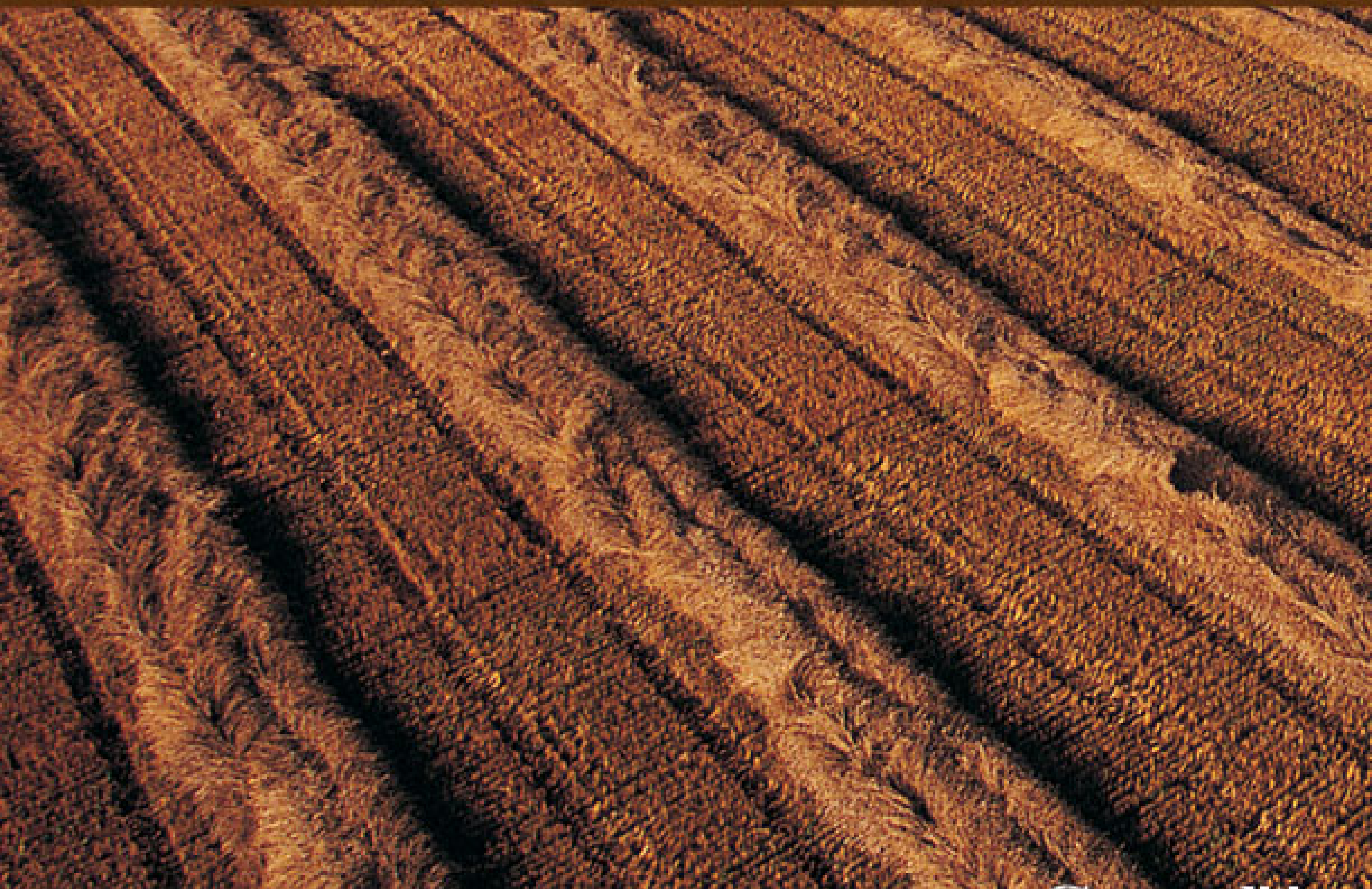
Inventory and Methodology for Assessing the Impacts of Environmental Regulations in the Agricultural Sector



Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada

Canada

INVENTORY AND METHODOLOGY FOR ASSESSING THE IMPACTS OF ENVIRONMENTAL REGULATIONS

in the

AGRICULTURE SECTOR

by

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March 2006

INVENTORY AND METHODOLOGY FOR ASSESSING THE IMPACTS OF ENVIRONMENTAL REGULATIONS IN THE AGRICULTURE SECTOR

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Acronyms

AAFC	Agriculture and Agri-food Canada
AU	Animal Units
ASRA	Agricultural Revenue Stabilization Account
CAFO	Concentrated Animal Feeding Operations
CEPA	Canadian Environmental Protection Act
CGE	Computable General Equilibrium
DCF	Discounted Cash Flow
DEFRA	Department for Environment Food and Rural Affairs
DRAM	Distributed random-access machine
ECE indicators	Environmental Compliance and Enforcement indicators
ER	Environmental Regulations
EVRI	Environmental Valuation Reference Inventory
GAO	General Accounting Office
GDP	Gross Domestic Product
GNP	Gross National Product
GREPA	Groupe de Recherche en Économie et Politique Agricoles
I-O	Input -Output
MAPAQ	Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec
MEDD	Ministère de l'écologie et du développement durable
NCO	Non-commodity Outputs
NMS	Nutrient Management Strategy
NMP	Nutrient Management Plan
NNP	Net National Product
NOAA	National Oceanic and Atmospheric Administration
OECD	Organisation for Economic Co-operation and Development
OMB	Office of the Management of Budget
OTA	Office of Technology Assessment
PEI	Prince Edward Island
RIA	Regulatory Impact Analysis
SEA	Socio-economic Analysis
USDA	United States Department of Agriculture
USEPA	United States Environment Protection Agency
UPA	Union des producteurs agricoles du Québec

Foreword

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. At the national level there is now underway a federal government wide initiative, SMART Regulation, to look at all types of regulations to better understand their impact on the economy and how to use regulations more effectively. With this background, the need to carry out a thorough assessment of agri-environmental regulations was identified in the environmental pillar of the Agricultural Policy Framework (APF). The objective of this assessment is to identify the relevant regulations at the federal, provincial and local levels, estimate the impact of farm-level agri-environmental regulations on the cost structure of farms, and determine what lessons can be learned on the role of regulations for future policy development. Phase I was completed in 2004 and this report discusses the key findings. An inventory of agri-environmental regulations was assembled which is described in this report and an analytical framework and methodology is proposed for an economic assessment of the impact of agri-environmental regulations.

With the increasing challenges to farm income, all factors that could affect a farm's cost structure and profitability are coming under increased scrutiny. Emerging low cost competitors, such as Brazil, are putting new pressures on market prices. In discussions with farm organizations and farm leaders, the impact of regulation on farm costs is an expressed area of concern. Empirical analysis is required to better understand the exact role that agri-environmental regulation plays in determining a farm's cost structure, how they compare between regions within Canada, and with international competitors, also to gain a better understanding of where and when they can be a valuable policy tool, and in what circumstances they can impact on competitiveness. In subsequent research, farm-level case studies are planned to provide the type of analysis and insight required to answer these questions and provide valuable insight for future policy development.

Executive Summary

This report is the first phase of a multi-stage process that aims to better understand the environmental regulatory constraints that affect the primary agricultural sector in Canada and their impact on competitiveness. This report also considers the environmental and social effectiveness of these agri-environmental measures with a view towards improving the next generation of agri-environmental policies.

The main goal of this report is to develop a methodological framework and determine assessment criteria for the evaluation of the impacts of those regulations on the environment, agricultural producers and society as a whole. More specifically, the methodological framework developed through this project is composed of three main set of methodologies.

The assessment of the impact of regulations on agricultural producers

For this exercise, the use of a technical economic model, applicable to different jurisdictions, for the impact evaluation of environmental regulations on agricultural producers is proposed. This model is consistent with the approach used by the Organization for Economic Co-operation and Development (OECD, 2002) for comparing regulations across countries. In addition, the chapter recommends the use of financial ratios to evaluate the potential impact of a set of environmental regulations on producers. The proposed ratios are a) environmental costs over total costs of production and b) environmental costs over total sales; these can be compared to benchmarks in industry or between jurisdictions. These ratios provide an estimation of the impact of regulations on producers' financial health and competitiveness.

The assessment of the impact of regulations on society

The use of a representative farm model is proposed to assess regulations' impact on society as a whole. The rationale is that the costs estimated for one farm can be multiplied by the number of farms (or commodity units) to estimate the aggregated private costs for producers in a specific economy, and this estimate can subsequently be used as a proxy for calculating total social costs. The use of a financial ratio is proposed as a complementary tool to assess the impact of costs on the sector's competitiveness. The proposed ratio is the environmental protection capital expenditure as a percentage of total capital expenditure.

Such impact assessment ultimately involves comparing costs with benefits. However, identifying and quantifying the benefits associated with environmental regulations is a complex and difficult undertaking, and perhaps especially for the agricultural sector. To overcome some of the challenges encountered, we propose to focus on water pollution at specific geographic scales and to use a benefit transfer methodology.

The assessment of the smartness of regulations

The process of designing smart regulations is guided by a number of principles that can be used as references for the evaluation of agri-environmental regulations. The principles guiding the design of the "smart regulation" include employing a mix of policy instruments to create positive interactions with each other, considering the full range of policy instruments when designing the mix and emphasizing the search for new policy instruments to meet the challenges of governance.

Adhering to these principles in designing and implementing agri-environmental regulations can contribute to improving their efficiency and effectiveness, as well as to increasing welfare gains. The set of criteria to be used for assessing agri-environmental policies and instruments are: effectiveness, economic efficiency, cost effectiveness, flexibility, enforcement mechanisms, transparency, fairness and equity and coherence. The report suggests a set of definitions as well as a questionnaire to be used to assess the effectiveness of regulations against these criteria.

The next steps

On the basis of this analysis, we recommend moving ahead with this program of work. To this end, Agriculture and Agri-Food Canada (AAFC) should consider taking the following two steps for moving into the next phases of the program.

The first step consists of an exercise of fine-tuning the critical methodologies. More specifically, to ensure the adequacy of the methodology proposed, to assess the impacts on producers and that the necessary information for conducting the case studies is available we also recommend:

- Testing the methodology that assesses the impacts on producers for a specific type of production, for example hog production.

- Creating an inventory of basic farm-level economic data in different jurisdictions necessary to respond to the needs of the case studies.
- Creating an inventory of available environmental and socio-economic data for specific spatial scales (e.g. watershed or sub-region).
- Conducting contingent valuation studies in Canada to be used in the benefit transfer methodology.

The second step is the actual implementation of the case studies. We suggest the latter should focus on a few sectors - hog, corn, beef, apple, wheat, and poultry- as they are representative of the Canadian agricultural production and there is a considerable amount of information available on them. The first of those case studies should be considered as a pilot study and should be conducted on the same sector as the test done in the first step. On the basis of the methodological framework developed, the report outlines the stages to go through for properly conducting the case studies. These consist of selecting a commodity, identifying existing regulations, determining the degree of compliance and enforcement, assessing the impact, and assessing the smartness of regulations.

Chapter 1
Introduction

In Canada, there is a significant lack of information about the technical and economic aspects of the impacts of agricultural policy measures on agricultural producers and the environment. Moreover, when this information is available, farmers' representatives, citizens and environmental groups frequently interpret it in varied and often contradicting ways. Since the early 90s, Canadian farmers – like many of their counterparts in other countries – have been facing ever-increasing environmental constraints. In a global economy that exacerbates competitive pressures, it is critical to have a clear understanding of both the economic costs imposed unto farmers by these constraints and of the societal benefits that justify such measures. An equally significant aspect is the increasing trend towards Canada-U.S. economic integration, and the opportunities and challenges this presents to Canada in its work toward achieving its environmental objectives.

It is in this context that Agriculture and Agri-Food Canada (AAFC) has requested the creation of a comprehensive inventory of the regulations affecting the environmental performance of primary agriculture in Canada; a methodology as well as an assessment criteria for the evaluation of the impacts of environmental regulations in the agricultural sector; and an analytical framework to evaluate the future role of regulations and other policy instruments in achieving the desired social, environmental and economic outcomes.

This study is part of a long-term process that not only aims to improve the effectiveness of environmental regulations in the Canadian agricultural sector, but also aims to move towards a more aggressive and efficient environmental strategy that may position Canada as a world leader in environmentally-responsible production. In this light, the overall objective is to assess the effectiveness of environmental regulations as they apply to primary agriculture in Canada, to evaluate their impact on the competitiveness of agricultural producers, and to evaluate their environmental and social efficiency with a view towards improving the budding generation of agro-environmental policies.

In other words, the following questions must be addressed:

- Do we comprehensively understand the set regulatory policy that Canadian farmers must adhere to? Is there coherence or conflict between existing policies and regulations?
- What are the cost implications and the impacts on competitiveness?
- Are the governments following the principle of "smart regulation"?

In practice, this phase of the project aims to develop a methodology to assess the usefulness and impact of current environmental regulations in the primary agricultural sector. Ultimately, the methodologies developed should help provide answers to the following questions: are the regulations altogether achieving their stated goals? What is the impact of regulations on the environment (to achieve environmental goals) and on farmers (benefits, costs and competitiveness)? How do the impacts vary across provinces/regions and why?

A first meeting with AAFC representatives gave us a clearer picture as to the overall mandate. From these discussions, we understand that the methodologies developed should:

- Give a general picture,
- Concern a set of regulations and not a particular regulation,
- Address regulations from an ex-post perspective,
- Be easily applicable,
- Be replicable to different jurisdictions with different characteristics.

Our literature review rapidly confirmed our first impression that, somehow, AAFC wishes to obtain a tool to assess the smartness of the set of policies governing the interface between agriculture and the environment in Canada.

This document is organised as follows:

Chapter 1 describes the structure of the document as illustrated in Figure 1.

Chapter 2 broadly presents the inventory of environmental regulations affecting primary agriculture in Canada and the database supporting it. It also presents the related agri-environmental indicators developed by AAFC.

Chapter 3 deals with the methodologies developed to assess the impact of those regulations on producers (or private costs and benefits).

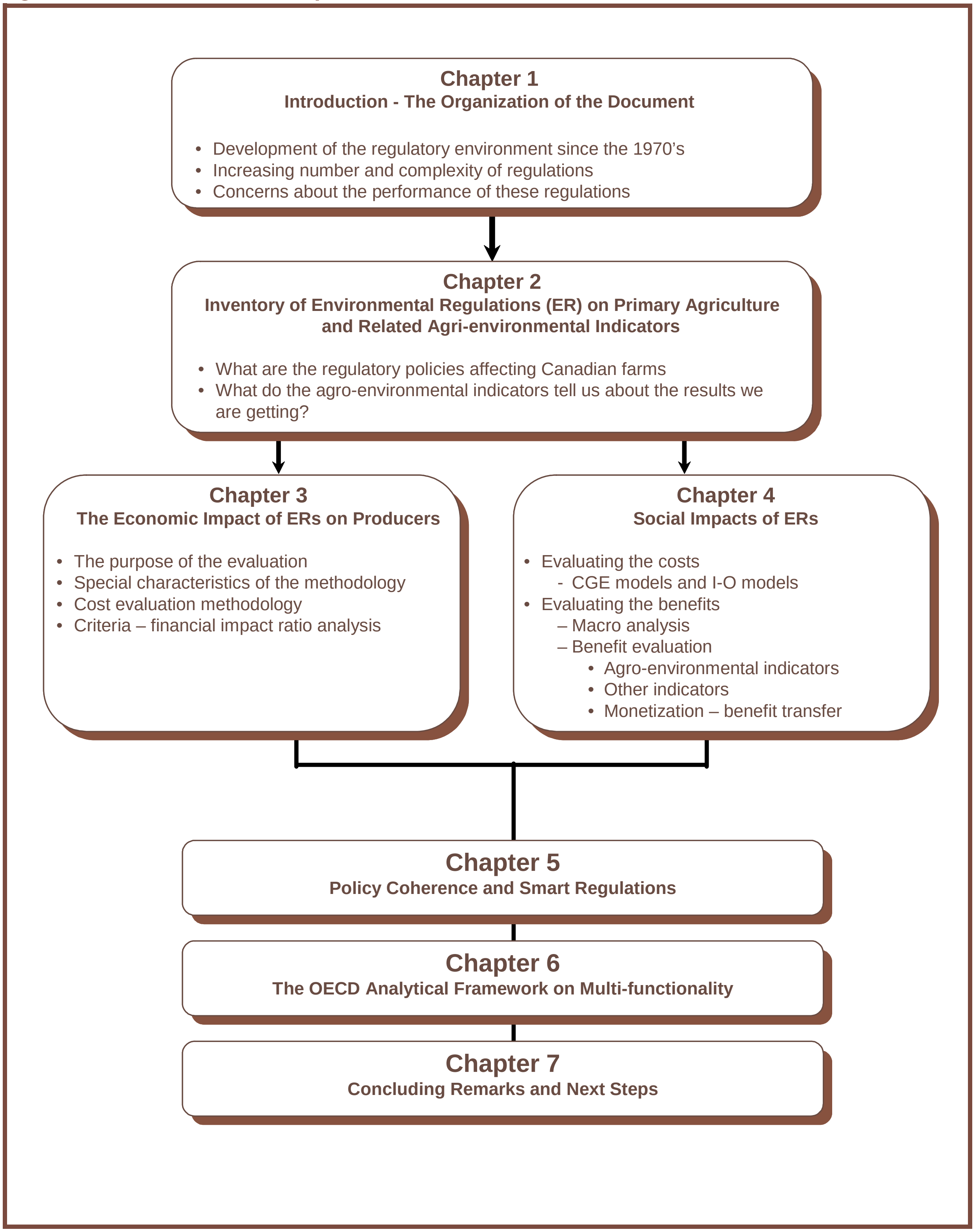
Chapter 4 deals with the methodologies developed to assess the costs and benefits to society in general (or social costs and benefits).

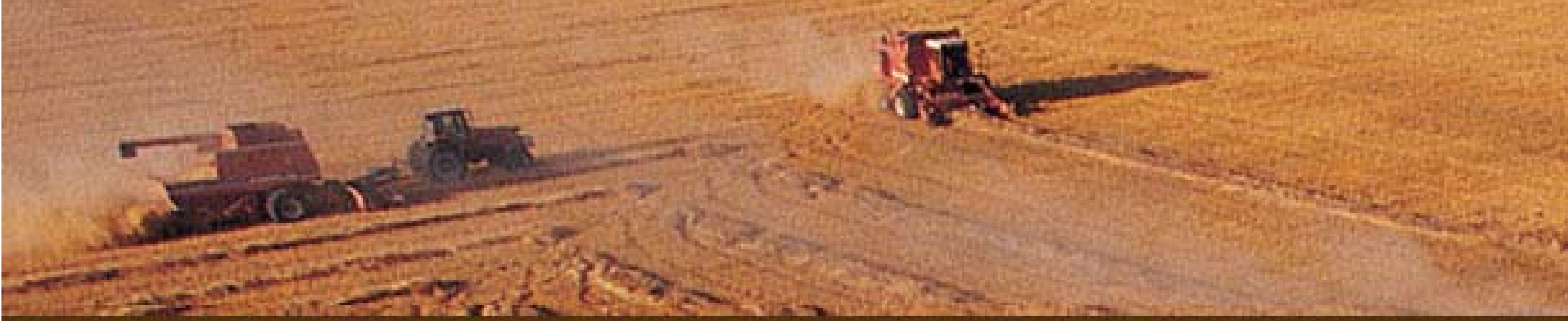
Chapter 5 presents a methodology to assess whether the regulations are both consistent with the principles of smart regulations and with other key policy instruments.

Chapter 6 describes the multi-functionality framework mainly based on OECD literature.

Chapter 7 provides the conclusions and recommendations.

Figure 1: Structure of the Report





CHAPTER 2
INVENTORY OF THE ENVIRONMENTAL REGULATIONS IN PRIMARY AGRICULTURE IN CANADA AND RELATED AGRI-ENVIRONMENTAL INDICATORS

Prior to evaluating the efficiency and effectiveness of the environmental regulations affecting Canada's agricultural sector, it is necessary to first have a clear idea of what those regulations actually are. To achieve this objective, ÉcoRessources has compiled an inventory of all the current regulations affecting the environmental performance of primary agriculture in Canada. In addition to offering an informative picture of the set of environmental regulations facing Canadian farmers, this inventory also serves as a valuable tool to better understand these regulations and their inter-linkages. We have organized the inventory into an easily searchable database in order to enable a quick identification of specific regulations or sets of regulations.

This chapter presents the inventory, its structure and the methodology that was used by ÉcoRessources to compile it. Moreover, the second part of this chapter presents the agri-environmental indicators that were incorporated into the database, which will serve our purpose of evaluating the environmental effectiveness of existing regulations.

2.1 The inventory

2.1.1 Methodology

Our first step was to research regulatory prescriptions that might have an impact on agricultural performance and Canadian farmers. We researched acts and legal documents at all government levels, and conducted our survey via internet searches and telephone conversations with key government representatives. Second, we divided up the laws into specific regulatory prescriptions, focusing on those affecting agricultural producers. These regulatory prescriptions have been our starting point in designing a logical and classified inventory. We compiled only legal requirements, i.e. those implying that farmers must act – or cease to act – in a certain way, as requested during the preliminary meeting with AAFC[1].

1. *Meeting with AAFC representatives in Ottawa on April 28, 2004.*

Local governments regulations

Since it is more difficult to find information on local environmental regulations that specifically affect agriculture, we created and used a research methodology that enabled us to get a general overview of provincial environmental regulations implemented by local governments (counties and municipalities). We gathered information in three ways:

1. By critical points

   - We searched for environmentally critical regions where agriculture is practiced and subsequently identified local governments that have jurisdiction over these regions. Consider, for example, the Chaudière River basin and Walkerton.

   - We searched for Canadian regions known for their agricultural importance.

2. By contacting local producers' associations such as those affiliated with the National Farmers Union, the Canadian Federation of Agriculture, Union des producteurs agricoles, etc.

3. By consulting provincial websites, which included a list of their municipalities, to get a general picture of the provinces, maps were also used to ensure that we covered all regions.

Flexible database

We would like to mention that although it was possible to compile an extensive inventory, the database that will be constructed will allow for the addition, removal and re-organisation of regulations. This is very important, as the environmental regulations affecting Canadian agriculture are likely to be significantly modified through time and at all government levels.

2.1.2 Classification

Our mandate was to compile an inventory of current regulations affecting the environmental performance of primary agriculture in Canada. As requested, we have compiled federal, provincial, territorial and local governments' regulatory prescriptions pertaining to agriculture. Since it was difficult to determine how many local regulations (at the municipal level) should be collected, we decided to present a general picture of what is done at the municipal level in each province. Considering that the stringency and the level of accuracy of environmental regulations at the local level differs considerably across provinces, we mainly compiled the local regulations that seemed to have a major impact on producers. We found more of this type of legislation in some provinces, such as British Columbia, than in others. The main reason why some provinces have more well-defined local environmental regulations is that they implemented a different control model on environmental legislation (see Appendix 1). Following this, each of the regulatory prescriptions was classified by:

- Act name, policy name, year,
- Location (province, municipality, etc.),
- Type of production (we noticed that the principal production influenced by legislation is livestock),
- Farm size (when applicable),
- Environmental purpose,
- Agri-environmental indicators as developed by AAFC,
- Other keywords.

The agri-environmental indicators, combined with economic and policy data, will provide a basis for the systematic and rigorous analysis of the effects of policy reforms on the environment.

2.2 Agri-environmental indicators

Through the *Environmental Strategy* prepared by the Organization for Economic Cooperation and Development's (OECD, 2004), member countries agreed to undertake national actions to support the environmental pillar of sustainable development in a cost-effective and equitable manner. This commitment, however, implies a better understanding of the state of the global environment, which in turn requires compiling a substantial amount of information. The OECD is thus coordinating an effort among its member countries to develop reliable agri-environmental indicators. These indicators aim to be significant tools for OECD member countries in their assessment of national actions in agriculture and aim to measure the environmental effectiveness of various regulatory prescriptions and reforms.

Since 1993, AAFC has also been developing environmental indicators with a similar objective. The result of its work has been published in a report entitled *Environmental Sustainability of Canadian Agriculture* (AAFC, 2000). The agri-environmental indicators developed by AAFC are measures of key environmental conditions, risks and changes resulting from agriculture and from the management practices used by producers. These indicators have been developed to evaluate and help understand the impact of agricultural activities on the environment and, as such, are valuable instruments to use to assess the impact of different sets of regulations on the environment and thus measure their efficiency.

