GREAT LAKES FACT SHEET

Putting an Economic Value on Wetlands – Concepts, Methods and Considerations

Canada's ecosystems and the biological diversity they support are natural assets which make significant contributions to the national economy. Functional ecosystems represent natural capital upon which our economy depends for the production of many goods and services. Being highly productive, biologically rich and providing many ecological services, wetlands are particularly important to both biodiversity and the economy. Methods to measure the sociological and economic benefits of wetlands show promise and are beginning to demonstrate the returns on investment from actions to sustain wetlands and the benefits that may be lost if they are degraded.

Valuing the economic benefits of wetlands can help set priorities and allocate spending on conservation initiatives. Valuation can also be used to consider the public's values of wetland systems and encourage public participation in certain initiatives. For instance, valuation may help to achieve wetland conservation objectives under the Great Lakes Wetlands Conservation Action Plan, and may be applicable in environmental assessment (EA) processes. More specifically, valuation could assist EA decision-making by providing a reference value against which other economic factors could be compared in order to determine the significance of environmental effects – the bottom-line in most EAs.

What is a wetland?

A wetland is land that is seasonally or permanently covered by shallow water, as well as land where the water table is close to or at the surface. In either case, the presence of abundant water has caused the formation of hydric soils and favoured the dominance of either hydrophytic or water tolerant plants. These unique areas represent a combination of terrestrial and aquatic characteristics, and are further categorized by type as marsh, swamp, fen and bog.

This fact sheet is intended to help planners, decision makers, policy makers and conservationists better understand the economic valuation of wetlands including the tools and methods used to value these natural features.

Habitat for species at risk (Spotted Turtle) *John Mitchell*

Valuing Ecosystems – an Introduction

Putting an economic value on something as abstract as the ecological services of a wetland is a difficult idea for most people. More commonly, the open market puts dollar values on society's goods and services. In the case of wetlands, there is no direct market for services such as clean water, maintenance of biodiversity, and flood control. There is, however, a growing recognition that such natural benefits do have real economic value and that these values need to be included in decision-making processes.

Aesthetic value (Great Blue Heron) *©Ducks Unlimited Canada Claude Ponthieux*

Environment Canada Environnement Canada

The first step in addressing the full economic picture of wetland benefits is to recognize that the non-market benefits wetlands produce are every bit as important as more traditional commodity (good) values. Table 1 gives examples of economic wetland benefits. In many ways, the economic benefits received from wetlands are comparable to the benefits received from things such as public schooling, health care and municipal infrastructure.

Unfortunately, to date, society has generally only realized the benefit of wetland services after they have disappeared. Problems with flooding, lost recreational opportunities, reduced fish populations and more costly water treatment are examples of costs understood only after a wetland ecosystem has been degraded or destroyed.

The idea behind putting an economic value on some of these wetland benefits before ecosystem-altering decisions are made is to recognize these potential costs up front and thereby put wetland-related decisions on a more economically sound footing.

Nature's water filtration plant *Doug Forder*

Table 1 - Examples of Economic Wetland Benefits

USE BENEFITS			NON-USE BENEFITS
Direct Use Benefits	Indirect Use Benefits	Option Benefits	Existence Benefits
• recreation - boating - birding - wildlife viewing - walking - fishing • trapping/hunting • commercial harvest - nuts - berries - grains - fish - peat - forestry	• nutrient retention • water filtration • flood control • shoreline protection • groundwater recharge • external ecosystem support • micro-climate stabilization • erosion control • associated expenditures, e.g., travel, guides, gear, etc.	• potential future uses (as per direct and indirect uses) • future value of information, e.g., pharmaceuticals, education	• biodiversity • culture • heritage • bequest value

(Modified from Barbier *et al.* 1997)

Conserving Great Lakes Wetlands

Investigating the economic benefits of wetlands is an initiative under the Great Lakes Wetlands Conservation Action Plan (GLWCAP). The GLWCAP is a cooperative program that involves federal and provincial governments and non-government organizations in efforts to establish a comprehensive wetlands conservation program for Great Lakes wetlands. The Action Plan's goal is to create, reclaim, rehabilitate and protect wetland habitat in the lower Great Lakes basin. The Action Plan adopted eight strategies to work toward this goal:

1. increase public awareness and commitment to protecting wetlands;
2. develop a wetlands database and an increased understanding of wetland dynamics;
3. secure wetlands;
4. create, reclaim and rehabilitate wetlands;
5. strengthen legislation, policies, agreements and compliance;
6. strengthen local planning and commitment to protecting wetlands;
7. improve coordination and planning among government and non-governmental organizations; and
8. evaluate the program.

