

# Forest Management and Non-timber Values: Opportunities and Challenges

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**Abstract** -- Non-timber valuation methods are reviewed and assessed in relation to their use in forest management. While significant advances have been made in the methods for assessing and incorporating environmental values in forest management, limitations in data and knowledge transfer have precluded widespread use of the tools. Eventually, however, changes in social institutions will be required to fully implement consideration of both timber and non-timber values in forest management decisions.

## Introduction

In this paper we review definitions of non-timber or environmental values and briefly describe some of the methods available for environmental valuation. We focus on some challenges associated with valuation and speculate on what the future might be for forest management regarding non-timber values.

## What are Non-timber Values?

One could define non-timber values as the values of all things arising from forested landscapes other than timber. This circular definition, however, does not illustrate the complexity associated with "valuing" goods and services. Included in environmental values (a term often used as an alternative to non-timber values) are values of goods created by forest ecosystems (fruits, medicinal plants, etc.), values for ecosystem services (water quality control, carbon sequestration), values for ecosystem supported activities (hiking, fishing, etc.), and values for forest environments independent of goods and services generated by them (wilderness, biodiversity). Naturally, these elements are inter-related. Individuals value the harvest of big game animals (a good), but this value is part of the recreational hunting experience (an activity). Forest ecosystems provide a variety of goods and services which people value either directly through purchases (lumber) or indirectly through expenditures of time and money on activities. Some values are related to the actual consumption or extraction of resources, while others are related to the state of the forest environment and their values are independent of consumption.

A question that arises from this discussion is "what is value?" In this paper we define value in terms of the trade-offs people are willing to make. If individuals are willing to obtain more of a particular good or service at the expense of another good or service, they are implicitly revealing a value. In the marketplace these values are measurable in monetary terms. In some cases it may be

possible to measure non-market goods values in monetary terms while in other it may not be possible<sup>1</sup>.

## Why Value Non-timber Goods and Services?

Forest management, like any form of management, requires an expression of "what is important" before it can take place. Without the articulation and explicit assessment of priorities in forest management plans the goals or desires of forest owners and the success of management agencies cannot be assessed. It is apparent to us that the answer to the question "what is important" has changed significantly over time in the management of Canada's forests. We feel that the current interest and focus on non-timber values by many forest managers connotes an important shift in "what is important". Thus, the most direct reason for valuing environmental goods and services is to **explicitly incorporate** those values into management plans and decisions.

However, understanding environmental or non-timber values is also relevant in outlining or forecasting the implications of alternative management actions. The impact of certain management alternatives, for example, on the level and distribution of the values of recreational activities can be examined using some valuation methods. In these cases, **changes** in non-timber values are more important than merely assessing the current level of value. This provides information on the social and economic implications of management choices.

Information on environmental values is particularly relevant for the management of public forests since these lands often have regulations regarding the production of multiple benefits to society. However, understanding these values is also relevant for private forests, especially where regulatory mechanisms are employed or through market devices like forest certification. Certification is an

<sup>1</sup> A recent notable (and controversial) endeavor aimed at valuing the world's ecosystem services in monetary terms was presented by Costanza et al (1997) in *Nature*.

attempt to signal to markets and consumers that forest products are produced using methods that consider environmental or non-timber aspects of the ecosystem. The consideration of non-timber values will probably be necessary in order for a producer to be certified.

A recent movement within national, and even some provincial, governments has been the adoption of natural capital accounts to go beyond the measurement of economic activity through traditional GDP measures alone. Environmental valuation methods form at least part of the tool kit necessary to achieve this objective.

Finally, the very process of measuring environmental values could serve as a component in the facilitation of public involvement in forest management. In this regard, the measurement and discussion of a broader set of forest values provides opportunities for the integration of ecological "boundaries" and/or implications within the public discussion. We feel that the current state of public involvement in forest management relies too much on unstructured methods (e.g. open houses) and requires the incorporation of more structured approaches involving accurate assessments of forest resource values.

