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Environmental and Economic Impact Assessments of Environmental Regulations for the Agriculture Sector

A Case Study of Potato Farming

Canada

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For

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Environmental and Economic Impact Assessments of Environmental Regulations for the Agriculture Sector: A Case Study of Potato Farming

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Foreword

Emerging low cost competitors, such as, Brazil and Argentina, and high rates of farm subsidization in the United States and Europe are putting pressures on market prices. With the increased challenges to farm income, all factors that could affect a farm's cost structure and profitability are coming under increased scrutiny. In discussions with farm organizations and farm leaders, the impact of regulations on farm costs is an expressed area of concern with reference to competitiveness.

There is a growing concern about the impact that regulations, and specifically those regulations targeted at environmental issues, have on the competitiveness of primary agriculture. With this background, the need to carry out a thorough assessment of the role and impact of agri-environmental regulations was identified in the environmental pillar of the Agricultural Policy Framework (APF).

Empirical analysis is required to better understand the impacts of agri-environmental regulations on a farm's cost structure, and to compare differences between provinces within Canada. With this purpose in mind, Agriculture and Agri-Food Canada (AAFC) has commissioned a series of studies to increase the policy makers' and industry's understanding of the impact and role of environmental regulations in the farming sector.

A report titled "Inventory and Methodology for Assessing the Impacts of Environmental Regulations in the Agricultural Sector" which outlines the methodology for carrying out an impact assessment was released in March 2006 (available on AAFC On-Line, at www.agr.gc.ca/pol/index_e.php?s1=pub&s2=inven&page=intro). A comprehensive inventory of agri-environmental regulations was also compiled. Employing this methodology, case studies on potato and hog farming have been completed. The objective of these assessments was to estimate the impact of agri-environmental regulations imposed by all three levels of governments (Federal, Provincial and Municipal) on the cost structure and competitiveness of farms. The environmental impacts of these regulations were estimated qualitatively based on available information.

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Executive summary

This study presents an environmental and economic impact assessment of the environmental regulations affecting potato farmers in Canada. Farm level private costs and benefits are quantified, and an aggregate picture of their impacts regionally is assessed within Canada. Social costs and benefits are addressed qualitatively in this study.

Selected case studies were developed for the major potato producing provinces that collectively represent 94% of the potato production in Canada. These six provinces are, from west to east: Alberta, Manitoba, Ontario, Quebec, New Brunswick and Prince Edward Island. The focus of the study developed a consistent framework in the case studies against which to assess direct economic costs of the environmental regulations. Financial statements of revenue and costs were developed from available public data and are presented in a common platform that provides ease of comparative analysis across the provinces. The full set of environmental regulations affecting potato producers has been developed for each of the provinces. Their impact on potato farmers and the environment have been considered in detail through consultations with environmental and agricultural experts and literature review at the provincial and national and international level. The results of these findings have been aggregated and, as a cost, proportionately applied to the remaining 6% of production in Canada to represent the total cost for potato farmers for all of Canada.

Potential for negative environmental impacts relating to potatoes are similar to that of other crops in Canada. Additionally potatoes tend to leave the soil exposed, post harvest, and because it is a higher valued crop than many other small grains and forages, is subject to more intense production management which can mean more applications of chemicals to the crop. Finally, in Alberta and Manitoba, extensive irrigation causes substantial interaction with natural waterways and habitats, and the proximity of P.E.I. and New Brunswick's production to major water ecosystems creates additional concern for these environments. These concerns are more specifically: water pollution as a result of erosion, pesticide or fertilizer contamination; watershed damage as a result of improper irrigation infrastructure; watershed and habitat damage as a result of pesticide or fertilizer contamination; and soil condition damage from compacted soils, loss of soil organic matter and loss of tilth as a result of shorter rotations.

This study estimates that environmental regulations cost potato farmers in Canada $4,839,072 annually. However, 68% of that total cost comes from potato farmers in P.E.I. ($3,277,738). Cost to potato farmers in the balance of the country is insignificant relative to the total costs of producing potatoes for those farmers. In most cases (aside from P.E.I.) environmental regulations

would be less than .7% of total annual production costs. Even in P.E.I., the cost of environmental regulations is approximately 1.3% of total production costs and is not considered a significant factor to the production of potatoes in that province. There is a wide variety of production systems across the case studies, each requiring substantially different infrastructure and capital costs. Production in Alberta and Manitoba is mostly irrigated while most production in the other provinces is not. The major cost related to environmental regulations is where there is a requirement to maintain buffer zones around sensitive areas such as waterways and maintenance of highly erodable soils (vegetative buffers in P.E.I.). This creates a significant variability of the annual cost of environmental regulations compared to the annual capital costs of potato farming in each of the provinces. In Alberta and Manitoba where capital costs are very high to support the irrigation infrastructure, environmental regulatory cost is estimated at 1.4% and .56% of annual capital costs respectively. In Quebec and P.E.I. where buffer zone legislation exists and potatoes are predominantly grown without irrigation, annual environmental costs are estimated at 4.19% and 12.68% of annual capital costs respectively.

Given the insignificance of the cost of the major environmental regulation it is apparent that indirect costs associated with environmental regulations affecting potato producers are relatively insignificant. Some of these costs would be: environmental costs related to on farm fuel storage; compliance with endangered species legislation; and licensing costs born by professional pesticide applicators. When broken down to the annual costs associated with potato production they do not represent a materially measurable cost.

The environmental impact of environmental regulations is not clearly discernable. Compliance with existing regulations is thought to be very high, however there is no empirical data to support this other than anecdotal interviews with regulators and industry experts. Although, not specific to potatoes, the findings of the 6th Edition of the Fraser Institute's report analyzing environmental indicators in Canada, and AAFC's 2005, Environmental Sustainability of Canadian Agriculture Agro-Environmental Indicator Report Series #2 find improvement in many areas. There is still need for improvement in relation to issues associated with nitrogen use and residue and farming affects on biodiversity. Furthermore, environmental awareness by farmers has created significant improvements to "normal" production practices in terms of handling farm chemicals and minimizing soil erosion voluntarily. It therefore, seems likely that a significant amount of any impact of improved environmental practices cannot be attributed directly to environmental regulation, but to other factors.

Limitations of the study found that there is no existing body of empirical research and data developed that isolates the impacts of potato production on the environment. Data in Canada or other countries (i.e. US) developed specifically for regulations as they apply to the production of potatoes to support the development of macro impact assessments does not exist. Therefore, beyond the micro-economic impact on potato producers, much of the study provides an assessment that is based on interviews with environmental and agricultural experts from anecdotal evidence and provides a comprehensive overview of what is required to develop more technically complete environmental impact analysis. Additionally, a search for comparable evaluations of the impacts of environmental regulations in row crop production in other countries was unsuccessful. Therefore there are no relevant cost ratios against which to compare the findings of this report.

Several models were considered to quantify the social benefits of environmental regulations in potato farming. Although in the end the most appropriate evaluation was qualitative, it remains evident that this type of analysis is extremely complex. As an illustration; it is difficult to sepa-

rate "normal' practices from "regulated" practice. By example, a more complete evaluation of the avoided costs of contamination to Canada's waterways as a result of impact of environmental regulations and best practices in the production of potatoes in Canada would provide a more complete relevant indicator of the significant value of the current practices of potato farmers directed at protecting the environment.

Overall, environmental regulators state that compliance with this set of environmental regulations is high, the financial burden for producers as a result of environmental regulations is not high, and although research shows improvements in the environmental condition of the country it is difficult to attribute these improvements to any one crop and even more difficult to attribute them to environmental regulation in the light of numerous voluntary beneficial management practices that are being adopted by producers.

SECTION 1

Introduction

The following study presents an environmental and economic impact assessment of the environmental regulations affecting the agricultural sector of potato production in Canada. The focus is to evaluate the competitiveness effects of these costs (and their variability) between and across provinces within Canada. Farm level private costs and benefits are quantified and an aggregate picture of their impacts regionally is assessed within Canada. Social costs and benefits are addressed qualitatively only in this study.

This study has been prepared by developing selected case studies of major producing provinces within the country. As Phase II, this study further explores the recommendations resulting from Phase I. Phase I began with two objectives, first the initial creation of an inventory of the environmental regulations that affect farmers. Second, a study of an analytical framework and methodology that could be used to guide economic assessment of the impact of the set of environmental regulations affecting Canadian farms. As a continuation of Phase I, this report further develops the details of that regulatory set as it applies specifically to potato farms and carries out an economic impact assessment that draws on findings of the Phase I report. The focus of this study has been to attempt to fully understand the "practical", direct impacts of environmental regulations on farmers in Canada, and to evaluate from those results the total impact of potato farmers in Canada and consider the qualitative socio-economic impact to Canadians.

Concomitantly with this report being presented the Government of Canada is in the early stages of implementing the "Smart Regulation" principles throughout the federal government[1]. Another of the tasks of this study is to review the existing regulation set in light of the Smart Regulation principles. This review looks particularly at the criteria as they apply to the government departments with responsibilities to the environment and agriculture in Canada. Smart Regulations are intended to help the Government of Canada work towards a regulatory system that is responsive to changes in the economy, the environment and the circumstances in the country. Employing continuous improvement these regulations are designed to protect the health and safety of Canadians, contribute to a healthy environment, and foster the conditions that lead to an innovative and prosperous economy.[2]

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1. *Government of Canada, Smart Regulation Report on Actions and Plans, March 2005. http://www.regulation.gc.ca/default.asp?Page=report&Language=E&doc=toc_e.htm*
2. *Government of Canada, Regulation Website Home. http://www.regulation.gc.ca/default.asp?Language=e&Page=Home*

In a Canadian farm context compared to small grains, oilseeds and hay production, potato production has been historically considered a "higher value" intensive commercial crop. There has been motivation to maximize the frequency of potato production with shorter cycles in the crop rotation and to promote production by producing on the best lands, maximizing use of irrigation where necessary, intensifying use of pesticides to minimize crop damage, and maximizing use of fertilizers to promote growth. The agronomic nature of potatoes, combined with the planting and harvesting processes tend to draw more attention to concerns of soil surface condition than in many other types of field crops. Fields are row cropped instead of solid seeded, the plant tissue at harvest does not tend to provide much field cover, and the process of actually digging in the soil to harvest the potatoes tends to leave the soil more exposed, post harvest, than many other types of crop production like cereal and hay production, and therefore has greater potential to have negative impacts regarding soil compaction, soil tilth and organic matter.

In assessing any type of environmental impacts researchers often make use of indicators which are monitored for changes that can be attributed to specific actions or activities. In order to begin to understand the large-scale impacts of agricultural activities on the environment, AAFC, in 2000 published a report identifying and discussing trends in a preliminary list of AEI's. This report defined AEI's as "measures of key environmental conditions, risks, or changes resulting from agriculture, or of management practices used by producers".[3] This early list of indicators focuses on a number of key areas including water quality, soil quality, air quality, biodiversity, and environmental farm management.

The use and development of AEI's is a dynamic process that involves continuous improvement and subsequent changes to the indicators and the ways in which they are measured and calculated. While the overarching areas listed above will likely remain constant, the measures used to evaluate their 'health' will evolve. The most recent evolution of AAFC's AEI's indicates that, overall, based on the factors evaluated, the health of the Canadian environment is improving. The challenge, or limitation with using these results for application to a specific sector of the agriculture industry is that it is very difficult to use these measures to distinguish between types of production (potatoes within crops, crops within all of agriculture), and, as noted by the 2005 report, this research presents an intermediary stage in the development of a comprehensive set of AEI's for Canada.

3. *McRae, T. C.A.S. Smith, and L.J. Gregorich (eds). 2000. Environmental Sustainability of Canadian Agriculture: Report of the Agri-Environmental Indicator Project. Agriculture and Agri-Food Canada, Ottawa. www.agr.gc.ca/env/naharp-pnarsa (under Related Documents)*

SECTION 2

Scope of the study

The scope of this study includes an environmental and economic impact assessment of the environmental regulations affecting potato farmers in Canada. Farm level private costs and benefits are quantified using the methodology set out below. Early into the study it was determined that there does not exist data specific to potato production on which to quantify the social benefits and costs of these regulations. This is discussed in considerable detail later in the report. Also, it was beyond the scope of this study to research primary data to support such analysis. Therefore, this study presents a qualitative assessment of the social costs and benefits as they relate to the impacts of environmental regulations affecting potato farmers in Canada.

The focus of the study was to assess the variability, and therefore the competitive impacts of the variability between provinces in Canada. Also, this study is concerned with the cost of environmental regulations as they exist, and does not address the adequacy, effectiveness or "fairness" of these regulations.

As described in more detail in the methodology section of this document, for the purposes of this study, we have focused on 6 of the 10 potato producing provinces which account for more than 94% of the total potato acres in Canada. We believe that by developing case studies for each of these provinces and assessing the variability of the regulations and impact of regulations among these provinces it is possible to approximate the variability of environmental regulations impact for potato production in Canada. Subsequently this measure can be effectively translated to illustrate the effect or impact to a national context.

Case studies have been developed that reflect as much as is possible "typical" farm cases for each individual province. Available public farm cost data was used from each province to create the case study for evaluation. Farm revenue was estimated from public data from Statistics Canada. It was thought that pubic data was more transparent for the reader than developing revenues and costs from privately available farm data. Since the crop production landscape in each province is dominated by larger numbers of smaller land holdings of potato production, and relatively few very large commercial operations, our methodology to divide total farmers in the province by total number of hectares will tend to skew our case study to be more consistent with smaller land holdings as a production unit. Where there are significant differences in production practices and economies of scale related to large farm units these may or may not be individually reflected in any particular farm case study.

It is fair to say that regulations protecting environmental concerns in relation to agricultural practice are mostly recent in design. By example, pesticide use licensing, filing farm management plans, and crop rotation legislation, where it exists, is relatively new. Therefore, information on compliance and impact is very limited in a public context as there does not seem to be formal monitoring processes and data compilation methods employed at the provincial or federal levels for regulations affecting potato farmers. In order to develop the most relevant estimation of environmental impact possible, information from discussions with farmers and farm associations was combined with anecdotal evidence from enforcement officers and literature assessing changes in the six provinces considered in this study.

Finally, the scope of this study is confined to the existing set of regulations in each province. In many cases environmental issues identified in the National Agri-environmental indicators list may be of valid concern in potato production, but if there are no regulations governing the issues, those judgments are outside the scope of this study.

SECTION 3

Methodology

As the second phase of a process initiated by AAFC/EcoRessources in 2004 (Phase I), the goal of this project (Phase II) is to develop a case study for evaluation of the environmental and economic impacts of environmental regulations on a single sector of the agriculture industry, both at provincial and national levels.

1) The set of regulations affecting farmers have been developed using the Phase I report as a starting point and then fully developing the details of those regulations and determining any others that might exist. This was completed by direct contact interviews with experts in both federal and provincial government departments (both environmental and agricultural) that have knowledge of the regulations affecting potato producers (and in most cases more broadly, crop producers). A search was conducted for any existing Impact Assessment Statements specific to each regulation.

2) Also from the interviews, additional issues discussed were: compliance, practices, and impacts on farms specific to the regulations.

3) Considerable review of existing material was conducted related to environmental issues in crop production and how costs are evaluated from material prepared by and for the OECD, and the US Environmental Protection Agency (EPA). The Government of Canada has prepared a report: Environmental Sustainability of Canadian Agriculture Agro-Environmental Indicator Report Series #2 (2005) in which the environmental issues pertinent to potato production were addressed within the framework. This report was reviewed, and its relevance specific to potato production discussed in this report.

