# A Discussion Paper on Environmental and Natural Resources Accounting and Potential Applications in African Countries

March 2002

# A Discussion Paper on Environmental and Natural Resources Accounting and Potential Applications in African Countries

(ENCAP IV, Subtask 5c)

*Prepared by*
Juan Sève, IRG

March 2002

# Contents

# Acronyms

| | |
|---|---|
| ABS | Australian Bureau of Statistics |
| ANDP | adjusted net domestic product |
| BEA | Bureau of Economic Analysis (United States) |
| CBS | Central Bureau of Statistics |
| CICA | Inter-institutional Committee on Environmental Accounting (*Comité Interinstitucional de Cuentas Ambientales*, Colombia) |
| CONEMA | National Commission on Environmental Statistics (*Comisión Nacional de Estadísticas del Medio Ambiente*, Panama) |
| DENR | Department of Environment and Natural Resources (Philippines) |
| EMA | environmental management accounting |
| ENRA | environmental and natural resources accounting |
| ENRAP | environmental and natural resources accounting project |
| EDP | environmentally adjusted domestic product |
| EPA | Environmental Protection Agency (United States) |
| ESA | European System of Accounts |
| Eurostat | Statistical Office of the European Communities |
| FSO | Federal Statistical Office (Germany) |
| GATT | General Agreement on Tariffs and Trade |
| GDP | gross domestic product |
| GIS | geographic information systems |
| IBGE | Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística*) |
| IFEN | French Institute of the Environment (*Institut français de l'environnement*) |
| IIESA | Integrated Economic and Environmental Satellite Accounts (United States) |
| INEGI | National Statistics, Geography, and Informatics Institute (*Instituto Nacional de Estadística Geografía e Informática*, Mexico) |
| MEW | measure of economic welfare |
| MFA | material flow accounts |
| NAMEA | national accounts matrix including environmental accounts |
| NDP | net domestic product |
| NEB | net environmental benefit |
| NEEFD | National Exotic Forest Description (New Zealand) |
| NGO | non-governmental organization |
| NNW | net national welfare |
| NPA | National Patrimony Account (France) |
| NRA | natural resources accounting |
| NRA | Norwegian Resource Accounting System |
| NRAP | Natural Resources Accounting Project |
| NREA | Natural Resource and Environmental Accounts Project (Uruguay) |
| NZSNA | New Zealand System of National Accounts |
| OAS | Organization of American States |
| OECD | Organization for Economic Cooperation and Development |
| PACE | Pollution Abatement and Control Expenditures survey |

| | |
|---|---|
| PIDS | Philippine Institute of Development Studies |
| PSEEA | Philippine System of Environmental and Economic Accounting |
| SCEEM | Mexican system of economic and ecological accounts (*Sistema de cuentas económicas y ecológicas de México*) |
| SEEA | Satellite System for Integrated Environmental and Economic Accounting |
| SERIEE | European System for the Collection of Economic Information on the Environment |
| SIDA | Swedish International Development Agency |
| SNA | System of National Accounts |
| SNI | sustainable national income |
| TDRI | Thailand Development Research Institute |
| UGR | German Environment-Economy Comprehensive Accounting System |
| UN | United Nations |
| UNECE | United Nations Economic Commission for Europe |
| UNEP | United Nations Environmental Programme |
| UNSTAT | United Nations Statistical Division |
| USAID | United States Agency for International Development |
| VROM | Ministry of Housing, Physical Planning, and Environment (Netherlands) |
| WB | World Bank |
| WRI | World Resources Institute |
| WWF | World Wildlife Fund |

# 1. What Is Environmental and Natural Resource Accounting, and How Can It Be Used?

The main purpose of accounting is to provide economic information. Households, businesses and governments are interested in economic information to measure their performance and to prepare decisions. Usually, accounts are divided into *income accounts*, which record values of inputs and outputs during a given period, and *asset accounts*, which reflect the value of assets and liabilities at a given point in time.

The basic purpose of national income accounts is to provide a comprehensive view of a nation's economy, and in principle, these accounts measure the nation's total income and output. The most important indicator in national economic accounts is gross domestic product (GDP), which is a measure of a nation's total output of goods and services and the total income generated by that output. However, GDP, as well as other indicators derived from it, measures the performance of an economy on the basis of prices from marketplace transactions. This market price basis for measuring values constitutes a weakness of conventional indicators from the standpoint of environment and natural resources. In fact, while interactions between economic activity and the environment have become increasingly evident, indicators like GDP ignore such interactions. On the one hand, GDP measures economic performance on the basis of market transactions; on the other hand, economic performance benefits from a number of services provided by the natural environment, which are not transacted in markets, and therefore not captured by GDP or other conventional indicators.

## 1.1 Interactions between the economy and the environment

Whether they enter the marketplace directly or not, environmental and natural resources make important contributions to long-term economic performance and can therefore be considered economic assets. Among the services provided by the environment to society are inputs to production processes, such as waste disposal services provided by water and air, and outputs derived directly from nature such as recreational and ecological services (e.g., microclimates, soil protection, even water flows, biodiversity conservation and carbon sequestration). Because these services are not normally bought and sold at market prices, they are not measured by conventional economic accounts.[1]

Services of the environment and natural resources will in fact have economic value if they are scarce in an economic sense, i.e., when demand for the services is limited by available supply. If such services were traded in markets, they would have observable market prices, and thus would be included in the conventional accounts. However, they are typically not marketed in spite of their economic value, either because property rights to the assets have not been established or

---

[1] Basically, due to the absence of exclusive rights and the possibility of simultaneous consumption affecting many environmental services, these cannot be, for the most part, efficiently transacted in markets.

because the "owner" of the property right (often the government) chooses not to act as a seller of the services (DENR 1994).[2]

Over the past three decades, there has been increasing awareness of the interactions between societies and their natural environments. This awareness has been sharpened by concerns about resource scarcity, environmental degradation and global environmental issues such as climate change, and has motivated attempts to expand the scope of national accounting systems by including environmental assets and services. This is part of a larger movement to develop broader economic indicators focusing primarily on environmental quality, but also on other nonmarket activities, such as household production and the use of leisure time (Nordhaus et al. 1999).

More specifically, in many African countries, as a result of population growth, persistent rural poverty, and other factors, the degradation of a number of environmental and natural resources, such as forest cover, arable soils, pastures, inland fisheries, and water flows has attained such extreme proportions, that the economic growth capabilities of many nations are already being affected. However, the economic effects of these trends are not reflected in the national accounts, which provide the essential data, based on which most economic policy decisions are made. Also not represented in the national income accounts is household production, a major component of many (and perhaps most) African economies.

The new emphasis that governments have placed on sustainable development is a major source of criticisms of the traditional national accounts. Measures such as net domestic product (NDP) while better than GDP for measuring sustainability, account only for the depreciation of produced assets, ignoring the value of depletion of natural resources and degradation of the environment.[3] They cannot serve, therefore, as guides for policies aimed at achieving sustainable development (Hamilton & Lutz 1996). When economic policy decisions are based on the omission of environmental costs, including the value of natural resource depletion, economic activities can be encouraged to the detriment of the environment and natural resource base, and of long-term economic growth itself.

---

[2] Recent trends in environmental policy include attempts to develop market-based instruments (such as the trading of emissions permits), as well as environmental taxes and subsidies. These transactions would be included in conventional economic accounts. However, at present, such transactions cover only a minute part of the total value of environmental services, and not all environmental services lend themselves to such instruments.

[3] Net domestic product is gross domestic product, less the allowance for depreciation of capital goods (Nordhaus et al. 1999).

## 1.2 Purpose of environmental and natural resource accounting (ENRA) and its linkages to conventional economic accounting[4]

The modern national income and product accounts are among the great contributions of economics during the twentieth century. Among other things, they are used to judge economic performance over time, to compare the economies of different nations, to measure a nation's savings and investment, and to track the business cycle. The fundamental purpose of national accounts is to provide a coherent and comprehensive picture of a nation's economy. These accounts measure the total income and output of an entire nation, including households; business and not for profit enterprises; and different levels of government, all of which are included in the GDP measure. GDP represents the sum of the monetary values of consumption, gross investment, government purchases of goods and services, and net exports produced within the nation during a given year (output side). It also represents the income earned as wages, profits and interest, as well as indirect taxes (input side).[5] In addition, to the totals for a nation, the accounts provide a rich array of data on output and incomes in different industries and regions, as well as a record of international transactions (Nordhaus et al. 1999). In the preparation of their national accounts, most countries of the world follow the guidelines of the System of National Accounts (SNA) sponsored by the United Nations. A brief review of the history and main purposes of the SNA is provided in **Text Box 1**.

### Text Box 1. The System of National Accounts (SNA)

The System of National Accounts (SNA) was developed during the second half of the twentieth century based on an initiative of the United Nations. 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.

*Adapted from:* World Wildlife Fund. 1995. *Real Value for Nature: An Overview of Global Efforts to Achieve True Measures of Economic Progress*. WWF International, Gland, Switzerland.

---

[4] ENRA, as understood in this report, should not be confused with environmental management accounting (EMA). EMA consists of a set of accounting procedures, focused primarily on material flows and cost accounting methods, with the purpose of supporting decision-making processes internal to a firm or establishment, regarding both physical and monetized procedures related to activities with a potential environmental impact. The United Nations, through its Environmental Management Initiative is promoting EMA in the interest of waste minimization and pollution prevention within industry (United Nations Division for Sustainable Development 2001).

[5] The input and output sides of conventional national income accounts are discussed in more detail in Section 2 of this paper.

In most countries, a basic principle of the accounts is that national output is normally defined to be the production that is reflected in the sales and purchases of the market economy. The omission of many nonmarket activities—particularly those involving natural resources and the environment—is the very concern that has led to a variety of environmental accounting efforts. The purposes of augmented accounting are to provide more comprehensive measures of output, saving, and investment; to ensure that the accounts treat economic activity in a consistent way when both market and nonmarket activities are included; and to provide information on the interaction between the economy and the environment so that natural and environmental resources can be more effectively managed.

Early efforts at environmental accounting grew out of dissatisfaction with the perceived failure of the conventional national economic accounts and, in particular, GDP to provide a meaningful measure of social performance in the face of environmental degradation. Indeed, GDP could increase in the face of environmental degradation due, say, to clean up an oil spill or to increased health expenditures necessitated by poor air quality, or a clear-cut in a tropical rainforest area (DENR 1994). In these three cases, GDP would register the clean up effort, the increased health expenditures and the timber harvest as contributing to economic growth (i.e., they reflect market transactions), but would not reflect either the environmental damage from the oil spill, or the deteriorating air quality affecting the health of the citizens or the loss of environmental services from the degradation of the forest cover.

Apart from concerns about GDP as a measure of national well being, two other weaknesses are apparent. First, the conventional accounts treat reproducible wealth and natural wealth inconsistently in the calculation of a nation's net domestic product (NDP). In principle, NDP is a measure of a nation's "sustainable" income, since it allows for replacement of losses in the capital stock (see footnote 3). However, while depreciation of man-made wealth is subtracted from GDP to obtain NDP, there is no parallel calculation for any depreciation in the stock of natural resources (e.g., the depletion of oil and gas deposits, forests, soils and aquifers).[6] Second, the conventional national accounts overlook important inputs and outputs that have economic significance but are neglected because they lack market-determined values. Typically neglected environmental inputs to production processes are waste disposal services provided by water bodies and air sheds; typically neglected outputs are recreational and ecological services provided "free" by nature (DENR 1994).

