Green Accounting: Issues and Challenges

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National income measures like Gross Domestic Product (GDP) and Net Domestic Product (NDP) have been used as measures of the economic progress and standard of living in almost all countries for a long time. Decision makers and researchers use these measures for new policy initiatives and to analyze policy alternatives respectively. The traditional Systems of National Accounting (SNA) are now recognized as inadequate, as they cannot accurately measure the contribution of environment and the impact of economic activities on it due to the exclusion of the non-marketed services provided by natural assets, inconsistent treatment of depreciation on man-made and natural assets, and inadequate representation of the degradation of environment. This gives a false impression of increase in income to the decision makers and researchers, while natural wealth is actually reducing. Hence, green accounting can be useful for sustainable national income accounting and in removing the current biases.

Introduction

Environmental and natural resource issues have risen to the top of the political ferment during the last two decades. Concerns about energy consumption and the degree to which national forests should be used for timber production or protected wilderness areas are examples of continuing resource policy issues. Environmental problems such as environmental pollution, depletion of the ozone layer and the threat of global warming have drawn national and international attention. When analyzing public policy in the above lines, decision makers often turn to the national accounts. If properly done, national accounting can be a useful instrument for economic analysis and policy evaluation.

National income accounting is one of the most important policymaking tools to appear in the last 50 years. Its measures like Gross Domestic Product (GDP) and Net Domestic Product (NDP) have been used as measures of the economic progress and standard of

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living in almost all countries. Decision makers and researchers use these measures for new policy initiatives and to analyze policy alternatives respectively. The traditional Systems of National Accounting (SNA)[1] are now recognized as inadequate, as they cannot accurately measure the contribution of environment and the impact of economic activities on environment due to the exclusion of the non-marketed services provided by natural assets, inconsistent treatment of depreciation on man-made and natural assets, and inadequate representation of the degradation of environment. This gives a false impression of increase in income to the decision makers and researchers while natural wealth is, in reality, reducing. Hence, green accounting can be useful for sustainable national income[2] accounting and in removing the current biases.

The major purpose of an environmental accounting system is its capability to assist in the understanding and management of potential tradeoffs between conventional economic development objectives and environmental goals as a tool of policy formulation. The theory of environmental management that has developed over the past three decades views the environment as a source of economic wealth whose value reflects the services provided to society by the environment. If these services were traded in conventional markets, they would presumably command a positive price, reflecting what society would be willing to pay for them, as well as their scarcity. With this theory in mind, and linking it with the conventional economic accounts, one approach is to define an additional economic sector, i.e., 'Nature', and to account for the non-marketed goods and services generated by this sector in a way that is similar to the treatment of marketed goods and services generated by conventional sectors (Peskin, 2000).

Since the Earth Day 1970, environmentalists have challenged economists' definitions of progress, wealth, and development—pointing out that economic theories and models short-change nature as well as future generations. They highlight the absurdities of Gross National Product (GNP) accounting, such as in Alaska, which posted gains after the

[1] The System of National Accounts (SNA) was developed during the second half of the 20th century based on an initiative of the UN. The effort started in 1950 with the compilation of national income estimates using data sources from 41 countries for the period 1938-48. In 1953, the UN produced the report, "A System of National Accounts and Supporting Tables." This was the first SNA adopted by the UN Statistical Commission. In 1968, a revised, expanded version of the SNA was approved. The revision was deemed necessary to systematize various national efforts to extend and disaggregate national accounts for economic analysis. This was the international standard for national accounting for 25 years. Based on reviews starting in 1975, with major inputs from the Statistical Office of the European Communities (Eurostat), a significantly revised SNA was approved in 1993. This SNA represents the joint effort of international organizations and national statistical agencies and constitutes the current standard for conventional economic accounts. The main objective of the 1993 SNA is to provide a comprehensive conceptual and accounting framework which can be used to create a macro-economic database suitable for analyzing and evaluating the performance of an economy. The existence of such a database is a prerequisite for informed, rational policy formulation and decision making. Major uses of the SNA are—(a) monitoring the behavior of the economy; (b) providing data for macro-economic analysis; (c) serving as a quantitative base for economic policy formulation; and (d) international comparison (WWF, 1995).

[2] From the point of view of a national economy, sustainable national income is usually defined as the maximum amount a nation can consume while ensuring that all future generations can have living standards at least as high as those of the current generation. Economic welfare, in this view, consists of per capita consumption of goods and services, both market and non-market (Nordhaus, 1999).

