Advancing the Economics of Ecosystems and Biodiversity in Canada:

A Survey of Economic Instruments for the Conservation & Protection of Biodiversity

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Sustainable Prosperity

BACKGROUND PAPER

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Sustainable Prosperity (SP) is a national research and policy network based at the University of Ottawa.

SP focuses on market-based approaches to build a stronger, greener economy. It brings together business, policy and academic leaders to help innovative ideas inform policy development.

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Executive Summary

Nature, and the many services it provides, is the foundation of life on Earth. It underlies most human economic activity and wealth creation. It supports healthy individuals and communities.

However, humans are now consuming the Earth's natural resources faster than the planet can replenish most of them. This unsustainable use is not only causing an unprecedented decline in biological diversity, it is also wasting a priceless natural asset – one that provides free, life -supporting services in the form of cleaning air and water, renourishing soil, stabilizing climate, pollinating plants, and many others. The value of these ecosystem services can be very high. For example, one study estimates that southern Ontario's Greenbelt provides services worth $2.6 billion per year. Globally, a recent United Nations study estimates that loss of ecosystem services will cost over $2 trillion annually by 2050 – or 7% of global GDP – on our current trajectory.[1]

Yet the value of these precious ecosystem services is not counted in market prices, in most cases, with the result that our economic and ecological signals are misaligned. A major part of our 'balance sheet' (representing nature's value) is missing, leading us to use nature's resources wastefully and unsustainably – much as a tenant who does not pay for electricity tends to leave the lights on.

While Canada is blessed with a rich endowment of natural resources, and a relatively small population, we still face significant, and growing, problems of biodiversity loss and natural resource depletion. Remedying these problems, and using our natural capital more productively, is essential to ensure an ecologically and economically healthy future.

The good news is that in addressing the challenge of conserving our natural wealth, policymakers have a powerful and proven tool readily at their disposal. *Economic instruments* (EIs) can provide incentives to maintain ecosystems and the services they provide in a cost-effective manner. Such instruments can harness the economic self-interests of individuals, corporations and communities to conserve biodiversity.[2] They can encourage environmentally friendly practices, boost green technology and innovation, and discourage resource waste and inefficiency – without harming (and potentially *enhancing*) competitiveness. And they can be applied in a wide range of ecosystem settings – from private woodlots and ranches, to public forests and downtown neighbourhoods.

EIs are not mere academic theory. There are hundreds of examples of effective EIs at work around the world at all levels of government, aimed at conserving ecosystem services and/or biodiversity.[3] If well designed, such EIs can advance environmental and economic goals, and do so in a manner that is socially fair. They are often most effective when used as part of a mix of policy tools.

[1] Valuation methods are improving, but these numbers should be seen as rough estimates - particularly at this scale.
[2] Biodiversity can be measured by "species diversity" or "species richness" (or both).
[3] Biodiversity and ecosystem services are inter-related. Maintaining healthy levels of biodiversity contributes to the stability of an ecosystem as well its ability to provide services. The converse is also true: protecting ecosystem services typically has positive effects on biodiversity.

To date Canada has made less use of EIs than most other developed countries – a problem that has been highlighted in several Organization for Economic Co-operation and Development (OECD) reports. However, that may be starting to change. This report identifies nearly 40 such programs in place and working across Canada through federal and provincial governments. Even more are in the pilot stage. Most target a particular type of ecosystem or service. Examples of existing Canadian EI programs include:

- in Manitoba, the provincial government is seeking to prevent soil erosion and improve water quality by offering a *Riparian Tax Credit* to farm operators who take action to improve the management of lakeshores, riverbanks and streambanks on their property;
- in Saskatchewan, Ducks Unlimited has led an innovative "*reverse auction*" to pay landowners for restoring wetlands in their fields and pastures, in an effort to restore 56,000 hectares of wetlands over 20 years;
- in Alberta, the province's *Greenhouse Gas Offset System* enables companies to pay landowners for managing their farms or forests to store additional carbon, while maintaining biodiversity. And the program may soon be extended to public forest management;
- in Ontario, the South Nation Conservation Authority has instituted a water quality trading program designed to reduce phosphorus discharge to the watershed; and
- the federal *Ecological Gifts Program* seeks to protect ecologically important areas across Canada, by providing tax credits to landowners who donate ecologically sensitive lands to environmental charities.

These existing programs merely scratch the surface of the potential for using economic tools to better manage Canada's ecosystems (across all sectors), and value the vital services they provide. Examples of *other* possible policies include:

- eliminating or reforming harmful subsidies that use taxpayer dollars to reward ecological degradation, such as forest loss, wetland destruction or urban sprawl;
- creating ecosystem service markets, such as offsets for conserving fish or endangered species habitat, that provide economics incentives to safeguard nature's services; and
- imposing charges on water pollution, to encourage cleaner practices and technology, and generate revenues to finance clean water infrastructure.

Conserving nature and its many ecosystem services is a smart investment, not only in our health and quality of life, but also in laying the foundation for sustainable economic prosperity. The economy of the future is likely to reward countries that are low polluting and make productive use of scarce natural capital. Given the increasing array of threats to biodiversity, it is important that governments, resource managers and landowners better understand the real economic value of the life-supporting services provided by nature. There is a growing need for a Canadian dialogue on the role market-based approaches could play in helping us to better manage natural capital and conserve biodiversity – to become wiser stewards of the natural wealth hidden in our forests, wetlands, farms, lakes and cities, and to build a greener, stronger economy.

Report Contents

1. Introduction

This study provides an overview of the state of knowledge and experience with the use of Economic Instruments ("EIs") (also known as *market-based instruments* or MBIs) to conserve biological diversity and provide essential ecosystem services in Canada.

1.1 Scope and Objectives of the Study

The study has been prepared for policymakers, resource managers, communities, landowners and interested members of the public. It seeks to:

- promote understanding of the full economic value of the life-supporting services provided by nature; and
- discuss how EIs can be applied in Canada – drawing on experience here and elsewhere – to better manage natural capital and conserve biodiversity.

The report focuses on two principal categories of EIs; those that:

- *promote incentives for biodiversity conservation*, including through price-based instruments (such as user-fees, charges, taxes),[4] market-based instrument (such as tradable permits, offsets and land banks), and other tools such as payments for ecosystem services; and
- *reduce disincentives to biodiversity conservation*, particularly subsidies that create perverse incentives for economic activities that degrade ecosystems and harm species.

The analysis draws on observations and lessons learned from Canadian and international experience that could prove useful for designing future market-based policies concerning natural capital and biodiversity.

The report is organized into six sections:

Section 1, introduces the **concept of EIs** and provides a brief overview of their use to date in Canada, and the challenges and benefits of increasing their application.

Section 2 surveys the **current state of knowledge** and application of EIs to address biodiversity conservation, focusing on four **key ecosystems** in Canada: forests, wetlands, agricultural lands, and waters.

Section 3 discusses the **three main types of EIs** (payments for ecosystem services, taxes or fees to reward ecosystem stewardship, and markets for green goods and services), reviews **lessons learned from their implementation** in Canada and elsewhere, and explores possible areas for the **future use of EIs** as incentives in Canada.

[4] "Tax", "charge", "fee" and "levy" are often used interchangeably in the literature, to refer to imposing an additional fee on environmentally damaging activities.

Section 4 focuses on the need to **reduce disincentives** that can lead to biodiversity loss, including **reforming harmful subsidies**. It examines opportunities for potential reform and 're-focus' in the areas of agriculture, fisheries, transport and water.

Section 5 considers potential **criteria** that policymakers could apply to assess and match the effectiveness of particular EIs for specific biodiversity challenges. It draws on concepts of instrument choice, political economy and institutional demands and governance structures.

Section 6 concludes with a set of **targeted recommendations** to address opportunities to strengthen and expand the application of EIs in Canada in support of biodiversity conservation and ecosystem services.

1. 2 The Concept of Economic Instruments

The term EIs refers to market-based instruments used by policy makers to achieve environmental goals. An EI can stimulate an economic actor to adopt environmentally friendly behaviour or technology, or abandon environmentally harmful behaviour and inefficient, "dirty" technology. Such policy measures seek to leverage the economic interest of individuals, corporations, organizations and communities to protect ecosystems and the services that they provide.

The underlying rationale is that human impacts on ecosystems create real costs (and sometimes benefits), but those costs and benefits are rarely included in market prices; they are an "externality". The aim of EIs is to help correct this market failure: to more fully incorporated the value of nature into prices, so that it can better be taken into account in economic decision-making by consumers and others. For example, if the price of using water included the cost of the resulting damage to the ecosystem and the services it provides, then water would cost more, leading to less waste and more efficient use. Consequently the ecosystem would be less degraded, with more abundant, clean water that is able to provide better quality services. The net effect of the higher price would be positive for society.

EIs can also reward people, corporations or communities for actions that are beneficial to the environment, such as through tax breaks, ecosystem service markets, incentives for the development of new technology, or even direct subsidies and payments.[5] By recognizing the economic value of ecosystem services – such as the role of forests in preventing soil erosion and flooding, the role of insects in pollination for agriculture, the role of wetlands in water purification, or the role of parks for leisure and recreation – we can slow or even prevent their current degradation. If we do not protect these ecosystem services, and avoid irreversible loss, Canadians will have to spend a growing portion of their budget to replace

[5] It should be noted that economic incentives are not necessarily limited to monetary rewards or penalties, but that other incentives, such as time savings, technology transfer or training could also be considered.

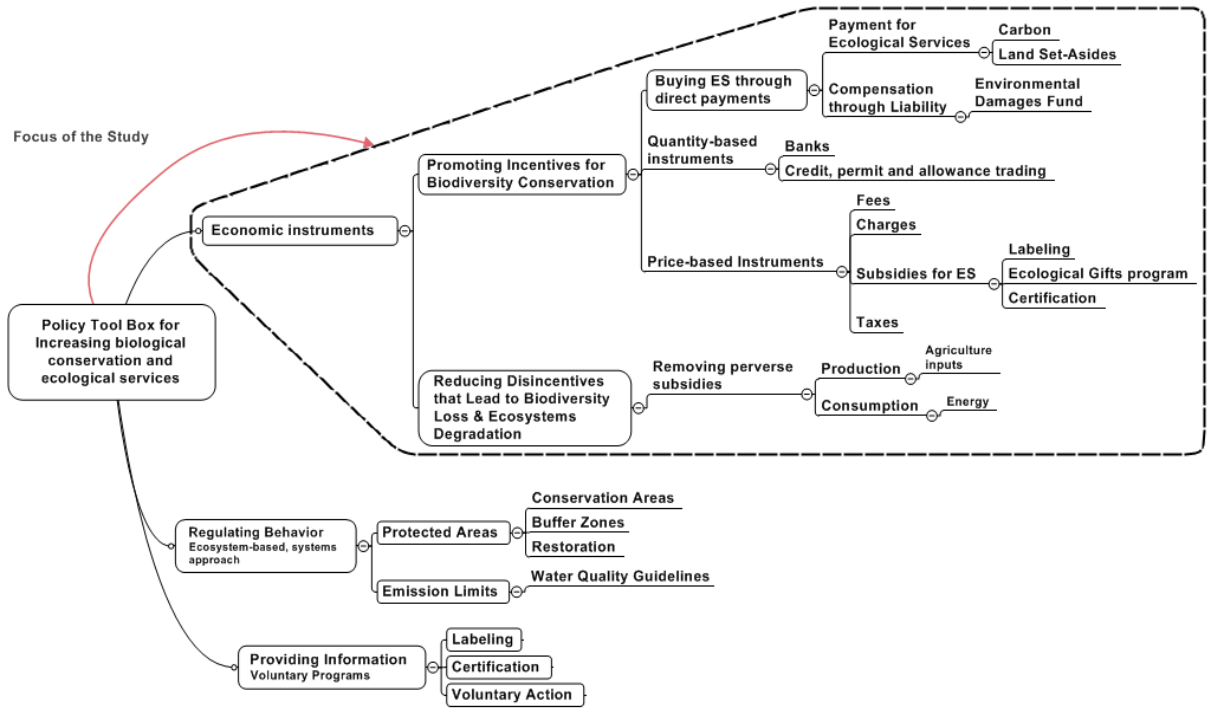
(with technology) the services that nature provided free of charge. In many cases, this may not be feasible.[6]

EIs are not the only type of environmental policy tool available. Policy makers can select or mix several instruments, including: the provision of information (e.g. reports, alerts, labelling, certification, recognition); the creation of voluntary tools (e.g., guidelines or conservation agreements); and so-called "command-and-control" regulations (e.g. emissions limits, habitat protection rules, water permits, pesticide bans). Command-and-control regulations have traditionally been the most heavily used instrument. They can be quite effective, particularly where the goal is an outright ban or strict, site-specific limits on an activity that threatens health or the environment, such as highly toxic pollution.

In many instances, EIs can complement or augment these other policy tools, as part of the overall mix of instruments. For instance, a regulatory limit on carbon dioxide (CO_2) emissions is necessary to support emission trading – which can include forestry and agriculture – thereby allowing an ecological goal to be achieved in a less costly and more flexible manner.

This report focuses on the use of these EIs in Canada to protect biodiversity and ecosystems. Figure 1 highlights this focus within the broader tool kit.

Figure 1: EIs for Biodiversity Conservation and the Provision of Ecosystem Services



[6] Ecologists are generally quite sceptical of technological substitutes for services rendered by nature. However, some of these services can still perhaps be approximated by technology at a cost.

1. 3 Ecosystem Services, Biodiversity Conservation and Economic Instruments

Biodiversity and Ecosystem Services

The increasing adoption of EIs has been closely linked to the recognition that ecosystem services have value, an idea that has been gaining prominence since the 1992 United Nations Conference on Environment and Development. Putting a value on nature is a complicated subject. While, its full value may be unquantifiable, because of its intrinsic and spiritual components, nature's ecosystems also undeniably provide services to society of real and tangible economic value. Wetlands purify water, forests prevent erosion and flooding, marine ecosystems provide food. These services, which nature provides for free, can have significant value (some are priceless). And if they are degraded, it may be very costly – or even impossible – to replace them with technological substitutes. Therefore, in an anthropocentric sense, nature is a form of non-replaceable capital necessary for us to survive and prosper. This "natural capital" needs investment and maintenance, like other forms of capital.

Ecosystem services can be defined as "the benefits people obtain from ecosystems".[7] The Millennium Ecosystem Assessment divides these services into four categories[8]: *provisioning services* such as food, water, timber and fibre; *supporting services* such as soil formation, photosynthesis and nutrient cycling; *regulating services* that affect climate, floods, disease, wastes and water quality; and *cultural services* that provide recreational, aesthetic, and spiritual benefits.[9]

Protecting natural capital and ecosystem services entails protecting biodiversity, and vice versa. For example, the health of a particular species can often be used as an indicator of ecosystem health, or as a motivational symbol for larger environmental goals. Similarly, the health of an ecosystem is dependent on the state of the species within it, and their interrelations. Although the role of individual species in the functioning of these ecosystems is often difficult to ascertain, biodiversity as a whole underpins ecosystem functioning and the provision of ecosystem services. Examples include the positive relationship between biodiversity and biomass, pollination, and resilience to shocks such as severe weather events. Soil biodiversity (including microbes, fungi, earthworms and nematodes) is particularly important in providing a wide array of ecosystem services

[7] Scholarly literature can refer to 'goods and services'. In this report, references to 'ecosystem services' are taken to include goods such as food, genetic resources for research, and timber. This is consistent with current U.N. practice and also avoids unintended trade law connotations of the term "goods".

[8] Millennium Ecosystem Assessment, 2005

[9] There has been criticism of the purported arbitrariness of these categories. Fisher et al., propose that ecosystem services be placed into three categories according to their distance from human benefits: 1.) intermediate services, 2.) final services and 3.) actual benefits. This approach is more consistent with conventional accounting systems, and helps avoid double counting - for example, pollination is an intermediate service, food provision is a final service, and the fruit is the benefit.

crucial to farming, such as nutrient uptake, nutrient cycling, regulation of soil erosion, carbon sequestration, biological control of pests and disease.[10]
Biodiversity supports these ecosystem services, which in turn are inextricably linked to climate change objectives. For example, biodiversity supports healthy soil and forests that can better sequester carbon. Agricultural biodiversity also helps protect crop yields from yearly climate fluctuations, which could increase in severity with climate change. Maintaining healthy levels of biodiversity is the best way to help species and ecosystems cope with the stresses that will come from a changing climate (much like healthy people are better able to cope with additional stress).

Calculating the value of ecosystem services can be difficult, although estimation methodologies are improving. One academic study attempted to quantify the overall value of nature's ecosystem services. It estimated conservatively that their worth is $33 trillion per year – twice the total human GDP of the planet (in 1997).[11] This rough estimate has been widely debated and heavily criticized, both for its methodology and for being either too low or too high.[12] But its order of magnitude at least serves to illustrate the enormous value of the services nature provides to us.

Natural Capital Deterioration, Biodiversity Loss and Market Failure

Canada is blessed with a particularly rich endowment of natural capital. The estimated value of the ecological goods and services in various Canadian eco-regions ranges from $2.6 billion per year from southern Ontario's Greenbelt[13], to $5.4 billion from B.C.'s lower mainland[14], to $703 billion per year from Canada's boreal forests.[15] Globally, a major study commissioned by the United Nations Environment Program and others recently estimated that loss of ecosystem services will cost $2-4.5 trillion annually by 2050 – or 7% of global GDP – if current rates of ecosystem degradation continue.[16] (These figures should be seen as rough estimates; the information base and methodologies for such ecosystem-wide valuations are still evolving.)

At present, however, markets fail to incorporate the value of most natural capital, particularly ecosystem services, into economic decision-making. As a result, many of these services are decreasing in quantity and quality, and some are imperilled. Markets, as they are currently organised, are also failing to adequately protect biodiversity. One reason is that society is often simply not fully aware of the value of biodiversity, or ecosystem services. However, the predominant reason is that the actual costs of environmental

[10] Wonneck, 2010
[11] Costanza et al, 1997
[12] (1998) 25 Ecological Economics 1, 1-72 (special issue responding to Coztanza *et al* article)
[13] David Suzuki Foundation, 2008
[14] David Suzuki Foundation,2010
[15] Canadian Boreal Initiative and the Pembina Institute, 2009. The original 2005 Report estimated the value at $93.2 billion. The increase to $703 billion, in the 2009 report, is primarily due to the revaluation of stored carbon in forests and wetlands, which is now $582 billion (based on an amortized annuity calculation of stored carbon) versus its original valuation of $1.85 billion.
[16] TEEB, 2008

degradation are generally "externalized": those who consume or pollute typically receive most of the economic "benefits", but only pay a small portion of the total "costs" of the damage that they cause. [17] The remaining costs – or "externalities" - of degraded ecosystem services are imposed on society, future generations, and the broader environment.