Apart from the environmental and natural resource concerns discussed above, there is a vast amount of nonmarket activities producing goods and services that are quite similar to those produced in the marketplace, but are omitted from traditional accounts. Time spent cooking in restaurants is counted, while cooking at home is not; nannies' services are measured as part of GDP, while parents' services are not; the value of swimming at a commercial swimming pool is

---

[6] Man-made assets—buildings and equipment, for example—are valued as productive capital, and are even written off against the value of production as they depreciate. This practice recognizes that a consumption level maintained by drawing down the stock of capital exceeds the sustainable level of income. Natural resource assets are not so valued, and their loss entails no debit charge against current income that would account for the decrease in potential future production. A country could exhaust its mineral resources, cut down its forests, erode its soils, pollute its aquifers, and hunt its wildlife and fisheries to extinction, but measured income would not be affected as these assets disappeared (Repetto et al. 1989).

captured by GDP, while the value of swimming in the ocean is not. The need to include nonmarket components arises because of the trade-offs between market and nonmarket activity. For example, resources devoted to removing lead from gasoline and paint will lower conventionally measured consumption, but will raise the nation's human capital by protecting the population from brain damage and other debilitating illnesses (Nordhaus et al. 1999). **Although many different approaches have been taken, the guiding principle of augmented economic accounts is to measure as much economic activity as is feasible, regardless of whether it takes place inside or outside the marketplace**.

A set of well-designed augmented accounts can overcome the recognized shortcomings of the current market-based accounts. The collection of the required additional data is an investment that would have a high economic return for a nation because better information would allow both the public and private sectors to make better decisions. Examples of how comprehensive economic accounts can bring economic benefits include: better estimates of the impact of regulatory programs on productivity, improved analyses of the costs and benefits of environmental regulations, and more effective management of a nation's public lands and resources (Nordhaus et al. 1999). Augmented national accounts would also be valuable as indicators of whether economic activity is sustainable.[7]

Two major issues arise in the design of augmented accounts. The **first** is where to draw the line when extending the accounts beyond the boundary of market transactions. Should the line be drawn at near-market activities?[8] Should they extend to other private goods and services, such as educational investments and the value of visits to national parks? Should they extend to include public goods such as the value of clean air and clean water? Should they include international concerns such as the damages from ozone depletion and global warming? The **second** major issue is how to measure nonmarket activities. Measurement involves collecting data that will support estimates of both quantities and prices. Nonmarket activities pose difficulties mainly because there are no objective records of the valuations. There are numerous techniques available for estimating both the quantity and the value of nonmarket activities, but they almost always require gathering additional data and involve complex imputations. One additional issue involved in decisions about how far to extend the boundary of environmental accounts concerns data quality. As the accounts move further away from the current market boundary line, the quality of the data becomes increasingly suspect, and the cost of obtaining the data becomes increasingly large (Nordhaus et al. 1999).

---

[7] 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 et al. 1999).

[8] *Near market* goods and services are those that can be provided both via markets and outside markets. An example is vegetables that are purchased in a store versus those grown for home consumption (Nordhaus et al. 1999).

# 2. Overview of ENRA as an accounting system[9]

## 2.1 Conceptual issues and account organization

As discussed in the previous section, an augmented accounting framework that includes natural and environmental resources should be based on the principle that services derived from such resources do in fact have *economic value* if they are scarce in an economic sense, i.e., when demand for the services is limited by available supply. If such services were traded in markets, they would have observable market prices, and thus would be included in the conventional accounts. The economic dimension of augmented accounts requires that they conform to economic theory and the basic principles of optimal management of the environment as a set of economic assets that provide services to society.

An important role of theory is to assure that an accounting framework is logically consistent, i.e., the framework must guarantee that there is no double counting, that there is a logical connection between production costs, inventory accumulation, and the value of sales, and that asset accounts and current accounts are also logically connected. This function of accounting theory is well accepted by those who develop both national and environmental accounting systems. Another role of theory is that it provides credibility to accounting entries. Given the data and valuation difficulties already discussed, theories from a number of disciplines (e.g., economics, engineering, chemistry, physics and biology) are often needed to support the entries in an environmental accounting system (Peskin 2000).

A major purpose of an environmental accounting system is its capability to assist in the understanding and management of potential trade-offs 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).

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. Since a major purpose of an ENRA system is the understanding of trade-offs

---

[9] This section is based primarily on the framework applied by the Environmental and Natural Resources Accounting Project (ENRAP) sponsored by USAID/Philippines.

between economic development and environmental policy goals, the *management* function appears to be more important than *scorekeeping*.

One of the most comprehensive augmented accounting systems is the framework that has been applied in the Philippines since the early 1990s by the USAID-funded Environmental and Natural Resources Accounting Project (ENRAP). The basic principle of the ENRAP framework is that the services of *economically* valuable environmental assets should be treated in an accounting system just like the services of man-made assets, such as factories and machines. Consistent with this focus on economic values is the related emphasis on the *economic* depreciation of natural assets, defined as the change in the asset *value* over time.[10]

A unique feature of the ENRAP framework is that it allows for two values to be placed on pollution: one from the point of view of the polluter, and one from the point of view of the injured party. Specifically, pollution is shown to result from the use of a *waste disposal service* provided by the natural environment. This service, which is of value to the polluter, may compete with other services provided by the natural environment such as health, recreation, and support of animal plants and species. As a result of this competition, waste disposal services also lead to *damages to the environment*. However, due to the absence of markets (or other efficient allocation instruments) the numerical value of the *damage* usually will not equal the value of the *disposal service*—thus the need for a dual valuation (DENR 1964). The ENRAP framework also accounts for environmental services other than waste disposal that are directly consumed by society. These include recreation services, esthetic services, and the support of ecological systems. Because of the dual valuation, the accounting framework requires a balancing entry equal to the difference between the value of all the services provided by the environment (i.e., for waste disposal and for all other purposes) and any resulting environmental damages.

A further feature of the ENRAP framework is an accounting for the unmarketed production of fuelwood and food by rural households. While the Philippine effort did not cover all unmarketed household production, household fuelwood and food production in the uplands were considered as especially important because of their possible links to deforestation.

**Table 1** displays a modified national account consistent with the ENRAP framework and consolidated over all economic sectors.

---

[10] *Physical* degradation of environmental and natural resource assets is not of importance in the accounting system unless the physical decline implies economic losses in the value of these assets. While the physical condition of a natural resource influences its value, other factors—particularly the anticipated value of future services generated by the asset—can also play a significant role (DENR 1994).

**Table 1.   Modified National Income and Product Accounts**

| Input | Output |
|---|---|
| Compensation of Employees | Personal Consumption |
| Indirect Taxes | Government Consumption |
| Depreciation (Produced Assets) | Capital Formation |
| Net Operating Surplus | Exports (-) |
| | Imports |
| | Statistical discrepancy |
| CHARGES AGAINST | |
| GROSS DOMESTIC PRODUCT | GROSS DOMESTIC PRODUCT |
| Capital Depreciation (-) | Capital Depreciation (-) |
| CHARGES AGAINST | |
| NET DOMESTIC PRODUCT | NET DOMESTIC PRODUCT |
| Natural resource inputs to | |
| Unmarketed Household Production | Unmarketed Household Production |
| Upland agriculture | Upland agriculture |
| Fuelwood | Fuelwood |
| Environmental Waste Disposal Services (-) | Environmental Damages (-) |
| Air | Air |
| Water | Water |
| Net Environmental Benefit (Disbenefit) | Direct Nature Services (+) |
| Natural Resource Depreciation (-) | Natural Resource Depreciation (-) |
| Forests | Forests |
| Fisheries | Fisheries |
| Minerals | Minerals |
| Soils | Soils |
| CHARGES AGAINST MODIFIED | MODIFIED |
| NET DOMESTIC PRODUCT | NET DOMESTIC PRODUCT |
| Capital Depreciation (+) | Capital Depreciation (+) |
| Natural Resource Depreciation (+) | Natural Resource Depreciation (+) |
| CHARGES AGAINST MODIFIED | MODIFIED |
| GROSS DOMESTIC PRODUCT | GROSS DOMESTIC PRODUCT |

*Source:* DENR 1994

The top part of the table represents the conventional GDP account, while the lower portion contains the ENRAP adjustments. The input side (i.e., inputs necessary to produce the GDP) includes compensation of employees, operating surpluses (i.e., interest income and operating profits before deductions for asset depreciation), as well as indirect taxes (i.e., primarily excise, sales and local property taxes, which are included because they are part of the sales prices of goods and services). On the other hand, personal-income and corporate-profit taxes, being taxes on income, are considered to be part of income, first disbursed to income recipients, and then collected by the government. This is why there is no separate line item for income taxes. The output side of GDP includes personal and government consumption, gross capital formation (i.e., not adjusted for depreciation), and net exports (i.e., exports minus imports). By definition, (see footnote 3), Net domestic Product (NDP) is obtained by deducting an allowance for the depreciation of produced assets from GDP on both the input and output sides.

The first adjustment shown is for the part of household production of fuelwood and mountain region agricultural crops not measured in the conventional GDP.[11] Waste disposal services are shown next on the input side of the ledger and, as a matter of convention, are valued negatively since they are viewed as "free" subsidies of nature. Resulting damages are entered on the output side and are also valued negatively, since they may be considered as negative outputs. Also shown on the output side are the positive non-disposal services of the environment (e.g., recreation) entered as Direct Nature Services. Turning again to the input side is the balancing entry, **Net Environmental Benefit**, which is explained below. Final adjustments are for Natural Resource Depreciation, subtracted from both sides of the accounts to produce the modified NDP figure. Both conventional and natural resource depreciation must be added back to yield a modified GDP figure (DENR 1964).

The entry **Net Environmental Benefit** (disbenefit) serves three purposes. First, it is a balancing entry, defined as the difference between the absolute value of all environmental services (waste disposal and environmental quality services) and damages. It thus assures that the input side and the output side of the modified accounts will have the same total. Second, it can be used as a crude measure of the efficiency of environmental management. It can be shown that if environmental services are properly valued, a Net Environmental Benefit (NEB) equal to zero implies a socially optimal allocation of environmental services.[12] If NEB is negative, then the level of services is too high (i.e., overuse of the environment); if NEB is positive, then any losses in well-being due to environmental damages would be more than offset by freeing up resources that could serve other beneficial purposes. Third, since NEB measures the net current account value of the environment, the accumulated, discounted NEB provides a measure of the asset value of nature (Peskin and de los Angeles 2001).

The consolidated account shown in **Table 1** summarizes large amounts of detailed data that can be disaggregated into individual industries and economic sectors. While GDP and NDP totals in the consolidated account are useful for scorekeeping purposes, the detailed information on which this summary is based is usually more important for serving the management objectives of the

---

[11] Since household production is valued at its input costs, the input and output entries are the same.

[12] Details are contained in Peskin, H.M. 1989. *Accounting for Natural Resource Depletion and Degradation in Developing Countries*—Environmental Department Working Paper No. 13. Washington, DC: The World Bank.

accounting process. This implies that from a *management* standpoint, the *process* of accounting is as important as the production of the accounts themselves.

## 2.2    Discussion on the valuation of environmental services and assets[13]

In keeping with the economic foundations of the framework, the environmental service entries shown in **Table 1** should reflect what consumers of these services would be willing to pay for them. In the case of damages, the values should reflect what injured parties would be willing to pay to avoid them. Techniques for estimating these values are well documented in the technical literature.[14] However, in practice, it is often not possible to apply most of these techniques for the full scope of environmental services in developing countries. In the particular case of the Philippines, ENRAP project staff first developed preliminary estimates based on available studies and data. In subsequent phases, more detailed methodologies were developed, which are compiled in a procedures manual.[15]

The value of *waste disposal services* was estimated by the costs polluters would expect to pay if they were denied these services. This approach is based on the assumption that prospective pollution control costs approximate the value of waste disposal. Environmental damage estimates were primarily confined to estimates of health damage due to air and water pollution, damages to marine fisheries, and damages to reservoirs. While in principle, the valuation of health damages should reflect the society's willingness to pay to avoid these damages, in practice the health effects were valued by the costs of lost incomes and direct medical expenditures. Damages to fisheries reflect the value of estimated losses in fish catch, while damages to reservoirs (primarily due to siltation) reflect reductions in their useful lives.[16]

As with waste disposal services, the value of *direct nature services* should reflect what users of these services would be willing to pay for them. Estimates reflect the amount various types of users would pay for recreational services. Initially, estimates depended on adaptations of foreign studies, while subsequent refinements included data from direct surveys.

