



PROJECT REPORT

Economic Indicators and Their Use in Sustainable Forest Management

Draft (In Review)

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ABSTRACT

The economic sustainability literature highlights important theoretical and practical limitations when developing economic indicators to assess sustainable forest management. Since SFM is multi-disciplinary, no body of theoretical knowledge can embrace all of its dimensions. Further, there is a significant gap between economic theory and management application which will likely remain. For the economic indicators, spatial scales have a very significant impact on the indicator chosen and there is a danger of not selecting the best indicator simply because there is no or poor data.

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1 INTRODUCTION

Sustainable development was defined by the Brundtland Commission (1987) as “development that meets the needs of the present generation without compromising the needs of future generations.” When the concept was formally introduced, a demand for tools to assess sustainability was created (Milon and Shogren 1995). At roughly the same time, similar ideas were developing in the economics literature where efforts were underway to better merge economic ideas with ecology (Archibugi *et al.* 1989; Pearce and Turner 1990; Costanza *et al.* 1991; Swingland 2002; Freeman 2003). The consequence has been a rethinking of how we approach business and the environment in virtually every sector of the economy (Capra and Pauli 1995; Jenkins and Smith 1999).

In the forest sector, the use of criteria and indicator frameworks and certification systems became the means for defining and assessing sustainable forest management (SFM), particularly in developed economies. However, these frameworks and systems are not helpful in dealing with some key conflicts in economic theory or the controversies over the theory of economic value (FAO 1998; Vincent and Hartwick 1998; Nordhaus and Kokkelnenberg 1999; Mittelsteadt *et al.* 2001; Adamowicz 2003). There are also serious challenges with the economic indicators used in the context of SFM. This paper will explore these conflicts and challenges.

2 BACKGROUND

2.1 Sustainable Development in the Forest Sector

The concept of sustainable development brought attention to the existing limitations of forest management models that primarily concentrate on sustained yield timber management (Bull and Schwab 2002). In response, a broad coalition of stakeholders in the forest sector developed the concept of SFM. The concept recognizes a broad array of forest benefits¹, inappropriate (wasteful) forest uses and user groups, as well as the need for the improvement of tools to assess such benefits and costs (FAO 1998). SFM poses at least two important challenges to forest economists: new economic theories and models that integrate the SFM concept rather than rely on sustained yield theory (Bull and Schwab 2002); and new multi-stakeholder friendly technical tools to assess the economic sustainability of forest management activities.

¹ Forests resources are known for providing a range of benefits to society. These include both market and non-market goods and services: 1) forests as a source of timber; 2) forests as a source of tangible non-market products (this includes products such as fruits, mushrooms and medicinals that are collected and consumed by households but not bought and sold in markets; 3) forests as a source of less tangible amenities consumed by households (such as existence values for biodiversity and the satisfaction gained from scenic and cultural values); 4) forests as a source of environmental services to other industries (ecological functions such as watershed protection); 5) forests as a source and sink for carbon dioxide; 6) forests as a source of land for other purposes; 7) forest management as an activity that creates demand for inputs such as labour, materials and human-made capital (Vincent and Hartwick 1998).

Mittelsteadt et al. (2001), in tackling the economic theories and model challenge, suggested that sustainable development requires that total capital² be non-declining over time, maximizing the overall net benefits to present and future generations. The notion of non-declining may suggest to some that total capital be in a “static equilibrium”; however, in a world of increasing population, sustainability could incorporate a notion of growth in total capital. Other economists have argued that sustainable growth should also consider measures of an increase in ‘quality of life’ (Boulding 1991).

For developing economic tools or procedures at the forest management unit level, Veeman (1989) and Mittelsteadt et al. (2001) suggest a holistic notion of sustainable development that includes three critical elements:

1. a growth element (a component that analyzes the long-run productive capacity of the economy, where non-market values and depreciation of environmental assets are incorporated);
2. distributional element (a component that analyzes the impacts of economic growth on poverty rates and income inequality); and
3. an environmental element (a component that includes environmental and ecological underpinning needed to sustain economic growth over time).

Transforming these laudable elements into economic indicators at the forest management unit level is not without difficulties, and some of the key challenges include finding the appropriate theoretical foundation and a set of appropriate economic indicators.

2.2 Economic Theories

According to neo-classical economic theory, economic development was measured in terms of increase in production, derived from the scarce resource we utilize (Costanza et al. 1991; Daly 1991). During the recovery process from the Great Depression in the 1930s, this theory suggests that we should maximize the productivity of the limiting factor of development— human-made capital—since natural capital was widely perceived to be abundant (Daly 1991). As a result, public policy concepts mainly aimed at increasing the productivity of human-made capital in order to gain economic growth. The overall effect was to greatly increase the consumption of natural capital and, in the post-depression period, productivity became a fundamental determinant of firm- or individual-level profitability and set the national standard of living levels (Veeman and Luckert 2000). In essence, neo-classical economists incorporated the contribution of nature into production functions (Archibugi et al. 1989), and those components of nature not considered ‘productive’ were treated as an externality.

