INFO bulletin

Forest Practices Board

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Board Bulletin, Volume 8 - Ecosystem Services and British Columbia's Forest and Range Lands

This bulletin is the eighth in a series of Forest Practices Board bulletins describing new aspects of forest legislation, practices and trends, and their implications for forest stewardship. These bulletins are intended to foster discussion and to improve understanding of forest practices.

Introduction

In its capacity as public watchdog for sound forest practices in British Columbia, the Forest Practices Board promotes stewardship of the full range of forest values that reflect the broad public interest in forest lands. This bulletin describes the importance of "ecosystem services" provided by British Columbia forests, and the need to take these ecosystem services into account in forest management decisions.

This Bulletin is intended to increase awareness and stimulate discussion. It is directed to a general audience, including forest planners, decision-makers and policy-makers. The bulletin draws largely on the work of others.

What are ecosystem services?

Ecosystem services are the benefits that people receive from ecosystems. These include the provision of timber, stabilization of climate, control of storm water, and provision of drinking water and recreation opportunities. Managed ecosystems, as well as natural systems, can provide ecosystem services.

Ecosystem services are receiving international attention as essential to human well-being. A recent Millennium Ecosystem Assessment was initiated under the support of the United Nations. In 2005, it reported that:

> Human actions during the last 50 years have altered ecosystems to an extent and degree unprecedented in human history . . . further improvement [in human health and wealth] may be limited by an insufficient supply of key ecosystem services. [1]

The Assessment also said that:

protection of nature's services is unlikely to be a priority so long as they are perceived to be free and limitless by those using them.

The concept of ecosystem services provides a framework for describing and analyzing the attributes of ecosystems that benefit humans, and the effects of policy and management actions on those attributes.

There are different ways of classifying ecosystem services. The Millennium Ecosystem Assessment classifies ecosystem services into four categories:

- *provisioning*: such as food, water and fuel
- *regulating*: such as regulation of water flow and climate
- *cultural*: such as spiritual, aesthetic, recreational and educational
- *supporting*: such as soil formation

Note that under this classification system, supporting services, as the name suggests, support other vital ecosystem services but do not directly benefit humans by themselves. The Assessment found that, globally, we have been exploiting the provisioning services (e.g. timber) to improve social and economic well-being, at the expense of supporting, regulating and cultural services.

Recognition of ecosystem services is an emerging trend globally and nationally. For example, the Supreme Court of Canada recently confirmed that ecosystem services have an economic value in law.[2] The decision in *British Columbia v. Canadian Forest Products Ltd*, (also known as the Stone Fire case) means the government can sue for compensation for the loss of ecosystem services when public land is damaged. The Forest Practices Board participated in the appeal as an Intervenor.

Ecosystem services from British Columbia's forest and rangelands

British Columbia's forests and rangelands provide numerous ecosystem services that benefit humans. For example, they *provide wood* for lumber and pulp production and firewood, as well as *non-timber forest products*, such as mushrooms and salal. They help to *control the flow of stormwater* (see box)

Controlling the flow of stormwater

Forests affect the timing and magnitude of peak flows. Forests regulate spring peak streamflow by four processes. The forest canopy intercepts a percentage of the snowfall and returns it to the atmosphere, reducing the amount of water reaching the ground to become runoff. The forest provides shade, reducing snowmelt rates. The reduction in wind speed in a forested stand also reduces snow melt rates. Finally, trees transpire water during growth.

A recent Board report examined the effects of the Mountain Pine Beetle infestation and salvage logging on the hydrology of the Baker Creek drainage, tributary to the Fraser River, near Quesnel. The study found that peak flow changes likely to result from both the infestation and salvage logging have implications on flooding, channel stability and fish habitat in watersheds similar to Baker Creek.[3]

British Columbia's forests provide *clean water* for human consumption and for fish and other aquatic organisms. They provide *clean a*ir through the removal of pollutants and help to *stabilize climate* (e.g. temperature and rainfall). Climate stabilization includes a role in storage and release of carbon dioxide.

Forests and rangelands play an important role in providing *habitat for plants and animals*, including shade and shelter from heat, cold, wind, rain, snow and predators. They provide *pollination* of crop foods, such as fruit, and natural foods that sustain all biodiversity. They help to *prevent the spread of invasive plants.* Invasive plants opportunistically move into disturbed areas; areas in their natural state—occupied by native plants--are more resistant to invasive plants.

The *energy of the streams and rivers* can be harnessed to provide hydroelectric power. In addition, forests and rangelands provide recreation and tourism opportunities. They provide opportunities for scientific discovery (e.g. plant compounds with potential medicinal value). They provide aesthetic, spiritual and cultural values. They provide a resource base for future economic uses that are currently not foreseen.

