SUSTAINABLE FOREST MANAGEMENT NETWORK

RÉSEAU DE GESTION DURABLE DES FORÊTS

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Ecosystem Service Valuation, Market-Based Instruments, and Sustainable Forest Management: A Primer

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Ecosystem Service Valuation, Market-Based Instruments, and Sustainable Forest Management: A Primer

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1.0 Introduction

A major issue facing land managers including forest companies is that many of the environmental benefits and costs associated with their land use decisions are not reflected in their incentives. For example, forest companies currently receive little or no monetary reward for incorporating ecological values into land management plans; in fact, they often incur costs and meet resistance from shareholders. To maintain public benefits from land management practices it is important that there be incentives encouraging the provision and protection of ecosystem goods and services. The concept of maintaining natural capital to provide ecosystem goods and services is receiving widespread support from governments and the public; however several challenges remain in implementing this approach broadly.

Market-based instruments are policy tools that use financial incentives to maintain and enhance natural capital.

There are many values associated with forest ecosystems. Some are bought and sold on markets while many are not. This introduces the need for ways to measure, value, and make tradeoffs between the value of forests for commodities such as timber and energy versus non-market values for recreation, water retention and filtration, and wildlife habitat. Since non-market services have traditionally not been valued in the market-place, we need new policies and incentives that incorporate the values of natural capital into the bottom line or profits of companies and shareholders. Market-based instruments are policy tools that use financial incentives to maintain and enhance natural capital.

This document provides an overview of the state of knowledge with respect to measurement, valuation, and the application of market-based approaches designed to conserve ecological goods and services in forests. We start with an overview of concepts related to ecosystem services and their economic valuation; such valuation can help inform policy development and support sustainable forest management. We then discuss policy approaches, including various market-based instruments, and note some policy-related challenges. We end with illustrations of how market-based policies can contribute to sustainable forest management in Canada.

2.0 Ecosystem services (ES) and their valuation

2.1 Key concepts and definitions

Forest lands and the renewable and non-renewable resources contained within are a stock of natural capital that provides a number of ecosystem services contributing to human well-being. Natural capital includes renewable and non-renewable resources such as minerals and energy, forests, water and fisheries, and ecosystems that provide essential services (Olewiler 2004).

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Ecosystem services (ES) are the benefits people obtain from ecosystems including "provisioning services" such as food and water; "regulating services" such as flood and climate control; "supporting services" such as soil formation and nutrient cycling; and "cultural services" such as recreational, spiritual, religious and other nonmaterial benefits (e.g. Millennium Ecosystem Assessment 2005, Daily 1997, Sanchirico and Siikamaki 2007).

The key concept that distinguishes ES from other environmental objectives is the focus on the direct and indirect human benefits derived from natural capital (Brown et al. 2006). The contribution of services to human wellbeing is fundamental to the definition of ES, and represents a shift in the way ecosystems are considered in policy and by the public.

A number of substitute terms representing the same concept also appear in the literature including "ecosystem goods and services" and "environmental goods and services". In this document we adopt the term ecosystem services based on the standard set by the Millennium Ecosystem Assessment.

The value of ES to society creates a need to maintain the natural capital such as functioning forest ecosystems which support those processes (Brown et al. 2006). Engineered substitutes for natural capital can often replace lost ES flows. For example, if removing the forest surrounding a river results in diminished drinking water quality, it is possible for humans to build a water treatment plant as a substitute.

> **Human-made substitutes for natural capital can be more costly for society to produce than protection of the original ecosystem services (Brown et al. 2006).**

Yet human-built substitutes often require more than just human and physical capital; they often also require additional ecosystem services. In addition, engineered solutions are often targeted at only one kind of ES while degraded natural capital reduces multiple ES. Finally, human-made substitutes for natural capital can be more costly for society to produce than protection of the original ecosystem services (Brown et al. 2006). For example, wetlands provide important services such as flood mitigation and storm surge protection, and the loss of coastal wetlands contributed to the damages associated with 2005 Hurricane Katrina in Louisiana which range in the hundreds of billions of dollars. The costs to replace the lost natural capital range from $17 billion to $50 billion, costs which were not valued in a typical real estate transaction to develop wetlands (Ruhl et al. 2009).

New York City's Watershed Management Program described in Box 1 provides another example where maintaining natural capital is cheaper than investing human-made physical capital.

While markets exist for some ES such as recreation, markets for many ES do not exist for several reasons including (see, for example, Murtough et al. 2002):

- Public good characteristics (including issues related to ownership) that make some ES difficult to market (see Box 2);
- Significant transaction costs (i.e., costs incurred for participating in ES markets due, for example, to few buyers and sellers in the market, and differences in the information available to buyers and sellers about the costs of delivering ES);
- Scientific uncertainty about the benefits or qualities associated with specific ES.

