

## INDICATOR 64

### **Indicator 64: Capacity To Conduct and Apply Research and Development Aimed at Improving Forest Management and Development of Methodologies To Measure and Integrate Environmental and Social Costs and Benefits into Markets and Public Policies, and To Reflect Forest-Related Resource Depletion or Replenishment in National Accounting Systems**

#### **Rationale for Use of Indicator:**

The Technical Advisory Committee (TAC) provided the following rationale for Indicator 64:

“This indicator describes national emphasis being given to developing methods that integrate forest-related resource and environmental and social values into market and public decisionmaking. In the past, decisionmakers have generally been unable to quantify many important social and environmental values of forests, and therefore decisions were based primarily on traditional economic measurements of forest market values. The indicator also shows progress in the development of methods that incorporate forest resource, environmental, and social data into national accounting systems.”

Following this rationale, reporting on Indicator 64 would include tracking progress in incorporating environmental and social values in both the public and private sector decisionmaking at the smallest scale (e.g., a national forest or a firm), as well as progress in incorporating such information into large-scale reporting such as national income accounts and national assessments.

#### **Data Available to Quantify the Indicator**

The TAC suggested four groups of measures that could be used to quantify Indicator 64:

- List of the relevant methods and publications that have been or are being developed to address this indicator.
- Description of the ways such methodologies have been specifically incorporated into market and public policies.
- List of environmental and social values that have been quantified and included in national Gross Domestic Product (GDP) reports and national forest resource assessments.
- Number of person years or budget as a percentage of last year’s budget devoted to R&D of relevant methodologies.

Those four groups will be used in describing the current status of efforts to develop methodologies and incorporate those methodologies into policies and decisionmaking.

### Relevant methods and publications

Forests provide a wide range of goods and services. Tangible outputs from the forest include timber, forage, and special forest products. The forest environment provides opportunities for recreation, and also provides numerous ecological services, such as watershed protection, wildlife habitat, and carbon storage. The full range of goods and services is well illustrated in Criteria 1 through 6. Numerous methodologies exist for estimating the value of forest goods and services.

In this section, valuation methodologies relevant to forest resources are discussed. The values derived from these methodologies are used in various types of analyses, including cost-benefit analysis. These methods are also the basis for many of the values used in environmental accounting frameworks. Methods for environmental accounting are described in the latter part of the section.

### Forest valuation

There are numerous well-documented, reliable valuation methods that can be applied to forest resources. These methods can be applied at all geographic scales from a small geographic area to the Nation. The methods can be used to provide information relevant to land management, regulatory actions, and policy options. Valuation methodologies can be broken into two major categories: revealed preference methods and stated preference methods (Freeman, 2002).

Revealed preference methods are based on data from actual transactions or other documented behavior to infer the value of goods and services. Within this category of methods are direct and indirect valuation methods. Direct methods include market prices and simulated markets. Indirect methods include the travel-cost, hedonic valuation, avoidance expenditures, and referendum voting.

Values for commercially traded outputs from the forest are often readily available through market data that is regularly collected and published. Other outputs, including many special forest products, may be traded in informal or local markets, or collected on a subsistence basis. For these types of products, it may be possible to approximate market values, since these outputs have the characteristics of private goods. For nonmarket goods and services, the indirect methods are generally applied, although there have been experiments with simulated markets.

Stated preference methods rely on questioning people about their preferences in a hypothetical scenario. Direct methods in this category include bidding games and willing to pay questions. Indirect methods include contingent ranking, contingent activity, and contingent referendum. The indirect methods may result in monetary estimates of willingness to pay, depending on the study design and good or service being assessed.

Both revealed preference and stated preference methods are well documented in the literature (Herriges and Kling 1999, Ward and Beal, Mitchell and Carson 1989). Several forthcoming books will provide updated overviews of nonmarket valuation methods (Champ et al. 2002, Carson 2002, and Bateman et al. 2002). Champ et al. (2002) provide the policy context for nonmarket valuation, economic foundation for the methods, and a guide to implementing the most prevalent revealed and stated preference techniques. Carson (2002) focuses on contingent valuation, and Bateman et al. (2002) focus on stated preference techniques.

