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LESSONS LEARNED FROM ENVIRONMENTAL ACCOUNTING: FINDINGS FROM NINE CASE STUDIES

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SUMMARY

Environmental accounting – the modification of the national income accounts to take into account the economic role of the environment – has grown in importance over the past ten years. However, many countries have not yet implemented such accounts, and there is considerable controversy about whether and how to do so. This paper aims to shed light on this situation through nine country case studies; Norway, The Netherlands, Sweden, France, Canada, The Philippines, Namibia, Germany, and the United States.

The case studies ask a series of questions about each country, including:

- What accounts has it built, using which methods?
- Which institution has built the accounts?
- How has the accounting work been funded?
- How are the data being used, and by whom?
- Does the choice of topics, methods, or institutional context have a bearing on the effectiveness with which the accounts are used?

Environmental accounts are being implemented with an array of goals in mind. One of the most ambitious is that they will help steer the economy onto a sustainable path or provide macroeconomic indicators that reflect the role of the environment in the economy. The cases suggest that this goal is not being achieved, largely because the accounts include neither meaningful adjusted macroeconomic indicators nor the value of non-marketed environmental goods and services.

A more modest goal is that the accounts and the data underlying them will make it easier to analyze sectoral and macroeconomic issues, so as to design policies that reflect a more comprehensive understanding of the relationship between the economy and the environment. This does seem to be occurring in the case study countries, and is the major use of the accounting data.

A third goal is held in particular by environmental advocacy groups, who hope that the accounts will help them make a case for increased environmental protection. The cases suggest that advocacy groups are infrequent users of the accounts or the data underlying them. This may be because the accounts do not include the macroeconomic indicators or valuation data that would help identify tradeoffs between economic growth and the environment. It may also be because relatively few advocacy groups are engaged in the analytical work to which the accounting data are best suited.

A fourth aim for the accounts is that the process of building them will serve as a catalyst for organizing data in new ways, reconciling discrepancies in underlying data, and investing in new data collection. A number of countries found that the accounting process helped systematize existing data. By and large use of the accounts did not increase willingness to invest in primary data collection, however, and most accounts rely on data collected by other government agencies for other purposes.

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LIST OF ACRONYMS

DENR	Department of Environment and Natural Resources (Philippines)
DOE	Department of Energy (USA)
EDP	Environmentally-adjusted Domestic Product
EEA	European Environment Agency
EIOLCA	economic input-output life cycle assessment
ENRAP	Environment and Natural Resources Accounting Project (Philippines)
EPA	Environmental Protection Agency (USA)
EU	European Union
FSO	Federal Statistical Office (Germany)
GWS	Society for Research on Economic Structure (Germany)
IFEN	French Institute for the Environment
KI	Konjuncturinstitutet (Swedish National Institute for Economic Research)
MFA	material flow accounts
MIES	Interministerial Mission on the Greenhouse Effect (France)
NAMEA	National Accounts Matrix with Environmental Accounts
NOREEA	Norwegian Economic and Environmental Accounts
NRA	Natural Resource Accounts (Namibia)
NSCB	National Statistical Coordination Board (Philippines)
PACE	Pollution Abatement and Control Expenditure (US survey)
PIOT	physical input-output table
SEEA	System of Integrated Environmental and Economic Accounting (UN)
SIDA	Swedish International Development Agency
SNA	System of National Accounts
SNI	sustainable national income
TMR	total material requirement
USAID	United States Agency for International Development
USGS	United States Geological Survey

INTRODUCTION

Environmental accounting – the modification of the national income accounts to take into account the economic role of the environment – began in the 1970s, and has grown in importance in the past decade. However, these accounts are still controversial, and many countries have held back on developing them so far. Moreover, although considerable effort has been invested by statisticians, national income accountants, economists and environmentalists in developing theoretically sound and practically feasible methods for building environmental accounts, there is still considerable disagreement about how to do this.

This paper aims to shed light on this situation through a series of case studies of countries that have made significant investments in the development of environmental accounts. The goal of these case studies, which were conducted in 1999 and 2000, is to see what lessons we can learn from countries experienced with environmental accounts, in order to inform and guide those that have not yet built them.

The case studies ask a series of questions about each country:

- What has the country done in the way of environmental accounting? Environmental accounts can cover a wide range of topics, and can address them using different methods.
- What is the institutional setting for building the accounts? Typically they are undertaken either by the national statistical office, the national accounts office, or the ministry of environment.
- How has the accounting work been funded; by the government or by a bilateral or multilateral donor? What, if anything, is the influence of funding source on choice of topics or methods?
- How are the data being used, and by whom? Can we identify clear applications of the accounting data to address policy decisions?
- Does the choice of topics, methods, or institutional context affect the effectiveness with which the data are used to address policy questions?

CHOICE OF CASES

The case study countries were chosen based on several criteria:

- How long accounting work has been in process. In order to look at the influence of the accounts on policy, we had to look at countries that have been doing this for as long as possible.
- Breadth of environmental concerns and accounting topics. To have a good basis for comparison and understanding, we sought to include countries confronting a range of environmental problems, and which have chosen different approaches to environmental accounting.
- Funding sources. We sought to look both at projects funded by the government itself and projects funded by others.

- Level of development. Including both developed and developing countries was a key element of the study.

Based on these criteria, we identified nine countries for consideration: Norway, Sweden, the Netherlands, France, Canada, the Philippines, Namibia, Germany, and the United States. Norway, the Netherlands, and France were included because they were "early adopters" of environmental accounting, developing their own methods during the 1970s and 1980s in response to their own environmental and economic priorities. Sweden was chosen as a European Union (EU) country that has actively worked with Eurostat (the statistical office of the EU) in helping to design, test, and implement accounting methods intended for all EU countries. Germany was included because it has taken a lead on material flow accounts and land accounting, and has also worked closely with Eurostat.[1] Canada was included because it has made a significant commitment to accounting without the influence or support of the EU, and because of the extent of its natural resources and their importance in the Canadian accounts. All of these countries are actively engaged in working with the United Nations on the development of its approach to environmental accounting, the System of Integrated Economic and Environmental Accounting (SEEA). Consequently, their work is consistent with what will be included in the revisions of that system that are expected out in 2001.

The Philippines and Namibia were the only two developing countries identified that have made an ongoing commitment to environmental accounting. To those who are familiar with the history of environmental accounting, this may come as a surprise, given the widespread attention received by the Indonesian work described in *Wasting Assets*, a well-known publication of the World Resources Institute. (Repetto et al., 1989) However, like many less-familiar environmental accounting studies on developing countries, this was not the outcome of an ongoing commitment by the government to account for its own environment; it was a one-time study undertaken largely by expatriates and not followed up by institutionalization within the Indonesian government. In some countries, such as Brazil, academic economists have worked on environmental accounts, but there has not been an ongoing government commitment to build routine accounting data. Other developing countries that have initiated their own work on environmental accounting have only done so within the past few years, and so did not have enough experience to warrant looking at how the data are being used. This was the case, for example, of Chile. Preliminary forest accounting work was undertaken in that country in the mid-1990s, but it was halted for political reasons. Implementation of the UN SEEA has begun subsequently, but it is not far enough along to show use of the data.

Those familiar with this field may also be surprised to see the United States in the list. The United States announced an ambitious accounting program in 1993, which was terminated by Congress shortly thereafter in response to objections by resource-based industries. Further work in the field by the Bureau of Economic Analysis (BEA, the US national accounting office) has been specifically prohibited in each year's appropriation bill since then. As of the writing of this report, the Congressional ban on environmental accounting had not yet been lifted, so nothing done in the United States is officially given the label of environmental accounting. However, the United States does, in fact, undertake a number of activities that elsewhere are called

[1] Other European countries also have considerable expertise with environmental accounting, but time constraints made it impossible to include all of them.

environmental accounting. For that reason, we asked the same questions about ongoing work in the United States as we have asked elsewhere, in order to assess whether the integration of the data within a single program or framework is essential to their utility.

WHAT IS ENVIRONMENTAL ACCOUNTING?

There is no single agreed-upon definition of environmental accounting by which we can decide which projects should be included in this study. Data that have been included in the environmental accounts of different countries include all of the following:

- pollutant emissions in physical terms by economic sector
- actual environmental protection expenditures by economic sector
- hypothetical expenditures that would be required to further reduce pollution (sometimes called "maintenance cost"), by economic sector
- output of the environmental protection industry
- environmental taxes, fees, and subsidies
- physical asset accounts for natural resources such as forests, minerals, energy sources, fish, land, etc., detailing the total stock and the changes in stock due to different causes
- monetary asset accounts paralleling the physical accounts in structure
- physical and monetary flow accounts for natural resources, detailing their use by sector
- physical input/output tables (PIOT)
- material flow accounts; these can be understood to encompass physical pollutant emission accounts, physical resource asset and flow accounts, and PIOTs.
- monetary value of non-marketed goods and services provided by the environment
- monetary value of the cost imposed by environmental degradation (this can be equivalent to the preceding item)
- adjusted macroeconomic indicators, such as green GDP, sustainable national income, or genuine savings.