In other words, failing to put a value on ecosystem services can be seen as, in effect, a large, unintended subsidy – one that is paid by society (present and future) to enterprises involved in resource extraction and polluting activities. This subsidy constitutes a large-scale market failure. In short, our economic and ecological signals are misaligned; a major part of our 'balance sheet' (representing nature's value) is missing, leading us to use nature's resources wastefully and unsustainable – much as a tenant who does not pay for electricity tends to leave the lights on.

This market failure needs to be addressed. Natural capital needs to be valued and invested in, just like other inputs into production, otherwise it will deteriorate and society's aggregate production (and wellbeing) will begin to fall.[18] Uncertainty over the exact value of this natural capital, and the ecosystem services that it provides, should not prevent policymakers from creating incentives based on prices for ecosystem services. Some incentive – even based on 'best estimate' numbers – is better than none at all. Failing to price ecosystem services means their price is zero, which leads to waste and ecosystem degradation. The services produced by ecosystems are essential for human survival, and in many cases they cannot be replaced by man-made technology (e,g. ozone layer, stable climate, clean air, pollination), or it is very expensive to do so (e.g. depleted soil, polluted water).

The overuse of natural capital and resulting degradation of ecosystems has had devastating impacts on biodiversity. Globally, it is estimated that humans are consuming Earth's natural resources 30% faster than the planet can replenish them.[19] Similarly, more than 60% of the Earth's ecosystem services are being degraded or used unsustainably, according to the Millennium Ecosystem Assessment.[20] This unsustainable ecosystem use places severe stress on species. Consequently, we are in an age of extreme biodiversity loss. Our current era has been termed the Holocene Extinction, because rates of extinction are 1,000-10,000 times the background rate,[21] overwhelmingly due to anthropogenic activities. The United Nations estimates that between 10 and 50 times the current spending is necessary, simply to significantly decrease the global rate of biodiversity loss, let alone halt it.

Biodiversity loss rates in Canada are not yet as severe as in many other developed countries, largely because we have a relatively small population in a very large land area. Overall Canada ranks eighth best of 25 OECD countries in terms of the percentage of its species that are endangered or 'at risk' (a surprisingly poor ranking, given our small

[17] The inverse is also true – some of the benefits of environmentally *positive* actions are also externalized.
[18] UNEP 2009
[19] Living Planet Report, 2008 (Canada has one of the world's heaviest "ecological footprints.")
[20] Millennium Ecosystem Assessment, 2005
[21] C. Michael Hogan, 2010

population and vast land mass).[22] However, Canada has witnessed significant biodiversity declines in certain eco-regions and habitats, particularly in the southern, more densely inhabited regions of the country.[23] For example, 99% of the original tall grass prairie, and over 90% of southern Ontario's Carolinian forests, have been lost – making these two of Canada's main endangered species 'hot spots'.[24] Habitat loss is the main reason why more than 600 species across Canada have been formally classified as "at risk" (plus many more that have not yet been assessed).[25] If we are to stem, and eventually reverse, the escalating rate of species loss, many actions will be needed; but perhaps the most important is to put a value on biodiversity, and the habitat that supports it, and create economic incentives to better conserve that habitat.

Economic Instruments and the Polluter/User Pays Principles

Economic tools and instruments can address two of the main causes of environmentally unsustainable behaviour – a lack of awareness of the economic value of nature, and failure to reflect that value in market prices (i.e. "externalities"). In terms of the former, economists can help determine and then communicate the value of ecosystem services (drawing on scientific research). In some cases, this increased awareness alone can improve environmental outcomes, as it becomes apparent that it is in our own economic self-interest to improve our environmental behaviour. One example of increased *government* awareness of the value of ecosystem services occurred in New York State in 1996, where valuation of the water filtration services provided by the Catskills/Delaware watershed (which provides 90% of the drinking water for New York City) led the government to invest over one billion dollars in watershed restoration and reforestation. Construction of a new filtration system to achieve the same water quality improvements, by contrast, would have cost an estimated $6 billion. [26]

In some cases, making individuals aware of how they can benefit directly from ecosystem services can lead them to switch to less environmentally harmful practices. For instance, studies have shown that greater biodiversity can often increase crop yields for farmers. Other management practices (for example, those that reduce erosion) can be beneficial to both biodiversity and farmers. While self-interest alone could motivate change in these cases, the perceived risk involved in adopting new practices could dissuade such positive action. One recent program (the Ecological Goods and Services Pilot Project) in PEI addressed this risk by providing insurance against decreased crop yields to farmers who reduced their fertilizer use. Because levels of fertilizer use were often already very high (and no longer marginally productive), participants experienced no significant change in yield despite the reduced use of fertilizer over the two year period that the pilot was in place.[27]

[22] OECD 2001
[23] Environment Canada, June 2004
[24] Elgie, S., 2003
[25] See, the Committee on the Status of Endangered Wildlife in Canada, online: www.cosewic.gc.ca
[26] NRTEE, 2010; Chichilnisky, G. and G. Heal. 1998
[27] Cheverie, F. 2009

However, because of negative *externalities*, a mere understanding of the economic benefits provided by ecosystem services often is not sufficient to generate environmentally sustainable behaviour. In these cases, even if an activity would make society as a whole worse off, it still might not be undertaken because the individual economic actor (be it a company, a farmer, or an urban consumer) can capture most of the benefits and avoid most of the costs.[28] Because of these hidden ecological costs, the market is failing to do its job of providing accurate price signals – and thus its "invisible hand" is failing to align individual's self-interest with society's collective interest.

This problem can be corrected when either external *costs* are "internalized" through taxes or charges, or when external *benefits* are internalized, (for example, by payments for agricultural practices that improve downstream water quality). Internalizing external costs forms the basis of two closely related principles at the heart of many EIs: the polluter-pays principle and the user-pays principle.

The polluter-pays principle requires that those who cause damage to ecosystems must pay the cost, through taxes, fines, offsets, payment of full clean-up costs, or other measures. It is not only applicable when laws are broken or in the case of the accidental large-scale damage (such as the 2010 Gulf of Mexico oil spill), but also can be applied to routine "operational" pollution. For example, many of the existing regulations in Canada and other countries set a maximum emission limit for specific pollutants. Companies have no incentive to reduce emissions below this point. However, if "legal" emissions were also taxed or otherwise 'priced', further reductions below the maximum permissible limit could be expected in many cases – because there would be an economic incentive to do so. For example, if a water discharge permit or approval (e.g. under the *Fisheries Act*) included a fee linked to the amount and impact of the discharge, it would be a strong incentive to adopt cleaner technologies and practices. When the marginal cost of reducing pollution is not great, even a modest tax or charge could produce significant ecosystem improvements.

The user-pays principle is similar to polluter-pays, but focuses on paying for the *use* or *depletion* of natural resources and ecosystem services, as opposed to the degradation of their quality. (Ideally, the costs of both depletion and degradation are integrated into the price).[29] For the general public, this principle can apply with regard to utilities such as water and electricity; paying the full environmental cost of using these resources encourages conservation (however, equity issues may need to be addressed, as discussed below). For industry, the principle can be applied to the use or extraction of natural resources such as water or timber. For example, industry and agriculture together account for most water use; if the price that they paid reflected the true environmental cost of this use it would be a strong incentive to invest in more efficient technologies and practices. Similarly, if forestry companies paid a fee linked to the ecological impacts of logging, there would be an incentive to avoid important habitat areas and use lower-impact practices.

[28] The opposite situation can also occur: an economic actor will refrain from undertaking an activity that is of overall benefit to society because it bears the cost, but not the benefit. In this case, payments can be used to incentivize the socially optimal behaviour.

[29] The distinction between degrading or depleting a resource is somewhat arbitrary; many activities do both.

(This could be done, for example, by varying stumpage fees based on the ecological sensitivity of the site.)

In other words, charging the true environmental cost will encourage companies and consumers to use natural capital more efficiently and productively; it will maximize the return to society from the use of scarce natural resources and encourage their conservation.

Valuing Ecosystem Services: Its Uses and Limits

Economic valuation, whereby monetary values are assigned to ecosystem services and biodiversity, is an important tool in the design of EIs; it can be used to determine the proper price for a tax, charge or payment – which in turn determines how big an incentive the EI provides. Theoretically, the price should reflect the marginal change in value of the affected ecosystem service due to its use. (An EI price can also be set *without* doing valuation, for instance by looking at what price is needed to incent a change in behaviour or technology.)

Valuation also has many other practical uses. For instance, compensation schemes need valuations of ecosystem services in order to provide adequate levels of redress. In the case of accidents such as oil spills, economic valuation of the lost ecosystem services can help calculate liability for environmental damage. Such liability schemes function as an indirect EI in the sense that the threat of having to pay compensation for damages creates an incentive for potentially responsible parties to reduce the probability of environmental damage.

Valuation is also essential for cost-benefit analysis, a critical tool in policy evaluation or in setting environmental targets. Without a monetary value for environmental costs and benefits, it is difficult to weigh the merits of different policy options or targets. Finally, as noted above, information that communicates the benefits of biodiversity conservation, or the replacement costs of degraded ecosystem services, can sometimes motivate positive action on its own.

On the other hand, valuating ecosystem services can be costly, and presents conceptual, technical and scientific challenges. Scientific understanding of ecosystems remains incomplete, and mathematical models of ecosystems quickly become complex. It is often difficult to ascertain the degree to which the quantity and quality of a service is affected by anthropogenic activity. There are ecological irreversibilities, threshold levels and feedback loops that are often not fully understood. Not to mention the challenges of valuing intrinsic and spiritual values.

And even if the impacts on a service could be fully and accurately predicted, valuation techniques, while improving, are not always robust. Different techniques can arrive at different values. Some techniques rely on indirect proxies for the species or service being valued. Limited public knowledge of a service or species can also affect results. For

individual species, economic valuations can be notoriously disparate and fickle, and are often dependent on aesthetic criteria which lead to higher values for "charismatic" species. Moreover, techniques that rely on the cost of substituting technology for an ecosystem services are often speculative and controversial.

Two Canadian experts, Vic Adamowicz and Peter Boxall, while noting that ecosystem service valuation has significantly improved, identify a number of key outstanding challenges, including:

- recognising and measuring passive use values and existence values;
- ecological–economic complexities;
- irreversibilities;
- a continuing lack of consistent or accurate data;
- the need for a value of wildlife survey; and
- scaling-up from experiments and pilot projects.[30]

Despite these challenges, in practice ecosystems are implicitly valued all the time in the absence of formal valuation. For example, there are fines for contraventions of emission standards or other environmental infractions, stumpage fees for forestry, and charges for (some) water permits. It can be argued that careful valuation-based pricing would be a considerable improvement over current *ad hoc* valuations. Valuation techniques are improving and becoming more robust, and work is being pioneered to integrate economic valuation with approaches from other disciplines. As noted by one recent article, *ecosystem services valuation* is starting to "transcend disciplinary boundaries and synthesize tools, skills, and methodologies from various disciplines."[31] In the end, it is likely to prove both useful and necessary to invest in the proper valuation of ecosystem services in Canada.

1. 4 Economic Instruments Applied in Canada

When it comes to the use of EIs, Canada lags behind most other developed countries. The most recent Environmental Performance Review for Canada by the Organization for Economic Co-operation and Development (OECD) concluded that:

> "Fiscal instruments are generally used as fiscal deductions rather than to internalise externalities, thereby impeding economic efficiency. Market based instruments are insufficiently used to foster integration of environmental concerns into sectoral policies."[32]

The report recommended that Canada "consider ways to improve the cost-effectiveness of environmental policies by extending the use of *economic instruments* such as charges for water supply and air and water pollution, [and] further implement *emissions trading*

[30] V. Adamowicz and P. Boxall, forthcoming
[31] Liu S, Costanza R, Farber S, Troy A, 2010
[32] OECD, 2004a

schemes (e.g., for greenhouse gases, SOx and NOx)." It also recommended further use of EIs to address *biodiversity* as well as other issues.[33]

Although the use of EIs in Canada is still fairly limited, they are now being *considered* regularly in government instrument choice and design. Federal legislation such as the *Canadian Environmental Protection Act* (CEPA, 99),[34] Treasury Board guidelines for the development of regulations by federal departments,[35] and departmental tools for regulatory impact analysis (such as Environment Canada's Quality Screening of Management Tools), require assessment of the feasibility of EIs. As noted by the Treasury Board in 2005, governments are considering a broader suite of policies to deliver on public policy priorities:

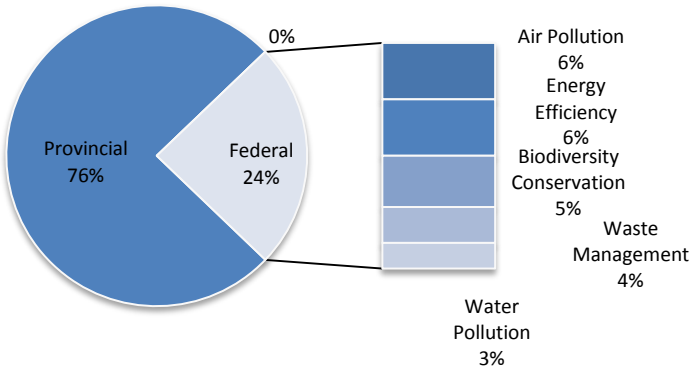
> "Many governments are now considering instruments other than regulation to achieve public policy outcomes. Prompted by factors such as globalization, international competitiveness, increased emphasis on market solutions, and new philosophies of governance, they are seeking new or modified instruments that provide effective approaches to policy making ... concerns about the negative effects of conventional laws on industry innovation and competitiveness have made governments look to other forms of laws."

In addition, there are a growing number of examples of EIs being used across Canada. A 2008 Environment Canada survey of Canadian programs identified more than 150 discrete environmental measures that could be characterized as EIs.[36] Roughly one-quarter of these measures are being implemented by the federal government. The remainder are implemented by provinces.

These programs are being applied across a range of environmental issues (Figure 2). Examples of EIs at the federal level include:

- subsidies such as the Ecological Gifts Program, Invasive Alien Species Program, and the Habitat Conservation[37] and Habitat Stewardship

Figure 2: Canadian EIs Programs



[33] OECD, 2004a
[34] *CEPA, 99* enable deposit-refund systems (DRS) and trading programs (or units)
[35] Treasury Board of Canada Secretariat, 2005. ("Some well-known instruments that can be used singly or in combination are ... economic instruments, including market-based instruments, taxes, fees, user charges, loans and loan guarantees, and public expenditure".)
[36] Parts of this synthesis are drawn from OECD, 2008 b, from information assembled by Environment Canada for the OECD and from further assessments by economists at Sustainable Prosperity (www.sustainableprosperity.ca)
[37] See Environment Canada, http://www.ec.gc.ca/habitat/default.asp?lang=En&n=2C1B0D7E-1

Programs[38] (which provide funding to support habitat conservation and restoration for species at risk and migratory birds);

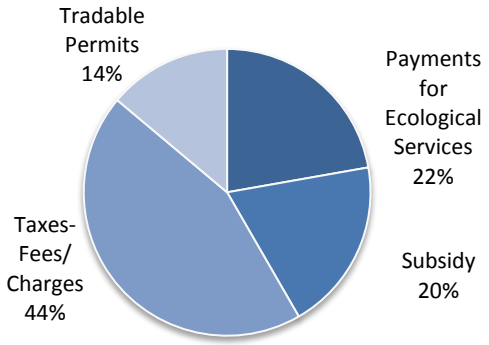
- offset instruments under the *Fisheries Act* (in order to achieve "no net loss")[39] and trading of individual transferable fishing quotas.

Including provincial programs, nearly 40 EIs surveyed in Canada are primarily aimed at biodiversity conservation. These target forest biodiversity, inland and wetland ecosystems, marine and coastal areas, agricultural lands, species at risk and ecosystem services. (These programs are discussed in more detail in parts 2 and 3 of this report, and are summarized in the Appendix.)

While the application of EIs is becoming more common, their design could be improved by linkingthe EIs more directly to environmental outcomes. Larger negative effects on biodiversity and ecosystem services, for example, should incur larger fees, charges, tariffs or penalties. The converse is also true: greater benefits to biodiversity and ecosystem services could be rewarded with greater payments or other incentives.

Among the Canadian programs reviewed, nearly half use taxes and charges, others use payments for ecosystem services, subsidies, or tradable permits (Figure 3). Of the tax and charge policies surveyed, most were simple user fees that only minimally affect behaviour – in only a few examples are fees tied to activity levels such as water withdrawals.[40] The Canadian payment for ecosystem services (PES) programs mostly consisted of direct subsidies or grants. Furthermore, there are very few studies which assess the effectiveness of the current examples (particularly rigorous studies).

Figure 3: Biodiversity EIs



1.5 The Benefits of Enhancing the Use of Economic Instruments in Canada

EIs can complement or substitute for traditional regulations, when there is a need for more flexibility, greater cost effectiveness, creative entrepreneurial solutions, and the development of innovative technology. Of course traditional "command-and-control" regulations, such as uniform emission limits or technology standards, can also be effective

[38] See Environment Canada, http://www.ec.gc.ca/hsp-pih/default.asp?lang=En&n=59BF488F-1
[39] Fisheries and Oceans Canada, 2007. The Fisheries Department policy allows offsets or banking only by the actual proponent, not with third parties.
[40] Water use from municipal water supply is not included in the data set

if enforcement threats are credible. However, better environmental outcomes can often be reached for the same cost when these regulations are combined with EIs. For example, the emission trading program for Acid Rain in the U.S. achieved 25% greater emission reductions at about 50% lower cost than traditional command and control regulations.[41]

There are some well-established cases of successful EIs internationally and in Canada concerning biodiversity. For example, U.S. wetland conservation laws allow the use of offsets, which have significantly reduced mitigation costs, though they have not always achieved their conservation goals due to poor implementation and follow-up.[42] Similar lessons have been learned under Fisheries and Oceans Canada's Fish Habitat Compensation program, which has provided greater flexibility in conserving habitat, but in many cases "no net loss" of fish habitat has not been achieved.[43] These examples highlight the importance of rigorous assessments to identify whether EIs have achieved their stated goals, and which adjustments could be made to improve outcomes. Such studies have not been done, or done rigorously, in many cases.

Ideally, such assessments would not only specifically attempt to measure biodiversity and ecosystem service improvements, but also explore the economic, social and political impacts of the program. Designing effective methodologies for such assessments can be a challenge. For example, it is often wise to include both a quantitative and a qualitative component, as some criteria may not be comparable or quantifiable, and a single figure may not provide sufficient information for policymakers to base decisions on. Moreover, policy assessment criteria could include the potential for continuous improvement or innovation, flexibility in compliance methods, distributional impacts, potential for rebound or leakage to other areas, and effects on productivity and competitiveness.