Generally, economists are comfortable with the methods for measuring market goods, and the use of market values because they reflect actual behavior. However, market prices also reflect a complex set of influences such as subsidies and the tax code that distort markets from the conceptual ideal of perfect competition. Some types of nonmarket valuation methods are still controversial. However, most of the controversy is associated with measurement of passive use values, which can be extremely important in assessing public preferences for public resources.

The valuation methodologies discussed so far have been in the context of economic valuation. Economic techniques are not appropriate for some types of forest values. The revealed and stated preference techniques described previously are not restricted to economic applications. Variations of the methods are also used in developing noneconomic measures of value.

Other methods have been developed to address resource values. One example is the measure of relative scenic beauty of forests. Quantitative models have been built that relate public perceptions of scenic beauty to the biophysical characteristics of the scenes. The Scenic Beauty Estimation method (Daniel and Boster 1976) has been applied to numerous forest scenic quality issues in several regions, including the Northeast (Brush 1979), the northern Rocky Mountains (Benson and Ullrich 1981), and the Southwest (Brown and Daniel 1984).

Some values derived from the forest may be impossible to define and measure in a way that lends itself to a structure of criteria and indicators. Many of the spiritual, cultural, and aesthetic values associated with forests are difficult to translate into simple measures. The wide range of values associated with forests is described in Driver et al. (1996).

The existing methodologies allow analysts to estimate some technical measures of value, using economic concepts or other social concepts of value. These measures can be useful in the policy and decisionmaking process. However, in addition to the individual values measured through these techniques, there are individual values not captured by these methods. Values can also change over time in response to changing information and other personal factors. In addition, there are collective societal values that interact with individual values. These collective values can also change over time. Methods such as content analysis have been used to assess changes in public values for natural resource management (Bengston et al 1999; Bengston and Xu 1995).

Environmental accounting

Environmental accounting is a general term that encompasses a variety of approaches to better incorporate environmental benefits and costs into accounting systems. Table 1 displays a categorization of accounting types and their parallel in environmental accounting.

Table 1. Categorization of Accounting Types

<b>General Type of Accounting</b>	<b>Environmental Accounting Parallel</b>
<i>Management accounting</i> : the identification, collection, estimation, analysis, and use of cost and other information for decisionmaking within an organization	<i>Environmental management accounting</i> : management accounting with a particular focus on materials and energy flow information and environmental cost information
<i>Financial Accounting</i> : the development and reporting of financial information by an organization to external parties (e.g., bankers, stockholders)	<i>Environmental financial accounting</i> : financial accounting with a particular focus on reporting environmental liability costs and other significant environmental costs
<i>National accounting</i> : the development of economic and other information to characterize national income and economic health	<i>Environmental national accounting</i> : national accounting with a particular focus on natural resource stocks and flows, environmental costs, and externality costs

Source: Environmental Management Accounting Research and Information Center (EMARIC), at Tellus Institute, Boston, MA.

Environmental management and financial accounting have become an increasing area of interest for private enterprises. Schaltegger and Burritt (2000) suggest that the emergence of environmental accounting in firm-level decisionmaking is a result of pressure from stakeholders concerned about the environmental impacts of corporate activities and the increasing costs of environmental impacts. The combination of the two factors has gained the attention of corporate decisionmakers. Their book provides a review of the issues, concepts, and practices of environmental accounting by private industry, including an extensive bibliography. The tools and information on environmental management accounting can be used by forest industry as well as by public forest managers.

In 1992, the Environmental Protection Agency (EPA) began the Environmental Accounting Project (EAP) in response to a concern from stakeholders that an industry will not adopt pollution prevention as a first choice until managers have information that allow them to compare the costs and benefits of alternative approaches. Under the guidance of a group of experts, EPA developed a program in collaboration with private industry to develop managerial accounting techniques that business managers can use to fully account for environmental costs and benefits. Information from the EPA project will soon be incorporated into a new “International Environmental Management Accounting Web site” that will be launched in early March 2002. The new Web site will have information on environmental management accounting resources and activities in the United States and in many other countries. The Web site will be hosted by the Environmental Management Accounting Research and Information Center.

A “greening” of national income and product accounts has been a topic of consideration for decades. The standard System of National Accounts (SNA), first developed after World War II, provides a system of indicators of production, the incomes resulting from that production, and the resultant changes in wealth. Most countries use the SNA as a guide to the preparation of double-entry economic accounts that provide a comprehensive picture of the economy. Recognition that the SNA does not adequately address the depletion of natural resources, expenditures on environmental restoration, and the costs of pollution abatement has led to numerous efforts to revise and/or augment the SNA. A number of publications document international efforts to address these issues (Ahmad et al 1989, Lutz 1993).