Some of the ecosystem services provided by British Columbia's forest and range lands have value globally. This is the case, for example, with species habitat, biological diversity, tourism opportunities and timber.

Economic value and hidden costs

It is important to realize that ecosystem services have an *economic* value, even though they may not all have *commercial* value. After all, the environment is the source of all life and every economy.

Canada's National Round Table on the Environment and the Economy has a mandate under the 1993 *National Round Table on the Environment and Economy Act.* The Round Table has said that

failure to account for the costs and benefits of ecosystem services is a key barrier to conservation:

> At present, we understand neither the true value of our ecosystem services, nor what it would cost to replace them. What we do know, however, is that not understanding these costs and benefits is compromising our ability to make meaningful decisions about the balance between nature conservation and industrial development. While it is difficult to measure and place a value on the ecological services that nature provides, better understanding and quantification of these forms of natural capital will be critical to our ability to manage change over the long term.[4]

In January 2007, the Conference Board of Canada, a not-for-profit organization that specializes in economic trends, organizational performance and public policy issues, said that:

> There is growing recognition that gross domestic product (GDP) produced at the expense of the global environment, and at the expense of scarce and finite physical resources, overstates the net contribution of that economic growth to our prosperity. Indeed, measures of national wealth should ideally include some estimation of the net impact on the scarce natural resources used to produce that wealth—the costs imposed on the physical environment--in addition to the current estimation of the economic benefits from growth.[5]

There are several ways to estimate the economic value of ecosystem services. All these methods have limitations and must be used with care. The most obvious method is the ***market price*** approach. This approach can put a value on services for which there is an established market, including timber, some non-timber forest products, and other tradable goods and services.

Even where there is not direct, market measure of value, economists have devised methods to estimate economic value. [6] The ***cost-based*** approach estimates either the cost of replacing the ecosystem service with manufactured infrastructure or the cost of mitigating or averting damage to the service. This approach can put a value on regulating- and supporting-services such as water quality.

The ***production function*** approach estimates value by examining the effect a change in the ecosystem would have on the production of a marketable product. This technique may be used to value regulating- and supporting-services like water flow and soil quality.

The ***surrogate market*** approach estimates value through inferred behaviour; people reveal their preferences for a good or service through how much they pay for something else. For example, the surrogate market approach can be used to value non-commercial recreation opportunities by calculating how much people pay to travel to or live near recreational destinations.

Finally, the ***stated preference*** approach estimates value by asking people what they would be willing to pay or trade to conserve a specific ecosystem service. This approach is suited for

services that are more difficult to quantify, such as conservation of old growth, or cultural and spiritual fulfillment.

There are several uses for economic valuation.[7] One use is to estimate the value of the total flow of benefits from ecosystems. This can be used, for example, to estimate the contribution of ecosystem services to national wealth.

Economic valuation can also be used to estimate the net economic benefits of interventions that alter ecosystem conditions, such as ecosystem restoration projects, or logging operations.

Other uses of economic valuation include examining how the costs and benefits of ecosystems are distributed (discussed below under **Distribution of benefits and costs**), and identifying potential financing sources for conservation.

Economic valuation of ecosystem services allows "apples and apples" comparisons of the economic costs and benefits of industrial or commercial development, including impacts on the environment. Economic valuation of ecosystem services can inform resource-management decisions but should never be the sole basis for decisions. Other considerations, such as social, scientific, ethical, and moral values also need to be taken into account. Decisions affecting ecosystems require a balancing of societal objectives.

Distribution of benefits and costs

Identifying the range of ecosystem services from forests and rangelands helps us to understand how these benefits are distributed. Not everyone benefits to the same degree from every service. For example, a family living in a forest may benefit from access to firewood, access to water for domestic use, and employment in the forest industry. A family living in a nearby community may make their livelihood in the forest industry. A family living downstream may benefit from the regulation of the flow and quality of water.

A family that is more remote from this forest may receive none of these benefits. Yet the family may consider the forest as an important provider of biodiversity or habitat for species at risk.

Globally, people may value the biodiversity, habitat and tourism opportunities created by conservation of B.C. forests. B.C. residents value these things, too, but they are also concerned about employment and government revenue from services that have an established market value, such as harvesting the timber resource.

Drivers of change

Changes in local land use and forest cover can change the ecosystem services provided by an area of land. Changes may result from urban development, park designation, or designation as a reserve zone within a provincial forest. External inputs, such as fire suppression, fertilization, pest control, new technology or irrigation may also cause changes.

Other factors that can directly bring about changes in ecosystem services include species introduction or removal, harvest and resource consumption, climate change, and natural, physical and biological factors.