Rather than adopting an *a priori* definition of environmental accounting, and seeing which of the items above fall within it, it is more useful for our purposes to include within the broad concept of environmental accounting anything which its practitioners choose to place there. Our cases may then help us assess which of these activities turns out to have the most interesting applications and therefore justify continued support.

By looking for commonalities among all of these items above, we can nevertheless identify a few elements that characterize all of these efforts. First, they all provide tools with which to link environmental and economic data so that they can be analyzed jointly and tradeoffs in resource allocation can be evaluated. Second, they entail comprehensive coverage rather than providing micro data about individual cases within the area of interest. This means they can be used for macroeconomic policy-making and sectoral analysis, rather than for decisions at the project or local level. Third, the accounts contain time series data produced on a regular basis, to permit observation and analysis of trends over time.

WHAT MIGHT WE FIND?

Our expectations in looking at the use of environmental accounting data are shaped by the claims made for them by their supporters, and the reasons why people create them. The cases may shed light on whether these expectations are achieved, and on some of the debates that run through the accounting process.

- Environmentalists, ecological economists, and others focused on sustainable development hope that the accounts will give governments a basis for assessing the sustainability of current economic activity, show what a sustainable development path would look like, and allow decision-makers to design policies that will set their economies on that path.

- Only slightly less ambitious, some people working on environmental and economic issues look to environmental accounts to provide indicators of macroeconomic performance that take into account the role of the environment as a producer of welfare and the impacts of economic growth on the environment. Such indicators may not go as far as measuring sustainability, but nevertheless do reflect the fact that that environmental harm may reduce economic performance and welfare.

- A more modest hope may be that the accounts will permit analysis of specific sectors of the economy, specific environmental policy issues, and the links between the two. For example, accounting data on pollutant emissions by economic sector are useful for understanding the sources of environmental problems. Data on environmental protection expenditures by sector may allow us to go farther, to assess how environmental regulation is affecting competitiveness, profits, employment, and so on. Data on the hypothetical expenditures that would be required to further reduce pollution from each sector are useful to project the economic impact of tighter regulation or of compliance with international agreements such as the Kyoto Protocol. Estimates of the harm caused by that pollution would allow us to place proposed regulations into a cost-benefit framework and assess whether they are justified on economic grounds.

- Some environment groups may expect the accounts to provide data useful for advocacy work. They may expect that environmental accounting will lead to increased environmental protection, and in some instances they may only support development of the accounts if it is likely to lead to that outcome.

- Underlying the development of environmental accounts is a debate about the place of modeling and valuation in accounting systems. There is much debate about whether the accounts should include estimates of sustainable income or green GDP calculated using complex models of the economy, or estimated monetary values for non-marketed environmental goods and services derived from economics valuation exercises. Statisticians often argue that such values are not comparable to or are less reliable than the historical data of the accounts, and should remain within the realm of economic analysis. Economists and some environmentalists, in contrast, argue that the national income accounts already rely heavily on estimates and model results, and this work is no different. The cases will shed light on how this debate has played itself out in the countries studied.

- Another thread running through development of the accounts concerns the relationship between environmental statistics and environmental accounting – and similarly, between statistical offices and accounting offices. This is both a technical and an institutional issue. On the technical side, it touches on whether the data frameworks used to organize "conventional" environmental statistics are compatible with those needed for environmental accounting, i.e. to link environmental and economic data. On the institutional side, it deals with who builds the accounts, who receives the public funding that accounting could bring, and which data are used in producing national environmental indicators that may attract considerable media or political attention.

- In a related point, data users may hope that the process of building environmental accounts will serve as a catalyst for reconciling data from different sources, so that they will be easier to use for all purposes even by those who don't use the accounts themselves.

The broadest goal of these cases is to answer a fundamental question sometimes asked about environmental accounting – "so what?" Does the development of environmental accounts make any difference to how we factor the environment into our public decision-making? If the cases show that environmental accounts lead to more informed or objective decision-making, we will feel assured that the investment in building them has been justified.

THE CASES

The case discussions that follow present highlights of the experiences of the countries studied so far. It would not be feasible in a paper of this scope to provide a detailed review of all the work of those countries. Instead, we consider specific findings that are particularly illustrative of the problems involved in building and using environmental accounts, and that offer useful lessons to other countries moving ahead in this area.[2]

NORWAY

Norway was among the first countries to make a commitment to environmental accounting and an innovator in the development of accounting frameworks. Their work began in the 1970s, in response to the Club of Rome's publication of *Limits to Growth* and a growing environmental movement. The Norwegians became concerned that their natural resources, on which their economy is relatively dependent compared to other European countries, would run out. They therefore developed accounts that tracked their use of natural resources, focusing on forests, fisheries, energy, and land. These accounts were integrated into models used for macroeconomic planning, taking into account the roles of resource-based sectors in economic growth. The accounting work was commissioned by the Ministry of Environment. The Research Department of Statistics Norway did much of the work, and integrated the data into their macroeconomic models. The environmental statistics unit of Statistics Norway, established in 1978, undertook to develop accounts for air pollutant emissions, which were closely tied to the energy accounts.

In addition to macroeconomic modeling, the data underlying the resource accounts were used for narrower purposes. The Ministry of Energy used water accounts data to identify opportunities for and track hydropower development. In the 1980s these data were also input into a debate over how the remaining undeveloped rivers should be used. Competition for use of the rivers was growing between the energy sector, which wanted to maximize hydropower output, and environmentalists, who wanted rivers left undeveloped. The Ministry of Energy used the river data to assess the potential of each stretch for further hydropower development and its potential for recreation. Rivers that were strong candidates for hydropower and of little use for other purposes could easily be allocated to the energy sector, while those with strong recreation potential and little interest for energy could be protected from further development. This narrowed the field of debate to those river stretches well suited to both purposes, and simplified resolution of the conflict.

Although the Norwegians led in the development of resource accounts, they have not continued building most of them. By the mid-1980s, they found that their natural resources were not running out, and the scare about depletion passed. Moreover, although the Ministry of Environment had commissioned the work, they had no authority over resource management, and therefore made little use of the data. The sectoral ministries with responsibility for resource management worked from their own data, and did not use the accounts themselves. The

[2] Almost all of the information provided in these case descriptions came from interviews conducted by the author; for this reason sources for individual facts are not cited, although documents are. For more detail or for information about how to follow up with sources of the ideas discussed here, please contact the author.

management of resource data therefore reverted back to the sectoral ministries, and publication of most resource accounts *per se* ceased.

The only issues that Statistics Norway continued to address were energy and air pollution. Norway is a significant producer of both hydropower, with which they meet most of their own electricity needs, and petroleum, which is exported. Energy is a key resource in all economies because of its importance in other productive sectors; in Norway it is doubly important, since they are a producer as well as a user. Moreover, the Ministry of Environment is responsible for managing pollution, and therefore was itself a user of the energy account. They therefore had an interest in ensuring that the data continued to be produced.

Energy accounts provide detailed data on how much of each type of energy is used, by what sectors, and for what purposes. They also provide data on the prices of that energy. In Norway, as in many countries, the energy accounts are used to estimate air pollutant emissions due to combustion. This depends on knowing the composition of each type of fuel and the technology used to burn it, whether it be in factories or in vehicles. Countries then apply standard coefficients relating fuel and combustion process to emissions. This allows them to produce air emissions data by sector and to estimate carbon, lead, particulates, and other pollutant emissions resulting from fuel combustion.

Two statistical problems must be resolved by any country that seeks to link energy use and air emissions data to the national income accounts. First, environmental statistics on air pollution are usually classified by technical source, distinguishing point sources (factories) from mobile sources (vehicles). Second, they cover all emissions that occur within the physical space of the country, irrespective of whether the polluter is based in the country or elsewhere ("resident" or "non-resident," to use national accounts terminology).

The national income accounts differ from conventional environmental statistics on both of these points. In the accounts, energy use and emissions must be allocated to the industrial sector responsible for the pollution, so mobile source emissions must be divided between the commercial transport sector and the industry shipping its own goods, depending on who owns the vehicle fleet. Regarding the location of emissions, in the national income accounts these must be allocated to the country in which the purchasing firm is resident, irrespective of where the pollution occurs. This is particularly an issue with respect to the emissions from ships and airplanes. Conventional environmental statistics allocate them to the country where they actually occur, but for consistency with the national accounts they must be allocated to the country where the shipping company or airline is resident and thus whose industry causes the emissions.

In all countries, resolving these two problems is essential to link emissions and energy use data to national accounts; this constitutes a significant portion of the marginal effort involved in expanding conventional air emissions data into environmental accounts. Norway's approach has been to characterize each emission according to five parameters: the pollutant emitted, the technical process leading to its emission, the carrier for the emission (e.g. type of fuel being burned), the economic sector emitting the pollutant, and where the emission occurs (in three dimensions, in order to have maximum information about pollution from airplanes and in transit). With this level of detail, emissions can be sorted so as to be compatible with the

national income accounts or conventional environmental statistics, making it relatively easy for the country's air pollution data to be used in analytical work.