The United Nations Statistical Division published a handbook on environmental accounting in 1993, commonly referred to as the System of Environmental and Economic Accounts (SEEA). The original SEEA was issued as an interim draft. A revision of the original handbook, known as SEEA 2000, should be available in the near future. The revision of SEEA maintains the linkages between physical flows and manufacture of goods. It also introduces the idea of hybrid accounts, which augment the 1993 SNA with physical measures for residual outputs and resource inputs. The current version of SEEA 2000 can be viewed electronically at <http://www4.statcan.ca/citygrp/london/publicrev/pubrev.htm>.

Hamilton and Lutz (1996) reviewed the methods that have been developed for green accounting, discussed their potential for policy application, and reviewed empirical examples by country. They grouped the various methods proposed for environmental accounting into four approaches: (1) adjusted national accounting aggregates, (2) natural resource accounts, (3) resource and pollutant flow accounts, and (4) environmental expenditure accounts.

In the United States, several academic studies focused on constructing welfare-adjusted measures of national accounts. The Index of Sustainable Economic Welfare (ISEW) (Daly and Cobb 1989) included some measures of long-term environmental damage, loss of wetlands, and depletion of nonrenewable resources. Nordhaus (1992) constructed an estimate, called “Hicks Income No. 1” that revised the Daly and Cobb work. The

Genuine Progress Indicator (GPI) is a modification of the ISEW. It adjusts GDP to account for variables not included in GDP (such as the value of time spent on household work), and subtracts out defensive expenditures, social costs, and depreciation of environmental assets and natural resources (Cobb, Goodman, and Wackernagel 1999).

Although most adjustments for GDP focus on subtracting depletion of natural resources, it is equally important to add in the value of accretions to resource stocks. Resource depletion or environmental degradation would result in negative adjustments, while increases in the value of the resource would result in positive adjustments. This approach results in depletion being treated symmetrically with consumption of fixed capital, and increases treated symmetrically with investment.

Natural resource accounts take a balance sheet approach to measure opening and closing resource stocks. Measures of physical quantity are included, and monetary values may be included. Prince and Gordon (1994) undertook an empirical analysis of total rents from the depletion of oil in the United States from 1981 to 1990. Effects on air and water quality were also estimated. The U.S. Department of Commerce Bureau of Economic Analysis (BEA) began work on augmented accounting in the early 1980s. The U.S. version of environmental accounting, the Integrated Environmental and Economic Satellite Account (IEESA) began in 1992. The first official accounts were published in 1994, with a full set of subsoil mineral assets accounts with estimates of the value of mineral reserves (Bureau of Economic Analysis 1994a, 1994b). These accounts were prototype satellite accounts, designed for illustrative purposes and kept separate from BEA's core accounts. After their release in 1994, Congress requested that BEA put the work on hold pending an outside review by the National Research Council.

Environmental expenditure accounts provide detailed data on expenditures for protection and enhancement of the environment. In the mid-1970s, the BEA developed estimates of pollution abatement and control expenditures. The survey of environmental protection expenditures has been discontinued, and the last accounts were produced in 1994.

#### Use of methods in market and public policies

The TAC suggested focusing on the ways that methodologies have been incorporated into market and public policies. Even more useful is to examine to what extent environmental and social costs are incorporated into policies and decisionmaking.

Recognition of the environmental and social values of forests is evident in virtually every piece of Federal legislation about forests from the creation of the first forest reserves. Guiding legislation for Federal forests requires public land managers to consider the wide range of benefits from the forests in decisionmaking. Although considerable controversy remains over the appropriate balance of goods and services on the Federal lands, environmental and social values have become increasingly important in determining management decisions over the last several decades. The change in emphasis reflects changing social values, and improved information about the many roles of forests in providing goods and services. The methodologies developed to estimate the values of

these goods and services have played a role in bringing information to the decisionmaking process. The development of nonmarket valuation methods improved the consideration of some nonmarket values by providing monetary values comparable to market values.

Similarly, State laws and State and local regulations often reflect public concerns about forest resources, and most directly affect the management of non-Federal forest land. Protection other environmental values associated with forests is the purpose of numerous laws and ordinances [reference to other indicators].

