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Determining the value of forests: an economic measure

Highlights

- The field of forest economics has advanced from a strict focus on timber values to a broader view of economic, ecological, and social values, which require different valuation techniques.
- Environmental valuation techniques are widely used in forest management practices, including: natural resource utilization, land-use allocation, damage assessment, resource accounting, and market based approaches for sustaining ecosystems services.
- By calculating the Total Economic Value (i.e., benefits and costs associated with the use and/or conservation of resources), managers can incorporate sustainable forest management principles directly into economic decision making.

Forests are valuable because they provide many services and products that enhance the well being of society, including timber supply, wildlife habitat and environmental services. However, measuring the value of forests is complicated because many different elements need to be considered. Some values are easily measured by market prices (such as the value of timber). Other values (such as non-timber forest products or the existence value of the forest) are more complicated to measure, but still must be considered because they undeniably influence society's well being.

Environmental valuation is a relevant and useful technique in sustainable forest management. Foresters need to understand the concept of value as used in economic analyses to understand how economic tools can be used to manage natural resources and develop public policy. Resource managers need to recognize the different types of values that forests provide and understand that different methods must be used to directly measure or indirectly determine these values. This research note outlines the concept of economic value and its importance, the different types of values, how they are measured, and how this information is used in developing policy or evaluating projects.

The concept of value

The concept of value has different meanings depending on the context in which it is used. For example, ecologists may consider the intrinsic value of forests. The intrinsic value is the value that something has for itself, independent of any use or function given to it by someone. However, intrinsic value is only one type of value considered from the economic perspective. In practice, economic forest values often refer to the contribution that forest products and services make to human "welfare". Welfare is a measure of people's well being derived from the consumption of goods and services, either public or private. People assign value to the use, right to use, or to the mere existence of environmental amenities.

The role of economists is to try to determine the economic value of forests i.e. the monetary value that would have an equivalent effect on people's utility. Utility is a measure of enjoyment or happiness a person experiences from consuming a good or service. Economic values can be calculated directly from market information, or indirectly from information about people's preferences, such as people's willingness to pay for the use or conservation of a specific forest asset.

Why is environmental valuation important?

Environmental valuation is the integration of environmental values with traditional economic modeling. When economic measures are adjusted to incorporate environmental factors, decision-makers are better able to determine a baseline value for comparing the economic and environmental sustainability of proposed projects in the future. Environmental valuation is a proactive, relevant tool that can be used to address potentially competing interests in the forest (such as fibre extraction and biodiversity conservation) while respecting the economic fundamentals of forest products production. It can also be used to assess the effects of various forest management policies on societal goods.

Environmental valuation has a variety of practical applications for government and industry in policy development and private economic management. It can be used to develop accurate benefit-cost analyses and land use plans. Valuation can also be used to determine compensation for environmental damages caused by the actions of individuals or companies. For example, environmental valuation can be used to calculate penalties to a company whose actions result in damages to a water supply. Environmental valuation can also be used to calculate marginal costs and benefits caused by different policy or regulatory scenarios, allowing government officials to conduct regulatory analyses. One of the main objectives of environmental valuation is to capture depreciation and passive values of natural resource stocks, so they can be used in natural resource accounting. Environmental values are also used to differentiate measures of economic growth and economic development.

Types of environmental values

Forest values are usually categorized as **use values** or **non-use values** although **option values** share similarities with both categories (Figure 1).

- **Use values** are the economic values obtained through using the forest and its resources.
  - *Direct use values* are relatively easy to measure and have been commonly included in economic studies. Some examples of direct use include timber extraction, recreation, or collection of non-timber forest products.
  - *Indirect use values* of forests, which have not been traditionally considered in economic analyses, include biodiversity conservation, watershed regulation, and carbon storage and sequestration.
- **Non-use values** that flow from forests do not require actual use of the resources.
  - The *existence value* reflects that an individual may appreciate the fact that forests exist and acknowledge the role they have in the cycle of life.
  - Similarly, some people take satisfaction in knowing that old-growth forest will be left for future generations (*bequest value*), that other people have the opportunity to enjoy forest environmental amenities (*philanthropic value*), or because conservation of forests is the "right" thing to do (*altruistic value*).
- **Option values** refer to the option to use forest environmental amenities in the future, even though no current consumption exists. *Semi-option values* are those values associated with avoiding irreversible consequences of economic choices made in the present, while learning about future benefits/losses related to such choices. An example of semi-option value is the willingness to pay to conserve an area of forest to protect the yet unknown information

enclosed in such an ecosystem. This information could potentially be used in the future for the development of new techniques of plant breeding, new medicines, or industrial processes.

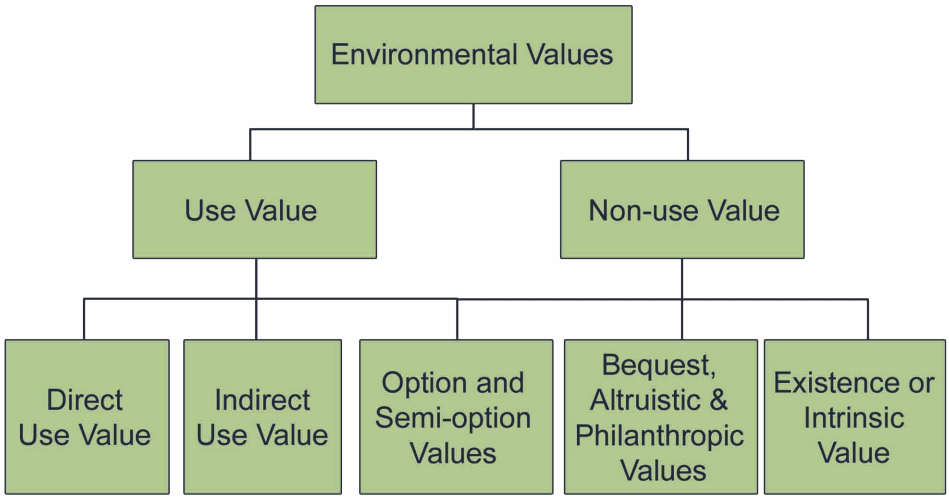

Figure 1. Classification of forest environmental values.