Similar issues arise in addressing other residuals, such as solid waste and water pollution. In the solid waste arena, Norway's data come primarily from treatment plants. Less detail is available on the source of the waste, which can be distinguished only between major groups such as households and industry. As a result, analyses of links between solid waste and economic growth are considerably less informative than the analyses of air pollution.

Norway has a long history of using macroeconomic models in planning. They have integrated their energy and air pollution accounts into these models in several ways. First, they use them to project the role of the energy sector in their economy. Second, they project the impacts of energy price changes on their economy, through changes in industrial and household demand. Third, like most European countries, they are using their accounts data to analyze the economic impacts of complying with the Kyoto Protocol and the efficiency and effectiveness of different policies to reduce carbon emissions. They have also linked transportation to this analysis, since it is both a major source of greenhouse gas emissions and an important input into economic activity and household consumption. In addition to this suite of related issues, the Norwegians have used their emissions data to develop their national positions in the negotiations leading to development of the European sulfur protocol.

The institutional structure for Norwegian environmental accounting has differed somewhat from other countries. Statistics Norway includes divisions responsible for environmental statistics, national accounts, and research. The research division does the country's macroeconomic modeling, relying on data provided by other parts of the organization, and also built the resource accounts of the 1970s and 1980s. The environment statistics division has done the work on energy accounts and air pollution. Until recently, the national accounts division was not involved with the environmental accounts. In 1997, the environmental statistics and national accounts divisions teamed up to form the Norwegian Economic and Environmental Accounting project, or NOREEA, which is developing emissions accounts using the NAMEA approach. (See discussion of the Netherlands below for more information on the NAMEA.)

This structure is unusual in several respects. Typically the data compilation for the environmental accounts is done by the agencies responsible for environment statistics or national accounts, while economic researchers are in other government agencies, universities, or independent research institutes. In many countries the environmental statistics and national accounts offices are also in different ministries, rather than both being within the statistical agency as in Norway. This close link between the researchers and both sets of data producers should help ensure both that the data meet researchers' needs and that the researchers understand how the data have been built and therefore how they can and cannot be used. It could also facilitate the process of ensuring that as data are developed they may be structured so as to be usable for many purposes, as the Norwegians have done for their air data. This requires effective collaboration between the different agencies, which is not always easy to achieve.

Norwegian environment groups do not seem to be using the environmental accounting data in their work, based on conversations with a few groups that are doing economic work. While they

are aware of the accounts, they do not find the data useful. One group, the Bellona Foundation, works closely with industrial companies, helping them improve their own environmental performance. For that purpose, the accounting data are too aggregate to be useful. Bellona staff envision certain accounting data that might be useful to them, which are not available. For example, if material flow accounts provided detailed information by type of product, they could make it possible to identify "unaccounted for" toxic flows that are dispersed into the environment. Bellona staff do not think that valuation of environmental damages or benefits using willingness-to-pay techniques would be useful, because willingness to pay is a function of income as well as preferences, and therefore is rooted in the current income distribution. They see the entire accounting effort as a response to the need to comply with international protocols, which they feel creates an incentive to distort the data.

THE NETHERLANDS

The Netherlands was also a leader in the development and adoption of environmental accounting. Dutch interest in this area originated with the work of economist Roefie Hueting in the Central Bureau of Statistics, who developed and sought to implement a measure of sustainable national income that would take into account the degradation and depletion of environmental assets resulting from economic activity. His proposals met with considerable opposition, because his approach was perceived as model building and therefore outside the purview of statisticians focused on tracking historical data. However, his strong advocacy for environmental accounting led the national income accountants to consider other ways to link environmental and economic data, ones that were more consistent with their view of the scope of statistics and national accounting.

The result was the development of the so-called NAMEA, the National Accounts Matrix including Environmental Accounts. The NAMEA builds on the input/output framework of the national income accounts by introducing additional columns containing physical data on air pollutant emissions by sector, for twelve different pollutants. The table also includes imports of pollution from the rest of the world, and exports to the rest of the world. The physical data on emissions have been aggregated into a series of environmental theme indicators. Two of these are international in impact, pertaining to greenhouse effect and ozone layer depletion. Others are national, covering acid rain, eutrophication, and waste. Official NAMEA publications have focused on emissions and waste, and these will be refined further in future work. These themes, particularly those on climate change, acid rain and eutrophication, are being used to set policy targets for the country's environmental performance.

Development of the NAMEA created the need to organize emissions data so they would be compatible with the national accounts. The basic data are collected by the Ministry of Environment, which organizes them in the traditional way with all transport emissions grouped together. They collaborate with the national accountants, who have taken on the task of reclassifying the data according to economic sector. The Ministry of Environment continues to use the conventional underlying data in its work on climate change, since it must be compatible with the classification conventions of the Intergovernmental Panel on Climate Change. However, an array of other organizations, including private research institutes and consultants,

the Central Planning Bureau, and the Ministry of Economic Affairs, are using the adjusted data to analyze economic dimensions of the same issues. Although they are not necessarily using the environmental themes generated by the NAMEA or the input/output framework underlying it, the availability of emissions data organized by sector has made it possible to address the costs and structural effects of changes in environmental policy. Thus the implementation of the NAMEA has served as a catalyst to structure data in a systematic way that makes them useful for an array of new purposes.

The Dutch experience using the NAMEA data in policy analysis is informative. In the mid-1990s, the Ministry Housing, Spatial Planning and Environment and members of the Parliament became interested in using the NAMEA data to assess how structural changes in the Dutch economy could be encouraged in order to reduce impacts on the environment. The Institute for Environmental Studies of the Free University investigated the question, integrating the NAMEA data into an overall model of the economy to determine the economic structure required to achieve tighter environmental targets. One of their major conclusions was that agriculture would have to be dramatically scaled back to reduce the impact of climate change on the economy, as livestock are a major source of greenhouse gas emissions in the Netherlands. This conclusion was politically unacceptable, and at the time the report was essentially shelved. However, the conclusion was still on the table, and both policy-makers and the Dutch public were well aware of negative environmental impacts of agriculture. In fall, 1999, as the interviews for this study were underway, a new minister of agriculture was named in the Netherlands; one of his first promises was to significantly reduce the number of pigs in the country. While that may have been a response to economic as well as environmental pressures, it does suggest that the analysis based on the accounts helped ensure that a policy considered unthinkable a few years earlier could come to be accepted as people have time to adjust to it.

Use of the environmental themes produced from the NAMEA is harder to pinpoint. When they are released, they are written up in newspapers as are other macro indicators. While we cannot tell who reads this information or exactly how they use it, the fact that it is published in the daily press suggests that there is enough public interest to warrant the media giving them this attention.

The NAMEA framework has been officially adopted by the European Union, which is providing financial support to other EU countries to develop their own NAMEA systems. The decision to adopt this approach and support its diffusion across Europe probably results from several factors. Because it involves accounting for physical rather than monetary aspects of the environment, statisticians in most countries are comfortable producing it. While the use of NAMEA data to assess the costs or structural implications of meeting environmental targets relies on complementary analysis of the overall economy and of the cost of preventing future pollution, this is clearly the work of economists rather than a routine operational task of the statistical office. Another factor is that the NAMEA data meet a current need of all European countries, to design cost-effective policies to meet their emission reduction targets under the Kyoto Protocol, so most countries are willing to invest in building these systems.

Although much of the focus of Dutch accounting has been on the NAMEA and other physical accounts, the idea of calculating sustainable national income has not been forgotten. The Ministry of Economic Affairs and the Ministry of Environment have recently teamed up to fund

a pilot project implementing the proposals made by Roefie Hueting some thirty years earlier. The work relies on the NAMEA data, as well as information from many other sources. The logic behind this approach is that is that an implicit set of preferences underlies calculation of conventional national income, which may not be the actual preferences of the population. It is therefore of interest to estimate what national income would be under different preference assumptions. Sustainable national income (SNI) is such an estimate under the assumption that people would prefer a sustainable economy; that is, an economy that transfers all environmental functions to future generations without using them up in the present.

The researchers, who include Hueting and his colleagues at the CBS and economists from the Institute for Environmental Studies, have developed standards for pollutant emissions and resource use based on scientific assessments of what would be physically sustainable. They have then built abatement cost curves for production and consumption sectors, based on currently available technology and technology that can reasonably be anticipated in the foreseeable future. In keeping with the precautionary principle, they do not assume future development of technologies that are totally unknown at present. Using these cost curves, they have estimated the cost of meeting the emissions and resource use targets. Where technical measures would not suffice to attain the sustainability standards or would be too expensive, they assume that the public will accept policies that encourage use of more environmentally benign products or activities; e.g. consuming less meat if animal husbandry cannot be undertaken in an environmentally sound way. Where neither of these types of measures will suffice, they assume that production would have to be reduced in order to attain the standards. The SNI exercise involves a comparative static approach, focused on the distance between the current development path and the one under sustainability assumptions. The changes in output and consumption required by the sustainability standards lead to shifts in economic structure which are modeled using a general equilibrium model; SNI is calculated on the basis of that model. If this were done regularly over time, with new technologies built into the calculations each year as they are developed, then the trend in the difference between the SNI and conventional NI would show whether the society as moving towards or away from a sustainable economy.