BOX 1

The Catskill watershed (Heal 2000)

In the 1990s, water entering New York City from the Catskill watershed had fallen in quality to the point where a new filtration plant was required. Capital costs for the plant, not including ongoing operating costs, were estimated at $6 to $8 billion. Repairing the watershed, however, was estimated to cost only $1 to $1.5 billion. The decision was clear. The watershed agreement is also believed to have boosted the upstate economy at a rate of $100 million a year, with much of this economic stimulus coming from the following (Kenny 2006):

Increased employment. New York City pays upstate locals to work for the Department of Environmental Conservation. Local contractors are paid to install septic systems, upgrade wastewater treatment plants and set up storm-water-protection measures.

Increased subsides. Farmers receive reimbursements for building fences and bridges that keep livestock away from waterways. Landowners are paid to keep forests undeveloped.

Increased ecotourism. Benefits to local businesses from increased tourism to the area associated with appreciation of the restored natural environment.

BOX 2

Public goods and transaction costs

- A good is a **public good** when its consumption by one individual does not reduce availability for its consumption by others (i.e., non-rival), and when no one can be effectively excluded from benefiting from the good (i.e., nonexclusive). An example of a public good is radio waves.
- **Transaction costs** are the costs incurred in making an economic exchange. An example is the commission paid when buying or selling stocks, or cost of information required for an exchange.

The public goods problem is the most critical "market failure" (inability of markets to provide a socially efficient level of ES). It suggests that even if we had scientific certainty and markets existed with low transactions costs, there would still be an inability to supply ES at the level desired by society because of free riding – people benefiting from ES without paying for them – and the resulting inability of individual entities (people, companies, or other agencies) to capture the full benefits associated with ES.

In theory, functioning markets provide information (through prices and profits) to society about the relative value of goods and services in the economy. Scarce resources can thus be reallocated to their highest benefit use. In the case of the market failures described above, there is a need to use other methods to value ES and incorporate these values into public policy and individual decision making. The purpose of this primer is to describe current methods and challenges for valuation of ES, followed by a discussion of how proxy markets for ES can be developed in order to provide incentives for individuals to account for the value of ES in their consumption and production choices.

2.2 Economic valuation of ecosystem services: an aid to decision-making

The objective of economic valuation is to reliably and objectively inform decision-makers about the full benefits and costs of a particular course of action. It is frequently not enough to know that ecosystems are valuable; it is often necessary to know how valuable they are relative to other outcomes, and how that value may be affected by alternative management actions and to inform trade-off decisions (Pagiola et al. 2004).

Broadly defined, the total economic value of forest-based ES includes "use" and "non-use" values (Heal et al. 2005):

A. Use values

- ***Direct-use values.*** Includes consumptive uses (e.g., harvesting of timber, mushrooms, wildlife, etc.) and non-consumptive uses (e.g., hiking, bird watching);
- ***Indirect-use values.*** Include ecological services that maintain and protect natural and human systems (e.g., maintenance of water quality and flow, flood control and storm protection, nutrient retention and microclimate stabilization, and the production and consumption activities they support).

B. Non-use values

- The value of forest-related ecosystems and their components beyond their current use possibilities (for example, valuing the existence of the forest for its own sake, or for uses of future generations).

In a broad sense, **economic valuation of ES** is the process of assigning monetary values to all ES, whether marketed or not. In practice, it is usually used with reference to ES that are not normally marketed. For instance one definition describes it as

> "(a)ssigning monetary value to environmental factors (such as the quality of air and water and damage caused by pollution) that are normally not taken into account in financial valuation."
>
> (www.BusinessDictionary.com, accessed July 10, 2009)

The terms "**ecosystem service valuation**" **(ESV)** or "**environmental service valuation**" are sometimes used interchangeably with the above. (See www.ecosystemvaluation.org for additional definitions and examples.)

Economic valuation of ES is important for several reasons. It can help establish which ES values individuals think are important and investigate how individuals make trade-offs between alternative ES or between ES and other commodities. It can provide ways to measure the benefits and costs of different policy options that alter ES conditions. In some cases, it can provide data to maintain public support and funding for ES conservation and/or provision. (For further discussion of these points, see Pagiola et al. 2004.) Economic valuation can therefore help policy-makers to:

- set standards and objectives related to ES,
- develop approaches to weigh competing policy issues,
- design incentives that encourage ES provision and protection, and
- evaluate policy outcomes.

Some examples of using ecosystem valuation are given in Box 3.

Despite the lack of a market price for many ES, methods are available to estimate their economic value. In fact, it is their economic value (and not price) that is important for benefit cost analysis and economic assessment.