Economic Value

To begin with, it is useful to look at what is meant by *economic value*. In economic theory, value means exchange value. Since money is the medium of exchange, the value of the benefit is generally determined by its price – that is, the quantity of money for which it will be exchanged. However, the value of a benefit is not simply the price of that product on the open market. It is, rather, the worth of that benefit to a potential buyer. This is measured in economic terms as *willingness to pay*. For example, in an oversimplified economy where only two commodities are exchanged – bread and rice – the value of a loaf of bread is determined by how much rice one is willing to give up, or exchange, to get that loaf of bread. In other words, the economic value of the bread is measured by people's willingness to pay with rice.

Market price, on the other hand, is a measure of the minimum that some people are willing to pay for a benefit – they will buy a good, for example, if their willingness to pay is equal to or more than the market price. As well, there are many other forms of value beyond market economic terms including subjective and intrinsic values. These values are particularly important in environmental conservation in general, but especially important for wetlands.

Therefore, in considering the value of natural areas such as wetlands, one is trying to determine people's willingness to pay for benefits ranging from aesthetic beauty to recreational opportunities to clean water.

Canadians spend thousands of dollars on recreational fishing each year

Liz Sauer

Exploring by canoe *Nottawasaga Valley Conservation Authority*

Definitions

Processes: The fundamental hydrological, chemical and physical activities that occur in a wetland that are linked to the biological productivity of the wetland. For example, the role of wetlands in global carbon cycling.

Functions: The results of the interaction of the wetland's ecological processes. For example, a wetland's natural processes may result in the recovery and export of nutrient-rich material (sediment) to a downstream area.

Benefits: The goods and services made possible by a wetland's functions. For example, by reducing wave energy and stabilizing shorelines, the wetland reduces the chances of property damage. This reduced risk is a benefit to society.

Value: The economic worth to society of the benefits provided by wetlands, whether in general terms (e.g., the wetland has value because it supports a commercial fishery) or in specific dollar terms (e.g., Point Pelee's recreation value based on gross expenditure is about $4 million – Hvenegaard *et al.* 1989).

The problem with using willingness to pay to measure the value of wetlands is that it requires a carefully designed survey, so it is not as straightforward as market price. Nonetheless, there is growing evidence of consumers' willingness to pay for ecological benefits. Trends such as the growing demand for ecologically certified wood products, organic foods, shade-grown coffee, non-toxic cleaners, and other goods and services with an environmental advantage, suggest that there is increasing market recognition of the economic value of preserving natural areas and processes.

Biological productivity (Black Tern) *John Mitchell*

Market Failure

If ecosystem values are as real as other economic values, why do economic decisions tend to favour the destruction of natural ecosystems rather than their retention?

Economists trace this problem to *market failure* – the failure of markets to reflect the full or true cost of goods or services. In the case of a wetland, the calculation of the economic value of filling the wetland to build housing does not, in most cases, include costs such as loss of water quality or flood control because these services do not have readily available dollar values such as those available for goods (e.g., real estate). In fact, these ecosystem services are provided for free – they do not have to be purchased. It is only when these services are lost that actual monetary costs are incurred. So paradoxically, the zero price for wetland services is of very high value to human well-being. Since it is difficult for an individual owner to receive direct monetary benefit for those benefits which a wetland provides to others (e.g., downstream water quality improvement or producing waterfowl which migrate elsewhere), the true value of such benefits is generally not taken into account in land use decisions.

Wetlands attract many visitors *Paul Casselman*

There are a few factors that contribute to market failure when it comes to natural systems.