4) "Typical" case studies were developed at the farm level for each of the provinces studied that present a summary of revenue and costs so that any environmental regulatory costs could be analyzed against this data to better understand the relative financial impact these regulations may have on an individual farm. The study evaluates these costs in terms of their significance, financially, on the farm income statement. Source data for the cost information was obtained from provincial government departments of agriculture published cost data. Revenue data was developed from average historical data from Statistics Canada reports. The purpose of this analysis was not to create a revenue and cost sample that necessarily represents a particular farm size or model, but rather provide a sample that contains relative costs for a particular province and demonstrate some of the variability province to province.

5) A baseline cost was established using a "zero constraint is zero cost" approach.

6) The impact of each regulation was evaluated at the farm level as to the cost it created to the farm unit. These impacts were then evaluated on an aggregate basis per province studied, and compared across provinces for the relative competitiveness impact on each province.

7) A qualitative analysis of the socio impacts is discussed. Because there is little data at this time to quantify these impacts, in addition to the qualitative analysis, the study presents some of the methodologies that could be applicable to gain a better understanding of the social costs and benefits and the issues involved in using those methodologies for future evaluation.

8) Recently (first report in 2005), the Government of Canada launched the Smart Regulation initiative to guide the development of all regulations by the government. The environmental regulation set is discussed in terms of the fit with the Smart Regulation principles by giving consideration to the set of criteria in the Phase I report.

Selection of Provinces

The first step was to select a set of case studies from across Canada that would provide the capability to develop comparative analysis of the major potato producing regions within Canada and evaluate their comparative position to each other in regard to costs associated with environmental regulations that affect potato farmers. The methodology began with the selection of 6 provinces to focus on for information gathering and research application. The choice of Alberta, Manitoba, Ontario, Quebec, New Brunswick and Prince Edward Island allowed for a more compact field of research that still addressed more than 94% of the country's potato production as demonstrated in Table 1.

Table 1: Potato production in Canada, 2005

	AREA PLANTED	AREA HARVESTED	YIELD	TOTAL PRODUCTION
	Hectares	Hectares	Tonnes/Hectares	Tonnes
Canada	**161,500**	**153,400**	**27.92**	**4,282,500**
Newfoundland and Labrador	300	200	22.5	4,500
Prince Edward Island	38,600	37,800	29.17	1,102,700
Nova Scotia	2,100	2,000	23.9	47,800
New Brunswick	22,900	22,500	29.09	654,500
Quebec	18,100	17,600	26.39	464,500
Ontario	14,700	14,400	18.12	260,900
Manitoba	34,800	30,800	23.5	723,900
Saskatchewan	4,000	4,000	29.75	119,000
Alberta	22,700	20,800	38.63	803,600
British Columbia	3,300	3,300	30.64	101,100

Source: Statistics Canada, 2005.

Complete regulatory set

Upon selection of the provinces to be analyzed, a regulatory set was assembled that encompassed all of the environmental regulations in those provinces that impacted potato production. Compilation of the regulatory set resulted in a greater awareness of some of the unique characteristics of the regulations in each province and in this industry. For example, a number of environmental regulations have exemptions for farm operators. Also, the regulations of the Department of Fisheries and Oceans in regards to the equipment that must be used in irrigation systems has very different impacts on potato producers in Manitoba than it has on the majority of producers in Alberta (both irrigated production systems) and further has much different implications than these same regulations in the Maritimes.

Although Phase II was intended to build upon a database compiled in Phase I, it was quickly apparent that the Phase I database did not include the level of detail necessary for our analysis. As a result, the first step of Phase II was to compile the complete regulatory set and study the regulations in detail as they applied to potato production. Contact with both provincial departments of agriculture and departments of environment, several other related public sources in the provinces and contact with the Federal Department of Oceans and Fisheries and the Federal Department of the Environment were used to compile the complete list and understand the impact of the regulations for potato producers (Appendix B).

In addition to compiling the regulatory set we were prepared to conduct an analysis of all relevant Regulatory Impact Assessment Statements. We searched for Impact Assessment Statements (RIAS) with a search of the Canada Gazette (where statements of all RIAS are published) and queries to federal environmental officials but were unable to find evidence of the existence of any statements in relation to the regulations in the data set. Further communications with individuals in the provincial departments of environment and agriculture (Appendix B), as well as comprehensive searches of each provincial government's website (Appendix A) failed to identify provincial RIAS that would apply to the environmental regulations impacting potato producers. In New Brunswick, provincial representatives identified a provincial regulation known as the "Business Impact Test Checklist (BITC)" that is similar to the federal regulation governing RIAS statements. However, we did not find any BITC statements prepared in regards to environmental regulations affecting potato producers.

Finally the regulation set was reviewed against the "Smart Regulations" and the results of that assessment have been presented in the study.

Develop farm case studies

The next step in the methodology was to develop complete cost of production information for each of the 6 provinces to allow for an assessment of impact and the development of a representative farm in each province. Information was obtained through publicly available sources and discussed with provincial potato specialists wherever possible (Appendix B). It was the intent to establish a cost model as a representative "Current Cost Model" for the production year 2005. However, as a result of the cost data available, data published later than January 2003 was considered to approximate "current" costs, and data published prior to 2003 were adjusted for estimated inflation to bring them forward to 2003 values.

Through the process of conducting the study we found that information available from public sources was very limited and in many cases outdated. The following was the most current public cost data available by province for potato production:

- *Manitoba – 2005*
- *Ontario – 2003*
- *Quebec – 2003*
- *Alberta – 2000*
- *Prince Edward Island – 1995*
- *New Brunswick - 1994*

Each cost of production budget was presented using very different line items but similar categorization of these line items. The categories are input costs, operating costs and annual capital costs. For this purpose, budgets are presented by category for the sake of consistency. We have isolated out the applicable environmental regulation costs.

Baseline cost methodology

In cases where there was a variance in environmental regulation cost across the provinces, we assumed zero regulation cost as the baseline. The AAFC/EcoRessources Phase I report suggests 3 methods for establishing a baseline: (a) zero constraint; (b) prior to last regulation; and (c) comparing with regulation imposed on a competitor.[4] EcoRessources suggested that the most suitable methodology is to use the least cost non-zero example (province) for each regulation where regulation exists. In a province where no regulation exists for that item, a cost credit is created for comparative purposes. Attempts to follow this methodology revealed that most regulations did not have an effect to compare across all provinces and that when there was an effect, the provincial (competitor) differences were of such different magnitudes that applying a cost credit did not make intuitive sense.

We believe that in this case, the most suitable methodology is EcoRessources' method a) zero constraint where the baseline for a particular regulation is the situation where there is no regulation and no cost. This methodology allows for calculation of absolute costs per regulation per province and totaling these costs creates a cross province comparison based on absolute or actual cost of environmental regulation compliance.

Farm case impact analysis

The historical financial data set is utilized to determine direct impacts to the producer: total production costs, new costs incurred as a result of regulation, costs eliminated as a result of regulation, revenues from potato farming, income lost/gained (net income effects). As well, indirect effects to the producer are examined. Because total capital investment information was unavailable, the impact of environmental regulation on potato farmers was captured and differentiated using income comparative and annual capital cost (depreciation) ratios of: (a) environmental

4. *AAFC/EcoRessources. 2005. Inventory and Impact Evaluation Criteria – Methodology of Environmental Regulations for the Agricultural Sector. Agriculture and Agri-Food Canada.*

cost/total production cost, (b) environmental cost/total sales and (c) environmental cost/annual capital cost. Comparative analysis was conducted across the 6 provincial case studies to better understand each of their relative competitive positions. The analysis began with an assumption that the end result would be a general range of costs in each province, and would require the creation of a minimum, maximum and average scenario for presentation. The findings of the comparative analysis indicated that costs were more prescriptive, and this presentation was not appropriate. Instead, point estimates are presented as representative costs by each province.

The case study profiles determine an "average" farm size for each province by dividing the total potato acres in each province by the number of potato farmers in each province. Farm cost information is then presented as a "per-hectare" as well as a "per-farm" basis for each case study.

Aggregate impact analysis

The provincial case study impacts have been aggregated by multiplying the cost of regulation per representative farm by the number of farms in each province to present a total cumulative impact of the 6 provinces in the study. Finally, since these provinces represent 94% of the potato production in Canada the total impact of the six provinces was multiplied by a factor of 1.06 to represent the impact on the total production of potatoes in all provinces in Canada. We understand that this is likely a high adjustment because the weighting of the result of the higher regulatory cost in P.E.I. probably provides a higher adjustment factor to Nova Scotia, Saskatchewan and B.C. than would otherwise exist. However, since this is applied to a relatively small part of the production it still provides a reasonable and conservative approach to cost.

Comparative presentation

The last component of the financial analysis is to present the comparative provincial costs. Because the size of the farms is different, this cost has been reduced back to a "per hectare" cost for comparative purposes. The ratio analysis is also presented with this analysis, as discussed above.

To provide an additional indicator of environmental compliance cost we were prepared to highlight a ratio comparing expenditures on environmental protection in the agriculture industry with national expenditures on environmental protection. Unfortunately this information is not available from Statistics Canada in a more specific value pertaining only to the agricultural industry. The only value available is an aggregation for all food production, and we do not believe that comparing expenditures for the entire food industry, which will include food processors among others, is an appropriate indicator for the scale of costs to primary agricultural production, and specifically the potato production sector.

It was also within the scope of this study to compare, at a high level, the costs of environmental regulations faced by potato producers in Canada with those faced by producers in other jurisdictions. A thorough investigation of sources such as the United States Environmental Protection Agency ("EPA"), the United Nations ("UN"), the Environmental Valuation Reference Inventory ("EVRI"), and the Organization for Economic Cooperation and Development ("OECD) among other common environmental information sources failed to uncover any such publications. Searches were completed for environmental regulations and potato production as well as row crop production but the only detailed information that was discovered focused the cost of environmental regulations in the hog and livestock sectors. Appendix A outlines the sources searched for this information.

SOCIO-ECONOMIC ANALYSIS

As a result of the relatively insubstantial economic impact of environmental regulations in the potato sector, there was little value in conducting as input-output analysis. Input-output models, as discussed later in this document, are designed to illustrate the impacts of shocks on a system, and the cost impacts of environmental regulations in the potato sector were not of sufficient size to result in shocks.

The socio-economic analysis included in the Phase I report discusses the use of aggregated farm costs as a proxy for social costs and thus, also as an indication of social benefit. However, we have outlined the limitations to the use of these values as proxies.

Although the development of a valuation model was outside of the budget and scope of this project, we have highlighted a range of valuation options and discussed some of the challenges with valuing non-market goods such as environmental benefits. While there are not specific values associated with the discussion of these models, we have discussed the nature of the social benefits and costs where possible in qualitative terms.

Moving forward we have identified some of the information that would be necessary to complete this level of analysis and that will be needed for future, more detailed projects involving valuation of impacts.

SECTION 4

Environmental regulation set by province

The establishment of a comprehensive regulation set began with the AAFC/EcoRessources database previously compiled. This data set was updated with current information from interviews with individuals working in agriculture and environment in each of the 6 provinces and further supplemented with information directly from the Acts and Regulations. Additional detail was also added to the database to facilitate our analysis of impacts. Outlined below is the complete set of environmental regulations that impact potato producers in each of the case study provinces. This set includes only those regulations that impact potato producers and the details have been paraphrased for ease of application.[5] A more detailed table of the regulation set is presented in Appendix F.

PROVINCIAL REGULATIONS

Alberta

Pesticide Code of Practices

The Pesticide Code of Practices was developed to protect water contamination by agricultural chemicals that are used for crop protection. This legislation governs use, application and storage of pesticides.

Impact

This regulation restricts the application of pesticides to 30 horizontal meters from surface water, and requires that applicators obtain appropriate licenses. However, agricultural producers are exempt from this regulation and as such are not impacted.

Manitoba

Pesticides and Fertilizers Control Act

The Pesticides and Fertilizers Control Act's applies to potato producers in that it ensures the accredited licensing and adequate insurance of custom operators and vendors that work with commercial pesticides and fertilizers.

5. *For more information regarding the regulations consult the online version of the Act and its regulations which are available from each provincial governments website and the Department of Fisheries and Ocean site.*

Impact

No regulation under this act pertains to private agricultural producers. Producers do not need any level of permit or insurance to apply pesticides and fertilizers on their own operation. Therefore there is no impact to farmers.

Water Rights Act

The Water Rights Act governs allocation of water for irrigation, domestic, municipal and industrial purposes. The Water Rights Regulation states that producers must apply to Manitoba conservation for a license or permit to take water for irrigation.

Impact

There is a $50 lifetime fee per license. If a producer wishes to increase his/her irrigation area, he/she must make an additional application for this increase and incur an additional license fee. This additional cost will be included in the financial impact assessment of producers in each province that is detailed in subsequent sections.

Ontario

Pesticide Act

The Pesticide Act's main statute is to protect the environment and water resources from discharge of pesticides or anything containing a pesticide. The Pesticide Act Regulation applies to the licensing of pesticide vendors, users and applicators. In the case of farmers, pesticide users are required to have differing degrees of pesticide permits depending on whether they are applying chemical to their own land or participating in custom application.

Impact

Farmers and farm employees who are involved in pesticide application and/or transportation must apply for a pesticide license. Licenses cost $85 and are valid for five years. In order to make first application for a license, applicants must participate in a one-day course and write an open book exam. Operators applying for a license renewal have the option to just write the exam without taking the course over again. The financial impact of this cost to potato producers will be illustrated later in this document.

Ontario Water Resources Act

The Ontario Water Resources Act's main statute is to protect the quality and safety of Ontario water resources. The Water Taking and Transfer regulation was implemented to protect and preserve Ontario's sustainable water supply. The regulation stipulates that anyone taking more than a total of 50,000 litres of water in a day from a lake, stream, river or groundwater source must obtain a permit.

Impact

All agricultural irrigation and water use is required to have a Permit to Take Water from the Ontario government. However, farmers and permits for agricultural use are exempt from permit fees and therefore the impact to potato producers is limited to filling out an application to get an irrigation permit approved. Therefore, the only impact is a minor amount of labour to complete the permit application. This regulation will not be addressed further in this study as the cost is considered immaterial.

Quebec

The Pesticides Act

In Quebec, The Pesticide Act governs the use, sale and licensing of agents using pesticides. Under the Pesticides Management Code, custom operators must have a permit for the application of pesticides. Farmers do not need a permit, however, they do need to hold a certificate. The certificate attests to the producer's competence in the field of pesticides and authorizes him/her to carry on activities such as spraying crops with pesticides.

Impact

Producers must attain a certificate from the Minister that is renewable every five years. As there is no direct cost associated with obtaining this certificate other than a small amount of labour to complete the application, this regulation will not be included in the cost impact assessment detailed later in this report is considered immaterial.

Environmental Quality Act

The Environmental Quality Act ensures ongoing supervision of the quality of the environment and promotes environmental protection. The application distance regulation controls the distance from watercourses or bodies of water that pesticides may be applied. Pesticides must not be applied within 1 meter of watercourses with a total flow area of less than $2m^2$ or within 3 meters of watercourses with a total flow area of greater than $2m^2$. Pesticides must not be applied within 3 meters of bodies of water.

Impact

Producers are impacted by the buffer zone because crop protection products cannot be used to control damaging pests in these areas and the potential revenue is decreased from loss of crop. This potential loss of revenue will be addressed in the cost models that follow.

New Brunswick

Clean Environment Act

The objective of the Clean Environment Act is to protect the environment, plant and animal life. The regulations of this Act state that no one can cause or permit any contaminant to directly or indirectly pollute water in the province.