With a need to design policy to deliver multiple expected outcomes, a mix of instruments is often selected by policy-makers, both in Canada and abroad, so the strength of one instrument can balance the weakness of another.[44] Instrument choice has evolved in many cases from an either-or proposition between one instrument or approach and another, to a search for complementarity between instruments and approaches. Common combinations include:

- information, transparency and education with other instruments;
- voluntarism with command-and-control;
- self-regulation with command-and-control;
- command-and-control with subsidies; and
- command-and-control with broad-based EIs.[45]

[41] Elgie, 2007. Ontario has a similar program, but it has generated little activity, due to the limited number of potential traders
[42] Biodiversity Neutral Initiative 2005
[43] Quigley J.T, Harper D.J. 2006b. (DFO's policy does not allow "trading" with third parties for habitat offsets)
[44] Treasury Board of Canada Secretariat, 2005
[45] Gunningham, Grabosky and Sinclair, 1998

Sequencing EIs and regulations can ease the transition to new policies. One successful example in Canada was the phasing out of leaded gasoline, which is harmful to human health and ecological systems. In advance of a ban implemented in 1989, an additional tax was placed on leaded gasoline at federal and provincial levels. With differential prices averaging about 5 to 10% of the pump price (about two cents per litre), lead was virtually removed from the gasoline supply in advance of the ban. The regulation combined with the consumption disincentive worked together to deliver both health and biodiversity benefits to Canadians, and allowed for a cost-effective phase-out.

Another example of a complementary policy mix involves adding risk management tools to cap-and-trade schemes. In cap-and-trade, a quantity target is set based on the maximum allowable total level of an environmentally harmful activity, such as water use or phosphorus loading in a watershed. For the regulator, the cap creates certainty regarding the quantity of water that will be used, but for the buyer there is uncertainty regarding the price of the permits/allowances in advance of trading. To address this uncertainty, the regulator can place an upper value on the price of the tradable allowances. The price ceiling acts like a tax, where payments to the regulator can be made if allowance prices (in trading markets) reach the price ceiling. This combination of the desirable traits of two alternative EIs - relative cost certainty due to the price ceiling, and total consumption certainty due to the cap - can create a more effective policy package. Alberta's greenhouse gas regulatory system, for example, uses this price ceiling approach.[46]

Challenges to the Appropriate and Effective Use of EIs

While EIs offer a number of advantages, they are not a panacea. Firstly, the use of an EI implies that a trade-off can be made between a monetary payment and a negative environmental consequence. For example, a carbon tax would certainly discourage carbon emissions, but emissions still would be permissible if the tax is paid (though if combined with a cap, there could be an absolute limit). Such a trade-off occurs in almost all environmental regulations, since cost-benefit analysis informs the standard chosen, but with EIs it is more transparent.

While such trade-offs may be acceptable in some contexts, they may be less realistic or appropriate in other settings. The potential for trade-offs depends on the particular problem, especially whether there is either strong or weak potential for substitution. For instance, where the goal is to virtually eliminate a pollutant (e.g., lead or DDT), or to prohibit certain activities (e.g. mining in a park) then EIs are not appropriate.

The IUCN and others have argued that there are cases when it is inappropriate to consider exchanges or monetary trade-offs[47], such as when an ecosystem or species is particularly threatened and any additional harm is unacceptable. For example, where a species is highly endangered, and *increases* in population and habitat are needed, the use of habitat offsets –

[46] See Government of Alberta, http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/cl13212 (Alberta's cap is intensity based, not absolute)
[47] ten Kate, K. *et a*l. 2004

which allow destruction of current habitat – may be problematic (although EIs have been used successfully for species at risk in some instances, where there *is* still room for trade-offs). Furthermore, for individual species, economic valuations are notoriously disparate and fickle, and are often dependent on aesthetic criteria which lead to higher values for "charismatic" species. In the above-noted situations, or when risks are unknown but potentially very large, specific regulatory limits, or even outright bans, may be simpler, easier to administer, more appropriate and more effective. However, other EIs which reward conservation measures and habitat restoration, such as PES, can still play an important role.

If not applied with caution, the use of EIs (like other instruments) can raise political, social, cultural and equity issues. In reverse auctions, for example, instead of offering a high price to buy a good or service, a low price is offered to sell a good or service – for example, wetland restoration. However, anecdotal evidence suggests that reverse-auctions can sometimes exacerbate tensions within a community when neighbours compete with each other regarding the environmental value of their land and the low cost at which they claim that they can protect ecosystem services by means of alternative management practices.[48] This competition can cause resentment if there is distrust over the valuation of the land, the efficacy of the proposed management improvements, or if low offers are perceived to reduce the value of labour generally. As with regular auctions, there can also be collusion among sellers.

These problems generally can be addressed through design specifications, such as whether the bidding process is transparent, whether it is repeated, or whether upper and lower limits are placed on bids. Despite these challenges, reverse-auctions hold promise and can be a very cost-effective manner of achieving environmental goals.

There is also debate regarding whether PES programs, which provide incentives to those with poor environmental records to improve their practices, are unfair to others with superior environmental practices who receive no such reward (because they have already improved their practices). Such PES programs can be seen as rewarding previously unsound environmental practices. It also can be difficult to determine the additional benefits that a PES provides ("additionality"), as this requires not only measuring the environmental impact after the PES, but also the estimated environmental impact in the absence of the payment, which is often hypothetical. The payment program also can create an incentive to potential beneficiaries to overstate both the damage that would likely occur without the payment (often based on past practice), as well as the beneficial effect of the payment, in order to inflate the amount they are paid. Careful monitoring and measurement, and rigorous estimation protocols, can reduce this problem. Alternatively, an auction approach (or other competitive process) can be an effective means of discovering the true price needed to incent behavioural change.

[48] Campbell, I., 2010

The sustainability of PES funding can also be a concern, where funds are committed only on an annual or short-term basis. Another issue for PES programs is the risk of crowding out voluntary environmental performance, and having to pay for actions that once were done voluntarily.

Among EIs, the growing acceptance of trading schemes for carbon means that their applicability to other environmental "goods" is increasingly being considered. Yet there can still be some opposition to trading, particularly when it involves elements of ecosystems, such as water[49] or biodiversity. Such opposition can stem from ethical concerns ("commodifying" nature) or equity ones (privatizing water). Part of the issue is addressing concepts of ownership and public access. Difficult questions that need to be resolved include: What are the nature and extent of rights over the resource/service being traded? How does this affect others' access to or use of it (especially if they are not participating in the market)? Are there upper limits in place for individual users or emitters (in addition to the overall cap)? What is the basis for the allocation of permits (historical or other)?

A separate technical issue is whether the form of the market is appropriate to what is being traded. With carbon emissions, for example, the effect on climate is considered to be global, not local, and therefore equivalent regardless of the geographic source of emission, be it Alberta, Quebec or China. Carbon, therefore, may be traded globally with no price adjustment. However, other resources or emissions have a different environmental impact depending on their location and on other factors. For example, it may be problematic to trade water emission rights among different basins, or to allow endangered species habitat impacts to be offset in another part of the country. The manner in which a particular pollutant or resource is traded, and whether it can be traded at all, must reflect this differential impact.

By successfully addressing these potential challenges, policy-makers can significantly improve the efficacy and public acceptance of EIs. If, on the other hand, EIs are designed without considering the potential for differential ecological impacts, or disruptive effects on communities, or without adequate stakeholder consultation, then their effectiveness could be seriously jeopardized and public opinion could turn against their use. Considering the promise of EIs, this would be both unfortunate and unnecessary.

International and domestic experience suggests that EIs should be considered as an important policy tool to address environmental damage and biodiversity loss. Their main assets are that they (a) are cost-effective, and (b) create incentives for innovative practices and cleaner, more efficient technologies. They may be particularly effective when sequenced appropriately and complemented by a mix of regulatory and other measures. Future work could focus on reinforcing EIs and addressing challenges, while monitoring, documenting and communicating successes. The flexibility and great potential of EIs, as well as the importance and urgency of conserving biodiversity, should motivate the public and policymakers alike to consider their potential for more widespread adoption in Canada.

[49] The Council of Canadians is very concerned about the relationship between water markets and privatization, for example. See http://www.canadians.org/water/index.html

2. Economic Instruments for Biodiversity Conservation: Survey of Knowledge and Practical Experience

This section presents a brief survey of the research and experience in applying EIs for biodiversity conservation in four types of ecosystems. The main focus is on Canadian experience, although international are also highlighted where they offer valuable lessons.

Internationally, there has been considerable progress in the development, testing and study of the use of EIs for biodiversity conservation, though more remains to be done.[50] Canada's use of EIs, though lagging behind most developed countries, appears to be growing. In 2008, the OECD identified at least 73 initiatives that use EIs for biodiversity conservation in a variety of different Canadian ecosystems and in different regulated sectors, such as agriculture, forestry and fisheries. Of the 73 initiatives identified, however, some are no longer in use, and in fact not all could be characterized as actual EIs. Further, according to this study, though the most commonly used EIs for biodiversity conservation could be described as positive subsidies; few attempts have been made to actually reform the subsidies that provide perverse incentives, degrading ecosystems and biodiversity.[51]

The list of illustrative examples compiled for this report, while not an exhaustive survey of all EI initiatives in Canada, does identify nearly 40 existing programs and initiatives that use EIs for biodiversity conservation at different levels of government. Some of these initiatives target one specific ecosystem type, while others have been designed to be applicable across different ecosystem types) either simultaneously or separately.[52]

[50] Hanley, N. and Barbier, E.B. 2009; TEEB 2009
[51] OECD, 2008b
[52] To see a list of public programs and private initiatives using MBI approaches for biodiversity conservation and management in Canada see Appendix. For more information about each of the programs or initiatives cited by this paper see Annex.

2.1 Economic Instruments for Forest Biodiversity

A variety of programs has been implemented to address biodiversity loss in Canadian forests at federal, provincial, municipal and private levels. While some of these programs reward the provision of benefits through payments to landowners through tax breaks and/or other payment mechanisms, others use either price-based or quantity-based approaches. Although far less frequent, certain federal initiatives also have attempted to remove perverse incentives.[53]

Relevant examples of PES programs include the federal ***Ecological Gifts Program***[54] (see box), and Ontario's ***Managed Forest Tax Incentive Program***.[55] The ***Tax-free Intergenerational Transfers of Commercial Farm Woodlots Program***[56] is an example of a federal initiative to remove perverse incentives. In terms of private initiatives, the voluntary offset project of the ***Albian Sands Energy's Muskeg River Oil Sands Mine***[57] also provides a useful example of a voluntary, initiative to combat biodiversity loss.

Internationally, Costa Rica and the United States provide extensive experience with the design and use of PES for the conservation of forest ecosystem services and biodiversity. The ***Costa Rican PES Program***[58] protects watersheds upstream from major urban centres by compensating landowners for hydrological services; it has become a model for others of its type on a global level, due to its sustainability and excellent forest conservation outcomes. This program has been in place since 1997, with funding of more than US$110 million derived from a fuel tax and

Canada's Ecological Gifts Program

Goal: "The creation of a network of protected areas that reaches across virtually every habitat and region in Canada"

This program encourages landowners to protect valuable pieces of nature in perpetuity by donating) ecologically sensitive lands or a partial interest in their lands (conservation easements, covenants or servitudes), either to environmental charities or government bodies. Donors are eligible to receive income tax benefits in return.

Actors: Individual and corporate landowners (ecosystem service providers), government and charities (beneficiary)

Ecosystem Service: A broad range.

Financing mechanism and method of payment: "tax credit or deduction to donors and a reduction in the taxable capital gain realized on the disposition of the property. Corporate donors may deduct the amount of their gift directly from their taxable income, while the value of an individual's gift is converted to a non-refundable tax credit. Any unused portion of the credit or deduction may be carried forward for up to five years, and [none] of the capital gain is taxed."

[53] For more information about the programs using Economic Instruments for forests biodiversity in Canada and abroad, see Annex.
[54] Environment Canada, Not dated. Ecological Gifts Program. Online: http://www.ec.gc.ca/pde-egp/default.asp?lang=En&n=FCD2A728-1
[55] Ministry of Natural Resources Ontario, Land Stewardship Programs
[56] Woodlot Info Shop . Not dated. Intergenerational Transfer. Online: http://www.woodlotinfoshop.ca/currentissues.asp?cmPageID=178
[57] Pembina Institute, 2008
[58] Department of Sustainable Development (DSD). Not dated. Payments for Environmental Services Programs. Online: http://www.oas.org/dsd/PES/Programs.htm#_edn1

private contributions. By 2006 this program protected over 500,000ha of forest through over 6,000 contracts with landowners[59]. Similarly, the ***Healthy Forest Reserve Program***[60] in the United States is a PES that provides flexibility for owners of either forestlands or historical forestland converted to cropland to restore and enhance their forests through different types of agreements while receiving both economic and technical incentives.[61]

Interest in market-based approaches for forest biodiversity conservation and their effectiveness has increased in recent years. A number of studies evaluating the current or potential use of such approaches have been undertaken by Canadian researchers. Four studies highlighting the potential of using EIs in Canada's forest ecosystems are discussed briefly here.

Nathalie Chalifour has argued, in Advancing Biodiversity Conservation in Canada through Ecological Fiscal Reform - The Current Situation and Future Potential, that "while Canadian governments have instituted a number of incentive measures to promote conservation on privately owned lands, they have not capitalized on environmental fiscal reform as a means to facilitate conservation on publicly owned lands licensed for industrial use." She notes that fiscal policy reform is an important, emerging tool that "could be very effective and efficient in advancing nature conservation in Canada, in a way that simultaneously supports the country's economic objectives."[62]

The need to look at the critical role of fiscal reform has been reinforced by leading Canadian economists. As noted by Dr. Nancy Olewiler in Natural Capital: Securing Natural Capital and Ecological Goods and Services for Canada, written for the Canadian Priorities Agenda, both regulatory and incentive-based policies can promote the conservation of natural capital (in *all* ecosystem types – not just forests). The article proposes several new policies that could help to achieve these goals in Canada, namely: i) Canada's Conservation Plan, ii) Canada's Conservation Fund, and iii) provincial incentive-based policies to secure natural capital. While the proposed Canada's Conservation Plan is more related to the gathering of information regarding Canada's natural capital, Canada's Conservation Fund would focus on the creation or increase of taxes on activities that degrade natural capital. As Dr. Olewiler recommends, one possible way forward involves the adoption of a new carbon and air pollutants tax or "conservation tax." Despite potential political resistance to such a tax, she notes that Canadians may come to support these types of environmental policies with careful communication and outreach.[63]

The report entitled Natural Capital: Using Ecosystem Service Valuation and Market-Based Instruments as Tools for Sustainable Forest Management is a state of knowledge report done for the Sustainable Forest Management Network in 2009 by a team of economics, law

[59] DSD, not dated
[60] Environmental Defense Fund (EDF). Not dated. Healthy Forests Reserve Program. Online: http://www.edf.org/page.cfm?tagID=21
[61] *Ibid*
[62] Chalifour, 2004
[63] Olewiler, 2008:4

and policy scholars. It compares a variety of market-based instruments based on variables such as cost (flexibility) and environmental effectiveness (fixed versus flexible target). This study finds that in many circumstances command-and-control instruments are not as cost-effective as taxes, conservation auctions, or tradable permits. It concludes that: i) the value of ecosystem goods and services is increasingly being recognized; ii) public policy is required to address market failures that result in economic decisions that do not take these values into account; iii) market based instruments are often the lowest cost means of achieving environmental performance standards; and iv) the challenge lies in matching market-based instruments to specific problems. In addition, as this study notes, "although barriers exist, market-based instruments show promise in achieving sustainable forest management." [64]

More recently, an in-depth paper by Professor Stewart Elgie explores the link between forest carbon markets and biodiversity. Based on a thorough review of existing economic studies, plus original economic modeling, the study concludes that CO2 markets will not only provide a strong incentive to store more carbon in forests, the resulting management changes will be ones that generally will also benefit biodiversity - such as reduced logging, longer rotation ages, and more selective harvesting. The study also points out the shortcomings of an offsets approach (mainly high costs and unreliable carbon gains) and recommends that Canada transition to including forests in a *cap-and-trade* system as soon as possible – not as offsets, but among the 'capped' sectors.[65]

2.2 Economic Instruments for Wetlands Biodiversity

PES programs (including the use of reverse auctions to determine the level of the payment) have been designed and piloted for wetland conservation in Canada.[66] Ducks Unlimited, an organization working on wetland conservation across North America, has been involved in the development of these instruments through the *Habitat Conservation Program,*[67] being implemented in several provinces. In Saskatchewan, a reverse auction program was undertaken as part of the *Wetland Restoration Pilot Project.*[68]

Internationally, EIs have become integrated in wetland protection policies in several countries.[69] In India, for example, the *Madhya Pradesh Lake Conservation Authority* and *Winrock International India* designed an incentive-based scheme to balance conflicting interests of farmers and downstream lake users, while supporting organic agriculture in the Bhoj wetlands.[70]

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[64] Anderson *et al.*, 2010
[65] Elgie, 2011
[66] To see a list of public programs and private initiatives using MBI approaches for biodiversity conservation and management in Canada see Appendix. For more information about the programs using Economic Instruments for Wetlands Biodiversity in Canada and abroad, see Annex.
[67] DUC. Not dated (a). Habitat Conservation. Online: http://www.ducks.ca/aboutduc/how/conserve.html
[68] DUC. Not dated (b). Wetland Restoration program. Online: http://www.ducks.ca/aboutduc/news/archives/prov2008/081112.html
[69] W. Van Vuuren and P Roy, 1993
[70] Agarwal *et al.*, 2007

Perhaps the best known wetland EI program is the U.S. "no net loss" requirement under its *Clean Water Act*.[71] In effect for over 20 years, it requires that adverse impacts to wetlands be offset through compensatory mitigation that replaces these lost wetland functions and values. Offsets, however, must only be used as a last resort; proponents must first seek to *avoid* the damage, or *minimize* it "to the extent appropriate and practicable."[72] If some damage is unavoidable, the legislation requires that the area and quality of compensatory habitat provided be *greater than* the area disturbed – often by a ratio of 2:1 or more.[73] Each year, approximately 47,000 acres of restored or replaced wetlands compensate for 21,000 acres of wetland "losses".[74]

Nevertheless, the "no net loss" policy goal has not always been achieved in practice.[75] This is partly due to poor implementation and enforcement[76], but also partly due to the difficulty in identifying and replacing the ecosystem functions and values provided by a particular wetland. A 2002 study of over 200 U.S. wetland mitigation banks found that 61 percent defined credits simply by acreage, as opposed to function and quality.[77]

At least five Canadian provinces have enshrined similar "no net loss" (or "net gain") programs for wetlands either in law or policy.[78] Although the use of third party habitat offsets or banking is still rare in Canada, the Nova Scotia Department of Transportation has developed an innovative habitat banking program (for wetlands and fisheries) as part of new highway construction.[79]

In recent years, there have been attempts to assess the current state of knowledge regarding wetland management issues in Canada. In 2010, a workshop on **"Wetlands Management, Economics and Policy"** brought together Canadian and international experts on the use of EIs for wetlands conservation and sustainable use"[80] In this workshop, scholars found that current policies to avoid wetland drainage through regulations and subsidies have been largely ineffective in promoting wetland retention and that adjustments are required to ensure that EIs actually conserve wetlands. They also cautioned that wetlands conservation requires greater recognition of uncertainty with regard to impacts on particular ecosystem services and how to mitigate or replace them.[81]

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[71] *Clean Water Act*, 33 U.S.C. §1344, s. 404 (The requirement is for no net loss of wetland *functions and values.*)

[72] U.S. EPA, Guidelines for Specification of Disposal Sites for Dredged or Fill Material, 40 C.F.R. § 230.91(c) (mitigation sequencing); Memorandum of Agreement between the Army and the Environmental Protection Agency: The determination of mitigation under the Clean Water Act section 404(b)(1) Guidelines, online: <http://water.epa.gov/lawsregs/guidance/wetlands/mitigate.cfm>

[73] Pembina Institute, 2008. See also: BBOP, 2009, Appendix. A at 11, 19-20, 24, 27 and 31 (summarizing key laws and policies in U.S. and Australia, and applicable compensation ratios)

[74] Martin *et al*, 2006

[75] Kihslinger, R. 2008

[76] Sudol and Ambrose, 2002

[77] Biodiversity Neutral Initiative, 2005

[78] Rubec, C. and Hanson, A., 2008

[79] Transportation Association of Canada, 2006

[80] University of Alberta, 2010

[81] Cortus, B. *et al*, forthcoming

In another recent study, *Landowners' Willingness to Adopt Riparian Wetland Conservation Management,* economic modeling indicated that a payment system for wetland restoration likely would be more accepted by farmers who manage smaller parcels of land.[82] The study also found that farmers were more willing to engage in conservation activities to ensure the continuity of the erosion control services provided by wetlands than for the role of wetlands in wildlife conservation.[83] This suggests that wetland PES programs should emphasize their role in providing multiple services, not just biodiversity.