Distribution of costs and benefits between owners and non-owners

Unlike other assets, a wetland may deliver more benefits to the community than to an individual owner. Compared to the general community, the individual owner may receive only a small proportion of benefits, such as groundwater replenishment, and therefore will tend to undervalue these benefits. In fact, the owner may even feel economically penalized for preserving a wetland for the good of the community and may see more immediate value in developing the wetland, for which the community will bear most of the costs in terms of lost benefits.

The tragedy of the commons

With a widely shared resource there is little incentive for an individual to curb activities to benefit others. For example, a wetland may support large populations of frogs, but without any sort of limits or fees, there is no incentive for an individual harvester to limit the number of frogs taken for bait, food or classroom dissection. The result would be a rapidly shrinking frog population and the reduction of a specific benefit for everyone who uses the wetland.

Missing costs

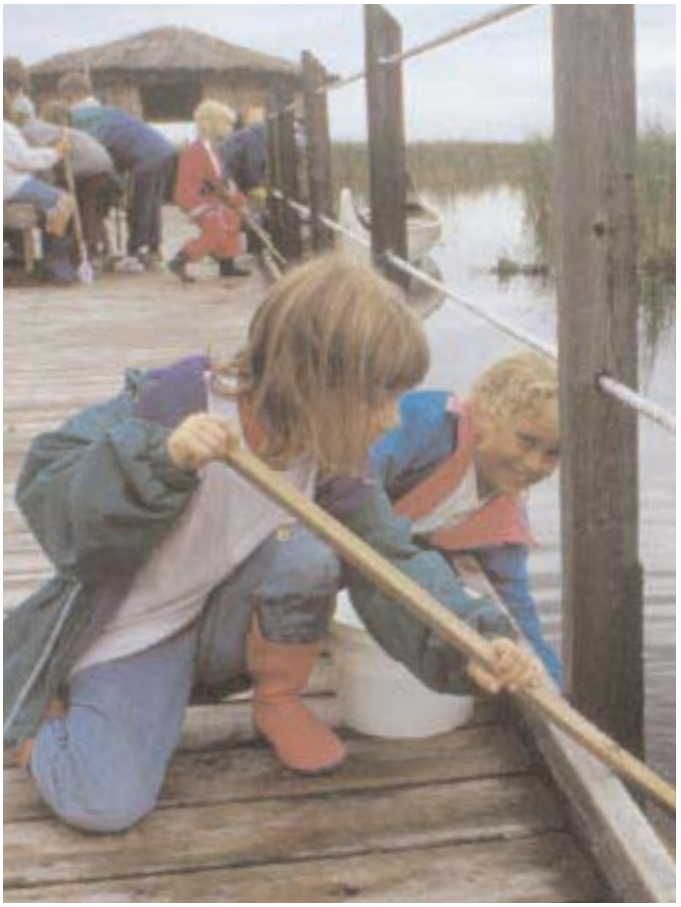
The market price of a good may not reflect all of the production costs. For example, if a company freely discharges its waste into a stream that feeds into a wetland, the economic damage done to the wetland, whether it's fewer fish produced or impaired water quality, is not reflected in the market price of the company's goods. In other words, the market does not include the lost economic value of the wetland in the company's production costs.

Cumulative effects

When taken together, a combination of relatively small incremental changes to a wetland or a number of wetlands within a watershed, can have more dramatic effects than those recognized when individual changes are made. These cumulative effects result from past, planned and future changes and are difficult to recognize and assess physically as well as economically in part because of the dynamic nature of ecosystems.

Limited understanding of science

The ability to measure value is also limited by scientific understanding of the ecological functioning of wetlands. Biologists, hydrologists and engineers do not yet fully appreciate or understand all of the benefits that wetlands provide to protect ecosystem stability. This lack of scientific understanding undervalues wetland benefits and contributes to market failure.



Wetlands provide educational opportunities *©Ducks Unlimited Canada Brian Wolitski*

Counteracting Market Failure

To counteract the problem of market failure, it can be useful to find ways to calculate the economic value of wetland benefits in a way the market understands – in dollars. This helps both individuals and policy makers more easily compare alternative uses and policy options. A value for the economic benefits that would be lost through the development of a wetland, for example, could prompt policy makers to put resources into the conservation of the wetland instead.