Exxon Valdez oil spill, because the additional costs of the clean-up were added to GNP, instead of being subtracted (as environmentalists advocate). GNP ignores the value of clear water, fish and pristine, scenic environments like Prince William Sound (Henderson, 1991). In this connection, green accounting/environmental accounting is an attempt to measure sustainable development by correcting the national income accounts for the depletion of natural capital. In other words, the notion of more fully incorporating the use of natural resources and the environment into the national accounts is called 'green accounting'. Green accounting is one of the methods that takes into account environmental resources and services, and changes therein, and measures their effects on SNA to reveal true maximum income which a nation can consume while maintaining a sustainable development and growth without jeopardizing the interests of the present and future generations as well as our neighbors. More specifically, when satellite accounts[3] are linked with national accounts, it is termed as green accounting. Environmentally adjusted net Domestic Product (EDP) or Environmentally adjusted Net Income (ENI) is obtained by deducting environmental cost from Net Capital Formation[4] (NCF) (Dasgupta, 2005). Green accounting addresses the shortcoming of traditional national accounting and is based on the concept that a proper assessment of a country's income and wealth needs to account for the contributions of activities made by all sectors of the economy and their impact on resource depletion and degradation.

This paper is organized as follows: The following section explains the flaws in the traditional SNA. The next section addresses the flaws of the traditional SNA's treatment of natural resources and environment. The succeeding section analyzes green accounting issues and challenges before the policymakers. Progresses of green accounting in India, along with its practical difficulties, are explained in the next section.

Flaws in the Traditional SNA

It was only in the 1960s and the early 1970s that the importance of environment highlighted the deficiencies in SNA. Measures of economic activity in the national accounts can be misleading when important information about natural resources and the environment is either missing or mislabeled. The desire to improve measurement of the effects of economic policies is responsible for much of the interest in adding more information to the accounts about natural resources and the environment. The growing interest in policies that promote 'sustainable development', for example, has led to suggestions that natural resources and the environment be treated as capital assets providing services to the economy—the so-called natural assets/capitals.

Firstly, the traditional SNA focused mainly on goods and services that are bought and sold in markets and ignored the non-marketed services provided by natural assets. For example, forests provide many environmental services like flood control, protection from soil erosion, carbon sequestration and amenity values in addition to marketed products

[3] Satellite accounts are supplementary accounts relating to the environment and disclosing of environmental costs.

[4] Net capital formation = Net Domestic Product – Final Consumption – (Exports – Imports).

like timber and fuel wood. The SNA only consider the economic contribution of forests and ignore the environmental services. Similarly, the waste disposal services of the environment are not recorded in the national accounts.

Secondly, natural capital contributes to production, just as physical capital does. The absorptive capacity of the environment or the wood from harvested timber can contribute to production, just as machines contribute to the manufacture of goods. Similarly, the environment or natural resources can depreciate, just as machines do from wear and tear. Also, as with physical capital, investment can be made in some forms of natural capital as a means of maintaining or increasing its stock; for example, expenditures to maintain levels of environmental quality or to expand the stock of timber. Investment in either physical or natural capital requires that current consumption be sacrificed in expectation of a flow of income in the future. In short, SNA neglect the stock of natural resources as well as environment, and their depletion coupled with the degradation in environmental quality.

Thirdly, SNA do not adequately represent the degradation of environment. The waste assimilative capabilities of the environment are also ignored in the SNA system. Money spent on avoiding damages caused by the so-called pollution-defensive expenditures[5] on such items as pollution abatement equipment and some prescription medicines is included in national income, but is not differentiated from other forms of investment or consumption in the national accounts.

Approaches to Address the Flaws in the Traditional SNA's Treatment of Natural Resources and Environment

Responses to the dissatisfaction towards the conventional accounts have led to various environmental accounting approaches. The differences in approach appear to reflect differences in emphasis placed on correcting either the scorekeeping or management[6] weaknesses in the conventional economic accounts. These approaches can be grouped under four headings—pollution expenditure accounting; physical accounting; development of green indicators; and extension of the SNA type systems (Peskin and Angeles, 1999).