2.2.1 Identifying the indicators

AAFC has used a conceptual framework within which the relationships and linkages between agricultural production and the environment, as well as with economic and social factors, have been schematised. The framework is called the *Driving Force-Outcome-Response Framework*[2]. Six broad groups of agri-environmental indicators have been developed on the basis of this framework. These groups relate to issues of:

- Environmental farm management;
- Soil quality;
- Water quality;
- Greenhouse gas emissions;
- Agro-ecosystem biodiversity; and
- Production intensity.

Some of these groups have several sub-components. We used a set of 14 indicators to estimate the impacts of sets of environmental regulations on Canadian agriculture.

2.2.2 Calculation methods

All indicators are based on calculations of bio-physical and farm management practices, and the information was generalized to describe the environmental conditions of a specific landscape at a given time. Three principal methods[3] were used by AAFC to calculate each indicator.

2. *Ibid, p. 9.*

3. *Ibid, p.14.*

***Method 1*:** Integrated information on soil, climate and landscape from *Soil Landscapes of Canada* with data from the *Census of Agriculture*, using existing or modified mathematical models or formulas, including:

- The Century model was used to calculate changes in the amount of soil carbon over time;
- The methodology of the Intergovernmental Panel on the Climate Change, to estimate soil emissions of nitrous oxide; and
- The Revised Universal Soil Loss Equation for application in Canada, to estimate the risk of soil erosion by water.

***Method 2*:** Integrated information on soil, climate, and landscape from *Soil Landscape of Canada* with data from the *Census of Agriculture* and custom data sets (from provincial agencies, private sector, or other sources), using mathematical formulas developed specially for these applications. This method was necessary for cases where process models or formulas did not already exist.

***Method 3*:** Summarized information from the *Census of Agriculture*, from special surveys or a combination of these two sources.

2.2.3 Use and interpretation of indicators in our project

The AAFC indicators provide a general overview of a certain aspect of the state of the environment for a given province or area. However, their usefulness and their accuracy in establishing the impact of a set of regulations on the environment must be qualified. Indeed, there are many factors that influence the state of the environment in a region and over time, and the indicators do not allow for the identification of the specific impacts of the regulations, among other things. Therefore, they only provide a general picture of possible trends and the results should be interpreted with caution. Nevertheless, the agri-environmental indicators provide valuable estimates of environmental changes (whether caused by regulations or not) and are extremely useful in making regional comparisons.

Another weakness of the agri-environmental indicators is that they do not provide a precise picture of the environmental conditions of any specific location. Therefore, the indicators will not be effective at assessing the impact of local regulations. Yet, an important objective of our study is to figure out the impact of those regulations that are implemented by local governments (municipalities, counties etc.). In order to accurately evaluate these regulations, ÉcoRessources suggests using pressure indicators, which are more easily applicable to local regulations. A description of these indicators follows.

Table 1: National Agri-Environmental Indicators

Indicator group	Agri-environmental indicator	Description	Method type
Environmental farm management	Soil cover by crops and residue	Number of days per year when soil is left exposed under specific crop and land management regimes.	Method 2
	Management of farm nutrients and pesticide inputs	Adoption of best management practices for handling fertilizer, manure and pesticides.	Method 3
Soil quality	Risk of water erosion	Potential for soil loss in surface runoff under prevailing landscape and climatic conditions, and management practices.	Method 1
	Risk of wind erosion	Potential for soil loss under prevailing landscape and wind conditions, and management practices	Method 1
	Soil organic carbon	Estimate of change in organic carbon levels in soils under prevailing management practices.	Method 2
	Risk of tillage erosion	Potential for soil redistribution under prevailing landscape conditions, tillage and cropping practices	Method 2
	Risk of soil compaction	Potential for change in degree of compaction of clay-rich soils estimated from inherent soil compactness and cropping system.	Method 2
	Risk of soil salinization	Potential for change in the degree of soil salinity estimated from land use, hydrologic, climatic, and soil properties.	Method 2
Water quality	Risk of water contamination by nitrogen	Potential for nitrogen levels running off farmland into water to exceed Canadian drinking water standard	Method 2
	Risk of water contamination by phosphorus	Potential for phosphorus to move off farmland into surface waters.	Method 1
Agroecosystem greenhouse gas emissions	Agricultural greenhouse gas budget	Estimated emissions of nitrous oxide, methane, and dioxide from agriculture production systems; summary of balances expressed in carbon dioxide equivalents	Method 2
Agroecosystem biodiversity	Availability of wildlife habitats on farmland	Number of habitat-use units for which habitat has increased, remained constant, or decreased	Method 2
Production intensity	Energy use	Energy content of agricultural inputs and outputs	Method 3
	Residual nitrogen	Difference between the amount of nitrogen added to farm soils and the amount removed in harvested crop	Method 2

Source: ***Agriculture and Agri-Food Canada, Environmental Sustainability of Canadian Agriculture, Reports of the Agri-Environmental Indicators Project, p.14.***

2.2.4 Local regulations: The use of pressure indicators

We have argued that the agri-environmental indicators developed by AAFC are efficient tools for providing a regional overview of the environmental landscape at a precise moment, but that they could not be used for assessing the impact of regulations at the local or municipal level. Therefore, ÉcoRessources suggests using a number of pressure indicators to evaluate local regulations and the obtained results will present a more realistic picture of land use at the local level.

2.2.5 Identifying and calculating pressure indicators

In order to quantify the agricultural pressure on the environment at the local level, ÉcoRessources has identified a number of indicators. The main characteristic of these indicators is that they are easily quantifiable. The method used to calculate the pressure indicators is to summarize information from the Census of Agriculture and from local governments. Nolet and Nolet (1997) have already conducted a similar exercise for identifying the sources of agricultural pressure on the St. Lawrence River in Quebec. The following table gives an idea of the status of the information for each indicator suggested by ÉcoRessources in Quebec. This information can be retrieved from the registration file of the ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ).

Table 2: Pressure indicators and availability of information in Quebec

Pressure indicator	Quality of the information
Number of animal units per basin	Doubtful (not validated)
Quantity of fertilizers used per basin	Doubtful (not validated)
Quantity and type of pesticides used per basin	Very doubtful (incomplete)
Area cultivated per crop per basin	Doubtful (not validated)

Source: Nolet and Nolet (1997) Rapport 1998 sur l'État du Saint-Laurent : La contribution des activités agricoles à la détérioration du Saint-Laurent, St Laurent vision 2000, Canada p. 34.

2.2.6 Pressure indicators' limitations

Table 2 gives us an idea of the main limitations associated with the pressure indicators. The availability and particularly the quality of the information might also be a problem in remote areas. Furthermore, many municipalities might not have compiled this type of information and data.

While we know that regulations are likely to have a significant impact on the pressure indicators, many other factors might affect them. Thus, care must be taken when interpreting the causality link between the regulations and the values of pressure indicators. Furthermore, pressure indicators do not provide information about environmental outcomes. In order to circumvent this problem, we suggest, in Chapter 4, a methodology to link the state of the environment with the monetary evaluation of the benefits.

CHAPTER 3
THE IMPACT ON PRODUCERS

Economic Impact of Environmental Regulations on Producers

> "Estimating the costs to producers of complying with environmental regulations is a daunting task. […] Agriculture is subject to a complex regime of regulatory instruments in Canada. Many of these instruments reinforce one another. For example, municipal permit allocation, common law remedies and provincial and federal water quality legislation all contribute to protecting surface water quality. So it is not possible to attribute the costs of complying with surface water quality standards to any one policy or program and many of the compliance costs are unobservable." (Fox, G. and J. Kidon, 2002, p. 165)

What is an environmental cost for producers? Intuitively, one would think that the answer to this question would be straightforward: that costs simply correspond to the expenses that producers must incur to comply with a new regulation.

Measuring the economic impacts associated with an environmental regulation for agricultural producers might then sound like a simple exercise. Following the partial budgets methodology, only four basic items have to be taken into account:

a) The new costs incurred ($ and $/unit)

- Labour costs
- New equipment or inputs;

b) The costs that are eliminated ($ and $/unit)

- Seeds, fertilisers, pesticides
- Gasoline and energy
- Transportation and insurances
- Labour costs
- Animal food and animals;

c) The income lost ($ and $/unit)

- Yield lost
- Area in culture lost
- Volume lost
- Payments from programs; and

d) The income gained ($ and $/unit)

- Supplementary yield
- New culture or production of animals (area in culture or product)
- Volume of new products
- New payments from programs.

However, it is important to point out that the methodology we are suggesting for the purpose of assessing the impact of regulations on producers needs to take into account the context within which the study is conducted and the limitations related to this context.

First, ÉcoRessources has been asked to conduct an ex-post as opposed to ex-ante impact assessment study. Second, AAFC requested that ÉcoRessources determine the impact of a set of environmental regulations for the agricultural sector as opposed to individual regulations. This increases the complexity of developing a methodology. Third, crucial differences exist between the expenses incurred for environmental purposes and the costs associated with an environmental regulation. The main differences are that a) some costs are in fact opportunities lost, and b) the baseline that is chosen to define the additional requirement plays an important role in accounting for costs. The issue is to identify the costs that must be considered as normal (the reference line) and those that must be considered as supplementary and associated with the new regulation.

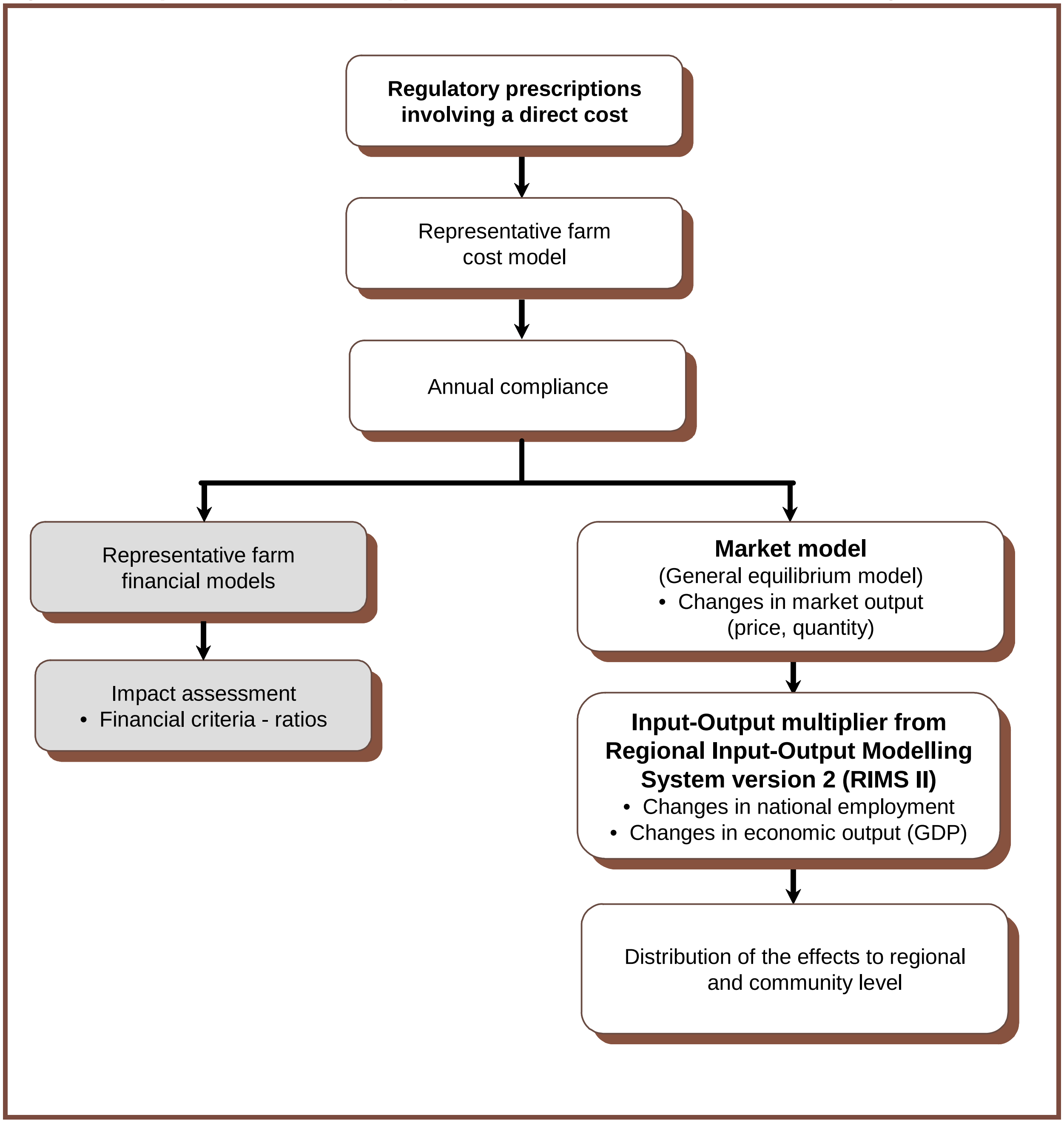
3.1 Discussion of the methodology

1. **Ex-post as opposed to ex-ante analysis**

In a methodology concerning the evaluation of the effects of environmental regulations on producers, it is challenging to conduct an ex-post analysis since there are producers that respect the regulations and others that do not. In this context, we could use the hypothesis that producers who do not respect the regulations do not infer any additional costs. Thus, it is suggested that the impact assessment on producers should be conducted as if the producers were respecting the regulations.

Therefore, we suggest the use of a technical economic model such as those that are used in ex-ante analyses to assess the impacts of regulations on producers in an ex-ante perspective. The US Environmental Protection Agency's (EPA) "model CAFOs" is a good example and Figure 2 summarizes how this model works.

Figure 2 : Representative farm approach - EPA model used in the CAFO regulations



In summary, by using farm cost models the EPA is able to infer farmers' compliance costs, which can then be used for two different purposes. First, representative farm financials models can serve to calculate impact assessments in the form of criteria-ratio. It is this part (in grey in Figure 2) that relates to the impacts on producers and is of interest in this chapter. Second, the annual compliance costs can be used in market models (general equilibrium) to generate inputs that can then be fed into input-output models in order to assess regional and community-level impacts. The latter calculations will serve to assess societal impacts, and are therefore outlined in more details in the next chapter.

Although in Canada neither the AAFC nor Environment Canada has developed a comprehensive set of farm models similar to the one used by the EPA, i.e. one including all agricultural production sectors and farm sizes, different federal and provincial agencies use farm models to manage various programs that target producers. Good examples of these are the production cost models developed by the Financière agricole in Quebec to administer the Programme d'assurance stabilisation des revenus agricoles (an income stabilization scheme). In Quebec, and in other provinces, crop insurance programs' interventions are also based on production cost models that help to determine the eventual payments to producers in case of natural disasters.

However, as noted by the OECD, it is difficult to compare the few existing national studies that estimate the costs of environmental regulations because they each use different cost bases and cost principles. It is not informative in an economic sense to compare costs unless they have been calculated using rigorous methodologies with similar points of departure, e.g. depreciation periods for investments and discount rates (OECD, 2002a). As a result, the relevant question becomes: "do we need such a comprehensive tool to attain our objective?" The answer lies in the definition of our objective. Do we want implementation costs to be expressed in absolute terms or would it be preferable to have a relative perspective of the costs imposed on producers in different jurisdictions? We suggest that the impact should be expressed in relative rather than in absolute terms.

Given the objectives of the current study, there is no need for a very comprehensive tool for each sector, region and operation size. Instead, we suggest the use of one technical economic model to assess the impact of the regulations on producers' costs as they apply in different jurisdictions. The choice of the model is not very important as we work in relative terms and not in absolute terms. This suggestion is consistent with the approaches used by the OECD (2002a) when trying to compare the set of regulations imposed on pig producers in five different countries.

Using Danish factor costs and cost principles, the OECD study consistently compares the costs of manure regulations in five countries. First, the study builds a reference case by calculating the costs of complying with Danish regulations for three representative pig farm sizes. Second, in order to compare differences in regulatory requirements, the costs facing Danish producers are re-calculated to comply with the regulations applied in the other four countries. The cost assessment is based on a bottom-up approach, starting with the physical and regulatory requirements imposed on pig producers (OECD, 2002a, p.83).

The OECD study, which examines the effects of manure management regulations on international competitiveness in the pig sector, can further illustrate the methodology's application to a more complicated regulatory set. The following table presents the different policies and measures, what we have called a regulatory set and the assumptions used for computing the financial ratios used.

This comparison method shows the cost impacts of different regulatory approaches, e.g. the relative importance of environmental regulations rather than the significance of absolute cost differences resulting from environmental requirements (OECD, 2002a).

Table 3: OECD Methodology - Manure Manageemnt - Pig Farms Denmark

Prescription	Technology	Cost Calculation
		Note: All capital costs have been annualized assuming a 6% interest rate and depreciation periods according to those applied by the Danish Agricultural Advisory Service
Maximum allowable nutrient application		
Manure storage capacity and technology	Nine months capacity adjusted for precipitation	
Required storage technology	Storage tanks Floating cover	Surface area for coverage calculated on the basis of an average height for storage tanks of 4 meters
Required manure application technology	Liquid dragline Additional transport	Largest farm @ 40% of manure applied 5 km away
Application prohibition period		
Nutrient planning		Paperwork time assessed according to best estimates from county officials and local farm advisory centers
Nutrient bookkeeping		Paperwork time assessed according to best estimates from county officials and local farm advisory centers
Nutrient accounting		Paperwork time assessed according to best estimates from county officials and local farm advisory centers
Pollution permit requirements		
Environmental impact assess-ment	Soil and groundwater test	Costs treated as investments – depreciated over 10 years
Land ownership requirements		
Buffer zone requirements		
Compliance incentives		
Value of nutrient in manure	Only nitrogen considered	Subtracted from the cost of field application

Note: Results are presented for three farm sizes with low and high estimate for each size - no aggregation
Results are presented as a share of the total production costs per pig weighing 98-110 kg ready for slaughter.

Representative pig farm sizes
A) A medium-size pig farm of 125 animal units
B) A large-size pig farm of 249 AU.
C) A very large-size pig farm of 500 AU.

Sources: Danish Institute of Agricultural Sciences and Danish Agricultural Advisory Services, OECD, Agriculture, Trade and the Environment: The Pig Sector.

The impact of a set of environmental regulations as opposed to individual regulations

AAFC's objective is to compare the burden imposed on producers across the country. In this perspective, we understand that the economic impact assessment of an individual regulation is of no interest since different jurisdictions use different kinds of regulations to address environmental problems. Therefore, the emphasis on an individual regulation would not allow for the inter-jurisdictional comparison that is needed.

Consequently, how do we define a set of regulations? It could be defined by jurisdictions, by production types or by agri-environmental indicators. We suggest using a combination of these factors. Therefore, a set of regulations would be the sum of the dispositions and regulations attached to a production type and developed to meet a particular environmental objective in a certain jurisdiction.

Following this definition, it is then possible to identify a number of sets of regulations that address the following concerns:

1. Manure management;
2. Pesticides management;
3. Riparian buffer zones; and
4. Field crop management practices.

Of course, the sets of regulations would vary according to the production type and the jurisdiction that imposes it. The difficulty lies in the determination of the baseline.

In fact, different scenarios can be used as a baseline, as has been established by Doyon (2003). The actual norm, scientific consensus, best management practices, or business-as-usual scenarios are all references that have been suggested in the literature as baselines to measure the impact of a given regulation on an industry. Those references, when applied to agriculture, all share a common characteristic: they vary regionally in function of territories' climatic and topographical characteristics.

This is an important characteristic given the national perspective of our study. It means that it will be difficult to find a common baseline for the different regulatory requirements and environmental objectives of the various regions of the country. At the same time, a common baseline is necessary in order to enable comparisons and when using one, we must ensure that it is not interpreted as a homogeneous set of regulations for all provinces or regions since some regions face widely different environmental circumstances.

Another difficulty lies in the fact that we are in an ex-post situation as opposed to an ex-ante, which is the traditional way of doing a regulatory impact analysis. Keeping those constraints in mind, ÉcoRessources has considered three possibilities for a baseline: a) a situation where there are no regulations (as if society did not expect anything from producers, thus rendering all taken efforts into costs); b) the situation prior to the last regulation; and c) a comparison with the regulations imposed on competitors.

a) Comparing with a situation where there is no regulation:

We have dubbed this baseline possibility “zero constraint”. In other words, we assume there are no environmental requirements. This means that every action agricultural producers take in response to environmental regulations must be accounted as a cost they take on themselves. However, if taken out of context, such a baseline would exaggerate the environmental burden imposed on producers.

b) Comparing with the situation prior to the last regulation:

A possible methodological choice would be to chronologically classify all regulations in order to assess their impacts as they have been enacted over time. With this methodology, the prevailing situation – before a new regulation is adopted – would serve as the baseline. While this sounds like an ideal methodology, in reality it means a different baseline would need to be built for each jurisdiction, thus making comparisons difficult. Furthermore, given limited available information, it would not be a realistic alternative.

c) Comparing with the regulations imposed on a competitor:

We could also determine a baseline by comparing the regulations imposed on producers to those imposed on competitors according to some pre-specified criteria. For instance, if we refer to buffer zones, we could decide that three meters is our baseline. Possible criteria for the baseline then include:

i. Using a median of the Canadian context or of the main competitors’ situation. However, a median would be difficult to estimate in many cases.

ii. Using the most restrictive requirement of the competitors or of other Canadian provinces. The main issue here is that almost no costs would be recognized for environmentally positive behaviour.

iii. We could use the least restrictive requirement of the competitors or of Canadian provinces (excluding the absence of regulation).

We recommend using the last suggestion (iii) for the following reasons: a baseline defined according to such pre-specified criteria would a) enable us to identify the additional costs incurred by agricultural producers operating in jurisdictions where regulations are more stringent than the pre-specified criteria and b) enable us to identify environmental credits (negative costs) rewarded to producers operating in jurisdictions where regulations are less stringent.

Such a cost and credit method allows us to maintain a relative overall perspective of the results. Another benefit of this method is that it allows us to consider different individual factors (e.g. different environmental circumstances) that could help to explain the differences in regulations and/or costs imposed on producers. This can be viewed as both an advantage and a disadvantage. The advantage is that it would then become irrelevant to identify the ideal set of rules for each regulatory environment in each jurisdiction, a task that is beyond the scope of the present mandate. The disadvantage is that it likely would become difficult to distinguish between producer costs that result from stringent regulations and those that spring from specific environmental circumstances, which require higher intervention.

ÉcoRessources suggests overcoming this difficulty by incorporating, for each of the regulatory requirements, a qualitative overview of the initial environmental conditions in each jurisdiction. Moreover, we recommend the use of ratio analyses such as those developed by the OECD (2002a) in order to improve the analysis. Such ratios will be further discussed following the case study. The ratio analysis done by the OECD is in some sense similar to the one conducted by the EPA in its CAFO analysis.

3.2 Case study: application of the methodology to the riparian buffer strips in potato production

Due to their multiple functions, buffer strips offer numerous environmental advantages. Principal amongst these is the alleviation of multiple nuisances, hence helping to improve the state of rural ecosystems as well as rural society's well-being. However, even where buffer strips might allow for environmental gains, certain disadvantages might cause producers to consider them unprofitable. Indeed, in the short run, the creation of a buffer strip means a loss of land suitable for cultivation. Of course the perception of this loss and its subsequent importance depend on the width of the buffer strip. Yet other costs and inconveniences make producers apprehensive about their use, these include costs related to the establishment and maintenance of the strips as well as numerous other annoyances such as possible drain obstructions.

In order to estimate the costs associated with the loss of cultivable land caused by buffer strips, we used the production cost model developed by La Financière agricole (Cost model, 2004) for managing the potato Agricultural Revenue Stabilization Account (ASRA). We also collected average revenue data based on potato sales in Quebec between January 2002 and December 2002. The loss of cultivable land was estimated from the hypothesis that a stream of 1,000 meters runs along every square kilometer of agricultural land.

Table 4: Technical economic ASRA model for potatoes (2002)

Various production costs	$/hectare
Variable costs	
Seeds	736,70
Fertilizers	790,47
Pesticides	431,58
Rented land	62,09
Labor (contracted)	89,92
Additional labor	496,29
Machinery repair and maintenance	322,15
Fuel and lubricants	152,88
Propane gas	2,58
Electricity	83,71
Marketing costs	48,63
Interests on long-term loans	85,31
Subtotal	3 302,31
ASRA contribution	2,85
Fixed Costs	
Building and land maintenance	128,27
Various insurances	82,99
Property taxes	36,08
Interests on mid-term and long-term loans	208,73
Other costs	168,58
Subtotal	624,65
MINUS	
Other revenues	719,04
Monetary Costs Total	3 210,77
Amortization	464,17
Farmer’s remuneration	373,88
Return on owner’s equity	308,36
Non-Monetary Costs Total	1 146,41
PRODUCTION COST	43 57,18
PRODUCTS	
Potato sales	5 798,17

Source: ÉcoRessources Consultants compilation of data from La Financière agricole du Québec

The ASRA model for potatoes was built in 2000. The model is based on a typical farm in Quebec with 177.48 ha of toiled land of which 103.75 ha are devoted to potato production, while 48 ha are rotated, 17 ha grow oats, 4 ha grow wheat, 10 ha grow barley, 17 ha grow peas, soy beans and canola and 25.73 ha of toiled land are not included in the model.

