    - Competition among neighbours with bidding process
    - Design impacted by budget

B.2.5 Focus Group Results by Group

Focus Group Responses - Program Objectives/Criteria for Consideration in Program Design, Stakeholder Roles, Identification and Rationale for Eligibility of Land Types and Practices and Recommended Measurement Tools

GROUP 1 (Christopher Minaker)	GROUP 2 (James Hood)	GROUP 3 (Esther Salvano)	GROUP 4 (Erica Vido)	GROUP 5 (Tony Szumigalski)
Program Objectives/Criteria for Consideration for Program Design				
• Program should involve no additional/minimal paperwork • Program should complement other programs and there should be no competing objectives (i.e., between BRM and ALUS) • Program should strike a balance between long-term sequestration of land and shifting economic realities (i.e., bad year for livestock=using land for pasture) • Program outcomes should be measurable and accountable so that government can report back to taxpayers(i.e., measurable environmental benefit with the taxpayer and incremental change in status quo by dollars) • Program should be "farmer flexible" – mix of flexible and fixed long-term components (i.e., rotation of crop lands, but fixture of wetlands) • Program should recognize agronomic realities – farmers need to make money • Program should shift notion of responsibility on the part of the producer – from "producer" to "landscape manager" • Program should have clear environmental objectives and be balanced with adaptive	• Landowner acceptability: program must contribute to quality of life • Educational support must be part of the program • "Change agent" (i.e., ensures that change happens) • Program must address flexibility issues (balance between administration and producer requirements) • Program must be consistent with climate change issues, buffering risk and adapting to shock • Program should focus on water quality and quantity (especially as these pertain to climate change effects on Lake Winnipeg) • Program should include a consistent	Environmental outcomes of the program should be: • Healthy functioning of watersheds; focus on biodiversity, habitat (overarching goal) • Improvement and sustainability of water quality and quantity • Sustainability of agricultural landscape (focus on rural community and producers) • Adaptation to and mitigation of climate change – landscape resilience to weather extremes Program design should consider: • Sustainable and long-term funding • Reconnection of urban and rural linkages • "Education-Communication Participation-Implication-	• Program incentives must affect decision making and behavior • Program should result in measurable environmental outcomes/benefits • Program should be economically viable for both providers and users of goods/services • Program must be flexible to respond to regional vagaries, region specific characteristics and individual farm needs/ issues • Program must be simple to deliver, use and understand • Program must be compatible with rural culture	• Program goal should be to sustain and enhance existing natural capital in agro-Manitoba • Program design should focus on economically sustainable/feasible agriculture and rural economies (i.e., provide more incentives for EG&S provision rather than use the regulatory approach and be relevant within markets and economic realities) • Flexibility within the program is key • Proper valuation of services must be used in program design (i.e., identification of value of benefit such as clean water • Program should pay for outcomes, not necessarily change • Program requires public support behind EG&S • Program should incorporate connection between EG&S and public demand for services • Program implementation requires public support, sufficient funding and commitment • Program should be multifunctional; it should consider whole suite of public goods