BOX 3

Examples of policy adoption and corresponding ecosystem service values

1) The Little Bow Project/Highwood Diversion Plan (Alberta Environmental Protection 1994):

Alberta Public Works, Supply and Services and Alberta Environmental Protection jointly proposed a project to improve in-stream flows on the Highwood River while allowing irrigation expansion in the Little Bow River Basin. The policy led to the creation of a storage reservoir and the restoration of a historical lake that had recently remained dry. Ecosystem service values associated with the proposed project were used to show the benefits and costs of the proposed project which justified implementation. For instance the net benefit of the water-based recreation improvements for the region was estimated to be in the range of $0.38 to $0.55 million per year.

2) Conserving natural forest capital in the Lower Fraser Valley of B.C. (Olewiler 2004):

Existing forest areas in the Lower Fraser Valley of British Columbia are estimated to provide $134/ha/year in forest ecosystem goods and service values such as forage, fishing and hunting terrain, wildlife viewing and other forms of recreation. In addition, the value of carbon sequestration services from the forest areas is estimated to range from $150 - $6,080 per ha. These ES values were used to justify the adoption of policies which will conserve areas of natural forest capital in the Lower Fraser Valley.

3) Forest protection policies in Indonesia (Pattanayak and Butry 2005):

In 1993, the government of Indonesia established Ruteng Park on 32,000 ha of tropical forest land. This was done to prevent further deforestation, to initiate reforestation and land conservation, and to enhance watershed protection. The estimated economic value of drought-mitigation services provided to downstream farmers by the protected area is in the range of a $9 - $24 increase in annual agricultural profits per household, in a region where average household earnings are just $780/year.

Economic value is the amount (usually measured in monetary units) an individual would be willing to pay for an improvement in ES, or the amount they would be willing to accept to compensate for a decline in ES.

Economic value is the amount (usually measured in monetary units) an individual would be willing to pay for an improvement in ES, or the amount they would be willing to accept to compensate for a decline in ES (see Heal et al. 2005 for details). The willingness to pay (or willingness to accept) captures the value of the ES in monetary terms facilitating comparison with other monetary estimates of costs, investments required, etc. Note that these are measures of value arising from individual tradeoff decisions and could be captured using other metrics, but the use of monetary measures provides measurements in a common set of units.

Methods for estimating the economic value of ES can be categorized into two main approaches: *(i)* ***revealed preference approaches*** based on observations on what individuals actually give up to enjoy ES and from which we can infer individual preferences or willingness to pay for ES; and *(ii)* ***stated preference approaches*** that use structured surveys to ask individuals to state their willingness to pay for ES directly, or to choose between different levels of ES and other market goods and services.[1] There is increasing confidence in many forms of environmental valuation.

[1] For a detailed discussion of the advantages, limitations and specific techniques characteristic of these two approaches, see Heal et al. (2005).

Conceptual, empirical and methodological challenges remain, however, as discussed in the literature. These must be addressed to ensure effective policy implementation. Such challenges are beyond the scope of this primer. Interested readers should refer to Heal et al. (2005), Pagiola et al. (2004), Pattanayak and Butry (2005), or Adamowicz (2007).

In the absence of explicit valuation information, ES end up being valued implicitly through the choice of policy. For example, a policy that taxes carbon dioxide emissions at $15 per tonne sets an implicit value of carbon sequestration activities at $15 per tonne of CO_2. It is not clear, however, how much carbon can be sequestered at that cost, or what the final greenhouse gas equivalent reduction will be from the policy. In addition, without calibrating the policy through ES valuation, it is unlikely that these implicit values for carbon are equal to the social benefits of greenhouse gas reductions. In other words, the implied values will not account for all of the changes in direct-use, indirect-use, and non-use values associated with climate change. In some instances (such as the greenhouse gas example) where the costs and benefits of a policy approach are contentious or highly uncertain, an implicit or "ad hoc" approach can be used initially to assign a value to an ES; the value can later be adjusted in response to new and better information.

In spite of its importance, two significant challenges hamper the use of ecosystem valuation in policy:

1. Defining endpoints of policy change:

   Selecting a particular ES, or bundle of ES, for consideration presents challenges related to the definition of tangible policy goals or endpoints. Ecological endpoints are "concrete statements, intuitively expressed and commonly understood, about what matters in nature" (Boyd 2007, p. 27).

2. Understanding the impact of policy change on endpoints:

   ES valuation requires defining the scope of ES change associated with a particular policy, including choosing appropriate spatial scales, and selecting the temporal period for analysis.

Gaps in our scientific understanding of ecological processes, lack of data, as well as the implications of bundling different ES together, still present barriers to the definition of such endpoints and understanding the impacts of policy change. Addressing these challenges requires improved communication between the natural sciences (which describe outcomes in natural systems) and the social sciences (which connect natural outcomes to human well-being) (Heal et al. 2005, Boyd 2007).

In summary, economic valuation can help us set priorities or targets for policy. It can also help identify who benefits from ES, and who will provide the funds necessary for ES provision. However, as we will discuss in the next section, economic valuation, while often useful, is not essential for the implementation of market-based policy approaches for ES. We now turn to a discussion of policy options.