2.3 Economic Instruments for Agricultural Biodiversity

Agricultural land management can adversely affect biodiversity by placing significant pressures on natural resources (soil, water, vegetation) or replacing diverse ecosystems with monocultures.[84] However, if well-managed, agricultural stewardship can support a significant degree of biodiversity.[85]

Canada has designed and implemented several different incentive programs to reduce the loss of biodiversity (or at least targeted species) on agricultural lands.[86] While most of these approaches use a form of PES, there also have been some limited efforts to remove perverse incentives. Examples of PES schemes on agricultural lands at the provincial level include:

- the *Alternative Land Use Services programs*,[87] which have been implemented in different provinces such as Alberta and Prince Edward Island;
- the *Recreational Access Management Program*[88] in Alberta; and
- the *Conservation Land Tax Incentive Program*[89] in Ontario.[90]

Further, as part of the Canadian Bio-energy Initiatives and Programs, Finance Canada removed the excise tax exemptions for ethanol and biodiesel in April 2008,[91] although whether this is an environmentally positive incentive remains debatable.

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[82] Yu, Jia. 2009
[83] K. Belcher and J. Yu, forthcoming
[84] W. B. Harms and H. F. Stortelderandw, 1987
[85] V Adamowicz, forthcoming
[86] To see a list of public programs and private initiatives using MBI approaches for biodiversity conservation and management in Canada see Appendix. For more information about the programs using Economic Instruments for Agricultural lands and biodiversity in Canada and abroad, see Annex.
[87] Prince Edward Island. Not dated. Alternative Land Use Services, Guidelines, Applicant Information and Application Form. Online: http://www.gov.pe.ca/photos/original/af_alusguide.pdf; see also Delta Waterfowl. January, 2010. "ALUS in Alberta: A New Approach for Habitat Conservation." Online: http://www.deltawaterfowl.org/media/pr/2010/100120-ALUSCanada.php
[88] Government of Alberta. 2009. Recreational Access Management Program (RAMP). Online: http://www.srd.alberta.ca/FishingHuntingTrapping/RecreationalAccessManagementProgram/documents/RecreationalAccessManagementProgram-July2009.pdf
[89] Ministry of Natural Resources Ontario. Not dated. Conservation Land Tax Incentive Program (CLTIP). Online: http://www.mnr.gov.on.ca/en/Business/CLTIP/index.html
[90] For a more detailed information about these programs see Annex.
[91] Canadian Bio-energy Association , 2009:38

In May 2007, an experts' workshop in Alberta reviewed Australia's experience with EIs on agricultural lands. The participants observed that Canada has comparatively little experience with market-based instruments for land stewardship, and recommended that Canadian governments launch pilot projects to test EIs in the Canadian context.[92]

Agriculture and Agri-Food Canada ran a series of pilot projects from 2007 to 2009 on PES[93] testing a wide variety of approaches. These included annual payments and insurance for beneficial management practices in PEI. This pilot is of considerable interest, because several of its components are based on the premise that in many cases the benefits of improved environmental management would accrue to the producer (though there would be additional "external" benefits to the environment as a whole and the larger community). It can therefore be profitable to change management practices. Normally, if an action is profitable, it does not need to be further stimulated with an EI. However, because such management practices may be novel to the producer, the outcome contains an element of uncertainty. By eliminating this uncertainty with the insurance provided by the EI, the producer is then much more likely to adopt the new practices. In theory, as these new practices become more familiar and tested, and as a precedent of profitable outcomes becomes established, the need for such insurance decreases, and the payments can be phased out. The concept can be applied to a wide range of potentially profitable management changes, including the previously noted example linking biodiversity to initiatives aimed at higher yields, greater stability and improved resilience to climate change.[94]

Other agriculture pilot projects have investigated:

- watershed approaches to best management practices in Nova Scotia;
- the feasibility of using environmental farm plans to increase ecological goods and services with the Eastern Canada Soil and Water Conservation Centre;
- community approaches to lowering nutrients in surface water in Bassin-Versant de la Rivière -aux-Brochets, in Quebec;
- wetland restoration and auction tools, with Ducks Unlimited; and
- ecological goods and services provided by agri-forestry practices, with EcoResources, and annual PES incentives with the Manitoba Alternative Land Use Service (ALUS) program.[95]

At the international level, the European Union Agri-Environmental Measures[96] provides incentives for farmers to adopt "additional good farming practices" intended "to protect and enhance the environment on their farmland and help maintain the countryside."[97] The

[92] Rae, G. 2007. http://www.landtrusts-alberta.ca/documents/MBIs1_001.pdf?PHPSESSID=3dj4l5bj5bvac8ggm7en503mv0
[93] AAFC, 2009
[94] Wonneck, 2010
[95] Campbell, 2010
[96] *Food and Agriculture Organization* of the United Nations (FAO). Not dated. PES. Online: http://www.fao.org/es/esa/pesal/PESmaterials7.html
[97] *Ibid*

US Conservation Reserve Program[98] is one of the largest PES programs in the world. With annual funding of more than US$1.4 billion, this program supports activities to restore and improve agricultural lands, with a focus on soil erosion, water quality and wildlife habitat. It has been applied on over 13 million hectares of private lands to date. A 2004 study found that the program was very successful: erosion on CRP-funded land was greatly reduced, and benefits to water quality, wildlife and recreation were significant.[99] However, the program has also been criticized on a number of grounds: that owners of agriculturally unproductive land were overpaid; that these payments are unfair to other farmers who improve their practices without such payments; and for over-counting of the true amount of land removed from production as a result of the program. [100]

Some of the most innovative PES approaches on private lands are taking place in Australia. In 2001, the State of Victoria first implemented the BushTender Program, which uses an auction system to encourage "landholders to provide management that will improve the biodiversity values of bush/habitat on their lands."[101] This highly successful program, which has become a model for other auction programs around the world (including in Saskatchewan), has now been expanded into a broader EcoTender program covering multiple ecosystem services (salinity, biodiversity, carbon sequestration and water quality).[102]

A well-know international example of a habitat *offsets* approach can be found in the U.S. *Endangered Species Act*. A person or company may seek authority for activities which disturb an endangered species' critical habitat, if they commit to protect or restore compensatory habitat elsewhere (as a last resort, after avoidance and mitigation have been used).[103] This program applies to all types of habitat disturbance, not just agriculture. Like the wetlands 'no net loss' program, this program has reduced costs, but has a mixed record in terms of its biological effectiveness – largely due to spotty implementation and oversight, and to scientific uncertainties about providing habitat of equal or greater quality.[104]

2.4 Economic Instruments for Aquatic Biodiversity

At the provincial and federal levels, PES and other EI programs, including both price-based and quantity-based approaches, have been used to address problems threatening marine

[98] US Department of Agriculture (USDA). Not dated, Conservation Reserve Program (CRP). Online: "http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp-sp, and at: http://www.wi.nrcs.usda.gov/programs/crp.html
[99] Sullivan *et al.*, 2004
[100] FAO, 2007
[101] Stoneham *et al*., 2002
[102] Victoria, Department of Sustainability and Environment, http://www.dse.vic.gov.au/DSE/nrence.nsf/LinkView/F18669E8E2A4C02FCA256FDB00031592DC837B2FCBEF4B4BCA2573B6001A9728
[103] *Endangered Species Act*, 16 U.S.C. §1531, ss. 7(a)(2), 10(a)(1)(B). See also U.S. Department of the Interior, 2003
[104] Fox J., and A. Nino-Murcia, 2005

and inland water biodiversity.[105] Examples include, at the federal level, Fisheries and Oceans Canada's Fish Habitat Compensation Program for damages to fish habitat, and at the provincial level, the Riparian Tax Credit in Manitoba.[106]

The Fish Habitat Compensation program in Canada pursues "no net loss" as a policy goal. The *Fisheries Act* prohibits 'harmful alteration, disruption or destruction' to fish habitat (HADD) unless it is authorized via section 35 (2) of the Act.[107] In this case, developers are required to compensate for any unavoidable HADD through the restoration or creation of other fish habitat.[108] Unlike US offset programs, this program does not allow monetary payments in lieu of compensation[109] and precludes the use of third party offsets or habitat banks.[110] The project proponent is responsible for providing the required habitat compensation.

One study reviewing the program concluded that the offset program has not been entirely successful; approximately 63% of projects resulted in net losses in habitat productivity, 25% achieved the "no net loss" goal, and 12% achieved a net gain in habitat productivity.[111] The study highlighted the necessity of adopting quantitative rather than subjective evaluations and confirmed poor compliance with permit requirements. A majority of "authorisations had either larger HADD areas and/or smaller compensatory areas than authorised." Only a minority of them (approximately 20%) "had smaller HADD areas and/or larger compensation than authorised." The authors also concluded limits in present understanding of ecosystem functions was also a contributing factor.

In addition, the program's prohibition of third party offsets or banking likely raises the cost of providing habitat compensation in many cases. The Department may want to reconsider this limitation; banking and offsets, in a well designed program, can often achieve similar or better habitat outcomes at lower cost, based on the experience with such approaches elsewhere.

[105] To see a list of public programs and private initiatives using MBI approaches for biodiversity conservation and management in Canada see Appendix. For more information about the programs using Economic Instruments for marine and inland water biodiversity in Canada and abroad, see Annex.
[106] Manitoba. Not dated. The Riparian Tax Credit. Online: http://www.gov.mb.ca/finance/tao/pdf/riparian/info_for_taxpayers.pdf
[107] *Fisheries Act*
[108] Fisheries and Oceans Canada, 2007
[109] *Ibid*
[110] Madsen, 2010
[111] Quigley and Harper, 2006b

2.5 Conclusions

Different initiatives using EI approaches have been implemented in Canada and internationally as a way to encourage biodiversity conservation.[112] This survey has identified nearly 40 initiatives implemented at the federal, provincial, municipal and private levels. Despite the increasing use of EI approaches in the Canadian context, most of these programs are still at their pilot or infancy stages. It is nevertheless possible to draw some tentative lessons from Canadian and international experience.

First, although these Canadian EIs provide incentives that promote environmentally improved practices and biodiversity conservation, they are typically not explicitly linked to ecosystem services. By generally undervaluing ecosystem services these EIs, while a step in the right direction, are not fully effective at preventing the unsustainable use of natural capital and resulting biodiversity loss. They could therefore benefit from ecosystem valuation studies. Second, the greater use of EIs in Europe, Australia and the U.S. indicates that the opportunity exists to expand both the number and types of EIs in Canada, and to learn from the experiences elsewhere (good and bad). Third, the experience to date indicates that EIs – either alone or as part of a policy mix – can often achieve biodiversity goals in a more flexible, cost effective manner than traditional regulation, if they are well designed and implemented (which has not always been the case). Lastly, to gain support and be effective, EIs not only should achieve environment goals in a cost-effective manner, they also should be consistent with broader social policy goals – and at the very least should not exacerbate social disparities or problems.

3. Promoting Incentives for Biodiversity Conservation

This section builds on the preceding review of the literature and experience regarding EIs. While section 2 focused on their use in different types of ecosystems, this part focuses on different *types of EIs*. Specifically, it reviews three categories of instruments:

- *Payment for Ecosystem Services (PES) instruments* that provide direct compensation for increasing the supply of ecosystem services, including liability schemes that earmark funds to supply ecosystem services;
- *Taxes or fees* that encourage ecosystem stewardship; and
- *Markets* for ecosystem services, such as trading systems, banks and offsets.

For each category, the section identifies the types of EIs contemplated, the situations in which they are most effective, highlights lessons-learned from their implementation, and discusses their application in Canada – building on the initial overview in section 1.4. This section also looks forward, exploring possible areas for future application of these instruments in Canada.

[112] OECD, 2008b

3.1 Payment for Ecosystem Services

PES programs, as noted above, usually provide direct compensation for increasing the supply of a specific ecosystem service. They are voluntary transactions where a well-defined environmental service (or parcel of land that secures the service) is bought by a service buyer from a service seller, subject to proscriptions or conditions related to a continued supply of the service (conditionality).[113] These instruments typically involve payments to landowners to change cropping practices, set aside buffer zones, reforest, or engage in other activities that may be less profitable for them, but otherwise beneficial to the environment.

While PES programs tend to target a specific problem, like soil erosion or wetland loss, high spill-over benefits are usually present where land is set aside or damaging uses are restricted. PES can involve direct compensation between buyers and sellers, as occurs in payments for carbon sequestration. Another possibility is the engagement of a third party, such as when governments pay directly for the ecosystem service -- as, for example, in PES for watershed-based forest conservation to supply higher quality water downstream. Government involvement can range from a relatively passive role of only setting the rules in order to facilitate compensation, to a more active role in designing and implementing the entire program, including sometimes providing compensation.
Certain liability schemes function in a similar way. For example, under the federal government's Environmental Damages Fund,[114] court-awarded or negotiated settlements channel funds to pay for damages associated with the violation of laws such as the *Fisheries Act*. Such funds can be earmarked for direct replacement of lost services, such as fish stocking or stream rehabilitation, or for offsetting of lost services, such as through the purchase, protection or restoration of off-site habitat areas.

Finally, fiscal transfers can be used to promote ecological goals. Given that most lands in Canada (south of 60) are under provincial jurisdiction, fiscal transfers to secure minimum quality objectives (as is done in health care) are an obvious instrument that would align well with Canadian governance structures. At a basic level, the federal government could contribute to provincial programs that support conservation – at least in regard to species of federal concern (migratory birds, fish, species at risk). (A similar approach is taken where provinces agree to enforce federal environmental laws.). The federal government could make the transfer of funds conditional on specific outcomes or goals.

This mechanism is not limited to bilateral transfers between governments. Transfers to locally based non-governmental organizations are now a standard practice in Canada, with examples in areas such as environmental improvement (the Atlantic Canada Coastal Action Program), forestry (model forests), fisheries (co-management) and wildlife habitat (habitat conservation and stewardship programs). The most prominent example is the $225 million

[113] Wunder, 2005
[114] This is a specified purpose account outside of consolidated revenue fund that where court awards are specifically earmarked for activities such as stream remediation or purchasing wetlands to offset environmental damages.

provided by the federal government to Nature Conservancy Canada and its partner organizations to support the implementation of the Natural Areas Conservation Program. Required to match government funds, these organizations negotiate with private landowners to acquire ecologically sensitive land (either through donation, purchase or steward agreements).[115]

While not all of these examples are tied directly to paying for ecosystem services, they provide examples of conservation-related transfers that *could* be so targeted.

An international inventory of PES programs identifies more than 300 programs in some stage of implementation worldwide.[116] Most of these programs have been implemented only recently and many are still at the pilot or experimental stages. Generally, these PES directly compensate for either land set-asides or new management practices. Although the goals of these initiatives vary according to the economic sector, they all have either a direct or indirect biodiversity conservation goal (e.g., creating networks of protected areas, achieving government environmental objectives; reducing levels of soil erosion/stream siltation, improving water quality and enhancing wildlife habitat).

Most PES programs relate to ecosystem services associated with forests, water, biodiversity, carbon and soil. The first such programs tended to focus on ecosystem services where the causal link between the provider of the service and the beneficiary was relatively easy to establish and where minor changes in behaviour could be expected to lead to substantial increases in the ecosystem services provided.

In Canada, PES initiatives, though still not widely used, occupy an increasingly important place in the toolbox of environmental policy instruments. Both the federal and provincial governments have designed and implemented programs. This survey identified at least 10 of PES programs in Canada. To date, these programs have mostly focused on private agricultural lands. Considering that many Canadian natural resources are publicly

Habitat Stewardship Program (HSP)

The HSP (for species at risk) allocates up to $10 million per year to projects that conserve and protect species at risk and their habitats. Implemented by Environment Canada, Fisheries and Oceans Canada, and the Parks Canada Agency, the HSP provides funding to "stewards" for implementing activities [voluntary actions] that protect or conserve habitats for species designated by COSEWIC as nationally "at risk". Activities are encouraged for private lands, provincial Crown lands, Aboriginal lands, or in aquatic and marine areas that:

1. Secure or protect habitat to protect species at risk and support recovery;
2. Mitigate threats to species at risk caused by human activities; and
3. Support other priority activities in recovery strategies or action plans.

Examples of stewardship activities are:

- Installing nest boxes in Ontario and Quebec for several species of birds;
- Monitoring marine mammal populations and protecting important habitats from disturbance;
- Developing selective fishing methods to avoid impacts on species at risk
- Involving Aboriginal communities in the conservation of declining fish species;
- Community-based projects to restore riverbanks and prevent soil erosion.