Impact

Producers must not engage in activities that could result in pesticides entering watercourses or wetlands. This regulation involves similar requirements to the Department of Fisheries and Oceans (DFO) regulations regarding deleterious substances. Due to the fact that DFO regulations are Federal requirements, this provincial Act does not result in any different costs to New Brunswick producers than producers in other provinces, and as such it is not included as an additional comparative cost in the financial models that follow.

Clean Water Act

The Clean Water Act strives to protect watercourses, wetland areas, and waters of the province from damage. The regulations within the Clean Water Act outline the buffer zones that must be allowed for different activities and how the size of those zones vary between different types of protected areas[6] and different types of activities.

6. *Map of New Brunswick protected areas. www.web11.snb.ca/snb7001/e/2000/2900e_1e_i.asp#12*

Impact

The amount of area impacted by Protected Area legislation is not significant. Despite the fact that potato producers who may be farming near these areas will experience a loss of land as a result of the required set-backs and a loss of yield due to as restrictions on pesticide use this will not be illustrated as a cost in the cost models that follow because of the relative area that is designated as protected.

Pesticides Control Act

The intent of the Pesticides Control Act is to govern the use of pesticides and issuance of certificates and permits. It requires that any person who is involved in the mixing, loading, handling or application of pesticides hold a Pesticide Applicator's Certificate, the cost of this certificate is $10 a year for a private classification and $25 a year for a commercial classification. Additionally, the license holder is required to maintain records regarding the total quantity of each pesticide that they use or apply in each year.

Impact

As a result of the certification requirements, producers incur the costs of licensing themselves and any employees. This cost is factored in to the financial impact model that follows, however, as the amount of time that a producer will have to spend maintaining records is highly variable and impossible to estimate, there is no accounting for this potential cost of time.

Prince Edward Island

Pesticide Control Act

The Pesticide Control Act governs the use of pesticides and licensing of applicators and vendors. All producers and farm assistants who apply and/or transport pesticides must obtain a pesticides license. The license does not expire under the condition that license holders attend a mandatory number of pesticide training events. A license holder must obtain 15 credits over 5 years where one credit is obtained per four hours of pesticide training event.

Impact

Producers must pay an initial license fee of $75 for their own license and also each of their employees' licenses. Producers and their employees must also take the time to attend pesticide training event. If these events require an enrollment fee, the producer bears the cost of the enrollment fee and the time dedicated to the course. This cost is not incorporated into the analysis.

Environmental Protection Act

The purpose of the Environmental Protection Act is to manage, protect and enhance the environment. The buffer zone regulation mandates vegetation buffers around surface water and wetland resources to protect these resources and aquatic life from soil erosion and harmful surface run-off. The regulation states that no person shall plant an agricultural crop within 10 meters of a watercourse or wetland area. If the grade of slope on the upland side of the watercourse or wetland is greater than 5%, the legislated buffer zone is increased to 20 meters. Included in the buffer zone regulation is winter cover limits. Winter cover, either a winter cover crop or mulch must be applied to harvested row cropland within three weeks of harvest and no later than November 30.

Impact

Producers are impacted by the buffer zone because this cannot be cropped and the potential revenue from this area is lost (opportunity cost). The winter cover regulation impact is the cost of

planting a winter cover crop on row cropland or applying mulch. Because most producers do not associate a cost with applying mulch, this cost will not be addressed further in this report.

Agricultural Crop Rotation Act

The Agricultural Crop Rotation Act legislates crop rotation practices for the purposes of maintaining and improving surface water quality, ground water quality, soil quality and productivity by reducing run-off and soil erosion. It is applied to a specific set of regulated crops.

Impact

Potatoes are a regulated crop, and potato producers can only plant this crop on any parcel of land every 3 years. In the years between potatoes, crops other than those regulated, must be planted. Through interviews with individuals involved in the potato industry in the 6 provinces, it became apparent that some practices including crop rotations are considered "best management practices" and are implemented by virtually all potato producers. While there is obviously a cost associated with using a crop rotation (opportunity cost of continuously cropping potatoes) rotations are common practice in all potato producing regions. It is apparent that to producers across the country, the costs of continuous cropping, (erosion, soil damage, disease, lost soil productivity and increased input requirements) are greater than the costs of using a rotation. The cost of rotating has not been included as a cost resulting from regulation, because rotations would be expected to continue occurring normally in the absence of regulation.

The crop rotation act also stipulates that where any portion of land comprising more than 1.0 hectares has a slope greater than 9%, that part of the land must not be planted with regulated crops. The land may be planted with regulated crops where there is a management plan approved by a P.E.I. Department of Agriculture official. The cost associated with this regulation has not been included because P.E.I. government officials stated that this regulation affects only a small, localized group of farmers that crop land located in the center of the island. Also, due to the regulation exemption through a management plan, some of this land remains in potatoes.

Federal regulations

Department of Fisheries and Oceans (DFO) Canada, Fisheries Act

The Department of Fisheries and Oceans regulates all activities that may have an impact on fish habitat. Sections 30 and 37 of the Fisheries Act apply to irrigated potato farmers and govern irrigation pipe intakes and bank alterations relating to pump access roads. The Act stipulates that every water intake constructed or adapted for conducting water from any Canadian fisheries waters for irrigating must use a fish guard or screen to prevent the passage of fish from any Canadian fisheries waters into the water intake. It also states that where a person carries on or proposes to carry on any work that is likely to result in the alteration, disruption or destruction of fish habitat, or in the deposit of a deleterious substance in water frequented by fish the person must provide the Minister with such plans and specifications of the work so that fish habitat remains unchanged. The costs associated with compliance with regulations regarding deposit of deleterious substances in water and alteration, disruption or destruction of fish habitat are not included in the cost models below because they do not result in disparate costs among the provinces when performing comparative analysis. The regulations are the same across the country and have a consistent impact on producers in different provinces.

When creating new water intakes or bank access roads, producers must make application to their regional DFO office. The application must describe the measures the producer is taking to minimize fish kill by the intake pipe and to minimize bank erosion and/or fish habitat alteration in

the process of building an access road. DFO has a number of guidelines on acceptable procedures but no one of these procedures is legislated. Depending in what region the producer resides there are different procedures that comply with DFO regulations and can be implemented at the lowest cost.

As discussed earlier, these regulations have very different effects on the two provinces that have extensive irrigation systems for potato production. The irrigation districts in Alberta have resulted in a situation where a third party is responsible for regulation compliance.

As a result of the development of irrigation districts in much of Alberta, producers pay for access to an irrigation district, but are not directly concerned with the measures necessary to comply with regulations – that is the responsibility of the irrigation district. In comparison, in Manitoba producers develop and run their own irrigation intakes directly out of natural waterways and are therefore responsible for compliance with regulations concerning irrigation systems. There remains the question as to whether or not the costs of compliance would change in the absence of regulation. It is our belief that while the irrigation systems in Manitoba would likely be significantly different in the absence of regulation, due to the way that irrigation systems have developed, and the size of the intakes needed, it is likely that irrigation districts in Alberta would not only continue to operate in the interests of the sustainability of their operations but would likely take steps to maintain the integrity of the watercourse that supports them.

Pesticide Control Act

The Federal Pesticides Control Act governs the use and storage of pesticides in Canada. The impact of the regulations under this act have not been included in the financial impact models that follow because the costs associated with compliance are comparable across the country and as such do not result in a variation of the costs born by producers in different provinces.

Summary of regulations

Environmental regulations are often perceived as a burden that must be born by producers. However, in the case of potato production there are very few regulations that specifically target production of this crop. The Agricultural Crop Rotation Act in Prince Edward Island focuses on the production of regulated crops (potatoes and other row crops). Additionally, the slope regulations in Prince Edward Island restrict any land with more than one hectare at a slope of 9% from being planted with regulated crops, but neither of these isolates potato production from other similarly intensive production.

As a result, there is little evidence that the environmental regulations faced by potato producers result in a comparative disadvantage in relation to the environmental regulations faced by other agricultural producers. All of the other environmental regulations presented in this study apply to any type of agricultural production. For example any producer applying pesticides to any crop in New Brunswick is required to have a pesticide applicators license and any producer growing any product is required to comply with the buffer zone requirements outlined in the Prince Edward Island Environmental Protection Act.

Further, as will be outlined in greater detail in the section that follows, the financial implications of most of these environmental regulations are minimal and arguments that they result in unrealistic financial burdens appear to be unfounded. The most significant impact occurs as a result of buffer zone regulations because of the amount of land that is taken out of high value production and restricted to less profitable grass production.

SECTION 5

Financial and economic impact assessment

Environmental cost analysis – a financial exercise

This section presents a case study farm for each province including the size, average revenue, input costs, operating costs, annual capital costs and total costs. Within each of these cost categories, environmental regulation compliance cost has been segregated and itemized separately. Average revenue calculations were based on a four-year average and are included in Appendix C. Where applicable, the average number of operators per farm has been calculated using Statistics Canada data. The calculations behind the economic cost of the applicable environmental regulations for each case study farm are further explained and the relevant details included. Detailed cost of production budgets are available by province in Appendix E and regulation compliance costs are not segregated in the detailed budgets, but included within the general line item descriptions.

Alberta

Case study farm

The most recent potato cost of production data available from Alberta Agriculture was last calculated in 2000. Statistics Canada collects farm input cost data for each province on a yearly basis (not specific to potatoes; all crops). To bring the Alberta data to a current cost level, we compared the Statistics Canada cost data for 2000 and 2004. The difference in costs between 1995 and 2004 were calculated and translated into an average inflation rate per line item (Appendix D). This inflation rate was applied to each of the 2000 cost of production budget items resulting in the following adjusted cost of production budget. A detailed case farm budget is available in Appendix E. This budget was discussed with the Alberta potato specialist (Appendix B) and although some line item differences were noted, they were not material.

Line items in the cost of production budget that had corresponding Statistics Canada data were calculated using the inflation rate that corresponded to each line item. Line items in the cost of production budget that do not have corresponding Statistics Canada data were calculated using the average inflation rate of the set. Alberta Agriculture did not stipulate what size of farm the 2000 cost of production budget was based on, therefore, an average potato farm size for Alberta was calculated. In 2001, Alberta harvested 23,610 hectares of potatoes over 434 farms. Using this data, an average potato farm would cultivate 54 hectares.

Table 1: Alberta case study profile

54 HECTARE FARM SIZE	$/HECTARE
Average revenue	6,997.44
Total input costs	1,412.08
Total operating costs	2,722.78
Total annual capital costs*	1,420.17
Regulation cost	19.94
Total costs per hectare	5,574.97

**Excluding environmental regulation costs.*
Source: Costs – Estimated from Alberta Agriculture, Food and Rural Development, "Estimated Production Costs and Returns for Processing Potatoes" 2000 and adjusted for inflation, see Appendix D.

Regulation impact

The effect of environmental regulations in Alberta for potatoes is restricted to the federal regulations of the Department of Fisheries and Oceans, Canada. According to the 2004 Alberta Irrigation Information published by Alberta Agriculture, Food and Rural Development approximately 80% of potatoes in that province were irrigated in 2004. This information is based on Alberta's thirteen irrigation districts that account for approximately 84% of Alberta's irrigated land. DFO regulations would apply in Alberta due to the prevalence of irrigated acres of this crop. In the case of irrigation within the thirteen irrigation districts, producers do not need to ensure that the irrigation system they use complies with DFO regulations because the irrigation district organization is responsible for DFO compliance. That is, the irrigation district organization is responsible for most aspects of irrigation system management and maintenance and producers simply pay a fee for the district to manage these items. Part of this fee would include costs associated with DFO regulation requirement costs incurred by the irrigation district. In 2004, in the districts that recorded growing potatoes, these fees ranged from $7.50/hectare to $17.90/hectare. This would result in an annual cost range of $1,000.35 to $2,387.50 on a representative Alberta potato farm of 54 hectares located within an irrigation district. Because there is no accurate method to segregate DFO regulation compliance within the irrigation district fee, Manitoba DFO compliance costs were used as a proxy. As outlined below, the annual cost of DFO compliance in Manitoba is approximately $1,075. This cost can be used as a proxy for DFO compliance cost in Alberta and is inclusive of funding from the Canada-Alberta Farm Stewardship Program. Also for the purposes of cost modeling, the costs of water rights in Manitoba are used as a proxy for the cost of water rights in Alberta. As outlined below, the annual water rights cost per Manitoban farm is $2.00. The two costs combined ($1,077), divided by the average size of an Albertan potato farm (54 ha) reveals an average regulation cost of $19.94 per hectare.

Manitoba

Case study farm

Manitoba Agriculture, Food and Rural Initiatives publishes potato cost of production data every year. The 2005 budget is shown below and a detailed budget is available in Appendix E.

The budget is based on 161 hectares of irrigated processing potatoes. Like Alberta, Manitoba potatoes are largely irrigated. In 2002, 74% of the total potato acres were irrigated and this percentage continues to grow.

Table 2: Manitoba case study profile

161 HECTARE FARM SIZE	$/HECTARE
Average revenue	4,599.87
Total input costs	1,556.06
Total operating costs	1,915.02
Total annual capital costs*	1,192.63
Regulation cost	6.68
Total costs per hectare	**4,670.39**

**Excluding environmental regulation costs.*
Source: Costs – Manitoba Agriculture, Food and Rural Initiatives "Irrigated Processing Potato – Cost of Production 2005".

Regulation impact

The only provincial regulation in Manitoba that affects potato farms is the regulation pertaining to water rights licenses. However, this fee is only $50 per application and is amortized over the life of the irrigation project. Over a standard capital amortization period of 25 years, the annual cost to Manitoba producers is $2.00.

However, because of irrigation's prevalence in Manitoba, federal Department of Fisheries (DFO) regulations must be considered. Due to the location of processing facilities and access to water resources, many potato producers are located along natural water ways, particularly the Assiniboine River that serves as an irrigation water source. Unlike Alberta, there are no irrigation districts in Manitoba and each producer manages and makes application for his/her own water uptake system. These applications consider the DFO stipulations in place regarding bank condition management and end-of-pipe guidelines. Conversations with Department of Fisheries staff and Manitoba producers confirmed the following capital budget would be representative of a Manitoba potato producer's DFO regulation compliance cost.

River access	$15,200.00
Intake screen	$ 4,500.00
Total	**$19,700.00**

River access costs include bush clearing, bank leveling and bank stabilization structures according to guidelines proposed by DFO. Each intake screen must also meet DFO guidelines.

The Canada-Manitoba Farm Stewardship Program is a federal funding initiative that provides financial incentives for environmental farming practices. Within this program, there are 30 "best management practices" that are eligible for various levels of funding. The best management practices that would be relevant to a project involved with DFO compliance are "riparian area management" and "irrigation management." Riparian area management would apply to the river access and is 50% funded while irrigation management would apply to the intake screen and is 30% funded. This funding would bring the total cost of the project down to $10,750.00. The average useful life of these items is ten years and using straight line amortization, the annual capital is $1,075 or $6.68 per hectare on the representative Manitoba farm.

Irrigation and riverbank management projects such as this require engineering and consulting costs that are separate from the actual capital expenditures on required equipment. The Prairie Farm Rehabilitation Administration provided the following estimates for consulting and engineering costs for a project of this size.

Fish Habitat Assessment	$5,000
Agronomic Study	$5,000
Erosion and Sediment Control Plan	$5,000
Environmental Act Proposal	$18,000
Civil Design	$25,000
TOTAL	**$58,000**

The civil design costs cannot be fully attributed to DFO compliance cost as a portion of these costs would be associated with road access design and bank management design. The total of the consulting and engineering costs is approximately $58,000, however, these costs can be subsidized under the Canada-Manitoba Water Supply Expansion Fund. This is a federal funding initiated that funds the planning costs associated with a water supply expansion project. The funding covers 100% of the project if it is associated with new water supply expansions, not improvements to existing structures. The costs presented above are associated with building a new pumping station, therefore for the purposes of cost modeling, we will assume 100% of the consulting and engineering costs are subsidized, therefore, the net cost is assumed to be $0.