A draft report from the Food and Agricultural Organization summarized the status of efforts to address forestry in national accounting (FAO 1998). Although the national income and product accounts include aggregate measures of forest sector activities, these are limited to forest assets with commercial timber value. Important “noncommercial” forest sector activities lack market exchange values, including provision of services such as recreation opportunities, watershed protection, and climate modification. In addition, many special forest products, such as berries, mushrooms, and game, are often reported in the agricultural sector to the extent they enter markets. Several attempts to develop a satellite account for the forest sector have been undertaken. A number of countries have participated in tests of forest sector accounting, partially to help formulate an accounting framework that could be used to calculate most of the indicators for the Ministerial Conference on the protection of forests in Europe (the pan-European C&I). Countries that have focused on forestry accounts include Canada, Australia, Denmark, Finland, Germany, Norway, Sweden, and the United Kingdom.

Quantification of environmental and social values/incorporation into national accounts and national forest resource assessments

#### National income and product accounts

The BEA has the responsibility for U.S. national income and product accounts. BEA’s efforts to develop accounts for renewable and environmental resources were suspended in 1994 when Congress called for a review by the National Academy of Science on integrated economic and environmental accounts.

The National Academy of Science commissioned a blue-ribbon panel of the National Research Council (NRC) to assess BEA’s efforts on environmental accounting. The panel’s report was issued in 1999 (Nordhaus and Kokkelenberg 1999). The NRC panel found that “extending the national income and product accounts to include assets and production activities associated with natural resources is an important goal” (page 2), and would provide useful information for decisionmaking. Further, they determined that the rationale is “solidly grounded in mainstream economic analysis and that BEA’s activities are consistent with the extensive domestic and international efforts to improve and extend

the NIPA” (page 2). Developing a set of comprehensive nonmarket economic accounts was determined to be a high priority for the Nation. The panel reinforced BEA’s decision to use satellite accounts, and to keep the core income and products accounts intact, i.e., reflecting primarily market activity (Nordhaus and Kokkelenberg 1999).

Overall, the panel concluded that development of environmental and natural resource accounts is an essential investment for the Nation, and recommended that Congress authorize and fund BEA to recommence its work in this area. If BEA’s phased approach is used, then refining the estimates for subsoil minerals would be the first priority, followed by constructing forest accounts. The panel concluded that the United States has most of the data and methods required to develop forest accounts. The panel further recommended that BEA consider a more comprehensive approach, moving to develop a comprehensive set of near-market and nonmarket accounts that would be more comprehensive in describing the size and distribution of economic activity and welfare (Nordhaus and Kokkelenberg 1999).

As a result of the interruption of their work, the panel concluded that the United States has fallen behind other countries in expanding national income and product accounts (Nordhaus and Kokkelenberg 1999). BEA has not been funded to continue work on integrated accounts for the national income and product accounts since the NRC report was released. Therefore, there have been no further efforts underwritten by the Federal Government to extend the national accounts.

#### National forest resource assessments

The United States has legislation (Forest and Rangeland Renewable Resources Planning Act of 1974) that requires an assessment of the Nation’s renewable resources every 10 years. This assessment is the responsibility of the USDA Forest Service. The most recent is 2000 RPA Assessment, which summarizes trends in forest resources (Forest Service 2001). The 2000 Assessment used the Montreal Process Criteria and Indicators as an organizing framework. To the extent data were available on environmental and social costs and benefits at a regional or national scale, those data were incorporated into the assessment. Much of the data reported for the Montreal Process indicators are based on the same data sources used for the RPA Assessment.

#### *Personnel and budget devoted to R&D on relevant methodologies*

There are no data currently available on U.S. resources devoted to developing the methodologies discussed in the previous sections. A diverse group of public agencies, universities, nongovernment organizations, international agencies, and private enterprises are involved in developing methodologies relevant to Indicator 64.

There has been a long history of academic and government involvement in developing methods for valuing forest resources. Research on nonmarket valuation methodologies is of more recent origin than market methods. Universities have been instrumental in much

of the theoretical and methodological work on nonmarket resource valuation. This research occurs in a wide range of departments, including agricultural and resource economics, economics, and forestry departments. Numerous State and Federal agencies have provided resources over the years for developing and testing nonmarket valuation methodologies to value natural resources. Federal agencies that have been involved in this area of research include the U.S. Environmental Protection Agency, Forest Service, the USDA Economic Research Service, the U.S. Army Corps of Engineers, the National Aeronautic and Aerospace Administration, the USDI Fish and Wildlife Service, USDI National Park Service, USDI Bureau of Land Management, and USDI Bureau of Reclamation.