3.0 Market-based (economic) instruments and ecosystem service provision

3.1 The role of economic instruments[2]

There is emerging agreement that we can not rely on protected areas alone to preserve and sustain ES on forest lands, especially given finite budgets for conservation (Sanchirico and Siikimaki 2007). We therefore need to also look at the different approaches for maintaining ES on "working" (non-protected or partially protected) landscapes. Policy options related to ES provision fall into several general categories.

The traditional approach to environmental management has been prescriptive **command-and-control (CAC)**, for example, regulation mandating specific production technologies, management requirements, and/or pollution reduction targets. In the case of protection of forest ecosystem health, the government might establish zoning restrictions to prohibit specific land use practices. At present the vast majority of ES policies in Canada are of the CAC type.

Recently there has been a movement away from prescriptive approaches towards more decentralized outcome based management, which gives firms the flexibility to determine how to manage for environmental objectives. Market-based instruments (MBIs) are incentive policies that have been increasingly used to give this flexibility to firms.[3] MBIs operate through the financial incentives of the firms to reward (or penalize) decisions based on their environmental outcome. The common element is a desire to change the behaviour of land users by altering the structure of incentives they may consider (Pagiola et al. 2004, UNEP 2004). Because they have the ability to incorporate ES values directly into the incentives of decision makers, MBIs help address the problem of missing markets for ES. MBIs include a range of policy tools, from pollution taxes and tradable permits to direct payments for private conservation efforts. MBIs can be either regulatory (e.g., environmental taxes or tradable permits schemes) or voluntary (e.g., payments for ecosystem services). Some examples of existing MBIs are highlighted in Box 4.

Instrument choice: some considerations

In theory and in practice market-based approaches can be a cost effective means for solving problems (e.g. Tietenberg and Johnstone 2004). Compared to CAC regulation, MBIs reduce compliance costs by allowing producers to allocate reductions in pollution and/or resource extraction to areas where they are less costly to implement.[4] For instance, instead of using one-size-fits-all technology standards for emissions, tradable emissions permits provide incentives to adopt stronger abatement technologies where they are most appropriate, resulting in an overall cost savings to

[2] In this primer we do not discuss the full range of policy approaches for the provision of ES, but focus on market-based instruments as an approach to provide incentives for ES provision.

[3] "Market-based" here refers to the fact that these policies involve price-based incentives; it is not meant to imply that the ES in question are bought and sold within a conventional market, although some may be. Market-based instruments also include instances where payments for ES are made through taxes or subsidies.

[4] For a more detailed listing of the benefits usually associated with MBI approaches, refer to UNEP (2004).

BOX 4

Examples of incentive programs for ecosystem goods and services provision

CANADA:

1) **SFM certification**[1]
   Forest certification is a process by which forestry firms demonstrate conformity to the specific standards of a certification scheme in the hope that they will have an advantage either in terms of price point or maintaining market share over non-certified competitors. (See www.certificationcanada.org). Canada has the largest area of third-party independently certified forest in the world, with almost 146 million hectares certified to at least one of the following certification schemes: Canadian Standards Association, Forest Stewardship Council, and Sustainable Forestry Initiative (Certification Canada 2008).

2) **Ontario's Managed Forest Tax Incentive Program (MFTIP)**
   A voluntary program which encourages the stewardship of Ontario's private forests by providing lower property taxes to forest landowners who agree to prepare and follow a Managed Forest Plan. (See www.mnr.gov.on.ca/MNR_E000245.pdf.)

3) **Alberta's carbon offset program**
   Carbon credits generated by a variety of means can be purchased by firms who need offsets to meet required reductions in carbon emissions intensity. (See www.carbonoffsetsolutions.ca.)

4) **Canada-Alberta Farm Stewardship Program: cost sharing for best management practices**
   Provides eligible Alberta farmers with financial assistance for reducing environmental risks through better stewardship. Part of Canada's National Farm Stewardship Program. (See http://albertaefp.com.)

OTHER:

5) **Australia's Bush Tender Program**
   Landholders are allowed to form bids requesting payment for the sustainable management practices they are willing to undertake to protect remnant vegetation in biologically sensitive areas. Bids are compared against bids from other participating landholders before acceptance. (See www.qmdc.org.au/get-involved/bush-tender-2007.html.)

6) **The U.S. Conservation Reserve Program**
   Landholders are encouraged to convert highly erodible cropland and other environmentally sensitive acreage to vegetative cover through an annual rental payment and cost sharing agreements. (See www.nrcs.usda.gov/programs/crp.)

7) **U.S. TMDL (Total Maximum Daily Load) programs for water pollution**
   TMDLs calculate the maximum amount of pollution a water body can receive while still meeting water quality standards, then allocate it to pollutant sources. TMDL allocations may be achieved via incentive-based, non-regulatory or regulatory means. (See www.epa.gov/owow/tmdl.)