The value of *household production* of fuelwood was calculated based on the estimated amount of labor required multiplied by an assumed wage rate. Other household production (mainly agricultural crops), was valued using available prices for equivalent crops that were sold in markets.

---

[13] These comments are based on DENR 1964.

[14] An excellent treatment of this subject is provided in Freeman, A.M. 1993. *The Measurement of Environmental and Resource Values*. Resources for the Future. Washington, DC.

[15] See DENR 2000. *Guidebook for Environmental and Natural Resources Accounting: Methods and Procedures*.

[16] Valuation of waste disposal services and damages provides an opportunity for collaboration between ENRA and EMA efforts. ENRA could benefit considerably from the detailed work on material flows and cost estimation required by EMA (as pointed out in the Appendix, Germany is a leader in aggregating material flow accounts at the national level). On the other hand, EMA efforts could benefit from ENRA's use of analytical techniques in estimating the value of environmental impacts.

Finally, ENRAP's estimates of *depreciation of natural resources* relied on a number of methods depending on the resource being considered. The basic principle is that all these estimates should reflect changes in the asset value of the resource over the accounting year.

## 2.3    Different environmental and natural resource accounting approaches

Responses to the dissatisfaction with 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* weaknesses in the conventional economic accounts. These approaches can be grouped under four headings (Peskin 1994).

*1.    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. Such data series have been maintained in the United States since 1972 and are available in other countries such as the OECD members. These data refer to expenditures already incurred, either due to public policy or to standard business and household practice. Therefore, they are a re-specification of information already contained in the conventional accounts. The motivation in the United States for statistics on pollution abatement expenditure appears to be for better management of economic and environmental policy. The data have been used for analyzing the effects of environmental policy costs on productivity.

*2.    Physical accounting*
Another approach, followed especially by France, Germany, Norway, and several other industrialized countries, is to measure physical changes in the stock of environmental assets over time. Additionally, several developing countries have used a physical accounting approach as a starting point in their environmental accounting efforts.[17] In such systems, decisions must be made to define physical measures relevant to environmental policy concerns. Forest resources, for example, can be measured physically in terms of area, timber volume, species variety, non-timber forest products potential, etc. The appropriate choice will depend on relevant policy objectives, i.e., timber management, fuelwood supply, biodiversity protection, or other goals. In Norway, where this approach has been followed for many years, the intent is to generate information and analyses to support the nation's economic planning process.

*3.    "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 work has proceeded along two parallel paths. First, there have been ambitious efforts to replace GDP and NDP with entirely new indicators of social well being. The best-known example of this approach is the Nordhaus-Tobin "Measure of Economic Welfare" (MEW) indicator. Similar approaches have been developed by the Japanese, i.e., the Net National Welfare (NNW).[18] A second, more conservative approach has been promoted by Robert Repetto and his colleagues at the World

---

[17] See the **Appendix** for details.

[18] See Nordhaus et al. for an interesting discussion on these comprehensive measures.

Resources Institute (Repetto et al. 1989). The thrust of this effort is 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.

*4.      Extensions of SNA-type systems*
The fourth group of approaches builds upon the existing systems of national accounts, principally the United Nations System of National Accounts (SNA). The attempt is to introduce sufficient modifications to account for all environmental-economic interactions. This approach is the most ambitious and covers 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 SNA-type systems are the UN Satellite System for Integrated Environmental and Economic Accounting approach (SEEA) and the ENRAP framework adopted in the Philippines.[19]

## 2.4      Environmental and resource accounting as contributor to policy formulation

The *management* aspect (as opposed to the *scorekeeping* aspect) is essential to the capability of an environmental accounting system to support policy formulation. A comparison of bottom line numbers, like an adjusted GDP compared to a conventional GDP will give a broad-brush idea of how the use of environmental resources may be affecting the overall performance of an economy. However, this comparison is of little use in understanding the economic implications of major problems related to environmental and natural resources, and does not provide much help in formulating policies to handle such problems.

Another basic condition for an ENRA system to contribute to policy formulation is the emphasis on institutionalization, including the time and effort to achieve it. While environmental and natural resource accounting efforts, in one way or another, have been conducted in at least fifty countries, most of the activities in developing nations have been either research or "pilot" projects, without an institutional follow-on, and therefore have had very minor policy impact, if any.

In the particular case of ENRAP in the Philippines, two of the original purposes were: a) to focus on policy formulation, and b) the eventual institutionalization of the effort. These objectives were largely attained, partly due to continued support by USAID over a 9-year period, but also because the project was designed and managed with these objectives in mind. In addition, throughout the ENRAP effort it was always understood that both the accounting process (i.e., efficient organization of information) and the accounting results (environmentally adjusted accounts and associated data) were both essential to policy formulation.

---

[19] Interesting discussions comparing the two approaches are contained in Nordhaus et al. 1999 and in Peskin & de los Angeles 2001.

Five major features of the program were central to its ability to support policy formulation:

1.  *ENRAP was a Philippine project*. Philippine nationals conducted and managed activities with very limited foreign participation.

2.  *Policy makers participated in the ENRAP process*. To establish the usefulness and credibility of the accounting process, the project sought the involvement of policy makers through a steering committee composed of high-level officials from various government agencies, the NGO community and USAID.

3.  *The accounts were developed iteratively*. Early, preliminary sets of accounts served to point out the way to more accurate and refined accounts that were developed in subsequent phases.

4.  *Policy relevance was continuously demonstrated*. Integral to the project were a number of independent policy analyses that relied on ENRAP data. These studies, some of which are summarized below, covered a number of environmental and resource policy issues of concern.

5.  *ENRAP had a continual outreach program*. The project sustained an active effort to keep policy makers and the general public informed through workshops, briefings, organization of conferences in country, attendance at overseas conferences, mailing lists, and periodic newsletters. Such outreach activities were crucial to the institutionalization of the process within the Philippine policy making system.

Various applications to national policy and sector-specific concerns arose from the databases generated by ENRAP. These concerns were investigated at either the national, sectoral or subnational levels as a response to the needs expressed by various policymakers and interest groups, and as a result of interactions between ENRAP and other users of the data.

The following list synthesizes the most important policy studies conducted by the ENRAP project (DENR 1996).

1.  *Economic growth and pollution*. Current growth targets will result in an unclean economy unless technological changes in both production and pollution management materialize. This study was based on an adaptation of the Philippine Input-Output matrix.

2.  *Impact of intensified pollution control on competitiveness*. Reduction in business competitiveness due to improved environmental controls is not substantial. The results reveal that for the large majority of industries, there is no need to be apprehensive of the effects of the full internalization of environmental costs, whether through stricter enforcement of laws or through economic instruments.

3.  *Trade liberalization and pollution*. Trade liberalization under current technologies will result in higher pollution intensity, but this is more likely to occur from increased

resource-based extraction (e.g., agricultural production in sloped lands and mining) than from increased manufacturing.[20]

4. *Declining fisheries resources and impacts.* Drastic decline of the small pelagic fishery is forthcoming unless a large reduction in fishing effort is effected.

5. *Reduction of lead in gasoline.* Further reduction of lead in gasoline could be attained through fuel price reforms. A later version of this study led to an Executive Order banning lead compounds in automotive fuels.

6. *Improvements in energy use.* Improvements in both energy intensities and pollution management in energy generation processes would reduce air emissions substantially.

7. *Importance of small- and medium-scale industries in pollution management.* Inclusion of small- and medium- scale industries in pollution management strategies is important. For instance, current monitoring of water pollution discharges focuses on those establishments that generate at least 30 $m^3$ of wastewater daily. However, for some sectors, such as pig production, most polluters are of a smaller scale and thus go unmonitored.

---

[20] See **Text Box 2** for details.

# 3. Experiences in Countries Using ENRA, with Particular Emphasis on Africa

Since the early seventies, a considerable amount of work has been conducted in the field of environmental and resource accounting. In one way or another, at least fifty countries have participated or have shown a definite interest in such efforts.[21] However, while virtually all these efforts respond to concerns about interactions between the natural environment and the economy, there is much variety as to approaches, emphases, amounts of funding, and levels of official commitment. Environmental and natural resources accounting projects have ranged from comprehensive efforts benefiting from official endorsement (e.g., ENRAP in the Philippines) to detailed physical or valuation work focusing on a limited number of specific sectors (e.g., Indonesia), to pilot studies, and even very preliminary attempts to consider the possibility of undertaking an ENRA effort (e.g., Bolivia).

Of the 16 industrialized countries reviewed, all have conducted major ENRA efforts of some kind. Additionally, the large majority of these countries have institutionalized some type of ENRA function within their public administration systems. For the most part, ENRA activities in industrialized countries have focused on physical aspects of resource stocks and uses, on environmental damages, and on environmental expenditures. As a result of these activities, large amounts of environmental data are being made available to public and private concerns for their use in the preparation of policy and business decisions. However, the evidence reviewed suggests that in general, no major official attempts are being made to develop comprehensive environmentally augmented national income accounts in monetary terms leading to adjusted overall national income indicators (e.g., green GDP or NDP). Although such attempts have existed in some advanced countries (e.g., Japan and the U.S.), they have been conducted either as pilot studies or academic exercises. A large number of ENRA studies can be found in industrialized countries. A few are of a comprehensive nature, while most focus on a small number of specific sectors (e.g., forestry, fisheries, minerals, and water).

In sum, a considerable amount of ENRA work has been conducted in industrialized countries, especially over the past two decades. Much of this work is currently contributing to the preparation of improved policy decisions regarding trade-offs between economic expansion and environmental protection. However, a universally accepted comprehensive ENRA approach (i.e., an environmentally adjusted equivalent of the SNA) has not yet materialized.

One major reason for the lack of a uniform approach could be the need for fairly involved economic modeling in the valuation of environmental services and in estimating the value and depreciation of natural resource assets, which are not included in the conventional accounts. These calculations require strong capabilities in economic analysis, which normally are not part of the *modus operandi* or traditions of the statistical agencies charged with preparing the national income and product accounts in most countries.

---

[21] A set of summaries of national level experiences is provided in the **Appendix**.

An important difference between industrialized and developing nations regarding ENRA efforts has to do with funding and technical support. Advanced countries, if and when they have chosen to undertake such efforts, have normally established and funded their own institutional programs. In contrast, developing countries have invariably been supported by foreign funding agencies, both bilateral and multilateral. Dependence upon foreign support constrains ENRA efforts in less developed nations in more ways than one. First, a targeted amount of funds constrains a project to perform within the funding limits. Second, certain donors, like United Nations agencies in particular, have shown a preference for specific approaches (i.e., SEEA). As a result of these constraints, efforts in developing countries have ranged from modestly funded pilot studies (e.g., Tanzania) to multi-year projects, some of which have had clear institutionalization potential (e.g., ENRAP in the Philippines). Also in the Philippines, a peculiar situation developed as a result of two major foreign agencies (USAID and UNDP) funding two major projects (ENRAP and PSEEA) with two different NRA approaches, leading to uncomfortable competition, which has confused Philippine officials.[22]

In the 31 developing countries reviewed, the intensity of ENRA work shows tremendous variety, going from modest expressions of interest on the part of government authorities (e.g., several Latin American countries) to full-fledged comprehensive efforts progressing towards institutionalization (e.g., China, Mexico and the Philippines).