An estimate of establishment and maintenance costs for buffer strips in Quebec was calculated according to an agri-environmental model conceived by the Comité de références économiques en agriculture du Québec (GEAGRI, 1999).

Agricultural regulations often rely on the decisions of local jurisdictions. It is therefore important to fully take into account the regulatory requirements of various jurisdictions. An overview of the current regulatory requirements in the Canadian provinces is provided in the following table. For the purpose of this exercise, the competitors are defined as the different jurisdictions in Canada.S

Table 5: Main characteristics of provincial regulations concerning buffer strips throughout Canada

	Nfld.	N.S.	P.E.I.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Buffer zone regulation available	No	No	Yes	No	Yes	Yes	No	No	No	No
Buffer zone width			10 m		3 m	3 m				
Quantity of soil lost to the buffer zone regulation			6,505		22,900 acres	75,000 acres				
Estimated rate of agricultural soil lost by regulation			1.50%	0.50%	0.54%					

Source: ÉcoRessources Consultants compilation of data from La Financière agricole du Québec

The following table sums up the various costs that a model potato-producing farm would encounter when using different buffer strips of varying width, which border streams and ditches. The establishment and maintenance costs used are integrated in the table of results.

Some clarifications must be made regarding the use of the Quebec ASRA model. Since the model has been built to evaluate the minimal payments producers must receive to cover their costs, it integrates non-monetary costs such as depreciation, the producer's remuneration as well as the return on owner's equity. We chose not to include those costs in our calculation.

Another point worth mentioning is that our analysis excludes any government support producers might obtain to help alleviate the implementation costs of a given regulation. We have done this because we believe that in this scenario it is necessary to separate the cost of a regulation from the financing of its implementation. However, we recognize the importance of government support in an analytical context where the object is to measure the impact on competitiveness of all government interventions. This, however, is yet another issue that should be addressed in future analyses.

Table 6 indicates that costs for making a buffer strip along streams are marginal. A cereal producer, whose situation approximately corresponds to the farm model used by the ASRA, would see his/her initial annual income (approximately $247,000) reduced by $1,923 after having established a three meter buffer strip and by $6,277 per year after having created a ten meter buffer strip.

Now, as indicated in our proposed methodology, we consider as the baseline the least restrictive requirement of our competitor or, in this case, another Canadian province (excluding those that have no regulations). In the end, the requirements of Quebec and Ontario (three meters) become the baseline. Using three meters as a baseline, we come to the conclusion that Ontario and Quebec producers, as long as they are not located in a municipality that imposes more stringent regulations, incur no additional environmental costs for the establishment of a buffer strip along streams. In contrast, Prince Edward Island producers, facing the more stringent regulation of ten meters, have to pay an extra $4,393 above the baseline cost. Meanwhile, in our model, potato farm producers living in British Columbia, Alberta, Saskatchewan, Manitoba, Nova Scotia, Newfoundland and New Brunswick – who face no regulations – are in fact enjoying an environmental credit amounting to $1,923.

Table 6: Cost of implementing buffer riparian zones on a farm producing potatoes in Canada

	1 Provinces without regulations No buffer strip			2 Reference Quebec and Ontario 3m buffer strip			3 Prince Edward Island 10m buffer strip		
	Potato	Other productions	Total farm	Potato	Other productions	Total farm	Corn	Soya	Total farm
Area cultivated	103.75	73.73	177.48	103.13	73.29	176.42	101.68	72.26	173.93
Variable costs	3,302		3,302	3,302	0		3,302	0	
Fixed costs	625		625	629		625	638		625
Total costs	3,927	0	3,927	3,931	0	3,931	3,940	0	3,940
Revenue									
Sales price/ha	5,798	719		5,798	719		5,798	719	
Total sales	601,560	53,015	654,575	597,951	52,697	650,648	589,529	51,955	641,483
Costs for the producer	407,420		407,420	405,402		405,402	400,605		400,605
Revenues for producer			247,155			245,246			240,878
Costs or average annual gain (6 yrs)									
Establishment (1 yr)				-49	-35		-113	-115	
Maintenance (5 yrs)				-9	6		-29	21	
Cost or annual gain				-57	-28	-14	-143	-94	-39
Balance sheet			247,155			245,232			240,839
Environmental cost/ credit			1,923			0			-4,393

Source: La Financière Agricole, ÉcoRessources Consultants' compilation.

This does not mean in any way that the regulations in Prince Edward Island are too stringent nor does it mean that there should be regulations in British Columbia, Alberta, Saskatchewan, Manitoba, Nova Scotia, Newfoundland and New Brunswick. These findings only show that because of favourable environmental conditions or on account of regulations that are not stringent enough, the producers located in those provinces enjoy an environmental comparative advantage. As such, we are not arguing the fairness/unfairness of this advantage.

On a similar note, it is impossible to establish whether the additional costs imposed on Prince Edward Island producers are exaggerated or, conversely, are too small. The only thing we can safely say is that Prince Edward Island producers suffer from a comparative disadvantage due to prevailing environmental conditions in the province. However, one must also consider other factors that determine the global comparative advantages and disadvantages of a given product stemming from a given jurisdiction. Following this, the use of ratios should then help us to better analyse the obtained results.

Analysis based on ratios

In order to make the obtained results more meaningful, it is preferable to use ratios that may illustrate the potential impact of such regulations on agricultural sectors. This type of ratio is used in studies that are dedicated to applications rather than to theoretical developments. For example, the report entitled *Agriculture Trade and Environment Linkages in the Pig Sector* (OECD, 2002a) refers to environmental costs in proportion to total production costs as a good indicator of the impact of environmental regulations on the sector.

Referring to Jaffe et al. (1995 in OECD (2002a)) this OECD report states that :

> "Several studies conclude that negative effects on competitiveness cannot be clearly identified. One reason often given for this finding is that costs imposed by environmental regulations are relatively modest compared to other costs and generally do not exceed 1-2% of production cost."

Moreover, the study refers to Sullivan et al. (2002 in OECD (2002a)) who established that, in the U.S., manure management costs in the pig sector represent between 1% and 8% of the total cost of raising pigs. Using the same methodology, the OECD report establishes that in Denmark the general range of manure management costs is 3.5-7.0% of the total production costs. According to OECD, these costs are slightly higher than the environmental costs incurred in conventional manufacturing industries.

Along the same lines, in a paper entitled *Measuring the Impact of Regulations on Small Firms*, the National Center for Environmental Economics proposes using similar ratio tools. Given various constraints such as availability of the information and applicability, the use of such ratios as indicators would offer a general overview of the situation. In addition, it could: a) be used to study the impact of a set of regulations; b) address regulations from an ex-post perspective; c) be easily applicable; and d) be replicated for different jurisdictions that have different characteristics.

The definition of ratios

1. Environmental costs as a percentage of total production costs

As previously mentioned, the OECD analysis, as well as many other studies on the impact of regulations on different manufacturing sectors, have used environmental costs as a percentage of total production costs in order to indicate the impact of environmental regulations on the sector. ÉcoRessources suggests to also use this indicator in agriculture, as the OECD has done, and to compare the subsequent results to those of other agricultural and economic sectors.

As an indication, the following range of values could be used:

- in the U.S., manure management costs in the pig sector represent between 1% and 8% of the total cost of raising pigs;
- in Denmark, the general range of manure management costs is within 3.5-7.0%; and
- in the whole economy these generally do not exceed 1-2% of production costs.

2. Environmental costs as a percentage of total sales

U.S. federal agencies such as the Environmental Protection Agency (EPA) and the United States Department of Agriculture (USDA) have for many years been analyzing the impacts of regulatory requirements on regulated communities. For example, the *Clean Water Act*, which requires to evaluate economic achievability, has, since the early 1970s, prompted the EPA to analyze the economic and financial impacts of effluent guidelines on affected industries. Generally, the EPA measures impacts using a variety of approaches that attempt to examine post-compliance changes in key financial variables and in many cases a benchmark is developed. Usually, the EPA uses more than one financial variable in an assessment because a single variable is rarely sufficient to fully describe the relative financial health of an affected body.

For the CAFO rulemaking, the EPA selected its criteria in accordance with those commonly used in the agricultural sector to measure financial stress, and in conjunction with those the Agency used in the past to establish the affordability of effluent guidelines developed for other industries. The EPA focuses on three financial criteria to check out if the final CAFO regulations are affordable to affected businesses: 1) an initial screening comparing incremental pre-tax costs to total gross revenue (sales test); 2) projected post-compliance cash flow over a 10-year period (discounted cash flow [DCF] analysis); and 3) an estimation of an operation's debt-asset ratio under a post-compliance scenario (debt-asset test).

Given the information available in the different Canadian production cost models, we suggest using, as our only criterion, the incremental pre-tax costs to total gross revenue (e.g. the sales test). The EPA suggests using a three percent pre-tax costs to total gross revenue ratio as a baseline and, in fact, when the sales test results in a value lower than three percent, the EPA considers it affordable. Therefore, we suggest using this as a reference for the evaluation of the impact of agricultural regulations on the sector.

The data in Table 7 permit the construction of the two ratios suggested as indicators of the impact environmental regulations have on production costs.

Table 7: Cost of implementing buffer riparian zones on a potato-producting farm in Canada expressed as a percentage of total costs and revenues

	No buffer strip	3m buffer strip	10 m buffer strip
Cost for producer	$407,420	$405,402	$400,605
Revenue for producer	$247,155	$245,246	$240,878
Environmental cost/credit	$1,923	$0	$4,393
Environmental cost as % of total cost	0%	0%	1.8%
Environmental cost as % of revenue	0%	0%	1.1%

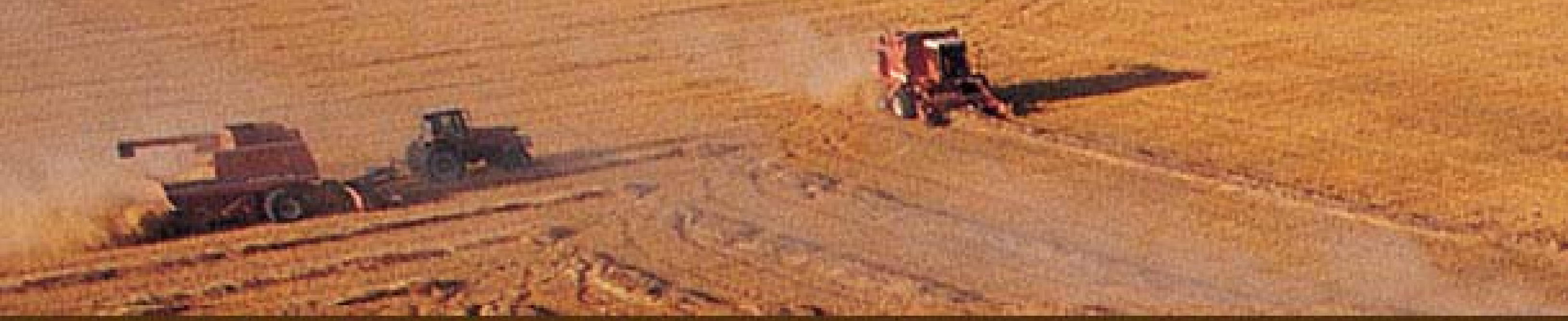
Source: ÉcoResources Consultants compilation.

These results can be interpreted in different ways. At first, it is tempting to compare the ratios between provinces and in doing so, we would conclude that Prince Edward Island producers bear a heavier burden than other producers in Canada. This is no surprise, but we must again insist on the fact that this analysis does not suggest any conclusions with regards to whether the regulations are too severe or not.

The purpose of the ratios is to compare these results to the benchmarks identified above. As previously mentioned, in the whole economy these ratios generally do not exceed 1-2% of production costs, and in Denmark the general level of manure management costs is within a range of 3.5-7.0%. This comparison leads us to conclude that even in Prince Edward Island, where stream buffer strips are the largest, the costs imposed on producers do not seem excessive. Of course this holds true as long as there are no other important environmental costs imposed on Prince Edward Island potatoes producers.

There are some limits to the use of the proposed ratios and it is significant to point them out. We must again emphasize that by choosing one production model we do not seek to imply that this model is an accurate description of any given production in various jurisdictions. In the example above, the model we used indeed accurately describes the reality of potato production in Quebec. However, it may not offer a good estimate of the production reality in other provinces. In fact, in other jurisdictions potato producers may face different markets, use different varieties of potatoes and as a result incur different production costs.

The ratios give a good idea of the burden environmental regulations impose on producers but they must be interpreted with care. For instance, it is important to take into consideration that in Prince Edward Island the soil is sandy and that the rivers are relatively small. As a result, the soil is easily carried into the water and potential damages can be significant. This explains the need for a stricter regulatory environment in Prince Edward Island.



Chapter 4
Societal impacts (social costs and benefits)

The government's main objective in adopting environmental regulations is to produce public benefits by reducing damages to the environment and the risk of deterioration of public health. These benefits are reflected by changes in the quality of the environment and by the related improvements in the present or potential use of resources.

In addition to the private costs that are imposed on producers, which we addressed in the previous chapter, government interventions also produce social costs. These costs are illustrated in the following table by the shaded areas.

Table 8: Social costs and benefits to society identification draft

Social costs	Social benefits
Regulatory costs to industry (direct resource costs)	WATER
Annualized capital costy	Improved surface water quality
Operations and maintenance costs	Reduced incidence of fish kill
Costs to governments	Reduced contamination of private wells
Costs to permitting authorities - Administrative costs	Reduced contamination of animal water supplies
Other costs	Reduced eutrophication of estuaries
Transfers - Subsidy - Fiscal	Reduced water treatment costs
Market impacts (price driven) - General equilibrium models	Reduced eutrophication & pathogen contamination of coastal & estuarine waters
Transitional costs (resulting from closure, relocation, etc.) - result of financial impact analyses - Worker relocation	Reduced pathogen contamination of private & public underground sources of drinking water
Indirect costs (effects on product quality, productivity and innovation)	Reduced human & ecological risks from antibiotics, hormones, metals, salts
Distributional analysis - Entity size - - Income level - Regional - Age - Gender - Minority status - Time (future generations)	Improved soil properties
	Reduced cost of commercial fertilizers for non-CAFO operations
	Air
	Air emissions from animal confinement operations
	Reduction in ammonia and hydrogen sulphide emissions
	Reduction in greenhouse gas emissions
	Reduction in criteria air emissions from energy recovery systems
	Air emissions from land application activities
	Reduction in air emissions from vehicles
	Energy impacts

Sources: Agricultural pollutants: sediments, nutrients, pesticides, salts and pathogens.

Possible cost evaluation methodologies

For clarification purposes, we have distinguished top-down and bottom-up methodologies. The top-down methodologies are based on data gathered at a regional, state or country level. The bottom-up methodologies are based on an analysis that begins at the farm level and build up to the level of general society.

Statistical regressions (top-down methodology)

Stephen Meyer (1995), from the Massachusetts Institute of Technology, compared the economic performance of 50 states in the U.S. during the period of 1973 to 1989 with the stringency of their environmental measures (e.g. policies, programs and regulations) using statistical evaluation procedures. Following this strategy, he found a positive (but not significant) correlation between environmental measures and a range of economic indicators, including gross state product, labour productivity and employment. This type of statistical regression model has not been applied to agriculture but some scholars have studied the impact of environmental regulations on the spatial distribution of livestock operations in the U.S.

For instance, Herath, Weersink and Carpentier (2003) proceeded much like Meyer for the entire economy. They used a statistical regression to link the stringency of the environmental regulations to the concentration of livestock productions in the different states. Thus, changes in the state production levels of hogs, dairy and feed-cattle were examined for the period of 1975 to 2000. The annual growth rate in inventories served as the dependant variable used as an aggregate measure of spatial production.

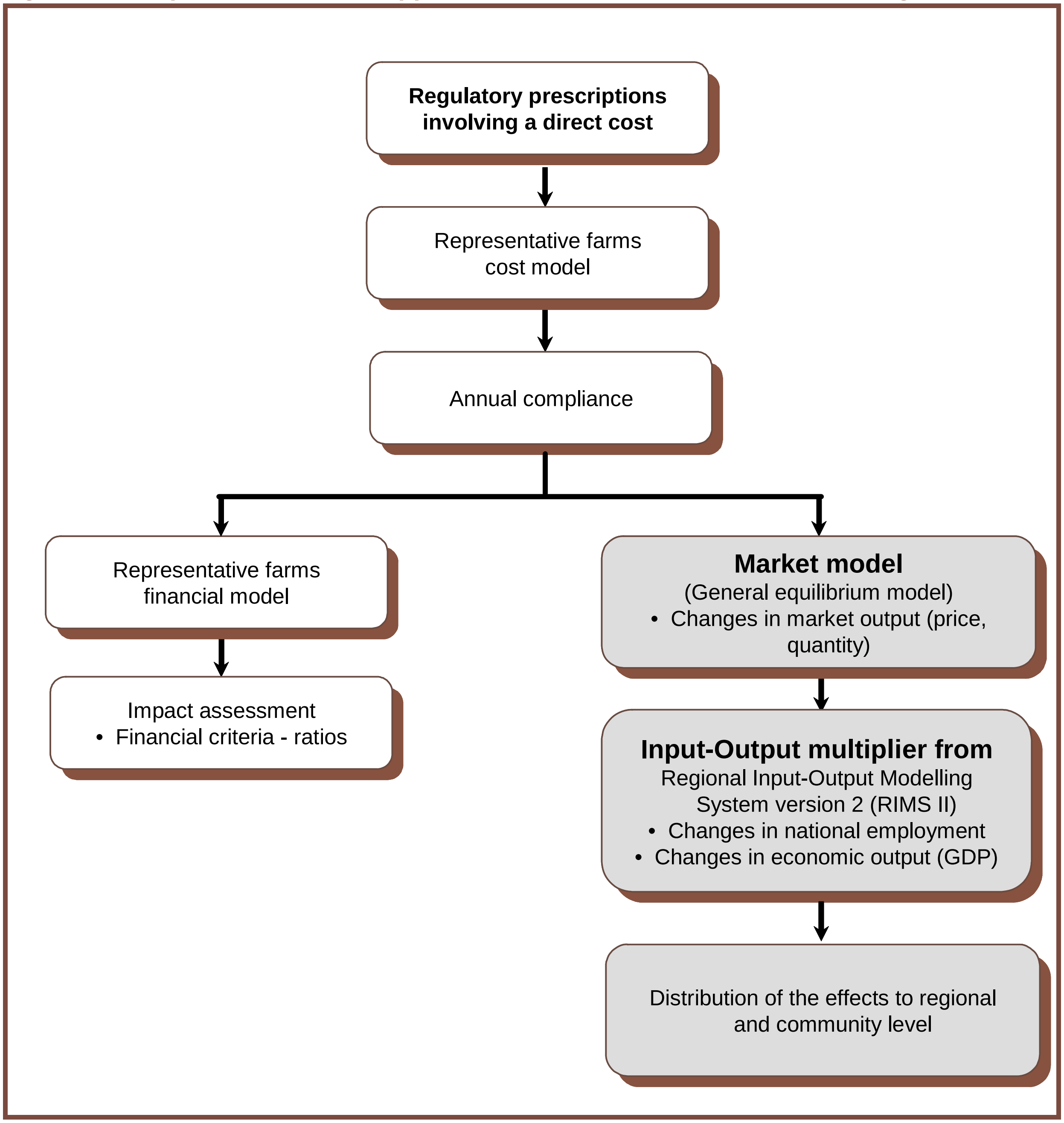
Looking at the work of Herath, Weersink and Carpentier (2003), it appears that statistical regressions could, in theory, be used to assess the impact of environmental regulations in agriculture on the Canadian economy as a whole. It would then be possible to rank provinces in terms of the stringency of their environmental regulations in agriculture and try to link this to the evolution of the GDP in the different provinces. However, the statistical robustness of the results is likely to be weak given that the sample population consists of only nine Canadian provinces. To increase the number of observations, some U.S. states could be added, but this would greatly increase the level of difficulties. Moreover, since Meyer's work shows that the impact of environmental regulations on GDP in general is not significant, one might expect that the impact of environmental regulations affecting only a subset of the economy – such as the agricultural sector – would be even less significant.

Technical economic models (representative farm approach – EPA) – bottom-up methodology

A representative farm approach would be consistent with past research conducted by the USDA, the land-grant universities and their affiliated research organizations. These and other organizations have widely adopted the representative farm approach to examine a broad range of policy issues, including changes in federal agricultural policy and pricing programs, domestic food programs, environmental legislation and international trade. This approach has also been used to assess agricultural market changes for both livestock and crop commodities, as well as to evaluate the financial impact of implementing management measures and installing animal waste systems at livestock and poultry operations.

As discussed earlier, the EPA has similarly developed financial models for each economic sector and region as well as for different sizes of operations. These CAFO models are used to compute the average costs and economic impacts of the revised regulations across differently sized, managed, and geographically-distinct operations. Figure 3 summarizes the CAFO models, the branch in grey being the relvant one for this chapter. These models provide the basis for calculating the total annual costs of the final regulations and are used to evaluate potential financial impacts on regulated CAFOs. The EPA then uses an input-output model to assess additional market impacts, including national level changes in prices and available quantities, as well as changes in national aggregates such as employment and economic output Gross National Product (GNP).

Figure 3 : Representative farm approach - EPA model used in the CAFO regulations



A representative approach provides a means to assess average impacts across numerous facilities by grouping them into broader categories to account for the multitude of differences among animal confinement operations. This approach allows for the accounting of differences in performance among farming operations.

In addition, this analysis also allows for the examination of changes throughout the economy as impacts are absorbed at various stages of the food marketing chain. It is intended as a long-term analysis to show the societal impacts of the regulations, including effects on pricing and quantity. Other market changes examined by the EPA include changes in regional employment and changes in U.S. livestock and poultry trade (imports and exports). This analysis uses national level production and employment impacts to approximate potential regional impacts at the community level.

According to the U.S. Congress, Office of Technology Assessment, Industry (U.S. OTA 1994) the ex-ante evaluation of the impact of environmental regulation can be done through general equilibrium models. Giving an example, U.S. OTA (1994) refers to Denisen[4] who found that in the absence of environmental regulations from 1973 to 1982, annual U.S. GNP growth would have been 0.07 % higher. Therefore, the question of interest is: are the tools needed to implement similar approaches available in Canada?

a) Representative farm model

As mentioned before, at the federal and provincial levels in Canada, different agencies use farm models to manage different kinds of programs that target producers. Nevertheless, there is no comprehensive set of farm models. Although Canada does not have a comprehensive tool to assess the impacts of a set of regulations on producers, it appears that most of the necessary information exists in various forms and can be put together and used to evaluate such impacts.

b) Use of the general equilibrium model

The federal government (Ministry of Finance) has developed a general equilibrium model in order to assess the impact of some shocks on the economy. It is likely that this model could be modified, such as the DRAM model was, to assess the impact of environmental regulations, and more precisely environmental regulations that affect agriculture. The results could then be used as inputs for the input-output model. However, such modifications are likely to require significant time and monetary efforts and such a model is not easily replicable for different jurisdictions.

c) Use of the input-output model

An empirical strategy could be based on the input-output (I-O) model of Statistic Canada. The economic impact of environmental regulations could be calculated for all Canadian provinces using I-O simulations. More specifically, economic impacts can be separated into three elements (Baillargeon and Hamel, 1993):

1. Direct effects: when part of the sector's initial demand directly contributes to the use of factors of production, such as labour and capital;

2. Indirect effects: the economic effects or impact on input suppliers; and

3. Induced effects: the growth in economic activity resulting from increased income (e.g. salaries and wages). In other words, the effects of income by those who receive it.

4. *Denison, E.F., Trends in American Economic Growth, 1929–1982, Brookings Institution, Washington, DC, (1985)*

In simple terms, direct effects are the result of investment expenditures in a targeted sector. Indirect effects are associated with the economic impact of investment expenditures upstream of the sector. Induced effects are associated with new spending or the economic impact of investment expenditures downstream of the sector (Juneau, 1998).