[115] See Environment Canada, http://www.ec.gc.ca/default.asp?lang=En&xml=782EBD4F-60D5-4895-9D7A-46A378A100C3

[116] EnviroEconomics, 2009, http://enviroeconomics.ca/blog/

owned,[117] one important question is whether and how such instruments can be applied to improve natural resources management on *public* lands, for instance to encourage improved conservation of habitat for species at risk on Crown forest lands managed by private companies.[118]

In PES programs, compensation has traditionally been provided by governments, though emerging programs also leverage private funds. Some newer programs focus on directing funds from those who benefit from improved ecosystem services to those who can supply more of that ecosystem, service (such as downstream water users paying for upstream conservation of riparian forests). Compensation is often scaled to income from land use and not to the value of the ecosystem services supplied, for example the expenses for supplying ecosystem services or lost revenues from changing land use practices.

None of the policies or programs reviewed tied the level of compensation to the value of ecosystem services supplied. Typically, detailed ecological assessments first identify suitable ES for compensation, and compensation is then based on lost income or increased costs from changing land use practices. Institutional limitations often preclude the use of economic valuation to scale the level of compensation to the value of the ES supplied. Instead, in most operating programs, compensation is based on classes of eligible activities or land types.

PES programs tend to work best when environmental services are visible, beneficiaries are well organized, and when land user communities have clear and secure property rights, strong legal frameworks and access to capital[119]. In most cases, such programs in Canada have not yet conducted detailed analysis of their benefits. Even in well-established programs, such as voluntary agricultural PES programs, reporting often is limited to the amount of compensation provided and the number of beneficiaries, rather than impacts on ecosystem services. Canada is not unique in this regard; one review of PES programs around the world concluded that their effectiveness was largely unknown, because of the scarcity of analyses based on solid monitoring and evaluation methods.[120]

Examples of federal, provincial and private PES programs in Canada are provided in the Appendices, and a smaller number are listed in the table below.

[117] Environment Canada, 2007
[118] Chalifour, 2005
[119] Although the subject of debate, payments by Vittel (a corporation that bottles and sells mineral water) to farmers in northeastern France in order that they reduce nitrate contamination of the aquifer are often described as a near-perfect example of a PES in terms of satisfying these criteria. See Perrot-Maitre, 2006
[120] Bond *et al*, 2009

Examples of Rewarding Benefits through PES and tax breaks			
Promoter	**Program/ initiative**	**Targeted Ecosystem**	**Targeted activity**
Federal	National Environmental Farm Planning Initiative	agricultural lands (expired)	Agriculture, Forestry, Nature Protection, Species Management
	National Farm Stewardship Program	agricultural lands (expired)	
	Endangered Species Recovery Fund	forests, wetlands, inland water, marine	
	Habitat Stewardship Program for Species at Risk	forests, wetlands, inland water, marine	
Provincial	Alternative Land Use (Prince Edward)	agricultural lands; forests	Agriculture, Forestry, Nature protection, Fisheries
	Environmental Farm Action Plan (Manitoba)	agricultural lands	
	Conservation Land Tax Incentive Program (Ontario)	agricultural lands	
	Managed Forest Tax Incentive Program (Ontario)	forests	
	The Riparian Tax Credit (Manitoba)	inland waters	
Private	Habitat Conservation (Ducks Unlimited Canada)	wetlands	Agriculture, Nature Protection

3.2 Taxes or Fees that Reward Ecosystem Stewardship

Environmental taxes or fees are currently being used in many countries, including Canada. They have been widely described as an effective and cost efficient instrument that provides flexibility to industry and potential revenue for government, which in turn can be used to fund complementary remediation. Tax instruments are also rooted in the polluter pays and user pays principles, as costs can be passed directly to producers and consumers of polluting or environmentally harmful goods. They are an essential element of ecological fiscal reform (tax "bads", not "goods").

On the other hand, policymakers cannot be certain of how consumers and polluters will respond to a tax (in economic theory, the degree to which they will limit their activities as a result of the tax depends upon the "elasticity" of supply and demand) and as a result, cannot be assured that a maximum level of consumption or pollution is not exceeded. Where this uncertainty is problematic, a potential solution is to simply combine the tax with regulations that prohibit consumption or pollution above a certain level.

With regards future directions, to be most effective, the application of a fee or tax should be closely tied to the ecological impact, such as pollutant loading levels, and the rate set at a level that motivates behavioural change. Fees are less effective when their rate is set at a low level, or not aligned with the ecological impacts. For example, stumpage fees for logging almost never include a charge for the ecological impacts of logging (e.g. on wildlife, water or CO2), let alone variable charges to reflect different levels of ecological sensitivity.

Departments often have the authority to apply user fees or charges, but surprisingly little use has been made of such powers in Canada to date.[121] However, they are starting to be used a bit more often, such as the extended producer responsibility (or "eco-fees") in B.C., Ontario and elsewhere. However, jurisdictions often do not set such fees at a level sufficient to significantly change behaviour (an example is the very low water use rates in much of Canada). Environmental taxes are another form of fee, albeit one that generally falls under the exclusive jurisdiction of the Finance departments (although they normally consider such proposals from other departments).

In designing such environmental pricing systems, the theoretically ideal approach (economically) is that tax rate or fee should be set equal to ecological costs or damages.[122] This creates an incentive to reduce environmental harm down to a level that is socially optimal. In reality, however, valuing ecological damages is challenging, as there are often high levels of uncertainty, and this can result in artificially low valuations that fail to provide the incentive needed to reach the environmental objective. Other challenges include the lack of valuation expertise and the high cost of valuation studies. These obstacles can be addressed by using ES value studies from other, similar places (i.e. "benefits transfer") – which can provide useful though coarse 'work-around strategies'.

The Riparian Tax Credit (Manitoba)

Goals: To encourage farm operators to upgrade their management of lakeshores and river and stream banks (mostly to prevent soil erosion and to improve water quality).

Description of the program: Agricultural and livestock producers who voluntarily agree to protect a strip of agricultural inland receive a tax credit if they commit to protect the land for a five-year period.

Actors: Agricultural and livestock producers across Manitoba, who have a lake or waterway running through their property.

Financing mechanism and method of payment: "The basic tax reduction is paid on acreage within the 100-foot strip along the waterway."

Observations:

Although this is a tax expenditure, some PES characteristics are also present:
Compliance is verified.

Due in part to these valuation challenges, in practice, an environmental fee or tax rate is often set at a level that reflects *abatement costs*, i.e. what it will cost to bring about the desired change in practices, products or technologies. To better predict the degree to which a tax will encourages the use of substitute products or technologies, its design should take into account the "price elasticity of demand" of the substitutes – i.e. the effect of a change in price on the demand for each substitute. The demand for some products is particularly sensitive to a change in price, while the demand for others may change very little. In general, by changing relative costs, taxes can stimulate a move to more benign production inputs – such as where a tax on water

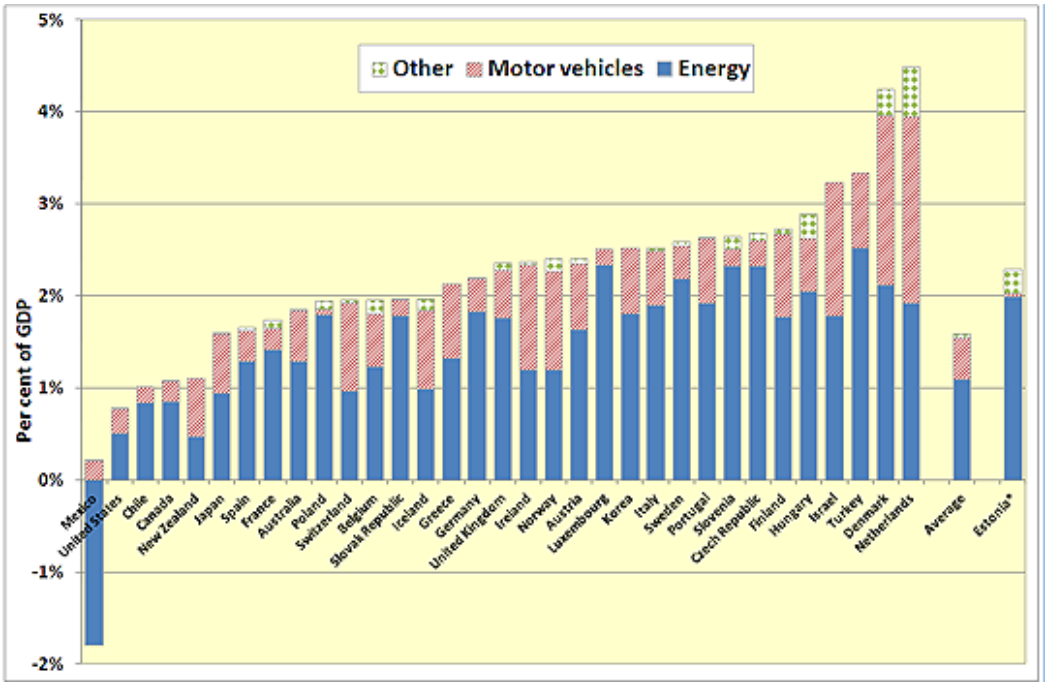
[121] CEPA's Section 328 provides the Minister with authority to impose 'cost recovery' fees, which are defined as not exceeding "the cost to Her Majesty in right of Canada of providing the service or use of the facility".
[122] Economic theory dictates that the "optimal" tax rate is found where the marginal social cost curve and the marginal cost of abatement curve meet.

discharge makes water recycling cost-effective. Environmental taxes or fees are most useful when three basic conditions are met:

- the objective is to *reduce* rather than eliminate the harmful activity;
- it is possible to *measure* the quantities of activity on which the tax would be imposed; and
- there are lower-impact *alternatives* to the taxed activity, with a modest price gap.

The OECD, in recent years, has conducted extensive analyses of the use and effectiveness of environmental taxes and fees in its member countries. A 2010 OECD report discusses the important role that such charges can play in driving eco-innovation, lowering the cost of environmental improvements, and spurring green growth. That report also concludes that Canada ranks 30th of 33 OECD countries in its use of environmental taxes and fees.[123]

Composition of Environmentally Related Tax Revenues by Country: 2008



Most of the taxes and fees used in Canada for ecosystem or biodiversity conservation are implemented at the provincial levels.[124] Examples are provided in the Appendices to this report, with a few illustrations listed in the table on the following page.

[123] OECD, 2010
[124] OECD, 2008b

Setting More Accurate Prices using Market-Based Instruments (Price-based)			
Promoter	**Program/ initiative**	**Targeted ecosystem**	**Targeted activity**
Federal	Water permit fees in national parks	inland waters	Tourism, townsites
Provincial	Water use permit fees (most provinces)	Inland waters	Hunting, tourism, fisheries, forestry, others
	Charge on water discharge (BC, Quebec)	inland waters	
	Charge on fishing licences (most provinces)	inland waters	
	Charge for entrance to parks/ wildlife reserves (most provinces)	All ecosystems	
	Hunting licences fees (all provinces)	All ecosystems	
	Carbon tax (B.C.)	All ecosystems	
	Alberta charge for overcutting	Forests	

In most cases, these fees or taxes do not reflect ecosystem costs or benefits; they are meant to generate revenue, and are not set at a sufficient level to significantly affect behaviour. B.C.'s carbon tax is an exception; it is an example of a well-designed environmental tax. The rate rises annually on a pre-set schedule, to provide certainty about future return on carbon reducing investments.

3.3 Markets for the Protection of Biodiversity and Ecosystem Services

This section refers to various types of trading schemes (permits, allowances, offsets) as well as the use of banks (wetland mitigation banks, conservation banks). The current use of cap-and-trade carbon markets in several parts of the world provides a well-known example of a market-based EI. Under a tradable permit system, an allowable overall level of pollution or resource use is established (the quantity is capped) and allocated among regulated entities in the form of permits (or allowances). Firms that keep their use/emission levels below their allotted level may sell their surplus permits to other firms or use them to offset excess emissions.[125] In other words, the quantity of pollution is pre-determined, and the price is then allowed to vary (although the price could also be controlled in order to reduce volatility). Such trading systems are one of the two types of EIs integrated into CEPA, 1999 (referred to as "tradable units").

Environment Canada has the authority under CEPA to implement tradable units to manage toxic substances, nutrients, fuels, international air and water pollutants, and federal activities (section 326). Federal tradable allowances systems have been used to phase-out

[125] Stavins, 2003

certain ozone-depleting substances (methyl bromide, HCFCs) and solvent degreasers (PERC and TCE). Moreover, trading systems are under consideration to deal with carbon and other polluting substances.

In provinces, trading schemes are currently used for SO2 and NOx (Ontario). Alberta has a trading market for CO2, and several other provinces are planning to bring in their own versions (ON, MB, BC and QC). Alberta's CO2 market will include offsets for agriculture and forestry (once protocols are finalized), and thus extends to the natural resources sector.

Unlike other countries that have created markets for wetlands or for endangered species (particularly the U.S.), Canada has rarely used trading instruments to address biodiversity problems. However, there are several water and water pollution trading schemes. In terms of water quality, the World Resources Institute has identified 21 Trading initiatives in the United States, whereas only one was identified in Canada.[126] In Ontario, the South Nation Conservation Area, located between the Ottawa and St. Lawrence rivers, has created a water quality market to reduce phosphorus leaching. A cap on total phosphorus use was put in place – developers can then purchase credits from farmers who have reduced their phosphorus leaching through best management practices. Despite some initial difficulties, the program has succeeded in achieving its environmental objectives cost effectively, and in the future, might be further developed[127]

The table below offers several examples of programs that use market-based instruments for ecosystem services at federal and provincial levels in Canada. The further scan is provided in the Appendix to this Report.

Setting More Accurate Prices using Market-Based Instruments (Trading-based)			
Promoter	**Program/ initiative**	**Targeted ecosystem**	**Targeted activity**
Federal	Individual transferable fishing quotas / Fish compensation program	Marine and coastal	Fishing
Provincial	Tradable hunting rights (Alberta)	Varied	Hunting, agriculture, water use, carbon emitting activities
	Water discharge trading (Ontario)		
	CO2 offsets for forestry and agriculture (Alberta)		

There is significant potential for trading-based schemes to be used more broadly in Canada for biodiversity. For example, there is extensive experience with offsets under wetland "no net loss" policies in the U.S. and elsewhere, and such approaches could improve the cost-effectiveness of Canadian wetland conservation – as well as fish habitat conservation (under the *Fisheries Act*). Similarly, habitat conservation offsets could be used under

[126] Voora *et. al.*, 2009
[127] See the South Nation Conservation website for details of the program , as well as data, http://www.nation.on.ca/en/your-water/

federal and provincial endangered species laws, to lower compliance costs and add flexibility, drawing on experience in the U.S., Australia and other places.

4. Removing Subsidies that Lead to Biodiversity Loss and Ecosystem Degradation

Over the past two decades, a growing number of studies have highlighted how some government subsidies can serve as a powerful disincentive to sustainability by encouraging overuse and waste of scarce natural resources and placing additional stress on the health of ecosystems. International examples of subsidy reform or removal indicate that new policies can not only lead to a healthier, cleaner environment, but also can have positive economic outcomes by reducing the burden on government budgets and preserving precious natural capital and their ecosystem services for future generations. In other words, reforming harmful subsidies not only makes good environmental sense, but also is in Canada's economic self-interest.

The preceding two sections focused on disincentives to biodiversity conservation resulting from failing to account for full environmental costs. Such disincentives can be *remedied through positive government actions*, in the form of regulations or economic incentives (green taxes or trading schemes). This section focuses on situations where disincentives to biodiversity conservation are *caused by government action,* in the form of subsidies that promote unsustainable use of resources or ecosystems.

4.1 Subsidies and their Potential Effects on the Environment

The World Trade Organization (WTO) defines a subsidy as "a financial contribution by a government, or agent of a government, that confers a benefit on its recipients". The OECD definition differs slightly: "…a government action that confers an advantage on consumers or producers in order to supplement their income or lower their cost".[128] This latter definition is broader, incorporating non-financial transactions such as quotas.

Subsidies come in many different forms. They can include direct transfers of funds or financial guarantees (to cover possible liabilities, such as for nuclear accidents). They may consist of income or price support (e.g., for agricultural goods and water), tax credits, exemptions and rebates (e.g., for fuel), low-interest loans, preferential treatment, and use of regulatory support mechanisms (e.g., demand quotas). They can take the form of implicit income transfers when natural resources (e.g., water, energy) or services are priced at below-cost rates. Sometimes they can be difficult to identify, if they are off-budget and therefore less evident.

[128] OECD, 2005

Monitoring subsidies can be challenging. A variety of terms is used to designate subsidies (such as "transfers", "payments", "support measures", "assistance" and "protection") according to their purpose and sector. Complicating matters further, different measurement approaches often are used, resulting in widely varying subsidy estimates within sectors, and incomparable data between sectors. For instance, the WTO definition excludes general infrastructure projects, whereas the OECD definition is broader and could include some infrastructure projects, such as the subsidized construction of forestry roads. Additionally, the WTO definition excludes transfers from consumers to producers through border protection, whereas OECD estimates of agriculture "support" include these transfers.

Subsidies can serve laudable social and economic goals. Some, however, encourage the unsustainable use of natural resources and thereby harm the environment and deplete natural capital, which in turn has negative impacts on both society and the economy.[129] Furthermore, some environmentally harmful subsidies may also be inequitable; production-increasing agricultural subsidies in Canada, for instance, often benefit larger, richer farms more than smaller ones. When environmentally harmful subsidies are identified, policymakers should ask whether there are other means of achieving policy goals that are less detrimental to the environment.

Subsidies are environmentally harmful when they encourage excessive production or consumption of a resource or service. One way this happens is by under-pricing natural resources (i.e., below production cost), as is common in global and Canadian markets (e.g., for water), which causes their overuse by consumers and producers. Other subsidies tend to increase production by artificially reducing producers' costs or enhancing revenues (e.g., by subsidizing the modernization of equipment), or by relating the size of the subsidy to the quantity of output. The specific environmental consequences of over-use depend on the nature of the resource.

Determining the exact *extent* of the environmental impact of subsidies can be complicated by the existence of "price elasticities", "leakage" and "policy filters", which can amplify or diminish their effects, as well as by imperfect scientific understanding of ecosystems and threshold levels. Nonetheless, if a subsidy is likely to cause significant harm to biodiversity or deplete natural capital then it ought to be removed or revised – especially where it may lead to irreversible damage (such as species loss), consistent with the precautionary principle – unless there is a compelling policy reason to maintain it..

To help identify where subsidy reform is most needed and would be most beneficial, the OECD has developed a number of tools. The 'quick scan' model[130] can be used to determine whether a subsidy is likely to be environmentally harmful, and the 'checklist'[131] helps answer whether removing the subsidy will benefit the environment. Should a subsidy be identified as potentially environmentally harmful, the "integrated assessment

[129] OECD, 2002
[130] OECD, 1998
[131] Pieters, 2003

methodology"[132] provides further guidance on evaluating the environmental impact of the subsidy and implementing alternative policies.