It would be possible to survey Federal agencies, universities, nongovernmental organizations, and international organizations about the resources devoted to this area of research. Another potential measure of effort in this area would be to track the number of related papers published in academic journals. In order to capture the disciplinary range involved in valuation, the list of journals surveyed would have to be quite large. Also, in the nonmarket valuation research, a significant amount of the research applications are found in the grey literature.

R&D on methods for corporate environmental accounting is even more difficult to track. In addition to academic contributions in this area, corporations are devoting resources to this area. The EPA's Environmental Accounting Project will be taken over by the Environmental Management Accounting Research and Information Center. The center plans to continue work to promote and integrate environmental management accounting principles and practices into decisionmaking by U.S. businesses and government organizations. Efforts to examine data overlaps and links between environmental management accounting and higher-level forms of environmental accounting, such as national environmental accounting, are also part of future plans.

Within the Federal Government, the BEA is responsible for national accounts. Currently, no BEA resources are being assigned to topics relevant to Indicator 64, as discussed previously. Nongovernmental organizations, particularly the World Resources Institute (WRI), have been actively engaged in this area in the past. The WRI is not currently involved in the area, although work on materials flow accounting is still ongoing. The work on the GPI, which is supported by a nonprofit research and policy organization, is continuing.

A number of international organizations of which the United States is a member continue developing and refining methods. The World Bank and the United Nations Statistical Division are particularly important in providing leadership and support for efforts in environmental accounting. Contributions from academia have played an important role in this area, and will continue to contribute in the future.

## Limitations of Methods

Although there have been numerous methods developed to address the environmental and social costs and benefits associated with forests, the existing methods also have limitations. Regardless of the scale of the analysis (e.g., a private firm or the U.S. economy), there are often two problems to resolve. The first is reliable data on the physical quantities. Even where measures are clearly defined, collecting data is often expensive. In some cases data are collected, but not in a consistent fashion that allows simple aggregation. There are numerous mechanisms for collecting market information, but few for standard collection of quantities associated with nonmarket goods and services.

A second limitation is valuing the environmental goods and services. Nonmarket valuation techniques can be applied to many environmental goods and services, although data collection using these techniques can be expensive. There has been considerable controversy over the validity of nonmarket valuation techniques, particularly contingent valuation. Research on the validity and reliability of these methods continues, and should improve the application of these methods.

For a number of public resources, measures of supply costs are often problematic. For example, public agencies have struggled with matching the cost of supplying recreation opportunities with the benefits of recreation use. Accounting frameworks such as those developed for analysis of the timber sale program have not been applied to other resources.

The NRC panel concluded that much of the data needed for extending the national accounts are already collected by Federal agencies, although not necessarily in a manner that would suffice for environmental accounting. Clearly a coordinated interagency data collection would be needed to develop improved natural resource and environmental data (Nordhaus and Kokkelenberg 1999). From a national accounting perspective, the values derived from some nonmarket techniques are not always conceptually comparable to values used in other accounts. National accounts are based on market values, which by definition are marginal values. This view presumes that marginal values are the only appropriate value for national accounting, which raises a question about the national accounting framework. One of the guiding principles of cost-benefit analysis is that the correct value for a resource change depends on whether the change is marginal or nonmarginal (i.e., does the change result in a price change?). For unique natural assets that are nonmarginal in character, a marginal price is not relevant. Therefore, it must be considered whether the national accounting framework can appropriately address changes in these types of assets.

## Problems related to scientific/social/political/economic and institutional concerns

The major institutional barrier to further progress in this area is the ongoing Congressional prohibition on national environmental accounting at the Bureau of Economic Analysis. Although the National Research Council panel recommended that efforts on environmental accounting should be a priority, funds have not been restored for this effort.

## Cross-cutting relationships with other indicators

This indicator is cross-cutting with many of the indicators in Criteria 1-6, as well as several indicators in Criterion 7. In order to apply many of the methodologies, information is required both on physical measures of forest resources and on the values associated with those resources.

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