How are forest economic values determined?

Environmental valuation is the estimation of the economic value of all the products and services provided by forests, including use, non-use and option values as described above. These products and services can be broad-ranging and challenging to measure. Values are usually based on monetary values equivalent to changes in public welfare that are generated by variations in the quantity and quality of environmental assets. All valuation methods are based on consumer preferences. These preferences might be revealed through market or surrogate market information or through people's willingness to trade off money against the availability and/or quality of environmental goods and services. The latter is used when a market does not exist from which information can be extracted. These methodologies are called *revealed preferences* and *stated preferences*, respectively.

Once these preferences have been determined, they can be used to compare the *Total Economic Value* (TEV) of both development and non-development of a particular project. The TEV is defined as the sum of all environmental values, including use, non-use and option values. Economists use the TEV to quantify the net impact on the value of an environmental asset (e.g. caribou populations) as a result of the development of a project. TEV is widely used in cost-benefit analyses of economic projects such as timber extraction and mining. In general, a project should be developed if the total economic value of developing it is higher than the TEV of not doing so.

Examples of environmental valuation

Although some types of environmental values can seem abstract and difficult to measure, they must be considered to understand economic modeling used in different sustainable forest management issues. The following examples from SFM Network research illustrate how environmental valuation can be used to make decisions related to sustainable forest management.

Assessing the value of old-growth forests

The techniques described above could be used by a provincial government to evaluate whether to allocate timber licenses to a mature forest surrounding a provincial park. By calculating the total

economic value (TEV) of both developing and not developing the project, decision makers could directly compare the economic gains from stumpage fees to the economic gains through public use of that forest for hunting, recreation, and/or cultural experiences.

van Kooten and Bulte (1998) conducted such an analysis to compute the socially-optimal stocks of mature forests. They calculated local non-timber forest values, recreation, hunting and wildlife values, non-use amenities and carbon sequestration values of mature forests. Results suggested that the optimal area of remaining mature forest could be up to 55% depending on the methodologies and assumptions used in the analysis.

Evaluating pest outbreaks

Lantz (2007) evaluated the impact of Spruce Budworm (SBW) outbreaks and its management on forest carbon dynamics in the 2008-2012 period. The author tested the cost-effectiveness of investing in pest management activities for forest carbon sequestration, and determined the optimal proportion of the land base to be protected, using non-market socio-economic benefits of SBW control. Non-market benefits were measured as the willingness to pay to protect forests from SBW outbreaks, and costs were measured as the willingness to compensate those affected by the outbreaks. This project developed a modeling framework that was adopted by the New Brunswick Department of Natural Resources to quantify provincial economic impacts caused by SBW. Managers have used this model to minimize the impacts of outbreak through salvage harvesting and harvest rescheduling.

Values attributed to hunting

McFarlane *et al.* (1998) examined the economic value of hunting, hunters' forest social values and management preferences. They found that big game hunters spent approximately $172 million in 1996, which is a significant non-timber use of boreal forests. It was also found that hunters supported SFM practices and held high existence values of forests. These types of measures help managers establish forest management goals and strategic guidelines. Also, knowing the values of various stakeholder groups will help managers predict how stakeholders will react to management practices and what groups will be positively or negatively impacted by changes in management.

Afforestation policies

Suchanek *et al.* (2001) determined how much landowners would need to be compensated to convert their pastures and cropland into forests for economic, environmental, social and carbon-uptake purposes. The results indicated that on average farmers were willing to accept a compensation of approximately $40 per acre to convert their land into forest. This value can be used by social planners and managers to build programs that successfully promote afforestation activities.

Further research in environmental valuation

The main challenge economists face when conducting environmental valuation is the accuracy of results. Rudd and van Kooten (1998), for example, found that welfare measures derived using standard environmental valuation methodologies did not provide accurate approximations of welfare values in cases where people had difficulties in defining their preferences for non-market environmental amenities. As a result, new methodologies involving complex mathematical methods are being developed to improve estimations of environmental values.

Summary

Obvious economic benefits exist from the direct use of forests, such as harvesting trees. However, a variety of other direct use, indirect use, and non-use values are also relevant when determining the net

economic benefits of developing economic projects. Alternative forest values must be considered when evaluating projects to ensure that optimal benefits to society are achieved.

Social planners can use forest environmental values to compute more accurate measures of societal benefits that could potentially result in the design and implementation of more efficient and equitable land use policies. Application of environmental valuation may benefit forestry companies from a strategic perspective, providing information that will allow them to balance public perception and stakeholder values. Organization may use this information in a proactive manner to limit future conflicts.

Economists still face challenges when calculating environmental values and welfare. These measures should not be overlooked in policy as they could lead to the significant underestimation of the economic benefits of conservation, a bias towards development in the decision-making process, and reduced social well being.

Further reading

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Management Implications

- Forest managers should recognize the importance of the different environmental values of forests, and their impact on people's well being. Some economic values will be easier to evaluate than others.
- When evaluating economic projects, the impacts on environmental assets (quantity and quality) should be considered as well as financial profit.
- Stated preference and revealed preference are useful approaches to estimate environmental values associated with the direct and indirect use of forest resources.

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