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management – recognize work already done • Program design should consider the "whole farm" as the primary unit of analysis – holistic approach • Primary objectives and classifications for land types (i.e., what benefits can be captured for what land types) should be established in program design	message from government – clear non-oscillating stand from the government in terms of program objectives and criteria	Stewardship" • Transparent transaction between supply and demand of the good/service: what we are getting/providing and at what cost/benefit		(e.g., water, biodiversity, carbon sequestration • Program design should consider efficiency, transparency, accountability and clarity (i.e. efficient process participation process, application timelines)
Stakeholder Roles				
• Government: local, provincial, federal • Society/Urbanites (environment recreation) • Consumers • Producers (Recognition for work already done) • Community Impacts – Those in the environmental zone • NGOs (expertise, interlocutors, fundraisers)	• Media (communication) • Three levels of government: i.e. MASC (funding, communication, policy and science, delivery) • NGOs (communication, funding) • Conservation Districts (delivery) • Academia – including international (policy and science) • Research industry: IISD (International Institute of Sustainable Development, Winnipeg), Delta, George Morris, DVC (maybe Diablo Valley College, California) (policy and science) • Producer groups (communication, delivery)	• Federal, provincial and municipal governments – different departments: conservation, water stewardship, agriculture, infrastructure, health (funding, programming, managing, planning, investigation, promotion, extension) • NGO: conservation, agricultural (funding, managing, education, promotion) • Universities (investigation, research) • Society • First Nations	• Land use decision makers, i.e., agents/landowners) (make land-use decisions, i.e., whether to participate in programs) • Government (program and related policy development, education, research, provision of incentives or regulations) • Farm groups (organized delivery of information both up, i.e. to governments, and down, i.e. to producers, extension, collaboration with farmers/farms, dealing with politicians – nurturing political will) • Private conservation groups (communication of benefits/ outcomes, provision of support, some	• Federal government: AAFC, EC, NRCAN, DFO, Parks Canada (provision of funding, research, information) – the federal government represents the public • Provincial government: MAFRI, Water Stewardship, MHHC, MCDA, MASC (provision of funding, policy development role and administration) • ENGOs: conservation organizations, e.g., DU, Delta, individual conservation districts (building environmental capacity, funding but limited to mainly projects) • Commodity groups: KAP etc. (provide link to farmer) – important for producer buy-in • Farmers, landowners, communities (provision of EG&S) • Municipal government/conservation districts (local delivery through hands-on frontline capacity with farmers; interface with landowners)

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	• Producers (in-kind contributions) • General public (communication)		financial support)	
Identification and Rationale for Eligibility of Land Types and Practices				
Under assumed program objectives of encouraging / maintaining: clean water, GHG reduction, bio-diversity, soil quality and soil erosion reduction: • Riparian Areas: sloughs, marshlands, wetlands • Fragile Lands: BMP programs cover securing grasslands so EG&S program should cover maintenance of grasslands • Marginal Land: planting trees, grasslands • Natural Areas • Wetlands Suggestion for program design: • BMP programs pay for setting up the lands and then EG&S program pays for maintenance Comments: • There is no 'cookie-cutter' approach that is feasible because of the approval process and paperwork. Each farm is different and requires a different management practice • *The land types mentioned above are "low hanging fruit," i.e., the best "bang for the buck" lands	• "All non broken lands"	• Wetlands • Riparian Areas • Natural Areas • Fragile Lands • Consider implementation of BMPs on better quality land (i.e., class 2) • Put to forage crops by rotation	• Wetlands • Riparian Areas • Natural Lands: choose cheapest lands, i.e., can't afford to restore primary agricultural lands to natural • Determine eligibility by soil types • Need better data to determine which lands would qualify • Local partners should determine which areas/ lands to place under programs	• Wetlands: restoration and/or maintenance • Streams/Riparian Areas: maintenance and enhancement (but wintering site, watering and manure management are BMPs) • Native Uplands Management: rotational grazing, woodlot management • Perennial Forage Lands: for annually cropped lands • Buffer Stripping/Natural Buffers: EGS + BMP, either natural vs. man-made buffers • Natural Cover Land / Perennial Cover on Sensitive Lands: better for BMPs (cover types = grassland or trees) Comments: • Eligibility depends on which of these have the biggest "bang for the buck" • Hard to distinguish between EG&S and BMPs; there is a big overlap
Recommended Measurement Tools				
Comments on modeling: • PEI model for valuation of environmental assets –Prince Edward Island Model Forest Network Partnership (PEIMFNP)	Comments on payments: • Graduated payment–as changes occur receive	Comments on payments: • Bid system – reverse auction (i.e., the agency	Comments on payments: • Long-term • Auction/offset credit	