Pollution Expenditure Accounting

One of the first reactions to perceived weaknesses in the conventional economic accounts was to develop data series on pollution abatement and other environmental expenditures. This involved developing data series on pollution abatement and other environmental expenditures. Such data series have been maintained by the US since 1972 and are also available for

[5] The defensive expenditures are the expenditures incurred in repairing the environment or the abatement expenditures incurred in preventing further damage to the environment like installation of electrostatic precipitators to remove Solid Particulate Matter (SPM) in a boiler or a furnace or a de-sulfurization process to remove sulfur oxides.

[6] Accounting systems, in general, have two principal objectives: scorekeeping and management. Scorekeeping refers to the calculation of statistics—such as GDP or NDP—measuring the performance of a business or an economy. Management refers to the body of data generated by the accounting process that supports the formulation and implementation of business or economic policy.

other OECD countries. However, there are some limitations of this approach—(1) These data refer to expenditure already incurred, either due to policy or standard business and household practice. Hence, they should not be considered as additions to conventional economic accounts as they are a re-specification of the information already accounted for; (2) The abatement expenditure data may tend to overestimate the true opportunity costs, as they contain outlays on materials which are already included in the value-added expression of the sector producing these materials, thus there may be the risk of double counting; and (3) The practice of comparing pollution abatement expenditures with GDP is misleading since the GDP covers primary costs and is free from double counting. This can be addressed by using input-output techniques. The use of pollution expenditure data has limited scope for policy. They can only give an indication of how various environmental policies may affect the productivity.

Physical Accounting

The second approach to improve the conventional economic accounts is to supplement these accounts with physical information about the natural environment and its status. This approach is especially followed by France, Germany, Norway and several other industrialized countries to measure physical changes in the stock of environmental assets over time. Physical accounting refers to the natural resource and environmental accounting of stocks and changes in stocks in physical (non-monetary) units, for example, weight, area or number. Qualitative measures, expressed in terms of quality classes, types of uses or ecosystem characteristics, may supplement quantitative measures. The combined changes in asset quality and quantity are called volume changes.[7]

For example, information—such as the area under dense forests, open forests, volume of stock of timber, area disturbed by fire etc.; or the quality of air in terms of CO_2 emissions, suspended particulate matter, nitrogen oxide emissions etc.; or physical indicators like dissolved oxygen, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) pH, etc.—can also be arranged in conventional input-output type of matrices. For example, the Netherlands has used such a complete input-output matrix system in their National Accounting Matrix, including Environmental Accounts (NAMEA). The system fully integrates economic and physical environmental information. Development of such physical accounts is important as the accounts can provide the inputs for the construction of various environmental indicators and thus be used for scorekeeping purposes. However, it is very difficult to use these physical accounts for policy purposes. Some of the reasons include: (1) the choice of appropriate physical units of measure is not obvious; (2) the units are incomparable; (3) difficulty in getting condensed description as the units are not similar; (4) involves development of huge data sets due to different quality indicators for forests, air, land and water without reaching general conclusions on their (economic and non-economic) significance; and (5) the potential severity of the environmental problem is not reflected and hence the decision makers will not be able to set relative environmental priorities while taking various investment decisions.

[7] http://stats.oecd.org/glossary/detail.asp?ID=2061; accessed on the July 26, 2009.

However, two important scientific communities—the International Society for Industrial Ecology and the International Society for Ecological Economics—have acknowledged the physical accounting framework to be a major tool to address society's environmental problems. In both contexts, it is shared that the economy has to be seen as a sub-system of the environment, being embedded into natural processes. The main argument is that any economic activity has to rely on a certain exchange of material and energy between nature and the economy or within the economy.

Development of Green Indicators

A third approach, and perhaps the one with the longest history, is to replace conventional GDP or NDP measures with some alternative social indicators. This approach has progressed along two parallel paths. First, social wellbeing indicators have been introduced to replace GDP and NDP. This has been achieved by altering the conventional aggregates like subtracting pollution expenditures from the GDP, adding the factors like negative effects of urbanization, etc. Some of the examples of this approach are the Measure of Economic Welfare (MEW) indicator by Nordhaus and Tobin (1972), the Net National Welfare (NNW) indicator developed for Japan (Uno, 1998) and the Index of Sustainable Economic Welfare (ISEW) (Daly and Cobb, 1989). Secondly, a more conservative approach has been promoted by Robert Repetto and his colleagues at the World Resources Institute (Repetto *et al.*, 1989), which proposed to modify the conventional measures of net product, such as NDP, by accounting for the conventionally neglected depreciation of natural assets such as forests, mineral stocks, fish stocks and soils. Such adjustments have been made on an experimental basis in several countries, particularly Indonesia, Costa Rica, China, Brazil and the Philippines. The main criticism of the approach is that while various indexes may indicate that the society is worse off than might be suggested by the conventional GDP, they give the policymaker a little indication of what to do about it.