The I–O models developed by Statistics Canada can be used to simulate the impact of various investment projects (expenditure shocks) on economic activity in terms of production, jobs, income, taxes and imports (Thompson and Thore, 1992). These models are based on the structure of inter-industrial linkages. I-O models work with expenditures, so the downstream impact of various sectors cannot be evaluated (Poole, 1999). For instance, simulating an increase in biofood production at the primary level makes it possible to measure the impact on input suppliers, but not the downstream impact on the processing and distribution of the processed products. In other words, I–O models allow for the measurement of direct and indirect effects, but not of induced effects (Poole, 1999). In the case of this study, simulating a shock at the production level would allow us to measure the direct and indirect economic impacts of an environmental regulation at the farm level.

Thus, it seems possible to work towards combining different production cost models and to then use the results as input in the I-O model. It would give a general picture of the impacts of environmental regulations that could be used as an indicator of social cost. However, this might not be easily applicable. For this reason, we suggest to use the representative farm models, to aggregate it in order to measure the total private economic impacts on all farms producing a particular commodity, and to then use it as a proxy of the social cost of environmental regulations.

The use of financial ratios could then be used as a complementary tool to assess the significance of those costs in terms of their impact on the competitiveness of the industry.

Analysis based on a global ratio

Given the constraints we are facing, a complementary methodology could be the use of a ratio that would illustrate the potential impact of those regulations on the agricultural sector and hence on the economy. The idea is simply that if there is no strong impact on the agricultural sector, there should not be a larger impact on the economy as a whole. ÉcoRessources proposes a ratio that would represent environmental protection capital expenditures over total capital expenditures.

In January of 2004, Statistics Canada released a study portraying environmental protection capital expenditures in agriculture in Canada. The study is based on a farm financial survey in which few questions directly concern environmental expenditures. Using this information, it is possible to build a ratio of environmental protection capital expenditures as a percentage of total capital expenditures. Such a ratio could be used as an indicator of the possible impact of environmental regulations on the agricultural sector and is comparable to similar ratios in other industries and other countries, including the following:

- U.S. 2.8% of total capital expenditures (1990);
- Japan 3.5% of total capital expenditures (1990);
- Netherlands 4.5% of total capital expenditures (1990); and

- Canada (primary and manufacturing industry only); nominal 1995 $2.1 billion or 1.8% of total capital expenditures:
  -1996 $1.9 billion or 1.5% of total capital expenditures;
  -1997 $1.7 billion or 1.2% of total capital expenditures.

Source: Environment Canada, http://www.ec.gc.ca

One concern with this indicator is that the questionnaire used to compile the information provides only a portion of the information required concerning environmental capital expenditures. Another limit lies in the fact that many of the environmental costs in agriculture are not capital expenditures. Therefore, such an indicator allows only a limited amount of interpretation.

Evaluation of the benefits – the difficulties faced

A serious limitation of several of the studies previously mentioned is that while they include the costs of environmental regulations, they do not include their benefits. Therefore, these models usually indicate that regulations lower the GDP. In reality, there are a number of advantages that can be derived from regulations, both for the polluting firm and the rest of society. For instance, a polluting firm may benefit from pollution control when the latter involves implementing changes in the production process that result in increased productivity, lower energy and resource use, and/or increased workers' welfare. Sizeable benefits also occur outside the firm. For example, a more efficient use of natural resources – leading to lower pollution levels and therefore increasing, for instance, agricultural and fishery yields – also reduces health care and maintenance costs, as well as capital expenditures on environmental controls (e.g. public water treatment plants, among others,) all of which in turn increase the GDP (U.S. OTA, 1994).

When these benefits are adequately accounted for, conclusions about the contribution of environmental regulations to a country's GDP might reverse and become positive. Even in situations where benefits may be minimal, omitting them always casts an exaggerated picture of economic losses.

Furthermore, some benefits are non-monetary and are difficult to include in the GDP calculation. For example, factors such as the recreational use of natural resources, reduced nuisance (e.g. odour) from pollution, and even biodiversity, which might result from a cleaner environment, would not necessarily be accounted for in existing economic measures. Indeed, there are important flaws in the way national wealth is calculated with respect to natural resources. While the depreciation of man-made capital assets (e.g. plants, equipment, buildings) is subtracted from GNP to calculate the net national product (NNP), the depreciation of either natural capital (e.g. soil, forests, fisheries, minerals) or human capital (e.g. illness due to pollution), due to their depletion, is not subtracted. As a result, not all of the results of defensive activities that slow down the degradation of natural and human resources should be measured in GDP, even if these raise the level of societal welfare (U.S. OTA, 1994).

While it is important to include these benefits in any assessment of the relationship between environmental regulations and economic growth, accurate and comprehensive methods to estimate the benefits associated with environmental regulations have not yet been fully developed. According to U.S OTA, 1994, the U.S. spends significant resources regulating some pollutants that cause little damage to health or the environment, while it spends few resources abating other pollutants that cause greater environmental damage and eventually lower GDP (e.g. indoor air pollution). In contrast, some others who consider such examples argue that the benefits of environmental regulations outweigh the overall costs.

Nevertheless, even where the benefits derived from regulations do exceed the costs, the latter usually occur in the present while the benefits often occur in the future. If other countries choose to minimize short-term costs by limiting regulation, they may gain a short-term competitive advantage that can also be translated into a long-term advantage. In addition, costs may be concentrated, affecting certain industries, workers and communities, while benefits may be diffused (U.S OTA, 1994).

Ultimately, this brings us back to the argument that an environmental policy is only economically efficient if it strikes an appropriate balance between costs and benefits. According to Latacz-Lohmann (2001), to make this possible the marginal value of environmental improvement must be equal or superior to the marginal costs of generating that improvement. It is clear, however, that efficiency criteria are of little use in practical policy design because of the inherent difficulties in quantifying the costs and benefits of environmental measures, let alone their marginal values. The problem is exacerbated by the spatial dimension of most agri-environmental problems. The same physical impact, for instance the leaching of one kilogram of nitrate, may have widely varying economic impacts depending on where the leaching occurs (Latacz-Lohmann, 2001).

However, although efficiency criterion cannot be made fully operational at the level of practical policy design, it is by no means superfluous. It provides a useful reminder to policymakers that the design of environmental policies essentially is (or should be) an exercise of weighing costs against benefits (and trying to maximize the difference). This is particularly important for the first step in the policy design process (i.e. the definition of policy goals).

Meanwhile, the purpose of a regulation is to correct a market failure caused by a negative externality and, hence, to reduce a stress on the environment (reduce a damage). Conversely, its purpose is to produce a benefit by restoring the ecosystem. Providing benefits is a regulation's essential purpose and aim, and as a result, regulations are inherently social.

The benefits of a regulation are reflected by identifiable changes in environmental quality after a regulation has been enacted, and by the related improvements in the range of potential uses of the resource in question. The value of the regulation is then measured according to how people value these changes and new opportunities. This can be measured through welfare measures, which look at the willingness to pay and the willingness to accept compensation.

The standard approach to addressing this issue is similar to that of identifying the costs in a cost-benefit analysis:

- What are the categories of benefits (objectives) of the different prescriptions for the regulations considered?
- What pollutants are the regulatory prescriptions intended to reduce?
- What are the pathways from the regulated pollutants to the environment (e.g. water, air)?
- What are the impacts of these pollutants on human health and the environment?
- To what extent is the regulation responsible for the reduction of pollutants?
- What is the value of the reduction of pollutants?

The full process requires the availability of relevant ecological knowledge, methods, data and models to describe the source-receptor relationship and to characterize the environmental consequences on the ecological endpoints. The results of this exercise are, in principle, contrasted to the costs of the regulatory prescriptions and should produce a positive net result. But the identification of the benefits and their value measurement is a very delicate operation, even more so for the agricultural sector.

First, let us consider the fact that generally speaking, the regulator (usually the government) seldom has sufficient information about possible economic damages. In most cases, the solution to this problem lies in adopting a cost effective approach. In practice, this means that the outcome is achieved at the least possible cost. But how do we define the outcome?

In the agricultural sector, that question is of particular relevance because the physical nature of non-point pollution limits the ways in which a goal may be defined. There are two general types of policy goals: 1) physical goals (e.g. water quality and runoff) and 2) input and technology-based goals.

Considering the physical goals, a certain number of characteristics limit their applicability:

- The random nature of non-point source pollution requires that these goals be set to attain a probability of occurrences of a given outcome, rather than a specific outcome.
- In theory, the method of pollution control that achieves a physical goal with the greatest expected social net benefits will generally differ from the cost-effective method of achieving that same goal.
- Notwithstanding the difficulty of monitoring the results – mainly because of the large number of producers – there are great difficulties in identifying the role the agricultural sector plays in generating the environmental damages we seek to prevent or eliminate.

Conversely, input and technology-based goals offer an interesting and practical alternative to physical goals. They can be directly controlled and more easily verified. However, these goals are " blind" to environmental benefits or damages, which are site-specific (e.g. watershed-based). In essence, input and technology-based goals are more difficult to translate into benefits. Despite these difficulties, some studies have tried to identify the benefits expected from a regulatory initiative in the agricultural sector and to monetize them.

In the U.S., Canada and most OECD countries, requirements to perform a regulatory impact analysis (RIA) for every major regulation adopted by governments have been introduced as part of an overall effort to improve the efficiency of both government policies and more particularly of regulations. The RIA seeks maily to determine whether a regulatory initiative produces benefits that justify the subsequent costs when considering the distribution of outcomes across society. It also aims to minimize the costs and market distortions associated with a given regulation and to examine alternative goals-based and non-regulatory approaches. The RIA is based on a cost-benefit analysis framework, which means that the studies have to consider and demonstrate, at least in principle, that the imposed costs are proportionate or lower to the resulting benefits.[5]

5. *See OECD program on public management and governance (PUMA) - http://www1.oecd.org/puma/*

The EPA CAFO benefit study

The EPA CAFO benefit study, which concentrates on water pollution, is one of the most thorough exercises in identifying and valuing the benefits of environmental improvements resulting from regulations in the agricultural sector. This study is part of a RIA done under executive order 12866. The final rule for CAFO was published in the federal register on February 12, 2003. The EPA study uses the benefit transfer methodology to monetize benefits. This contrasts the primary approach, which uses the standard techniques of benefit valuation. The reason is very simple: the resources and the time required are very important, and because of the uncertainty involved in the estimation of the physical reductions of pollutants resulting from the regulation, the benefits related to the increased knowledge from those primary studies are not justified by their costs. The methodology used concentrated on the most important changes in environmental quality as a result of the regulations and its subsequent beneficial uses. These changes were then monetized using the benefit transfer methodology.

In the U.S., the formal requirement of conducting a RIA dates back to 1981[6] and the EPA issued its first *Guidelines for Performing Regulatory Impact Analysis* in 1983. The latest edition of these guidelines was issued in September 2002 and contains a detailed discussion as well as various recommendations for analysing the benefits of regulatory initiatives[7] and addressing the challenges involved in valuing them. The guidelines recommend: 1) the valuation of benefits on an effect-by-effect basis by aggregating individual evaluations to arrive at total benefits and 2) using the benefit transfer approach because of its multiple advantages. The recent benefit analysis done for the CAFO RIA clearly illustrates this kind of approach (see OMB guidelines).

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6. *Executive order 12291, which directed federal agencies to assess the costs, benefits and economic impact of their major regulations and establishing a formal review process using by the Office of the Management of Budget (OMB).*

7. *Guidelines for Preparing Economic Analysis, USEPA 2000.*

OMB Guidelines

Benefit estimates (excerpt)

A discussion of the expected benefits of the selected regulatory option is needed for each major final rule in the accounting statement and associated report. How is the proposed action expected to provide the anticipated benefits? What are the monetized values of all of the potential real incremental benefits to society?

Results should be presented by:

- Including a schedule of monetized benefits that show the type and timing of benefits and express the estimates in this table in constant, undiscounted dollars.
- Listing the quantifiable benefits, but not possible to monetize, including their timing.
- Describing benefits that can be monetized, such as decreases in the risk of extinction of endangered species.
- Identifying or cross-referencing the data or studies on which the benefit estimates are based.

In recent years, the US Congress has required – under the *Regulatory Right to Know Act* (December 2000) – that the Office of Management and Budget (OMB) produce an annual report on the costs and benefits of federal regulation. That same year, the OMB issued its *Guidelines to Standardised Measures of Costs and Benefits and the Format of Accounting Statements*[8]. The report is based on the RIAs done by the different Agencies during the preceding year. The OMB guidelines outline a process to deal with benefit estimates.

In Canada, a socio-economic analysis (SEA) has been required for every major regulation since 1986. The regulatory policy was revised substantially in 1992 and the formal requirement to submit a RIA to the Treasury Board for every major regulation was strengthened. A regulatory impact analysis statement is published in the Canada Gazette to summarize the RIA (OECD 2002b). A *Benefit-Cost Analysis Guide for Regulatory Programs*[9] has been issued by the Treasury Board to guide analysts in performing a RIA. The guide contains a section on *Evaluating Environmental Quality and Other Public Goods,* and human health impacts are treated in a section on risk analysis.

It is worth mentioning that Environment Canada has initiated the development, with the EPA, of the Environmental Valuation Reference Inventory (EVRI)[10], of a searchable database of empirical studies on the economic value of environmental benefits and human health effects. This database is a tool to help policy analysts use the benefits transfer approach. EVRI has now acquired the support and endorsement of the European Community and the French Ministère de l'écologie et du développement durable(MEDD) and the British Department for Environment, Food and Rural Affairs (DEFRA) environment departments.

8. *http://www.whitehouse.gov/omb/memoranda/m00-08.pdf.*
9. *Treasury Board of Canada, August 1995.*
10. *http://www.evri.ca/*

Some Canadian provinces have also developed their own process of regulatory improvement comprising a RIA but most of these studies are not publicly available.[11] These requirements have built best-practice experiences and have stimulated progress in the use of benefit valuation methodologies and tools. But much more needs to be done. Because of the numerous shortcomings in valuing benefits to support policy decisions, the EPA has been engaged in a major process to improve its capacity to value benefits. Its *Framework for the Economic Assessment of Ecological Benefits* (EPA, 2002) outlines a process for conducting assessments of ecological benefits – assuming that the necessary methods, models and data are available. But because of knowledge gaps, and a lack of available tools to overcome these, the implementation of the framework requires developing tools to overcome such gaps. One of the basic gaps is the inability of ecological assessments to serve as a basis for valuing benefits. The ecology-economics interface is not adequate, and it is intended for ex-ante evaluation studies. We dare to say that this situation is exacerbated in the Canadian context.

The ex-post studies on the impact of environmental regulations that have been done to date rely mostly on the ex-ante RIAs that were done to justify these regulations in the first place. In our case, since most - if not all - regulations were adopted by provinces these RIAs are either non-existent or inaccessible.

In the present study, the questions we are trying to answer are:

- Are these regulations producing the environmental, social and economic benefits they were expected to deliver?
- Are these regulations efficient?
- What are the results of the prescriptions and costs that were imposed on primary agriculture?

Since RIAs have not been conducted for all regulations considered, and therefore benefits have not been identified, quantified and monetized, we lack information. At best we can have access to a few studies, which can give us an indication of some of the expected benefits of those regulations. A literature review reveals that in OECD countries governments seldom conduct ex-post studies of either the performance of their regulations or their RIAs[12], but this situation is changing. It is, however, worth noting that these ex-post analyses are not without their own shortcomings.

The major difficulties identified by the U.S. General Accounting Office (GAO)[13] are: 1) determining the baseline against which the changes can be identified and measured; 2) isolating the reasons for the actions taken; 3) obtaining valid cost data from the regulated entities; and 4) quantifying the benefits. Experts interviewed for the GAO study agreed that it is extremely difficult to quantify the benefits as part of a retrospective study. Two major reasons cited by the experts were that: 1) data on benefits is simply not available and 2) it is very difficult to assign the benefits to a particular regulatory action versus other factors.

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11. *For example see Quebec's Secrétariat de l'allègement réglementaire guide http://www.mce.gouv.qc.ca/f/objets/Etude_impact.pdf.*

12. *See "Proceedings from the OECD expert meeting on Regulatory Performance: Ex Post Evaluation of Regulatory Policies, OECD, Paris, 22 September 2003 - http://www.oecd.org/dataoecd/34/30/30401951.pdf.*

13. *Environmental Protection: Assessing the Impacts of EPA's Regulation Trough Retrospective Studies, US General Accounting Office, Report to Congressional Requesters, September 1999, GAO/RCED-99-250.*

In our case the difficulty is compounded by the fact we are examining a set of regulations without having an ex-ante analysis, and that we are doing this with a limited, and probably inconsistent, set of ecological indicators, and on a limited spatial and temporal scale.

Benefit assessment

As stated by Easter and Archibald (1998), in any evaluation of environmental regulations one of the critical issues is assigning a value to non-markets goods. Available valuation techniques such as travel costs, hedonic pricing and contingent valuation each have their strengths and weaknesses. Some are more relevant for valuing specific environmental goods and services than others. As with any other estimate, they are subject to error. The size of the error, however, depends on how well the study is done and how well its assumptions match future events such as population and industrial growth. Even estimates based on market values are subject to error since efforts to predict future economic conditions are fraught with common uncertainties. In any analysis, it is essential to make clear to the decision-maker the underlying assumptions, the limitations of the model and the level of accuracy of the data.

Both the hedonic pricing and travel cost techniques use changes in the value of market goods as a means to determine the value of changes in the environmental quality of the said market good. For hedonic pricing, the market goods could be a house, land or the change in the cost of labour. In the travel cost technique, a cost is assumed to have the same impact on users as an admissions fee and the difference in travel costs among users is used to derive the demand for a particular recreation site.

A challenge with the hedonic approach is to isolate the effects of the change in environmental quality on the price of land, house and labour. Hedonic analysis can be used only where land, housing or labour markets are reasonably well-developed and situated in densely populated areas where many market transactions occur. For example, an active housing market close to a lake would provide a good basis for determining how much an improvement in water quality has added to the value of a lakeside house.

According to Easter and Archibald (1998), contingent valuation is potentially the most comprehensive and flexible of non-market valuation methods. Under appropriate conditions, it can provide estimates of both the use value" and non-use values associated with changes in environmental regulations. Non-use values are related to an individual's desire to know that a certain environmental asset exists and will continue to exist in the future, even though he/she may never make use of it. Contingent valuation is the only widely-used procedure for estimating these non-use values.

On the other hand, contingent valuation remains controversial primarily because it is based on stated preferences rather than on revealed preferences. This concern is not about to vanish but it can be partially addressed by continued efforts to improve its application (Bishop and Welsh, 1998). In some cases, it is also possible to combine revealed and stated preferences, to determine if non-users and users have the same preferences, and to improve estimates.

Benefit transfer methodology

Benefit transfer methodology is the adaptation and use of economic information derived from a specific site(s) under certain resource and policy conditions and transferred to a site with similar resources and conditions. The site providing the data is typically called the study site, while the site to which data is transferred is called the policy site. The methodology essentially consists of transferring the results of one or several studies from one location to another to derive the economic values involved in a project or policy. The most important challenge is to identify the most appropriate studies for the exercise.

Benefit transfer is considered a feasible alternative to using one of the primary methodologies, which we introduced in the previous section, that use either revealed or stated preferences. Benefit transfer has clear advantages: 1) original studies are expensive and time consuming and 2) benefit transfers can reduce the time and financial resources needed to produce benefit estimates for a proposed policy. It also has its drawbacks; most notably that benefit transfers are not as accurate as original studies. However, in many circumstances or policy-making contexts, the information this methodology provides is very valuable, particularly because it offers the only structured economic information available and provides a ballpark figure.

There is abundant economic literature on benefit transfers, and there is even a tool that was developed to facilitate and improve the quality of using this methodology. It is called the Environmental Valuation Reference Inventory (EVRI) and was developed by economists at Environment Canada in co-operation with the EPA. EVRI is essentially an inventory of recognized quality studies organized into a searchable database that can be used for benefit transfers.

Conversely, the National Oceanic and Atmospheric Administration (NOAA) recommends taking into account three factors when choosing the appropriate studies:

1. comparability of the users and resources and/or services being valued, as well as the changes resulting from the new environmental attention;
2. comparability of the changes in quality or quantity of resources and/or services; and
3. the quality of the studies being used to determine the transfer [59 FR 1183].

Experience shows that in order to be worthwhile, the methodology still requires a large amount of specific information and a more rigorous process.

We should keep in mind that, with this exercise, we are aiming to measure what is called the consumer surplus. Consumer surplus is the value of an environmental service beyond what must be paid to enjoy it. Consumer surplus is also referred to as net willingness to pay, or willingness to pay in excess of the cost of the good. Total economic use value is consumer surplus plus the costs of participation.

There are four basic transfer methods: 1) Single point estimate transfer; 2) Average value transfer; 3) Benefit function transfer; and 4) Meta analysis function transfer.

Below is a brief description of each:

1. **Single point estimate transfer**

   A single point estimate transfer is based on the use of an estimate from a single relevant primary research study or from a range of point estimates if more than one study is relevant.

2. **Average value transfer**

   An average value transfer is based on using a measure of the average measure of either all, or subsets of, relevant and applicable studies.

3. **Benefit function transfer**

   Benefit function transfers entail the use of a model that statistically relates benefit measures with study factors such as the characteristics of the user population and of the resources being evaluated. The transfer of an entire demand function is considered conceptually sounder than value transfers.

4. **Meta analysis function transfer**

   Meta analysis is a statistical summary of the relationships between benefit measures and the quantifiable characteristics of a study.

Each of these methods involves the following steps:

Table 9: Steps in performing benefit transfers

	Steps
1.	Identify the natural resources affected by a proposed action
2.	Translate resource impacts into changes in use (recreational, etc).
3.	Measure use changes.
4.	Conduct a literature search of relevant study sites.
5.	Assess the relevance and applicability of study site data.
6.	Use the value provided or an average, or adapt the demand or benefit functions to the characteristics of the policy site, and forecast benefit measures.
7.	Multiply the benefit measure by the total changes in use.

Proposed benefit evaluation strategy

Did the regulations produce their expected results? What is their environmental performance? What are the benefits that society derives from these regulations?

As we have seen, the answer to these questions is not at all straightforward because most of the time the expected environmental results are either unclear in the regulations, or are not framed in a way that allow for a reasonable follow-up of their impact. Sometimes, they are not even measured at all. They often are input or technology-based goals. In this indirect perspective, we could simply rely on what we could call regulatory performance and look at enforcement and compliance indicators to see if the regulatory prescriptions are implemented properly. But this is only part of the answer because it does not provide much information about the environmental outcomes.

To provide a case scenario, when looking at the water pollution in a given jurisdiction/region, we would propose to first assess the level of damage caused by specific pollutants that are both used in primary agricultural activities and are native to a given jurisdiction or region. In other words, we would seek to contain the pool of benefits we consider. We would do this by:

a) Looking at the most impacted watersheds for which we should have environmental indicators (e.g. pressure, state) related to the environmental problems that justified the regulation of the concerned jurisdiction and to the related socio-economic information. The spatial scale (e.g. watersheds, sub-regions) is essentially determined by the available environmental and socio-economic data.

b) Using a benefit transfer methodology (stated preferences) to build a ballpark figure.

c) Using this information - in combination with existing ecological data, literature reviews of specific studies, and the socio-economic information of the jurisdiction - to develop a sense of the trade-offs between the benefits and the costs indicators developed in the preceding section.

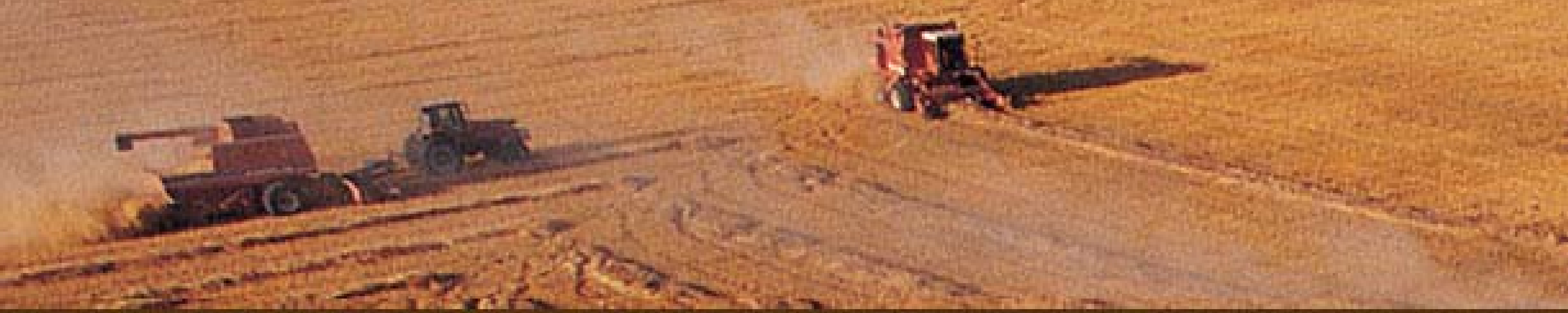
This strategy could be used for specific productions if they are associated with specific and measured pollutants. For example, atrazine is often associated with corn and potato productions. The contribution of each production to the ensuing environmental damage (as caused by atrazine concentration in surface water) could be estimated by taking the application rate by surface unit of atrazine for each production and multiplying it by the cultivated area for each production in the watershed. The end result would be the total amount of atrazine introduced into the watershed over the course of a given year, and the contribution of each production to environmental pressures and damages. This crude analysis could be rendered more sophisticated, but we should always keep in mind that we are looking for a ballpark figure.