The preliminary results from this work suggest that dramatic reductions and structural changes in output would be required to meet the standards proposed; on the order of a 50% reduction in world income. This result is particularly sensitive to two inputs into the analysis, on which criticisms of the work have focused: the way the researchers deal with future technology and the standards set in order to achieve sustainability (or the assumption that such strong sustainability would in fact be a social preference). Statistics Netherlands has not ruled out the continued calculation of SNI or of other green national incomes based on other environmental preferences.

SWEDEN

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. They have worked closely with Eurostat on the implementation of many of its recommended activities, and have received financial support from the European Union for several components of their work.

The environmental accounting work is lodged in the environment statistics section of Statistics Sweden. The work depends on input data from the national accounts office, particularly its production of energy accounts on which the NAMEA is based. The environmental accounting is also coordinated with the research activities of the National Institute for Economic Research (KI, the Konjuncturinstitutet). KI is a public organization that does analytical work for the parliament and other government bodies. Their Division for Environmental and Resource Economics has been a major user of the accounting data from the beginning of the work, and they have served on the steering committees that set up and managed the accounting work. This arrangement has ensured that the statisticians are not under pressure to do modeling work, but also ensures some degree of collaboration between the two groups so that the data actually needed for analytical studies are available.

As in other European countries, the core work of the Swedish accounts has been on energy, air pollutant emissions, and climate change models. Demand for analytical work has come from a number of sources. The Ministry of Finance routinely undertakes medium-term economic forecasts based on a general equilibrium model developed at KI. They have recently integrated an environmental module into this work, which uses environmental accounting data to link emissions to productive sectors and assess the economic impacts of different environmental goals. It also is linked to transportation models, since transport is a major source of pollutant emissions and a key input into production. They have used this to assess the implications of Kyoto Protocol targets for economic activity.

The Swedish Government has also called for a number of studies based on the accounting data. They have created national commissions on climate change, growth and environment, and green taxes, all of which have commissioned analytical work relating the economy and 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 about tax policy, climate change, and economic growth.

The Parliament has also requested that the Government have KI estimate a green GDP figure for Sweden. The Green Party, in particular, is interested in seeing such a figure complement the conventional economic reports produced in the context of the government budget process. KI has done some work in this area, essentially following the SEEA approach to resources and pollution. Thus they estimated monetary values for the depreciation of natural resources and estimated the costs of preventing further pollution by Swedish households and industry. They have presented these figures as shares of GDP. They have not, however, actually deducted these figures from GPD to calculate the SEEA's EDP1 or EDP2. The economists at KI felt they did not know what such indicators meant, and did not want to publish them. The data they have provided obviously allow anyone else to make the final calculations if they feel there results are meaningful, but the KI economists have not done so themselves.

KI has used the accounting data to undertake valuation studies assessing the costs imposed by pollution in Sweden. Cost imposed *in Sweden* is not the same as cost imposed *by Swedish pollution*; their interest was in how acid rain imported from elsewhere in Europe has imposed costs in Sweden. They developed estimates of costs due to forest loss, crop loss, health impacts,

and declines in real estate values. The results of this study have informed Swedish positions in the European negotiations on sulfur emissions.

The Parliament is also working on a set of environmental indicators that will be produced with the routine budget reports. The budget reports serve, in a sense, as an economic "state of the nation" survey. The environmental indicators are joined to them, in order to make it easy to relate economic and environmental progress. A lengthy process has been undertaken to define a broad set of indicators and then whittle them down to the six presented in the main budget report, covering CO_2 emissions, sulfur dioxide, nitrous oxides, energy efficiency, marine discharges of phosphorous and nitrogen, and automobile emissions. The environmental indicators are not derived from the environmental accounts, but are based on data produced by the Environmental Protection Agency. This source for the data does not seem to have been the result of a conscious decision that the EPA data were more suitable than the accounts data. Rather, it seems to have resulted from a lack of awareness of the accounting data as a possible useful basis for developing indicators. The defining of indicators is still in process, and the choice of headline indicators for future budget reports may change, so the accounting data could play a larger role in the future.

Swedish accounting data are being used by consulting firms that advise businesses on their environmental performance. One firm, IVL, has used the accounting data to produce indicators on energy use and pollutant emissions per unit of output for sixteen industrial sectors. These were aggregated to produce indicators of the industries' impacts on the greenhouse effect, acidification, and eutrophication. They used a system for weighting the contributions of the different pollutants to the indicators that was adopted by the International Standards Organisation (ISO) and has been used in many countries. They are using these indicators to help individual firms assess their own performance relative to the norm for their industry, and to help them develop priorities for monitoring their environmental impacts.

FRANCE

France was a third early-adopter of environmental accounting. In the 1980s it began developing its own approach to the design of environmental accounts, referred to as the *Comptes du patrimoine*, or patrimony accounts. These were an integrated system structured around three distinct but linked units of analysis. Resources were measured in physical terms, and their stocks and flows quantified. In addition to natural resources, patrimony accounts were to include cultural resources and any other assets that were received from previous generations and should be passed on to future generations. Places were to be organized into geographical accounts, giving physical data about assets organized by location and by ecological and land characteristics. The identity and actions of agents - people and institutions using the resources - were to be represented in both physical and monetary terms in agent accounts, which provide information about how resources are used and where. All data in the system would be integrated within this broad framework of resource, place, and agent accounts.

Implementation of the patrimony accounts proved difficult, because they are so comprehensive. Portions of the system were constructed, particularly those focused on forests and water. In 1992 the newly created French Institute for the Environment (IFEN, the Institut Français de

l'Environnement) took over the country's environmental accounting work. At first, IFEN staff planned to continue using the patrimony accounts framework. However, over several years of additional work they seem to have decided that, while visionary, the patrimony accounts were too ambitious and might never be accomplished if they were not reined in and divided into more manageable pieces.

The forest and water portions of this system have been channeled into other accounting activities. France is one of the pilot countries for the Eurostat 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 for several years in building water accounts, an area of interest to many countries but rarely undertaken because of the difficulties involved.

The French water accounts are designed to present information about water quality, quantity, and pollutant emissions. IFEN is working with data that are gathered by the river basin agencies in the course of collecting taxes on water use and emissions of certain pollutants. Because of their source, these data are not representative of all watercourses in the country, and are not ideal for water accounting. However, as they are the best currently available, IFEN has used them to complete national watercourse maps showing the presence of organic matter, nitrates and eutrophication. They have developed indicators of water quality for each river size class and have applied them in fifty-five river basins, allowing them to compare water quality across river basins. They have partly overlaid these data with information on economic activity, particularly agriculture, allowing them to identify areas with particularly severe water quality problems. They have recently begun work on water quantity as well, but only for a small area of the country on a pilot basis. This work focuses on measuring water quantity on each stretch of the river, related to rainfall and runoff.

The French government recently expressed its commitment to environmental accounting by reactivated its Interministerial Commission on the Patrimony Accounts. This has led to initiation of several new water accounting efforts. IFEN has launched a joint project with the Water Directorate of the Ministry of Environment to model the data coming from the national river survey and to compute annual accounts and derived indices both at the catchment and administrative level, thus facilitating comparison with economic data. These indices have been recognized as a powerful assessment tool both by OECD and by the European Environment Agency (EEA), and may be used to report quality issues for the EU's "Water Framework Directive." Emissions accounts have been addressed in a different way. A specific pilot approach was developed to meet the data needs of both the EEA and the Marine Convention. The calculation model was developed in such a way that NAMEA matrixes could be output from calculations, as well as very technical data sorted by process producing the emissions, by means of waste transmission vector (e.g.sewers) and economic sector.

The Ministry of Environment's Water Directorate is interested in developing water accounts that focus on estimating the economic value of water in difference uses, including as a support to aquatic ecosystems and for other environmental purposes. They are also interested in valuing the costs imposed by water pollution. In pilot studies, they have looked at marketed monetary damages of pollution through its impacts on tourism and drinking water treatment; they have estimated that these represent only about 20% of the total costs imposed. The Directorate works

on water use planning with the river basin authorities, which supply water and manage pollutant emissions. Their interest in water valuation, therefore, originates with an interest in helping the authorities make water allocation decisions based on a fuller understanding of both the marketed and the non-marketed uses of water, rather than making them based only engineering considerations or simpler financial criteria.

France is one of the few countries studied that has attempted to build biodiversity into its accounts, a subject of considerable interest to environmentalists. However, their work in this area is limited to disaggregating government expenditures that can be understood as being in support of biodiversity conservation, such as protected areas management. They have not attempted to value the economic or life-support services provide by biological diversity, nor have they attempted to quantify the impacts on biodiversity of economic activity.