It is apparent that in most countries where actual ENRA work has been conducted, foreign funding and technical support have been a major factor. This is reflected by a large amount of studies and reports authored by foreign experts and funded by donor institutions. It is also apparent that much of the ENRA work in most of these countries was conducted from the late eighties through the mid-nineties, and has subsequently stopped or has received low priority due to insufficient funding.

In sum, although there exists a substantial body of knowledge that can be used as a basis for starting or continuing ENRA work in developing countries, the official will to pursue such efforts through the institutionalization phase, does not seem evident for the most part, with China, Mexico and the Philippines being notable exceptions. Perhaps the governments of most developing nations do not see a short-term priority in examining the trade-offs between economic growth and environmental conservation in the design of their development policies.

In the African continent, the records reviewed show that only five countries (Angola, Botswana, Namibia, Tanzania and Zimbabwe) have considered or attempted ENRA efforts. This compares unfavorably with developing nations in Asia (8 countries) and Latin America (17 countries).

African ENRA efforts, on the whole, have been quite modest. In the case of **Angola**, the National Environmental Action Plan has included a focus on NRA, initially for petroleum (WWF 1995), and there is no information on any further developments.

**Botswana**, in contrast, in the late eighties, constructed a set of integrated environmental and economic accounts to assist in the preparation and implementation of a National Development

---

[22] PSEEA is an acronym for Philippine System of Environmental and Economic Accounting.

Plan and a conservation strategy. Preliminary accounts were constructed for livestock, food crops, forestry (including fuelwood), minerals, and water. Initially, physical accounts were established, with the intent of eventually valuing some of the environmental variables. This information, however, is based on a report dating from 1989 (Perrings, cited by Lange & Duchin 1993), and no later information on the Botswana environmental accounts could be found in the available literature.

The case of **Namibia** has benefited from a longer-term vision. Namibia's work on resource accounting began in the mid-1990s with financial support from USAID and Swedish SIDA and continued through the late 1990s. Namibia's economy is largely dependent on natural resources, and with almost no industry. Consequently, environmental accounting has focused entirely on natural assets, with no attention to pollution issues. Work has concentrated on water, fisheries, minerals, and livestock, and a project is also underway on energy. The primary output has been policy studies, rather than publication of accounting data (Hecht 2000).

The work in **Tanzania** was limited to a study conducted in 1989 by Henry Peskin. This study focused on fuelwood and included the imputation of a value for physical depletion of forest resources in Tanzania in 1980 due to fuelwood production. This was the first study to correct GDP for exclusion of nontimber values and one of the first to correct NDP for net accumulation of forest capital (Vincent and Hartwick 1997).

Finally, the experience in **Zimbabwe** also consisted of a single study published in 1993. This was an academic study that focused on roundwood (fuelwood and construction timber) in natural forests, gold, and agricultural soils. The Zimbabwe study emphasized data problems suggesting that the implementation of SEEA to a wider range of developing countries would prove complex.

Regarding lessons from other developing countries that would be of benefit to African countries interested in pursuing ENRA efforts, the experiences of China, Mexico and the Philippines are recommended for their thoroughness, their depth and their long-term vision leading to institutionalization of the ENRA processes. Other interesting lessons, although not quite as complete would be based on the Costa-Rican, Indonesian, and Malaysian experiences, especially because of the interesting discussions on methodology and policy implications that they contain. Lessons of experience for all these countries as well as many others are summarized in the **Appendix**.

# 4. Brief Discussion on Trade-Environment Interactions and Possible Role for an ENRA Approach

Regarding the role of ENRA in environment-trade interactions, it must be said at the outset that a conventional system of national economic accounts does measure actual international trade flows. Therefore, if an augmented system of accounts is to include the stocks and flows of natural resources and environmental services, it should be designed to reflect both the domestic and international aspects of interactions between the environment and the economy.

## 4.1 Importance of foreign trade in economic development

The importance of international trade in economic development has been recognized for centuries and has been formally summarized in the "principle of comparative advantage." This principle, also known as the "law of comparative costs," was originally coined by the British economist David Ricardo in the early Eighteenth Century. In simple terms, this law states that a country will tend to export commodities whose production requires **relatively** more than other commodities of those resources of which it has most. Under free international markets, comparative advantage will determine what countries will tend to specialize in what commodities as they face such markets. Accordingly, as each country finds its economic sectors of specialization, a more efficient allocation of resources and a higher level of income and welfare is attained than in the absence of trade.

However, throughout economic history, open international markets have been rather rare. In fact, over much of the nineteenth and twentieth centuries, trade flows between countries have suffered major restrictions (i.e., tariffs, quotas and others), which have distorted comparative advantages. These restrictions were imposed mainly as a result of social and political forces within countries, primarily in order to protect economic sectors considered important, from foreign competition. Only since the mid-twentieth century have there been sustained international efforts to reduce and eventually eliminate international trade restrictions. Current international trends suggest a steady movement towards an increasingly open world economy, in which globally competitive markets are becoming the norm.

It is important to add that comparative advantages can also be distorted from an environmental standpoint. This happens to the extent that the prices of goods and services do not reflect the environmental effects of their production. The economically efficient implementation of environmental protection measures allows for a correction of such distortions and must become part of overall trade liberalization efforts.

For a number of historical reasons linked to both ancestral traditions and their recent colonial past, African economies have been strongly tied to international commodity markets through agricultural and raw material exports. Many of these countries have also been subject to trade distortions, either through multilateral currency policies (e.g., the CFA Franc), or through internal policies in efforts to protect their infant industries. Facing the globalization trends of today's world economy, efforts are underway to eliminate these distortions and encourage

African countries to move towards trade and specialization patterns based on comparative advantage.

## 4.2    Potential environmental impacts of foreign trade

There already exist strong linkages between environmental policies and international trade. These linkages will become increasingly important as environmental policies tend to be more restrictive, and as people all over the world become increasingly aware of ecological interdependencies. This evolution of international linkages suggests that environmental policies and trade policies should no longer be implemented without evaluating these interactions (Barde 1992).

As African nations intensify their participation in the global economy, a higher level of economic activity is expected to occur. This anticipated economic expansion raises a number of key questions dealing with environmental effects, such as:

- What will be the environmental effects of an overall increase in economic activity?

- In what way will policies stimulating specific types of exports also lead to increased environmental damages?

- In what way will remaining trade restrictions in industrialized countries prevent the diversification of exports from African countries, forcing them to intensify activities in environmentally sensitive sectors?

- In what way will increased economic activity lead to increased trans-boundary environmental effects (e.g., a river carrying industrial or soil-originated pollution to a country downstream)?

- What will be the effect of expanded economic activity on the emission of greenhouse gases?

A properly designed ENRA system can address these environmental issues tied to international trade, and assist in the formulation of policies, as well as in the preparation of negotiations leading to international and bilateral agreements.

## 4.3    Using ENRA to evaluate interactions between foreign trade and the environment

Regarding the effects of trade on the environment, two opposing viewpoints have been at the heart of the debate for years. One position is that trade liberalization, as a factor of economic growth, will increase pressures on the environment. The opposite position is that since trade liberalization is a factor of growth it will allow for additional economic resources to be allocated to environmental protection (Barde 1992).

The capability of an accounting system to measure the trade-offs involved, should help in the resolution of such debate. Ideally, international agreements should be implemented in such a way that commercial exchanges and environmental protection will not conflict with each other, but be mutually reinforcing. Environmental protection must not be a pretext for trade restrictions and trade policies must not obstruct environmental protection.

A hypothetical scenario is to be tested in African countries benefiting from an increased volume of international trade, and that consequently will specialize in certain sectors. Initially, the natural resources used in such sectors might be exploited more intensely, leading, perhaps, to increased environmental damage. However, if increased trade is successful in stimulating an expansion of overall economic activity, these countries should eventually acquire the institutional and administrative capacity to implement increased environmental protection (Stoughton and White 2000). Managing such a scenario will require careful monitoring, particularly of the depletion of resources and the waste assimilation capacity of the environment to ensure they do not attain critical levels. A properly designed ENRA system can be of great help in measuring these effects in both physical and monetary terms. A concrete example of a study on environmental effects of trade liberalization is presented in **Text Box 2**.

### Text Box 2.   Policy Study on Trade Liberalization and Pollution in the Philippines

In 1993, using the ENRAP accounting framework and database, the Philippine Institute of Development Studies (PIDS) investigated the likely effects of trade reforms to anticipate debates related to the proposed ratification of the General Agreement on Tariffs and Trade (GATT). Changes in pollution intensity estimates were examined based on projections of sectoral output changes, given various mechanisms for liberalizing trade. Two effects were indicated under various combinations of reductions in tariffs and exchange rate flexibility.

On one hand, shifts in output composition within the manufacturing sector from pollution-intensive processing to cleaner processing technologies are expected for two reasons. First, the burden of pollution control, as a share of total production cost, is modest for manufacturing industries. Second, the export orientation of most manufacturing industries is likely to exert additional pressure for improving global competitiveness including pollution management. Thus, under stricter implementation of pollution standards, this sector's discharges are likely to decline.

On the other hand, higher pollution intensity is expected to be generated from increased resource-based extraction, especially under open access to land-based resources and uncertain property rights. Indiscriminate application of cropping patterns should be anticipated particularly because of the difficulty in monitoring a large number of small landholdings. The overall pollution intensity is dominated by resource-based producing industries, such as agricultural production in sloped land and mining. The aggregate effect on increased pollution intensity is less under a more open economy, where the exchange rate is flexible and tariff reform hurts the heavily protected pollution-generating industries.

These results were used by the Department of Environment and Natural Resources during the congressional hearings on the ratification of the GATT. The findings indicate the need to intensify ongoing policy reforms on forestlands that address the open access conditions prevailing in most public lands.

*Adapted from:* Department of Environment and Natural Resources (Philippines). 1996. *The Philippine Environmental and Natural Resources Accounting Project (ENRAP-PHASE III) – Main Report.* DENR/USAID, Manila.

# 5. Considerations for the Design of an ENRA Effort in One or More Countries of Sub-Saharan Africa

As the discussions in the previous sections may suggest, a properly conducted ENRA effort, i.e., one that will be comprehensive, focus on the *management* function of environmental accounting, lead to policy formulation, and end up as an institutionalized function, will require critical doses of data, analytical capability, staffing, funding, and time. At first glance, these requirements may seem overwhelming, particularly in many African countries, where even official national economic accounts are of poor quality, and sizable informal sectors are omitted from the accounts as presently assembled. However, some of the experiences reviewed suggest that ENRA programs can start as modest efforts focusing on a limited number of priority sectors.

If an ENRA effort is to go beyond the level of a one-time academic study, an initial focus on institutionalization is essential. This implies the endorsement and support of the national government, and the fact that most of the work must be done by country nationals in order to develop a core of capable in-country professionals. More importantly, given the substantial commitment of human and financial resources required, the policy formulation purposes of the effort must be clear, the feasibility of constructing an ENRA system must be assessed, and the policy making users must be identified before proceeding with data collection.

The "learning by doing" aspect of building an ENRA effort is also fundamental. In fact, a major lesson of experience, particularly from the Philippines, is that the best way of developing accounting techniques is by implementing the accounts. The "learning by doing process" can begin by assembling rather crude data for the construction of initial accounts. This initial exercise will point the way towards those sectors where data refinement will substantially improve the accounting structure (Peskin 1993). The purpose of "learning by doing" should be the training of a critical mass of national professionals capable of undertaking and maintaining ENRA systems without the need for foreign involvement.