² Total capital stock includes human-made capital, natural capital (forests, subsoil assets, air and water, etc.), and human capital (human skills and ingenuity) (Vincent and Hartwick 1998).

Today, some analysts suggest that the limiting factor in production is natural capital, not human capital (Daly 1991; Boulding 1991). Other researchers increasingly emphasize the danger of ignoring the role of nature as the life-support system that economies depend on (Archibugi et al. 1989; Hardin 1991). Human welfare is no longer entirely determined by increased material output available for consumption, but also includes components of non-marketed, un-priced, or poorly priced and intangible services from natural resources (Veeman and Luckert 2000). To respond to the need for including the environment more explicitly, one economic sub-discipline that has emerged is ecological economics (Archibugi et al. 1989).

So far, in the forest sector, few attempts have been made to incorporate theories of ecological economics or related theories into traditional forest management theories (Kant 2003; Lee and Field 2005). Part of our reluctance lies in our limited knowledge of diffuse ecosystem services and causality (Swingland 2002; Kant 2003; Bull et al 2004).

At the forest management unit level it seems that different stakeholder groups are positioning themselves around these two major economic theories. The ‘Malthusians’ seem to focus on the crisis in natural capital depletion and suggest the appropriate theory for SFM is ecological economics. The ‘optimists’ subscribe to neo-classical economic theory and find solutions in technological change, changes in consumer preferences, or scientific management. The theoretical impasse that has emerged seems to be playing itself out at the forest management unit level as an impasse over selecting economic indicators.

2.3 Economic Indicators in Sustainable Forest Management

As important as it is to define policy goals, it is equally important to evaluate the progress towards the defined policy goals; indicators can play an important role in evaluating the effectiveness of policy mechanisms and inform public policy decisions (Milon and Shogren 1995). For example, well known indicators such as Gross National Product (GNP) and Consumer Price Index (CPI), which concentrated primarily on maximizing production, were developed during the Great Depression in order to inform public policy decisions (Archibugi et al. 1989). Today, when one policy goal is sustainable development, indicators such as GNP and CPI are limited in their utility since they ignore the contribution of aspects of nature to production, and thus do not fully capture the impacts of current production activities on future income or economic welfare (FAO 1998). New indicators, such as Green Gross Domestic Product, have been proposed as a replacement (Ahmad et al. 1989; Vincent and Hartwick 1998; Nordhaus and Kokkelnenberg 1999).

As mentioned, C&I/certification systems frameworks are now a popular means of assessing progress towards SFM for both governments and firms. In 1994, Canada first adopted C&I under the Montreal Process and, in 1995, the Canadian Council of Forest Ministers (CCFM) developed C&I at the national level. An examination of the CCFM criteria (Table 1) identifies the social, economic, and environmental pillars commonly used in various C&I initiatives, and the most explicit economic indicators under the

elements are: productive capacity; competitiveness of resource industries; contribution to the national economy; and non-timber values in Criterion 5.

TABLE 1. *Criteria for sustainable forest management.*

Criterion	Description	Criterion Emphasis
Criterion 1	Conservation of biological diversity	Environment
Criterion 2	Maintenance and enhancement of forest ecosystem condition and productivity	Environment
Criterion 3	Conservation of soil and water resource	Environment
Criterion 4	Forest ecosystem contributions to global ecological cycles	Environment
Criterion 5	Multiple benefits of forests to society	Economic & Social
Criterion 6	Accepting society's responsibility for sustainable development	Social

Table 2 presents examples of economic indicators at two of the three commonly discussed spatial scales: national and local. It is clear that the relationships between the two level of indicators is very weak and in most cases non-existent. It is also disconcerting that, in some provinces at least, SFM economic indicators are not being used in reporting (BC Ministry of Forests 2004).

In order to assess SFM indicators for the C&I system, the key attributes approved by the Canadian Council of Forest Ministers (2004) are:

- *Relevant* – Each indicator must relate clearly to a particular criterion, and should represent significant information about the values embodied by the criterion. An indicator must be sensitive and responsive to change in the sense that management actions and other forces can readily influence its behaviour.
- *Measurable* – An indicator should be based on available or easily obtainable, scientifically valid, empirical measurements that can be consistently repeated over time to observe trends. Obtaining indicator data must be practical and fiscally feasible.
- *Understandable* – Indicators must be understandable not only to resource [forest] managers but also to the informed public, especially if public interests are to be incorporated into planning exercises. Simplicity and clarity are also characteristics that make indicators more understandable.
- *Can be Forecast* – Future behaviour of indicators should also be predictable with reasonable accuracy, if they are to guide management or policy decisions. It must be possible to make an assessment of future indicator behaviour, given certain management actions, policies or other factors.