France is also working on some of the more conventional accounting activities supported by Eurostat and underway elsewhere in Europe. The Eurostat SERIEE system for accounting for economic activities related to the environment was initially developed by French consultants, and of course the French are implementing it. As in a number of countries, their data on the environmental protection industry, and in particular on employment in the sector, have been an input into debates over the economic impacts of environmental controls. This is something of a double-edged sword. On the one hand, environmentalists (and Ministry of Environment staff) are eager to use environmental protection expenditure data to show that protecting the environment is not that expensive and will not cause economic harm. On the other hand, in countries with high unemployment, like France, the employment created by environmental regulation is often cited as an argument for environmental controls. In France, the latter argument has been made in Ministry of Environment presentations to the Parliament, in part to justify the Ministry's own budget.

IFEN is working on organizing energy use and greenhouse gas emissions data in order to link them to the national accounts. However one government agency responsible for climate change, the Interministerial Mission on the Greenhouse Effect (MIES), indicated that their analytical work and modeling relied on underlying data structured according to the physical source of emissions rather than according to the sectoral breakdown of the SNA. This may be the case for two reasons. First, the accounting work on greenhouse gas emissions may not be far enough along to be as useful as the conventional emissions data. Second, the MIES analytical work focuses on identifying low-cost, efficient strategies to reduce emissions, rather than on the indirect economic implications of those strategies. This may enable them to rely on data that are not structured by productive sector, and therefore to use the conventional environmental statistics rather than the environmental accounting data.

CANADA

The Canadian accounting program is run by Statistics Canada. It is integrated into a single effort entitled "Econnections: Linking the Environment and the Economy" and described in a publication series of that name. This program includes work on natural resource accounts, 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 The availability of the Econnections publication itself is perhaps an indicator of this; 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 consolidated publication. The availability of this publication, which is distributed in a paper version as well as on a CD-rom, has probably strengthened the public's image of the accounting work as an integrated whole. It is not clear, however, whether it has influenced the actual use made of the data.

Like other developed countries, Canada has used its accounting data, particularly the energy accounts and related air pollutant emissions data, extensively in its analysis of climate change and strategies for meeting its Kyoto Protocol targets. While this work uses only a small subset of the accounting data, it is high on the political agenda at present, and from that perspective constitutes a major use of the data. The country has launched a broad-based set of roundtables discussing the impacts of climate change, strategies for meeting the Kyoto Protocol targets, and the economic implications of those strategies. Participants in these round tables, which include federal agencies, provincial governments, industry associations, environment groups, and hired consultants, are looking at climate change from a number of different perspectives. Like other countries, they are interested in cost-effective strategies for meeting Canada's target under the Kyoto Protocol, and are using model-based work to analyze the impacts of different fiscal and regulatory policies. They are also interested in the impacts of reduced world demand for energy, especially in the province of Alberta, whose economy is heavily dependent on energy production. In addition, because of Canada's rich forest resources, they are interested in the potential to use the carbon sequestration in their forests to offset their emissions. These broad concerns mean that the analysis of climate change depends not only on the country's energy accounts and air pollutant emissions data, but also on the forest accounts.

One somewhat unusual problem arising with the use of the data relates to Alberta's strong dependence on energy production for its economic base. Alberta stands to be hard hit by the decreased demand for energy that should result from the Kyoto Protocol, especially as the province is a major source of coal-based power. There is, therefore, considerable interest in analyzing impacts at the provincial level. However, there are only two large energy producers in Alberta. Statistics Canada is not allowed to release any of its data at a level of disaggregation that would permit identification of individual firms; but release of provincial energy data for Alberta would allow users to identify information about these two firms. Therefore it has not been possible to do much of the key analytical work in the Albertan situation, because it would violate the commitment to confidentiality on which basis Statistics Canada can require firms to submit data about their activities.

Canada has placed strong emphasis on the development of environmental protection expenditure accounts and accounts on the environment industry. In these areas the division responsible for environmental accounting in Statistics Canada is conducting its own surveys, rather than depending on data collected by others. Their work has in the past been funded in part by Industry Canada, which is a user of their data about the environment industry. Industry Canada has selected a group of industries to support as leading export sectors in the Canadian economy, of which the environmental protection industry is one. To justify inclusion of the environment

sector and to design effective programs to support it, they need data on activity and employment in the sector, and therefore contributed to the costs of collecting the data. This has supported development of a database used by many other organizations as well, including the Export Development Corporation, the Department of External Affairs, Canadian consulates abroad, the Canadian Environment Industry Association, and so on.

Canada has published a descriptive view of the data in its accounts, in a volume entitled *Human Activity and the Environment 1994*. (An updated version should be available in 2000.) This book is similar to a state of the environment report, but it focuses on both environmental and economic issues, providing both statistical data and syntheses of the links between economy and environment. This book is targeted at the general public, but Statistics Canada staff see teachers and journalists as a particularly valuable audience, because they will use the information to educate others. They are particularly happy that school children are using the data in class projects on the environment – though of course the children know nothing about the environmental accounting program or the source of the data. Demand has been high for this volume, and when the interviews were conducted for this study the updated version was eagerly awaited.

Although Statistics Canada does not calculate green GDP, several Canadian organizations are using the accounts data in the calculation of measures of welfare. Researchers in Alberta and in Atlantic Canada have used some of the data in calculations of provincial versions of the genuine progress indicator, a welfare measure that includes both economic and social data. An Ottawa-based research group, the Centre for the Study of Living Standards, is calculating its own index of economic well-bring, which is based on consumption, wealth, economic uncertainty and equity. They have used the accounting data on natural resource stocks and CO_2 emissions in developing these indicators. Their work was initially funded by Human Resources Development Canada, and the indicator is used by policy-makers looking for a broad indicator of the quality of life.

THE PHILIPPINES

The Philippines offers rich experience for other countries considering environmental accounting, because two separate, parallel projects were underway there for much of the 1990s. In 1991 the Environment and Natural Resources Accounting Projectc (ENRAP) began in the Department of Environment and Natural Resources (DENR), with financial support from the United States Agency for International Development (USAID). At USAID's initiative, the project received technical support from Henry Peskin, an economist working in this field since the 1970s. ENRAP followed the so-called "Peskin approach," which is closely tied to economic theory and is not always compatible with the SNA.

In the mid-1990s, the National Statistical Coordination Board (NSCB), the government agency responsible for the national income accounts, began implementing the United Nations' System of Integrated Economic and Environmental Accounting, or SEEA. They received financial support and technical assistance from the United Nations for the accounting work which was part of a larger UN effort referred to as the Integrated Environmental Management for Sustainable

Development Programme. The NSCB work was referred to as Environmental and Natural Resources Accounting, or ENRA, creating occasional confusion among acronyms between ENRA and ENRAP; we will refer to it simply as the NSCB project.

The stated goals of ENRAP are to build data useful for analysis of public policy and to encourage policy-makers to use those data. The project began with a search through government, private, and research sources for data with which to build the accounts. Work focused on forest and mineral asset accounts, costs of preventing pollution, costs imposed by pollution, and valuing non-marketed household use of the environment. 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. While the data were often inadequate, the philosophy was that if results were widely distributed and policy recommendations made based on weak data, it would make it easier to identify better data sources, and perhaps also generate political support for funding further primary data collection. Because the project was not in the national statistical office, there was less concern than in official statistical offices about putting the project's name on unproven data. The project also organized symposia, conferences, and workshops about policy questions, at which civil servants, elected officials, analysts, and other interested people could discuss the issues and consider the implications of the ENRAP studies. Over time, in the second and third phases of the project, the project focused on more detailed issues, taking on some regional accounting, cost benefit analyses, and primary data collection.

The NSCB project was developed in order to implement the UN SEEA, without ENRAP's focus on data use. They built resource accounts for forests, minerals, fish, and soil, and estimated the costs of preventing pollution of air and water. At the start of their work, they relied on ENRAP reports in identifying data sources and on both UN and ENRAP technical assistance in building the accounts. They have published asset accounts, and are working on improving their data on pollution prevention costs. (NSCB, May 1998)

Unlike any of the other countries considered in this study, both Philippine projects produced green GDP figures. ENRAP published overall macroeconomic accounts for 1988 and 1992, including environmentally adjusted GDP figures calculated using the Peskin approach, which differs significantly from the SEEA aggregates. The NSCB staff did preliminary calculations of SEEA's EDP1 and EDP2, but never officially published them. There has been interest in these numbers from policy-makers outside the NSCB, notably from the Philippine Commission on Sustainable Development. However, NSCB statisticians expressed reluctance to publish them as official statistics, because they are not convinced that such aggregates are meaningful indicators. Neither project is aware of any real policy use of the green GDP figures.

ENRAP staff are well aware of how their work has been used for policy purposes. For example, a recent debate about reducing automobile emissions was informed by ENRAP comparisons of the costs and benefits of reducing emissions to different levels, which were distributed through a high-level conference on the subject organized by ENRAP staff. National park officials are using ENRAP travel demand surveys and willingness-to-pay studies in setting park entry fees. ENRAP studies have led to a shift in perceptions about the country's environmental problems. When the project began, public officials were largely focused on forest depletion, but ENRAP

showed that in fact the costs of contaminated drinking water, traffic congestion, and urban air pollution were much higher than those imposed by unsustainable use of natural resources.