These direct drivers are in turn influenced by powerful indirect drivers: demographic; economic; sociopolitical; science and technology; cultural and religious. One of the main demographic drivers, for example, is population growth. Population growth in British Columbia has led to land use changes as land is converted to urban and suburban residential use. Population growth also creates economic pressures: the need to provide employment, the need for increased government revenue to provide services, and increased consumption of ecosystem services.

Conclusions

Our understanding of the complex functions of ecosystems and the benefits they provide to humans is still limited. The concept of ecosystem services that benefit humans has only recently gained wide interest. No one has ready answers to the many questions raised by the concept of ecosystem services. Nevertheless, based on the Board's experience and a substantial body of research literature, some points emerge.

Probably the most important is for decision-makers in government and the private sector to integrate information on ecosystem services into decision making. This includes decision-making at every level and scale: broad public policy decisions (such as legislation and setting government objectives); land-use planning; forest stewardship plans; site-level choices (such as harvesting methods and restoration of damaged sites) and enforcement decisions (e.g. environmental penalties). To a degree, of course, this is already being done. What is needed is continual improvement in the way this integration takes place.

Recognizing that ecosystem services have economic value, decisions need to factor in degradation of ecosystem services as a real cost, a cost that must be weighed along with social, economic and other environmental costs and benefits.

Several things will be required in order to continue to improve the integration of information about ecosystem services into decision-making:

- as a society, we should continue to improve our understanding of the ecological functions that underlie the benefits provided to humans by forest ecosystems.

- we also need to better understand the benefits provided and how these benefits are distributed among members of society.

- Governments, academic researchers and others need to continue to explore and develop methods to measure the benefits of ecosystem services. This may include finding efficient and effective ways to measure the economic value of those services and therefore to understand the true economic costs and benefits of resource development. Considerable work is already underway nationally and internationally.

- Economic valuation techniques need to be incorporated into decision-making where appropriate.

High level direction, or at least acknowledgment of the issue, from government and resource companies would assist in this integration. Cooperation among various disciplines will be needed, including ecologists and economists.

The drivers of change in ecosystem services need to be understood. The Millennium Ecosystem Assessment concluded that, globally, "policies outside the forest sector are often more important than policies within the sector in determining the social and ecological sustainability of forest management." Actions taken in the forestry sector could be compromised, made worse, or enhanced by factors arising outside the sector, including oil and gas development, urban development and responses to climate change.

Growing awareness of the concept of ecosystem services will require government and licensees to inform the public about how ecosystem services have been considered in forest and range management decisions. Conversely, engagement of the public should lead to a greater understanding of the benefits of ecosystem services, the distribution of those benefits, and ways to maintain the services.

The concept of ecosystem services is a useful way to think about the benefits the natural environment provides to humans, and should be part of government, community, and business decision-making.

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[1] *Ecosystems and Human Well-being*, Vol. 1: Current State and Trends, Findings of the Condition and Trends Working Group of the Millennium Ecosystem Assessment, Island Press (2005), p.2. http://scc.lexum.umontreal.ca/en/2004/2004scc38/2004scc38.html

[2] (2004) 2 Supreme Court Reports. 74 http://www.millenniumassessment.org/en/Condition.aspx

[3] *The Effect of Mountain Pine Beetle Attack and Salvage Harvesting on Streamflows* FPB/SIR/16, March 2007; http://www.fpb.gov.bc.ca/special/investigations/SIR16/The_Effect_%20of_%20Mountain_%20Pine_%20Beetle_%20Attack_%20and_%20Salvage_%20Harvesting_%20on_%20Streamflows_SIR16.pdf

[4] *Securing Canada's Natural Capital: A Vision for Nature Conservation in the 21st Century*, National Round Table on the Environment and the Economy (2003), p.40 www.nrtee-trnee.ca/Publications/HTML/SOD_Nature_E.htm

[5] *The Canada Project Final Report Volume 1: Mission Possible—Stellar Canadian Performance in the Global Economy*, The Conference Board of Canada, January 2007. http://www.conferenceboard.ca/documents.asp?rnext=1886

[6] adapted from: *Value: Counting Ecosystems as Water Infrastructure*, The World Conservation Union (2004) www.waterandnature.org/value/ ; see, also *Ecosystems and Human Well-being* (endnote 1), Chap. 2.3.

[7] *Assessing the Economic Value of Ecosystem Conservation*, Pagiola and others, The World Bank Environment Department Paper No. 101. http://www-wds.worldbank.org/external/default/main?pagePK=64193027&piPK=64187937&theSitePK=523679&menuPK=64187510&searchMenuPK=64187511&siteName=WDS&entityID=000012009_20041208104054