## How Can We Value Environmental Goods and Services?

The value of environmental goods and services can be determined by observing individual choice behaviour and inferring tradeoffs, or, eliciting tradeoffs from structured survey processes. We first discuss the use of choice behaviour in revealing values associated with the use of forest resources.

### *Use Values: The "Easy" Non-timber Values*

Environmental values fall into two categories, use values and passive use values. Use values are values related to some use, activity or traceable economic behavioural trail. Outdoor recreation, for example, typically requires expenditures on travel and other goods. Thus, even though recreation may not be priced in a market, expenditures on recreation related items provide a behavioural trail that can be used to measure values. Effects of changes in scenery or aesthetic attributes of forest environments on real estate values can also be considered use values. Thus, by observing human behaviour in response to environmental changes models can be constructed of how people respond to these changes and implicitly reveal what trade-offs they make. Furthermore, these types of models provide explicit links between behaviour, environmental attributes, and demographic characteristics of the population. They are explicitly spatial and via projections of demographic and environmental changes, can be temporal. Models of this type can be integrated with current spatial, temporal forest management decision models. These methods can be used to assess the impact of alternative management plans (access implications, forest cover change implications, etc.) on recreation values. They can also be used to

predict changes in human use expected from alternative forest management plans.

An example is Figure 1 which is from a computer simulation program that calculates recreational hunting site choice (by wildlife management unit in Alberta) in response to changes in environmental quality attributes (moose population, access, forestry activity, etc.) and economic factors (costs of travel, location of residence, etc.). In this case the effect of a change in moose populations is simulated and the program identifies the economic value and predictions of the change in hunting site choice behaviour.

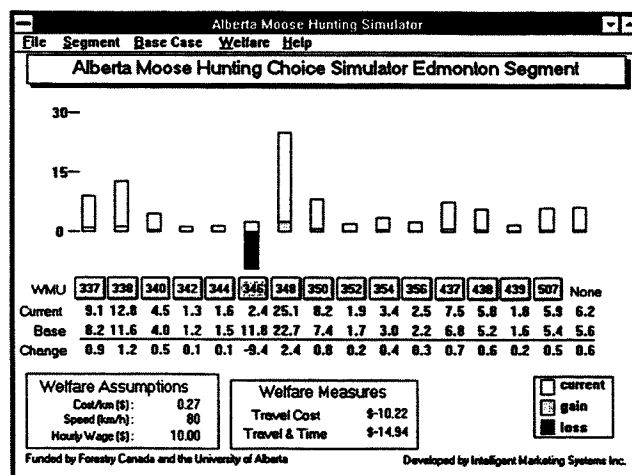


Figure 1: An Example of a Decision Support System for Moose Hunting Site Choice in West Central Alberta (bars illustrate the distribution of trips across wildlife management units).

While recreation is a significant component of the use of forest lands, there are other components that can be examined including the demand for residences (e.g. cottages) in response to demographic and environmental changes. In addition to assessing human behavioural changes (and implicitly values) economic methods can be used to determine the values of changes in ecosystem services (for example water quality or carbon cycling). The implications of changes in water quality can be evaluated through links with cost functions for water treatment. Carbon sequestration values can be estimated using emerging markets for CO<sub>2</sub> emissions reductions.

The techniques employed to evaluate these use values include travel cost models (commonly used in recreation demand, Freeman, 1993; Bockstael et al, 1989), hedonic price models (used in property value analysis, Freeman, 1993) and a host of production function methods that examine the impact of environmental change on outputs or expenditures (Freeman, 1993; Braden and Kolstad, 1989).

While these methods are relatively well developed, there are challenges associated with their use. For example, while these methods are able to incorporate a variety of forest attributes and link them to human behavior, the best methods for linking such information, including various scales of GIS information, are still being

examined. An even more complex situation is the integration of dynamics into the system. Forest processes are complex and simulations of such processes will need to be integrated with the models of human behaviour. The dynamic elements of human behaviour, including changes in demographics, habits, preferences and other issues also need to be addressed. These features and the role of social interactions (congestion effects, social groups, etc) on choice behaviour are areas that will benefit from interaction between economists and other social scientists.