In contrast to the ENRAP experience, NSCB staff are less aware of how or whether their data have been used. Their focus has been on producing the data, and, like most national statistical offices, they are not data users themselves. They are aware that the ENRAP project (and the analytical work expected to continue within DENR in follow-up to that project) has been a major actual or potential user of the NSCB data. This suggests potentially good complementarity between the two projects, as DENR could become a strong and informed user of NSCB accounting data.

The existence of two separate projects using different methods, estimating different resource depletion figures, and calculating different values for green GDP, has caused some confusion about environmental accounting in the Philippines. In some respects the projects have collaborated effectively, ENRAP providing technical assistance to the NSCB, and the NSCB organizing a workshop at which they worked to clarify the methodological differences between the two projects. In other respects, however, there has been some competition between them. This is in part an outcome of the substantive differences in approach to accounting, although it also resulted in part from more mundane institutional and personality conflicts.

Notwithstanding the confusion caused by the two different green GDP figures, the Philippine president issued an executive order in 1997 on environmental accounting. It calls for continuation to the work as a joint effort of NSCB, DENR, and the National Economic Development Authority. This suggests a potentially-effective collaboration between statisticians, environmentalists, and economic policy-makers. If adequate resources are available for all of these institutions, then the Philippines could provide a good example of how statisticians and economists could work together, the former producing routine accounting data while the latter apply them to analytical and policy work.

This case highlights the utility of ENRAP-type outreach efforts to ensure that accounting data are used for analytical work and made accessible to public officials. Other countries may learn from this experience about the utility of involving both official statisticians and analysts in a collaborative effort from the start, rather than allowing the growth of the competition which has plagued Philippine work.

NAMIBIA

Namibia's work on resource accounting began in the mid-1990s with financial support from USAID and the Swedish International Development Agency, SIDA. Namibia is a poor, very arid country in southern Africa, whose economy is largely dependent on natural resources, and which has almost no industry. Consequently, environmental accounting has focused entirely on natural assets, with no attention at all to the pollution issues that dominate the work of developed countries. Work has focused on water, fisheries, minerals, and livestock, and a project is also underway on energy.

The Natural Resources Accounting project, NRA, has been implemented in the Directorate of Environmental Affairs of the Ministry of Environment and Tourism. The Directorate operates like a policy shop for the Ministry. Also housed in the Directorate is another donor-funded project, specifically aimed at building capacity in environmental economics and encouraging the use of economic approaches in analyzing environmental issues. The two projects work together, with some staff involved with activities of both. The primary output of the NRA has been policy studies, rather than publication of accounting data. At times the line becomes blurred between the accounting and economics projects. One person explained that the distinguishing features of the NRA work are a focus on data usable for macroeconomic analysis and use of secondary data. However another NRA staff member expects to begin survey work on willingness to pay for use of specific natural parks, so even this distinction may be lost in the future.

The NRA project has done extensive work on accounting for water, which is the most critical and limited resource in Namibia. In such an arid context, ensuring that the available water is used in a cost-effective way is crucial. The project has analyzed water use by economic sector, and has published figures comparing value-added per unit of water by sector with the contribution of each sector to GDP. These figures have been widely quoted in a series of major water studies undertaken in the country in the past two years. They can lead to dramatic conclusions about the country's resource allocation strategy. For example, they show that that value added per unit of water used is N$ 7.2 per cubic meter for agriculture, whereas it is close to N$200 for manufacturing and almost N$575 for the service sector. Since water use in commercial agriculture is highly subsidized in Namibia (as, indeed, in most countries), this result has attracted considerable attention.

The widespread attention received by these figures has generated equally widespread discussion among economists about whether they really are a meaningful indicator of anything. The conceptual goal of such analysis is to estimate the value of water, what its price would be if it were sold, or the economic rent earned by water users. To the extent that water is priced, the price reflects the costs of extracting, treating, and distributing it, not the scarcity cost of the water itself. Consequently, water prices do not serve to ensure that the resource will be allocated according to its real value. Estimating a water price or rent is very difficult, whereas estimating sectoral value-added per unit of water use is relatively easy. However, that figure is not the price, rent, or "value" of the water itself. Obviously, the output of the service and manufacturing sectors depends on many inputs other than water, whereas water is a major input into agriculture. Therefore it goes without saying that value added per unit of water will be higher in services and manufacturing than in agriculture; if we calculated value added per unit of all inputs combined the results might be more evenly distributed across sectors.

This discussion shows some of the difficulties in using resource accounts for policy purposes. Some economists have concluded that analysts should not calculate value added per unit of water, because it is so easy for users to misinterpret the indicator and use it as if it were a water price. At a recent meeting of economists, even speakers who were well aware of the limits of this figure inadvertently referred to it as "the value of water." Other economists argued that despite its limits, the value added figure is useful. For example, international comparisons of value added per unit of water within the same sector might be of interest – although even there it

may not be clear whether they reflect relative efficiencies of the countries' economic activity or relative scarcity of water.

The NRA project has also done extensive work on fisheries accounts, and particularly on the national policy of "Namibianization" in the allocation of fishing quota. The project examined rent capture in the fishing industry, looking at who received fishing quota and whether the fishing rents accrued to the country. The Namibianization policy entails an explicit decision to allow Namibian-owned companies to retain more of the fishing rents they generate than foreign-owned companies. This amounts to a decision that the public sector will forego some of the rents in order to generate domestic employment and help Namibians gradually take over the fishing industry from the foreign firms that have dominated it. The accounting analysis made it possible to identify the costs of this policy, thus allowing policy-makers to decide whether this is a reasonable price for the government to pay, in foregone rent capture, in return for the jobs created.

The NRA researchers went further, looking at the Namibian-owned firms and whether their revenues were really accruing within the country. They found evidence that in fact foreign firms were able to retain control of fishing companies while putting a Namibian at the head, so that they qualified for the reduced quota prices but still did not significantly benefit Namibian workers. These results were distributed in a draft report, and were raised to a Namibian public official who appeared at an international conference outside of the country. However, they were politically sensitive within the country. Their release led the Ministry of Fisheries to back away from work with the NRA project. The draft report was never finalized, and the project stopped distributing it. The project has not done any work on fisheries since, although they do constitute a significant resource for the country.

This points to the possible risks involved in linking analytical work with environmental accounting. The experiences of other countries have highlighted the need to ensure that data are used, and suggest that accountants and analysts should work together if the data are to really have an impact on policy. In this case, however, the project may have taken the links too far, and the political sensitivity of the analytical work could actually threaten the ability to continue with fisheries accounting. Obviously a balance must be struck; while accounting projects will benefit from ensuring that their data are used, they should be careful to maintain some distance from controversial conclusions, in order to contain possible negative reactions to the analysis rather than the data themselves.

GERMANY

The German Federal Statistical Office (FSO) began work on environmental accounting in the 1980s, initially focusing on environmental expenditure and energy flow. At present it is concentrating on physical accounts, and leaving modeling and valuation to economists outside of the government. The focus of the work is on materials and energy flow accounts, physical input-output tables, annual data on air and water pollution, solid waste, and land use by industry. A Scientific Council advises the FSO on its environmental accounting work. It has devoted some attention to the FSO's focus on physical accounts, and to the question of whether to calculate

environmentally-adjusted GDP figures. The Council's sense is that the green GDP figures recommended in the UN SEEA are not useful because they do not capture the structural change that would occur if the country were to implement more rigorous environmental policies.

FSO operates in partnership with economic research institutes that are using the accounting data to build macroeconomic models addressing links between the economy and the environment. Such models have played an important role in the debate on green taxes in Germany and in other policy debates. For example, the Center for European Economic Research in Mannheim is analyzing impacts of climate change and compliance with the Kyoto Protocol in Europe, while the German Institute for Economic Research in Berlin is working on contract to the Federal Environment Agency analyzing trends in German CO_2 emissions.

The Society for Research on Economic Structure (Gesellschaft für Wirtschaftliche Strukturforschung, or GWS), a research group affiliated with University of Osnabrück, has done extensive work in collaboration with the FSO, as well as being represented on the Scientific Council. In the framework of existing multi-sectoral approaches to modeling the German economy, they have added elements to address the links between pollution, energy use, and economic output. This is being used to analyze the economic impacts of meeting the country's targets under the Kyoto Protocol. They are doing this with support from the Federal Environment Agency, which is interested in being able to project the impacts of alternate economic and fiscal policies on energy consumption, greenhouse gas emissions, other air pollution, and the economy. Thus although FSO has been reluctant to go beyond physical data in the official accounts, they do help ensure that their data are used in analytical work that takes greater risks than the accountants themselves wish to take.

GWS and the Environmental Protection Agency are interested in expanding their models to consider the impacts of economic growth and policies on land use and water quality. Their hope is to be able to identify federal policies that might have an impact on demand for land, given that in Germany land use is regulated by local rather than national authorities. The land accounts, prepared by FSO, include data on land use, classified into aggregate categories such as buildings, traffic, and manufacturing, and land cover, such as water, roads, or vegetation. Additional data on land use by economic sector available from the accounts have been used to understand land requirements for different kinds of production. The roads are allocated to productive sectors based on road miles traveled in the course of production by that sector. Because of the nature of the data, however, FSO cannot build them in greater detail in accounts covering the whole country; users who need finer sectoral classifications or other detail must work individually with the Statistical Office to obtain them.