4.2 Environmentally Harmful Subsidies, by Sector

Agriculture

Covering approximately 7% of Canada's land area, agriculture provides habitat for about half of Canada's species at risk, and over 550 species of terrestrial vertebrates. Extending over such an enormous area, and directly affecting so many aspects of ecosystems, agriculture inevitably has significant impacts on biodiversity. Unfortunately, according to a recent report, the capacity of agricultural landscapes in Canada to provide habitat for species has declined over the past 20 years, due mostly to the intensification of agricultural production and habitat loss due to agricultural expansion and change of land use.[133]

Some subsidies to agriculture, however, encourage agricultural intensification and expansion by either directly tying the level of payments to production levels, or by decreasing the costs of inputs (such as fertilisers and pesticides). Market price support can also increase domestic agricultural production. As agricultural subsidies have traditionally been particularly large in comparison with other sectors, their overall environmental impact is considerable. Subsidies encouraging intensification can, for example, result in:

- the loss of pollinators and other non-target species (due to pesticides);
- soil degradation (from erosion);
- eutrophication of aquatic ecosystems (from fertilizers and nutrients); and
- hydrological changes to habitats and aquifer depletion (resulting from water provision and irrigation subsidies).[134]
- Decreased species richness as a result of crop specialization and the reduction of fallow land.

In general, maximizing agricultural production is often associated with increased crop specialization and a reduction in fallow land, and these have been shown to negatively affect species richness.[135]

Canadian subsidies to agriculture are neither exceptionally large nor small by OECD standards. Canada's average level of overall producer support from 2007-2009 was 17% of farm receipts. In comparison, many OECD members had significantly higher levels of producer support. For instance, support was 23% in the European Union, and 61% in Norway. On the other hand, Canadian support was greater than that of Mexico (12%), the United States (9%), Australia (4%) and New Zealand (1%).[136]

[132] OECD, 2007
[133] Canadian Councils of Resource Ministers, 2010
[134] TEEB, 2009
[135] Gottschalk, 2007
[136] OECD, 2010

In general, there has been progress among OECD countries as a whole in reducing the proportion of subsidies which are likely to be most environmentally harmful, i.e. those that are linked to production levels. Subsidies which do not require production have increased from negligible proportions of total producer support in 1995 to almost a quarter of producer support in 2008.[137]

Canada has also been a part of this trend – in 1986 it had no subsidies that were not tied to production, whereas in 2008 these subsidies constituted 12% of total support[138]. Nevertheless, more than half of all Canadian agricultural subsidies, even if not directly tied to production, are still considered production-increasing by the OECD (market price support, subsidies to output, and subsidies based on the unconstrained use of variable inputs). Furthermore, in 2009 Canada increased farmer support more than any other OECD country – subsidies rose from 13% to 20% of total receipts.[139]

Some subsidies target specific commodities, and the resulting agricultural specialization is generally less supportive of biodiversity. For instance, the Western Grain Transportation Act subsidized transportation costs for grain and favoured its production over other crops; when it was repealed in 1995, agricultural diversification increased in the Prairie Provinces.[140] Many commodity-specific subsidies fall under subsidized crop "insurance" programs. For example, Quebec corn farmers increased production by 85% between 1986 and 2006, and a subsidized insurance program (Farm Income Stabilization Insurance) is believed to have been a significant contributor to this increase.[141]

One obstacle to reforming agriculture subsidies is the perception that they predominantly support small family-farms and a traditional way of life. The reality, however, is quite different: a 2003 study found that the majority of the subsidies in OECD countries were captured by larger and wealthier producers, which also tend to use more intensive farming practices, and to be less agriculturally diversified than smaller farms.[142]

[137] OECD, 2009
[138] *Ibid*
[139] OECD, 2010. This increase was mainly a result of increased market price support for dairy products through import restrictions (border protection) when prices fell. Although market price support is not directly tied to output, it can increase the profitable level of domestic production, which tends to intensify agricultural efforts and be harmful to biodiversity. Unlike other forms of subsidies, however, market price support is paid for by consumers and not by taxpayers generally.
[140] Unisfera 2003
[141] Commission sur l'avenir de l'agriculture et de l'agroalimentaire québécois 2008. During this same period Ontario corn producers *decreased* production by 9 per cent. The report suggests that the difference could be explained by the existence of subsidized insurance for corn in Quebec and the lack of such a program in Ontario (while disputing the accuracy of the term "insurance" for this program). The Farm Income Stabilization Insurance has also supported the pork industry in Quebec.
[142] OECD, 2003

Fisheries

The recent history of fisheries provides a tragic example of the social and economic consequences of unsustainable use of natural resources. Ironically, by enabling overfishing, subsidies can endanger the livelihoods that they are meant to protect. In some fishing regions in Eastern Canada, where fish stocks have already collapsed, the effects on communities have been devastating. Subsidies to fishers in the cod industry greatly contributed to excessive fishing capacity and effort, which was a major factor in the collapse of the fishery by the early 1990s. In order to compete with European distant-water trawlers, Canada had introduced a number of subsidies, such as direct grants and low-interest loans for vessel construction and modernization.[143] Ultimately, Canadian fishing capacity was five times greater than was needed to catch the annual quota[144]. There are similar examples internationally; it is estimated that almost one third of the world's marine fisheries are close to collapse or have already collapsed.[145]

The environmental impacts of fisheries subsidies are not limited to declining fish stocks, but also include damage to seafloor organisms due to trawling and increased greenhouse gas emissions due to fuel subsidies for fishing vessels. Subsidies that increase fishing effort and capacity have been identified as the most harmful to fish stocks. Such subsidies include support for fleet expansion and modernization, and tax preferences for fuel.[146] For instance, at about 18 cents a litre, Canada provides over $90 million (USD) per year in fuel subsidies to fisheries.[147]

The Fisheries Economics Research Centre, at the University of British Columbia, has been collecting information on fishing subsidies in Canada and internationally, and has organized many of them into three categories according to their sustainability: the good, the bad and the ugly[148]. This information, which is available online,[149] has recently released been updated in the Journal of Bioeconomics.[150] The Centre is currently developing a project to determine the ecological effects of these subsidies.

Management regimes which effectively enforce the "total allowable catch" can limit subsidies' negative effects, in theory – although in practice catch limits may be difficult to enforce.[151] Furthermore, subsidies which contribute to excess capacity create an incentive to lobby for greater catch limits. Other policies that reduce capacity and ease the transition to decreased fishing effort, such as job training and job creation projects for the affected regions, and greater scientific monitoring of fish stocks, could be implemented in the place of these subsidies.

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[143] Anyanova, E., 2008
[144] Porter G., 2001
[145] FAO, 2008
[146] UNEP, 2004a
[147] Sumaila *et al*., 2008
[148] For an explanation of this classification, see Sumaila and Pauly, 2006
[149] See http://www.seaaroundus.org/Subsidy/default.aspx?GeoEntityID=31
[150] Sumaila *et al*., 2010
[151] OECD, 2000a; WTO, 2000; Munro and Sumaila, 2002; UNEP, 2004a

However, even some potentially environmentally friendly subsidies, such as decommissioning schemes (e.g. license and vessel buyback) which are meant to decrease fishing effort and capacity can sometimes have the opposite effect.[152] Although in the short run these subsidies can reduce capacity, they can also increase the profitability of those who remain in the fishery. Both increased fisher income and the higher value of fishing vessels (in the case of vessel buybacks) can lead to greater investment in fishing capacity. One historical but illustrative Canadian example is the license buyback in the Atlantic Canada Inshore Lobster Fishery, which retired 22.6 percent of the licenses in the fishery as of 1978. Although the initial effects were beneficial both to the remaining fishers and to the fishery, as income increased so too did investment into fishing vessels, eliminating these environmentally positive outcomes.[153]

Internationally, Norway provides an example of successful reform of fishing subsidies that resulted in a self-sustaining industry. Fisheries subsidies in that country were reduced by 85%, from a peak of US$ 150 million/year in 1981(amounting to approximately 70% of the value added in the industry) to US 30$ million by 1994. During the same period, cod and herring stocks went up by 110% and 1,040% respectively. Social measures were put in place in order to lessen the impact on those who had come to depend on the subsidies: the transition, however, was not easy. Studying both the strengths and weaknesses of the Norwegian efforts could provide a valuable learning opportunity regarding the manner to reduce subsidies while minimizing social upheaval.[154]

Transportation

Two forms of environmentally harmful transportation subsidies are those for fuel, and those directed at building and maintaining roads. Subsidizing fossil fuel can increase vehicle use, adding to air pollution and greenhouse gas emissions. Although in Canada taxes on fuel consumption are higher than in the United States, differential taxation within Canada acts as a subsidy – such as with regards to fuel costs in fisheries.

Whether road building, in cases where the costs are not recovered by tolls, fuel taxes or other means, should be considered a subsidy is a matter of debate. Road building does reduce transportation costs for consumers and business alike, and therefore can increase vehicular use and associated pollution and greenhouse gas emissions. However, it also can be considered general infrastructure, and intended to benefit society as a whole, rather than a specific group.

Some public road construction, however, disproportionately benefits specific industries, such as mining or forestry, by providing access to remote areas, and should be considered a subsidy – one which often contributes to biodiversity impacts. A recent study on deforestation patterns showed that road construction and improvement is one of the three

[152] Sumaila and Pauly, 2006
[153] Porter G., 2001
[154] OECD, 2006b

main proximate causes of deforestation globally.[155] Road building can also destroy and fragments habitat, affecting ecosystems and species populations.[156] For instance, habitat fragmentation is a main cause of declines of woodland caribou in Canada.[157]
In general, road expenditure would be less harmful to biodiversity if it were focused on already-accessed areas – or, better still, were directed more at public transit.[158] Other subsidies in Canada that could be seen as running counter to greenhouse gas emissions reduction targets are those to airports[159], airlines and airplane manufacturing industries.[160] In the same vein, the recent Canadian bailout of the auto industry (a form of subsidy) did not include any conditions requiring the companies to invest in building higher mileage cars or otherwise achieve environmental gains, as part of receiving (extensive) public funds.

Water

Canadians consume a huge amount of water – approximately nine times per capita that of United Kingdom residents. Only the United States ranks worse on a per capita basis. The commonly held view that access to water is a right implies that government has a duty to provide it at an affordable rate. However, once this right is assured (by, for example, subsidizing water provision up to a certain pre-determined "lifeline" level) additional subsidies should be reduced or removed. Moreover, in Canada, most water use (about 70%) serves as an input to industry – including thermoelectric power producers, the pulp and paper and oil industries, and irrigation farmers (where subsidies encourage water-intensive crops in arid areas).[161]

For private citizens, subsidized water provision is sometimes used for non-essential purposes, such as excessive lawn and garden watering, or for private swimming pools. Canadian municipal water rates are among the lowest in the OECD.[162] In 2004 approximately 30% of domestic users paid a flat rate for water, 45.4% paid a "constant" rate proportional to the amount used, and only 23% paid an increasing block rate, whereby the rate increases as consumption increases. The use of declining block rates, whereby the rate decreases as consumption increases, has diminished considerably to 7.9% of residential users (down from 24% in 1991). Overall, there has been a trend to increase metering and volume based pricing. In Canada, pricing has proven to be a very effective incentive for water conservation – for instance, residential water consumption is 70 to 80% higher under flat rates than under volume-based rates.[163]

[155] CIFOR ,2006
[156] Kettunen *et al.*, 2007
[157] Canadian Councils of Resource Ministers, 2010
[158] CIFOR, 2006
[159] Airport subsidies have substantially decreased since the 1994 (when they were estimated by Transport Canada to be $2.3 billion Cdn), as the federal government began privatizing airport management and operations while retaining land ownership. See Transport Canada http://www.tc.gc.ca/eng/programs/airports-policy-menu-71.htm
[160] The nature, extent or even existence of these subsidies is often contested. For an example of an international dispute involving possible subsidies to Bombardier, see: http://csis.org/files/media/csis/pubs/pp0312doh%5B1%5D.pdf
[161] NRTEE, 2010 (Statistics Canada excludes water use from hydroelectric power generation from this figure).
[162] OECD, 2004
[163] Environment Canada, 2008b

In general, whether with regard to residential, industrial or agricultural use, below-cost pricing (when rates do not cover operating and management costs) leads to water over-use and wastage. This can result in falling water tables, reduced availability for other user groups, and damage to the aquifer itself (through, for example, salt water intrusion and increased pollution). Reforming water subsidies is increasingly urgent in the light of climate change: by 2050, the Intergovernmental Panel on Climate Change projects that the area of land subject to increasing water stress will be more than double the land with decreasing water stress.[164] In southern Canada, for example, the frequency and severity of droughts are predicted to increase – adversely affecting biodiversity (and people).[165]

Energy

Canada is the fifth largest energy producer in the world, and one of the greatest energy consumers on a per capita basis. Reforming Canadian policy on energy subsidies can significantly decrease Canada's contribution to climate change, as well as other environmental impacts. The fossil fuel industry, in particular, is among the most heavily subsidized economic sectors globally, through direct payments, tax breaks, or support for research and development.[166] These subsidies, in addition to increasing consumption, can also "lock-in" inefficient technologies and practices in energy-intensive industries.

The combustion of fossil fuels is not only the primary source of greenhouse gases, but also of acid rain and smog. Coal is the least efficient fossil fuel in terms of total carbon emissions per unit of energy, and the most polluting, followed by oil and natural gas.

Energy production can also leave a very large ecological footprint. The extraction and processing of oil from the Albertan oil sands is of particular concern; its production is not only more energy-intensive than conventional oil, it generally leaves a larger ecological footprint, in terms of water use, toxic waste, and land disturbance.[167] Coal mining also has many potential adverse environmental impacts, including the release of waste products (such as thorium, uranium and heavy metal contaminants), habitat destruction, and the contamination of waterways due to the formation of sulphuric acid.

Along with other G-20 countries at the Pittsburgh Summit of September 2009, Canada committed to phasing out fossil fuel subsidies that encourage wasteful consumption. Explicitly following up on this commitment, the United States has already proposed in its 2010 budget to eliminate twelve different tax preferences for oil, gas and coal producers. Canada has not yet made similar commitments to cut fossil fuel subsidies, despite reported recommendations from the Finance Department to do so.

From 1996 to 2006, Canada provided over $1 billion per year in subsidies of various kinds to the oil and gas industry. Recently, to its credit, the federal government has begun to

[164] IPCC, 2007
[165] Parry ML, *et al.*, 2007
[166] International Energy Agency, 2008
[167] Timoney and Lee, 2009

reduce these subsidies, including phasing out generous tax breaks for oil sands producers. Still, significant subsidies remain, including:

- preferential tax depreciation rates for oilsands leases and the intangible costs of building oilsands mines
- the Canadian exploration expense for the costs of determining the existence, location, extent or quality of the resource, and which is deductible at a rate of 100% in the year incurred;
- the Canadian development expenses, which is deductible at a rate of 30% a year (and includes the costs of acquiring a mineral property and the right to explore for oilsands projects, which are classified as a part of the mining sector, and which would otherwise be deductible at only 10% per year if considered a part of the conventional oil sector);
- flow-through shares, which function as a tax shelter allowing mostly non-taxable junior companies to sell unused tax deductions from Canadian exploration expenses and Canadian development expenses to investors; and
- accelerated tangible capital costs allowances for mining (including coal mining, though the 2007 Budget announced that these will be phased out for oilsands by 2015).[168]

The International Institute for Sustainable Development's Global Subsidies Initiative recently conducted a detailed study of fossil fuel subsidies provided by the federal government and by Alberta, Saskatchewan and Newfoundland and Labrador. Published in October 2010, the study identified over 40 subsidy programmes, totalling $2.84 billion in 2008 alone[169], consisting predominantly of preferential tax treatments and investment incentives for exploration and drilling.

It should be noted that not all of the subsidies to oil, gas and coal sectors are environmentally negative. For example, the federal and Alberta governments have provided $3 billion in recent years to support research and development to advance carbon capture and storage technology, which could greatly reduce the greenhouse gas emissions from fossil fuels.[170]

However, even the production of energy from non-fossil fuels can cause substantial damage to the environment. Subsidizing them as alternatives to fossil fuels should therefore be done with caution, as their environmental impacts could be significant. For example, hydroelectric dams can flood large areas of land, resulting in the loss of wildlife habitat and reducing biodiversity[171] as well as causing the release of naturally occurring methane and mercury. Uranium mining and nuclear power generation create radioactive waste, as well as the risk of large scale irradiation from a nuclear accident. Wind energy can harm biodiversity and bird-life, though the extent of this harm is highly dependent upon location of the turbines.[172] Subsidies to bio-fuel production or consumption encourage land use

[168] See, Memo from the Deputy Minister of Finance to the Minister. Online: http://pubs.pembina.org/reports/department-of-finance-subsidies-memo.pdf
[169] IISD, 2010
[170] Rennie, S., 2010, online: http://ca.news.yahoo.com/s/capress/101107/national/carbon_taxes
[171] McAllister 2001
[172] UNEP, 2005; Drewitt and Langston 2008

changes in Canada and internationally that not only can destroy habitat in biodiversity-rich areas, but can even increase net greenhouse gas emissions.[173] Although it is crucial to explore new sources of energy, subsidies to renewable energy must be examined from more than just a climate change perspective.

4.3 Reforming Subsidies: The Way Forward

Challenges to Reform

Policymakers should anticipate resistance and other challenges in undertaking subsidy reform. Firstly, subsidies can serve multiple policy objectives simultaneously. For this reason, care must be taken to assess the social and economic impacts of reforming or removing an environmentally harmful subsidy, and if some of these are negative, then the new policies should be designed to mitigate or eliminate those impacts. For example, a phase out of a subsidy on home heating oil should consider the effects on poor families who heat with oil. (In some cases, however, the subsidy is not well-targeted and the reform itself could lead to *more* equitable or otherwise positive social and economic outcomes.)

Secondly, the benefits of subsidies are often concentrated in the hands of a small group with considerable lobbying power to resist any reforms, while the economic and environmental costs are dispersed across the population and into the future.[174] Examples of efforts to remove perverse subsidies in Canada are shown in the table below.

Examples of Efforts to Remove Perverse Incentives in Canada			
Promoter	**Program/ initiative**	**Targeted Ecosystem**	**Targeted activity**
Federal	Removal of excise tax exemptions for bio-fuels	agricultural lands, forests, wetlands	Agriculture, Forestry, Oil, Nature Protection, Species Management
	Prohibition of the deduction of environmental fines and penalties	all	
	Intergenerational Transfers of Commercial Farm Woodlots	forests	
	Phase out of capital gains tax exemption for oil sands	forests, wetlands, waters	
	Limited reform of agricultural subsidies (reducing the proportion of support directly tied to production)	agriculture lands	
	Abolishment of the *Western Grain Transportation Act*	agriculture lands	

[173] Gibbs, 2008; Searchinger *et al.*, 2008; Fargione *et al.*, 2008
[174] OECD, 2002

Overcoming Resistance: Arguments for Reform

By demonstrating that reforming ecologically harmful subsidies is beneficial to the Canadian population as a whole, can reduce deficits, and that unintended side effects can be alleviated, policymakers can garner public support and overcome much of the resistance to change. Beyond the intrinsic value of nature, the importance of natural capital and ecosystem services to Canada's present and future well-being must be acknowledged.