Probably the most severe limitation in assessing and implementing non-timber values of this type is the lack of data. There are no systematic data collection programs that provide sufficient detail to generate spatial models of non-timber values. However, there are numerous opportunities available to do this (e.g. licensing data bases, campground and park entrance permits etc.). There have been few resources expended on the development of data collection processes of this type. Those data collection efforts that have been implemented tend to have significant gaps. For example, values associated with recreational hunting tend to focus on licensed hunters and not on members of Aboriginal groups. Recreational fishing data collection tends to ignore the substantial portion of the fishing public over 65 or under 16 years of age.

Finally, there is significant potential for non-timber valuation methods to be employed in an adaptive management framework much like many other topics in forest management. Existing models of non-timber valuation could be integrated within the design of management plans to examine the accuracy of the models and to revise the assumptions and methods employed after the implementation of the plan. Using adaptive management to study social phenomena is a relatively new concept for social scientists, and it may provide a better linkage between social and natural scientists in their quest for developing sustainable forest management protocols.

#### *Passive Use: The "Hard" Non-timber Values*

Passive use value is defined as individual willingness to pay for an environmental good, even though they may never intend to make any active use of it. Wilderness areas, wildlife habitats, protected areas, and biodiversity are examples of environmental goods that may have passive use values. In these cases, individuals derive satisfaction from the mere existence of the good. Since there is no behavioural trail, only direct survey methods (conversational methods) or methods that require people to evaluate scenarios and "construct" preferences, are useable. These methods could be closely linked to public involvement processes because the forum for collection and measurement of such preferences is often some form of public participation program. However, in the case of environmental valuation it is often a structured form of public involvement. It is worth noting that there is some controversy about the existence of passive use values (not just their measurement) and whether passive

use values are an economic phenomenon (e.g. Diamond and Hausman, 1993).

Methods used to determine passive use values involve the construction of hypothetical markets or scenarios. In these methods, values are estimated by examining the preferences that people state through changes in intended behaviour or choice. Frequently the behaviour involves the form of hypothetical tax payments or donations to focused environmental causes. One method used in these cases is contingent valuation (Mitchell and Carson, 1989). Note that one need not include money (or tax payments) as one of the elements in these trade-off elicitation methods. This type of "attribute based" mechanism or choice experiment has recently become popular for the examination of resource use issues (Adamowicz et al 1998a). Empirical studies involving choice experiments have involved employment levels, the stringency of recreation regulations, or changes in land use (e.g. Adamowicz et al. 1998b; Boxall et al. 1996). In this type of approach forest management scenarios can be explored where explicit management options and trade-offs can be embedded in the designs. Here valuation can be presented in terms other than money (but may also be monetary) and the valuation is derived from the trade-off expression made by the individual. Of course, these trade-off scenarios should correspond as well as possible to actual ecological and social predictions of the implications of alternative management plans.

The methods described above have also been referred to as multiattribute approaches to value (or preference) construction (Gregory and Slovic, 1997). Using such methods, preferences over environmental and social/economic attributes are constructed by observing choices made by individuals. These techniques have also been employed as conflict resolution tools as they may be able to generate solutions to resource conflict situations by finding alternatives that are acceptable to all parties involved (Costanza and Ruth, 1997; McDaniels, 1996).

Ideally these approaches should be linked with the ecological and socio-economic models of the forest planning area. This will facilitate "gaming" or construction of alternatives that realistically illustrate the ecological and socio-economic implications. However, we know that models of ecological and socio-economic processes are not perfect, thus introducing error and uncertainty into the system. Also, sophisticated models are not easily modified into ones that can generate alternatives easily and quickly. Nevertheless, one would like to use the best spatial and temporal representations of alternatives in these types of experiments.