Ontario

Case study farm

The Ontario Potato Board (OPB) published a processing potato cost of production budget for 2003 as follows:

Table 3: Ontario case study profile

20 HECTARE FARM SIZE	$/HECTARE
Average revenue	5,477.92
Total input costs	2,500.68
Total operating costs*	1,401.81
Annual capital costs	956.29
Regulation cost	4.20
Total costs per hectare	4,862.98

**Excluding environmental regulation costs.*
Source: Costs - Ontario Potato Board[7] "2003 Processing Potato Cost of Production".

A detailed budget is provided in Appendix E. In 2001, 876 farms reported harvesting 17,562 hectares of potatoes resulting in a representative farm size of 20 hectares.

Regulation impact

The only provincial environmental regulation in Ontario that would have an economic impact is the pesticides regulation. In 2001, the average Ontario farm had 1.4 operators. (Census of Agriculture, 2001). We have assumed an average of 2 operators for potato farms.

In this case, every five years the farm operator and his/her assistant would need to obtain or renew their licenses resulting in a cost of $170 ($85 x 2). Assuming that the operator and assistant both choose to take the one-day Grower Pesticide Safety Course offered by the Ontario Pesticide Education Program (OPEP), this would result in approximately 16 hours of farm labour. Statis-

7. *Personal Communication. Don Brubacher, Ontario Potato Board Manager, (519) 846-5553.*

tics Canada reports that the average hourly wage in Ontario for occupations unique to primary industry in February 2006 was $15.65. This would result in a total labour cost of $250.40 ($15.65 x 16) for the two operators to take the pesticide course.

These costs amortized over 5 years would result in an annual cost of $84.08 or $4.20 per hectare

Quebec

Case study farm

The Ministère de l'agriculture, des pêcheries et de l'alimentation of Quebec published a 2003 cost of production budget for potatoes as follows:

Table 4: Quebec case study profile

103.75 HECTARE FARM SIZE	$/HECTARE
Average revenue potential	5,550.16
Less: regulation revenue potential loss	27.76
Total average revenue potential	5,522.40
Total input costs	2,116.49
Total operating costs	1,626.00
Annual capital costs	662.23
Total costs per hectare	4,404.72

Source: Costs – Ministère de l'agriculture, des pêcheries et de l'alimentation, "Pommes de terre coût de production, janvier à décembre 2003".

The cost of production budget was based on a total of 177.48 ha, 103.75 of which were potatoes.

Regulation impact

The only regulation within Quebec that has potential for an economic impact to potato producers is that of buffer zones or application distance regulations. According to the Phase I report published by EcoRessources in 2004, 0.5% of agricultural soil is affected by the buffer zone regulation. This loss is based on a 3-meter pesticide application buffer zone surrounding water bodies and watercourses. The assumption is that the 3-meter buffer zone applies to all watercourses, even those with a total flow area of less than 2 cubic meters. The assumption is reasonable as it assumes a maximum impact of buffer zones in the province.

The application distance regulation impacts a producer economically due to the loss of potential yield in areas where pesticides cannot be applied. Yield loss can range from 0 loss to complete yield loss, and for the purposes of this study, 100% yield loss is assumed. Lost revenue potential is calculated using four year provincial averages for yield and price (Appendix C). On the representative farm, 0.519 ha is lost to buffer zones. (103.75 * 0.005). Multiplying this number by the five-year average yield and price per hectare results in a maximum revenue loss of $2,880.53 for the representative farm.

New Brunswick

Case study farm

The budget shown below has been generated using 1994 cost of production data published by the New Brunswick Department of Agriculture which is the most current data available from the

province. To bring the New Brunswick data to a current cost level, we compared the Statistics Canada farm operating expense cost data for 1994 and 2003. The difference in costs between 1994 and 2003 was calculated and translated into an inflation rate (Appendix D).

The inflation rates were applied to the 1994 cost of production data resulting in the following adjusted cost of production budget.

Table 5: New Brunswick case study profile

63 HECTARE FARM SIZE	$/HECTARE
Average revenue	5,029.75
Total input production	1,856.80
Total operating costs*	2,790.21
Annual capital costs	486.39
Regulation cost	0.32
Total costs per hectare	**5,133.72**

**Excluding environmental regulation costs.*
Source: Costs – Estimated from New Brunswick Agriculture, Fisheries and Aquaculture "Process Potato Enterprise Typical Expense per Acre" 1994 and adjusted for inflation see Appendix D.

The average inflation rate was applied to all line items in the 1994 cost of production budget. A detailed budget is available in Appendix E. This budget was discussed with provincial representatives (Appendix B), and although some line item discrepancies were identified, they were not material. In 2001, New Brunswick harvested 23,620 hectares over 374 farms resulting in an average farm size of 63 hectares.

The 2001 Census of Agriculture found that New Brunswick had a total of 3,034 farms and 3,890 operators for an average 1.3 per farm (all crops). Again, we have assumed an average of 2 operators per potato farm when calculating regulatory costs.

Regulation impact

The only environmental regulation that would have an economic impact to potato producers in New Brunswick is the regulation regarding licensing under the Pesticides Control Act. Each license costs $10 annually for a total annual cost of $20 on the representative farm.

Prince Edward Island

Case study farm

The budget shown below has been generated using 1995 cost of production data published by the Prince Edward Island Department of Agriculture. Statistics Canada collects farm input cost data for each province on a yearly basis (not specific to potatoes; all crops). To bring the P.E.I. data to a current cost level, we compared the Statistics Canada cost data for 1995 and 2003. The difference in costs between 1995 and 2003 was calculated and translated into an inflation rate. (Appendix D).

The inflation rates were applied to the 1995 cost of production data as follows:

Table 6: Prince Edward Island case study profile

92.52 HECTARE FARM SIZE	$/HECTARE
Average revenue potential	4,579.11
Less: regulation revenue potential loss	68.80
Total average revenue potential	4,510.31
Total input costs	2,213.84
Total operating costs*	3,183.27
Total capital costs	598.60
Regulation cost	7.01
Total costs per hectare	6,002.72

**Excluding environmental regulation costs.*
Source: Costs – Estimated from Prince Edward Island Agriculture and Forestry "Cost of Production – P.E.I. Table & Processing Potato Farms" 1995 and adjusted for inflation see Appendix D.

Line items in the cost of production budget that had corresponding Statistics Canada data were calculated using the directly corresponding inflation rate. Line items in the cost of production budget that do not have corresponding Statistics Canada data were calculated using the average inflation rate. A detailed cost of production budget is available in Appendix E. This budget was discussed with provincial agriculture representatives (Appendix B), and although some line item discrepancies were identified, they were not material and did not warrant changes to the indexed costs.

According to Statistics Canada, in 2001, 468 farms in P.E.I. planted a total of 43,300 hectares of potatoes. We have calculated that the average or typical farm cultivated 92.52 acres of potatoes.

The 2001 Census of Agriculture found that P.E.I. had a total of 1,845 farms and 2,455 operators for an average 1.33 operators per farm (all crops). We have assumed an average of 2 operators per farm.

Regulation impact

Pesticide Control Act

In the case of a two-operator farm, each of the operators would be required to obtain their pesticide license for $75 each or $150. To keep this license, the operators are required to attend 60 hours of pesticide training every 5 years. Statistics Canada reports that the typical hourly wage in Prince Edward Island for occupations unique to primary industry in February 2006 was $11.55. This would result in a total labour cost of $1,386 ($11.55 x 60 x 2) over five years.

The total annual compliance cost under the Pesticide Control Act would be $307.20 for the representative P.E.I. potato farm.

Buffer zone regulation

The estimated rate of agricultural soil lost by regulation in P.E.I. is 1.5% (EcoRessources Phase I report, 2004). On the representative farm 1.39 hectares of cropland would be affected by the buffer zone regulation. To calculate the revenue lost due to implementing buffer zones on the

case study farm, we used four year provincial averages for yield and price (Appendix D) and assume 100% yield loss.

The total revenue loss due to buffer zones on the case study farm would be $6,364.96 (1.39 x 7.47 x 613).

There are also costs associated with maintaining the buffer zones. In 2001, the Newfoundland Department of Forest Resources & Agrifoods together with Agriculture and Agri-Food Canada published a forage cost of production budget. We have approximated this cost for cost of forage established in P.E.I. The line items that would apply to maintaining buffer zones are shown in the table below.

Table 7: Newfoundland and Labrador forage cost of production

	$/HECTARE
Seed	78.78
Machinery and operating	90.51
Labour	296.23
Repairs	113.02
Total costs	578.54

Source: Agriculture and Agri-Food Canada "2001 Forage Cost of Production".

Considering these establishment costs, a hectare of forage costs a producer $578.54. On the representative potato farm with 1.39 hectares of buffer zone forage to maintain, this would result in a cost of $804.17. Once buffer zone forage is established, maintenance costs are limited to the machinery operating expense and labour to cut or mow the forage as producers express the area is too small to bother harvesting. The Newfoundland study cited that these maintenance costs were $284.61/hectare. In P.E.I. the typical forage establishment can be maintained for about 5 years before it must be seeded again. Therefore, establishment costs can be amortized over 5 years for an annual cost of $56.92. Adding on the buffer zone maintenance cost brings the annual cost of buffer zone maintenance on the representative farm to $341.53.

Total annual buffer zone cost is the cost of lost revenue plus the maintenance cost for a total of $6,706.49.

Comparative analysis

Table 9 outlines the aggregate comparative provincial cost to potato farmers of each environmental regulation. It is important to note that the table presents comparative findings as absolute costs because the baseline is assumed to be zero constraint. The cost per representative farm was multiplied by the number of potato farms reporting in the 2001 Census of Agriculture. The comparative total cost per province is analyzed per hectare of potatoes planted also according to the 2001 Census of Agriculture.

Table 8: Comparative analysis of environmental regulation cost on potato production

	ALBERTA	MANITOBA	ONTARIO	QUEBEC	NEW BRUNSWICK	PRINCE EDWARD ISLAND
Vegetative buffer zones	–	–	–	–	–	3,133,968
Pesticide buffer zones	–	–	–	524,490	–	–
Pesticide licenses and training	–	–	73,602	–	7,480	143,770
DFO regulations	470,783	209,752	–	–	–	–
Water rights	868	450	–	–	–	–
Total provincial cost	471,651	210,202	73,602	524,490	7,480	3,277,738
Per hectare cost	19.98	6.69	4.18	27.75	0.32	75.70

- *Vegetative buffer zones affect solely Prince Edward Island by a total cost of $3,133,968. No other province is affected by buffer zone legislation.*
- *Pesticide buffer zones affect only Quebec by a total cost to producers of $524,490. Pesticide licenses and training costs have an absolute cost in Ontario, New Brunswick and Prince Edward Island of $73,602, $7,480 and $143,770 respectively.*
- *Department of Fisheries and Oceans and Water Rights regulations affect the irrigation potato production provinces of Alberta and Manitoba. Manitoba per farm costs were applied to Alberta farms due to irrigation districts and the inability to separate environmental regulation compliance costs from irrigation district administration costs. The cost per farm was then provincially aggregated by number of potato farms in each province. Alberta's annual cost for DFO compliance is estimated at $470,783 and Manitoba at $209,752.*
- *Water rights regulation costs Alberta producers $868 annually and Manitoba producers $450 annually.*

Total comparative provincial costs of environmental regulations in the potato sector range from a $3,277,738 in Prince Edward Island to $7,480 in New Brunswick.

Further analysis of this range translates the effect to $75.70 per hectare in Prince Edward Island and $0.32 per hectare in New Brunswick with the other provinces falling somewhere in between these two numbers. Per hectare comparisons in Table 9 and Tables 2 thru 7 may be slightly different due to provincial "rounding up" of representative farm costs.

Finally, while it was desirable to compare the costs borne by Canadian potato producers with those faced by producers in other countries, as mentioned earlier, an extensive search for reports discussing the environmental regulation costs in other jurisdictions did not uncover any information for either potato production or row crop production.

The final cost analysis is to determine an overall total of the cost to Canadian potato farmers of environmental regulation affecting potato production. These costs are presented in Table 10.

In Table 10, total absolute annual environmental regulation cost in the six selected provinces is $4,565,163. This cost translates to a national annual environmental regulation cost to potato producers of $4,839,072.

Table 9: Provincial aggregate costs

	ABSOLUTE $
Alberta	471,651
Manitoba	210,202
Ontario	73,602
Quebec	524,490
New Brunswick	7,480
Prince Edward Island	3,277,738
Total of selected provinces	**4,565,163**
ADD: remaining 4 provinces	273,910
Canadian total	**4,839,072**

Table 11 presents three select financial ratios calculated on a per case study farm basis. The ratios have been calculated using absolute or actual costs per case study farm. In general, the ratios draw particular attention to the immateriality of environmental regulation costs in relation to other production costs incurred by potato producers. The highest proportion of total costs that environmental regulations exhibit is 1.3% in Prince Edward Island's ratios are significantly higher because of the vegetative buffer zone regulation. Specifically, per farm regulation cost as a percentage of capital cost is high in this region because of high relative regulation cost in relation to a moderate annual capital cost.

Table 10: Comparative environmental cost ratio analysis

PROVINCE	ENVIRONMENTAL COST		
	Total cost	Total revenue	Annual capital cost
		Percent	
Alberta	0.36	0.29	1.39
Manitoba	0.14	0.14	0.56
Ontario	0.09	0.08	0.44
Quebec	0.63	0.50	4.19
New Brunswick	0.00	0.00	0.07
Prince Edward Island	1.26	1.68	12.68

Environmental regulation costs as a percentage of capital costs are also slightly higher in Quebec due to the second highest per farm regulation cost numerator and low annual capital cost denominator.

Regulation costs in Alberta and Manitoba as a percentage of annual capital costs are also notable because these provinces have high irrigation infrastructure investment (capital) and moderate regulation costs.

Summary of financial impacts

One set of financial impacts that is not addressed in the analysis of the impacts is the set of indirect costs associated with environmental regulations. Examples of this would be the costs associ-

ated with environmental compliance in the storage of fuel, and compliance with endangered species legislation. These costs have not been included for two reasons (a) it is extremely difficult to estimate the portion of those costs that would apply specifically to potato production and (b) we expect these costs are not significant because of the minimal financial impact on the cost of potato production in Canada and the size of potato production in Canada in relation to other sources of impact that may exist.

SECTION 6

Socio-economic assessment

As outlined in the methodology, it is not possible to generate a quantitative evaluation from existing data of the social costs of environmental regulations for potato production at this time. However, the qualitative assessment that follows has been developed using information from discussions with farmers and farm associations combined with anecdotal evidence from enforcement officers and literature assessing changes in the six provinces considered in this study. This combination of information sources allows for a very general, national overview that is presented in light of the current environmental situation in the provinces reviewed and more specifically potato production in those six provinces.

Individuals responsible for enforcement of environmental regulations were contacted in Alberta, Manitoba, Ontario, Quebec, P.E.I. and Nova Scotia. Despite the geographic disparity, their responses to questions regarding enforcement of environmental regulations pertaining to potato production and levels of compliance were comparable. Consistently they reported that levels of compliance were very high based on charges laid, warnings issued and personal experience. Some estimated as high as 99%. However, when questioned further it was evident that enforcement often occurs either as a result of reports of non-compliance or previously determined 'target' sectors for a finite period of time. Additionally, while enforcement officers were able to provide opinions about the level of compliance in the agriculture sector, they were unable to segregate compliance into different types of production or farm operations such as potatoes, other crops or livestock.