Extension of the SNA-Type Systems

The fourth group of approach builds upon the existing systems of national accounts, principally the United Nations System of National Accounts. This approach brings forth sufficient modifications to include and estimate all environmental-economic interactions. It is the most ambitious approach to cover all the information needed for the other three approaches discussed above. While it can serve scorekeeping purposes, the main purpose of adopting this approach is the generation and systematic assembly of data needed to support a set of environmental and resource policies that will be consistent with overall economic objectives (i.e., management). Examples of extension of the SNA-type systems are the UN Satellite System for Integrated Environmental and Economic Accounting approach (SEEA) and the Environmental and Natural Resource Accounting Framework (ENRAP) (also referred to as Peskin framework) adopted in the Philippines. The principal difference between these two lies in the extent of their adherence to SNA concepts. SEEA appears much more concerned with adherence to the principle of SNA than to economic theory. The ENRAP framework, on the other hand, stresses more on the consistency with economic theory than with the SNA. The main objectives of SEEA are:

Segregation and elaboration of all environment-related flows and stocks of traditional accounts: This objective presents separately environmental protection expenditures.[8] "These expenditures have been considered as part of the costs necessary to compensate for the negative impacts of economic growth, in other words as defensive expenditures."[9]

Linkage of physical accounts with monetary environmental accounts and balance sheets: This objective describes the interrelationships between the natural environment and economy in physical terms (like changes in total stock or reserves of natural resources and changes therein, even if those resources are not affected by the economic system). These accounts provide the physical counterpart of the monetary stock and flow accounts of the SEEA.

Assessment of environmental costs and benefits: The SEEA expands and complements the SNA with regard to assigning costs to (a) the use of natural resources in production and final demand; and (b) the changes in environmental quality resulting from pollution and other impacts of production, consumption and natural events on the one hand, and environmental protection expenditures on the other.

Accounting for the maintenance of tangible wealth: The SEEA broadens the concept of capital to cover not only the man-made but also the natural capital. Natural capital includes scarce renewable resources such as marine or tropical forests, non-renewable resources like land, soil and subsoil assets (mineral deposits), and cyclical resources of air and water. Whereas capital formation is a broader term which includes the change in the capital accumulation.

Elaboration and measurement of indicators of environmentally adjusted product and income: Including the costs of depletion of natural resources and changes in environmental quality allows the calculation of modified macroeconomic aggregates in SEEA. This indicator is otherwise known as EDP.

The SEEA is a satellite system of the SNA that comprises four categories of accounts (United Nations *et al.*, 2003). "The first considers purely physical data relating to flows of materials and energy and marshals them as far as possible according to the accounting structure of the SNA. The accounts in this category also show how flow data in physical and monetary terms can be combined to produce the so-called hybrid flow accounts. Emission accounts for greenhouse gases are an example of the type included in this category."[10] Chapters 3 and 4 of the handbook have outlined this account elaborately.

The second category of accounts (Chapters 5 and 6) takes those elements of the existing SNA which are relevant to the good management of the environment and shows how the environment-related transactions can be made more explicit. To protect the environment, businessmen, governments and households maintained account of expenditures separately. This is an example of the accounts included in this category.

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[8] Environmental protection expenditures are actual expenses incurred by industries, households, the government and non-governmental organizations to avoid environmental degradation or eliminate the effects after degradation has taken place. They are included in the SNA, but are usually not identified separately in the conventional production and final use accounts.

[9] http://www.icsu-scope.org/downloadpubs/scope58/box3g.html, accessed on the July 26, 2009.

[10] http://stats.oecd.org/glossary/detail.asp?ID=2995, accessed on the July 26, 2009.