While there are many concerns about the "validity" of the response that individuals will make when facing such choices (see Mitchell and Carson for a summary), there are cases that are particularly relevant to forest management situations. In these cases individuals will be exposed to a great deal of complexity and information. What is the best way to present this information, or, to provide incentives for the individuals to capture this

complexity? Furthermore, can individuals (or groups of individuals) move beyond focusing only on what is immediately important to them and take on a view of making a social choice? These are issues that require additional experimentation, but it is worth noting that such experimentation is occurring in forestry, fisheries, mining, and other sectors in which public opinions on the best uses of resources differ.

### **What Values Should be Measured – Everything?**

It would be a daunting task to value all of the goods and services provided by forest ecosystems. Perhaps a social issue should be discussion of what the priorities of individual parcels of forested land should be. This raises the question again of "what is important" except at a more local level. Yet this discussion is already occurring across the country with the issues surrounding protected areas, enhanced (or intensive) forest management strategies, and ecosystem management. One solution to the question of what to value may be the selection of **key or indicator uses**, in which values are prioritized according to human preferences, linkage between sets of values, and impacts on the specific ecosystem.

### **Whose Values Should be Considered?**

Many (but not all) of the benefits arising from ecosystem goods and services tend to be "public" in nature. That is, these benefits accrue to the public at large and are difficult to capture by "private" firms or individuals. This suggests that regulatory agencies, perhaps in cooperation with industry and other groups, are responsible for the assessment and integration of environmental values into management. However, this is not a simple topic. Issues of incentives for management, the costs of data collection, analysis, and monitoring arise when considering the appropriate roles for government, industry, communities and other parties in the measurement and use of non-timber values.

In an economic approach to such an issue, whoever is affected, beneficially or adversely, should be considered part of the economic "calculus." This approach suggests that the values of the general public need to be incorporated with those of local stakeholders. What is really being discussed, however, is the "social scale" of decisions. Just as ecological systems function at various scales, so do social systems.

### **The Future of Non-timber Valuation**

The tools described above are creative methods for finding the links between environmental services, the economy, and human preferences. However, all of these modelling approaches presume that some single agency (industry, government or some other agency), or set of agencies, will act as the "implementers" of the management plan that arises from the judicious use of timber and non-timber analysis methods. This planning approach to resource management has been a central

notion for some time. However, we should strive towards approaches that provide feedback on the choices made so that this new information can be incorporated into the next set of choices. Information transmission regarding what is "demanded" by the consumers (products, environmental quality, etc.) and the potential for "supply" of these goods and services by our forest resources is required. The ecological implications of alternative choices will be part of the information flowing in response to the choices made.

One of the merits of markets is their ability to transmit information about the demand for attributes, goods or services. Markets distill information from a highly complex and heterogeneous world of consumers (a complex form of public involvement). These signals are transmitted to producers and researchers who respond. Of course, one of the reasons that there are many concerns about industrial impacts on the environment is that signals for demands for environmental quality are not included in the marketplace. Furthermore, signals of ecological impacts, direct or indirect, are not well transmitted within the set of information on costs of production.

Can new social institutions be constructed to facilitate this flow of information on environmental benefits and costs? Forest certification, and related environmental accreditation initiatives, are really attempts to build the environmental signals into market transactions. However, there may be social institutions that are outside of the marketplace, or indirectly linked to market processes, that may be effective. These institutions may evolve further as we grapple with the complexity of ecological and economic information and the difficulty of making decisions in an environment with a variety of preferences or opinions.

### **Conclusions**

For 30 years there has been a great deal of research effort spent on the measurement of environmental values and their incorporation into resource management. There is a wealth of technology and knowledge that can be implemented today to help incorporate these values into forest management. However, data limitations and a small pool of qualified personnel in Canada means that environmental valuation has not been implemented to its potential. While non-timber values and valuation techniques will continue to develop, it is also likely that new social institutions, market and non-market, will evolve as mechanisms for the integration of environmental demands and ecological linkages into the market and into the management of forest resources.

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