[1] Previous valuation studies for various forest certification schemes have shown mixed results with respect to the existence of a price premium, suggesting that certification is a means of non-price competition for market share (e.g., Jensen et al. 2003, Gronroos and Bowyer 1999, Rametsteiner 1999, Ozanne and Vlosky 1997, Winterhalter and Cassens 1993).

society for achieving an environmental target. The cost savings can be used to achieve greater emissions reductions than would have otherwise been the case.[5] Furthermore, MBIs tend to price all units of pollution and/or resource use. In contrast, CAC methods often allow environmental degradation to continue without penalty as long as they remain below regulatory thresholds.

Note that MBIs succeed because they delegate or decentralize environmental decisions, giving firms the flexibility to substitute emissions, damages, or other impacts at one location or point in time for another while still meeting an aggregate environmental target. However, there can be cases where such substitutions are not desirable and CAC policies are more appropriate – for example in managing hazardous substances, or protection of culturally or ecologically significant areas. In these cases, the delegation of environmental decisions to firms may lead to undesirable and potentially disastrous outcomes.[6]

In spite of the potential cost savings of MBIs over CAC, there are still a number of other considerations which affect the choice of policy instruments. These include the framework of environmental laws already in place, the technical capability and the costs to government ministries to administer market-based programs, and the political feasibility of MBIs in terms of the acceptability of the distribution of benefits, costs, and risks associated with the instruments (UNEP 2004).

3.2 Canadian context: challenges, opportunities and drivers for implementing market-based incentives

As we have seen, valuation of ES can be an important step in setting environmental objectives, and both valuation and MBIs have the potential to support and promote sustainable forest management. Although MBIs provide a number of advantages over traditional command-and-control approaches there are still a number of political and legal barriers to using MBIs for SFM.

Canada has been criticized over the lack of development of MBIs for environmental policy (OECD 2004). Canada's lack of institutional capacity, particularly concerning the ability to conduct environmental economic analysis and effectively implement market-based environmental policy, seems to differ from other OECD countries (see Renzetti 2005, Howlett 2007). Adamowicz (2007) argues that jurisdictional issues in Canada, along with frequently overlapping administrative boundaries, may further complicate the issue by fragmenting what limited institutional capacity does exist. These and other factors contribute to a certain amount of "policy inertia" with regard to use of market-based incentives to protect ecosystem goods and services in Canada.

In considering how to overcome issues of policy inertia, Adamowicz (2007) recognizes the role of policy entrepreneurs (or instrument champions) as drivers for new policy implementation. The idea of a policy entrepreneur is analogous to the role for effective leaders articulated by Brock (2004). Brock shows that strong leadership has the potential to reduce ambiguity aversion (essentially status-quo bias) and to counter peer-group effects, both of which can serve to prevent effective policy adoption. The UNEP (2004) also cites the need to provide policy-makers with practical guidance to help them decide which types of MBIs are likely to be effective in addressing specific environmental problems. Such guidance could take the form of decision support tools.[7]

In Canada, the development of environmental policy may now need to consider multiple levels of governments within and across jurisdictions, tenure and lease holders, resource sectors, interest groups, Aboriginal communities, and NGOs, among others – all frequently competing over the use of public resources. A unique aspect of many environmental resources in Canada is the issue of public and/or unallocated land. Since most of Canada's forest land is owned by provincial governments but essentially managed by private tenure-holders (e.g., forest companies, oil and gas or mining interests), this creates questions of ownership of ecosystem services. This uncertainty must be resolved for

5 This argument was used to justify the US SO_2 emissions trading program under Title IV of the 1990 Clean Air Act (Tietenberg 2003).

6 There is a vast literature on instrument selection which delves into questions regarding when each approach - MBIs, CAC, or others - may be most effective. For a summary of instrument selection considerations, refer to Stavins (2001) and Collins and Scoccimarro (2008).

7 For an example of a MBI decision support tool, see Collins and Scoccimarro 2008.

effective implementation of many forms of MBIs. Another challenge is related to the potential for strategic negotiations over policy baselines, as different parties attempt to position themselves to make significant profits with the introduction of new or unfamiliar policies (Howlett 2007).

4.0 Opportunities for developing ecosystem service markets for sustainable forest management

Market-based instruments could help correct issues that have not generally been addressed in Canadian forest policy. Some, such as SFM certification (Box 4), are already being used in Canada. Others have only been implemented on a relatively small scale, or have been used elsewhere in the world but have not yet been tried in a Canadian forest management context. Two examples of MBIs potentially relevant to forests and forest management are described below.

> **MBIs could help correct issues that have not generally been addressed in Canadian forest policy.**

4.1 Tradable disturbance permits

In Canada, provincial governments own nearly all forest land. Tenure allocation systems can result in overlapping tenures, with multiple users (e.g., forest companies, oil and gas interests) having access to the same area of land. The fact that one particular user does not have complete property rights often leads to more land disturbance than what would otherwise be socially desirable. This can result in negative impacts on biodiversity and other sustainable forest management objectives.