Similarly, such evaluations can lead to a better understanding of tax incentives, rebates or subsidies that could give individuals an economic incentive to retain a wetland. In effect, the community can purchase the wetland services from the individual.

(continued on page 8)

Arriving at

Approaches to valuing wetland benefits can be divided into three categories: direct, indirect and proxy. The first two approaches generally provide more precise economic measures, while proxy methods are more useful for "ball-park" estimates when time and resources are limited.

Approaches	Description	Example
Direct	Surveys can be used to ascertain people's willingness to pay for benefits provided by the wetland or the level of compensation they would expect for the loss of those benefits. Such surveys measure the value of specific benefits.	A survey which asks users what they would be willing to pay to retain a recreational area.
Indirect	Economists use mathematical models to estimate wetland values based on the market demand for related goods and services.	Expenditures and the distance traveled by people visiting a wetland are used as indicators of the value of the wetland for recreational purposes. Similarly, real-estate price differences could be used to estimate the value of the wetland's aesthetic benefits.
Proxy	The values of other goods and services are used to approximate the values of wetland benefits.	The replacement cost for a wetland benefit (e.g., water filtration), such as the cost of installing a buffer strip or building a water treatment plant, is used as a measure of the value of the benefit.
		Benefits
	Dollar estimates generated from previous studies, using any of the above approaches, are transferred to other sites when appropriate.	A dollar value of a certain coastal wetland (e.g., $1,000/hectare) is applied to a similar site elsewhere to approximate its value.

a Value

Yet, because of their ease of use, proxy methods are becoming more popular. Benefits transfer, can be used to apply values derived from the previous three approaches to other sites when appropriate.

Weaknesses	Strengths
This approach requires sophisticated survey design, analysis and interpretation.	This approach can measure relatively subtle changes in value and can also be used to calculate the value of non-use benefits.
This approach can not measure non-use benefits (e.g., option or bequest benefits) nor benefits that do not currently exist (e.g., the benefits of an enlarged wetland).	This approach is usually faster and less expensive as it can be based on easily accessible data.
This approach frequently confuses costs and benefits. For example, using the cost of a water treatment plant estimates the cost rather than the value of water filtration, (i.e., people's willingness to pay for clean water).	This approach can be more quickly calculated, but the result is only a very rough estimate of value.
ansfer	
Effort is required to ensure considerable similarity between the two sites (e.g., wetland type, nature and extent of use) so that the transfer of values makes logical sense and is defensible.	This method is fast and easy to calculate.

The most economically efficient choice is not necessarily the most socially acceptable or environmentally beneficial choice.

Canadians spend thousands of dollars to enjoy wildlife ©Ducks Unlimited Canada

Measuring Value

There is rarely an existing market for valuing wetland benefits, so different approaches that discern value through more intuitive means, such as surveys that measure our willingness to pay for certain benefits, must be examined.

In measuring value, it is important to remember that *net value* is desired – the gross value of a benefit less the costs that must be incurred to receive that benefit. As naturally occurring assets, wetlands provide most of their benefits at little or no cost to society and therefore tend to have high net values.

Efforts to put an accurate dollar value on wetland benefits are limited by: (1) scientific understanding of these complex natural systems; (2) current economic methods for establishing the values of the non-market benefits produced by wetlands; and (3) time and resources. Further, economic valuations are typically undertaken for the total of a specific wetland benefit – estimating a small or marginal change in a wetland is difficult. For example, a change in the benefit (e.g., fish nursery) within one corner of a wetland is more difficult to value than loss of the entire benefit as the change may not be proportional to the area lost or degraded.

For these reasons, instead of trying to judge the total value of the wetland, the focus is often on calculating the net value of specific wetland benefits that will be affected by a development or other change. So rather than attempting to calculate the total value of all wetland benefits now and in the future, a few specific existing benefits may show comparable value to a proposed alternative use. Consequently, many valuation studies determine only a fraction of a wetland's total value. In some cases, this partial valuation may prove inadequate for decision-making.

As naturally occurring assets, wetlands provide most of their benefits at little or no cost to society and therefore tend to have high net values.