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• PEIMFNP is a Model Forest Network project operating as an extension to the Nova Forest Alliance • Environmental sensitive index system Comments on payments: • No one-time payment; continuous payment based on benefits • Must depend on targeted outcome • Should depend on area and type of operation • Price discovery – what are landowners willing to accept? • Differential payments based on land structure	ongoing payments • Reward for environmental quality • Accountability of the program through proper information on uptake and measurable outcome • Payment should be just high enough to encourage adoption (i.e., enough to compensate for expense and opportunity cost) • No auction • Long-term payments tied to environmental quality • Premium for longer contacts	accepts offer for services up to an uptake ceiling goal (based on outcome or area)	• Tradable permits • Others • Price discovery through bid/offer	

APPENDIX C: OTHER PAYMENT SCENARIOS NOT USED IN THIS ANALYSIS

This section presents two other options for the determination of program payment levels based on the US Conservation Reserve Program. However, it is important to note that these options were not used in the cost-benefit analysis for this research. They are discussed here as further alternatives for a program payment framework that could be applied by MAFRI if an EG&S program were implemented in Manitoba.

The two options discussed below do not lend themselves to the modelling framework of this project due to the many site specific data requirements for the calculation of the payment levels. Furthermore, due to the proposed auction systems involved in both options, it is impossible to predict the true levels of these payments to quantify maximum costs of the program to government and other funding partners. However, the options demonstrate possible payment frameworks that could be adopted by MAFRI if the program were implemented, since site specific data would then be accessible through program participants.

Option 1: Conservation Reserve Program (CRP) Payments

The first option for payment level determination mirrors the current CRP approach to determining payment levels. Under the CRP, annual per acre payment levels are determined with a combination of a pre-set maximum annual rental payment and a bidding process by program participants. The maximum payment is quantified using the county average cropland rental rates adjusted for soil specific productivity levels. The CRP maintains maps of soil productivity for over 300,000 soil map units (covering all cropland soils in the United States). Specific soil productivity levels are based on an index of soil characteristics. A potential program participant can consult with CRP administrators to determine the regional rental rates and soil productivity of their acres. If their acres are considered, for example, at 25% above average productivity, their maximum program payment would be 25% above the average rental rate for the region. They can then choose to bid below the maximum payment level to increase their eligibility for program funding (eligibility is determined by the EBI, which includes a cost factor, i.e., the bidding price) (Barbarika, personal communication, 2008; University of Georgia, 2005).

As stated previously, this approach, although viable in program delivery as demonstrated by its application in the CRP, is difficult to apply as a cost scenario in the cost-benefit analysis. The difficulty lies in the variability of the payment level due to the site specific and bidding components. However, since this approach appears to be founded on reflecting the opportunity cost of producers of enrolling in the CRP, it is similar to the opportunity cost scenario that is used in the modelling component of this research.

Option 2: Payments Based on the Environmental Benefits Index

The second option for payment level determination within the proposed program is also based on the CRP framework. However, this option is not currently used within CRP. Rather, this option is a theoretical proposal for a payment level determination framework based on the CRP Environmental Benefits Index (EBI)[53].

[53] Note that the the CRP EBI is currently only used to determine eligibility for program funding and not used for payment level determination.

This option would, in theory, offer payments reflective of the environmental benefits provided by the acres enrolled in the program. In other words, the payments would represent the social benefit of the land, rather than the opportunity cost to the landowners.