Feedback regarding levels of compliance was also solicited from individuals involved in the agricultural sector either through non-government agricultural organizations, or with Federal and Provincial Departments of Agriculture. The responses from this line of interviews were not as confident in compliance levels as those provided by enforcement officers, but they consistently indicated that the majority of producers comply (estimates were 80% or greater).

Finally, to provide academic support to the anecdotal observations of enforcement officers and industry experts relevant literature addressing environmental indicators has been reviewed. The two most prominent sources include the most recent (6th Edition, 2004) of the Fraser Institute's reports analyzing environmental indicators in Canada, and Agriculture and Agri-Food Canada's 2005, Environmental Sustainability of Canadian Agriculture Agro-Environmental Indicator Report Series #2. Overall, the findings of the Fraser Institute indicate that environmental trends in Canada are improving, while the findings of the Agriculture Canada Report will be discussed in further detail below.

As discussed earlier in this document, potatoes are an intensive crop that requires a significant amount of inputs (chemicals and water) and can be resource depleting (soil condition) if not managed properly. As a result of producing this 'demanding' crop there are number of negative environmental impacts that could arise including but not limited to:

- *water pollution as a result of erosion*
- *water pollution as a result of pesticide contamination*
- *water pollution as a result of fertilizer contamination*
- *watershed damage as a result of improper irrigation infrastructure*
- *watershed/habitat damage as a result of pesticide/fertilizer contamination*
- *soil condition damage – compaction as a result of intensive production without adequate rotations*
- *soil damage – SOM loss as a result of insufficient rotations*
- *soil damage – loss of tilth*

Therefore it is relevant to consider the trends of those indicators that would reflect the impact of potato production. Of the 15 AAFC indicators outlined in Table 12 and presented in Environmental Sustainability of Canadian Agriculture Agro-Environmental Indicator Report Series #2 (2005), soil cover, nitrogen use efficiency, water erosion, tillage erosion, soil organic carbon, and nitrogen in water, indicators are most likely to be impacted by changes in potato production practices.

Table 1: National Agri-Environmental Indicators

ISSUE	INDICATOR RESULTS (2001 NATIONAL SNAPSHOT)	TREND (1981-2001)
Environmental farm management		
Soil cover	32% of cropland in the high and very high soil cover classes (300 soil cover days or more)	Improving
Nitrogen use efficiency	28% of cropland in the low or very low classes for Residual Soil Nitrogen	Worsening
Energy use efficiency	3% decline in the energy use efficiency ratio	Worsening
Soil quality		
Water erosion	86% of cropland in the very low class for the Risk of Water Erosion Indicator	Improving
Wind erosion	86% of cropland (Prairies) in the very low risk class for the Risk of Wind Erosion Indicator	Improving
Tillage erosion	50% of cropland in the very low risk class for the Risk of Tillage Erosion Indicator	Improving
Soil organic carbon	31% of cropland in the large increase class for the Soil Organic Carbon Change Indicator	Improving
Soil salinization	70% of agricultural and adjacent land (Prairies) in the very low risk class for the Risk of Soil Salinization Indicator	Improving

Table 1: National Agri-Environmental Indicators (Continued)

ISSUE	INDICATOR RESULTS (2001 NATIONAL SNAPSHOT)	TREND (1981-2001)
Water quality		
Nitrogen	65% of farmland in the low or very low risk classes for the Risk of Water Contamination by Nitrogen Indicator	Worsening
Phosphorus	29% of agricultural land (Quebec) in the low or very low risk classes for the Risk of Water Contamination by Phosphorus Indicator	Improving
Air quality		
Greenhouse gases	4.4% (2.5 Mt CO_2eq) reduction in the Agricultural GHG Budget (net emissions)	Improving
Biodiversity		
Wildlife habitat on farmland	19% of farmland showing a moderate or large increase in the Wildlife Habitat Capacity Indicator	Worsening

Source: Environmental Sustainability of Canadian Agriculure: Agri-Environmental Indicator Report Series #2. Agriculture and Agri-Food Canada, 2005.

These indicators and their limitations as presented in the AAFC 2005 report are summarized below.

Soil cover is an assessment of the number of days in a year in which cropped land is covered (preventing erosion and soil damage). Overall, the trend in Canada is an increase in cover from '81 to '01. Limitations of this indicator include the assumption that prior to '91 all crop and summerfallow was under conventional tillage (because information about conservation and zero till systems was not collected until 1991). Also, there is an assumption that different crops do not require different tillage practices. The discussion around this indicator noted the importance of using green manure or inter-row grasses to improve soil cover for low residue crops like potatoes.

The nitrogen use efficiency indicator, or residual soil nitrogen measures the amount of nitrogen that has been applied to soil but not removed in the harvested portion of the crop. In general this value was low and stable between 1981 and 1996 but increased significantly in 2001 (likely the result of a combination of increases in pulse acreages, lower crop yields and droughts which decreased uptake in much of the country). These factors present one of the limitations of this indicator – there are circumstances like drought that are beyond producer control and can have a significant impact on indicator trends. Additionally, while this measure addresses nitrogen application vs use, there is no accounting for the impacts of excess nitrogen. This is addressed by the risk of water contamination by nitrogen indicator. Other limitations of the residual soil nitrogen indicator include dependence on provincial recommendations for nitrogen input, which may be out of date, and the number of assumptions and approximations that are included in the calculation of the indicator. Finally, the 5-year lag between census data is a limitation, not only of this indicator, but of all indicators that require time sensitive and comparable information.

Water erosion is a significant problem in areas like Prince Edward Island where the combination of sloping land and row cropping can lead to substantial amounts of erosion. In fact, while the majority of cropland in Canada (86%) is in the very low risk class, the remaining 14% is at risk as a result of summerfallow and row cropping on sloping land. The most significant limiting factor for this indicator is that the calculations did not take into account some erosion control practices such as grassed waterways, strip cropping, terracing, contour cultivation and winter cover crops.

Many of these are common practices in areas with erosion concerns and as such risk will be over estimated.

The combination tillage practices and highly erodible landscapes can lead to a high risk of tillage erosion. As a result of improved tillage practices, this indicator is trending downward on average, however, sloping and row cropping has lead to continued high risk in areas like Ontario, New Brunswick and Prince Edward Island. In fact, and increase in potato production had a significant impact on the increase of risk in Prince Edward Island. Limitations of this indicator include a lack of research and subsequent data regarding tillage erosion as well as generalizations in terms of even cropping distribution and consistent erosion over landforms.

As soil organic matter is an important indicator of soil health, the soil organic carbon indicator was developed to assess how these levels are changing. Nationally, Canada has moved from a net loss of soil organic carbon in 1991 to a net gain in 1996 with most of the improvements occurring in the prairies. Research is currently in progress to refine the methods used to calculate carbon changes in agricultural soils.

Although nitrogen residue is addressed in an earlier indicator, the indicator of the risk of water contamination by nitrogen illustrate what can happen as a result of excess soil nitrogen. This indicator evaluates risk by combining results of the residual soil nitrogen indicator with environmental and land conditions in the area. As a result of substantially increased soil nitrogen residue in 2001, this indicator is also trending upwards although 65% of farmland remains in the low and very low risk classes.

A summary of the trends in each of these indicators for the 6 provinces considered in this report is presented in Table 13.

Table 2: Agricultural environmental indicator trends by province

	ALBERTA	MANITOBA	ONTARIO	QUEBEC	NEW BRUNSWICK	PRINCE EDWARD ISLAND
Soil cover	Increasing	Increasing	Increasing	Slight decrease	Slight increase	Slight increase
Residual soil nitrogen	Low '81-'96 high 2001	High	Moderate '81-'96 high 2001	Low '81-'96 moderate 2001	Moderate '81-'96 high 2001	Moderate '81-'96 high 2001
Water erosion risk	Low and improving	Low and improving	High but improving	Moderate	Low slight improvement	Moderate slight increase
Tillage erosion risk	Low and improving	Low and improving	Moderate, large amounts in high erosion risk, but improving	Increased erosivity but low erosion due to land characteristics	Over 50% of land in high risk area but improving	Over 50% of land in high risk area and worsening
Soil organic carbon (% of land by change occurring)	29% increasing, 18% stable, 53% decreasing	52% increasing, 8% stable, 40% decreasing	30% increasing, 12% stable, 58% decreasing	17% increasing, 83% decreasing	Atlantic Canada, 53% increasing, 8% stable, 39% decreasing	
Risk of water contamination by nitrogen	↓ in low risk, ↑ in moder. risk No land in high risk	↓ in low risk ↑ in moder. risk Majority of land in high risk	↓ in low risk ↑ in high risk	↓ in low risk ↑ in moder. risk ↑ in high risk	Atlantic Canada ↓ in low risk, ↑ in high risk	

Source: Environmental Sustainability of Canadian Agriculture: Agri-Environmental Indicator Report Series #2. *Agriculture and Agri-Food Canada, 2005.*

AAFC is currently in the process of developing a water use efficiency indicator that would be very applicable to potato production. One of the limitations of this indicator that is already apparent is the challenge in working with a lack of reliable water data as this information is not collected on a large scale across the country and will have to be compiled from a number of sources. Another indicator under development that will be a reflection of potato production practices is an integrated pest management ("IPM") adoption index. The most significant challenge associated with this indicator will be the collection of accurate and statistically significant data regarding the use of IPM systems and practices.

There are several limitations with using these indicators to represent the impacts of potato production. The first is that, in all of the provinces except New Brunswick and Prince Edward Island, potato production is a very small portion of annually cropped land; second it is difficult to isolate the impacts of potato production from those of other intensive production systems which are likely to occur in the same regions; third in terms of the specific impacts of regulations, it is very difficult to tell what benefits are the result of regulations as opposed to those that arise out of the use of environmental farm plans, and other best management practices. Included in the most recent AAFC Agri-Environmental Indicator Report is an acknowledgement that in many cases, good management practices are being used on farms across Canada. As noted by an interview with a Prince Edward Island potato specialist, very often producers do not get credit for what they have done and continue to do voluntarily that is in the best interests of the environment.

The environmental indicator analysis of AAFC combined with anecdotal evidence from soil science experts and best management practices, indicate that nationally, the impact of agriculture on the Canadian environment is improving. However, there are also evident limitations in these indicators such that it is impossible to determine whether improvements are the result of current regulations, best management practices, growing conditions, markets or a combination of them all. Regardless, based on the volume of land involved the overall environmental impact of potato production in Canada is not likely to be substantial.

Table 14 on the next page illustrates the volume of agricultural land in each of 6 provinces, the land in crops and the land growing potatoes. P.E.I. and New Brunswick stand out in terms of the concentration of potato production. It is likely that, especially in P.E.I., one of the reasons for the more stringent environmental regulations is density of agricultural production. However, even in P.E.I. and New Brunswick, taking into consideration only the top three potato producing census regions, potatoes comprise only 1/4 and 1/3 of total crop production respectively. Further, potato production in all other parts of the country is a minor portion of total agricultural land and total crop land.

This leads to the conclusion that while the environmental state of the country may be improving, based on the volume of potato production in the country, it is not apparent that this is the result of environmental regulations in the potato sector.

Finally, while it was within the scope of this study to analyze Federal and Provincial Regulatory Impact Assessment Statements ("RIAS") that had been generated for the environmental regulations included in this analysis, a comprehensive search did not uncover such documents at either the Federal or Provincial level. This comprehensive search included a search of the Canada Gazette, in which all Federal RIAS are published, as well as searches of each provincial website. Further, questions about the existence of Provincial RIAS were raised in interviews with Provincial Agriculture and Environment officials and none of these individuals were aware of RIAS available regarding environmental regulations impacting potato production.

Table 3: 2001 agricultural land use in Canada by province and top 3 potato producing census regions in each province

PROVINCE	HECTARES			POTATOES (% OF TOTAL)	POTATOES (% OF CROPS)
	Total area of farms	Land in crops	Potatoes		
CANADA	67,502,446	36,395,150	169,475	0.25	0.47
NEWFOUNDLAND AND LABRADOR	40,578	8,435	255	0.63	3.02
Top 3 census regions[a]	29,066	5,329	163	0.56	3.06
PRINCE EDWARD ISLAND	261,482	175,488	43,256	16.54	24.65
Top 3 census regions[b]	261,482	175,488	43,256	16.54	24.65
NOVA SCOTIA	407,046	119,219	2,070	0.51	1.74
Top 3 census regions[c]	153,291	53,101	2,012	1.31	3.79
NEW BRUNSWICK	388,053	148,883	23,620	6.09	15.87
Top 3 census regions[d]	138,388	65,837	22,257	16.08	33.81
QUEBEC	3,417,026	1,849,938	19,097	0.56	1.03
Top 3 census regions[e]	83,031	47,526	5,676	6.84	11.94
ONTARIO	5,466,233	3,656,705	17,562	0.32	0.48
Top 3 census regions[f]	361,273	250,870	10,082	2.79	4.02
MANITOBA	7,601,779	4,714,830	31,398	0.41	0.67
Top 3 census regions[g]	2,670,701	1,957,519	30,114	1.13	1.54
SASKATCHEWAN	26,265,645	15,375,929	5,102	0.02	0.02
Top 3 census regions[h]	3,473,914	2,110,999	3,001	0.09	0.14
ALBERTA	21,067,486	9,728,181	23,610	0.11	0.24
Top 3 census regions[i]	4,391,962	1,710,037	19,851	0.45	1.16
BRITISH COLUMBIA	2,587,118	617,545	3,507	0.14	0.57
Top 3 census regions[j]	82,196	37,340	2,613	3.18	6.70

[a] *Division No. 1, division No. 7 and division No. 4.*

[b] *Agricultural regions 1, 2 and 3.*

[c] *Annapolis County, Kings County, Cumberland County.*

[d] *Carleton County, Victoria County, Madawaska County.*

[e] *Le fjord du Saguenay, l'île d'Orléans, Joliette.*

[f] *Brant County, Simcoe County, Dufferin County.*

[g] *Agricultural regions 2, 7 and 8.*

[h] *Agricultural regions 3AN, 6B and 7B.*

[i] *Division No. 1, division No. 2 and division No. 8.*

[j] *Greater Vancouver Regional District, Squamish-Lillooet Regional District, Central Kooteny Regional District.*

Source: Statistics Canada, 2001 Census of Agriculture.

SOCIO-ECONOMIC IMPACT (BENEFITS)

One way to estimate social benefits is to use social costs as a proxy. While this may be a valid estimate, an accurate assessment of benefits will require a much more detailed approach.

Following the suggestion of EcoRessources in their 2000 Phase I, representative farm models have been developed for each of the 6 key provinces. Further, the application of these per acre costs to the total number of acres in potato production theoretically allows for the estimation of total private economic costs which it could be suggested may be used as a proxy for total social costs. However, we believe this value grossly underestimates the social benefits and is therefore of little value for consideration. Some alternate methodologies are discussed below. However data does not currently exist to develop these models. We provide them for future consideration of analysis.

Alternative models considered

Input-output

An Input-Output model can be developed by creating an input-output relationship that illustrates flows into and out of different sectors of the economy. The major value of an input-output model is the ability to determine the impact of shocks to the economy by monitoring how those flows respond to that shock. With further investigation into the economic impact of environmental regulation, it became apparent that in the potato sector, environmental regulations have not resulted in a shock to the system. As discussed earlier in this document, the two pieces of legislation that consistently impact potato production in the 6 provinces analyzed are regulations involving pesticide use and those outlining buffer zone requirements. The reality is that neither of these regulatory sets have resulted in dramatic changes in costs to potato producers or the way that they operate. As a result, the completion of an input-output model would not be effective in illustrating the range of external effects of environmental regulations in the potato sector. Also, the available factors to adjust total expenditures on environmental protection are not currently available for potato production, or even agricultural production. Currently the only level of detail pertains to food production which includes the industrial and processing portion of the food industry.