In effect, this strategy has recently been applied by Debailleul et al. (2003) to Quebec's primary agricultural production. Although the study was conducted with limited resources and in a very tight timeframe, it nonetheless produced interesting results.

Debailleul et al. (2003) identify the pollutants in question (phosphorus and nitrate) and the river basins for which there is available data (four river basins). They then document the relative contributions to the problem, as well as the different assumptions and indicators they need to contain the impacts of the regulatory policy. Following this, they identify the affected activities and the necessary socio-economic data and subsequently proceed with a benefit transfer exercise. The results are then submitted to a sensitivity analysis to verify their robustness and are later discussed.

Despite the fact that the exercise has a number of caveats, it represents the best estimate that can come out of the available information. The end product would be a multi-attribute type of matrix that would: 1) identify the expected benefits of the regulatory set; 2) present the monetary estimates derived from benefit transfer; 3) describe the quantitative information (ecological and socio-economic) for the non-monetized benefits; and 4) present the regulatory performance indicators.

In terms of this project, we suggest that a few contingent evaluations could be conducted, which together with existing studies could then be used to conduct benefit transfer studies to measure the benefits of environmental regulations.



CHAPTER 5

SMART REGULATION

5.1 A Policy Decision-Making Framework – Guidelines to design and evaluate good agri-environmental policies and criteria for evaluation

In its report entitled *Environmental Strategy: 2004 Review of Progress,* the OECD underlines that while some progress has been made in recent years to reduce the negative environmental impacts from agriculture, much more will be needed by 2010 to ensure the full implementation of the strategy by member countries. Moreover, the OECD emphasizes that market price support, output/land based payments and input subsidies (potentially the most environmentally harmful types of support) still account for 80% of total agricultural support in OECD countries (OECD, 2004). Indeed, environmental damage associated with monoculture, intensification and the use of environmentally sensitive land (practices that are encouraged by support measures linked to the production of specific agricultural commodities) continues.

Nevertheless, reforms in a number of countries have led to a small, gradual reduction in the overall support to the sector and some shifts from support based on output to other forms of support have occurred. Moreover, some agri-environmental measures have been introduced specifically to improve the environmental performance of agriculture. However, the pace of these developments has been modest, and while direct regulation of some pollutants (pesticides and other agro-chemical) has played some role in improving the environmental performance of agriculture, an internalisation of environmental costs through economic instruments such as taxes, charges and tradable permits are not yet widespread (OECD, 2004).

Johnson (1994) also argues that the policy arena as it exists is almost incomprehensible. Farmers deal, for instance, with price support, income enhancement, conservation and disaster relief programs, as well as with crop insurance, health inspectors, environmental regulation, financial programs, and patent and contract laws. They also benefit from grants to universities research programs and from funds devoted to the development of educational and technical expertise. He argues that under these conditions, co-ordinated efforts are needed to prevent well-intended programs from creating greater adverse externalities than the problems they seek to solve.

Along with this, several trends increase the demand for environmental regulations in the agricultural sector: scientific and technological change, globalisation and economic trends, evolving public attitudes and demands, and increasing complexity (Environment Canada, 2003). In the context of the increasing complexity of agricultural policies and demands for better environmental performance of agriculture, the debate over policies has recently become subtler, asking what are ways of regulating *better*, and how to use a more balanced and effective use of policy instruments to achieve our policy goals – in short a call for smart regulation (Ibid).

The term smart regulation was first coined by Neil Gunningham (1999) in the context of environmental policy to describe a post-command and control implementation style expected to be capable of dealing with increasingly technically and politically complex policy issues (Howlett and Rayner, 2003). As the concept evolved, smart regulation has come to focus on a small number of key suggestions (*Ibid*):

1. The importance of designing policies employing a mix of policy instruments carefully chosen to create positive interactions with each other and to respond to particular, context-dependent features of the policy sector.

2. The importance of considering the full range of policy instruments when designing the mix rather than assuming that a choice must be made between regulation and market.

3. Nonetheless, in the context of continuing pressures on governments to do more with less, incentive-based instruments, various forms of self-regulation by industry, and policies that can employ commercial and non-commercial third parties to achieve compliance (i.e. suppliers, customers and the growing number of auditors and certifiers) are the favoured instruments of smart regulation.

4. Finally, smart regulation emphasizes the importance of the search for new policy instruments to meet the challenges of governance. Next generation policy instruments (i.e. information instruments, various techniques of network management, etc.) are particularly important here.

In light of the above, it is clear that designing smart regulation and evaluating existing agri-environmental regulations involves keeping in mind that: 1) regulations are only one policy instrument among many; and 2) agri-environmental regulations interact with an array of other agricultural policies that have important impacts on the environment, on production and on agricultural producers' income and incentives. Furthermore, there is little doubt that agrienvironmental policies of various kinds will continue to increase in importance in the future, which underlines the importance of evaluating policy instruments - and the benefits they pledge to deliver - relative to their costs.

This section of the report highlights a number of general principles, criteria and guidelines for smart policy actions. Firstly, the policy tools that are available to policy-makers in their efforts to improve the environmental performance of agriculture will be identified and discussed. Secondly, general policy principles and criteria to assess the policy design process as well as individual policy instruments will be analysed, providing guidelines to evaluate and compare key instruments. As part of this process, an analytical framework to evaluate policy coherence among regulations, and between regulations and other policy instruments, will be suggested. Finally, the potential of employing the OECD analytical framework on multi-functionality to assess the efficiency of regulations, as well as other policy tools, will be evaluated in the next chapter.

This section thus aims to devise a decision-making framework for designing and implementing better agri-environmental policies (which we take here to be equivalent to smart regulation). It is worth noting that an External Advisory Committee on Smart Regulation (http://www.smartregulation.gc.ca/) has recently been created in Canada to provide advice to the federal government on regulatory issues. This committee is in the process of developing an analytical framework and a set of criteria to apply concepts and lessons from smart regulation to the

Canadian regulatory context. We suggest that their effort, when completed and rendered public, should be used by the AAFC and other consultants as a complement to our work. Their analysis will also include important issues such as risk management and international cooperation.

The decision-making framework developed here essentially involves three steps:

1. Determining the need for policy action;
2. Reviewing general policy design principles: improving systems for developing regulations; and
3. Reviewing the set of policy evaluation criteria to determine smart policy strategy/ instrument(s). As part of this, identify guidelines to assess the coherence of various instruments and policies.

5.2 How to determine the need for policy action

The first step to design good policies is to identify whether there is a need for policy action or not. The OECD (2001b) analysis of the policies and approaches that can contribute to improving the environmental performance of agriculture in a sustainable way has developed a set of criteria for examining the need for policy action, which are summarised in the box below:

General criteria for policy action

The general criteria to determine whether there is a case for any policy action to improve environmental performance by accounting for environmental costs and benefits requires responses to the following sequence of questions:

First, is there evidence that there is a demand to enhance environmental benefit, and/or a need to reduce environmental costs currently generated by farmers without being remunerated or charged? If yes, consider the following question. If not, there is no need for any policy action.

Second, is it technically possible and economically efficient to change current farming practices to more environmentally sound (good) farming practices? If yes, the desired environmental target levels have to be made operational and used as a basis for the necessary allocation of the associated costs and benefits. If not, current farming practices are already achieving the best environmental performance without any need for policy action at the farm level, although research and development could be encouraged to improve the farming practices.

Third, are current farming practices covered by farmers' property rights? If yes, farmers can expect to be compensated for providing environmental quality beyond good farming practices. It could also involve the redefinition of property rights in favour of the public's right to a healthy environment without, therefore, any financial incentive. In particular, when land use rights are merely implicit or presumptive, farmers' property rights would become explicitly defined through the definition of the reference level associated to good farming practices. If not, farmers should be obliged to adopt the appropriate farming practices required to achieve the environmental target levels at their own expense.

5.3 General policy design principles

Once the need for policy action is determined, regulating better implies that some general policy design principles must be assessed before identifying the specific nature of the policy action or instrument to be recommended. More specifically, four decision problems must ideally be addressed in the policy design process. As identified by Latacz-Lohmann (2001), these relate to the choice of an appropriate target to which the instrument is to be applied, the choice of addressee of the policy, the choice of the regulation area and then the choice of level of authority. Then, decision-makers can proceed to choosing an instrument. These variables combine to form a policy strategy. In theory, a large number of policy strategies can be generated through different combinations of the four policy design variables, each producing a specific outcome, which has to be assessed in light of the evaluation criteria identified in the following section. This section draws on Latacz-Lohmann's (2001) work. ent combinations of the four policy design variables, each producing a specific outcome, which has to be assessed in light of the evaluation criteria identified in the following section. This section draws on Latacz-Lohmann's (2001) work.

Choice of Target (or objective)

Many agri-environmental problems are the product of complex, multi-stage processes that may offer many potential points of intervention such as polluting inputs, emissions, the production process, or the quality of the ambient environment. Target in this context refers to the technological parameter to which the instrument is applied. For example, the non-point character of many agricultural emissions means that emissions are not measurable at a reasonable cost. In such cases, targets other than emissions are more appropriate because they are easier to monitor or lead to a more cost-effective allocation of control efforts. Nitrogen fertiliser, for example, would be a suitable proxy for nitrate emissions and indeed serves as the target for many nitrate pollution control policies (e.g. fertiliser tax).

The choice of target has important implications for the ease with which a policy can be enforced and for its effectiveness. For instance, a scheme that pays landholders on the basis of wildlife numbers (i.e. outcomes) provides much stronger incentives for entrepreneurship than a scheme that pays them for following management prescriptions. Moreover, the administrative costs are likely to be significantly higher for the first scheme as it requires environmental outcomes to be measured and quantified. The choice of target is also closely related to the identification of the objective(s) of a policy strategy.

In general, the policy instrument can be applied to a range of targets such as in Nichols (1984), and in Latacz-Lohmann (2001):

- Inputs (e.g. pesticides, fertilisers, energy);
- Outputs, products or by-products (e.g. animal manure);
- The production process (e.g. agri-environmental management prescriptions);
- Pollution abatement technology (e.g. odour filters, manure storage prescriptions);
- Emissions (if measurable);
- Quality of the ambient environment (e.g. concentration of a pollutant in the surrounding environment; number of rare plant species on a chalk meadow); and
- Exposure (e.g. the product of concentration and contact hours, or the number of visitors to a nature reserve).

Of importance for the design of agri-environmental policy is that the chosen target be clear, measurable and:

- Be as closely correlated with the environmental objectives as monitoring requirements and administrative feasibility permit; and
- Leave the addressees with as much choice as possible to determine their own cost-minimising mix of efforts to achieve the environmental objectives of the program (see the flexibility criteria in the next section).

It is worth noting that the link between any chosen target and the environmental outcomes targeted by the programme usually varies across farmers, landholdings and even across particular fields. Such variability calls for different degrees of control (i.e. a differentiation in the size of the policy incentive).

Choice of Addressee

Once the target of a policy intervention is clearly identified, the next step is to identify the addressee (the agent who has to take account of the policy). It could be an individual landholder, a defined group of landholders, the suppliers of polluting inputs (e.g. the fertiliser industry), the producers of pollution-control equipment, etc. The choice of addressee determines the number of agents the regulatory agency has to deal with. This, in turn, determines the level of administration costs.

Choice of Regulation Area

The choice of the regulation area is a particularly important element of policy design because different agri-environmental problems have different spatial dimensions. Some problems are small-scale, local, or confined to environmentally sensitive areas, while others may be of regional, national or even global importance. The geographical delimitation of an agri-environmental program should fit the spatial dimension of the problem in question.

The regulation area is the area within which the environmental policy strategy is legally binding and within which the same dose of policy instrument is applied. In other words, it is the area within which the policy is uniformly applied. The appropriate size of the regulation area depends on:

- The spatial dimension of the environmental problem which, in turn, depends on dispersion patterns (in the case of pollutants) and on the extent to which different localities exhibit different environmental sensitivities; and
- The spatial distribution of beneficiaries or demand.

It would be far too costly, for example, to regulate nitrogen usage everywhere in a country when nitrate is perceived as a pollution problem only in close proximity to bodies of water. Similarly, it would not make much sense to enhance landscape quality in areas that are hardly ever visited by the public. The available resources should instead be deployed in more densely populated areas where more people would benefit.

The use of small regulation areas allows the policy to be applied in a way that is more suitable to local circumstances. On the other hand, there may be economies of size associated with the administration costs, resulting in these costs becoming less if a large regulation area is chosen. It is also important to note that a larger (national) regulation area is likely to be politically more acceptable because it means that the policy applies to all farmers rather than to a group of (unlucky) farmers.

Choice of level of administration

Latacz-Lohmann's (2001) and Environment Canada's (2003) analyses suggest that regulatory instruments must be designed and implemented by those best situated and able to act. This should include involvement of all the different jurisdictions needed to achieve the policy target. Information is an important input into the design and running of environmental policies. It is obvious that different tiers of government have different levels of information about the factors that determine the potential benefits and costs of a policy. This information may relate to the natural and economic circumstances of a country, region or locality, to the structure and intensity of environmental preferences or to geographical differences in environmental sensitiveness. The use of (local) information allows agri-environmental policies to be better targeted and tailored to the particular circumstances of the locality, resulting in better cost-effectiveness and environmental efficiency of the measures undertaken.

The OECD, in its *Review of the Regulatory Reform in Canada* (2002b) also underlines that co-operation between different levels of governments is also particularly important in the context of a federal country. It also mentions that duplication of activities between federal and provincial governments has tended to be a source of inefficiencies and costs in Canada, even though the reduction of overlap between federal and provincial regulation has been a theme of regulatory reform in Canada since its early days (p.29).

Other Considerations

Finally, Environment Canada states that better systems for developing regulations, leading to better regulatory tools, should involve: consultation and collaboration; openness and transparency; adequate research; and should balance quality versus time and resources.

5.4 Criteria for evaluating the smartness of agri-environmental policy instruments

As argued by the OECD (2002b, p.38), a core administrative capacity for good regulation is the ability to choose the most efficient and effective policy tool, whether regulatory or non-regulatory. However, despite the wide range of policy tools available to policymakers, the single most commonly used tool in OECD countries to limit environmental damage from agriculture remains regulatory requirements (OECD 2004). Yet, Neil Gunningham (1999) underlines that present regulatory systems are often not up to the task and that:

> "An excessive reliance on "single instrument" approaches is misguided, because all instruments have strengths and weaknesses, and because none are sufficiently flexible and resilient to be able to successfully address all environmental problems in all contexts. Accordingly, a better strategy will seek to harness the strengths of individual mechanisms while compensating for their weaknesses by the use of additional instruments. That is, in the large majority of circumstances, a mix of regulatory instruments is required, tailored to specific policy goals."

Therefore, regulating better involves not only choosing optimal instruments tailored to specific environmental problems, but also identifying a reinforcing combination of instruments, which are counter-productive.

5.4.1 List of instruments

The first step towards achieving optimal policy mixes is to review the policy instruments that are available to policymakers. The instruments that we identified, on the basis of our literature review, are listed below. Their characteristics, as well as strengths and weaknesses, are discussed at length in Appendix 2. However, it is important to keep in mind that the variety of instruments available to policymakers to address a policy problem is limited only by their imagination (Howlett and Rayner, 2003).

There are a number of different ways to classify agri-environmental policy instruments. Following several authors' classification schemes, the instruments are here categorised according to the *degree to which they are voluntary*, and placed into three broad categories: command and control measures; economic incentive-based instruments (subdivided as non-tax and tax instruments); and advisory/informational tools.

1) Command and control measures

   a) Regulatory requirements/instruments
   b) Cross-compliance mechanisms;

2) Economic incentive-based instruments

   a) Non-tax instruments
      (i) Payments/cost-share policies
      (ii) Tradable rights/permits
      (iii) User charges and pricing
      (iv) Deposit-refund schemes
      (v) Land retirement programs

   b) Tax instruments
      (i) Environmental taxes/charges
      (ii) Tax incentives
      (iii) Tax shifting; and

3) Advisory/informational tools (voluntary)

   a) Research and development
   b) Education/ technical assistance
   c) Labelling standards/certification
   d) Community-based measures

(See Appendix 2 for a more detailed discussion of the instruments.

5.4.2 Smart regulatory instruments: criteria for evaluation

The variety in features among the above-mentioned policy tools implies a variation in the environmental effectiveness, economic efficiency and distributional consequences among them. On the basis of past lessons-learned and a number of authors' analytical work, it is possible to identify a set of criteria to evaluate agri-environmental policies and instruments. Adhering to this set of criteria when designing and implementing policies for improving agri-environmental performance can contribute to the efficiency and effectiveness of policies, as well as increase welfare gains. These criteria may, in some cases, be difficult to apply in practice. However, one should keep in mind that they are guidelines and despite some level of abstraction, they remain extremely valuable to inform and guide the choices policymakers face in formulating agri-environmental policies and evaluating existing programs.

An extensive literature review thus suggests that the smartness of agri-environmental measures should be assessed against the following set of criteria:

1. Effective
2. Economically efficient
3. Cost-effective
4. Flexible
5. Easy to enforce
6. Transparent
7. Fair and equitable
8. Coherent

Effectiveness

This criteria may seem intuitive, yet it is often not applied and therefore deserves being emphasized. It relates to the idea that good regulatory or policy instruments, in combination with other government initiatives, should achieve their intended policy objectives (i.e. meet the public policy goal for which they are intended) (Environment Canada, 2003). This does not mean 100% success in addressing the identified problem or opportunity, but that some reasonable target is achieved.

Once more, this underlines the importance of clearly identifying the goals and objectives of an intervention. Furthermore, it implies that targets and impacts of policies must be identifiable, measurable and monitored.

Economic efficiency

The main goal of smart regulations, as stated by Environment Canada (2003), is maximising the public good. The overriding criteria for assessing regulations and regulatory systems will thus be the promotion of the public good (i.e. whether the overall benefits of a policy exceed its cost) compared with all relevant alternatives, and considered from the point of view of the overall public. The necessary condition for a welfare gain from implementing agri-environmental policy measures is that the resulting environmental benefits exceed the costs associated with the policy (OECD, 2001a). However, measuring the costs and (especially) the benefits associated with regulations is far from being an easy task in practice.

Cost-effectiveness

The more simple and less information-intensive the cost-effectiveness criteria means that the instrument chosen should achieve the intended target at the lowest cost (Environment Canada, 2003). A better instrument will ensure that:

- The best environmental outcome is achieved for a given cost; or that
- A given outcome is achieved at the least possible cost (OECD, 2001a).

Furthermore, it requires that the environmental outcome associated with the policy is additional (i.e. would not have resulted without the policy action) (Ibid).

The costs of agri-environmental policies can be categorised into (Latacz-Lohmann, 2001):

- Compliance costs (i.e. the opportunity costs incurred by farmers in terms of profits fore-gone for following policy improvements plus any direct outlays); and
- Transaction costs (i.e. the costs of running the policy and facilitating exchange. The bulk here is borne by the regulatory agency – administrative costs).

As Latacz-Lohmann (2001) also underlines, there is often a trade-off between the two types of costs. A well-designed policy, which is spatially targeted and tailored to local environmental circumstances, is difficult to monitor and run, which results in relatively high administrative costs. Conversely, a uniform policy may reduce administrative costs but will likely give rise to higher farm-level opportunity costs.

Flexibility and incentives for entrepreneurship

The flexibility criteria has two aspects. Firstly, it relates to the policy measure's flexibility (i.e. the idea that the higher the flexibility of a policy instrument) the easier the tuning, enforceability and acceptability of policy action (OECD, 2001a). Regulations and policy instruments must be regularly and systematically reviewed and, where necessary, eliminated, modified or created to take into account changing business environments and scientific and technological advances.

Secondly, it relates to producer flexibility, i.e. it states that better policies will allow farmers to devise least-cost approaches to meeting environmental improvements rather than imposing a specific approach devised at municipal, provincial or federal level. This is often achieved when policies are performance-based. The wide range of biophysical and climatic conditions and farm management practices that prevail implies that measures would need to reflect such variation (Claassen et al., 2001).

A standard on fertiliser application rates, e.g. leaves the addressee with no choice at all as the course of action is prescribed. In contrast, a standard on nitrate leaching rates allows the farmer to determine his or her own most cost-effective mix of abatement measures, e.g. a combination of crop choice, planting of catch crops, and fertiliser reductions to achieve the ambient standard (Latacz-Lohmann, 2001). Flexibility provides the addressees of a policy with incentives to search actively for new, innovative ways of contributing to the environmental goals of the program.

Enforceability/compliance

This criteria is crucial, because even well-designed agri-environmental measures can fail if compliance is not properly monitored and enforced. Regulatory success thus requires that the resources and mechanisms needed to monitor and enforce the instrument be provided.

Adequate enforcement needs to be undertaken at the farm level, which involves compliance monitoring and sanctioning, although with actions implemented through markets, such as inorganic fertiliser or pesticide tax, there is no need for compliance monitoring at the farm level. It is in the farmers' self-interest to respond to the tax in the desired way. Most agri-environmental policies, however, do not have this incentive-compatibility property and thus do require adequate enforcement. Enforcement essentially involves two steps: compliance monitoring and sanctioning. Both require energy and resources, the costs of which add to the agency's transaction costs bill. Inadequate enforcement will result in high levels of non-compliance and reduced environmental benefits (Latacz-Lohmann, 2001).

The more difficult the measurement of the required farm obligation or outcome, the greater the enforcement cost (budgetary cost and environmental losses associated to the degree of non-compliance). For example, prescriptions that can be observed visually (e.g. land set-aside, establishment of green covers or landscape features) are easier to monitor and enforce than invisible constraints, which require sophisticated technical equipment to get reasonable compliance records (OECD, 2001a).

Measuring Canadian agricultural producers' compliance with environmental regulations would ideally involve holding inquiries at the farm level, for instance through detailed surveys and questionnaires. This would provide data about producers' practices and would help to determine whether regulations are being enforced or not. To this day, no such survey has been conducted at the Canadian level.

In the province of Quebec, however, a comparable survey was realised in 1998 by the Groupe de recherche en économie et politique agricoles (GREPA), under a joint contract between the Union des producteurs agricoles du Québec (UPA) and the Ministère de l'agriculture, des pêcheries et de l'alimentation du Québec MAPAQ (). The survey, which resulted in the *Portrait agroenvironnemental des fermes québécoises,* lasted for about six months. Over 100 investigators were mobilised to visit farms located across the province and to spend 1-1/2 hours on each farm to talk with the producers and fill out a detailed questionnaire.

The twelve page questionnaire included questions about types of production, farm sizes, buildings' characteristics, separating distances, quantities of fertiliser and pesticides used, manure disposal practices, services used by producers, irrigation practices, etc. The producers were not forced to respond, but they were guaranteed confidentiality, i.e. that no personal information would be shared with the ministry of environment. Furthermore, an extensive information and support campaign was launched by the UPA, the producers' association, to foster farmers' participation, aiming to reach a 90% participation rate.

Such a survey could probably be completed at the Canadian level with the help of provincial governments and producers' associations. However, it is a daunting task and it is unlikely that it could be accomplished within the current project's timeframe. Consequently, it is necessary to consider alternative methodologies.