Germany is a leader in the development of material flow accounts (MFA). The term "material flow accounts" can be used to refer to many different kinds of data systems. 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 units are generally measures of weight, although they could be measures of volume. National MFAs track the weight of several kinds of materials:

- inputs into production,

- outputs produced during production,
- "ancillary materials" that are filtered out during the production process and become waste (or residuals), and
- materials moved within the environment in order to access natural resources, such as mining overburden or soil excavated during construction.

The last two items together are termed "hidden flows" in material flow accounting terminology. The tracking of these hidden flows is one of the key structural differences between MFAs and the conventional accounts. The German MFAs also track the hidden flows generated during the production of by imports, estimating the volumes of waste and materials moved in the countries from which imported goods are purchased. These foreign hidden flows are termed the "rucksack." The MFAs sum all four of these flows, including the rucksack, across sectors and materials to calculate the "total material requirement" (TMR) of the economy. This is in some sense analogous to GNP, in that it provides a single total indicator of flows in the economy. However, because it includes both domestic hidden flows and international rucksacks it provides a more comprehensive measure than the conventional indicator.

Both FSO and the Wuppertal Institute, a research group focused on environment and economy, are engaged in building components of the German material flow accounts. FSO has collected much of the underlying data used to construct the accounts, and produces portions of the accounts annually in their Material and Energy Flow Information System (MEFIS). They have also compiled a physical input/output table (PIOT) for 1990, following the structure of the SNA monetary input/output accounts, and will publish a 1995 PIOT in 2001. It includes the residuals data in the NAMEA system, and has been used to produce indicators of greenhouse gas emissions analogous to the composite indicators produced through the Dutch NAMEA. The Wuppertal Institute, working in collaboration with the FSO, has done the additional work to organize data on rucksacks, which are not a component of the FSO's material flow accounts or its PIOTs. The Wuppertal Institute has published the results of the joint MFA work in joint publications with the World Resources Institute and other organizations. (Adriaanse et al, 1997)

While there seems to be considerable interest in national material flow accounts on the part of some national governments, and Eurostat is supporting EU member countries to begin developing them, the uses of national indicators such as TMR are not clear. The calculation of TMR involves comparing and summing tons of soil or rocks with tons of highly toxic materials that occur in much smaller quantities, which can providing a misleading understanding of the significance of each material for environmental quality. Even within the Wuppertal Institute, there is criticism of what is sometimes called the "ton ideology," and the argument is made that converting flows to monetary units makes more sense.

The physical data underlying the calculation of aggregate indicators like TMR are clearly useful. They have been used by the Ministry of Environment to produce headline indicators on such issues as energy productivity, raw material productivity, and land use, and have also been used to develop environmental indicators presented in the government's annual report on the state of the economy. Proponents of material flow accounts also argue that even given the obvious limitations inherent in converting everything to tons, the international comparisons of material requirements are interesting. Moreover, the method is useful for tracking national progress in

achieving “Factor 4” or “Factor 10” goals of reducing the materials flows through the economy as a way to reduce overall environmental impact. FSO has responded to this limitation of national aggregates by producing supplementary detailed tables for specific materials, including one presenting energy flows in Joules rather than by weight, another on water and waste flows, and a third providing air emissions weighted in terms of their contribution to global warming. The PIOT and the MEFIS show the flow of materials between economy and nature and within the economy in a breakdown by type of material, so they can be selected or aggregated according to the purpose of the analysis.

In addition to the national MFA work and disaggregation of energy and greenhouse gas emissions, the conceptual framework of material flow accounts is being applied at the micro level. This occurs in the field of industrial ecology, where it is being used to identify complementarities between the material flows of individual plants or firms, through which they can reduce both environmental impact and costs. In Germany, this is being done in the implementation of efforts to exploit symbioses between the inputs and waste outputs of neighboring industrial plants. These efforts are founded on detailed descriptions of plant-level material flows, which make it possible to identify complementarities among the plants, financial savings, and material flow and environmental benefits. While this is not an application of national MFA data, it does suggest that the MFA structure can also be quite useful at a micro level.

THE UNITED STATES

The United States’ accounting situation is different from the other countries studied. As discussed above, the US government has not undertaken any environmental accounting as such since 1995, when Congress halted the work that had been launched in the Bureau of Economic Analysis (BEA) and explicitly prohibited the agency from using any of its funds for this purpose. At Congressional direction, the Department of Commerce, where the BEA is housed, asked the National Academy of Sciences to organize an expert panel to make recommendations on what the US should do in this arena. Its report, published in July 1999 (Nordhaus and Kokkelenberg, 1999) recommended that BEA resume work on environmental accounting with a very ambitious program of activities that goes far beyond what most of the countries surveyed in this study have done. However as of this writing the panel’s recommendations have not been implemented, nor has the prohibition on BEA work been removed from the appropriations bills.

Despite this situation, it is useful to consider what is being done in the US. The interesting question is whether environmental accounting *per se* is needed to achieve the objectives mentioned above, such as building and using macroeconomic indicators that include the environment, linking economic and environmental data in the analysis of sectoral and policy issues, or using environmental data for advocacy work. To the extent that these activities are occurring in the absence of formal environmental accounts, it would suggest that the accounting itself is not essential. However if some of these activities are not possible, their absence suggests the added value added of building a formal system of environmental accounts.

The US Environmental Protection Agency (EPA) maintains databases on pollution control and emissions that would form the building blocks of portions of an environmental accounting system. Among the most comprehensive are the AIRS database (Aerometric Information Retrieval System), which provides data on pollutant emissions by sector, and the Toxic Release Inventory, comprised of self-reported information on releases of toxic chemicals into all environmental media by relatively large polluters. Another essential data source maintained by EPA is the set of pollution emissions coefficients fuel combustion, which are used to estimate mobile source pollution based on fuel consumption and vehicle type. EPA also maintains many kinds of data that could contribute to the development of environmental accounts, though on their own they are only indirectly related; for example, technical data about pesticides registered in the United States, information about hazardous waste sites and companies that handle hazardous waste, and data about drinking water quality.

Researchers at Carnegie Mellon University in Pittsburgh have integrated the major EPA databases on pollutant emissions into a system analogous in some ways both to the NAMEA systems of many European countries and to the micro-level use of material flow accounts. They have created a web-based software system and database used for "economic input-output lifecycle assessment" (EIOLCA).[3] The user selects an economic sector and specifies the value of increased output from that sector. The software returns estimates of the resulting increases in pollution (including backward linkages), the monetary value of the environmental damage caused by that pollution, the increase in economic activity, and other information. This system is based on the 1992 commodity/commodity input-output table, which breaks down the economy into 485 commodity sectors linked to SIC codes. The pollution impacts come from the AIRS database and the Toxic Release Inventory; the mobile source emissions are estimated using the combustion coefficients; and so on. The system is being used by individual firms to identify the economic and environmental impacts of changes in their production processes. For example, one firm used it as they decided to shift from disposable to recyclable packaging for computer equipment. While their decision was based purely on financial considerations, in corporate publicity about the move they highlighted their use of the EIOLCA system to estimate the resulting environmental benefits, clearly seeking to present themselves as an environmentally sensitive corporation.

Until 1994, the Bureau of the Census conducted a regular survey of Pollution Abatement and Control Expenditures (PACE). This included a significant portion of the data that other countries incorporate in their environmental protection expenditure accounts. It was used extensively by EPA and non-governmental analysts to assess both the direct costs of pollution control and its indirect impacts on the economy as a whole. For example, in 1997 EPA used it in a study of the historic and projected costs and benefits of the Clean Air Act called for by Congress (USEPA 1997 and 1999). In 1994 the PACE survey was discontinued for budgetary reasons. This is widely perceived by economists and environmental policy-makers to be a significant loss. The Science Advisory Board to EPA has strongly recommended to the Administrator that the survey be resumed and measures be taken to address the gap in the time series caused by its discontinuation. This is of particular importance as questions have arisen about the accuracy of past predictions of environmental protection costs, which could be verified if actual expenditure data were available.

[3] This system may be found at www.eiolca.net.

The PACE survey is a case where there is a clear policy need for data that are part of the environmental accounts, and when no longer available they have been widely missed. The absence of a formal program on environmental accounting is not the problem here; it is the data themselves that are essential. When they were available, it was not crucial that they be integrated into an accounting program. On the other hand, were environmental accounting resumed in the US, it might also be possible to resume collecting the PACE data, so they could go hand in hand.