Tradable Disturbance Permits (TDPs) are rights to disturb land (similar to surface rights) that can be traded between locations and sources of disturbance and over time to minimize the costs of reducing the development footprint. Under a TDP program the government caps the total amount of disturbance permitted on the landscape for a given time period (e.g. total number of hectares per year). Rights to disturb up to the cap are allocated to firms either through grandfathering or auction. Permits/disturbances are treated as equivalent no matter where the disturbance occurs and irrespective of the quality of habitat disturbed. TDPs allow firms to substitute their ecological footprint in one location and/or point in time with a reduced footprint in another location/point of time as long as global disturbance objectives are satisfied. TDPs reduce costs of meeting ecological objectives because they give firms the flexibility to choose where, when, and how much forest to disturb within regional land use constraints. At the same time, firms respond to signals from permit prices about the relative costs of disturbance at different times and locations when designing their resource development plans. This ensures that disturbance rights are allocated to the highest value developments. A TDP program may be combined with an offset/ mitigation credit program in order to provide additional incentives for reclamation of existing footprint (Box 5).

> **Tradable Disturbance Permits (TDPs) are rights to disturb land that can be traded between locations and sources of disturbance and over time to minimize the costs of reducing the development footprint.**

Although tradable permits have been used to manage a number of environmental issues, such as pollution and commercial fishing, we are unaware of their use in a forest management context.

There are a number of barriers that would need to be overcome before a TDP system could be implemented. These include:

i) Scientific challenges related to defining regional conservation objectives and their relationship to the level of disturbance;
ii) Valuation challenges related to setting the cap (amount of disturbance allowed per year);
iii) Implementation challenges related to developing administrative systems to support the exchange of disturbance permits and compliance monitoring and enforcement;
vi) Political and legal challenges related to changes in existing tenures, and impacts on aboriginal communities; and finally
v) Lack of understanding amongst stakeholders and government about the impact of the TDP system on conservation goals and costs.

In spite of these challenges, there is interest in exploring TDPs further as a tool for SFM. Both Alberta and the Northwest Territories have participated in Sustainable Forest Management Network research to investigate the feasibility of this instrument to manage cumulative effects on forest lands. In Alberta, TDPs are mentioned in Alberta's Land-use Framework (2008) as one of the conservation and stewardship tools that could be used to achieve regional cumulative effects objectives on public lands. In the end, assessing the efficacy of TDPs over alternative approaches will depend on a detailed comparison with other policies in terms of their impacts on costs to firms and tenure holders, communities, administrative and legal feasibility, and finally, on desired ecosystem outcomes.

BOX 5

CAP-AND-TRADE, CREDIT SYSTEMS, OFFSETS

Cap-and-trade systems limit the total allowable environmental impact (e.g. total emissions or total land disturbance per year), with allowances for impacts either auctioned or grandfathered to existing sources. **Credit** systems allow firms to earn credits for reducing impacts below the standard or baseline, which can be sold to other firms who wish to exceed the baseline. A **conservation offset** is a positive action to compensate for the negative environmental impacts associated with development. In some cases credits for offsets can be banked and traded in a market.

There is a direct relationship between conservation offsets and Tradable Disturbance Permits (TDPs). Both TDPs and offsets are flexible ways for firms to meet conservation objectives. TDPs represent allowances for creating disturbance while offsets represent obligations to reduce disturbance. When TDPs are grandfathered into existing resource access rights, offsets and TDPs are essentially equivalent programs. The difference is in the initial allocation or rights and obligations, cost and distributional consequences, and who bears the economic and ecological risks associated with the program (the public versus industry).

4.2 Forest carbon offsets

Forests can act as significant carbon sinks. Increases in carbon sequestration above baseline levels (i.e., the level that would be sequestered under the current business-as-usual forest management system) can be used to offset increases in carbon emissions from other parts of the economy.

In a forest carbon tendering system, government regulators ask for sealed bids from forestry firms, in which the firm provides the price at which it would sequester carbon. The regulator then purchases these temporary carbon offsets (i.e., offsets of fixed duration) from the lowest price suppliers, and sells them on the carbon market. An advantage of tendering forest carbon contracts is that the carbon offsets can be sold by government regulators – either in provincial, federal or international markets – thereby generating revenues for the carbon payments to forestry firms.[8]

This system allows government to promote carbon sequestration while minimizing the financial burden on taxpayers. Depending on the costs of carbon sequestration relative to carbon prices, in certain cases carbon sequestration might even be profitable to government. Although most Canadian forestry firms operate on public land, the long duration of forest tenures make a carbon auctioning system feasible for temporary carbon credits.