Another methodology to assess compliance would be to develop compliance and enforcement indicators. Such a methodology would involve identifying the key elements of compliance and enforcement strategies (field inspections and monitoring, staff training, publishing of compliance reports, etc.) and then build indicators to assess the (likely) compliance rates for given regulations, and thus regulatory performance. Indicators would be developed through answering questions such as those included in the following table:

Table 10: Compliance indicators: questions

	Question/Issue	Details
1.	Is there a regulatory compliance policy?	-Is it publicly available? -Has it been published?*
2.	Are there regulatory compliance reports being produced regularly	-Are they publicly available? -Have they been published?
3.	What are the resources devoted to monitoring and control by relevant jurisdictions?	Budgetary information - Person/year - Financial resources
4.	Is there organized information on prosecutions, penalties for non-compliance and condemnation under the statutes considered?	Is it published in a usable form?
5.	Are there targeted programs to support the implementation of the regulation (compliance assistance, information, training, etc.)?	What is the level of support?
6.	Have staff carrying out compliance assurance activities received appropriate training?	
7.	What is the number of inspections/field evaluations conducted annually?	

*The term "published" also includes available through the internet (e-government).

Many countries, aiming to promote effective enforcement of their environmental regulations, have developed such Environmental Compliance and Enforcement (ECE) indicators. Examples of ECE indicators and additional information can be found in the following links and documents:

Environment Canada: http://www.ec.gc.ca/CEPARegistry/enforcement/

Connecticut USA: http://dep.state.ct.us/enf/envcomp.htm

Delaware USA: http://www.dnrec.state.de.us/DNREC2000/Enforcement.asp

OECD: http://www.inece.org/indicators/workshop.html

Alberta Environment (2000). Compliance Assurance Principles, ISBN No. 0-7785-1175-6, Publication No. I/848.

Barrett, Frank & Dave Pascoe. Environmental Compliance and Enforcement Indicators: Environment Canada Pilot Projects – Addressing Challenges, Environment Canada, Canada.

OECD, INECE-OECD Expert Workshop on Environmental Compliance and Enforcement Indicators: Measuring What Matters, November 3-4, 2003, Paris, France.

Stahl, Michael M. Performance Indicators for Environmental Compliance and Enforcement Programs: the U.S. EPA Experience, Office of Compliance, United States Environment Protection Agency, USA.

Transparency

Accessibility and transparency of the policy measures must be maximized to promote learning and information sharing, to build trust among stakeholders and to gain political acceptance. Objectives should be clearly specified in terms of the environmental performance and targets to be achieved. They should ideally be quantifiable and formulated in a way that allows progress to be measured quantitatively (Latacz-Lohmann, 2001). Ex-post evaluations should, as far as practicable, use ecological measures of policy rather than participation-based measures (Ibid).

Fairness/equity and political acceptability

Fairness/equity relates to the distributional consequences of agri-environmental policies. Objectives should be easily identifiable in terms of their costs, benefits and distribution, in relation to how the associated costs and benefits are distributed or which groups in society gain and lose from the policy action. The more the distribution is in conformity with clearly defined and accepted property rights, the greater the acceptance and the lower the enforcement cost. Policies that use negative incentives to enforce the reference levels, and those that use positive incentives to reward farmers for improvements beyond the reference levels, are most likely to find broad political support among stakeholder groups. Moreover, if justice is demonstrated in the decision-making process (through, for instance, openness and transparency), the outcome is more likely to be more easily accepted.

Despite the importance of these issues, Latacz-Lohmann (2001) argues that there has been relatively little emphasis on the development of theory on the meaning of fairness, equity and justice in the context of natural resource policies.

Coherence and compatibility

Compatibility with other policies has become an increasingly important criteria for assessing environmental programmes for agriculture. Different programmes should be co-ordinated, so as to ensure that they do not duplicate or offset each other. In some cases there may be synergies between different types of policies and thus scope for a cross-achievement of policy objectives. Moreover, policies must be coherent with their own objectives, therefore unintended consequences or impacts of various instruments must be assessed.

Agricultural sustainability is an evolving process ever-seeking a balance between society's economic, environmental and social demands. Governmental policy and regulations, while attempting to correct adverse externalities, have at times within themselves created adverse externalities. Failures often lie within the policies themselves, but poor coordination among government agencies is also at fault (Johnson, 1994).

A good example is when the state designs policies to encourage an increase in production, regardless of existing pressures on the environment. Crop insurance policies that oblige agricultural producers to use insecticides and herbicides in order to be insured are another example.

> "Occasions when agri-environmental measures and agricultural policies pull in opposite directions and when pro-environmental measures simply offset the damaging environmental effects of input and production-linked policies reveal a lack of policy coherence and imply that the cost of environmental improvement in agriculture is higher than would otherwise be the case (OECD, 2003d, p.19)."

Responding to the environmental impact of agriculture must therefore be done partly through designing specific agri-environmental policy instruments and partly through agricultural policy reform. The starting point should always be to reform agricultural policies in order to reduce the production distortions associated with many forms of agricultural support (Lankoski, 1997). Reinstrumentation of domestic policies, for instance from market price support to direct income support, would reduce distortions in production and lead to environmental benefit through a shift to more sustainable farm management practices, a more optimal use of farm chemicals and a change in the composition and location of production (OECD, 1995) in Lankoski (1997).

According to Arnold and Villain (1990) in Lankoski (1997), the concentration of farms, land and livestock, the specialization in a narrow range of products, and the intensification of the use of fertilizers, pesticides, feedstuffs and energy have been responsible for the greatest environmental damage due to agricultural production in the U.S. They also mention that these factors have resulted partly from an adjustment process to technological and economic developments, but also have been reinforced by agricultural policies.

Evaluating whether agricultural policies or other specific agri-environmental instruments are consistent with environmental objectives, and whether they are coherent among themselves, can thus be achieved through responding to the following set of interrelated questions:

Does the policy, regulation or programme encourage an increase in agricultural production?

In general, the more a support policy provides an incentive to increase production of specific agricultural commodities, the greater is the incentive for:

- Monoculture production and specialisation. For instance, when programs are linked to specific crops or productions, they encourage the production of those crops, reducing rotation and stimulating specialization and spatial concentration of specific production lines. Specialisation of agriculture leads, among other things, to the development of capital intensive farming and stimulates the use of harmful inputs such as fertilisers and pesticides to maintain soil productivity. Moreover, as some crops are more polluting than others, specialisation into these crops could significantly increase agricultural pollution.

- Intensification of production. This encourages, for instance, the use of chemical fertilisers, and the pollution of water and soils.

- Use of environmentally sensitive land. Policies that, for instance, increase the price received by agricultural producers provide incentives for farmers to increase areas cultivated and keep lower-quality land in production. These lands are susceptible to soil erosion, and their use may therefore decrease water quality.

Therefore, the greater the incentive to increase production, the greater the environmental damages associated with a policy.

Does the policy, regulation or program provide an incentive for producers to increase their use of harmful inputs such as fertilisers and pesticides or encourage the supply of natural resources below their marginal cost (e.g. water)?

Policies that distort cost and price structures and are based on the use of specific inputs, which are harmful for the environment - such as subsidies for the purchase of fertilizers and pesticides - or that allow for the supply of natural resources below their marginal cost (e.g. irrigation water), encourage the enhanced use of inputs and for farmers to practise soil conservation and use organic manure more efficiently. In turn, excessive use of fertilisers leads, among other things, to eutrophication in surface waters and nitrate accumulation in ground waters.

On this basis of the above, we can conclude that agricultural policies tend to be more environmentally harmful, and thus inconsistent with environmental objectives, if they are linked to the five following elements::

Table 11: Coherence questions

Policy linked to:	Impact on the environment (on the basis of the two previous questions)	Example
Production volumes	When a policy is linked to production volumes or output, it tends to stimulate both production and the use of harmful inputs, creating strong pressure on the environment.	**Deficiency payments** These guarantee producers a per unit payment on output equal to the difference between the market price and administrative target price. This support measure varies directly with production volumes.
Market price	Policies linked to market price raise domestic producers' prices, thus create incentives to increase production, which in turn favours intensification and farming in marginal areas.	**Market price support** The market price, here, is fixed at a level higher than the equivalent world market price.
Specific commodities or production lines	Measures linked to specific commodities encourage the production of these commodities, limit culture or livestock choices and favour specialisation and intensification.	Crop insurance programs
Use of specific inputs	By reducing the price of specific inputs (pesticides, fertilisers, energy, water), these policies directly encourage the over-use of harmful inputs or natural resources.	Water or energy subsidies, tax refunds.
Area cultivated or on livestock owned	These measures are based on area cultivated or size of herd, and are allocated independently on quantity produced. Therefore, they will not stimulate increases in production or specialisation, but may create incentive to cultivate marginal land.	

Looking at these criteria is only a first step in evaluating coherence. Various policies must also be evaluated in conjunction with other policies. For instance, market price support can be judged to have harmful environmental consequences as it stimulates over production and accrued input use. However, if combined with other measures such as production quotas or supply controls, market price support will have a neutral impact on production and the environment. An overview of the production and other impact of various AAFC policies are provided in the AAFC Policy and Program list box.

Other measures, such as subsidies, can have positive or negative impacts from an environmental perspective. For example, government programs which provide grants to subsidise the purchase of new, high efficiency/low pollution industrial equipment may be considered environmentally beneficial subsidies, whereas subsidies that encourage the cultivation of marginal lands are environmentally harmful.

Also, it should be noted that policies that provide incentives to increase positive production (i.e. organic farming) or that stimulate the use of inputs that have no negative impact on the environment are not subject to the coherence criteria.

The Guide to the Environmental Analysis of AAFC Agricultural Policies Plans and Programs

AAFC policy and program list:

Income Stabilization policies may affect production decisions by affecting the expected returns or risks of different products. This can affect the allocation of land between crops, livestock and other uses, selection of crops, and related production practices such as nutrient applications, pest management, drainage and irrigation.

Crop insurance programs may affect land allocation and crop choice by favouring crops over other land uses and favouring higher-risk crops. These decisions may affect production decisions including fertilization, soil tillage or conservation and pest management. Crop insurance programs that include compensation for wildlife damage may affect wildlife management decisions.

Commodity-specific programs may raise their returns, affecting land allocation and crop choice. They may also affect nutrient applications, tillage and soil management, and pest management. Programs that increase returns to crops may increase or decrease input use, depending on the production function of the output.

Marketing boards, such as the Canadian Wheat Board, may change land allocation, crop selection, input use or soil management by affecting the returns and risks of products under their influence, and through quota allocation systems.

Supply management systems may affect allocation of land, crop selection, nutrient allocation and livestock numbers by affecting the returns and risks to products under their influence and competing land uses.

Policies that affect **input prices**, such as subsidies, tax exemptions, taxes and fees, may affect related production decisions, including land allocation, crop choice, tillage and soil conservation, nutrient application, wildlife management and livestock stocking levels.

Programs that support **irrigation or drainage** will affect decisions to irrigate or drain land, nutrient applications, and may affect the allocation of surrounding land among potential uses.

Programs that directly compensate particular **land uses**, such as the NAWMP (North American Waterfowl Management Plan) and the Permanent Cover Program, influence land use.

Soil conservation programs, such as AAFC's National Soil and Water Conservation Program and Prairie Farm Rehabilitation Adminitration's (PFRA) Shelterbelt Program affect conservation practices.

Research programs largely determine the production choices available to producers in the long term for all production practices, with particular subjects of research determining which producer decisions may be affected.

Food inspection and regulation may affect producer decisions if they affect the returns from particular crops or livestock. For example, grading or certification programs may provide premium returns, encouraging certain production methods or outputs. On the other hand, regulatory fees may raise the costs of some products, decreasing their returns.

Pesticide policies can affect pest management choices through the costs, availability, labelling and import opportunities of pesticides. For example, policies that raise pesticide costs may reduce their use, while policies that raise the cost of new pesticides or delay their approval may favour existing products over new ones. Pesticide regulations, such as minimum spraying distances from buffer strips, can affect wildlife habitat..

Processing support programs may affect land allocation, crop selection and livestock levels by inciting particular types of production to locate in particular areas. Livestock processing will attract livestock farms, and grain or horticultural processors will attract corresponding production to the area. Processing opportunities for crop residues, such as pulp plants, may affect residue disposal.

Source: The Guide to the Environmental Analysis of Agricultural Policies Plans and Programs of AAFC (2002) http://www.agr.gc.ca/policy/environment/sea_e.phtml

Other considerations

Environment Canada (2003) stipulates that its experience with environmental issues has repeatedly illustrated that it is simpler, more effective and less costly to prevent environmental problems than to deal with the damage after the fact. Remediation is almost always more costly than prevention. Therefore, another key feature of smart environmental regulation and good policy will be the extent to which it anticipates, instead of reacts to, environmental problems.

Additionally, good information is critical for the development of all policies and regulations. Time and resources are needed for adequate research to help understand the problems and issues. Policymakers and regulators also need information on a complete and up-to-date toolbox of instruments in order to select the best instruments available, including a review of best practices from other jurisdictions, and new approaches being proposed by the research communities. Information is not only needed in the initial development of the policy or regulation. The regulatory process should integrate provisions for ongoing feedback and retrospective analysis. Both the effectiveness and the costs of regulatory interventions need to be assessed after their implementation in order to ensure targets are being met, confirm original estimates, revise methodologies, and identify unintended consequences.

Finally, improving the consultation process is an essential element of the regulatory process in a modern democracy, and consultation is a formal requirement under federal statutes such as the *Canadian Environmental Protection Act* (CEPA) 1999. From early on in its history, Environment Canada has emphasized the importance of good communication and consultation with the public and concerned stakeholders. Opportunities for input by the general public, particularly from direct stakeholders, need to be built in at several stages in the development of a regulatory instrument. Effective consultation requires that the process and documents supporting the development of the regulation be open, clear and easy to understand.

5.5 The framework: set of questions

In light of the previous analysis, determining whether regulations or other policy instruments are consistent with the principles of smart regulation involves answering yes to the following questions:

Table 12: Analytical framework for the assessment of smart policies

	Question/Issue	Yes	No
1.	**Determining the need for policy action**		
1.1	**Is there evidence that there is a demand to enhance environmental benefits, and/or a need to reduce environmental costs currently generated by farmers without being remunerated or charged?** If no, there is no need for policy action.	___	___
1.2	**Is it technically possible and economically efficient to replace current farming practices with more environmentally (good) farming practices?** If not, current farming practices are already achieving the best environmental performance without any need for policy action at the farm level, although research and development could be encouraged to improve the farming practices.	___	___
1.3	**Are current farming practices covered by farmers' property rights?** If not, farmers should be obliged to adopt the appropriate farming practices required to achieve the environmental target levels at their own expense.	___	___
2	**Smart policy design process**		
2.1	Has the target of the intervention been clearly identified?	___	___
2.2	Has the addressee been identified?	___	___
2.3	Has the regulation area been defined?	___	___
2.4	Has the level of administration been optimally chosen?	___	___
2.5	Other issues - has the regulatory development process involved:	___	___
	-Consultation and collaboration?	___	___
	-Openness and transparency?	___	___
	-Adequate research?	___	___
	-A balance of quality versus time and resources?	___	___
3	**Criteria for evaluating smart agri-environmental measures**		
	Is the policy tool chosen, in itself and in comparison with other instruments:		
	- Effective?	___	___
	- Efficient	___	___
	- Cost-effective	___	___
	- Flexible	___	___
	- Easy to enforce	___	___
	- Transparent	___	___
	- Fair and equitable	___	___
	- Coherent	___	___
	To better evaluate coherence, the following questions should be answered:		
	Has it been ensured that the policy measure will not provide incentives for farmers to:		
	- Increase production?	___	___
	- Specialize their production?	___	___
	- Intensify production?	___	___
	- Increase their optimal use of harmful inputs?	___	___
	- Increase the area cultivated or the use of sensitive land?	___	___

Source: ÉcoRessources Consultants' compilation.

CHAPTER 6
THE MULTI-FUNCTIONALITY FRAMEWORK

The concept of multi-functionality, as applied to agriculture, refers to the idea that agriculture has many secondary functions in addition to producing food and fibre, and thus may at once contribute to (or detracts from) a range of societal objectives. Indeed, agricultural production generates an array of non-commodity outputs such as scenic landscapes, wildlife habitat, food security, environmental externalities, etc. Many of these outputs display the characteristics of public goods or negative externalities, and are therefore relevant to policy making.

Table 13: Some non-food by-products of agriculture

Environmental	Food Security
Positive	
Open space	**Elimination of hunger**
Scenic vistas	**Assures availability of food supply**
Isolation from congestion	
Watershed protection	**Rural Development**
Flood control	
Groundwater recharge	**Rural income and employment**
Soil conservation	**Viable rural communities**
Biodiversity	
Wildlife habitat	
Negative	**Social**
Odour	**Traditional country life**
Nutrient/pesticide runoff	**Small farm structure**
Watershed protection	**Cultural heritage**
Flood control	
Soil conservation	
Biodiversity loss	
Wildlife habitat	

Source: Bohman et al., 1999, p.9.

According to the OECD (2001b):

> "If there are welfare-enhancing or welfare-reducing outputs for which no markets exist, there will, in the absence of corrective measures, be no signals that tell farmers how much of these outputs to produce. The outputs would still be generated, as they are supplied jointly with agricultural commodities, but it would be a coincidence if their level, composition and quality corresponded to

those demanded by society. Agricultural policies that raise commodity production also influence the level of non-commodity outputs because of jointness."

Although it is difficult to accurately define multi-functionality and agree on possible interpretations of the concept, the OECD presents a comprehensive picture of multi-functionality in a document entitled *Multi-functionality – Towards an Analytical Framework*, 2001. The following paragraphs (in quotes) are partly extracted from that document and summarize some of the key issues that are being discussed, and are relevant to the agricultural policy debate.

The OECD's work on multi-functionality emphasises the joint production and (both positive and negative) externality and public good aspects of the multiple outputs of agriculture, and their implications for policy making.

The core elements of multi-functionality are, in this context:

1. The existence of multiple commodity and non-commodity outputs (NCO) that are jointly produced by agriculture; and

2. The fact that some of the non-commodity outputs exhibit the characteristics of externalities or public goods, with the result that markets for these goods do not exist or are poorly functioning."

Some countries, arguing that the commodity and NCOsof agriculture are closely linked, have used the concept of multi-functionality to defend some of their agricultural policies, such as output-based payments. They argue that these policies are necessary to obtain the socially desired non-food outputs (Bohmanet al., 1999) of agriculture. In other words, these countries are concerned that reductions in production-linked support to agriculture and trade liberalisation may, through a decline in food production, reduce some of the positive NCOs of agriculture, which are jointly produced with food, to below the level desired by society (OECD, 2001b).

However, it is not clear that agriculture is the most efficient provider of these outputs. In cases where the NCOs of agriculture could be decoupled, or supplied independently of agricultural production, it is often argued that the under-provision of public goods (or over-provision of negative externalities) could be targeted directly through policies that are tailored to these specific objectives. Then, the non-food products of agriculture could be produced, perhaps with greater efficiency, without agricultural production (Bohman et al., 1999, p.4). In fact, according to Mullarkey (2001), "virtually all of the desirable functions of agriculture are not unique to production of agriculture; there are almost always other, less trade-distorting means of supplying amenities and other goals sought under multi-functionality".

Policy implications

The OECD's analytical framework has led to the elaboration of a series of questions which

> "should be posed sequentially in order to arrive at policy insights. More specifically, the answers to the questions will provide guidance on the appropriate policy responses, if any. Because of complicated inter-linkages, the questions may not lend themselves to unambiguous answers. But they do provide a framework that will help keep the discussion sharply focussed on the key issues that have been identified. They allow for the elimination of cases in which policy interventions are not warranted while identifying others in which intervention may be beneficial and give some guidance as to the nature of the policy intervention that are likely to be most efficient (OECD, 2001b)".

QUESTIONS/GUIDELINES FOR POLICY ACTION

Jointness

1. Identify the source and degree of jointness. Which farming activities are directly linked to the production of a NCO? Do the linkages originate from non-allocable inputs and if so, do the non-allocable inputs affect the intensity of production?

2. Explore the possibilities of de-linkage and estimate the cost (examine economies of scope: are there possible cost savings due to joint provision?). Can jointness be altered or completely de-linked? If so, what is the cost? A difference in quality of the NCO should be taken into account. Methodologies are proposed in the framework.

3. Identify scale factors. What is the spatial distribution of NCOs? Are they site-specific, local, regional or national in occurrence, common or rare?

Market failure

1. Estimate the demand for the NCO. Use formal measurement where feasible (conjoint method, hedonic pricing, etc. – see OECD, 2003c).

2. Judge market failure.

Public good characteristics

1. What are the pertinent public good characteristics including spatial factors? Does the NCO meet the non-excludability and/or non-rivalry conditions?

2. Examine institutional arrangements.

Therefore, the first step is to determine the extent to which a NCO linked or can be dissociated from agricultural production, which has important implications for policy targeting and decoupling (OECD, 2001b).

However, determining that a non-agricultural commodity can be decoupled from commodity production is not sufficient. Once the degree of jointness is evaluated, it is still necessary to determine the least cost provider of the non-agricultural commodity. The costs of decoupling production and of providing the non-agricultural commodity through agriculture, as compared with relevant alternatives, must thus be calculated. Establishing whether there are economies of scope in the joint provision of commodity and NCOs by agriculture is also crucial. Specific methodologies to calculate costs are not developed here, but the OECD discusses them at length (OECD, 2003c). Then, market failure and public good issues are examined as they have significant policy implications as well.

In summary, the OCED developed a methodology to make the analytical framework on multi-functionality operational and to guide policy makers towards optimal policy strategies. It proposes a set of concrete ways in which the information needed about jointness (economies of scope), market failures and public goods can be obtained and analysed. However, the OECD work on multi-functionality is conducted in the context of seeking ways in which agricultural policy can pursue an array of objectives efficiently and effectively, with minimum economic distortion domestically and internationally (OECD, 2003c). Indeed, most of the discussion on multi-functionality (by the OECD and others) takes place within the context of agricultural trade. The framework is useful in determining which agricultural policies can be justified because of their multifunctional attributes, despite their trade distorting characteristics, and which policies cannot.

However the framework does not provide clear and systematic insights into the optimal policy instruments to be used in given circumstances. The OECD provides a table of benchmark policy options to be applied according to the degree of jointness, the existence or likelihood of market failure, and the spatial and public goods characteristics of the different NCOs (see Table 14), but it is not, as such, a systematic analysis of the efficiency of policies and regulations affecting primary agriculture.

Therefore, in the context of our project, we would like to question the relevance the multi-functionality framework as an analytical tool. Our aim is to study the use and role of the regulations that impact the environmental performance of agriculture and to develop methodologies to evaluate their impact, efficiency and effectiveness. It might be desirable to evaluate whether it is more efficient to target environmental externalities (or other multifunctional attributes) directly, for instance through agri-environmental measures, or indirectly through existing agricultural price and income support policies. The framework on multi-functionality would help to answer this type of questions. However, it does not tell us anything about optimal policy mixes and, in many ways, it is redundant if policy instruments have already been analysed with the use of the smart regulation framework.

In our opinion, adding the framework on multi-functionality to the current analysis would add multiple criteria and questions to the evaluation of regulations and policies, making it more burdensome and complex without significantly improving the quality of the conclusions. The framework on multi-functionality could be applied in parallel to the current analysis, in the context of evaluating the trade impacts of given policies for instance, but we do not recommend including it in the current project. We believe that the analytical work on smart regulations would be sufficient, as well as more relevant, to the current discussions.

Table 14: Benchmark policy options under perfect information and without transaction costs

	Multiple NCO with the same public good characteristic				Multiple NCO with different public good characteristics	
	Pure public good	Local public good	Club good (and private good)	Common property resources	Pure public good Others	Local public good Others (e.g. PPG)
Weak jointness (Non-economies of scope)	De-linked payments to the providers of NCOs by central government	De-linked payments to providers of NCOs by local government	Creation of single or multi-products clubs (or markets for use-values) with institutional assistance of mainly local government	Creation of rules for using NCOs	Combination of de-linked payments by central and local governments, or clubs and communities	Combination of de-linked payments by local government, and clubs and communities
Strong jointness (Economies of scope) – No market failure	No policy required	No policy required	No policy required	No policy required	No policy required	No policy required
Strong jointness (Economies of scope) – Market failure – Wide-spread (W)	NCO-linked and targeted or broad-based payments by central government	NCO-linked and targeted payments by local government	Creation of single or multi-product clubs (for markets for use-value) with institutional assistance of mainly local government. Clubs at national level may be created as well	Creation of rules for using NCOs	Policy mix (e.g. NCO-linked and broad-based payments supplemented by targeted payments by local governments)	NCO and targeted payments to be financed by local government and other relevant parties (e.g. Trusts comprising local government and other parties)
Strong jointness (Economies of scope) – Market failure – Limited (L)	NCO-linked and targeted payments by central government				NCO-linked and targeted payments to be financed by central government and relevant parties	
Strong jointness (Economies of scope) – Market failure – L and W	Combination of targeted and broad-based payments				Policy mix	

Source : OECD 2003c, p.42

Chapter 7
Concluding Remarks and Next Steps

On the basis of this analysis, we recommend moving ahead with this program of work and suggest two steps for moving into the next phases of the program.