"The third category of accounts in the SEEA comprises accounts for environmental assets measured in physical and monetary terms. Timber stock accounts showing opening and closing timber balances and the related changes over the course of an accounting period are an example. These accounts are described conceptually in Chapter 7".[11]

"The final category of SEEA accounts considers how the existing SNA might be adjusted to account for the impact of the economy on the environment. Three sorts of adjustments are considered—those relating to depletion, those concerning the so-called defensive expenditures and those relating to degradation. Chapters 9 and 10 cover this material."[12]

Green Accounting Issues and Challenges Before the Policymakers

An important benefit of green accounting is the increase of information available for analyzing policy issues. Among the key issues are the effect of environmental protection on economic growth, the distributional impacts of environmental and natural resource policies, and the link between trade and environmental and resource policies.

Environmental Protection and Economic Growth: The impact of environmental protection on the economy and employment is a matter of much debate. Researchers disagree about the effect of environmental policies on the economy. Since the extensive environmental legislation of the 1970s, interest has arisen in evaluating the economic and employment effects of environmental regulations. Many of the studies on the effects of environmental protection conclude that statutory limits on pollution reduce economic growth. For example, Denison's (1985) model relied extensively on the data from the national accounts and estimated that for the 1973-1982 period, the US government regulations for pollution abatement reduced the measured national output growth by 0.09% a year. Jorgenson and Wilcoxen (1990) used a general-equilibrium model to estimate the impact of environmental regulation on the economy by simulating its growth between 1973 and 1985, with and without regulation. The results indicate that environmental regulation reduced the annual growth rate of GNP by 0.19% a year from 1973 through 1985. Their estimates indicate that GNP was about 2.5% lower in 1985 than it would have been otherwise.

Given the current models, it is not clear what the net impact of such programs might be and whether significant differences in growth rates exist in the relative impact of one program over another. It is clear, however, that more detailed information is needed about the relationship among policy, expenditures on final and intermediate products, and environmental and natural resources. Information generated by an expanded set of accounts could provide the important pieces of the puzzle.

Distributional Impacts of Environmental and Natural Resource Policies: The benefits and costs of environmental and resources policies fall heavily on some industries or income groups than on others. Improved water quality especially seems to favor higher income groups, since most of the improvement is in urban areas. Employment in industries that pollute more, such as chemical and paper manufacturing, could be most affected by tighter

[11] http://stats.oecd.org/glossary/detail.asp?ID=2995, accessed on the July 26, 2009.

[12] *Ibid*.

air quality standards. Such a perception—whether correct or not—can cause political resistance to new initiatives that might result in policy improvements. The input-output accounts can be especially useful for analyzing the impact of legislation on different industries. Detailed models of the payments sector in input-output tables have also been developed to predict the effect of policies on income distribution.

Links Between Trade and Environmental and Natural Resource Policies: Policymakers have come to appreciate the notion that nations cannot make policies without considering what is happening in other countries. Concern about the effects of the North American Free Trade Agreement on the environment, for example, was an important consideration during negotiations and required working out a separate side agreement on environmental issues before the Administration was willing to submit the final agreement to the Congress. National accounting systems that include environmental and natural resources could provide useful information during negotiations over the nation's commitments to restore or maintain natural capital.

Trade restrictions have not been used when a country's production and processing methods result in excessive discharges of pollutants such as carbon, sulfur or nitrogen oxides, or chlorofluorocarbons across national boundaries. One reason is the difficulty of determining the effect of transboundary pollutants on industry costs. Expanding the input-output tables to include the use of waste disposal services and identify abatement costs could help in identifying primary and secondary costs of transboundary pollutants.

There are at least two more good reasons for incorporating environmental and natural resources into the national accounts. First, incorporating such information would result in a more comprehensive source of data for identifying the causes of economic problems related to the environment and natural resource management. Second, the process of compiling information for a single integrated data set could yield new and important insights.

Progresses of Green Accounting in India

Greening the national accounts is useful both for economic and environmental policy, especially in the developing countries. Developing countries are generally natural resource-based economies and are characterized by high population growth and pressure on natural resources. Most of the developing countries depend mainly on agriculture, fishing, forestry, mineral extraction and other primary activities rooted in the natural resources. Thus in these countries, omission of the degradation and depletion of the country's natural capital will lead to overestimation of the national income figures. This also gives a false illusion that economy is growing, when in fact the natural wealth (in fact the future wealth) is declining. By having some green indicator like EDP or genuine savings in place, the policies can be designed to enhance economic growth without extensive natural resource depletion, thereby achieving more sustainable income. It is also possible that after proper accounting of natural resources, the GDP may need to be adjusted downwards, as natural resource