In the US Conservation Reserve Program (CRP), the EBI factors are based on the relative environmental benefits, i.e., ecological goods and services of the land, in order to determine where funding should be allocated within the program. The EBI rankings are unique for each piece of land offered to CRP. Thus, each offer is assigned a point score based on its relative environmental factors and then competes with all other offers. Offer acceptability is then determined based on the ranking results. Six EBI factors (USDA, 2006) with the following point allocations[54] are considered under the program:

- Wildlife habitat benefits resulting from covers on contract acreage
  - Point score ranging from 0 to 100 points
  - Sub-factors:
    - Wildlife habitat cover benefits (0 to 50 points)
    - Wildlife enhancement (0, 5, or 20 points)
    - Wildlife priority zones (0 or 30 points)
- Water quality benefits from reduced erosion, runoff, and leaching
  - Point score ranging from 0 to 100 points
  - Sub-factors:
    - Location (0 to 30 points)
    - Groundwater quality (0 to 25 points)
    - Surface water quality (0 to 45 points)
- On-farm benefits from reduced erosion
  - Point score ranging from 0 to 100 points
- Benefits that will likely endure beyond the contract period (tree planting or rare and declining habitat restoration)
  - Point score ranging from 0 to 50 points
- Air quality benefits from reduced wind erosion
  - Point score ranging from 0 to 45 points
  - Sub-factors:
    - Wind erosion impacts (0 to 25 points)
    - Wind erosion soils list (0 to 5 points)
    - Air quality zones (0 to 5 points)
    - Carbon sequestration (3 to 10 points)
- Cost
  - The cost factors used in the CRP EBI are not relevant to this analysis.

This option would apply the EBI scoring system to develop a payment level determination scheme reflective of environmental benefits of the land enrolled in the Manitoba program. The EBI score and Manitoba land rental rates of proposed enrolled land would be used in combination to determine payments. The EBI score would represent the adjustment in the land rental rate applicable to the land based on the environmental services that it provides (similarly to the soil productivity adjustment made in CRP option 1). This approach to payment determination is described below. A graphical representation of this process is shown in Figure C.1.

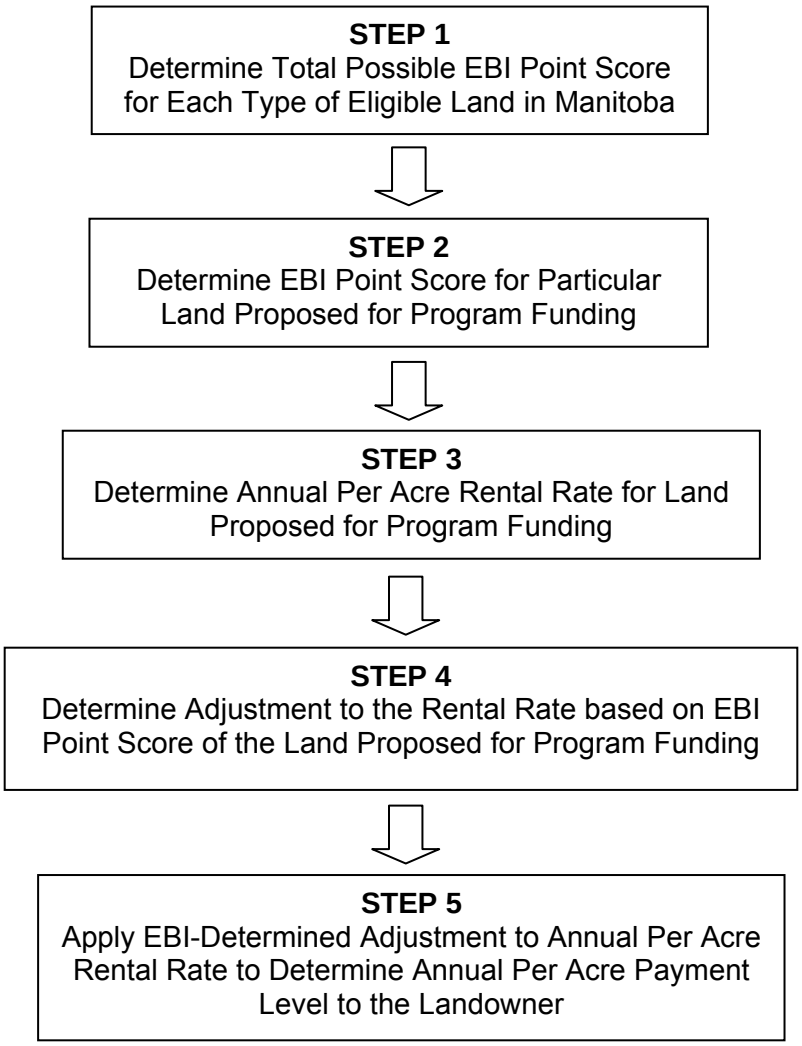
[54] A complete listing of the point scoring system is provided in the USDA Environmental Benefits Fact Sheet (USDA, 2006).