While the creation of a database mapping out the regulatory environment in the different jurisdictions is a relatively straightforward exercise, the task of identifying appropriate methodologies to assess the impacts and effectiveness of those regulations across jurisdictions/regions proved to be a much greater challenge. Two main challenges encountered in developing the methodological framework shine light on the fact that such an exercise is an on-going knowledge-building process. The first comes from the lack of a complete picture with regards to the socio-economic and agri-environmental context within which the regulations were put in place. Since the methodologies are applied ex-post, this means that the point of reference for evaluating the impacts is not documented enough to be well defined. The second challenge resides in the fact that these methodologies tackle whole sets of regulations affecting a particular production and have to be applicable across different jurisdictions and/or regions. For these reasons, we recommend that some of the methodologies proposed in this report be fine-tuned before using them to conduct the case studies.

Therefore, the steps presented here first discuss ways to fine-tune the methodologies and second outlines the stages to follow for conducting case studies using the methodological framework.

First step: Fine-tuning critical methodologies

The methodologies for which data and specific knowledge availability was most problematic are clearly the ones for assessing the impact of regulations on producers and the benefits of those regulations for society. To fine-tune these methodologies, we propose:

- For the methodology assessing the impact on producers:
  - Test the methodology for a specific type of production (e.g. hog production). The main goal of this test is to refine the methodology, verify its applicability across jurisdictions and identify data and knowledge gaps as well as strategies to compensate for these gaps.
  - Create an inventory of basic farm-level economic data in different jurisdictions necessary to respond to the needs of the case studies.

- For the assessment of benefits to society:
  - Since it is critical to have accessible and coherent environmental and socio-economic knowledge and data for specific spatial scales (e.g. watershed or sub-region) to properly characterize the impact of primary agricultural activities on the environment, we propose to create an integrated inventory of data across jurisdictions/regions to identify the gaps. The inventory should be done in which a way to help identify a few locations where agriculture causes important damages and where it is the only – or by far the most significant – cause of environmental damage. Appendix 3 gives a general sense of the type of information needed in the inventory.
  - The literature review conducted in this report reveals that there are a limited number of original studies that could feed into the benefit transfer methodology, both on agricultural non-point source pollution damages, and on the willingness to pay for alleviating these damages. Studies available were mostly conducted in the U.S. Considering the potential use of such studies in future policy-making decisions on agri-environmental measures in Canada, we recommend that the AAFC fund at least two of them to be conducted in a Canadian context.

Second step: Using the methodological framework for conducting case studies

The methodological framework (i.e. the set of methodologies) proposed in this report takes into account various aspects of a regulatory framework. In addition to the traditional cost and benefit trade-offs, it considers the compliance and enforcement aspects and the smartness of regulations. In conducting the case studies using the methodological framework, we suggest completing a first case study, using the same sector as the one used for the test done in the first step, before starting on the other ones. While a test was done on the methodology assessing the impacts on producers in the first step, the first case study may highlight issues arising with the other methodologies, which would in turn require adjustments for the next studies.

Conducting case studies for various commodities

A) Selecting a commodity

Since the aim of this project is to understand and assess the impact of sets of regulations, the proposed methodological framework involves conducting a series of case studies for particular commodities. For example, one case study could examine the impact of all the agri-environmental regulations affecting apple or beef producers.

We suggest conducting case studies for the following commodities because they are representative of the Canadian agricultural production and there is a considerable amount of information available for those sectors:

- Hog;
- Corn (corn/cereal in Ontario and Quebec);
- Beef (cattle and dairy farm);
- Apple;
- Wheat cereal/oilseed and grain farms; and
- Poultry.

B) Identifying existing regulations

Once a commodity is chosen, the next step is to assess whether regulations are in place to address environmental problems resulting from the production of that commodity. To this end, the inventory of the environmental regulations affecting primary agriculture in Canada developed as part of this project is a valuable tool. Steps C and D only apply for commodities covered by some regulations.

C) Determining the degree of compliance and enforcement

The existence of regulations does not necessarily imply that they have an impact on producers or that they benefit the environment or society. Producers could simply have ignored them because the penalties were insignificant (i.e. the compliance rate could be close to zero) or they have not been enforced. In that case, there is no need to try to quantify the impacts of those regulations.

Therefore it is pertinent to evaluate the degree of compliance and enforcement of regulations. A methodology to assess compliance and enforcement has been proposed in the report. Once again, if regulations are not complied with or enforced, step D does not apply.

D) Assessing the impact

Once regulations are compiled for a specific commodity, and it has been determined that those regulations are enforced at the farm level, the methodologies proposed can be useful to assess the costs of the regulations for producers and society as a whole as well as their environmental and societal benefits.

1. Impact of regulations on the costs for agricultural producers

We suggest the use of a technical economic model applied to different jurisdictions for assessing the impact of sets of regulations on the costs for producers. The specific choice of the model is not very important in this case since the analysis is conducted in relative rather than in absolute terms. This methodology is in line with the approach used by the OECD (2002) for comparing the set of regulations imposed on pig producers in five different countries.

The use of a baseline, which is defined here as the least restrictive requirement imposed on competitors in another jurisdictions (excluding the absence of regulation), enables us to quantify the variations in costs incurred for agricultural producers operating in jurisdictions where regulatory requirements are of a different stringency.

In addition to this calculation, we recommend the use of financial ratios to evaluate the potential impact of a set of environmental regulations on producers. The proposed ratios are a) environmental costs over total costs of production, and b) environmental costs over total sales. These rations can be compared to benchmarks in industry or between jurisdictions and give an idea of the impact of regulations on producers' financial health and competitiveness.

2. Impact of the regulatory set on society as a whole

We propose the representative farm model to measure ex-post the impact of a set of regulations on society as a whole. The rationale is that the costs estimated for one farm can be multiplied by the number of farms (or commodity units) to estimate the aggregated private costs for producers in a specific economy, and this estimate can subsequently be used as a proxy for calculating total social costs.

The use of a financial ratio is proposed as a complementary tool to assess the impact of costs on producers' competitiveness. The proposed ratio is the environmental protection capital expenditure as a percentage of total capital expenditure.

3. The benefits associated with the regulatory set

In any evaluation of environmental regulations one of the critical issues is assigning a value to non-markets goods. Contingent valuation appears to be the most inclusive and flexible of all the non-market valuation methods, yet they pose multiple difficulties (e.g. costs and time constraints). Therefore, we recommend the use of a benefit transfer methodology based on results from such valuation studies.

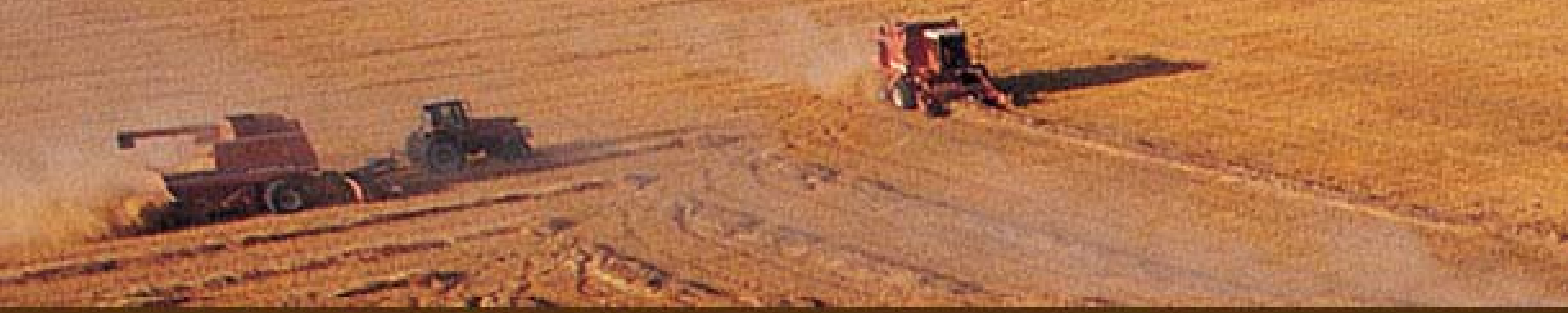
To identify the relevant benefits and whether they can be attributed to a given set of regulations, we propose a methodology that chooses a specific pollutant and analyses its impact on a river basin (or sub-regions). The methodology involves a) identifying the most impacted watersheds for which environmental indicators are available, b) use a benefit transfer methodology to get a ballpark figure for the benefits , and c) combine this figure with existing environmental data, a literature review of specific studies and the socio-economic information of a given jurisdiction to analyse the trade-off between the benefits and the costs, as developed in the preceding section.

This approach could be applied to specific commodities if the latter are associated with specific and measured pollutants.

E) Assessing the smartness of regulations

An extensive literature review suggested that the smartness of agri-environmental measures should be assessed against the following set of criteria: effectiveness, economic efficiency, cost effectiveness, flexibility, enforcement mechanisms, transparency, fairness and equity, and coherence. A set of definitions as well as a questionnaire to assess the effectiveness of regulations against these criteria have been developed and are presented in this chapter.

We propose the use of this assessment in two distinct cases. First, in the event that no regulations were identified for a particular commodity, or if it has been determined that existing regulations are not complied with or enforced, this assessment can be used to determine the relevance of policy actions and identify of optimal policy tools. Second, if regulations exist, are complied with and enforced, this assessment can help assess these regulations to determine whether they are the optimal policy tools for the specific commodity and the problem being tackled.



BIBLIOGRAPHY

Abler, David (2003). *Multi-functionality, Agricultural Policy, and Environmental Policy*, Penn State University, University Park, PA, USA.

Agriculture and Agri-Food Canada (1998). *The Federal-Provincial Crop Insurance Program - An Integrated Environmental-Economic Assessment*, Economic and Policy Analysis Directorate, Policy Branch, Ottawa (Canada).

Agriculture and Agri-Food Canada (2000). *Environmental Sustainability of Canadian Agriculture*, Reports of the Agri-Environmental Indicators Project, Research & Policy Branchs, Prairies Farm rehabilitation Administration, Ottawa (Canada).

Agriculture and Agri-Food Canada (2002). *Inventory of Policy Measures Addressing Environmental Issues in Agriculture in Canada,* Ottawa (Canada).

Atwood, Jay, Lynn Knight, Andrea Cattaneo & Peter Smith (2003). *Benefit Cost Analysis of the 2002 EQUIP Farm Bill Provisions*, USDA, NRCS Temple, TX, USDA NRCS & ERS Washington DC, U.S.A.

Baillargeon, C. et L. Hamel (1993). *Théorie de l'analyse avantage-coûts en vue d'une application à la gestion intégrée des ressources du milieu forestier.* COGESULT Inc., Juin 1993.

Berck, Peter & Peter Hess (2002). *Assessing the Economic Impacts of Large Scale Environmental Regulations in California,* Presented at the AAEA Annual Summer Meeting, 2002, U.S.A.

Bishop, Richard C. & Michael P. Welsh (1998), *Valuing Environmental Impacts for Regulatory Decisions, in Better Environmental Decisions* edited by Ken Sexton, et al., Island Press, Washington, D.C

Bohman, Mary, J. Cooper, D. Mullarkey, M.A. Normile, D. Skully, S. Vogel & E. Yound (1999). *The Use and Abuse of Multi-functionality*, Economic Research Service/USDA, U.S.A.

Boutin, Denis (2004). *Réconcilier le soutien à l'agriculture et la protection de l'environnement: tendances et perspectives*. MEQ.

Bromley, Daniel W (1996). *The Environmental Implications of Agriculture.* University of Wisconsin-Madison, Department of Agricultural and Applied Economics, USA.

Brouwer, Floor (2002). *Effects of Agricultural Policies and Practices on the Environment: Review of Empirical Work in OECD Countries,* COM/AGR/ENV/EPOC(2001)60/FINAL, OECD, Paris (France).

Carpentier, Chantal Line & David E. Ervin (2002). *Business Approaches to Agri-Environmental Management: Incentives, Constraints and Policy Issues,* COM/AGR/CA/ENV/EPOC(2001)61/FINAL, OECD, Paris (France).

Claassen, Roger & al (2001). *Agri-Environmental Policy at the Crossroads: Guideposts on a Changing Landscape*, Agricultural Economic Report Number 794, Economic Research Service, USDA, Washington (U.S.A).

Debailleul G., Louis Samuel Jacques, Esther Salvano et Olivier Tremblay (2003). *L'évaluation économique des coûts associés à l'impact environnemental des productions agricoles : état de la situation et application au Québec*, Rapport rédigé pour le ministère de l'Environnement du Québec.

Delache, Xavier (2002). *Multifonctionnalité de l'Agriculture : Cadre d'Analyse et Articulation avec les Instruments d'Intégration Agriculture-Environnement*, Maison de l'Unesco, Paris (France).

Dobbs, Thomas L. & Jules N. Pretty (2004). *Agri-Environmental Stewardship Schemes and "Multi-functionality", Review of Agricultural Economics*, Volume 26 Issue 2 page 220 - June 2004.

Dole, David (2001). *Measuring the impact of Regulation on Small Firms*, National Center for Environmental Economics, U.S.A.

Doyon, M (2003). *Élaboration d'un cadre de référence pour l'identification des coûts reliés au respect de l'environnement et des impacts positifs des nouvelles pratiques adoptées,* AGECO, mai 2003 Québec (Canada).

Easter, William & Sandra O. Archibald (1998). *Benefit-Cost Analysis in U.S Environmental Regulatory Decisions*, University of Minnesota, U.S.A.

Environment Canada (2001). *Environmental Protection and competitiveness: Summary Facts and Key Findings*, http://www.ec.gc.ca/erad/dwnld_html/FAFS_e.htm, 2004-05-28.

Environment Canada (2003). *Improving Environmental Regulation: An Environment Canada Perspective Paper*, Environment Canada Working Paper, Ottawa.

Environment Canada, Canadian Food Inspection Agency, Agriculture and Agri-Food Canada (2001). *Review of the Regulation of Nutrients in Canada*, Ottawa.

Feater, Peter, Daniel Hellerstein & LeRoy Hansen, (1999). *Economic Valuation of Environmental Benefits and the Targeting of Conservation Programs: The Case of the CRP*, Department of Agriculture. Agricultural Economic report No. 778, U.S.A.

Fox, Glenn & Jennifer Kidon (2002). *Canada, Public Concerns*, Environmental Standards and Agricultural Trade, CABI Publishing, New York, U.S.A.

Gabrynowicz, Stefan, (2003). *The Relationship Between Environmental Management and Economic Performance*, Department for Environmental and Heritage, South Australia, Australia.

Grimard, Julie (2004). *Regard sur l'Industrie agro-alimentaire et la communauté agricole*, Statistiques Canada, Ottawa.

Groupe Géagri inc (1999). *Bande riveraine*, AGDEX 570/821, Québec, (Canada).

Gunningham, N. & D. Sinclair (1999). *Regulatory pluralism: Designing Policy Mixes for Environmental Protection.* Law & Policy, Volume 21, Pp. 49-76, Australia.

Harris, M., L. Konya & L. Matyas, (2000). *Modelling the Impact of Environmental Regulations on Bilateral Trade Flows : OECD*, 1990-1996, Melbourne Institute Paper No. 11/00, Australia.

Herath, D., A. Weersink & C.L. Carpentier, (2003). *Spatial Dynamics of the Livestock Sector in the United States: Do Environmental Regulations Matter*, Journal of Agricultural and Resource Economics, Canada.

Hervieu, Bertrand (2002). *La Multifonctionnalité de l'Agriculture: Genèse et Fondement d'une Nouvelle Approche Conceptuelle de l'Activité Agricole*, John Libbey Eurotext, Paris (France).

Howlett, Michael & Jeremy Rayner (2003). "*Smart Regulation"? Canadian shellfish aquaculture and the evolution of instrument choice for industrial development*. Marine Policy 28 (2004), 171-184, Canada.

Jaffe, A., S. Peterson, P. Portney & R. Stavins (1995). *Environmental Regulation and the Competitiveness of US Manufacturing: What Does the Evidence Tell Us*?, Journal of Economic Literature, Vol. 33, No. 1, pp. 132-163.

Johnson, Larry A (1994). *Sustainability Issues: How Should Government Coordinate Farm Regulations and Policy*? Journal of Agricultural and Applied Economics, Volume 26, Number 1, July, 1994: 75-79, U.S.A.

Juneau, A (1998). *Impact économique des activités du secteur de la culture des cinq régions du Montréal métropolitain et de la région de l'île de Montréal,* Chambre de commerce de Montréal, Québec (Canada).

Lankoski, Jussi (1997). *Environmental Effects of Agricultural Trade Liberalization and Domestic Agricultural Policy Reforms,* UNCTAD Discussion Papers, paper No. 126. UNCTAD/OSG/DP/126, Switzerland.

Latacz-Lohmann, Uwe (2001). *A Policy Decision-Making Framework for Devising Optimal Implementation Strategies for Good Agricultural and Environmental Policy Practices.* OECD, COM/AGR/CA/ENV/EPOC(2000)56/FINAL, Paris (France).

Meyer, Stephen M. (1995). *The Economic Impact of Environmental Regulation*, Journal of Environmental Law and Practice, vol 3, no.2 (Sept-Oct), pp 4-15, U.S.A.

Mulatu, Abay, Raymond Florax & Cees Whithagen, (2001). *Environmental Regulations and Competitiveness*, Tinbergen Institute Discussion Paper, Netherlands.

Mullarkey, David (2001). "*Multifonctionality" and Agriculture: Do mixed goals distort trade?*, Choices: The Magazine of Food, Farm and Resource Issues, Winter 2001, U.S.A.

Nolet & Nolet (1997). *Rapport 1998 sur l'État du Saint-Laurent : La Contribution des Activités Agricoles à la Détérioration du Saint-Laurent*, St Laurent vision 2000, Canada.

OECD (2004). *OECD Environmental Strategy: 2004 Review of Progress*, Paris (France).

OECD (2003a). *Agri-Environmental Policy Measures: Overview of Developments*. COM/AGR/CA/ENV/EPOC/(2002)95/FINAL, Paris (France).

OECD (2003b). *Agriculture, Trade and the Environment: Linkages in the Dairy Sector- an Inventory of Policy Measures*. COM/ AGE/CA/ENV/EPOC(2003)18, Paris. (France).

OECD (2003c). *Multi-functionality: The Policy Implications*, Paris (France).

OECD (2003d). *Agricultural Policies in OECD Countries Monitoring and Evaluation*, Paris (France).

OECD (2002a). *Agriculture, Trade and Environment Linkages in the Pig Sector : Main Report,* COM/AGR/CA/ENV/EPOC(2002)92, Paris (France).

OECD (2002b). *Government Capacity to Assure High Quality Regulation*, OECD Reviews of Regulatory Reform - Regulatory Reform in Canada. Paris.

OECD (2002c). *Inventory of Policy Measures Addressing Environmental Issues in Agriculture*, April 2002. COM/AGR/CA/ENV/EPOC(2002)38, Paris (France).

OECD (2001a). *Improving the Environmental Performance of Agriculture: Policy Options and Market approaches*, Paris (France).

OECD (2001b). *Multi-functionality: Towards an Analytical Framework*, Paris (France).

OECD (2001c). *Production Effects of Agri-Environmental Policy Measures: Reconciling Trade and Environmental Objectives*. Paris, COM/AGR/ENV(2000)133/FINAL, Paris (France).

OECD (1998). *The Environmental Effects of Reforming Agricultural Policies*, Paris (France).

OTA-ITE-586 (1994). *Industry, Technology, and the Environment: Competitive Challenges and Business Opportunities*, U.S. Government Printing Office, Washington, DC.

Parris, Kevin (2002). *Actes de la conférence paneuropéenne sur l'agriculture et la biodiversité*. Conférence organisée par le Conseil de l'Europe en coopération avec le gouvernement français et le PNUE à Paris, France, 5-6-7 juin 2002.

Poole, E. (1999). *Guide d'utilisation du modèle d'entrées-sorties de Statistique Canada*, Statistique Canada, no 58-F, 1999.

Ribaudo M, Richard D. Horan & Mark E. Smith (1999). *Economics of Water Quality Protection From Nonpoint Sources: Theory and Practice,* Resource Economics Division, Economic Research Service, U.S. Department of Agriculture, Agricultural Economic Report No 782.

Ronningen, Katrina. *Multi-functionality: Applying the OECD framework, a review of the literature in environmental commodities and rural viability in Norway*, OECD, Paris.

Rude, J. (2000). A*n Examination of Nearly Green Programs: Case Studies for Canada, the United States and the European Union*. Trade Research Series, Agriculture and Agri-Food Canada, Ottawa.

Silveira, Rogério (2000). *Environmental Regulation, Innovation and the Competitiveness of Portuguess Firms,* Centro de Investigacao Sobre Economia Portuguesa, Portugal.

Somda, Zc, J.R. Allison, L.O. Ely, G.L. Newton & M.E. Wetzstein, (2002). *Economic and Environmental Evaluation if Dairy Manure Utilization for Year Round Crop Production*, Selected Paper prepared for presentation at Southern Agricultural Economic Association Annual Meeting, Mobile Alabama, U.S.A.

Thompson, G. & S. Thore (1992). *Computational Economics: economic modeling with optimization software*, The Scientific Press, pp. 349.

Union québécoise pour la conservation de la nature (2002). *La Contribution du Concept de Multifonctionnalité à la Poursuite d'Objectifs de Protection de l'Environnement*, Final report presented to Quebec Environment Department and Quebec Agriculture and Fisheries Department, Quebec (Canada).

U.S. Congress, Office of Technology Assessment, Industry (1994). Technology, and the Environment: Competitive Challenges and Business Opportunities, OTAITE- 586 (Washington, DC: U.S. Government Printing Office, January 1994).

U.S. Environmental Protection Agency, *Environmental Protection and Jobs: a Guide to the Basics*, Office of Sustainable Ecosystems and Communities, U.S.A.

U.S. Environmental Protection Agency (USEPA, 2002). *A Framework for the Economic Assessment of Ecological Benefits,* USA.

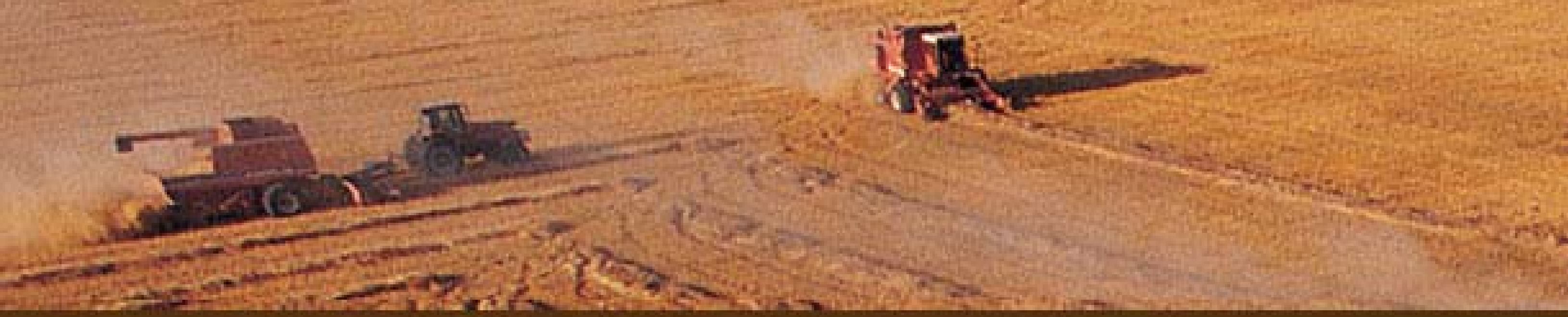
USEPA (2002), *A Framework for the Economic Assessment of Ecological Benefits*, February 2002, U.S.A

USEPA (1998), *Guidelines for ecological risk assessment,* Published on May 14, 1998, Federal Register 63(93):26846-26924, U.S.A

USEPA (2003), *Integrating Ecological Risk Assessment and Economic Analysis in Watersheds: A Conceptual Approach and Three Case Studies*, National Center for Environmental Assessment, Office of Research and Development, EPA/600/R-03/140R, September 2003

Wallart, Nicolas (2002). *L'estimation des bénéfices des réglementations,* Secrétariat d'État à l'économie, Berne.