TABLE 2. Selected SFM economic indicators at the national, provincial and local scale – examples.

CCFM National Indicators	Provincial Indicators	CCFM Local-level Indicators
Contribution of timber products to the gross domestic products	No economic indicators	Volume of standing timber to which appropriate road access has been developed
Value of secondary manufacturing of timber products per volume harvested		Earnings before interest, taxes, depreciation and amortization (EBITDA)
Production, consumption, imports and exports of timber products		Cash return on capital employed (CROCE)
Contribution of non-timber forest products and forest-based services to the gross domestic product.		Return on shareholders equity
Value of un-marketed non-timber forest products and forest-based services.		Ranking with respect to cost of delivered wood
Distribution of financial benefits from the timber products industry.		Number of jobs resulting from on-operation of the Tembec Woodlands Mills
Return on capital employed.		Number and value of contracts awarded enterprises in FML 01
Productivity Index.		Offers of economic opportunity to communities
Direct, indirect and induced employment.		
Average income in major employment categories.		

Source: CCFM 2004; BC Ministry of Forests 2004; Tembec Industries 2004

Other studies have added additional assessment criteria such as economic welfare (Mittelsteadt et al. 2001) and reference value³ (BC Ministry of Forests 2004). Forest certification systems have also struggled to find the most appropriate attributes for assessing indicators (Bull and Schwab 2001; Auld and Bull 2003; Hickey et al 2005). It seems that, in both the national and provincial C&I frameworks and various certification systems, the key attributes to assess economic indicators are yet to be determined.

³ Reference values—historical baselines, technical or scientific thresholds and desired targets—provide a context for assessment of states and trends.

3 ANALYSIS

The literature on economic sustainability and indicators identifies several theoretical and empirical challenges (Vincent and Hartwick 1998; Nordhaus and Kokkelnenberg 1999; Mittelsteadt et al. 2001; Adamowicz 2003; Kant 2003). This section highlights four key challenges in developing SFM economic indicators.

3.1 Difficulties with the Theory of Economic Value

As mentioned, moving towards ecological economics and sustainable forest management involves incorporating timber (private) goods and services as well as non-timber (public) values of forests into economic models, and developing appropriate indicators that assess the sustainability of these values against the other two pillars of C&I approaches: environment and social benefits.

In valuing non-marketable public benefits, many economists aim to translate them into market analogues and value the consumption of these goods and services (Adamowicz 2003). While there is consensus that accurate valuation is highly important, especially in the context of ecological economics, there is little agreement on which valuation method [economic and non-economic] to use (FAO 1998; Vincent and Hartwick 1998; Nordhaus and Kokkelnenberg 1999).

Researchers have identified difficulties and concerns in valuing the wide range of non-market benefits from forests. Kant (2003) analyses the problems in assigning market prices to non-timber values that can be characterized as public goods and services. He argues that certain forest values, such as spiritual and ecological values, cannot be translated into monetary values because they are not substitutes but complementary values. Furthermore, certain benefits from forests are difficult to value in terms of market analogues because they are never traded in markets although they may provide private values to forest dependant communities and are critical to community subsistence (FAO 1998; Vincent and Hartwick 1998; Kant 2003). Adamowicz (2003) points out that even if non-market forest values could be translated to market analogues, non-market values of forests often depend on the spatial scale where it is applied (e.g. recreation site), making it problematic to make direct comparisons of these values between countries, regions, and specific sites.

Clearly there are challenges in defining what to value, how to value it, and what methodology to use for trade-off analysis. Thus it is reasonable to see an impasse at the forest management unit level in the selection of economic indicators. Kant (2003) suggest that to tackle the issues related to problems in economic valuation and trade-offs we will have to depend on multi stakeholder decision-making processes.

3.2 Gap between Economic Theory and SFM Indicators

Adamowicz (2003) argues that the gap separating ecological and economic characteristics largely exist because of the complexities of the integration, and the inconsistency between the current indicators and ecological economic theory. The gap challenge also applies to the SFM framework since the economic sustainability indicators should build upon knowledge of the bio-physical dynamics of the natural capital (Boulding 1991; FAO 1998; Vincent and Hartwick 1998; Nordhaus and Kokkelenberg 1999). Table 2 illustrates the gap between the spatial scales of management and economic indicator information reported.

Adamowicz (2003) further argues that a gap between the conceptual notion of economic well-being and the indicators used in C&I systems also exists. The indicators used to measure well-being, such as employment and economic diversity, may not necessarily measure non-declining well-being, especially when both market and non-market values are included. Adamowicz (2003) suggests new indicators be developed, such as green Net National Product (NNP).