Wetlands for recreation and renewable harvest ©Ducks Unlimited Canada

Challenges And Limitations

Although economic valuations of natural areas allow a better measure of overall economic efficiency, they are just one factor in most decision-making processes. The most economically efficient choice is not necessarily the most socially acceptable or environmentally beneficial choice.

Wetlands simultaneously produce a number of benefits – from clean water and nutrient cycling to flood control and recreation. Unlike many traditional economic benefits, a number of people can enjoy these benefits without the value to the individual being in any way diminished. For example, the whole community gains from the clean water produced by the wetland, but only a few would prosper from the housing built on a filled wetland. That intact wetlands deliver multiple benefits simultaneously is often overlooked in comparisons with more traditional economic benefits.

The science of calculating economic values for wetlands is still relatively new and evolving and methods are continually being refined and enhanced. Putting values on naturally occurring services such as water filtration, erosion control or sediment trapping, in particular, is a much newer concept than valuing traditional consumptive or extractive uses such as fishing or hunting. It is becoming clear, however, that many natural areas, including wetlands, possess substantial economic value.

It may not always be appropriate to put a dollar-value on wetland benefits. Economic valuation is just one tool for those grappling with the question of how and when to conserve natural areas. It may be most useful when a proposed alternative use has a high perceived economic value. One of the biggest risks of undertaking an economic valuation of a wetland is that the assessment will be rushed or incomplete and actually lead to a gross undervaluation of a complex system. *(see centerfold table on page 6)*

Habitat for breeding, rearing and feeding. *Ian R. Kirkham*

Wetlands are important to sport and commercial fisheries

Anonymous

The fact that intact wetlands deliver multiple benefits simultaneously is often overlooked in comparisons with more traditional economic benefits.

Considerations for Determining Value

- Assess the full suite of wetland functions which will be affected by a proposed change.
- Determine who currently benefits from the wetland functions that would be affected.
- Determine the probable range of physical impacts of the proposed change on these functions. Try to determine the degree of impact on these functions in physical units as much as possible.
- Choose and apply a valuation method that is appropriate for the particular wetland functions that will be impacted.

Critical habitat for Northern Pike and many other fish species
Ontario Ministry of Natural Resources

Biological diversity (Green Frog)

©Ducks Unlimited Canada
Michel Blachas / Carole Piché

Long Point - A Case Study

A 1981 study of the large wetlands around Long Point, Lake Erie, Ontario used contingent valuation to measure the annual net recreational benefits received by Canadians who use these wetlands (Kreutzwiser, 1981). Contingent valuation measures what people are willing to pay over and above their current expenditures to receive the same benefits. The study also calculated the total expenditures made by recreational users of the wetlands.

The study found that recreational users spent $119,000 ($215,906 in 1999 Cdn dollars) in total to receive wetland benefits that were estimated to have a contingent value of $213,000 ($386,000 in 1999 Cdn dollars) per year. This implies that for every dollar users spent, they received $1.79 in benefits, a return of 179 percent.

This case shows that expenditures are not measures of economic value, but rather of the cost of attaining certain benefits. The study also illustrates that using expenditures as a proxy for estimating benefits can lead to a gross underestimation of these benefits.

Recreational use of the Long Point wetlands represents just one of the many benefits of these wetlands. Others benefits include wildlife production, nutrient retention, groundwater recharge/discharge, etc.

Birding is one of North America's fastest growing pastimes
Pete Ewins

Economic Valuation – The Literature

Various studies have been carried out on the value of natural areas, including wetlands. Many of the values derived specifically for Great Lakes wetlands are summarized in *Wetlands and Economics an Annotated Review of the Literature (1988 - 1998), with special reference to the wetlands of the Great Lakes* (Bardecki 1998) at: www.on.ec.gc.ca/glimr/data/wetland-valuation/intro.html. In reviewing these studies it is important to consider:

- most studies have focused on sites of high economic value (such as Long Point in Lake Erie or Saginaw Bay in Lake Michigan);
- the specific wetland benefits being valued in the study and the methodology chosen, which often explains differences in values; and,
- the science of economic valuation of natural areas and the biological understanding of these areas is constantly evolving. The complexity of wetland systems makes it difficult to arrive at a total value, so many studies tend to focus on the value of one or two specific benefits instead. In some situations, partial valuation may be adequate, while in others, a total value might be warranted.