Methods of valuing resources

Since potential water contamination is one of the main targets of environmental regulations for potatoes, one method used to determine the value of a non-market good such as clean water is to give it a market value. Following this approach it would be possible to determine the value of each of the natural resources impacted (or not impacted) and making the sum value of each resource, such as water, a proxy (albeit a conservative one). In the case of a resource such as water, this valuation would involve assessing the value of potable water by determining the population that lives downstream from potential sources of water pollution, (i.e. potato production), who use surface water as a source of potable water and do no have access to urban water treatment plants. The replacement cost of access to potable water is the cost of that entire population having to purchase bottled water for their daily use (as a result of water contamination). Although it would take time for agricultural impacts to result in a level of damage where water was completely unfit for consumption, considering that the impact of the potential damage needs to be the value of the impact carried into perpetuity this is a reasonable cost estimate. A valuation method such as this would result in a conservative cost estimate because it calculates a value using the highest quality use. However, it also fails to account for tertiary costs such as costs associated with transportation of bottled water and increased plastics use for containers

and does not account for other benefits of clean water such as recreational uses. As outlined before, valuing social benefits is an extremely complex process.

To continue this example, in developing this cost proxy an impact analysis would need to determine the percentage of the population that lives downstream from potato producing areas. The Oldman River area of Alberta feeds into the major river system in Saskatchewan which flows north through northern Manitoba. The southern part of Manitoba includes substantial rivers like the Assiniboine that travels across the southern part of the province through Winnipeg and then north to Lake Winnipeg. The southern region of Ontario lies along the St. Mary River which feeds into the St. Lawrence and out past the areas of Quebec with significant areas of potato production. Prince Edward Island is small enough land mass that quality changes in surface water have an impact on a large portion of the population, and New Brunswick is the source of numerous rivers and watersheds that ultimately feed into the ocean nearby.

Much like the method above that values clean water based on an avoided cost method using the market cost of bottled water, it is possible to value soil organic matter using the market value for carbon credits. A recent program also administered by the Saskatchewan Soil Conservation Association is the Pilot Emission Removals, Reductions and Learnings Initiative (P.E.R.R.L) initiated by Environment Canada. In the program, Environment Canada pays program administrators $18.71 per tonne of CO_2 equivalent sequestered in the soil through increased soil organic matter (ultimately through reduced tillage practices). For example, a producer in the brown soil zone who moves from reduced till to zero till will sequester .53 tonnes per hectare of CO_2 per year through increase soil organic matter. That is, Environment Canada has valued this increase in soil organic matter at $18.71/tonne of CO_2 equivalent. As there is already trade of carbon credits beginning to occur, this is a reasonable valuation of the benefits of soil organic matter.

Avoided costs

Erin Tegtmeier and Micheal Duffy[8], have used another method, similar to one of the approaches used by the Environmental Protection Agency in the United States, in an attempt to quantify the external costs of agricultural production in the United States. A summary of their results breaks down cost categories, identifies the relevant costs and points out whether crops or livestock are the main cause of that particular cost.

If these values are reasonable estimates of costs born by society as a result of agricultural impacts on the environment, another way of valuing the benefits of environmental regulation is to consider an avoided costs model. In order to duplicate this level of analysis in Canada, it would be necessary to gather all recent and relevant impact valuation literature. The findings of these documents would then need to be revised using current population, production, environmental damage and repair, health and other data in order to effectively scale the values to the unique Canadian situation. Obtaining literature that values all of the externalities is a challenge, but the most difficult aspect of this type of modeling will be gathering national data that can be used in adjusting the results. As noted by the Fraser Institute (2004), in the case of water alone, there is no national standard to measure quality against, nor are there guidelines for frequency of testing in terms of both time and space. The result is a wide variety of inconsistent monitoring that makes evaluating impact, or valuing quality difficult at best.

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8. *Tegtmeier, Erin and Micheal D. Duffy. External Costs of Agricultural Production in the United States. International Journal of Agricultural Sustainability. Vol. 2, No. 1, 2004.*

One of the many challenges with valuing social benefits is the number of variables that must be taken into consideration. Benefits of environmental regulations that should be considered in the course of impact analysis include the protection of water and soil resources, fish habitat, and soil quality. Additionally there are benefits that accrue from recreational use of water, prevention of health damage from pesticide contact, and a multitude of indirect benefits including but not limited to prevention of increased green house gas emissions as a result of not requiring greater levels of inputs to support depleted soil, and prevention of green house gas emissions as a result of not having to truck water to locations where water has been contaminated from soil or pesticides.

Evaluation of regulations according to smart regulation principles

The Government of Canada has launched the Smart Regulation initiative in an effort to improve the regulatory system to "keep pace with today's realities and our evolving needs. It strives for a better coordinated, more transparent system that remains forward-thinking, progressive, and accountable to the citizens it serves."[9] Much of this initiative has been launched through 2005. The publishing of the first report on actions and plans for Smart Regulations was released in March of 2005. In the Phase 1 report, the authors suggest a set of criteria against which to test the "smartness" of the set of environmental regulations:

- *Effectiveness*
- *Economic efficiency*
- *Cost effectiveness*
- *Flexibility*
- *Enforcement mechanisms*
- *Transparency*
- *Fairness and equity*
- *Coherence*

Because the concept of Smart Principles is very new, most public industry professionals, whether environmental or agricultural, declined to express definitive opinion whether or not specific regulations met specific components of the Smart Regulation criteria as set out above. All of the regulations currently in place were developed outside of the current Smart Regulation framework, so we are evaluating these principles ex-post for their ability to meet Smart Regulation criteria. The major comparative is the balance between agronomic commercial production and protecting the environment. In terms of the federal government, this then speaks to these principles primarily across departments of Agriculture and the Environment.

The information we received would suggest that there is reasonably good communication between the departments of Agriculture and the departments of the Environment at the National level as regulation has been developed. This opinion is however subjective, and there is not adequate information in the form of RIAS statements or other documentation to provide substantive evidence to support this. Practically however, it does seem that most of the regulations are devel-

9. Government of Canada. Regulations Website. http://www.regulation.gc.ca

oped with some intent to provide reasonably effective means of managing the environmental issue with consideration to an agronomic point of view. We conclude this because environmental regulation concerning potato production does not generally impede production in the various jurisdictions and we have not found evidence that cost of environmental regulation generally limits potato production in any of the jurisdictions. This would suggest that there is an effort to be reasonable and fair in the development of environmental regulation that affects potato production.

In reality as was identified in the Phase 1 report, there are differing degrees of regulation, measured as to there level of reliance on voluntary verses control measures. In agriculture considerable emphasis has been placed on the educational and "advisory" components of environmentally responsible agriculture, and generally speaking these measures as they relate to the handling and use of hazardous chemicals, fuel storage, responsible soil cultivation and protection of water ways have been enormously effective in recent years in improving farm practices, albeit these benefits are very difficult to measure.

The "smartness" of existing agri-centred environmental regulations have not yet developed to satisfy those criteria that currently foster the cross compliance of various issues affecting potato farmers. That is to say that most regulations operate in isolation of other government programs that affect potato farmers. By example, farmers that apply for government funding programs do not have their application linked to their compliance with environmental regulation. Therefore, it is felt that many other government programs for funding do not necessarily promote the most ideal environmental responsibility. This thinking concludes that more financial farm support linked to crop production generally promotes more intensive production of potatoes which in turn generally can have a negative impact environmentally (danger of correlating with the use of more chemical and shorter crop rotations etc.).

Department of Fisheries and Oceans, Canada is responsible for the natural waterways and regulate the interaction of the natural habitat with the activities of agriculture, particularly irrigation. Where farmers are responsible for those requirements directly, criteria for those developments seem to not be well understood by many farmers. This would suggest more needs to be done to improve the expectations in area of activity in and around natural waterways used for irrigation.

We can assume farmers are generally honest responsible operators that, given the right knowledge will make responsible decisions and operate to protect their environment. That is why regulations that require management plans, although not particularly popular with farmers, go a long way to provide an essentially self-policing commitment to environmental regulatory compliance. This speaks highly of both an effective and efficient regulation.

In terms of flexibility, the current regulation set, particularly at the provincial level, tends to be more prescriptive (specific buffer zones, specific phosphorous applications) rather than farmer determined abatements and restricted leeching specifications. It seems that where regulation exists, they are designed with prescriptive measures for clarity in interpretation and ease of monitoring.

Finally on page 71 of the Phase 1 report a questionnaire was developed to assist in determining the "smartness" of the environmental regulation set. In the absence of RIAS statements and in the absence of opinion from experts in government departments in agriculture and the environment opinions of the consultants would be too subjective at this point in time to be meaningful for this study.

Conclusion

The results of our economic and environmental impact assessment of environmental regulations in the potato sector point to 2 key findings:

1) For potato producers in most of the country, the cost implications of complying with environmental regulations are insignificant (P.E.I. may be an exception);
2) The condition of the environment in Canada is improving, but this is the result of a wide range of investments and initiatives and it is extremely difficult to trace benefits back to environmental regulations in potatoes specifically.

Given the recent implementation of many of the regulations that affect crop production in some of the provinces in Canada, and given societies continued concern about the impact of industry on the environment, it is likely that the level of regulation affecting potato farmers in Canada will increase in the years ahead. Where some provinces, like P.E.I., have tried to deal with soil quality and soil erosion and run off through regulatory methods, most other provinces have only dealt with direct impact on water sources. Even at that, most regulations that address water quality and impact the farm sector are focused on livestock production and the storage and use of livestock waste.

In terms of cropping practices many of the direct affects relate to permitting processes and costs which in total do not have a material cost impact on potato farms. There are several more regulatory requirements of custom pesticide applicators that do not exist for farmers directly. However, the amortization of these permitting and licensing costs spread over the acres of a commercial operator, again is simply not a material cost for the farmer even if it is an indirect part of the custom application fee charged by the custom operator.

Most of the incremental improvements in recent years of the environmental impact of crop farming, including potato farming have more to do with improved farming practices than environmental regulation influence. These improvements have come about largely because of improved farmer awareness and understanding of the long-term implications of their actions on the environment. Many activities that were unheard of 20 years ago, are now part of the normal routine. Central collection of empty pesticide containers in approved sites and minimum and zero tillage practices are examples of the wide-ranging practices that have become commonplace over this time on Canadian farms. Most of these are not so much a result of regulation than they are a result of awareness and facilitation of technologies and processes that accommodate these practices.

In assessing the impact of regulations on the agricultural sector as they apply to potato farms, it also became evident that not only is it difficult to attribute social costs and benefits specifically to potato farms, it is difficult to attribute benefits to regulations affecting crop farming and agriculture generally. Nationally, potato production does not occupy a significant portion of the total arable land in the country. As we talked to most regulators and enforcement offices it was clear that this crop is not particularly on their radar screen in terms of environmental impact in any particular community or jurisdiction (other than possibly P.E.I. and limited areas of New Brunswick). Most data sources do not monitor or report on potato production separately from other crops. Also, in many cases the influences of other factors on the environment outside of agriculture make it impossible to attribute cause and effect to potato production. Even where phosphate and nitrogen levels are measured, they are often not isolated to the production of one specific crop, but might be a function of several crops and several other factors in the history of the particular property.

Therefore, although it is likely that regulation that promotes voluntary environmentally sound practices in potato production creates significant social and economic benefits. At this time, there is simply no information to isolate those affects and attribute them specifically to regulations in potato farming.

With the focus of this report to provide economic impact assessments, comparatively speaking within Canada, the only significant costs that currently exist for potato farms from environmental regulations are in two key areas. The first relates to buffer zone requirements (currently exist in P.E.I. and Quebec) and the second relates to Department of Fisheries and Oceans requirements to protect natural waterways and habitat, particularly as it affects Manitoba producers. Neither of these cost areas, however, are seen to prohibit, or impede on, or significantly affect the production management choices of potato farmers in those regions.

Social benefits analysis requires considerably more data than has currently been collected for these regulations. We have outlined approaches to better modeling of social costs and benefits, but key data bases for these models are yet to be developed. Consistent national indicators and monitoring processes will facilitate accurate analysis of environmental impact. Even using methodologies like Benefits Transfer, most of the existing literature has been prepared for locations outside of Canada. To make it relevant, there is a significant magnitude of data that is needed to accomplish this in this Canadian sector. To trace cause and effect back to potato production it is necessary to create data that is broken down into smaller aggregation than “agriculture” and in many cases “food production”.

As a visual illustration of the impacts of this set of environmental regulations, Table 15 outlines the set of environmental regulations that apply to potato production, the likely activities that would ensue in the absence of regulation and finally the status of the relevant NAHARP AEI for that province. The complexities of relating indicators and measures of environmental health to regulations and specific types of production are apparent. Also evident is the challenge in attributing the activities of producers to regulations, as in the absence of regulation there are cases where producers’ actions mirror what is regulated in other jurisdictions.

In conclusion, current environmental regulations do not have major economic implications on the agricultural sector for potatoes in Canada. It is not clear at this time that environmental regulations in the potato sector have a significant economic or social impact on Canada. Even though there have been major improvements in farm practices that affect the environment in crop production and potato production, it is not apparent that farm practices are driven by environmental regulation that affect potato production.