- Step 1: Using the index outlined above, the four categories of land identified for Manitoba (i.e., riparian areas, wetlands, natural uplands and ecologically sensitive lands) would be allocated a maximum point score, considering the ecological goods and services applicable to the type of land. The total points allocated to the eligible land represent the potential benefits of the ecological goods and services from that land type, based on the points system developed for the CRP EBI program.
- Step 2: Next, the typical CRP eligibility process could be followed for each producer wishing to participate in the program (i.e., using the environmental factors in the EBI), the landowner would identify which of these factors would be applicable to the land they wish to enrol. The points allocated to each factor would then be summed to determine the total EBI score for the proposed enrolled acres.
- Step 3: Manitoba rental rates would be determined for the land proposed for enrolment. Rental rates could be regional averages (as in the CRP payment level determination approach).
- Step 4: The next step would be to determine the level of adjustment to the rental rate based on the EBI score of the land proposed for enrolment. There are several alternatives for this step:
    - Alternative 1: The EBI score could be divided by the total possible point score for each type of land (as determined in step 1). The resulting number represents the percentage of maximum potential ecological good or service benefits derived from that particular type of land. This percent could be added to the rental rate as the payment level adjustment (e.g., a 60% score for the particular land would demand a 60% increase to the rental rate per acre of enrolment).
    - Alternative 2: Instead of dividing the EBI score by the total possible score for the type of land, a baseline could be used to determine the rental rent adjustment. For example:
        - A baseline of zero could be used. In this case, any EBI score allocated to a particular landowner would represent an increase over the baseline, and, therefore, an upwards adjustment to the rental rate.
        - A baseline of the total possible point score for the type of land could be used, in which case all EBI scores would represent a downward adjustment to the rental rate.
        - The total possible EBI point score could be divided by two, resulting in a mid-point baseline for an EBI score. The landowner's EBI score could then be used to determine the percent change in environmental benefits provided relative to the midpoint (i.e., % change = (midpoint score – landowner score) / landowner score). This percent change could then be used as an upward adjustment to the rental rate (as with Alternative 1).
- Step 5: The level of adjustment, as determined by one of the alternatives, would then be applied to regional Manitoba rental rates to determine the per acre annual payment level for the particular land proposed for enrolment.

Note that, if this process was used along with the typical application of the EBI under CRP (i.e., highest point scores determine highest eligibility for funding), the land that demanded the highest payment levels would always be chosen over lower payment level lands. This is simply because the level of social environmental benefit for the land is used to determine both the most eligible land and the payment levels. As such, the land with the highest social environmental benefits would also demand the highest payment for those social benefits (*because* it supplies the highest environmental benefits).