Woods, Mollie & Lorie Srivastava (2003). *The Implications of Multi-functionality on World Commodity Markets: A Preliminary Examination*, paper presented at the International Conference "Agricultural policy reform and the WTO: Where are we heading?", Capri (Italy), June 23-26, 2003.Abler, David (2003). *Multi-functionality, Agricultural Policy, and Environmental Policy*, Penn State University, University Park, PA, USA.



Appendix A
Presentation of the Environmental Regulation Inventory Affecting Agriculture in Canada

The *Constitution Act* of 1867 assigned to provinces the primary responsibility over property and civil rights. While preparing the inventory, we noticed that certain provinces have control over principal agricultural operations and concrete environmental issues related to agriculture. Since then, many provinces have delegated this responsibility to local governments through their land use planning and zoning powers. The federal government still has some minimal environmental responsibility through its exclusive jurisdiction over federal land. *The Fisheries Act* and the *Canadian Environmental Protection Act* are examples of federal regulatory legislations.

While creating the inventory, we realized that environmental regulations affecting agriculture are either provincially- or municipally controlled, or are subject to a provincial-municipal partnership to regulate industry. However, many codes of practice and established by a senior government level have been incorporated into legislation by lower government levels.

Description of particular regulations affecting livestock producers across Canada

Subsequent to preparing the environmental regulation inventory affecting Canadian agriculture, we decided to present some of our thoughts. This section aims to explore the coordination between local and provincial governments and their approach to creating policies and regulations. Furthermore, we will discern the interaction between the two government levels of legislation by looking at regulations affecting livestock producers.

a) The provincial control model

Three provinces – New Brunswick, Prince Edward Island and Quebec – already have a regulatory system that is primarily controlled for livestock operations at the provincial level[14]. Presently Ontario has started to change its regulatory system regarding nutrient management. In fact, a regulation named the *Nutrient Management Act* came into force on September 30, 2003, which gives the Ontario government the right to regulate intensive livestock operations (300 animal units and more)[15].

14. *Carpentier, Chantal Line et David E. Ervin, 2002.*

15. *Ontario Ministry of Agriculture and Food, Municipalities and the Nutrient Management Act, [On line] http://www.gov.on.ca/OMAFRA/english/nm/municipal/kit.htm#intro*

New Brunswick

The New Brunswick government passed the *Livestock Operation Act* in 1999, which prohibits any new livestock operation from being carried out without a licence. It also obliges livestock producers to present a nutrient management plan signed by an agronomist, in order to get the licence. The role of local government is not great in relation to the control of intensive livestock operations in New Brunswick. This is primarily attributable to the fact that many counties have little or no land use control at the local level. In fact, many still do not require building permits to construct intensive livestock operations[16]. However, we hope that standardized provincial legislation on land-use areas will result in local planning throughout the province, and consequently in the greater involvement of local authorities in this type of issue.

Prince Edward Island

There are four provincial-level regulations for potato farming dealing with pesticide management and soil erosion management. Two regulations are in place regarding livestock operations and buffer zones.

Quebec

The province of Quebec operates in a manner similar to that of New Brunswick for livestock management, where a Certificate of Authorization is required for the construction of new livestock operations. In Quebec, this is required by the *Environment Quality Act* regulations. As opposite to New Brunswick's regulation, Quebec's regulation is more stringent and precise. Local governments have also developed complementary legislation.

b) The cooperative model

Another approach to the regulation of confined animal feedlot operations is a form of provincial and municipal cooperation, which is most evident in the provinces of Manitoba and Saskatchewan.

Manitoba

In Manitoba, the approval process generally begins at the local level where land-use bodies – such as the municipality and planning district – are charged with the responsibility and control of sitting livestock operations by issuing development permits. The land use policies employed by municipalities are outlined in the *Planning Act* and include specific policies in relation to agriculture.

One additional indicator of the co-operative relationship between levels of government in Manitoba is the establishment of Regional Technical Review Committees to assist municipalities in their decision-making. These committees, comprising representatives from Manitoba Agriculture and Food Conservation, and Intergovernmental Affairs are contacted by municipalities who seek technical information about proposed operations to see whether they meet all of the guidelines and regulations in force in the province.

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16. *Carpentier, Chantal Line and David E. Ervin, 2002.*

While exercising their local permitting and development powers, municipalities have employed a variety of policies and standards to respond to local needs. Among these are the establishment of specific livestock zones within which all intensive livestock operations over a specific size must be located, and the establishment of site specific guidelines for intensive livestock operations.

On the other hand, through its *Livestock Manure Mortalities Management Regulation* – pursuant to the *Environment Act* – Manitoba prescribes various requirements at the provincial level for the use, management and storage of livestock manure and mortalities in agricultural operations so that livestock, they are handled in a environmentally sound manner. Pursuant to this general purpose, a permit is required for the construction, modification or expansion of a manure storage facility.

Saskatchewan

The other province engaged in a co-operative approach is Saskatchewan. The provincial government has established legislation to regulate a part of the agricultural environment issue. Pursuant to the *Saskatchewan Agricultural Operation Act Regulations,* any proponent of a new livestock operation must receive approval for both a manure management plan and a manure storage plan[17].

At the municipal level, bylaws control the development of the operations through sitting, zoning and building permit phases, and also issue permits or approvals for heavy hauling once the operation begins[18].

As previously mentioned, Ontario has begun modifying its regulatory system of nutrient management in the province. Before the *Nutrient Management Act* came into force in January 2002, local governments received the lion's share of responsibly regarding environmental issues in agriculture. Since then, a form of collaboration between local and provincial governments has been established. The Ontario Ministry of Agri-Food has defined precise regulations for intensive livestock operations (over 300 animal units). In fact the *Nutrient Management Act 2002,* requires the operators of every new livestock farm that is capable of generating more than five nutrient units (NU) in a year, and every expanding livestock farm that will be capable of generating more than 300NU a year after expansion in Ontario, to develop and implement a nutrient management strategy (NMS), a nutrient management plan (NMP), or both[19].

Municipal by-laws may continue to apply to existing farms of less than 300NU, unless otherwise restricted by a provision in the regulation. In the fall of 2003, Ontario's government provided training and information to municipalities' representatives to help them handle the modification of the system.

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17. *The Agricultural Operation Act, S.S 1995, c. A-12.1.*
18. *Centre for Studies in Agriculture, Law and the Environment (1996). Expanding Intensive Hog Operations in Saskatchewan: Environment and Legal Constraint, p.24*
19. *Ontario Ministry of Agriculture and Food, Municipalities and the Nutrient Management Act, [on-line] http://www.gov.on.ca/OMAFRA/english/nm/municipal/kit.htm#intro*

c) The local control model

British Columbia and Nova Scotia have a similar regulatory approach: they rely primarily on the local government to approve the construction of new livestock operations through their planning and construction permitting processes. However, in both of these provinces there is very little guidance from the provincial level as to what should implicitly be expected. Municipalities retain the authority to issue land use permits. While preparing the inventory, we found out that many municipalities in British Columbia have regulations concerning environmentally sound means of production.

Similarly, Nova Scotia and British Columbia treat the control and regulation of intensive livestock operations as primarily a land-use issue, to be dealt with by the municipalities. Provincial governments provide information in the form of handbooks on such topics as farm waste management, manure storage and livestock production, but the purpose of these documents is only to provide a guide for agricultural producers of the environmental regulations, standards codes and guidelines that affect or may affect their farm management.

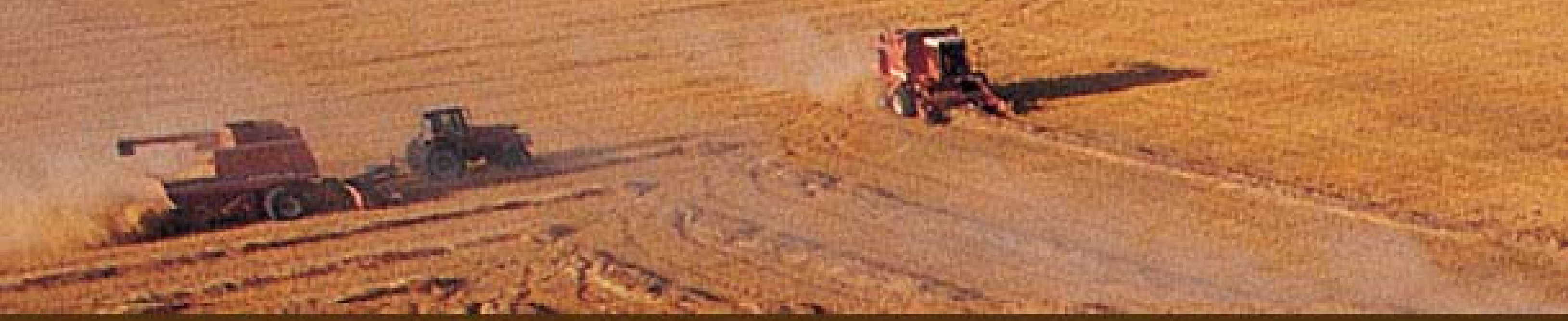
Liability and enforcement

There is very little information available on the enforcement of agricultural environment regulation. Many of the provinces either do not track this information, or track it only for the current year. We noticed, while seeking information through different levels of government, that detection of non-compliance is heavily dependant upon complaints and self-reporting. However, in Prince Edward Island we talked with the Sustainable Agriculture Resources Manager[20] about the detection of *Environmental Protection Act Regulations*, and he confirmed that there are five or six inspectors who work in the field, and once in a year they use a helicopter to inspect the buffer zone regulation above the main streams and rivers.

At the moment in Canada, the actual policy targets, instruments used and levels of application vary to such a great extent, that it is difficult to quantify or rank the stringency of different environmental regulations. Despite this, in our inventory of regulations we added a section named compliance rate, which could be utilized when the information is available.

Another consequence of this lack of information is that it renders more difficult the effort to estimate the degree to which environmental regulations, and their enforcement, impact farmer's on-site decisions.

20. *M. Ron Dehaan, Sustainable Agriculture Resources Manager (Acting), Agriculture Resource, Ministry of Agriculture, personal communication , May 2004.*



APPENDIX B

POLICY INSTRUMENTS

1. Command and Control Measures

These are compulsory restrictions, which offer no choice to farmers but to comply with specific rules and penalties, including the withdrawal of support.

1.1 Regulatory requirements/ instruments

Regulatory requirements are compulsory measures imposing requirements on producers to achieve specific levels of environmental quality, including environmental restrictions, bans, permit requirements, maximum rights or minimum obligations. Enforcement mechanisms, such as the courts, police or fines, are used where producers are found to be in breach of regulations or other legal requirements. Regulations lie at the far end of the policy spectrum in terms of the degree to which participation is voluntary. Rather than attempting to facilitate of encourage improved environmental performance, policymakers simply require it. Often, regulation is used where a high level of certainty about the outcome is required, or a where there is little flexibility allowable on the timing or nature of the outcome required.

Regulatory requirements have long been applied in the agricultural sector to deal with problems relating to the pollution of air and water, and protecting biodiversity and environmentally sensitive areas. These range from broad prohibitions or requirements, to very prescriptive details about farm management practices. In Canada, the federal government has set standards for nutrients, bacteria and pesticides, while the primary responsibility for the environmental regulation of agriculture rests with the provincial and municipal levels of government.

Advantages: can be the most effective of all policy tools in effecting changes to improve environmental quality, assuming that regulations are enforced. Unlike policy choices in which farmer participation is uncertain, regulations require that all farmers participate. This feature is particularly important if the consequences of not changing are drastic or irreversible.

Disadvantages: regulatory requirements can be the least flexible of all policy instruments, requiring that producers reach a specific environmental goal or adopt specific practices. Producers are not free to determine their own level of participation and the most appropriate way of meeting environmental objectives, based on their costs. Unless regulators know farm-specific costs and can use this information to establish farm-specific regulations, agri-environmental effort is not necessarily directed towards producers who can make changes at the lowest cost. Consequently, they can be less flexible and less efficient than economic incentives or other measures.

1.2 Cross-compliance mechanisms

These measures require a basic level of environmental compliance as a condition for eligibility for other programs. Compliance mechanisms share characteristics with both government standards for private goods/actions and economic incentives. They are similar to the former in that the government establishes a set of approved practices, except that compliance is linked to a direct economic payment. Because existing programs are used for leverage, compliance mechanisms require no budget outlay for producers' payments, although considerable technical assistance is needed to develop conservation compliance plans.

Advantages: compliance mechanisms are well-suited to certain agri-environmental problems that may be more difficult to address with, for instance, voluntary subsidy programs. For example, draining a wetland can trigger the loss of federal program benefits. In contrast, to protect wetlands with a voluntary subsidy program, policymakers might find themselves having to pay for maintenance of all wetlands or needing to decide which wetlands have sufficient conservation potential to warrant protection – potentially expensive in the former, and latter potentially difficult to establish in the latter.

Disadvantages: the distribution of agri-environmental incentives in this case depends on the distribution of federal farm program payments. Many environmental issues, particularly emerging issues such as livestock waste management, do not occur on farms that are the traditional clients of these programs. Also, if farm payments are countercyclical, program payments will be low when prices, and therefore incentives for plowing highly erodible land or draining wetland, are high.

2. Economic incentive-based instruments

Unlike command and control regulation, which are compulsory, economic instruments can be mandatory (e.g. taxes) or voluntary (e.g. payments). They create direct price signals for producers and consumers; prices that reflect scarce environmental resources and the costs of pollution. Economic instruments can provide positive incentives to farmers (e.g. payments) to encourage environmentally beneficial activities, or negative incentives (e.g. taxes) to discourage environmentally harmful practices. This way, the environmental implications of various choices are recognised. They provide farmers with greater flexibility of response than regulatory approaches, since producers are free to weight the incentive against the costs they will encounter. In that way, incentives can direct agri-environmental activity towards producers who can make changes at the lowest cost.

Economic instruments can also provide a continuing economic incentive for firms to reduce pollution, thereby stimulating innovation in the development and application of new technologies and processes. Moreover, the ongoing incentives with these instruments in some cases will achieve environmental goals more quickly, and can even encourage firms to surpass established standards or targets.

A further advantage of economic instruments is that they can involve lower administration costs for both governments and industries than some more traditional approaches. Nevertheless, perhaps one of the most practical reasons to use economic incentives and instruments is that they allow incremental progress. For instance, emission charges can be increased gradually. The goal may not be some abstract goal of fully costing environmental impacts, but rather smoothly adjusting relative price signals.

2.1 Non-tax instruments

2.1.1 Payments/ cost-share policies

These are payments to farmers and landowners for adopting and achieving environmentally desirable practices. Payments can be based on farming practices (e.g. less input-intensive practices, organic farming, etc.); on resource retirement (e.g. land retirement programs); or on fixed farm assets (e.g. granting monetary transfer to farmers to offset the investment cost of adjusting farm structure or equipment for environmental purposes or to meet the costs of regulatory requirements, etc).

Advantages: increase the likelihood that farmers will adopt environmentally desirable practices by reducing the net cost of doing so. When payment exceeds the cost, it can provide income support to farmers adopting sound environmental practices, compensating them for providing public amenities such as clean water or wildlife habitat. Also, if farmers are required to improve their environmental performance as a result of a separate regulatory requirement, public subsidies could reduce or eliminate the impact of that requirement on farm income.

Disadvantages: participation in such programs is often voluntary. Policies providing for less that 100% than adoption costs will then be effective only to the extent that targeted practices provide private economic benefits in addition to the environmental benefits. Because participation will increase as payment rate increases, it may be expensive for taxpayers to fund.

In addition, without specific controls, payments for targeted practices can induce producers to increase crop acreage and thus exacerbate environmental damages, even if damages per acre fall. Therefore, one difficulty with using some types of payments to achieve a reduction in negative externalities is that, while they reduce the externality, they may also expand the size of the market by making it more profitable – thereby requiring the subsidy or payment to be even bigger than would initially seem necessary. Payments also run counter to the general view that polluters should bear primary responsibility for pollution abatement costs (*i.e.* the polluter pays principle) (OECD, 2004).

2.1.2 Tradable rights/permits

This measure establishes environmental quotas, permits, restrictions and maximum rights or minimum obligations to economic agents which are transferable or tradable. This way, they are transferred to those who value them most highly. In this approach, most commonly, the responsible regulatory authority sets a ceiling on total allowable emissions of a pollutant. It then allocates the allowable emissions total among the polluters. It does this by issuing permits which authorise plants or other sources to emit a specified amount of the pollutant over a specified period of time or by way of a market mechanism such as by auctioning - or a combination of methods. Permits are subsequently allowed to be bought and sold.

Tradable permits are often useful where particular emissions or resource-use reduction targets or phase-our deadlines must be met. Trading works best where the location of emissions or resource use does not affect the environmental damage. However, trading permits can also be designed to take account of local factors – with adjustment to traded permits according to local environment sensitivity.

Tradable permits have rarely been applied to agriculture, but they have been used in the U.S. to reduce emissions of sulphur dioxide, and more recently in Canada to phase out consumption of methyl bromide. They are also the main instrument under consideration to reduce carbon dioxide emissions in Canada.

2.1.3 User charges and pricing

These are charges that can be imposed on users of services that have a harmful impact on the environment, and which are structured to reflect the cost of supplying the service. Examples of such services include municipal water supply and wastewater treatment, where many Canadians in urban areas pay on the basis of how much water they consume.

2.1.4 Deposit-refund schemes

These economic instruments can be used for products which can be reused or recycled and/or which create environmental problems if not disposed of in an acceptable manner. Under a deposit-refund scheme, a charge is imposed on the sale of such products. The charge, in full, or in part, is refunded when the product is returned to a collection system. Glass pop bottles are a well known example of a product using a deposit-refund system.

2.1.5 Land retirement programs

Although this measure can be considered as an economic payment, it deserved further discussion. These programs provide annual payments to farmers for retiring land from crop production, compensating farmers for foregone net revenues.

Advantages: are particularly well suited for securing environmental benefits that increase with the length of time land is removed from crop production. Retirement programs are also useful for protecting lands that cannot be sustainably farmed, such as those with very steep slopes. By removing land from crop production, land retirement also controls commodity supply. Finally, land retirement can be easily confirmed and, therefore, easily enforced.

Disadvantages: cannot address environmental damages from the vast majority of cropland that remains in production. Also, because program payments must cover the full value of the crop land in production (rather than a cost for modifying practices on land remaining in production), land retirement programs may be more expensive, per acre, than some other policies discussed.

2.2 Tax instruments

2.2.1 Environmental taxes/ charges

Environmental taxes are designed to modify behaviour by imposing a charge on particular activities or sources of an environmental problem. They involve imposing a tax on input or outputs that are a potential source of pollution or environmental degradation, thus creating a per unit charge for actions contributing to environmental degradation. They can be assessed on all units, or just on the number of units emitted or used above a certain threshold. If associated with an environmental goal, farmers who meet the goal might incur no additional cost from a tax program. Environmental taxes are useful where an environmental impact is closely linked to an economic activity.

An environmental tax rate is set according to the incentive effect it is intended to provide. It is therefore important to assess long- and short-run price elasticities of demand in order to set a tax at a level required to stimulate the desired change in behaviour. Where a low price elasticity reflects a lack of knowledge amongst farmers about alternatives (or a lack of willingness to experiment with alternatives as a result of risk-aversion or habitual behaviour), supporting complementary information instruments may increase the price-responsiveness of farmers and thus raise the environmental effectiveness of the tax.

Environmental tax policies make people face the environmental cost they impose on society, and are thus consistent with the polluters pay principle, and they do not promote the expansion of environmentally damaging activities. However, they may have a significant impact on farm income.

2.2.2 Tax incentives

Tax incentives are designed to encourage particular types of activities by reducing the tax burden for those who engage in these activities. Examples of tax incentives would include accelerated capital cost allowances for energy efficient equipment or renewable energy equipment such as windmills or solar panels.

2.2.3 Tax shifting

Tax shifting is a relatively new approach which seeks to reduce taxes in areas of the economy considered to be good, i.e. investment and labour (corporate and personal income taxes), and increase taxes on things which are considered bad, i.e. waste and pollution. Revenue neutrality is a key element of tax shifting, and refers to the idea that tax authorities (usually governments) neither increase nor decrease the overall amount of revenue they collect through tax shifting, only the sources change.

3. Advisory/informational tools (voluntary)

Example of information instruments include: written, internet or face to face advice; training; research and development; and awareness raising campaigns. They work best where a lack of information about how best to reduce environmental impacts is in itself a significant barrier to people changing their behaviour.

Advisory/information tools, which are voluntary measures, work best where people already have some incentive to change their behaviour. Voluntary instruments also tend to be chosen in preference to regulation or economic instruments where: changes in behaviour can be secured through the actions of a small number of market players, the scale or localised nature of environmental impacts would not warrant the introduction of national instruments, monitoring and enforcement of regulations and economic instruments would be so difficult that they would have little credibility, or where it would be difficult to design a regulation or economic instrument that would be environmentally effective (OECD, 2001b)

3.1 Research and development

Often undertaken to establish best management practices and optimal technologies, which are to be communicated to farmers through on-farm technical assistance, etc. Involve a broad range of scientific enquiry including ecology, engineering, farm management techniques, economics, farmer behaviour, etc.

3.2 Education/ technical assistance

Provide information and training to farmers to facilitate the adoption or use of more environmentally benign practices. Assistance can range from providing data or disseminating information about new technologies or practices.

Education and technical assistance may increase the use of conservation practices by farmers unaware of their effectiveness or unsure about how to adopt them. Private benefits to producers may include lowering production costs, reserving soil productivity, or reducing damage to their own resources such as ground water.

It their effort to improve the management nutrients in Canada, most provincial governments, in co-operation with producer groups, have prepared codes of practice and guidelines for farmers on issues such as manure handling, land management and appropriate use of fertiliser. Hog producers in most provinces also have developed codes and guidelines for handling animal wastes to reduce environmental impacts (Environment Canada et al.).

Labelling standards/ certification

These are voluntary participation measures whereas the government defines standards for products of processes, which must be met for certification. It helps create efficient private markets for goods produced with environmentally sound practices and increases the informational value of goods.

Government labelling and certification assure the consumers of the meaning and value of specialized labels, and make it easier for producers to capture price premiums for products produced under environmentally friendly conditions.

National certification eliminates confusion created when standards vary from region to region.

However, certification will generally be effective only when private gains from participation can be captured in a market setting. In some cases, it will be difficult to link program participation to measurable environmental benefits.

3.3 Community-based measures

These measures involve government support to community-based groups implementing collective projects to improve environmental quality. Canada has many such initiatives in the environmental field. Much emphasis is placed on mobilising and motivating people to take greater responsibility and improving the flow of information and using peer pressure to attain results. For example in Canada conservation clubs, development of guides, Agricultural Environmental Stewardship Initiative (AESI).

Source: OECD 2003a, Claassen et al. 2001, Environment Canada, Defra 2002, OECD 2002a

NOTE: An inventory of policy measures addressing environmental issues in Agriculture has been published by the AAFC and by the OECD and provides a good idea of the instruments that have actually been used (or not used) in Canada. See OECD (2002c) and AAFC (2002).

Appendix C
Environmental and Socio-Economic Data and Knowledge on Specific Spatial Scale (Sub-Region, Watershed)

Draft Fact Sheet

Objective: Information and knowledge integration (ecological and socio-economic)

Spatial scale: Watershed or sub-region – (Municipality)

Timeframe - Before and since regulatory initiatives - Future

Type of information:

- Data
- Studies – data analysis
- Expert knowledge

Type of environmental damages:

- Ecological
- Human health
- Materials damage (mostly market-based)

The following considerations are concentrated on ecological damages

Questions:

Ecological perspective :

- What is the nature of the problem that led to the regulatory initiatives - Past, present and Future?
- What are the ecosystem characteristics of concern - ecological endpoints?
- What is our state of knowledge on the problem?
- What data and data analysis are available and appropriate?
- What are the potential constraints?

Socio-economic perspective (illustrative):

Primary agriculture:

- What are the characteristics of the activities responsible for the problem ?
- What are the pathways from the activities to the ecological endpoints?
- What are the related pressures indicators and their evolution?

Regulatory perspective (illustrative):

- What are the specific objectives of the concerned regulatory prescriptions?
- What is the state of enforcement and compliance of the regulations

Table 15: Outline of the type of information and knowledge to be integrated

Category	Data	Knowledge
Ecologicial		
Ecosystem characteristics of concern		
Surface water	Quality-Quantity state-evolution	
Ground water	Quality-Quantity state-evolution	
Soil	state-evolution	
Air	state-evolution	
Agricultural		
Agricultural activities of concern		
Production/commodities	-Number of producers -Type of production activities	
Pressure indicators		
Socio-economic		
Recreational activitiy indicators		