Iterative development of the accounts is also a basic consideration. The economies and environmental conditions of several (and probably most) African countries are sufficiently complex that it would be unrealistic to believe that a complete set of accurate environmental and resource accounts could be established in the near term. The Philippine ENRAP framework, for example, by construction, attempts to maintain the completeness required by a national accounting system, but did not attempt high accuracy in the early phases of the project. In fact, what ENRAP set out to do initially, was to provide a complete accounting of environment-economy interactions, but with fairly crude estimates. **However, these rough calculations provided information of policy significance that did not change with further data refinement in subsequent project phases**. Additionally, the estimates indicated where the data were in most need of refinement. In sum, early, preliminary sets of accounts pointed the way towards more accurate and refined accounts in the future (DENR 1964).

Another important consideration has to do with the "home" of an ENRA effort. This is basic to the institution-building dimension. Because the subject matter is natural resource and environmental accounting, there is a natural tendency to place a project of this type within

environmental and resource administrations. The risk in proceeding in this direction is that usually these administrations focus on sectoral interests that are not always consistent with the comprehensive view provided by the augmented accounts. Additionally, any official government agency may be reluctant to publish accounts derived from crude data, or any data that might suggest problems with past policies. Therefore, it would be best, at least in the initial stages, to place an ENRA project in some non-governmental research institution with close ties to the government (Peskin 1993). While government control is risky for the reasons just stated, the exposure of government officials to both the process and the results is essential if an ENRA project is to have any policy impact. In the end, however, the official institutionalization of an ENRA effort will need close collaboration with (and perhaps control by) a central government administration such as a statistical bureau or a planning agency. This will require training of the officials in such agencies on a "learning by doing basis" under the guidance of project staff in moving towards the final stages of institutionalization.

# References

Barde, J.P. 1992. *Economie et Politique de L'Environnement*. Presses Universitaires de France, Paris.

Claude, M. 1997. *Informe Final – Estado y Evolución de las Cuentas del Medio Ambiente en América Latina*. Fundación Futuro Latinoamericano.

Department of Environment and Natural Resources (Philippines). 1994. *The Philippine Environmental and Natural Resources Accounting Project (ENRAP-PHASE II) – Technical Appendices.* DENR/USAID, Manila.

———. 1996. *The Philippine Environmental and Natural Resources Accounting Project (ENRAP-PHASE III) – Main Report.* DENR/USAID, Manila.

———. 2000. *Guidebook for Environmental and Natural Resources Accounting: Methods and Procedures*. Philippine Environmental and Natural Resources Accounting Project, DENR/USAID, Manila.

Hamilton, K., and E. Lutz. 1996. *Green National Accounts: Policy Uses and Empirical Experience*. The World Bank, Environment Department Paper No. 039.

Hecht, J.E. 2000. *Lessons Learned From Environmental Accounting: Findings From Nine Case Studies*. IUCN, Washington, DC.

Lange, G.M. 2000. *Fisheries Accounting in Namibia*. International Workshop on Environmental and Economic Accounting, 18–22 September 2000, Manila, Philippines

Lange, G.M., and F. Duchin. 1993. *Integrated Environmental-Economic Accounting, Natural Resource Accounts, and Natural Resources Management in Africa*. Paper prepared for the Bureau for Africa/USAID.

Nordhaus, W.D. (ed). 1999. *Nature's Numbers – Expanding the National Economic Accounts to Include the Environment*. National Research Council, Washington, DC.

Peskin, H.M. 1993. *Report on the Contribution of Resource and Environmental Accounting to Policy Formulation in the Developing Countries of Africa*. Unpublished manuscript, Environmental and Natural Resources Policy and Training Project. Winrock International Environmental Alliance/USAID Africa Bureau.

———. 2000. Environmental Accounting: *The Theoretical Foundations of ENRAP*. Paper and presentation prepared for the Conference on Resource Accounting and Policy, 3–4 February 2000, Manila, Philippines.

Peskin, H.M., and M.S. de los Angeles. 1999. *Accounting for Environmental Services: Contrasting the SEEA and the ENRAP Approaches*. Draft 4/20/99. Revised version of a

paper presented at the IX Pacific Science Congress, Academia Sinica, 16-17 November 1998, Taipei.

Repetto, R., W. Magrath, M. Wells, C. Beer, and F. Rossini. 1989. *Wasting Assets – Natural Resources in the National Income Accounts*. World Resources Institute, Washington, DC.

Stoughton, M., and A. White. 2000. *Trade and Environment: Critical Concepts and Considerations for Project Design and Implementation*. Environmental Policy Indefinite Quantity Contract (EPIQ)/USAID.

Savage, D.E. 2001. Personal communication.

United Nations Division for Sustainable Development. 2001. *Environmental Management Accounting Procedures and Principles*. United Nations, New York.

Vincent, J.R., and J.M. Hartwick. 1997. *Accounting for the Benefits of Forest Resources: Concepts and Experience*. Revised draft, commissioned by the FAO Forestry Department, dated July 10, 1997.

WWF (World Wildlife Fund). 1995. *Real Value for Nature: An Overview of Global Efforts to Achieve True Measures of Economic Progress.* WWF International, Gland, Switzerland.

# Appendix.    Summaries of National ENRA Efforts

The summaries in this appendix were obtained from the following sources:

Claude, M. 1997. *Informe Final – Estado y Evolución de las Cuentas del Medio Ambiente en América Latina.* Fundación Futuro Latinoamericano. **(MC)**

Hamilton, K., and E. Lutz. 1996. *Green National Accounts: Policy Uses and Empirical Experience.* The World Bank, Environment Department Paper No. 039. **(H&L)**

Hecht, J. 2000. *Lessons Learned From Environmental Accounting.* IUCN/The World Conservation Union, Washington, DC. **(JH)**

Lange, G.M. 2000. *Fisheries Accounting in Namibia.* International Workshop on Environmental and Economic Accounting, 18-22 September 2000, Manila, Philippines. **(GML)**

Lange, G.M., and F. Duchin. 1993. Integrated Environmental-Economic Accounting, Natural Resource Accounts, and Natural Resources Management in Africa. Paper prepared for the Bureau for Africa/USAID. **(L&D)**

Savage, D.E. 2001. Personal communication. **(DS)**

Vincent, J.R., and J.M. Hartwick. 1997. *Accounting for the Benefits of Forest Resources: Concepts and Experience.* Revised draft, commissioned by the FAO Forestry Department, dated July 10, 1997. **(V&H)**

WWF (World Wildlife Fund). 1995. *Real Value for Nature: An Overview of Global Efforts to Achieve True Measures of Economic Progress.* WWF International, Gland, Switzerland. **(WWF)**

1. **Angola**

- National Environmental Action Plan has included a focus on NRA, initially for petroleum (WWF)

2. **Argentina**

- Work has focused on methodology of patrimony accounts. Work has not been systematic (MC)
- Further limited work on environmental accounting is expected on abatement cost matrices and environmental protection expenditures, as well as damage function estimates and quantification of externalities (MC)

3. **Australia**

- The Australian Bureau of Statistics (ABS) supports the development of satellite accounts as part of the revised SNA (WWF)
- Increasing emphasis is being placed on physical and monetary accounting outside the SNA framework to improve environmental and resource management at regional and sectoral levels (WWF)

- An academic study conducted in 1993, focused on forests as natural habitat, subsoil assets, soil erosion, and salinization (V&H)
- A pilot project conducted by ABS in 1995 and 1996, to investigate the implementation of SNA93 recommendations focused on timber (in native forests and plantations), subsoil assets, land, and livestock. It provides probably the most sound estimates of asset values of timber stocks (V&H)

- In the mid-nineties, there was pressure from environmentalists and some parts of the government, as well as from the environmental protection industry to publish a 'green GDP.' This pressure has been resisted partly because uncertainties in valuation procedures and partly because of concerns about whether this indicator would send correct signals to policymakers (H&L)

4. **Austria**

- The Austrian Central Statistical Office has established a comprehensive framework for a new accounting system that relates the emissions, immissions, and environmental media of the domestic environment to the Austrian National Accounts. Implementation of the system has so far focused on damage evaluation and classification (WWF)
- The physical part of the system emphasizes the links with the SNA and the flow of environmental resources (WWF)

- A study on forest resources sponsored by the Austrian Central Statistical Office calculated the asset value of forests for timber production with the eventual intention of linking it to asset accounts (V&H)

### 5. Bolivia

- Work on environmental accounting started in 1994 with a UN-supported research project. This work was given low priority by government agencies. No quantitative results as of mid-1997. Interest in resource accounting, however appears to be increasing (MC)

### 6. Botswana

- In the late eighties, Botswana constructed a set of integrated environmental and economic accounts to assist in the preparation and implementation of a National Development Plan and a conservation strategy. Preliminary accounts were constructed for livestock, food crops, forestry including fuelwood, minerals, and water. Initially, physical accounts were established, with the intent of eventually valuing some of the environmental variables (L&D)

### 7. Brazil

- Work has focused on case studies intended to provide methodological guidelines for future work of the Brazilian Institute of Geography and Statistics (IBGE), which is the Brazilian equivalent of a central bureau of statistics. Accounts have been compiled for minerals, forests, and urban domestic use of water (WWF)

- There is nothing concrete on resource or environmental accounting. No work has been conducted on either satellite or physical accounts, apart from the theoretical work by Ronaldo Serôa da Motta, mentioned by WWF. Some interest has been expressed, but no concrete work is being done (MC)

### 8. Canada

- Statistics Canada's work on environmental accounting was encouraged by the publication of the Green Plan, which the Cabinet adopted in January 1992. The initiative envisages four basic accounts: the natural resource-stock accounts, the natural resource-use accounts, the waste and pollution output accounts, and the environmental expenditures accounts. All four are expected to have a meaningful link with the SNA (WWF)
- The project currently being developed does not attempt to meet the objective of adjusting the NDP. Statistics Canada "does not foresee, at least until there is wider international agreement, any changes to the traditional national accounting aggregates…" (WWF)
- Overall, the project focuses on including marketable natural resources in the stock accounts of the conventional SNA, and on environmental expenditures. Valuation of environmental damage is not part of the project, but future research is possible (WWF)
- New accounts are expected to be published regularly beyond 1997 (WWF)

- A study conducted in 1992, 1994 and 1996 by Statistics Canada and the province of Alberta focused on timber and carbon sequestration in natural forests and plantations for the province of Alberta. This was pioneer work on timber accounts in Canada and one of the first forest accounts to include carbon values (V&H)

- A pilot project conducted by Statistics Canada in 1996 and 1997 focused on timber in natural forests and plantations for the province of Ontario. Covering the period 1961-1991, the study presented the longest time series of any study and had access to some of the best data (V&H)

- The Canadian accounting program is run out of Statistics Canada and integrated into a single effort referred-to as "Econnections." This program includes a significant emphasis on resource accounting, plus work on environmental protection expenditures, the environmental protection industry, material flow accounts, and so on. Statistics Canada seems more concerned than many countries about organizing their accounting work within a single conceptual framework (JH)

- Canada is the only country publishing all of its environmental accounts data, along with a comprehensive description of the methods used to build the accounts in a single volume. However, it is not clear whether this volume has influenced the actual use made of the data. Although Statistics Canada does not calculate green GDP, several Canadian organizations are using the accounts data in the calculations of measures of welfare (JH)

- Like other developed countries, Canada has used its accounting data, particularly energy accounts and relevant pollution emissions data, in its analysis of climate change and strategies for meeting Kyoto protocol targets (JH)