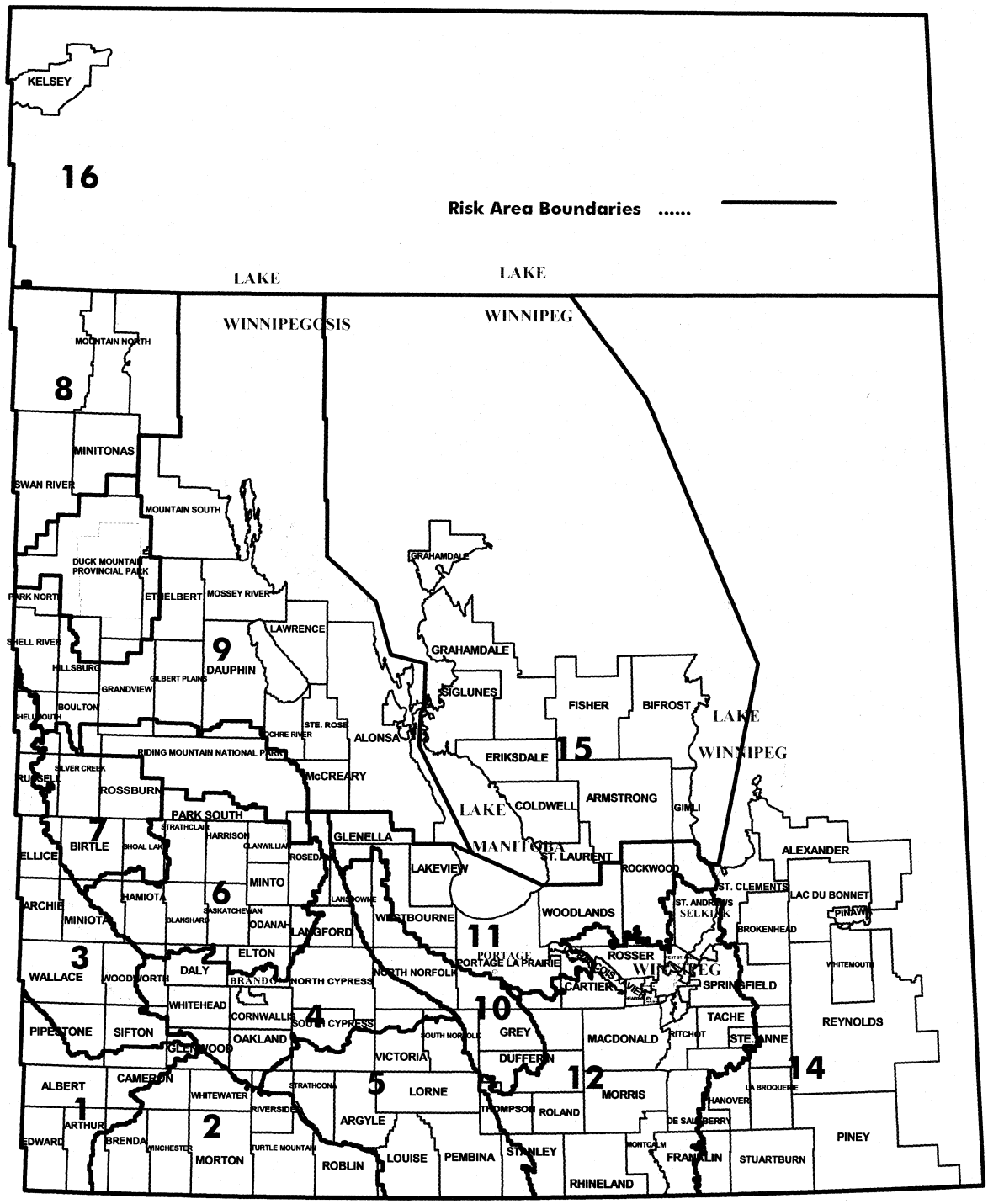
The repercussion of this option, therefore, is that program costs to the government and other funding partners would be very high. However, this approach could be made more feasible if an auction component, similar to that discussed in CRP option 1, was introduced as well. This way, the opportunity cost of producers would also come into play in payment level decisions and the final payment levels, and program costs would likely result somewhere between opportunity costs and environmental benefit values.