extraction no longer can be considered under value-added expression but as depreciation. The gap between GDP and EDP quantifies the extent of depletion and degradation, and therefore, serves as a signal of the importance of environmental effects. Not only this, the revised indicators of national wealth can also be used to compare (1) the standard of living over time; (2) standard of living across countries; (3) as an indicator of sustainable consumption; and (4) as a benefit-cost decision rule (i.e., to know whether or not a project that has an impact on the environment should be undertaken or not). There are other uses of these accounts for policy, like the measurement of physical resource scarcity, valuation of depletion, measuring the incidence and burden of existing regulations and taxes, estimating emission taxes and providing environmental components of existing macro-policy models.

Though it is important to account for natural resources in the national accounts, only a few researchers demonstrated how to account for natural resources in the national accounts in India. Brandon and Hommann (1995) used the first approach to provide an all-India-level estimate of urban and rural health effects due to water pollution (measured basically in terms of mortality and morbidity rates). Taking the estimate of reduction in Disability Adjusted Life Years (DALY) of the Indian population, they estimated the cost of water pollution in India to be anywhere between $3,076 and $8,344 bn.

In another study, Murty *et al.* (1999) illustrated how to account for water pollution. Water pollution is measured by a number of indicators like BOD, COD, pH, suspended solids, dissolved solids, variety of chemicals, metals, etc. Two approaches have been used in literature to value and account for the impacts of water pollution. The first is to assess the health and other impacts of water pollution on human and animal life. The second is take account of the cost of water treatment before discharging the effluents into the rivers, following the principle of 'polluter pays'. According to them, the total value added by Effluent Treatment Plant (ETP) activities is estimated to be Rs. 64.10 lakh, as against conventional GDP of Rs. 5,98,964 cr in the Indian economy in 1991-92. However, since the estimate is based only on about 25% of the industries, the actual value-added lost in conventional GDP is to the order of Rs. 16 cr.

Parikh and Parikh (1997) made an attempt to account for air pollution in India, using input-output sectoral information at the all-India level, power and transport sector and household-level emissions (including livestock sector). Two approaches can be used to value and account for the air quality changes within an income accounting framework. They are maintenance cost and avoidance cost approaches. They used the second method of assessing the damage due to air pollution.

Chopra and Kadekodi (1997) illustrated how to account for forests in the Yamuna basin for four states in north India. They have considered extraction, regeneration, degradation and preservation of forest resources. They considered four parameters—total dense forest area, annual forest degradation rate, extraction rate and regeneration rate.

From these physical values, the monetary values of the parameters are deduced. The shadow price of the stock of forest resource has been estimated using the ecological value of the biomass, which includes timber, non-timber forest products, ecological function values, etc. To estimate the value of the degraded area, the study uses contingent valuation method to analyze the Willingness to Pay (WTP) by the local communities to protect this forest area. The preservation value of the forests in the Yamuna basin is estimated using the net contribution of the tourists per year in Bharatpur National Park. The net contribution of the tourists per year is obtained using the travel cost method. The study found that the adjusted State Domestic Product (SDP) of Himachal Pradesh, on account of excessive extraction over and above regeneration, can go down by as much as 21.64%. The estimates of SDP adjustments for other states are –0.73 % for Rajasthan, –2.53% for Uttar Pradesh, and 0.04% for Haryana.

A comprehensive study at the state and national levels has been done by Haripriya (1998, 2000 and 2001). Haripriya (1998 and 2000) made an attempt to incorporate the forest resources in the state accounts of Maharashtra using the SEEA framework. In another study, Haripriya (2001) incorporated the forest resources into the national accounts for all the states. The study constructs accounts containing information on the opening stocks, changes due to economic activity (due to logging/illegal logging/afforestation), other accumulations (mean annual increment, regeneration and transfer to non-forest purposes), other volume changes (due to forest fires, stand mortality, animal grazing, etc.) and the closing stocks. The value of depletion is obtained by deducting the value of opening stocks from the value of the closing stocks. The studies adjusted the NDP in two ways. First, adjustments were made in the forest sector to include non-market production of timber, fuel wood and non-timber forest products left out of NDP. This converts NDP to Adjusted Net Domestic Product (ANDP). Second, the study adjusts ANDP for the depletion of forest assets to derive EDP. The forest accounts were limited to incorporating monetary benefits from timber, fuelwood, fodder and non-timber forest products. The study done for Maharashtra illustrates that the ratio of EDP to ANDP is around 99.3%.