Table 1: Summary of regulatory impacts and relevant NAHARP indicators

PROVINCE	REGULATIONS	IMPACT ON PRODUCTION	LIKELY IMPACT IN ABSENSE OF REGULATIONS	RELEVANT NAHARP INDICATOR
ALBERTA	Nothing specific to potato production			Soil Organic Carbon and Risk of Water Contamination by Nitrogen could improve
MANITOBA	Water Rights Act - permits	Minimal cost to producers		Risk of Water Contamination by Nitrogen should be watched
MANITOBA	Water Rights Act - engineering	Ensures environmentally acceptable irrigation systems		As above
ONTARIO	Pesticide Act - course and application required for pesticide applicators license	Ensures pesticide applicators are aware of Federal and Provincial pesticide regulations	EFP's provide this education, likely all producers in that program would comply without the courses	No indicator for pesticides
QUEBEC	Pesticides Act - pesticide application certificate required	No courses required, so no guaranteed level of awareness	EFP's provide this education, likely all producers in that program would comply without the courses	No indicator for pesticides
QUEBEC	Environmental Quality Act - buffer zones required for pesticide application	Minimal/zero evidence of pesticides in watercourses or bodies of water	EFP's provide this education, likely all producers involved in that program would comply without the courses BMP's would dictate the use of buffer zones regardless of regulations	No indicator for pesticides
NEW BRUNSWICK	Clean Environment Act - no contamination of water	It is likely that producers follow BMP's because the regulations lack guidelines for buffer zones, etc.	Minimal, because of the 'absolute' nature of the regulation and the lack of direction regarding suggested buffer zones. Likely producers would follow what they know or BMP's depending on their awareness of BMP's	No indicator addresses pesticides Risk of Water Contamination by Nitrogen is getting worse
NEW BRUNSWICK	Clean Water Act - buffer zones around protected areas	Minimal impact overall because of the number and geographic dispersity of protected areas	Limited	Low water erosion risk
NEW BRUNSWICK	Sloping Land Regulations	Overall, limited impact, but individual producers in sloping areas can be substantially impacted	According to local potato specialist, it is likely that BMP's such as grassed waterways or grass strips would be used in these high risk areas	> 50% of land in high risk for tillage erosion, but improving (no account for grassed waterways or grass strips)
NEW BRUNSWICK	Pesticides Control Act - pesticide application certificate required	Ensures that pesticide applicators are aware of Federal and Provincial pesticide regulations - some cost involved	EFP's provide this education, likely all producers in that program would comply without the courses	No indicator for pesticides

Table 1: Summary of regulatory impacts and relevant NAHARP indicators (Continued)

PROVINCE	REGULATIONS	IMPACT ON PRODUCTION	LIKELY IMPACT IN ABSENSE OF REGULATIONS	RELEVANT NAHARP INDICATOR
PRINCE EDWARD ISLAND	Pesticides Control Act - pesticide application certificate required	Ensures that pesticide applicators are aware of Federal and Provincial pesticides regulations - some cost involved	EFP's provide this education, likely all producers in that program would comply without the courses	No indicator for pesticides
PRINCE EDWARD ISLAND	Environmental Protection Act - buffer zone regulation	Ensures that cropping and chemical application does not occur to close to watercourses and wetlands	EFP's provide this education, possible that producers involved in that program would comply without the regulation	No indicator for pesticides > 50% of land in high risk for tillage erosion and getting worse
PRINCE EDWARD ISLAND	Environmental Protection Act - winter cover regulation	Requires that row cropped land have a winter cover to prevent erosion and damage to water areas	Some producers use green manure and winter cover in absense of regulation. It is likely that with increased education there would be more voluntary efforts	Water erosion risk increasing > 50% of land in high risk for tillage erosion and getting worse
PRINCE EDWARD ISLAND	Crop Rotation Act	Ensures row crops are not continuously cropped - producers must follow row crops with years of grasses and legumes	Crop rotations are a BMP, would happen without regulation. Producers are aware of the damages that continuous cropping does to the soil, their yields, disease control, etc.	Soil organic carbon best in the 6 provinces but coul improve > 50% of land in high risk for tillage erosion and getting worse

Source: Environmental Sustainability of Canadian Agriculture: Agri-Environmental Indicator Report Series #2. Agriculture and Agri-Food Canada, 2005.

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Agriculture and Agri-Food Canada/EcoRessources. 2005. Inventory and Impact Evaluation Criteria – Methodology of Environmental Regulations for the Agricultural Sector. Agriculture and Agri-Food Canada.

Brown, Jeremy S., Kenneth Green, Steven Hansen, and Liv Fredricksen. 2004. The Fraser Institute: Environmental Indicators (6th Edition).
http://www.fraserinstitute.ca/shared/readmore.asp?sNav=pb&id=651

Government of Canada. 2005. Smart Regulation Report on Actions and Plans.
http://www.regulation.gc.ca/default.asp?Language=E&Page=report

Government of Canada Regulation Website.
http://www.regulation.gc.ca/default.asp?Language=e&Page=Home

McRae, T. C.A.S. Smith, and L.J. Gregorich (eds). 2000. Environmental Sustainability of Canadian Agriculture: Report of the Agri-Environmental Indicator Project. Agriculture and Agri-Food Canada, Ottawa.
www.agr.gc.ca/env/naharp-pnarsa (under Related Documents).

Tegtmeier, Erin and Michael D. Duffy. External Costs of Agricultural Production in the United States. International Journal of Agricultural Sustainability. Vol. 2, No. 1, 2004.

APPENDIX A

Cost of environmental regulation: Literature search

One of the objectives of this report was to present a comparison of the cost implications of environmental regulations faced by Canadian potato producers with those faced by potato producers in other regions. When an extensive search failed to uncover any literature discussing environmental regulation costs faced by potato producers in other countries the search was expanded to include all row crops. Unfortunately a search for literature reporting on costs arising from environmental regulation for row crops was also unsuccessful.

Below is a listing of the sources searched for this information, in additional to general search engine research that was conducted. While this list may appear short, it includes the leading information sources in the area of environmental cost analysis including the Environmental Protection Agency in the United States, the Organizations for Economic Co-operation and Development and the Canadian Environmental Valuation Reference Inventory. Also noted below are examples of literature that was uncovered with similar objectives but focused on sectors that were not close enough to potato production to allow for comparison.

http://www.card.iastate.edu/research/tap/trade.aspx

Agricultural Competitiveness

Metcalfe, M.R. "Environmental Regulation and Implications for Competitiveness in International Pork Trade," Journal of Agricultural and Resource-Economics July 2002 27(1): 222-43.

Metcalfe, M.R. "U.S. Hog Production and the Influence of State Water Quality Regulation," Canadian Journal of Agricultural Economics March 2001; 49(1): 37-52.

Beghin J., and M. Metcalfe. "Market Hogs? An International Perspective on Environmental Regulation and Competitiveness in the Hog Industry." Choices 15 (1) (2000): 28-33.

Metcalfe, M.R. "State Legislation Regulating Animal Manure Management," Review of Agricultural Economics Fall-Winter 2000; 22(2): 519-32

http://www.oecd.org/dataoecd/25/41/19430433.pdf

Agriculture, Trade and the Environment: The Pig Sector

http://www.oecd.org/dataoecd/57/38/32163470.pdf

Impacts of Environmental Regulations on Intensive Livestock Production in the Netherlands

http://www.fao.org/trade/pub_en.asp

FAO Trade in Agriculture – no information pertaining to potatoes or row crops

http://www.evri.ca

Environmental Valuation Reference Inventory: Nothing specific to potatoes or row crops

http://www.epa.org

Environmental Protection Agency: No information or research specific to potatoes or row crops

Provincial Government Websites

Alberta:
http://www.gov.ab.ca/home/index.cfm
http://www3.gov.ab.ca/env/protenf/assessment/cea.html

Manitoba:
http://www.gov.mb.ca/index.html
http://www.gov.mb.ca/iedm/invest/busfacts/govt/env_assess.html

Ontario:
http://www.gov.on.ca/
http://www.ene.gov.on.ca/envision/news/2006/060601mb3.htm

Quebec:
http://www.gouv.qc.ca/portail/quebec/pgs/commun
http://www.mddep.gouv.qc.ca/evaluations/inter_en.htm

Prince Edward Island:
http://www.gov.pe.ca/
http://www.gov.pe.ca/infopei/index.php3?number=40190&lang=E

New Brunswick:
http://www.gnb.ca/
http://www.gnb.ca/0009/0373/0001/0011-e.asp

APPENDIX B

List of provincial contacts

Alberta:

- Tricia McAllister – Seed Potato Specialist
  - Alberta Agriculture and Food (780) 415-2315
  - RE: COP numbers, environmental hardships, what is unique in Alberta
- Several People – Inspection and Compliance Division of Alberta Environment
  - (403) 297-8271
  - Re: Environmental regulations and compliance
- Kevin Wilkinson – Alberta Environment, Water Approvals
  - (403) 297-5896
  - Re: irrigation districts, access to water, water and environmental regulations
- Vern Bachue – Potato Growers of Alberta
  - (403) 233-2262
  - Re: environmental restrictions, COP, irrigation districts
- Curtis Englot – Environment Canada, Edmonton
  - Responded to message left in general system
  - Re: environmental regulations and enforcement
- Environmental Impact Assessment Requirements
  - http://www3.gov.ab.ca/env/protenf/assessment/cea.html
  - only applies to development projects

Manitoba:

- Tom Gonsalves – Business Development Specialist – Potatoes
  - (204) 745-5671
  - Manitoba Agriculture and Food
- Ken Pluze – Manitoba Conservation
  - (204) 9445-7067
  - Re: Pesticides and Fertilizers Act

Manitoba: (Cont'd)

- Todd Schwartz – Fish Habitat Biologist – Department of Fisheries and Oceans
  - (204) 983-4231
  - Re: DFO regulations affecting potato producers
- Johan Botha – Prairie Farm Rehabilitation Administration, Engineer
  - (204) 822-7219
- Dana Hill – Landscape Stewardship Specialist
  - Manitoba Agriculture, Food and Rural Initiatives
  - (204) 750-1399
  - Re: Canada-Manitoba Farm Stewardship Program funding available for DFO regulation costs
- Potato Producers – cannot reveal contact information due to confidentiality reasons
  - Re: Cost of environmental regulation compliance
- Environmental Impact Assessment Requirements
  - http://www.gov.mb.ca/iedm/invest/busfacts/govt/env_assess.html
  - only applies to development projects

Ontario:

- Eugenia Banks – Potato Specialist OMAFRA
  - (519) 826-3678
- Don Brubacher – Ontario Potato Board
  - (519) 846-5553
- Pesticides Advisory Committee
  - (416) 314-9230
- Wayne Caldwell – Nutrient Management Advisory Committee
  - (519) 824-4120 ext. 56420
  - Re: Nutrient Management Act
- Violet – Pesticides Standards Branch
  - (416) 327-3699
  - Re: Pesticides Control Act
- Ministry of Environment
  - (416) 325-4000
  - Re: Clean Water Act, Environmental Protection Act
- Charlie Roland – Agricultural Environment Officer, Hamilton District Office
  - (905) 521-7650
  - Re: environmental regulations affecting potato production

Ontario: (Cont'd)

- Finbar Desir – Manager, Engineering and Technology
  - (519) 826-3549
  - Re: list of environmental regulations affecting potato production
- Daryl Finnigan – Resource Management Policy Analyst
  - (519) 826-3843
  - Re: list of environmental regulations affecting potato production
- Environmental Impact Assessment Requirements
  - http://www.ene.gov.on.ca/envision/news/2006/060601mb3.htm
  - only applies to development projects

Quebec:

- Denis Boutin – Direction des politiques en milieu terrestre, Service agricole
  - Ministère du Développement durable, de l'Environnement et des Parcs
  - Tél. : (418) 521-3950 #4462
- Mr. Gilles Hamel – Groupe d'experts en production de pomme de terre
  - (819) 378-0669
- Mr. Dijby Sall – Ministère de l'Agriculture, des Pêcheries et de l'Alimentation
  - (418) 380-2100 poste 3327
- Environmental Impact Assessment Requirements
  - http://www.mddep.gouv.qc.ca/evaluations/inter_en.htm
  - only applies to development projects

Prince Edward Island:

- Linda McFlane – Potato Development Officer
  - (902) 368-5606
- Paul McPhail – Potato Development Officer
  - (902) 368-5606
  - Re: RIAS, COP numbers
- Ivan Newnan – P.E.I. Potatoes
  - (902) 892-6551
  - Re: enviro regulations, COP
- Mike Nabuurs – Federation of Agriculture
  - (902) 368-7289
  - Re: regulations, impact of producers, compliance
- Dwight Thompson – Legislative and Program Specialist
  - (902) 620-3119
  - Re: Relevant Acts and Regulations

Prince Edward Island: (Cont'd)

- Brian Craig – Enforcement officer
  - (902) 368-4044
  - Re: enforcement and compliance
- Potato Producers – cannot reveal contact information due to confidentiality reasons
  - Re: Cost of environmental regulation compliance
- Environmental Impact Assessment Requirements
  - http://www.gov.pe.ca/infopei/index.php3?number=40190&lang=E
  - only applies to development projects

New Brunswick:

- Brian Duplessis – Manager Potato Development Centre
  - (506) 392-5199
  - had no COP information – is willing to help, but in this case directed me to Potatoes New Brunswick
- Rob Gareau – Potatoes New Brunswick
  - (506) 276-1820
  - most recent COP information is from 1994. This organization will be a good resource for other inquiries, but are in the process of collecting new COP info themselves so will be of limited assistance in that regard.
- Roger Theriault – Ag Consultant for Environmental and local government
  - (506) 856-2374
  - Re: regulations and compliance
- Environmental Impact Assessment Requirements
  - http://www.gnb.ca/0009/0373/0001/0011-e.asp
  - only applies to development projects

APPENDIX C

Average yield, revenue and harvested acres

ALBERTA			
Year	Average yield (cwt/hectare)	Average price (per cwt)	Harvested area (hectares)
2001	778	8.70	23,200
2002	692	9.70	22,600
2003	815	8.54	24,700
2004	865	8.58	23,100
Average	**788**	**8.88**	**23,400**

Source: Statistics Canada.

MANITOBA			
Year	Average yield (cwt/hectare)	Average price (per cwt)	Harvested area (hectares)
2001	578	8.35	30,200
2002	544	8.16	34,000
2003	605	7.44	41,100
2004	605	7.61	37,600
Average	**583**	**7.89**	**35,725**

Source: Statistics Canada.

ONTARIO			
Year	Average yield (cwt/hectare)	Average price (per cwt)	Harvested area (hectares)
2001	457	11.95	17,300
2002	413	13.93	16,900
2003	507	11.01	17,800
2004	499	9.82	15,800
Average	**469**	**11.68**	**16,950**

Source: Statistics Canada.

QUEBEC			
Year	Average yield (cwt/hectare)	Average price (per cwt)	Harvested area (hectares)
2001	568	11.64	18,600
2002	520	10.72	19,400
2003	587	7.84	19,800
2004	656	7.87	18,700
Average	**583**	**9.52**	**19,125**

Source: Statistics Canada.

NEW BRUNSWICK			
Year	Average yield (cwt/hectare)	Average price (per cwt)	Harvested area (hectares)
2001	618	10.86	23,200
2002	642	8.09	23,500
2003	630	6.37	23,700
2004	704	5.68	23,500
Average	**649**	**7.75**	**23,475**

Source: Statistics Canada.

PRINCE EDWARD ISLAND			
Year	Average yield (cwt/hectare)	Average price (per cwt)	Harvested area (hectares)
2001	425	10.52	43,300
2002	692	7.71	43,500
2003	655	5.87	42,700
2004	680	5.79	42,700
Average	**613**	**7.47**	**43,050**

Source: Statistics Canada.

APPENDIX D

Inflation calculations

ALBERTA (TYPICAL TOTAL FARM COSTS)			
	2000	2004	Inflation rate
Seed	121,587	153,397	26%
Fertilizer	513,237	602,397	17%
Chemicals	330,559	324,838	-2%
Fuel, oil and lube	384,869	401,462	4%
Irrigation fuel	1,085,417	1,109,701	2%
Hired labour	488,071	523,423	7%
Crop insurance	63,154	156,476	148%
Rent	194,218	223,195	15%
Maintenance and repairs	599,405	649,991	8%
Insurance	80,758	99,704	23%
Utilities	222,554	291,819	31%
Interest	572,786	485,586	-15%
Taxes	106,025	107,917	2%
Other	16,030	16,492	3%
Average			**19%**

Source: Statistics Canada.

NEW BRUNSWICK (TYPICAL TOTAL FARM COSTS)			
	1994	2003	Inflation rate
Tax	2,016	2,820	39.9%
Rent	3,348	4,861	45.2%
Interest after rebates	17,932	26,958	50.3%
Building and fence repairs	6,541	7,651	17%
Electricity	5,237	6,719	28.3%
Telephone	2,105	3,077	46.2%
Heating fuel	2,230	3,772	69.1%
Fertilizer	15,044	23,509	56.3%
Other	3,733	4,884	30.8%
Depreciation	27,758	42,655	53.7%
Average			**43.7%**

Source: Statistics Canada.

PRINCE EDWARD ISLAND (TYPICAL TOTAL FARM COSTS)			
	1995	2003	Inflation rate
Tax	2,504	2,906	16.1%
Rent	10,085	13,121	30.1%
Wages	42,284	57,623	36.3%
Interest after rebates	21,288	29,375	38%
Building and fence repairs	5,023	6,682	33%
Electricity	4,784	5,694	19%
Telephone	1,931	2,537	31.4%
Heating fuel	1,017	1,701	67.3%
Fertilizer	32,965	38,980	18.2%
Miscellaneous	18,574	24,613	32.5%
Depreciation	28,505	36,014	26.3%
Average			31.7%

Source: Statistics Canada.