## 9. Chile

- A study focusing on timber (native forests and plantations), subsoil assets, and fisheries was conducted by the National Accounts Department of the Central Bank of Chile to investigate implementation of SNA93 and SEEA recommendations. The physical accounts for native forests attracted worldwide attention when preliminary results were leaked to the press, as they indicated a sharp decrease in remaining area. The Central Bank has reportedly terminated the project (V&H)

- A project on Environmental Accounts in Chile started in 1993 with World Bank support. The project focused on physical accounts (mining, fisheries, forestry), matrices of emission coefficients and abatement costs, defensive expenditures, and valuation. There has been extensive methodological work. Preliminary results, particularly regarding the forestry sector, produced extensive debate that led to political conflicts, keeping the project from attaining its objectives (MC)

## 10. China

- In 1988, the Development Research Center of the State Council coordinated a project, "Chinese Resource Accounting and its Integration into National Accounts." It focused initially on physical accounts, then monetary valuation, individual resource accounting, and then a comprehensive system. The integration of resource accounting into the national accounting system through legislation is explicitly stated as an ultimate objective. Monetary accounting has always been a major focus (WWF)

- Carsten Stahmer, one of the authors of the UN handbook on SEEA, regards the Chinese work as a major contribution to the international community, for it has integrated Marxist economics, Chinese philosophy, and market economic principles in the determination of the value theory and pricing method for natural resources (WWF)

- Eight working groups have been focusing on: land, minerals, water, forestry, grassland, ocean, biological resources and recycled resources. Physical and monetary accounts for the eight resources have already been compiled on a preliminary basis (WWF)

- A study sponsored by the World Resources Institute (WRI) and the Ford Foundation (1993) focused on forest resources. The study added value of timber growth to GDP and added net accumulation of timber to NDP. It also calculated the asset value of forests for timber production, but did not link it to accounts (V&H)

## 11. Colombia

- In 1992 an Inter-institutional Committee on Environmental Accounting (CICA) was established. The Committee focuses on the development of a framework for physical accounts, the integration of these accounts in the national accounts, the adjustment of conventional macroeconomic indicators, and the analysis of public environmental expenditures (WWF)

- CICA has sponsored important projects, carried out by various institutions, focusing on environmental valuation and accounting. There is a core of well-informed professionals. There is an attempt to link environmental accounts to the SNA (MC)

## 12. Costa Rica

- Physical accounts were compiled for soils, forests, and fisheries for the period 1970-1989. Depreciations for these resources were calculated (WWF)

- A study conducted by WRI and the Tropical Science Center in 1991 focused on timber (natural forests), agricultural soils and fisheries. The study used geographic information systems (GIS) to construct estimates of forest areas over time, and ecological relationships to construct estimates of growing stocks in those areas. After the WRI study in Indonesia, this is the second-most widely cited study on natural resource depletion and national income accounts. This is the same as the WWF reference (V&H)
- An academic study (1996) was conducted to investigate how SEEA can be adapted to Costa Rican forest resources. The study focused on timber in natural forests and plantations, carbon sequestration, watershed protection and ecotourism. It concentrated on current accounts for timber, carbon stocks and watershed and ecotourism services. Asset values were not calculated (V&H)

- The Costa Rica experience of 1991(discussed in WWF and V&H) is considered a pioneer in Latin America. A new project was started in 1995, which may become a pilot experience for the rest of Central America. This project focuses on information leading to economic policy decisions with environmental impact. The project has attained interesting partial results, but its scope has been reduced due to lack of funding (MC)

## 13. Cuba

- Cuba has been focusing on shifting from the "Material Product System" to SNA 93, and has not done any concrete work on environmental accounting. However, the National Statistical Office has been working on an information system on environmental statistics (MC)

## 14. Czech Republic

- At a UNEP-sponsored workshop in 1994 it was reported that the National Statistical Office was working on the integration of environmental information in national accounts (WWF)

## 15. Denmark

- A physical satellite system linked to economic sectors of the national accounts is expected to be developed, focusing on the discharge of pollutants (WWF)
- In addition, Statistics Denmark is also compiling statistics of resource and environmental capital. This work is expected to provide a basis for a revised SNA in Denmark. The work is at an early stage with conceptual and methodological issues still to be addressed. There is no attempt to adjust the System of National Accounts at this stage (WWF)

## 16. Dominican Republic

- No environmental accounting project has been implemented to date, however, this could happen in the short-term. This could be the result of a number of data sets in various institutions that constitute the environment sector, and to the recent modernization of the national accounts sponsored by the UN. Also, an environmental accounting project is under discussion (MC)

## 17. Ecuador

- A PhD dissertation (1995) focused on timber (natural forests and plantations) and petroleum. The study added net accumulation of timber to NDP and net domestic investment, but did not calculate the asset value of forests (V&H)

- In Ecuador there are no institutions implementing environmental accounting, although a national project was under preparation in 1997. However, as of 1995, four studies dealing with resource accounting had been conducted. These have focused mainly on petroleum and forest resource depreciation (MC)
- The project under preparation focuses on methodology and institutionalization, with emphasis on the petroleum sector, particularly the effect of oil spills (MC)

## 18. El Salvador

- A project coordinated by a local NGO has assessed the adequacy of existing data and outlined an approach to integrating resource accounting into the SNA (WWF)

- A pilot project was being conducted by the Central Bank, but had produced no concrete results as of 1997. It is supposed to follow the SEEA approach (MC)

## 19. Finland

- Statistics Finland has compiled pilot physical accounts for forests, agriculture and foodstuffs (discontinued), energy and land use (WWF)
- Water accounting is a separate project handled by the National Board of Water and the Environment (WWF)
- As of 1991, only wood material accounting and energy accounting (including air emissions) were expected to be covered on a long term basis (WWF)

- A study conducted by Statistics Finland (1996) investigated the implementation of recommendations for forest resources in SNA93 and ESA95 (European System of Accounts), but did not consider recommendations in SEEA. The study focused on timber and natural resources and plantations, concentrated on current accounts and did not calculate asset values (V&H)
- Another study conducted by Statistics Finland investigated implementation of SEEA recommendations with the objective of integrating forest resource accounts in Finland's national accounts. The focus was on timber; Christmas trees and game; berries, mushrooms, reindeer farming and lichen; peat; carbon sequestration, biodiversity protection, and recreation; and acid deposition and defoliation. The study concentrated on current accounts by making several adjustments to value added in forests, but did not calculate asset value of forests. This is a most ambitious study in terms of addressing nontimber values (V&H)

## 20. France

- In 1978 the French government established the Interministerial Committee on Natural Resource Accounts and decided to design a Natural Patrimony Account (NPA) within its overall environmental information framework "to assess both quantitatively and qualitatively the state and the development of the natural patrimony, as well as the causes and effects of its evolution" (WWF)
- The government wanted the accounts to be compiled in both physical and monetary terms, independent of the SNA, although links could be made between the NPA and the SNA (WWF)
- The main objective is to demonstrate trade-offs between the economic, ecological and social functions of natural resources (WWF)
- Although monetary units can be applied, the system focuses on physical units (WWF)
- Although it is a comprehensive and visionary system, the NPA's complexity and limited budgetary resources have prevented the system from being fully implemented and having much policy impact (WWF)
- In 1991, the newly created French Institute of the Environment, under the Ministry of the Environment, initiated a program to continue work on the NPA. New accounts are being prepared for water quantity and quality, ecozone accounts concerning land use and land cover, and satellite accounts of environmental expenditure (WWF)

- The French Institute of the Environment (IFEN), over several years of additional work seems to have decided that the patrimony accounts were too ambitious and might never be accomplished if they were not reined in and divided into more manageable pieces (JH)

- France is one of the pilot countries for the European development of forest accounts, and there is some evidence that these data have been used to resolve local forest management disputes. IFEN has also been engaged in building water accounts, an area of interest to many countries, but rarely undertaken because of the difficulties involved (JH)
- IFEN is also working on organizing energy use and greenhouse gas emission in order to link them to national accounts (JH)

## 21. Germany

- In 1990 Germany developed a program for a system of Environment-Economy Comprehensive Accounting (UGR). The UGR was designed to include five types of information: environment-related economic activities (mainly defensive expenditures), use of natural resources, use of the environment as a sink of residuals, spatial characteristics (mainly land and land cover), and the qualitative condition of the environment (WWF)
- The Federal Statistical Office (FSO) appears to support a satellite approach, but it has not been specific about what it would include. It is expected that the German system will ultimately contain elements of three approaches (WWF)

- Potential policy applications of the UGR include waste issues, including recycling regulations and waste taxation; information to support policies to curb $CO_2$ emissions; measurement of which sectors bear the heaviest burden of environmental protection costs; and the analysis of transboundary pollution issues (H&L)

- The German Federal Statistical Office began work on environmental accounting in the 1980s. At present it is concentrating on physical accounts, leaving modeling and valuation to economists outside of the government (JH)
- Germany is a leader in the development of material flow accounts (MFA). Conceptually they parallel the structure of the national income accounts, but include physical data about the flow of materials rather than monetary data about financial flows. The MFAs aggregate these flows across sectors and materials to calculate the "total material requirement" of the economy. However, the uses of national indicators of this kind are not clear (JH)
- The conceptual framework of material flow accounts is also being applied at the micro level; it is being used to identify complementarities between the material flows of individual plants, through which they can reduce both environmental impact and costs (JH)

## 22. Guatemala

- No official institutions charged with environmental accounting exist in Guatemala. However, the implementation of an accounting project was under study in 1997 (MC)

## 23. Hungary

- The United Nations Environmental Programme (UNEP) has provided funding for a systematic program on environmental accounting technically coordinated by the United Nations Economic Commission for Europe (UNECE). The project focuses on water and forests. Preliminary results were due to be reported at a workshop in Budapest in March 1995 (WWF)

## 24. India

- In 1992 the Indira Gandhi Institute presented a report "Natural Resource Accounting: A Framework for India." Priorities are given to the assessment of physical environmental impacts of selected economic sectors, including the informal sector, and the compilation of physical accounts for soil, air, water, forests, biodiversity and a number of nonrenewable resources (WWF)
- Monetary accounts are seen as a logical step after physical accounts are compiled so as to achieve an integrated system similar to the SEEA (WWF)

## 25. Indonesia

- In 1989, physical accounts were compiled for petroleum, timber, and soils. The value of their depreciation was deducted from GDP. The costs of erosion in terms of productivity losses were also estimated and deducted from GDP (WWF)

- The 1989 study by WRI was conducted independently of the Indonesian government. The focus was timber (natural forests and plantations), petroleum, and agricultural soils. For current accounts the study added net accumulation of timber to GDP and gross domestic investment. Regarding asset accounts, it calculated the asset value of forests for timber production, but did not link it to asset accounts. This is the most widely cited study on natural resource depletion and national income accounts. This is the same study described in WWF (V&H)

## 26. Italy

- Two academics from the University of Rome carried out a study on a SEEA type of satellite accounting. The objective was to calculate a level of sustainable net domestic product that keeps both man made and natural capital intact (WWF)

## 27. Japan

- There is no government-sponsored effort to reform the SNA at present (WWF)
- However, in 1973, a set of net national welfare (NNW) accounts were developed (WWF)
- NNW accounts are available for each five-year period from 1955 through 1985 (WWF)
- The GDP adjustment to NNW is based on welfare criteria (WWF)

## 28. Malaysia

- In 1993, WWF-Malaysia published a short manual providing a procedure for compiling physical accounts and for calculating a resource-consumption allowance (depletion of natural resources) to be subtracted from NDP to yield an adjusted NDP (ANDP) (WWF)
- In the manual, natural resources accounting (NRA) is defined as "a way of accounting economically for changes in the quantity and quality of natural resources (WWF)
- The objective is to assess the effects of natural-resource changes on the economy so as to improve economic planning (WWF)