Verma (2002) made an attempt to use the green accounting approach to work out the true economic value of Himachal Pradesh (HP) forests, highlighting the watershed values in the local and regional economies and in the GDP of the state. The author found that the total economic value of forest is 2.61 times the value of the growing stock, 980 times the total expenditure incurred in the forestry sector and 2,607 times the revenue realized by the forests annually. It proves that the forestry sector's contribution to the economy of the state is grossly underestimated. Further, when the Gross State Domestic Product (GSDP) of the state is corrected for total economic value calculated through the current study, the contribution of forestry sector increases from 5.26% of GSDP to 92.00% of GSDP. In August 2002, the total economic value of HP forests so estimated by the author was used by the HP government to issue a notification for user agencies who are diverting forest lands for non-forest use by imposing a one-time levy on them (Rs. 10 lakh/hectare and Rs. 8 lakh/

hectare in dense and other forests respectively), besides the clause of compensatory afforestation, cost of catchments area treatment plan, rehabilitation of dumping sites, etc. Thus, HP has become the third state in India to impose an environmental value tax on agencies using forestlands where the major contribution comes from the watershed values of forests (Verma, 2002).

Green Indian States Trust (GIST) (2005) developed the green report through its Green Indian Accounting States Project (GAISP). "Under GAISP, proper accounting of forest resources was done. GAISP studied the value of timber, carbon, fuel wood and non-timber forest products to evaluate the GSDP. By treating forests as both productive and non-productive economic assets, GAISP found out, on an average, how many people were dependent on forests for timber, fuel wood, fodder, fruits, bamboo/cane/reeds and honey. It also studied the effect of logging, forest fires, encroachments and natural calamities to calculate a proper measure. This measure was termed Environmental Adjusted State Domestic Product (EASDP). According to GAISP, states should use EASDP to evaluate the Net State Domestic Product (NSDP) since it takes into account changes arising from environmental degradation. The gap between NSDP and EASDP indicates the extent of environmental degradation caused by economic activity like illegal logging. GIST felt that the present national accounting system did not appropriately value degradation of forest resources, a necessity, especially since forests also influence local and regional climate. According to the Green Accounts report, if the ratio of EASDP to NSDP is less than one, the economy is doing well in terms of environment. But if it is higher, then it means that economic growth has come at the expense of environmental degradation in these states" (GIST, 2005).

Atkinson and Haripriya (2006) accounted for forest wealth in India. Changes in the timber and carbon wealth embodied in these forests are related to important green national accounting aggregates such as genuine saving and the change in wealth per capita. Important accounting issues include the timing of carbon releases, which occur when forests are disturbed as well as the valuation of these releases. Their empirical findings suggest that while India's forest wealth is substantial, net changes in this wealth are arguably not so large, at least in relation to GNP. However, when viewed in the context of the wealth-diluting effects of population growth, this implies that a far larger additional savings effort is required to cover the (net) loss in forest values than otherwise appears to be the case (Atkinson and Haripriya, 2006). Finally, they examined ways in which the accounting approach that they adopt can be reconciled with approaches that stress conserving forest wealth.

Practical Difficulties

For estimating national income, India follows the methodology suggested by the United Nations. This, however, is more suitable for developed countries rather than for underdeveloped ones, which are largely characterized by non-monetized and

unorganized sectors. "The enterprises in underdeveloped economies produce at subsistence levels and are functionally undifferentiated. In addition to producing agricultural commodities, they take to other avocations (non-agricultural) during off-season and do not keep proper records of their secondary and primary inputs of production" (Bhat, 2000). Small capital assets, which may not be very important for a developed economy and therefore excluded from fixed capital investment, are crucial for underdeveloped ones. In India, estimating the imputed value of rent of owner-occupied dwellings is a difficult task. The expenditure method cannot be used where markets are unorganized. The production method cannot also be used for unorganized sectors such as small-scale industries, trade and transport, and so on. Different methods are used to measure the income generated by various sectors of the economy.

Conclusion

To conclude, green accounting is not a simple task, as it requires huge data. It needs an area-specific approach. Further, in India, there are several data limitations. There are also several valuation methods; While no method so far is perfect, some of the methods are controversial. However, these problems should not discourage the researchers from developing green accounts.

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