Figure C.1 EBI-Based Determination of Payment Levels for a Manitoba EG&S Program

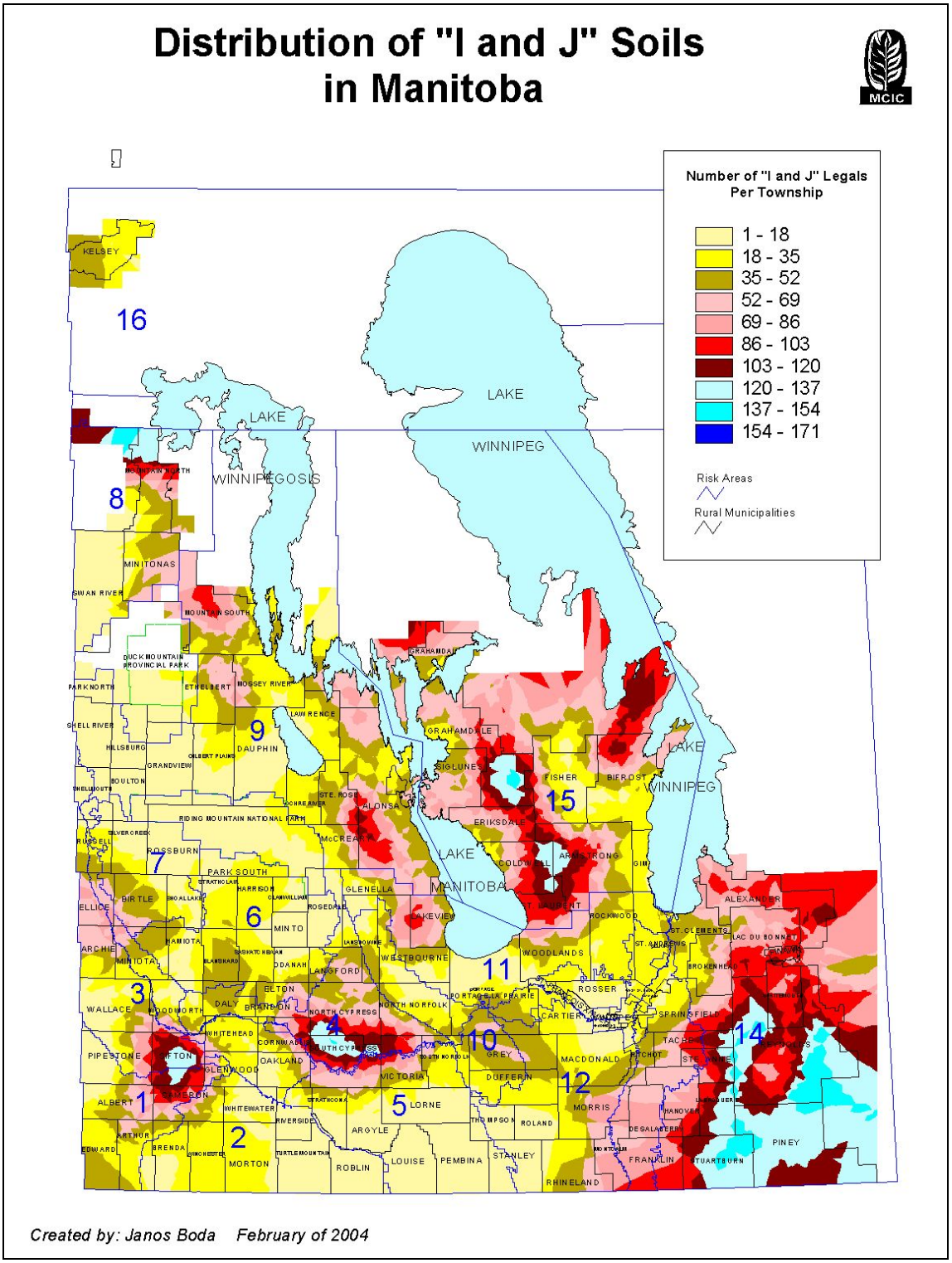


APPENDIX D: CROP INSURANCE INFORMATION