APPENDIX E

Detailed cost of production budgets for selected provinces

	ALBERTA 2004	MANITOBA 2005	ONTARIO 2003	QUEBEC 2003	N.B. 2003	P.E.I. 2003
Production costs (per ha)						
Seed	514.39	662.04	1,023.01	863.93	536.09	751.50
Fertilizer	339.19	298.38	733.90	815.15	518.34	788.91
Chemicals	558.50	595.64	684.47	437.41	802.37	673.42
Other	–	–	59.30	–	–	–
Total production costs	**$1,412.08**	**$1,556.06**	**$2,500.68**	**$2,116.49**	**$1,856.80**	**$2,213.84**
Operating costs (per ha)						
Fuel	163.93	133.46	–	172.75	195.27	231.45
Irrigated fuel	140.79	80.26	–	–	–	–
Trucking	–	98.54	–	–	–	–
Hired labour	768.50	419.38	600.46	492.85	805.92	1,256.05
Unpaid wages	–	–	–	–	–	117.86
Wage benefits	–	–	51.89	–	–	–
Crop insurance	55.10	–	–	–	248.52	91.09
Licenses	–	–	–	–	78.11	71.57
Other	191.68	184.31	–	–	74.56	98.23
Rent	–	–	–	63.43	81.66	241.12
Custom work	295.92	206.53	–	93.27	28.40	26.03
Maintenance and repairs	413.46	439.69	637.53	458.54	436.69	489.79
Insurance	27.46	185.60	–	80.64	102.96	74.82
Utilities	421.21	74.33	–	83.71	99.41	82.35
Business expense	–	–	–	–	42.60	–
Legal and professional fees	–	–	–	–	–	35.79
Taxes	215.29	–	–	38.65	21.30	22.94
Interest and bank charges	29.43	92.91	–	93.53	575.15	351.20
Marketing costs	–	–	116.14	48.63	–	–
Total operating costs	**$2,722.78**	**$1,915.02**	**$1,406.01**	**$1,626.00**	**$2,790.53**	**$3,190.28**
Capital costs (per ha)						
Interest	–	–	103.78	198.06	63.91	136.64
Depreciation equipment	465.79	744.52	–	464.17	323.08	351.35
Depreciation buildings	–	–	–	–	99.41	87.84

	ALBERTA 2004	MANITOBA 2005	ONTARIO 2003	QUEBEC 2003	N.B. 2003	P.E.I. 2003
Land	810.95	197.68	380.54	–	–	–
Other	163.37	–	471.97	–	–	22.77
Investment	–	257.11	–	–	–	–
Total capital costs	$1,440.11	$1,199.31	$956.29	$662.23	$486.39	$598.60
Total costs (per ha)	$5,574.97	$4,670.39	$4,862.98	$4,404.72	$5,133.72	$6,002.72

Source: Estimated from Alberta Agriculture, Food and Rural Development, "Estimated Production Costs and Returns for Processing Potatoes" 2000 and adjusted for inflation, see Appendix D.

Manitoba Agriculture, Food and Rural Initiatives "Irrigated Processing Potato - Cost of Production 2005".

Ontario Potato Board[10] "2003 Processing Potato Cost of Production".

Ministère de l'agriculture, des pêcheries et de l'alimentation, « Pommes de terre - Coût de production - Janvier à décembre 2003 ».

Estimated from New Brunswick Agriculture, Fisheries and Aquaculture "Process Potato Enterprise Average Expense per Acre" 1994 and adjusted for inflation see Appendix D.

Estimated from Prince Edward Island Agriculture and Forestry "Cost of Production - P.E.I. Table & Processing Potato Farms" 1995 and adjusted for inflation see Appendix D.

The preceding table lists the detailed cost of production information behind each line item presented in the provincial potato cost of production budgets in the body of the report. Due to a number of factors including allocation differences, out of date information and differing production methods in each region, many of the line items included in the budgets are largely variable. The budget information provided by provincial departments or producer groups in Manitoba, Ontario and Quebec. The Alberta, New Brunswick and Prince Edward Island budgets were calculated by applying an operating expense index to provincial cost of production budgets that were, for the purposes of the study, out of date. The indices consisted of whole farm operating expense statistics from Statistics Canada. The calculated percentage change in each line item category was applied to the respective line item in the cost of production budget to create a calculated current cost of production budget.

The Alberta, New Brunswick and Prince Edward Island calculated cost of production budgets were discussed with provincial potato specialists. Government staff were able to point out line items that were over or under estimated, however, when we applied these changes, it did not change the overall cost significantly to warrant making inconsistent and random changes to identified line items. For the sake of consistency of methodology and outcome, the calculated budgets remain at their indexed values. This allows for a starting point to apply regulation cost methodology and compare the cost of regulation across provinces. Individual budgets have been presented as given, and data within the budgets have not been further validated.

Line items that may not be as accurate as desired as a result of this methodology will be addressed below. Labour costs in P.E.I. may be higher than in the other provinces because table potatoes, which require additional labour for sorting and packaging have been included in the budget.

Maintenance and repairs has the potential to vary considerably across provinces due to difference in management style and infrastructure needs. In Alberta and Manitoba potatoes are mainly irrigated therefore infrastructure needs and maintenance costs are much higher. Where there is no irrigation, maintenance costs would be less. Condition of equipment can vary this cost as well because new equipment will have less maintenance cost. Depreciation cost is also

10. *Don Brubacher, Ontario Potato Board Manager, (519) 846-5553.*

affected by the age and amount of equipment that operations utilize. The Ontario value for repairs and maintenance could also be higher than the other provinces as a result of cost allocation – for example if $150 of that line item were re-allocated to insurance or fuel, both line item values would more closely align with that of the other provinces.

Crop insurance programs are provincially administered and vary widely across provinces. As well, it is known that the majority of Manitoba potato producers have crop insurance, but the approach to cost of production used by that province does not include that cost in cost of production calculations.

Utilities are much higher in Alberta than in the other provinces, which may be a reflection of older, less efficient equipment, or of different storage requirements as producers in Manitoba are increasingly able to deliver directly from the field to the processor minimizing the need for storage and the subsequent energy costs.

Business expenses are listed for New Brunswick and Legal and Professional Fees are identified for P.E.I. While the other provinces have not broken out these costs, it is not the result of a lack of comparable costs, but more likely another indication of allocation differences.

Land cost and investment also depends on the style of farming in each province as if land tends to be owned there will be higher land cost and also land investment cost due to incentives for farmers to make improvements on land that they own. Other areas of investment, such as more modern irrigation equipment might be reflected in higher depreciation costs in Manitoba and investment costs that are not reflected in the other provinces.

As is evident in this discussion, while the concept of comparing costs of production is valid, due a to a number of factors it is more product to compare the provinces on a general scale as is outlined in the document than it is in a more detailed way as outlined in the table above. Further, the intent of using cost of production numbers was to illustrate the impact of changes in regulations on costs, which is relevant despite the fact that the line items may not be as accurate as desired.

APPENDIX F

Complete table of potato environmental regulations

PROVINCE	DATE	ACT NAME	PURPOSE	WEBSITE	MNP NOTES
Alberta	1992	Environmental Protection and Enhancement Act	Application of pesticides	http://www.qp.gov.ab.ca/documents/Regs/PESTICID.cfm?frm_isbn=077329337X	Does not apply to agricultural operators as they do not require applicators licenses
Alberta	1992	Environmental Protection and Enhancement Act	Application of pesticides near watercourses	http://www.qp.gov.ab.ca/documents/Regs/PESTICID.cfm?frm_isbn=077329337X	Does not apply to agricultural operators as they do not require applicators licenses
Manitoba	1987	The Environment Act	Pesticide permit	http://web2.gov.mb.ca/laws/regs/pdf/e125-094.88r.pdf	Does not apply to private agricultural producers as are not required to have permits
Manitoba	1987	The Environment Act	Using pesticides	http://web2.gov.mb.ca/laws/regs/pdf/e125-094.88r.pdf	Does not apply to private agricultural producers as are not required to have permits
Manitoba	2002	The Pesticides and Fertilizers Control Act	Pesticide licence and insurance	http://web2.gov.mb.ca/laws/statutes/ccsm/p040e.php	Only applies to commercial or custom applicators
Manitoba	2002	The Pesticides and Fertilizers Control Act	Storage of pesticide equipment	http://web2.gov.mb.ca/laws/regs/pdf/p040-119.03.pdf	No cost associated with those regulations that apply
Ontario	1990	Pesticide Act	Environmental concerns with pesticide management	http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/90p11_e.htm	No additional comment
Ontario	1990	Pesticide Act	Back Flow System	http://www.e-laws.gov.on.ca/DBLaws/Regs/English/900914_e.htm	This does not differ from the requirements of Federal Pesticide regulations
Ontario	1990	Pesticide Act	Agriculture licence for pesticide use	http://www.e-laws.gov.on.ca/DBLaws/Regs/English/900914_e.htm	Agricultural producers pay $85 for their licenses
Quebec	1987	Pesticides Act	Pesticide Licence	http://www.publicationsduque-bec.gouv.qc.ca/home.php	Pesticides Act: No permit is required of 3) a farmer, for the work he performs or offers to perform, not as a business, for agricultural purposes; However, a certificate is required
Quebec	1987	Pesticides Act	Pesticide Management	http://www.publicationsduque-bec.gouv.qc.ca/home.php	No cost associated with those regulations that apply
Quebec	1987	Pesticides Act	Management of Pesticides Applying Zones	http://www.publicationsduque-bec.gouv.qc.ca/home.php	Does not apply to agricultural operators

**Penalties and descriptions of an Act/Regulation are available on-line and website addresses are given.*

APPENDIX F

PROVINCE	DATE	ACT NAME	PURPOSE	WEBSITE	MNP NOTES
Quebec	1987	Pesticides Act	Management of Pesticides Applying Zones	http://www.publicationsduque-bec.gouv.qc.ca/home.php	These distances are not the same as those reported by provincial ag representatives (therefore we used 3m as reported)
Quebec	1987	Pesticides Act	Buffer Zones	http://www.publicationsduque-bec.gouv.qc.ca/home.php	Applied via municipal regulations, so will vary. Requires a buffer zone of at least 3m from waterways including, at least 1 metre from the top of the slope
Quebec	2002	By-Law 114, 2002	Deforestation for Agricultural Use and Buffer Zone	Not available	Applied to deforestation - not likely to impact potato producers
Quebec	2003	By-Law 2003-10	Buffer Zone	http://www.cmquebec.qc.ca/documents/publication/200310_copy1.pdf?PHPSESSID=f92d193223265cd4f257f8ebf3f77c4b	Applied to deforestation - not likely to impact potato producers
N.B.	1989	Clean Water Act	Protected Areas	http://www.gnb.ca/0062/regs/2001-83.htm	MNP assumed no average cost because these are an extremely small area
N.B.	1974	Pesticides Control Act	Pesticide Manipulation	http://www.gnb.ca/acts/acts/p-08.htm	Same as Federal Regulations
N.B.	1982	Clean Environmental Act	General Environmental Con-sideration	http://www.gnb.ca/acts/acts/c-06.htm	Same as Federal Regulations
N.B.	1982	Clean Environmental Act	General	http://www.gnb.ca/0062/regs/82-126.htm	No additional comment
N.B.	1973	Pesticide Control Act	Pesticide storage and permit requirements	http://www.gnb.ca/0062/regs/96-126.htm	Same as Federal Regulations
P.E.I.	2001	Agricultural Crop Rotation Act	Soil Erosion	http://www.gov.pe.ca/law/statutes/pdf/a-08_01.pdf	No additional comment
P.E.I.	2001	Agicultural Crop Rotation Act	Soil Erosion – Crop Manage-ment Plan	http://www.gov.pe.ca/law/regulations/pdf/A&08-01.pdf	No additional comment
P.E.I.	1984	Pesticides Control Act	Pesticides Management	http://www.gov.pe.ca/law/statutes/pdf/p-04.pdf	No additional comment
P.E.I.	1984	Pesticides Control Act	Pesticides Management	http://www.gov.pe.ca/law/regulations/pdf/P&04G.pdf	No additional comment
P.E.I.	1988	Environmental Protection Act	Buffer Zone	http://www.gov.pe.ca/law/statutes/pdf/e-09.pdf	No additional comment
Canada	1985	Pest Control Product Act	Storage Distribution and Use of Control Products	http://laws.justice.gc.ca/en/P-9/92391.html	No additional comment
Canada	1985	Fisheries Act	Alteration of Fish Habitat	http://laws.justice.gc.ca/en/f-14/60199.html	No additional comment

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Complete table of potato environmental regulations

PROVINCE	DATE	ACT NAME	PURPOSE	WEBSITE	MNP NOTES
Manitoba	1990	Water Rights Act	Use and Manipulation of Water	http://web2.gov.mb.ca/laws/statutes/ccsm/w080e.php	There is a $50 lifetime fee per license. If a producer wishes to increase his/her irrigation area, he/she must make an additional application for this increase and incur an additional license fee.
Quebec	**	Environmental Quality Act	Application of pesticides – distance from water	Searched quebec regulations for « Loi sur la qualité de l'environnement » not a stand-alone site	No additional comment
N.B.	1989	Clean Water Act		http://www.gnb.ca/0062/regs/2001-83.htm	No additional comment
N.B.	1974	Pesticides Control Act		http://www.gnb.ca/0062/regs/96-126.htm	Any person who is involved in the mixing, loading, handling or application of pesticides must hold a Pesticide Applicator's Certificate, the cost of this certificate is $10 a year for a private classification and $25 a year for a commercial classification. Additionally, the license holder is required to maintain records regarding the total quantity of each pesticide that they use or apply in each year.
P.E.I.	1984	Pesticides Control Act	Pesticides Management	http://www.gov.pe.ca/law/regulations/pdf/P&04G.pdf	No additional comment
P.E.I.	1984	Pesticides Control Act	Pesticides Management	http://www.gov.pe.ca/law/regulations/pdf/P&04G.pdf	No additional comment
P.E.I.	1984	Pesticides Control Act	Pesticides Management	http://www.gov.pe.ca/law/regulations/pdf/P&04G.pdf	No additional comment
P.E.I.	1998	Environmental Protection Act	Buffer Zone	http://www.gov.pe.ca/law/statutes/pdf/e-09.pdf	No additional comment
P.E.I.	1998	Environmental Protection Act	Buffer Zone	http://www.gov.pe.ca/law/statutes/pdf/e-09.pdf	No additional comment
P.E.I.	1998	Environmental Protection Act	Buffer Zone	http://www.gov.pe.ca/law/statutes/pdf/e-09.pdf	No additional comment
P.E.I.	2001	Agricultural Crop Rotation Act	Soil Erosion – Crop Management Plan	http://www.gov.pe.ca/law/regulations/pdf/A&08-01.pdf	No additional comment
P.E.I.	2001	Agricultural Crop Rotation Act	Soil Erosion – Crop Management Plan	http://www.gov.pe.ca/law/regulations/pdf/A&08-01.pdf	Regulated crops (i.e. potatoes) can only be planted on any parcel of land once every 3 years. Producers must write a management plan, submit it to the P.E.I. Department of Agriculture for approval by a management specialist. There is no fee associated with submission.

**Penalties and descriptions of an Act/Regulation are available on-line and website addresses are given.*
***We were unable to determine the date that this regulation came into effect.*