Although forest carbon tendering is still a novel approach, the Australian state of Victoria is conducting a trial on it (DSE 2004). In Canada, some related initiatives include the following:

- **Alberta** has a market for carbon sequestration offsets. The Alberta Greenhouse Gas Emissions Trading System requires large industrial emitters to reduce intensity reductions by 12%, otherwise they must buy carbon offsets or pay a tax of $15 per tonne CO_2 equivalents (Boyd et al. 2008). Alberta has developed an offset protocol for afforestation of non-forest lands, but does not yet have a protocol for forest management offsets. (See www.carbonoffsetsolutions.ca/offsetprotocols/finalAB.html.)
- **Ontario** is looking into tradable carbon offsets that can be earned by tree planting, forest management and forest conservation. (See http://publicdocs.mnr.gov.on.ca/View.asp?Document_ID=15974&Attachment_ID=33671.)
- **Quebec, Ontario, Manitoba and British Columbia** (together with some U.S. states) are partners in the **Western Climate Initiative**, which is still in the process of designing its forest carbon offset mechanisms. (See www.westernclimateinitiative.org.)

[8] Alternatively, forestry firms that hold rights to carbon may enter into agreements to provide carbon offsets directly to agencies or firms interested in purchasing offsets.

5.0 Conclusions and key messages

- Can valuing ecosystem services (ES) help guide the development of market-based instruments (MBIs) and enhance sustainable forest management? The answer is "yes." Valuation of ES is useful in guiding government investments and providing targets for policy change.
- There are a number of challenges associated with valuation – science gaps, capacity, cost and time-constraints being especially important. In the absence of valuation information to set policy immediately, governments can select a target for ES based on other criteria and then evaluate policy outcomes in terms of costs and benefits. When the evaluation is complete, it can be used to calibrate the MBI to reflect public preferences for ES.
- MBIs attempt to make the adoption of environmentally sustainable practices more financially attractive. This can lead to favourable environmental outcomes without the use of prescriptive command-and-control regulation. MBIs can sometimes be used in conjunction with command-and-control approaches, which will still be necessary in some cases.
- The value of ES is increasingly being recognized, and often requires public policy to be protected. Compared to traditional command-and-control policies, MBIs are often a lower-cost way to achieve, and perhaps exceed, environmental performance standards. The challenge lies in matching MBIs to specific problems.
- There has been some progress in Canada towards using MBIs, especially with respect to carbon sequestration (e.g., the carbon offset market in Alberta). In forestry, although SFM certification is an incentive now widely used across Canada, MBIs are still not widely applied. Other regulatory MBI programs such as tradable permits and offsets also have the potential to encourage and reward SFM but have not yet been widely adopted.
- In spite of the potential opportunities, there remains a lack of capacity to implement MBIs in forestry. Capacity challenges include lack of information about the costs and benefits of improving ecosystem services, lack of science (including data and models) for understanding the ecological and economic consequences of policy change. There is also a lack of understanding of consumer and producer responses to various MBI incentives and programs, and the best way to structure resource/environmental markets and payments for ecosystem services.
- Experience in other jurisdictions suggests that significant investment in capacity to identify the values of ES protected by various policy approaches, and to evaluate and compare particular policies, is required to build stakeholder and institutional support for successful application of new approaches to SFM.

6.0 References cited

Adamowicz, W. 2007. Reflections on environmental policy in Canada. Canadian Journal of Agricultural Economics 55: 1-13.

Alberta Environmental Protection. 1994. Little Bow Project/Highwood Diversion Plan. Prepared by Planning Division, Water Resources Service, Alberta Environmental Protection. April 30th.

Boyd, J.W. 2007. The endpoint problem. Resources 165: 26-28.

Boyd, R., Gorecki, K., Brown, C. and Haugen-Kozyra, K. 2008. Broadening Alberta's carbon markets. Climate Change Central, Calgary, Alberta. Available online at www.climatechangecentral.com/files/C3_BroadeningAlbertasCarbonMarkets_PhaseI.pdf.

Brock, W.A. 2004. Tipping points, abrupt opinion changes, and punctuated policy change. p. 47-77. In Punctuated equilibrium and the dynamics of U.S. environmental policy (ed. R. Repetto). Yale University Press, New Haven, CT.

Brown, T.C., Bergstrom, J.C. and Loomis, J.B. 2006. Ecosystem goods and services: definition, valuation and provision. RMRS-RWU-4851 Discussion Paper. 31 May. 48 pp.

Certification Canada. 2008. SFM certification status in Canada – 2008 year-end. Available online at: www.certificationcanada.org/english/status_intentions/status.php.

Collins, D. and Scoccimarro, M. 2008. Market-based instruments decision support tool. Market-based Instruments Capacity Building Program (part of Market-based Instruments Pilot Program and the National Action Plan for Salinity and Water Quality). Department of Natural Resources and Water, Brisbane, Australia.