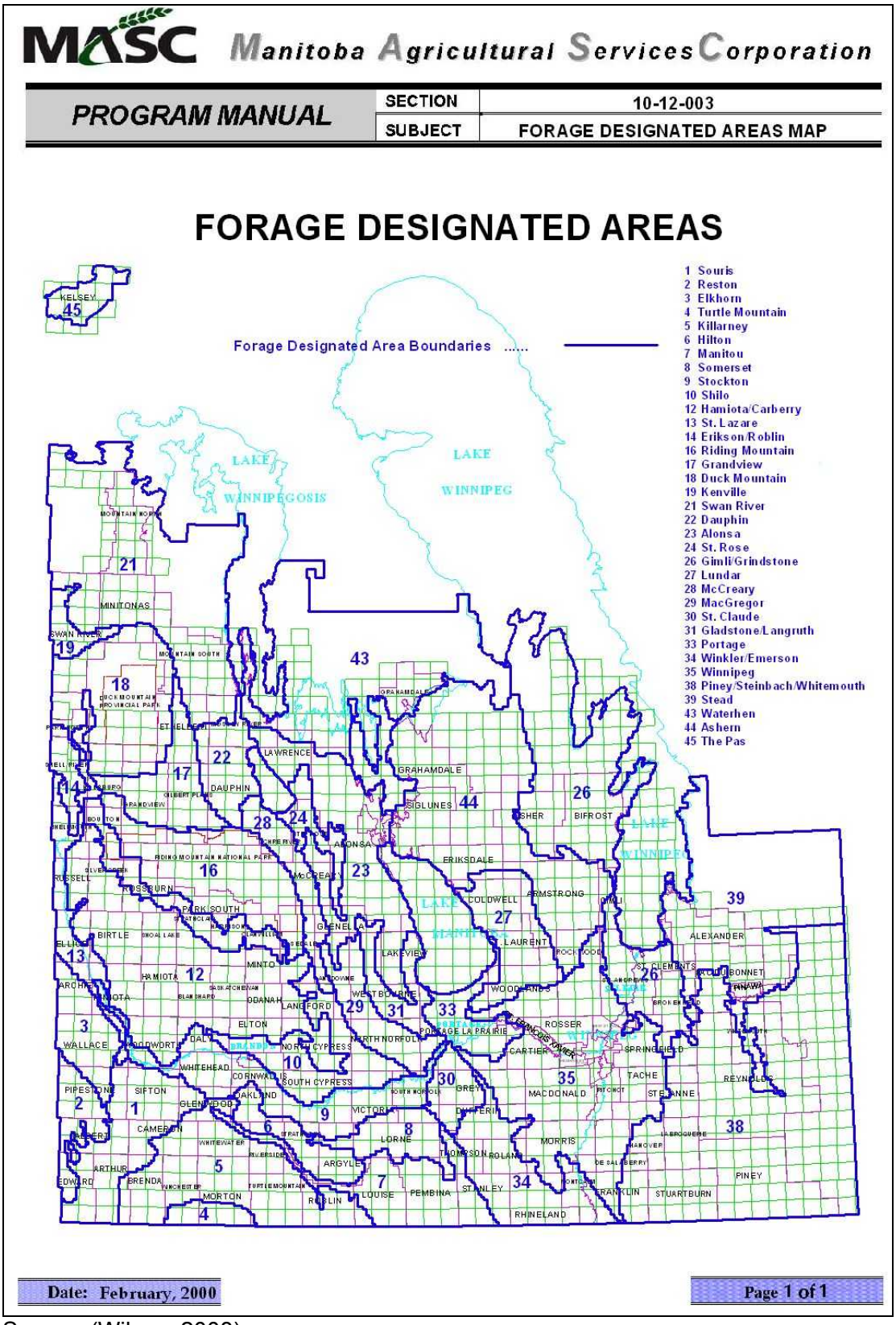
RISK AREAS



Source: (Wilcox, 2008)



Source: (Wilcox, 2008)



Source: (Wilcox, 2008)