Enhancing the transparency of subsidies can shed light not only on their environmental impacts, but also on their effectiveness in achieving their stated goals. Greater public awareness of the use or misuse of taxes can be a powerful driving force for change. Newly available funds from phased-out subsidies can fund alternative policies that target the original objectives of the subsidy more cost effectively.

However, environmental arguments should not be used to disguise other motivations for subsidy reform or removal, which could be political, fiscal, or economic in nature. Environmental goals can become contentious if they are (wrongly) blamed for unpopular cuts to subsidies. For the same reason, where subsidy reform *is* undertaken for environmental reasons, care should be taken to minimize or avoid adverse impacts on vulnerable sectors of society. Environmental goals should be undertaken in concert with, rather than at the expense of, social goals.

The following table can serve as a guide for policymakers wishing to undertake environmentally harmful subsidy reform.

Developing a road map for reform: a checklist for policy-makers

Is there a subsidy causing damage to ecosystems and biodiversity?

1. **Is there harm to the environment?**
2. **Is there a subsidy in place that contributes to environmental damage?** (e.g. by influencing consumption, production levels) and if so, what is it?
3. **Does it lead to significant or potentially excessive resource use?** e.g. water use leading to loss from aquifers; thresholds crossed (e.g. salination of aquifers); social impacts from reduced resource availability.
4. **Does it actually harm the environment or do 'policy filters' avoid such pressure/damage?** Consider wider policy scenarios, regulations (e.g. quotas) and enforcement/legality of activities.

Should the subsidy be the target of reform?

5. **Does the subsidy fulfil its objectives (social/economic/environmental)?** If not, it needs reform.
6. **Does the subsidy lack an in-built review process and has it been in place for a long time?** If so, it is likely to need reform (i.e. it has already locked in inefficient practices).
7. **Are there public calls for reform or removal or calls to use the funds for other purposes?** This is often an indicator for Points 8 and 9.
8. **How does the subsidy distribute social welfare?** If there are equity issues, it might be worth reforming it.
9. **Do any of the subsidy impacts lead to social or other economic losses?** e.g. tourism loss following over-fishing.
10. **Are there alternative less damaging technologies available which are hindered by the subsidy's existence of the subsidy?** If so, the subsidy might be slowing innovation and creating technological 'lock in'; reform could bring benefits.
11. **Does it offer value for money?** Where there is still a valid rationale for the subsidy, could the same or less money be used to achieve the same objectives with lesser environmental impacts?

Reform scenarios (if subsidy reform has been identified as bringing potential benefits):

12. Would the reform be **understandable for policy-makers and the public**?
13. Consider **what the reform would entail** (measure changed and compensatory measures). It is rarely a simple case of 'getting rid of the subsidy altogether'.

14. Assess the costs and benefits of potential reform in more detail:

- potential **environmental benefits**: include thinking on benefits in other countries and secondary effects, which can be perverse;
- potential **economic costs**: e.g. national (tax, GDP, etc), sector-wide, for winners and losers within the sector (including new entrants/future industry), for consumers/citizens (affordability);
- potential **social impacts**: e.g. jobs, skills, availability of goods/services, health;
- potential **competitiveness and innovation benefits**
- potential **ethical benefits** e.g. as regard fairness of income, appropriateness of support, links to future generations;
- is the reform **practical and enforceable**?

To identify the likelihood of success and whether it is worthwhile using political capital for reform, the following questions can be useful to set priorities for the road map.

Is there a policy/political opportunity for action?

15. Is there a window of opportunity? e.g. policy review process, evaluation, public demand?
16. Is there a potential policy champion?
17. Will there be sufficient political capital for success?

These questions can be answered at different levels. A quick scan can help develop the overall picture, but more detailed analysis is needed to clarify the details, identify what should be the exact nature of the reform and support the call for subsidy reform.

Source: TEEB, 2009

Some specific actions can be taken immediately. Focusing on the short term, Canada could:

- establish transparent and comprehensive subsidy inventories;
- assess their effectiveness against stated objectives, their cost efficiency and their environmental impacts; and
- develop prioritized plans of action for subsidy removal or reform, based on the results of these assessments.[175]

By reforming or removing environmentally harmful subsidies, Canada can remedy the present illogical situation whereby public funds are being spent in a way that destroys natural capital, resulting in a two-fold financial loss, as well as potentially irretrievable loss of biodiversity. Instead, we could move toward a more coherent policy that harmonizes social, economic and environmental goals, while reducing public expenditures.

[175] TEEB, 2009

5. Criteria for Selecting and Adopting Economic Instruments

There are several ways to assess the applicability of a given EI to a particular conservation or biodiversity problem. First, standard policy assessment criteria often are used to accept or reject alternative management tools (instrument choice). Secondly, the political economy must be considered. Lastly, institutional demands and governance structures also are highly relevant. Each of these areas is discussed below.

The choice of an EI will depend not only on the environmental objective, but also on cultural, social, financial and political considerations. Some instruments may be environmentally effective, economically efficient in theory, but administratively impractical or politically difficult to implement. The following set of policy assessment criteria may be useful in identifying the merits and shortcomings of a proposed EI:

- *Conservation Effectiveness:* Does the instrument effectively achieve a given conservation or environmental services provision target? Relevant questions to explore are: whether such an instrument has been tried before in Canada or internationally, whether similar results could be expected in the new jurisdiction, whether a change in scale could affect results, whether differences in local conditions (e.g., biotic, social, economic, cultural) may present new challenges that could affect the outcome, and whether it is an appropriate instrument considering its likely social and economic impacts.
- *Economic Efficiency*: Will the EI achieve its stated goals at equal or less cost than other measures? To evaluate this criterion, implementing, monitoring and compliance costs must be considered, in addition to any actual funds for payments (for PES). The cost effectiveness of EIs varies widely,[176] but they generally perform better than traditional regulatory approaches – often significantly so. For example, the U.S. Acid rain emission trading program achieved its SO2 reductions at approximately 50% lower cost than through traditional command and control regulation.[177]
- *Innovation:* Do the EIs promote innovation and learning-by-doing, so that costs of protecting an ecosystem service are reduced over time? Higher charges for water, fossil fuels or natural resources, for example, would encourage the development of more efficient behaviour and technology. There is a fairly large body of literature indicating that market-based environmental regulations are generally one of the most effective ways to promote eco-innovation (although this will vary based on specific conditions).[178]
- *Distributional Impact*: Can policies be designed to improve equity outcomes, or at least be equity neutral? (Distributional impact analysis can be complex). Environmentally favourable outcomes should not be seen to conflict with social objectives. For example,

[176] Market-based instruments are generally amongst the most cost effective EIs. However, this may not be the case if there is a need to create new significant administrative structures. See Campbell, I., 2010
[177] D. Ellerman *et al.*, 2003; C. Carlson *et al.*, 2000
[178] Ambec *et al.*, 2010

water or carbon taxes (like other consumption taxes) may have disproportionate effects on low-income citizens, yet these can be eliminated by charging little or nothing for low levels of consumption, or by providing tax refunds based on income or other factors. One of the advantages of EIs is that they can be flexible enough to achieve several goals simultaneously.

- *Stakeholder Participation and Support:* EIs need to be properly communicated to relevant stakeholders in terms of their likely multiple impacts. Based on the feedback, governments should assess whether the particular instrument being proposed is appropriate culturally, socially and economically. Environmentally, the instrument also could be improved by local knowledge of ecosystem services, as well as by an understanding of local customs and preferences. While EIs have many strengths, without proper consultation and informed design, they can sometimes heighten community tensions, offend local sensibilities, or result in other undesirable outcomes. Ensuring stakeholder input and broad (though not necessarily unanimous) approval of the instrument greatly increases its chances of success.
- *Administrative Feasibility*. EIs can have very different administrative requirements. Indeed, research and experience show that there are fundamental differences in administrative structures required to implement different types of EIs.
- *Political Factors:* There may be real political hurdles that constrain the adoption of an EI. These factors include the approval or resistance of powerful entities in the jurisdiction, public perception of the program, and electoral considerations. For example, new taxes are generally unpopular politically (although recycling of revenue can mitigate this). Another issue to address is jurisdiction. EIs for agriculture must deal with multiple governing bodies that have authority over land use, including environment, natural resource and zoning departments, and municipalities.[179] Political challenges need to be acknowledged, but should not impede implementation if the instrument is desirable on the basis of all the other criteria.
- *Complementarity:* An EI often can work with existing systems or mechanisms, and indeed may increase overall effectiveness or efficiency. EIs are rarely implemented in isolation and typically work best when they complement other approaches, such as information and communications measures.

Other factors in instrument choice can include considerations related to precedents, experience (in program design and delivery), jurisdiction and governance structures. As such, in future research and policy analysis, a political economy approach could provide a useful lens through which to view and assess the application of EIs in Canada. Experience has shown that EIs that are nested within existing institutional structures or mechanisms tend to be easier to implement.

This lesson has obvious implications. EIs that require significant new administrative structures and high governance demands can prove difficult to implement. A classic example is an emissions trading scheme, which usually requires extensive administration

[179] Campbell, I., 2010.

(to set baselines and oversee trading), whereas tax or fee-based regimes often require far less. The institutional demands of various EIs can also be organized according to their performance and functionality.

The chart below starts with the purposes of various types of EIs, and shows the different types of administrative structures, and levels of administrative burden, required for each (generally speaking). The following three *functions*, shown below, follow a continuum from providing little or no ES benefits to providing significant improvements for ecosystem services:

- The *financial function* usually provides the lowest amount of ecosystem services benefits, and is often related more to raising revenue and less towards supply of ecosystem services. Hunting licenses would be a good example, where a fee is paid but it is typically unrelated to the conservation of biodiversity or supply of ecosystem services.
- The *environmental incentive function* normally provides more significant ecosystem service benefits; the aim is usually to change behaviour, so generally the price is set at levels more closely aligned to the cost of changing behaviour (or adopting alternative practices) and less to the marginal value of the targeted ecosystem services. Most payments for ecosystem services programs, or environmental taxes, fall under this category.
- The *environmental cost function* typically seeks to motivate the greatest behavioural change, by charging (or paying) the marginal value of the ecosystem services provided by the EI. A prime example is when a company is ordered to pay the full cost of environmental damages it has caused. Canada's Environmental Damages Fund, which is used to repair environmental damage, is a good example.

Notably, as one moves towards the environmental function (left to right on the table below), or towards full-cost accounting, not only does the incentive to change behaviour increase, the technical and administrative demands of design and implementation also increase (normally). The skills required to value environmental damages or the benefits from compensation in a payment for ecosystem services scheme are high.

Administrative Structures Required by EI

Administrative burden being low (✓), medium (✓✓) or high (✓✓✓)

	EIs using Existing Administrative Structures					*Innovative EIs with New Administrative Structures*		
Primary purpose:	**Financial Function**			**Environmental Incentive Function**				**Environmental Cost Function**
Type of EI:	**License Fees**	**Broad Subsidies**	**Targeted Subsidies**	**PES**	**Resource Extraction Fees**	**Green Taxes**	**Quantity Trading**	**Damage Assessment**
EI Program Design Phase								
Legislative basis and legal	✓	✓	✓	✓	✓	✓	✓✓	✓✓
Rules and regulations	✓	✓	✓✓	✓✓	✓✓	✓✓	✓✓✓	✓✓
Valuation and economics				✓✓	✓	✓✓	✓✓✓	✓✓✓
Consultation	✓	✓	✓	✓	✓✓	✓✓	✓✓✓	✓
Dedicated Staff	✓	✓	✓	✓✓	✓✓	✓✓	✓✓✓	✓✓✓
Technology Assessment		✓	✓	✓	✓	✓	✓	
EI Program Implementation								
Technology Assessment		✓	✓	✓				
Revenue billing and collection	✓	✓	✓	✓	✓	✓	✓	✓
Enforcement	✓	✓	✓	✓	✓✓	✓✓	✓✓	✓✓
Monitoring and Auditing	✓	✓	✓	✓	✓✓	✓✓	✓	✓✓
Communication and public outreach	✓				✓	✓✓	✓✓	
Management and Boards						✓	✓	
Dedicated Staff		✓	✓	✓	✓✓	✓✓	✓✓	✓✓✓

Source: Sawyer, D. *et al.* 2005.

6. Conclusion: Better Integrating Economic Instruments into Canada's Policy Toolkit

This report has reviewed the experience with nearly 40 EIs in operation across Canada, as well as selected examples of their use abroad. While EIs are not a panacea for all problems, the evidence indicates that, when properly applied, they can provide several potential benefits, including: achieving biodiversity goals in a cost-effective manner, driving eco-efficiency and innovation, promoting more productive use of natural capital, and discouraging resource waste and inefficiency – without harming (and potentially *enhancing*) competitiveness. And they can be applied in a wide range of ecosystem settings – from private woodlots and ranches, to public forests, lakes and rivers. Such market-based measures, if well designed, can advance both environmental and economic goals, while addressing equity concerns. They are often most effective when used as part of a mix of policy tools.

Based on a review Canadian and international experiences, this report offers the following recommendations to support efforts to strengthen and expand the application of EIs in Canada:

1. **Increase the use of EIs to provide incentives for conservation of biodiversity and ecosystems:** While some successful examples of EIs already exist in Canada, there is potential for a much greater use of such instruments to promote the conservation of biodiversity and ecosystem services, and more productive use of natural capital. The fact that Canada lags behind most OECD countries in the use of EIs suggests that it is not taking full advantage of their potential benefits (a point that is emphasized regularly by the OECD). As a first step, it is important to assess *why* Canada is making relatively little use of EIs. While answering this question is beyond the scope of this survey paper, several possibilities could be considered.

    - New Instruments: The *Cabinet Directive on Streamlining Regulation* and its supporting guidelines require departments to consider a mix of instruments, including EIs, for proposed new regulations. If departments are too-rarely proposing EIs, it is important to understand why. For example, it could be that: (i) departments lack expertise and experience with the use of EIs (a common problem), or (ii) Treasury Board reviewers lack expertise or experience with the use of EIs. If an assessment confirms that one or both of these factors exist (or others), then steps could be taken to remedy the situation. For example, Treasury Board could build up its own in-house expertise on EIs (if that is a source of the problem). Alternatively, training courses could be developed for departments to build up their experience and expertise with EIs (if that is a source of the problem). This could be done by Environment Canada alone, or in combination with other departments. Such courses could draw in experts from other countries with greater experience using EIs, such as Australia or the Netherlands.

- Existing Instruments: The Regulatory Impact Analysis Statement process typically does not deal with existing instruments (except where periodic review is mandated). It could be worthwhile to carry out a *review of existing regulatory instruments* to examine where there is potential to achieve greater benefits through the use of EIs (and/or other tools). Such a review could start by prioritizing regulatory situations in which EIs typically would be most effective. One possible framework for identifying such situations is Environment Canada's Qualitative Screening of Management Tools.[180] Such a review could be carried out by Environment Canada alone, or in combination with other departments.

Such a review of existing and potential regulatory opportunities may find, for example, that EIs could be effectively used in situations such as the following (these are merely examples; further analysis is required):

- Species at Risk: An offset approach could potentially be used to help mitigate disturbance of critical habitat (when on-site mitigation is not enough), as has been done under U.S. legislation. In addition, a systematized approach to payments could be developed to provide incentives (or compensation) to land owners/managers who conserve habitat for species at risk. Innovative payment approaches, such as auctions or reverse auctions, could be considered, where ecologically appropriate.
- Water withdrawals: For water bodies under federal jurisdiction, consideration could be given to charging increased fees for water use and withdrawal, to promote greater water conservation.
- Migratory birds: The problem of forestry (and other) activities that disturb migratory bird nests and habitat is an ongoing regulatory challenge. If the goal is to achieve certain bird habitat disturbance thresholds within an ecosystem, a cost-effective option may be to use an offset system: a user who exceeds the threshold on its land (or management area) could contract with another user to conserve additional habitat in the same ecosystem.
- Fish habitat: Permitting third party offsets and banking, in appropriate circumstances, could allow 'no net loss' goals for fish habitat to be achieved in a more cost effective manner (assuming effective implementation and enforcement).

A review could investigate these and other options for increasing the use of EIs as part of Canada's policy toolkit. Where opportunities are identified, pilot projects could be a useful way to gain experience through learning-by-doing, as a step towards broader reforms.

2. **Review and reduce existing subsidies that provide disincentives to the conservation of biodiversity and ecosystems:** Conduct a systemic review of subsidies of activities that cause adverse effects on biodiversity and ecosystem services. The review should strive to identify such subsidies, quantify their costs, and develop

[180] More general guidance may be found in the Treasury Board document Assessing, Selecting, and Implementing Instruments for Government Action.

options for ways to either reduce subsidies or re-focus them towards more desirable outcomes. In assessing the costs and benefits of existing subsides and potential alternatives, it will be important to use methods that can effectively incorporate environmental values. The 1994 Federal Task Force on Economic Instruments and Disincentives to Sound Environmental Practices could be a useful working model for such a systematic review.[181] Such an exercise offers an opportunity to both enhance natural capital and reduce federal expenditures – a particularly important goal in a time of fiscal deficits.

3. **Develop a TEEB-Canada Report:** Form an independent Canadian Task Force on the Economics of Ecosystems and Biodiversity (TEEB), drawing on a range of experts and stakeholders from inside and outside government. Ideally, this could be done in partnership with provinces and municipal governments (though that is not essential). The task force could collect and review Canadian data and studies on the use of EIs, assess opportunities and challenges (drawing on domestic and international experience), and propose recommendations. As part of the exercise, it could assemble a database of federal, provincial and municipal EIs in Canada, and their effectiveness (building on existing efforts, such as this report).

   Building on the success of the global TEEB study, this Task Force could be used to raise awareness about the importance and value of biodiversity in Canada, and options to better conserve it. It also could provide valuable data to governments. Given Canada's position as the home of the UN Secretariat of the Convention on Biological Diversity, and the importance of nature conservation to Canada's global 'brand' (and that of its resource export industries), such a study could be of significant value and interest.

In sum, conserving nature and its many ecosystem services is a smart investment, not only in Canadians' health and quality of life, but also in laying the foundation for sustainable economic prosperity. The economy of the future is likely to reward countries (and companies) that are low polluting and make productive use of scarce natural capital. Given the increasing array of threats to biodiversity, it is important that governments, resource managers and landowners better understand the real economic value of the life-supporting services provided by nature. There is a growing need for a Canadian dialogue on the role market-based approaches could play in helping us to better manage natural capital and conserve biodiversity – to become wiser stewards of the natural wealth hidden in our forests, wetlands, farms, lakes and cities, and build a greener, stronger economy.