Daily, G.C. 1997. Introduction: what are ecosystem services? p.1-10. In Nature's Services: Societal Dependence on Natural Ecosystems, G.C. Daily (ed.). Island Press, Washington D.C.

DSE. 2004. CarbonTender: a new market for landholders. State of Victoria, Department of Sustainability and Environment, East Melbourne. Available online at: www.climatechange.vic.gov.au/CA256F310024B628/0/D69FB3EF2321291ECA25719A00025A0C/$File/CarbonTender+Stage2.pdf.

Government of Alberta. 2008. Land-use Framework. Government of Alberta, Edmonton, Alberta. Available online at: www.landuse.alberta.ca/AboutLanduseFramework/LUFProgress/documents/LanduseFramework-FINAL-Dec3-2008.pdf.)

Gronroos, J. and Bowyer, J. 1999. Assessment of the market potential for environmentally certified wood products in new homes in Minneapolis/St. Paul and Chicago. Forest Products Journal 49(6): 28-34.

Heal, G.M. 2000. Nature and the marketplace: capturing the value of ecosystem services. Island Press, Washington, D.C. 203 pp.

Heal, G.M., Barbier, E.B., Boyle, K.J., Covich, A.P., Gloss, S.P., Hershner, C.H., Hoehn, J.P., Pringle, C.M., Polasky, S., Segerson, K. and Shrader-Frechette, K. 2005. Valuing ecosystem services: toward better environmental decision-making. The National Academies Press, Washington D.C. 277 pp.

Howlett, M. 2007. Policy analytical capacity as a source of policy failure. Paper prepared for the Workshop on Policy Failure, Annual Meeting of the Canadian Political Science Association, Saskatoon Saskatchewan. May. 17 pp.

Jensen, K., Jakus, P.M., English, B. and Menard, J. 2003. Market participation and willingness to pay for environmentally certified products. Forest Science 49(4): 632-641.

Kenny, A. 2006. Ecosystem services in the New York City watershed. The Katoomba Group. Available online at: http://ecosystemmarketplace.com/pages/article.news.php?component_id=4130&\component_version_id=6440&language_id=12 .

Millenium Ecosystem Assessment. 2005. Ecosystems and human well-being : current state and trends : findings of the Condition and Trends Working Group / edited by Rashid Hassan, Robert Scholes, Neville Ash, Island Press, Washington, D.C.

Murtough, G., Aretino, G. and Matysek, A. 2002. Creating markets for ecosystem services. Productivity Commission Staff Research Paper, AusInfo, Canberra, Australia. 79 pp.

OECD. 2004. Environmental performance report: Canada. Paris, France.

Olewiler, N. 2004. The value of natural capital in settled areas of Canada. Published by Ducks Unlimited and the Nature Conservancy of Canada. 36 pp.

Ozanne, L. and Vlosky, R. 1997. Willingness to pay for environmentally certified wood products: a consumer perspective. Forest Products Journal 47(6): 39–48.

Pagiola, S., von Ritter, K. and Bishop, J. 2004. Assessing the economic value of ecosystem conservation. The World Bank Environment Department, Paper No. 101. October. 58 pp.

Pattanayak, S.K. and Butry, D.T. 2005. Spatial complementarity of forests and farms: accounting for ecosystem services. American Journal of Agricultural Economics 87(4): 995-1008.

Rametsteiner, E. 1999. The attitude of European consumers towards forests and forestry. Unasylva 196(50): 28-42.

Renzetti, S. 2005. Canadian agricultural water use and management. In The economics of natural and human resources in agriculture, A. Kimhi and I. Finkelshtain (eds.). Springer, Amsterdam, Netherlands.

Ruhl, J.B., Salzman, J. and Goodman, I. 2009. Implementing the new ecosystem services mandate of the Section 404 Compensatory Mitigation Program – a catalyst for advancing science and policy. Stetson Law Review, 39:251-272.

Sanchirico, J.N. and Siikamaki, J. 2007. Natural resource economics and policy in the 21st century: conservation of ecosystem services. Resources 165: 8-10.

Stavins, R.N. 2001. Lessons from the American experiment with market-based environmental policies. Resources for the Future Discussion Paper 01-53. Washington D.C. 26 pp.

Tietenberg, T. 2003. The tradable permits approach to protecting the commons: lessons for climate change. Oxford Review of Economic Policy, 19:400-419

Tietenberg, T. and Johnstone, N. 2004. Ex-post evaluation of tradable permits: methodological issues and literature review. p. 9-36. In Tradable permits: policy evaluation, design and policy reform. OECD.

UNEP. 2004. The use of economic instruments in environmental policy: opportunities and challenges. United Nations Publication 92-807-2391-X.

Winterhalter, D. and Cassens, D. 1993. Telling the sustainable forest from the trees. Furniture Design and Manufacturing 65(8): 101–106.

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