- By comparing ANDP with consumption, a new statistic, "true saving" can be calculated. If consumption exceeds ANDP, true saving is negative, and the country is living beyond its means (WWF)

- A 1993 study was sponsored by the Economic Planning Unit in the Prime Minister's Department. The study focused on timber, carbon sequestration, biodiversity, game in natural forests, subsoil assets and agricultural soils. The concentration was on current accounts, but asset value of forests was not calculated. This was one of the first studies to include a range of nontimber benefits as well as timber (V&H)

- An academic study (1997) updated and revised the 1993 study, focusing on timber in natural forests and on subsoil assets. Again, concentration was on current accounts, this time not only at the national level, but also considered Peninsular Malaysia, Sabah and Sarawak explicitly. This is one of the few studies to modify subnational accounts (V&H)

## 29. Mexico

- A case pilot study was conducted in 1990 and 1991. The objective was to integrate and link environmental and economic information and to determine whether environmentally adjusted national income aggregates could be derived. The case study used the SEEA framework (WWF)

- The study started with the existing SNA. It identified information related to three environmental aspects to be accounted for: oil depletion; deforestation and land use; and environmental degradation (arising from land erosion, air and water pollution, groundwater use, and the generation of solid wastes by the household sector) (WWF)

- The pilot study (published in 1993) was intended to test the key features of the SEEA. The focus was: forests (natural and plantations), soil erosion in forestland, petroleum, and environmental degradation (air and water pollution, solid waste, soil erosion, and groundwater depletion). The study concentrated on current accounts and did not calculate asset values. This is one of the few studies to treat deforestation as a process that not only reduced the stock of forestland but increased the stock of developed land (V&H)

- Mexico is implementing a System of Economic and Ecological Accounts (SCEEM). This has been a priority of the National Statistics, Geography and Informatics Institute (INEGI), which is responsible for the Mexican National Accounts. The project has been well received by Congress, which gives it a chance as a public policy formulation tool (MC)

- The SCEEM is essentially a Mexican version of SEEA. The main innovation is the enlargement of the asset boundary, including oil depletion, degradation concerns (water and air pollution, soil erosion, ground water use and the deposition of solid wastes), land use concerns, and deforestation. The accounts provide two measures of the Environmentally adjusted Domestic Product (EDP). "EDP1" is obtained by deducting the cost of resource depletion from NDP and "EDP2" by deducting environmental degradation (H&L)

**30. Namibia**

- Namibia's work on resource accounting began in the mid-1990s with financial support from USAID and the Swedish International Development Agency (SIDA). Work is carried out under the Natural Resources Accounting Project (NRA), implemented in the Directorate of Environmental Affairs of the Ministry of Environment and tourism (JH)
- Namibia's economy is largely dependent on natural resources, and with almost no industry. Consequently, environmental accounting under the NRA project has focused entirely on natural assets, with no attention to pollution issues. Work has concentrated on water, fisheries, minerals, and livestock, and a project is also underway on energy. The primary output has been policy studies, rather than publication of accounting data (JH)

- Studies on the fisheries and water sectors have established important sets of data on stocks, use, productivity and value estimates (JH, GML)

**31. Nepal**

- An academic study (1995) focused on timber, fuelwood and fodder. The study concentrated on current accounts, but did not calculate asset value of forests. This is one of the few studies to adjust GDP for production of nonmarket forest-related goods (V&H)

**32. Netherlands**

- The Central Bureau of Statistics (CBS) and the Ministry of Housing, Physical Planning and Environment (VROM) are currently supporting projects for adjusting the national accounts (WWF)
- The VROM project focuses on satellite accounts which contain environmental indicators (WWF)
- The NRA work underway in the CBS focuses on physical environmental information. The long-term aim is to link environmental data to a more integrated scheme of environmental accounts and national accounts in physical terms (WWF)

- Dutch interest in this area originated with the work of economist Roefie Hueting. His proposals met with considerable opposition, because his approach was perceived as model building and therefore outside the purview of statisticians focusing on tracking historical data. However, his strong advocacy led the national income accountants to consider other ways to link environmental and economic data, more consistent with their view of the scope of national accounting. The result was the development of the National Accounts Matrix including Environmental Accounts (NAMEA), which is based on an I-O framework. The NAMEA framework has been officially adopted by the EU, which is providing financial support to other EU countries to develop their own NAMEA systems. Because it involves accounting for physical rather than monetary aspects of the environment, statisticians in most countries are comfortable producing it (JH)
- Although Dutch environmental accounting has concentrated on the NAMEA and other physical account, there is a recent pilot project focused on implementing Hueting's earlier proposals. The central concept of this effort is "sustainable national income" (SNI), which assumes an economy that transfers all environmental functions to future generations. The

effort includes a combination of scientifically-based assessments of physical sustainability, abatement cost functions for production and consumption sectors, and general equilibrium modeling (JH)

## 33. New Zealand

- There is no official program on environmental accounting (WWF)
- A report prepared for the Ministry of Environment discussed the feasibility of compiling pilot resource accounts for indigenous forests in the country, but does not present any specific accounts (WWF)
- The accounts are expected to be independent of the SNA, as the valuation techniques appear to be too broad to fit into the framework of national accounts (WWF)

- The New Zealand System of National Accounts (NZSNA) is implementing resource accounting for timber plantations, focusing on both current and asset accounts. The physical basis is the National Exotic Forest Description (NEFD), which contains very detailed data on forest plantations (V&H)

- A study published in 1991 focused on natural resource accounting for New Zealand's indigenous forests. Owing to the relatively small volumes of economically exploitable timber, much of the discussion focused on non-marketed values and the total economic value of the resource (H&L)

## 34. Nicaragua

- No institutions (whether public, private, academic or NGOs) are working in this field. However, the Central Bank expects to implement a project of this kind. Deforestation should be a priority given the importance of fuelwood (MC)

## 35. Norway

- Norway is said to have the longest history of physical environmental accounting. The Central Bureau of Statistics (CBS) compiled accounts for forests in 1970 and for fish resources in 1974 (WWF)
- In 1974 a Norwegian Resource Accounting System (NRA) was initiated. The primary focus was on resource budgeting, reflecting the prevailing concern about "oil price shocks and the possible exhaustion of physical resources." Pilot accounts for energy, land use and fish resources were compiled (WWF)
- Since 1978, accounts have been compiled and published for petroleum, minerals, hydropower, land use, and selected air and water pollutants. These are natural resources or environmental aspects considered to be strategically important. The accounts are inputs to medium- and long-term economic models and "are viewed as a tool to help policy-makers better manage the natural environment." (WWF)
- Priority sectors have changed over time, e.g., current emphasis is on environmental degradation and the land use account is no longer compiled due to its limited use. This reflects the user-driven, issue-oriented approach of the CBS (WWF)

- The objective of the Norwegian system is not to adjust GDP and measure true income, although the system is linked to economic activity (WWF)

- Work on environmental accounting in Norway began in 1970. Accounts have been developed to track the use of natural resources, focusing on forests, fisheries, energy and land. The accounts have been integrated into economic models used for macroeconomic planning (JH)
- By the mid-1980s, Norwegians were making little use of the resource accounts and decided to discontinue most of them. The only natural resource that they have continued to track is energy. Norway also has detailed statistics on pollution, and linkages between energy and air pollution data have been established, which are used in economic planning models (JH)
- Norwegian environment groups do not seem to be using the environmental accounting data in their work (JH)

- The accounts have been used in economic models for energy planning, in particular to assess future energy requirements under alternative assumptions about technology or investment in energy sectors, and to assess the environmental consequences of expanded extraction and substitution among the different sources of energy. The energy and air pollution accounts are also used to explore the economic and environmental effects of different energy taxes for the reduction of carbon emissions. The accounts have also proved useful in analyzing the environmental consequences of alternative land uses (L&D)

- The original ambitious workplan has gradually been scaled back to a core set of accounts, as the policy usefulness of these accounts has become an explicit criterion for their development and continuation (H&L)
- Norwegians have not been keen on the notion of green GDP (H&L)
- The initial policy concerns motivating the accounts in Norway were the physical scarcity of resources. Today the resource accounting work is part of an ongoing effort to integrate resource and environmental issues into existing economic planning procedures. The focus of this effort has gradually narrowed to energy resources and air emissions, as well as the analysis of domestic consequences of international protocols to which Norway is a signatory (H&L)

## 36. Panama

- Although there are a number of environmental data sets in Panama, these are scattered in several institutions. As a result, an inter-institutional agreement was signed in 1996 to create a National Commission on Environmental Statistics (CONEMA) with the mission of compiling physical environmental statistics and accounts based on UN recommendations (MC)

## 37. Papua New Guinea

- A pilot study (1992) was carried out by the United Nations Statistical Division (UNSTAT) and the WB, with the involvement of the Papua New Guinea Statistical Office. The major objective was to test the SEEA "in a country at a relatively early stage of development and

with as yet moderate environmental problems." The study involved "a small, mainly external effort in a country having relatively weak institutional capacities and limited data" (WWF)

- The study identified environmental protection services and estimated the related expenditures. It also measured the depletion of mineral resources and valued environmental degradation. Estimates were made for: forest clearing for cultivation, logging, localized water pollution, and hydropower (WWF)

- The pilot study (1992, 1993, 1994) focused on nontimber values (ecological, social, and spiritual values) in natural forests, as well as subsoil assets and energy. The study was concentrated on current accounts and did not calculate asset value of forests. The authors originally intended to estimate net accumulation of timber, but they were unable to translate their estimates of changes in forest areas into estimates of changes in timber stocks (V&H)

## 38. Peru

- Although Peru has no institutions in charge of environmental accounting, the National Statistics Institute is interested in applying methodologies for the economic valuation of the nation's natural resources, as required by the Environment and Natural Resources Code of 1990. The idea of environmental and resource accounting is well received by Peruvian technicians and specialists. However, concrete results are scarce, except for a few studies (MC)

## 39. Philippines

- WRI assessed the depreciation for forestry, soil erosion, and coastal fisheries for the 1978-1987 period (WWF)
- In 1991, DENR and USAID set up the ENRAP project. The first phase (known as "NRAP") focused on the forest sector and adjusted the GNP for the depreciation of forests (WWF)
- The second phase, from January 1993 to March 1994 developed a more general accounting framework with the aim of supporting integrated environmental and economic policy formulation. The third phase started the institutionalization of the accounting process within government structures. Accounts were refined and updated to meet specific policy and management needs (WWF)

- NRAP phase I focused on current accounts of forest resources and calculated the asset value of dipterocarp forests, but did not link it to asset accounts. Apparently the first study to compare alternative methods for estimating net accumulation of timber (V&H)
- The WRI study referred-to by WWF focused on timber in natural forests, agricultural soils and fisheries. The approach is essentially identical to that applied in the Indonesia WRI study (V&H)

- The Philippines offers rich experience for other countries considering environmental accounting, because two separate, parallel projects were underway there for much of the 1990s (JH)
- In 1991, the Environmental and Natural Resources Accounting Project (ENRAP) began in the Department of Environmental and Natural Resources (DENR) with financial support from the United States Agency for International Development (USAID). The stated goals of

ENRAP were to build data useful for analysis of public policy and to encourage policy-makers to use those data. From the start, the project placed a major emphasis on publishing analytical studies that applied the accounting data to specific policy questions, so that policy makers could see how the work was relevant to decision-making. Over time, the project focused on more detailed issues, taking on some regional accounting, cost-benefit analyses, and primary data collection (JH)