[181] Task Force on Economic Instruments and Disincentives to Sound Environmental Practices, 1994

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Appendix: Examples of Canadian EIs Programs and Policies

Rewarding benefits through payments: Payment for Ecosystem Services and tax breaks (Examples)			
Promoter	**Program/ initiative**	**Targeted Ecosystem**	**Targeted Activity**
Federal	Ecological gifts program	Agricultural lands, forests, wetlands	Agriculture, Forestry, Tourism
	Habitat Stewardship program for species at risk	Forests, wetlands, agricultural lands	
	Subsidy for conservation of water courses and soils	Inland water	Agriculture, Forestry
	Subsidy for forest development agencies	Forests	Forestry
	Subsidy for forest based resources	Forests	Forestry
	Subsidy for reforestation	Forests	Forestry
	Tax-free intergenerational transfers of commercial farm woodlots	Forests	Forestry
Provincial	Alternative Land Use (Prince Edward) Alternative Land Use Services or "ALUS" (Alberta)	Agricultural lands; forests, wetlands	Agriculture, Forestry, Fisheries
	Conservation Land Tax Incentive Program (Ontario)	Agricultural lands	
	Managed Forest Tax Incentive Program (Ontario)	Forests	
	The Riparian Tax Credit (Manitoba)	Inland waters	
	Recreational Access Management Program (RAMP)	Agricultural lands	
Private/ Municipal	Habitat Conservation (Ducks Unlimited Canada)	Wetlands	Agriculture
	Wetland auctions program (Ducks Unlimited) (Saskatchewan)	Wetlands	Agriculture
	Landowner Environmental Assistance Program (ON) (with a municipal partnership).	Inland waters (watershed), forests, agricultural lands	Forestry , other

Setting Prices using market-based instruments (Quantity-Based) (Examples)			
Promoter	**Program/ initiative**	**Targeted Ecosystem**	**Targeted activity**
Federal	Individual Transferable fishing quotas	Marine and coastal	Fisheries, Industry, Forestry
	Transferable fishing quotas	Marine and coastal	
	Fish Habitat Compensation Program (*3rd party offsets or banking not allowed)	Marine and coastal	
	Transferable consumption allowances for degreasing solvents	Inland waters	
Provincial	Tradable Hunting rights (Alberta)	Forests	Hunting, Agriculture, Forestry, Water use,
	Water discharge trading (Ontario – South Nation	Inland waters	

	Conservation Authority)		Carbon emitting activities
	CO2 offsets for forestry and agriculture (Alberta)	Forests, Agriculture	
Private	The Albian Sands Energy's Muskeg River Oil Sands Mine project (voluntary offset)	Forests	Oil Industry

Setting Prices using taxes or fees (Price-Based)			
Promoter	**Program/ initiative**	**Targeted Ecosystem**	**Targeted activity**
Federal	Water permits in National parks	Inland waters	Tourism, Townsites
Provincial	Water abstraction permit fees (BC, NS)	Inland waters	Agriculture, Forestry, Fisheries, Tourism, Carbon Emitting Activities, Hunting
	Charge on discharge (BC, Quebec)	Inland waters	
	Charges on fishing licences (most provinces)	Inland waters	
	Charge for entrance to exploitation zone (Quebec)	All ecosystems	
	Charge for entrance to parks for fishers and hunters (Quebec)	All ecosystems	
	Charge for entrance to wildlife reserves (most provinces)	All ecosystems	
	Charge on agricultural inputs	Agricultural lands	
	Hunting Licences fees (Alberta, BC, Quebec, Saskatchewan)	Mountain, Forests	
	Charge on permit for hunting with snares (Quebec)	Forests	
	Fee on animal trapping (Alberta)	Mountain, Forests	
	Alberta charge for overcutting	Forests	
	Logging Tax (BC)	Forests	
	Carbon tax (B.C.)	All ecosystems	

Removing Perverse Incentives (i.e. Harmful Subsidies)			
Promoter	**Program/ initiative**	**Targeted Ecosystem**	**Regulated activity**
Federal	Removal of excise tax exemptions for bio-fuels.	agricultural lands, forests, wetlands	Agriculture, Forestry, Oil production, Other
	Prohibition of the deduction of environmental fines and penalties	All	
	Intergenerational Transfers of Commercial Farm Woodlots	Forests	
	Phase out of capital gains tax exemption for oil sands	Forests, wetlands, waters	
	Limited reform of agricultural subsidies (reducing amount directly tied to production)	Agriculture lands	
	Abolishment of the Western Grain Transportation Act	Agricultural lands	

Annex

Existing Experience with Economic Instruments for Forests Biodiversity in Canada

Federal Initiatives:

Table 2. What? Ecological gifts program **Where?** Sensitive lands (agricultural lands, wetlands, forests)

Description of the program: This program encourages individual and corporate landowners to protect valuable pieces of nature in perpetuity by donating ecologically sensitive lands (voluntary transfer of property) or a partial interest in their lands (conservation easements, covenants or servitudes), either to: i) environmental charities or ii) government bodies. Donors are eligible to receive income tax benefits in return.
Goal: "The creation of a network of protected areas that reaches across virtually every habitat and region in Canada"
Actors: Individual and corporate landowners (ecosystem service providers), government and charities (beneficiaries)
Service: Ecosystem services provided are not specified
Financing mechanism and method of payment: "tax credit or deduction to donors and a reduction in the taxable capital gain realized on the disposition of the property. Corporate donors may deduct the amount of their gift directly from their taxable income, while the value of an individual's gift is converted to a non-refundable tax credit. Any unused portion of the credit or deduction may be carried forward for up to five years, and 0 percent of the capital gain is taxed instead of the usual 50 per cent." http://www.cws-scf.ec.gc.ca/egp-pde/default.asp?lang=En&n=6C0F56D5-1
Observations:
The program encourages a one-time transaction, leading to a change of ecosystem services provider or land manager (change of owner).

Sources: Canadian Wildlife Service. Online at: http://www.cws-scf.ec.gc.ca/egp-pde/default.asp?lang=En&n=EC1F7288-1; http://www.cws-scf.ec.gc.ca/egp-pde/default.asp?lang=En&n=6C0F56D5-1, http://www.cws-scf.ec.gc.ca/egp-pde/default.asp?lang=En&n=6E9B56B5&offset=2&toc=show

Provincial initiatives:

Table 3. What? Managed Forest Tax Incentive Program (Ontario)	**Where?** Forests (private lands)

Description of the program: This program encourages landowners who own 4 hectares or more of forest of certain characteristics (e.g**.,** 1,000 trees of any size per hectare) to carry out specific management activities and to prepare and follow a Managed Forest Plan for their property. Some of the management activities approved under this program include: tree planting or harvesting; recreational activities such as hiking, skiing or hunting; wildlife management involving habitat work or participating in monitoring programs; protecting environmentally sensitive areas by limiting disturbance; and learning about the forest. Under this program the property is reassessed and classified as Managed Forest, and is eligible for a tax reduction.
Goal: To encourage the stewardship of Ontario's private forests
Actors: Landowners of forest lands, Ontario's Government, The Ontario Woodlot Association and the Ontario Forestry Association
Service: Not specified
Financing mechanism and method of payment: Property reassessed as "Managed Forest" is taxed at 25 percent of the municipal tax rate set for residential properties. A Five-Year Progress Report must be submitted by July 31st of the fifth year of the agreement. MNR audits include field visits that can take place at any time.
Sources: Ministry of Natural Resources Ontario "Land Stewardship Programs"

Removing Perverse Incentives

Federal Initiatives:

Table 4. What? Intergenerational Tax Free Transfers of Commercial Farm Woodlots	**Where?** Forest

Description of the program: This program defers the capital gains tax on the transfer of woodlots from one generation to another. Before the establishment of this incentive, the new owners would often pay the inheritance tax (capital gains) by harvesting the timber on the woodlot. This tax became therefore a perverse incentive, encouraging landowners to harvest.
Goal: By allowing the capital gains tax to be deferred in cases where harvesting could be profitable, this program aims to prevent harvesting decisions that are not based on sound forest management.
Actors: Commercial farm woodlot owners, government
Service: Not specified
Financing mechanism and method of payment: Tax savings/tax deferral

Sources: Woodlot Info Shop (WISh). Online at: http://www.woodlotinfoshop.ca/currentissues.asp?cmPageID=178

Existing Experience with Economic Instruments for Agricultural and Lands Biodiversity in Canada

Rewarding benefits through payments: Payment for Ecosystem Services and tax breaks

Provincial initiatives:

Table 5. What? Alternative Land Use (Prince Edward)	**Where?** Agricultural lands, wetlands, riparian zones

Description of the program: This program was aimed to protect or enhance the provision of ecological goods and services. It focused on aspects such as the value of wetlands in purifying water; the value of riparian buffer zones in filtering soil and other contaminates from run-off entering watercourses; and the value of natural areas in providing fish and wildlife habitat. In this program, "Applicants sign an agreement to receive financial compensation annually to move land from agricultural production or to establish/maintain beneficial management practices that protect soil and water quality or improve fish and wildlife." These activities include: i) retiring sensitive land (expanding buffer areas, establishing non-regulated grassed headlands, and retiring high-sloped lands), ii) taking land out of production, and iii) maintaining livestock fences adjacent to water courses and wetlands.
Goal: To reduce levels of soil erosion/stream siltation, improve water quality and enhance wildlife habitat
Actors: Landowners or farmers who own or lease agricultural lands
Service: water purification, soil filtration/ regulation, wildlife.
Financing mechanism and method of payment: Annual compensation/ payment. First payment is granted after the signature of the agreement between the parties. Subsequent payments are received once a year. They are subject to audits to verify compliance.
Observations: This initiative possesses several characteristics of a PES program: agreements are voluntary; there is at

least one seller and at least one buyer; the ecosystem services provided and/or purchased are specified; and payments are made after verifying of compliance.

Sources: ALUS Guidelines. Online at: http://www.gov.pe.ca/photos/original/af_alusguide.pdf

Table 6. What? Alternative Land Use Services or "ALUS" (Alberta) **Where?** Agricultural lands (private lands), wetlands, riparian buffer areas, forests

Description of the program: ALUS pays producers to provide ecosystem services and public goods, such as clean air, water and wildlife from their land . It was developed "in response to increasing public demands for ecological goods and services, such as wildlife habitat, clean air and water, habitat for at-risk wildlife species and other natural benefits." http://www.deltawaterfowl.org/media/pr/2010/100120-ALUSCanada.php Under this program farmers "provide ecological services in addition to food and fibre."
Goal: "To protect and restore wetlands, put in buffers along creeks and waterways to improve water quality and enhance fish habitat, plant native grasses around wetlands and in the uplands for bird-nesting habitat, re-introduce flowering plants for native pollinators, and improve habitat for grouse and other species along shelterbelts, and in restored, natural areas." (Daryl Watt)
Actors: Providers include farmers, ranchers and hunters. Buyers and brokers include governments, farming and ranching organizations, conservation groups and others.. Among the current partners of the program are: the Alberta Conservation Association, Alberta Sustainable Resource Development, County of Vermilion River, Cows and Fish, Delta Waterfowl, and Wildlife Habitat Canada.
Service: Clean air, water and wildlife.
Sources: http://www.deltawaterfowl.org/media/pr/2010/100120-ALUSCanada.php. Also see « Alternative Land Use Services (ALUS) Demonstration Project in the County of Vermilion River (CVR), Alberta 2009-10." Online at: http://whc.villagecms.com/en/conservation-projects/alberta/alternative-land-use-services-alus-demonstration-project-2009-10

Table 7. What? Conservation Land Tax Incentive Program (Ontario) **Where?** Agricultural lands (private lands)

Description of the program: This program encourages the protection of Ontario's provincially significant conservation lands (determined by the Ministry of Natural Resources) by providing property tax relief to landowners who agree to carry out specified activities to conserve the natural heritage values of their properties. Landowners participating in this program retain full ownership and property rights.
Goal: "To recognize, encourage and support the long-term private stewardship of Ontario's provincially significant conservation lands."
Actors: Landowners of provincially significant conservation lands and the Government of Ontario.
Service: Not specified
Financing mechanism and method of payment: A 100 percent tax exemption on the eligible portion of the property. The owners of these lands are sent an application during the summer prior to each new tax year.

Sources: Ministry of Natural Resources Ontario "Land Stewardship Programs"

Table 8. What? Recreational Access Management Program (RAMP) **Where?** Private Lands

Description of the program: "The Recreational Access Management Program (RAMP) is a three-year (2009-12) private lands hunting and fishing access and habitat stewardship program, funded by Alberta Sustainable Resource Development. "It is being piloted in Wildlife Management Units (WMU) 108 and 300 in the southwestern corner of Alberta." (Government of Alberta) It encourages "recreational hunting and fishing access opportunities". Landowners will enter into three year agreements, which are annually reviewed. These contracts can be cancelled by both: the landowner voluntarily, and the government of Alberta if the commitments adopted by the landowners were not complied with. http://www.srd.alberta.ca/FishingHuntingTrapping/RecreationalAccessManagementProgram/documents/RecreationalAccessManagementProgram-July2009.pdf
Goal: To create an access management partnership (and balance) between landowners and hunters and anglers, improve public recreational hunting and fishing access opportunities on private land; provide assistance to landowners to enhance working agricultural landscapes that provide quality habitat and hunting and fishing opportunities; Create a web-based system for hunters and anglers seeking information on recreational opportunities on private lands; Provide landowner incentives for maintaining and enhancing wildlife habitat and for offsetting the impacts of providing public

hunting and fishing; reduce landowner and user access conflicts on private lands; improve management of wildlife habitat on private lands. (Source: Government of Alberta)
Actors: Government of Alberta, landowners and companies owning 500 deeded acres or more, hunters and anglers.
Service: Recreational hunting and fishing access opportunities/Improvement of wildlife and fish habitat.
Financing mechanism and method of payment: Technical assistance, and incentive payments will be paid to the landowners based on the following aspects: i) Quality and quantity of recreational hunting and angling opportunities, ii) health of riparian and rangeland habitat and use of wildlife habitat practices. This program has two types of payments: i) Habitat Stewardship payments (to encourage stewardship), and ii) Access impacts payments (to offset the cost of hunter and angler access impacts). Payments will be made proportionally to each person or corporate entity named on the land title."

Sources: Government of Alberta, Sustainable Resource Development "The Recreational Access Management Program." Online at http://www.srd.alberta.ca/FishingHuntingTrapping/RecreationalAccessManagementProgram/Default.aspx, http://www.srd.alberta.ca/FishingHuntingTrapping/RecreationalAccessManagementProgram/documents/RecreationalAccessManagementProgram-July2009.pdf

Existing Experience with Economic Instruments for Wetlands Biodiversity in Canada

Rewarding benefits through payments: Payment for Ecosystem Services (PES) and tax breaks

Private Initiatives:

Table 9. What? Habitat Conservation (Ducks Unlimited Canada) **Where?** Wetlands

Description of the program: This program focuses on threatened wetlands. It includes: i) wetland rehabilitation, and ii) wetland protection through conservation easements, donation or purchase. Under conservation easements, landowners either sell or donate certain interests on their land, while retaining "the ownership and use of the land (and its earning capacity)". Landowners can receive tax benefits if the conservation easement is donated to the qualified conservation organization of their choice. Conservation easements can be purchased by the government or a conservation organization. Individuals can also donate a conservation easement.
Goals: To protect Canada's wetlands.
Actors: Landowners, Ducks Unlimited, other conservation organizations.
Financing mechanism and method of payment: Direct payment or tax reduction
Observations:
- One-time payment (for purchases), Tax reduction (donations).
- Ecosystem services sold are not specified

Sources: Ducks Unlimited Canada. Online at: http://www.ducks.ca/aboutduc/how/conserve.html

Table 10. What? Wetland restoration pilot project: reverse auctions program (Ducks Unlimited Canada- Saskatchewan) **Where?** Wetlands

Description of the program: This is a project led by the Assiniboine Watershed Stewardship Association (AWSA), with Ducks Unlimited Canada (DUC) and the Saskatchewan Watershed Authority as partners. It uses reverse auctions as a mechanism to protect wetlands. In the project, rather than bid on items as in a typical auction, "landowners act as sellers, and place bids on what they feel the restoration of the wetland in their field or pasture is worth to them."
"The pilot project began with a communication campaign targeted at landowners introducing them to the concept of the reverse auction and to place bids. The AWSA is now meeting with interested landowners to discuss which wetlands they would like to see restored, and to encourage bidding. The partners hope to begin assessing land and finalizing agreements this winter, with Ducks beginning restoration activities between spring and fall 2009."
Goals: To restore 56,000 individual wetland areas in the next 20 years.
Actors: Assiniboine Watershed Stewardship Association (AWSA), with Ducks Unlimited Canada (DUC) and the Saskatchewan Watershed Authority as partners and landowners as services providers.

Sources: DUC. Online at: http://www.ducks.ca/aboutduc/news/archives/prov2008/081112.html

Existing Experience with Economic Instruments for Marine and inland water Biodiversity in Canada

Rewarding benefits through payments: Payment for Ecosystem Services (PES) and tax breaks.

Provincial Initiatives:

Table 11. What? The Riparian Tax Credit (Manitoba) **Where?** Inland Waters

Description of the program: This program recognizes farm operators who take actions to improve the management of lakeshores and river and stream banks. Agricultural and livestock producers across Manitoba who voluntarily commit commitment to protect a strip of agricultural inland (which is suitable for cropping and has been used as crop land in the past; or which is suitable for grazing and is adjacent to current grazing land), receive a credit if they commit to protect the inland for a five-year period (wetlands are not eligible). Some of the protection activities undertaken by landowners include:

i) setting up a livestock exclusion zone 100 feet wide along each side of the lake or waterway;
ii) maintaining permanent fencing to separate grazing livestock from land in the exclusion zone,
iii) not carrying out agricultural activities within the exclusion zone (on former grazing lands).

Goals: This program aims to encourage farm operators to upgrade their management of lakeshores and river and stream banks (mostly to prevent soil erosion and to improve water quality).

Actors: Agricultural and livestock producers across Manitoba, who have a lake or waterway running through their property, and the province of Manitoba.

Financing mechanism and method of payment: "The basic tax reduction is paid on acreage within the 100-foot strip along the waterway." http://www.gov.mb.ca/finance/tao/pdf/riparian/info_for_taxpayers.pdf

Observations:

PES characteristics are present:

- The payment through tax reduction is done once a year.
- Compliance is verified
- The services purchased are well identified (activities intended to achieve water quality, and to prevent soil erosion)
- Actors of the scheme (Buyer, seller or service provider) are well identified

Sources: The Riparian Tax Credit: Information for taxpayers. Online at: http://www.gov.mb.ca/finance/tao/pdf/riparian/info_for_taxpayers.pdf