Wetland valuation studies in the Great Lakes basin are both complex and varied. Even for an individual wetland, estimated values are not necessarily comparable given different methods used and/or benefits assessed. Studies have looked at benefits and sites which range from recreation at Long Point, Point Pelee and Lake St. Clair; to commercial fisheries at Saginaw Bay in Lake Michigan; hunting, trapping and fishing at coastal Lake Michigan, Walpole Island and Lake St. Clair; and water quality improvement in the riparian wetlands of the Eramosa River in southwestern Ontario.

The economic valuation methods used are also varied, including direct methods such as contingent valuation; indirect methods such as travel cost, net profitability and production value; and proxy methods such as replacement costs and damage avoidance. Even when assessing the same site for the same benefit, a researcher using alternate valuation methods can estimate values that are very different.

There are a number of good sources for more detailed information on valuation methodologies and wetland economics for policy makers, including: Scodari 1994, Barbier *et al.* 1997 and D.M. King and M. Mazzotta's web site: www.ecosystemvaluation.org.

Shoreline protection and flood control *John Mitchell*

Final Thoughts

Decision-making processes are increasingly considering the economic values of natural systems, including wetlands. It is proving to be a useful tool with which to demonstrate the value of wetlands in terms people can understand – dollars. Yet, as illustrated, given the complexity and variety of valuation methods, one should only conduct wetland valuation with a full awareness of its challenges and limitations.

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References and Further Reading

Amacher, G.S., R.J. Brazee, J.W. Bulkley and R.W. Moll. 1988. An Interdisciplinary Approach to Valuation of Michigan's Coastal Wetlands (Ann Arbor: School of Natural Resources, University of Michigan).

Barbier, E.B., M. Acreman and D. Knowler. 1997. Economic Valuation of Wetlands, A Guide for Policy Makers and Planners. Ramsar Convention Bureau, Gland, Switzerland.

Bardecki, M.J. 1998. Wetlands and Economics: An Annotated Review of the Literature, 1988-1998, with special reference to the wetlands of the Great Lakes. Ryerson Polytechnic University, Toronto, Ontario. Prepared for Environment Canada - Ontario Region, May, 1998. Also available at: www.on.ec.gc.ca/glimr/data/wetland-valuation/intro.html.

Bardecki, M.J. 1988. The Application of Willingness-to-Pay, Opportunity Cost and Cumulative Impact Methods to Greenock Swamp, Ontario. Wetlands Are Not Wastelands Project Report 3 (Ottawa: Wildlife Habitat Canada and Environment Canada).

Elliot, M.L. and G. Mulamoottil. 1992. Agricultural and marsh land uses on Walpole Island: profit comparisons. Canadian Water Resources Journal 17:111-119.

Hvenegaard, G.T., J.H. Butler and D.K. Krystofiak. 1989 Economic values of bird watching at Point Pelee National Park, Canada. Wildlife Society Bulletin 17: 526-531.

Kreutzwiser, R.D. 1981. The economic significance of the Long Point marsh, Lake Erie, as a recreational resource. Journal of Great Lakes Research 7:105-110.

Raphael, C.N. and E. Jaworski. 1979. Economic value of fish, wildlife and recreation in Michigan's coastal wetlands. Coastal Zone Management Journal 5:181-194.

Schaefer, K., E. Snell and D. Hayman. 1996. "Valuing wetland nutrient buffers in the Eramosa River watershed" in C.E. Deslisle and M.S. Bouchard eds. Développement durable et rationnel des ressources hydriques: Compte rendu de la 49e Conférence annuelle de l'Association candienne des ressources hydriques, vol. II. Collection Environnement de l'Université de Montréal (Montréal: l'Université de Montréal) 629-638.

Scodari, P.F. 1994. Wetlands Protection: The Role of Economics. Environmental Law Institute, Washington, D.C.

van Vuuren, W. and P. Roy. 1993. Private and social returns from wetland preservation versus those from wetland conversion to agriculture. Ecological Economics 8(3): 289-305.

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