The gap between economic theory and SFM indicators is a significant challenge. The concept of SFM combines a host of theories from many disciplines and it recognizes diversity of preferences: preferences that are revealed through markets as well as non-market mechanism, across communities, time, and generations (Bernhard et al. 2003; Kant 2003). Instead of closing the gap, Barthod (1998) argues that the use of criteria and indicator frameworks can be viewed as an attempt to avoid the pitfall of overly disciplinary theoretical approaches that seek to specify abstract conditions for sustainable management. So perhaps economists of all persuasions will have to accept that the C&I framework contains necessarily complex concepts where technical-scientific and political-cultural consensus or compromise is needed and needs a multi-disciplinary theoretical foundation (Barthod 1998; Lee and Field 2005).

3.3 Scale of Indicator

It is recognized that the definition of sustainability depends on the spatial scale to which it is applied (Boulding 1991; FAO 1998; Vincent and Hartwick 1998; Nordhaus and Kokkelenberg 1999; Mittelsteadt et al. 2001). As indicated in Table 2, the measures of sustainability—indicators—often differ for countries, regions, and community levels, thereby limiting their transferability across spatial scales.

Where they do exist, the linkage between smaller and larger scales illustrates important interdependencies (Mittelsteadt et al. 2001). Many larger scale environmental, social, and economic decisions are influenced by decisions made at community levels. Conversely, community-level decisions can stem from the larger regional or national level initiatives. Therefore, Mittelsteadt et al. (2001) suggests that standardized measurements that enable comparisons among different scales are preferable. While this would be the ideal solution, we feel this is unrealistic since there are no studies that could

support this goal. For example, non-timber forest products and services indicators, a particularly difficult set of indicators to develop, are very sensitive to spatial scale (Adamowicz 2003). Many non-timber forest products, which are frequently non-priced, may represent an insignificant portion in national scales; however, at the household or community level, the economic significance of such products could be high (Mittelsteadt et al. 2001; Kant 2003).

3.4 Data Availability for Indicators

The availability of data represents a significant challenge in working with SFM indicators. Economic indicators relating to values of unmarketable and/or non-timber forest products, the value of forest services, and indirect/induced employment from forests found that relevant data was difficult, or sometimes impossible, to obtain. For example, the Technical Supplement for CCFM Criteria and Indicators (CCFM 2004) states that indicators such as “Contribution of non-timber forest products and forest-based services to the gross domestic product” and “Value of unmarketed non-timber forest products and forest-based services” do not have readily available data from reliable sources. Nordhaus and Kokkelenberg (1999) describe how the measurement of quantities for non-market goods and services, especially ones with characteristics of public goods, suffer from insufficient data. Mittelsteadt et al. (2001) also found that there is a lack of available data for economic indicators relating to income distribution.

Research indicates that there have to be tradeoffs in indicator selection, and the lack of available data is a serious impediment in the process. For example, there are indicators with data available which do not measure economic sustainability (Mittelsteadt et al. 2001), while there are other identified indicators that measure economic sustainability with no presently data available. Nordhaus and Kokkelenberg (1999) propose that we must mount central federal efforts to identify green data needed for measuring economic changes. The Technical Supplement of CCFM C&I (CCFM 2004) warns that the weakness of data for the non-timber sectors of the forest economy is unlikely to change unless data collection is encouraged at the provincial level. Similar efforts could also be useful at regional or local levels. In other words, government and industry investments in the acquisition of relevant economic data and data co-ordination could improve the selection of economic indicators used in defining sustainable forest management.

4 CONCLUSIONS

Identifying and using appropriate economic indicators for SFM still faces formidable challenges at both the theoretical and management level. We conclude that:

1. Both neo-classical and ecological economic theory is internally consistent. However, researchers increasingly emphasize the limitations of neo-classical economic frameworks in assessing sustainable forest management. The literature suggests moving towards integrated economic frameworks while recognizing the

- fundamental challenges of the theory of economic value. We conclude that stakeholder participation is imperative for SFM since different forest values are perceived and valued differently by different stakeholders.
2. The gap between economic theory and application is pronounced and perhaps it should remain. Nevertheless, for decision-making processes, new methods for measuring economic sustainability still need to be developed which are based on the concept of total capital. Future research must address such information gaps in helping to develop integrated economic indicators to assess SFM.
 3. Once economic indicators are selected, not all are relevant at all spatial scales. Field-level indicators are frequently simplified for justifiable reasons and spatial scale must be thoroughly discussed and incorporated into the set of indicators chosen. One stakeholder group should not dismiss another group working at a different scale since the context is very different.
 4. The “best” indicators often have incomplete datasets to support them. A selection process needs to be developed to help in balancing the “best” indicators against the “practical” indicators which may not always address the issue at hand. A cost/benefit analysis could act as a guide in the selection process.

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