- In the mid-1990s, the National Statistical Coordination Board began implementing SEEA. They received financial support from the UN for the project, which has been referred-to as PSEEA. This project was developed to implement SEEA without ENRAP's focus on data use. They built resource accounts for forests, minerals, fish, and soil, and estimated the costs of preventing air and water pollution. At the start, they relied on ENRAP technical assistance in building the accounts. They have published asset accounts, and are working on improving their data on pollution costs (JH)

- Unlike many countries, both projects (ENRAP and PSEEA) produced green GDP figures, although PSEEA has not published them (JH)

- The existence of two separate projects using different methods, estimating different resource depletion figures, and calculating different values for green GDP has confused Philippine officials. An important aspect of the Philippine experience is that ENRAP was run by analysts (mainly economists), while statisticians ran PSEEA. Other countries may learn from this experience about the importance of involving both official statisticians and analysts in a collaborative effort from the start, instead of allowing an uncomfortable competition to develop (JH)

- The Philippines is also an international leader in the field of Environmental Management Accounting (EMA), the subset of environmental accounting that is used for decision-making within an organization (e.g., an industrial firm or a government office). For example, the Philippines is the first country to require that the principles of EMA be included in two core accounting courses taken by every university-level accounting student in the country. Also, the EMA accounting work in the Philippines is being spearheaded neither by government nor by environmental experts, but by the Philippine professional accounting organization – with great success (DS)

## 40. Slovenia

- The country has initiated a program on environmental accounting. The Statistical Office has decided to use a combination of various approaches. Work will concentrate on the use of environmental information to gauge the effects of macroeconomic policies (WWF)

## 41. Spain

- The Inter-ministerial commission on Natural Heritage Accounts has reportedly produced accounts for water, land use, flora and fauna, waste, and marine resources for the period 1968–88 (WWF)

## 42. Sweden

- A Commission for Environmental Accounting was set up in 1990. Its main objective was "to analyze the feasibility of including natural resources and environment in Sweden's national accounts (WWF)
- The Commission presented a report in 1991, which envisaged a satellite system in both physical and monetary terms linked to the SNA and the SEEA. The Commission's recommendations emphasized satellite physical accounts and information concerning environmental expenditures (WWF)
- Physical accounts have been planned for energy, flows of chemicals, emissions, discharges, spilled waste, recycling, phosphorus and nitrogen (WWF)
- A long term goal is to transform the physical data of the environmental accounts into monetary terms (WWF)

- An academic forest resource accounting study (1992) focused on timber; fuelwood, berries, mushrooms and game; reindeer forage; carbon sequestration; biological diversity; and forest soils. Concentration was on current accounts and no asset value of forests was calculated. This was one of the first studies to address nonmarket values and one of the most ambitious, surpassed only by the Finland study of 1996 (V&H)

- Sweden has been working on environmental accounting through much of the 1990s and made an official decision to make this a routine government activity in 1996. As in other European countries, the core work of Swedish accounts has been on energy, air pollutant emissions, and climate change models. Demand for analytical work using the data has come from several policy-level sources (JH)
- The Swedish Government has created national commissions on climate change, growth and environment and green taxes, all of which have called for analytical work relating the economy to the environment. These commissions are central to the Swedish process for framing policy issues and analyzing strategies to resolve them. Thus, the accounting data are feeding into high visibility public debates on environmental dimensions of tax policy, climate change and economic growth (JH)
- Swedish environmental accounting data are also being used by consulting firms that advise businesses on their environmental performance (JH)

- As reported in 1993, Statistics Sweden has been given specific instructions to produce physical resource and environmental accounts as supplements to the traditional national accounts. Initial focus was on energy and heavy metals, to expand later into other areas, i.e., $CO_2$, $SO_2$, $NO_X$, hydrocarbons, and discharges of chlorinated organic compounds by the pulp and paper industry. Statistics Sweden has also been asked to work with the National Institute of Economic Research to develop methods and models for measuring the links between the economy and the environment (H&L)

## 43. Switzerland

- In 1992, the Federal Office of Statistics published an environmental accounting framework based on the physical environmental accounting model of the European System for the Collection of Economic Information on the Environment (SERIEE) and Eurostat (WWF)

## 44. Tanzania

- Peskin imputed a value for physical depletion of forest resources in Tanzania in 1980 due to fuelwood production (WWF)

- The Peskin study (1989) focused on fuelwood only, concentrated on current accounts and did not calculate asset value of forests. This was the first study to correct GDP for exclusion of nontimber values and one of the first to correct NDP for net accumulation of forest capital (V&H)

## 45. Thailand

- The Thailand Development Research Institute (TDRI) conducted a study to assess the effect of logging in 1989 on forest resources (WWF)

- The TDRI study was actually a PhD dissertation. It focused o reductions in timber stocks due to deforestation. It concentrated on current accounts and did not calculate the asset value of forests. This was the first study to compare net accumulation estimates from the net price and replacement cost methods (V&H)

## 46. United Kingdom

- There has been no major program on the adjustment of the SNA in the U.K. (WWF)
- The Central Statistical Office has carried out an experimental project on physical and monetary environmental accounting which covers oil and gas depletion and defensive expenditures with adjustments to the GDP for 1990 (WWF)
- The Department of the Environment has a task force on green accounts but there is no specific program to develop them (WWF)
- A study commissioned by the Department of the Environment (1992) developed a pilot framework of accounts for forestry, water and energy in physical terms similar to the Norwegian model. The work on forestry and water was part of a response to an OECD program of resource accounting in these two sectors (WWF)
- The study focused primarily on physical satellite accounts that are linked to the SNA in classification and concluded that this type of accounting has "most promise in terms of usefulness for policy analysis" (WWF)

- A study focusing on the land-use sectors was published in 1993. This study is one of the few that uses results derived from stated preference studies in a national accounting framework. The uses of the accounts are tentative, but indicate that policies that degrade the countryside are likely to have larger welfare impacts than will be apparent by looking at the conventional accounts (H&L)
- Another study, published in 1992, represents an application of the various strands of resource accounting approaches to the U.K. The data are assembled along the lines of the SEEA in balance sheets for 1990 in both physical terms and, where possible in monetary terms (H&L)

## 47. Uruguay

- In 1991 a research project on natural resource and environmental accounts (NREA) was carried out by the government and the Organization of American States (OAS) (WWF)
- The project prepared physical accounts for soil and proposed the establishment of an NREA system for the country (WWF)

- No projects on environmental accounting are being conducted in Uruguay, and it is not a short-term priority, although pilot projects are a possibility. However, there are some official programs focusing on natural resource inventories and valuation, which could be a good starting point. In this sense, there is precise information on soils and agricultural land use (MC)

## 48. United States

- The U.S. has long been focusing on the collection of data on pollution abatement expenditures. Current pollution control outlays are already included in the conventional accounting of costs, and the US has identified these costs separately since 1972 (WWF)
- The Bureau of Economic Analysis (BEA)started a program on resource accounting in the late 1970s but this was aborted after one publication on accounting for resource depletion (WWF)
- An individual study on the Chesapeake region was carried out using Peskin's approach (the same approach applied by ENRAP in the Philippines). An evaluation of environmental services as benefits, environmental damage and environmental depreciation as costs was made in 1982 and 1985. The study covers the links between non-market, productive environmental services and various other sectors of the economy. The approach is useful for devising cost-effective policies to achieve environmental benefits (WWF)
- The BEA started to work on natural-resource satellite accounts in 1992, focusing on accounts to assess the stock and flow of natural resources. In May 1994 the BEA released its work on Integrated Economic and Environmental Satellite Accounts (IEESA). While the IIESA build on the existing economic accounts, they do not replace them (WWF)
- The accounts cover major subsoil natural resources, such as petroleum, natural gas, coal, metals and other minerals over the period 1958–91 (WWF)

- A study was conducted by BEA (1996) as part of the workplan to develop the IEESA. At the request of Congress, the work has been put on hold pending completion of a National Academy of Sciences study of the IEESA. The focus was on timber, forestland, subsoil assets, land, and air and water quality. The study concentrated on asset accounts (in contrast to most other studies). It calculated asset values of timber and forestland stocks and included them in asset accounts. Both timber and forestland were treated as "Produced assets" ("Developed natural assets"), with timber being a "Cultivated fixed natural growth asset" (not "Work-in-progress") and forestland being in the "Developed land" category. This is one of the few studies to attempt to value timber stocks and forestland separately (V&H)

- The construction of welfare-adjusted measures of national accounts was the subject of several academic studies in the United States since the early seventies. These studies presented sustainability issues as an attempt to provide more 'realistic' income measures. However, the results of these studies vary widely (H&L)

- Another study published by the Congressional Budget Office (1994) presented estimates of total rents for the depletion of oil in the U.S. from 1981 to 1990. For the same period, the value of degradation of air and water quality was also estimated (H&L)
- The Bureau of Economic Analysis published its first Integrated Economic and Environmental Satellite Accounts (IEESA) in 1994. The accounts were designed to (i) examine the effects of changing patterns of demand on natural resource use; and (ii) support the analysis of the effects of changing resource costs and availability on the suppliers and users of natural resources (H&L)

- The U.S. government has not undertaken any environmental accounting since 1995, when Congress halted the work that had been launched by the Bureau of Economic Analysis and explicitly prohibited the agency from using any of its funds for this purpose (JH)
- At congressional direction, the Department of Commerce asked the National Academy of Sciences to organize an expert panel to make recommendations on what the U.S. should do in this field. The panel's report (Nordhaus 1999) recommended that BEA resume work on environmental accounting with a very ambitious program of activity. However, the recommendations have not been implemented, nor has the prohibition on BEA's work been removed (JH)
- Despite this situation, various agencies in the U.S. maintain databases that link economic activity with environmental issues. For example, the U.S. Environmental Protection Agency (EPA) maintains databases on pollution control and emissions that would form the building blocks of portions of an environmental accounting system. Other data maintained by EPA include pesticides, hazardous waste and drinking water quality. Researchers at Carnegie Mellon University have integrated major EPA databases on pollutant emissions into a system analogous in some ways to the NAMEA systems that exist in Europe and to the micro-level use of material flow accounts (see item on Germany) (JH)
- Until 1994, the Bureau of the Census conducted a regular survey of Pollution Abatement and Control Expenditures (PACE). This survey was discontinued for budgetary reasons. However, despite the lack of a formal accounting framework and the discontinuation of the PACE data, considerable effort is going into assessing the costs an macroeconomic impacts of reducing greenhouse gas emissions (JH)
- Other important U.S. databases include the materials flow work being conducted by the World Resources Institute (WRI), and a detailed physical database on U.S. forests, which was originally established in the 1930s, and continues to be updated by the Forest Service (JH)
- While the U.S. experience is somewhat scattered, it does provide some information about the utility of environmental accounting. The experience sheds some light on what may be missed out on important data applications as a result of not having a systematic environmental accounting system (JH)

## 49. Venezuela

- Although there are no formal institutions elaborating national environmental accounts, several individuals and organizations have shown interest in the subject. There are also various lessons of experience that could significantly contribute to the implementation of environmental accounts. A pilot project on "Quantification of Economy-Environment

Relationships" is being promoted by the Ministry of Environment and Renewable Natural Resources (MC)

## 50. Zimbabwe

- A study has been published (1993), accounting for deforestation in 1987, soil erosion in 1990, and mineral extraction from October 1990 to March 1993 (WWF)

- This was an academic study that focused on roundwood (fuelwood and construction timber) in natural forests, gold and agricultural soils. It concentrated on current accounts and did not calculate the asset value of forests. This is one of the few studies conducted in Africa (V&H)

- The Zimbabwe study emphasized data problems suggesting that the implementation of SEEA to a wider range of developing countries will prove complex (H&L)