Despite the lack of an accounting framework and the discontinuation of the PACE data, considerable effort is going into efforts to assess the costs and macroeconomic impacts of reducing greenhouse gas emissions. This depends in part on extensive energy supply, demand, and price data maintained by the Department of Energy (DOE). The policy context and advocacy goals of such efforts are different in the US from in Europe, since the Kyoto Protocol has not been transmitted to the Senate and there is considerable opposition to doing so. Thus while European analytical work focuses on how to reduce greenhouse gas emissions, US work also looks at whether to so at all. However people on all sides of the issue are relying on similar kinds of analytical work. For example, DOE's Energy Information Administration used a macroeconomic model of the US economy to project the energy demand and price implications of meeting the US targets under the Kyoto Protocol, responding to a request from Congress (USDOE 1999). Energy economists have built an array of models of US and global energy demand, dating back to the energy crises of the 1970s, which are now being used to address climate change issues (e.g. Nordhaus 1991). Think tanks like Resources for the Future in Washington are looking at detailed aspects of the design of carbon taxes and emissions trading systems (see www.weathervane.rff.org), while advocacy-oriented groups like Redefining Progress in San Francisco are arguing for specific policies with which to reduce emissions (see www.rprogress.org). At the same time, more conservative groups like the American Council for Capital Formation are using the same data and analyses to argue that the costs of reducing greenhouse gas emissions are too high to be borne by the US economy (Thorning 2000). The lack of a formal system of environmental accounting is not hindering this work, although the discontinuation of data series such as the PACE survey may affect it to some degree.

The US also has a portion of the data that would be used to build subsoil asset accounts. In addition to DOE's energy data, these include data maintained by the US Geological Survey (USGS) and energy industry trade associations such as the National Petroleum Council. The USGS data include estimates of the stocks and flows of a wide range of minerals, but do not include estimates of the monetary value of the stocks. The aim of much of this work is to project supply, so as to anticipate possible constraints on economic development or changes in price. Estimating the value of the stocks is not perceived as important for this purpose.

The World Resources Institute, with support from EPA and other sources, is building national material flow accounts for the United States (Adriaanse et al 1997). This work is in its early stages, and focuses primarily on national aggregates. Its EPA funders see the work so far as an experimental first step towards the identification of applications of more detailed and disaggregated data of this type, perhaps along the lines of the industrial ecology work in Germany and elsewhere in Europe. They are particularly interested in using the accounts to

identify sectors or materials for which recycling or reuse opportunities outweigh the extraction of additional material from the environment. They see the current work as useful not so much because the data now available have clear policy implications, but because the framework being used will catalyze development of new ideas about improving the sustainability of material use, and because the underlying data may be useful in identifying specific opportunities.

The US has good physical data on its forests, from on an ongoing ground-based inventory of sample plots that have been surveyed since the 1930s. Forest Service staff have made several efforts to integrate these into components of a forest accounting system. In the early 1990s, economists at the Pacific Northwest Research Station drew up rough estimates of forest asset accounts for the BEA. That work was discontinued, however, with the elimination of BEA environmental work in the mid-1990s. In the development of the draft 1995 RPA program under the Resources Planning Act, staff assessed the contribution to income and employment of goods and services provided by the national forests. They looked timber, minerals, fish, wildlife, and recreational activity, developing estimates at the regional scale that could be aggregated to the national level. In 2000, in the context of the implementation of the Government Performance and Results Act, they are updating and refining these estimates, and correcting overestimates of recreation benefits that they believe distorted the 1995 figures.

The 1995 data were used by ECONorthwest, a Portland-based consulting firm working under contract to the Sierra Club, to assess the contributions to income and employment of a range of goods and services provided by the Pacific Northwest forests. Their report (Cosgrove et al, 2000) argues that recreation, watershed protection, carbon sequestration services and unroaded wilderness contribute substantially more to economic well-being than do timber, minerals, wildlife and fish, rangeland, and other marketed goods and services. The data on the contributions of recreation and the other marketed goods and services come from the estimated forest accounts, while the data on watershed protection, carbon sequestration, and wilderness come from Forest Service valuation studies. Thus the data on marketed goods and services in the accounts were even more useful when supplemented with valuation studies may have been too controversial or uncertain to include within the accounting framework. The Sierra Club is using this report as a public education tool in its campaign to end commercial logging on federal forest lands. They have found the public interest to be overwhelming, both from their members and from the media.

The extensive forest data have also been used to calibrate a number of forest models, addressing both domestic and international forest management issues. For example, the CINTRAFOR Global Trade Model predicts the shares of imports and domestic output in the consumption of forest products. The Forest Service's Timber Assessment Market Model is a spatial model of hardwood and timber inventory elements of US forest products sector. TSM is a global timber supply model developed by Resources for the Future. While forest accounts would rely on the same data as these models, clearly they were not needed to spur the investment in primary data collection or to facilitate modeling of forest supply or demand.

While the US experience is somewhat scattered, it does provide some information about the utility of environmental accounting. What we are trying to assess is whether we are losing out on important data applications because we do not have a systematic environmental accounting

system. In a few cases, such as the ECONorthwest/Sierra Club forest report, existing accounting data were clearly useful, and had the accounts gone further in valuing non-marketed services they would have been even more useful. In many other cases, analytical work proceeds without the accounts, as long as the underlying data are available. The discontinuation of the PACE survey has constrained that work, further highlighting the importance of the underlying data. However, it is not the lack of an accounting system that leads to a lack of data; rather, the same political forces have led to both.

CONCLUSIONS

The introduction to this paper suggested that environmental accounting might help accomplish several goals. One is to help steer the economy on a sustainable path or provide macroeconomic indicators that reflect the role of the environment in the economy. This turns out to be linked to one of the sources of tension that can run through development of the accounts, over the relationship between economics and statistics and whether to include valuation and modeling results in the accounts.

A second goal of the accounts is to make it easier to analyze sectoral and macroeconomic issues, so as design policies that reflect a more comprehensive understanding of the relationship between the economy and the environment. This goal seems to be achieved either by the accounting systems themselves, or by the data underlying them.

A third goal is that of environmental advocacy groups, that the accounts may help make a case for increased environmental protection. For the most part this is not being achieved, for reasons that are discussed below.

A fourth goal is that the accounts and the process of building them will serve as a catalyst for organizing data in new ways, reconciling discrepancies in underlying data, and investing in new data collection. This is in some measure related to one of the other issues threading through much of the accounting work, of the relationship between the accounts and conventional environmental statistics. It is also to some degree related to the question of funding source for the data, and the impact of outside financial support. The cases shed some light on these issues, although they are far from conclusive.

MEASURING PROGRESS TOWARDS A SUSTAINABLE ECONOMY

The most ambitious objective of the environmental accounts is that they will allow us to shift our economies onto a sustainable path or, only slightly less ambitiously, that they will provide new macroeconomic indicators that take into account the role of the environment in the economy. They could do this by providing signals that reflect not only the size of the economy, but the extent to which that size depends on destruction of the resources on which it depends. The cases suggest that we are not achieving that objective.

To accomplish that goal, the accounting system would, at a minimum, have to incorporate information about the monetary value of environmental harm, which could be compared in a cost-benefit framework with measures of the economic advances associated with that harm. The accounts might also have to include some type of aggregate indicators that include the value of non-marketed goods and services as well as changes in those values over time if the environment degrades due to economic growth.

Neither of these elements is included in the accounts considered, with the exception of the Philippines ENRAP project. To varying degrees, these kinds of efforts are being undertaken outside the accounting context, building on the accounting data and other information, but at

least so far their accomplishments are more limited than some observers hope. The results have often been of interest to decision-makers, however, irrespective of whether they are formally part of the accounting framework.

Several factors may shed light on why the environmental accounts do not achieve this goal. First, the simple macroeconomic indicators proposed by the SEEA or Peskin approaches may not be adequate to tell us much about sustainability, and few countries even calculate them. The accountants on the NSCB project calculated EDP1 and EDP2, but neither they nor the members of the National Statistical Coordination Board felt that the meaning of these indicators was clear enough to release them as part of official government statistics. The Swedish National Institute for Economic Research compiled the data underlying EDP1 and EDP2, but was equally reluctant to publish the aggregates. The Philippines ENRAP project published environmentally-adjusted GDP that included valuation of environmental harm. They found, however, that no one was actually interested in using the results, although there was interest in some of the underlying damage values.

Thus relatively simple accounting-type macroeconomic indicators may be inadequate to tell us whether our economies are on a sustainable path. The SEEA figures do not take into account the costs caused by environmental damage, and therefore lack one of the major elements of concern in monitoring sustainability. The Peskin figures do include estimates of such damages, but there is still little interest in using them. None of these indicators captures the economic adjustments that would occur if we were to actually run our economy in a more sustainable way.

This suggests that a more complex approach is needed to develop meaningful sustainability measures. The Netherlands has undertaken two such analyses, one based on the NAMEA framework and the other following the Hueting approach to Sustainable National Income. Neither of these has been incorporated into the accounting system as a routine activity, although Hueting argues that his is accounting rather than modeling and could be estimated routinely as are the rest of the accounts.

The issue of whether measures of sustainable income and the value of environmental damages should be included within the accounts is related to the different perspectives of statisticians and accountants, on the one hand, and economic analysts, on the other. Environmental accounts are usually built by accountants or statisticians who focus on gathering and ordering historical data and making them available to the public. The accounts are used, however, by economic analysts who focus on applying the data in analytical frameworks and on ensuring that public decisions are based on objective analysis of the relevant issues.

Assessing the sustainability of the economy requires understanding not only the observable data that the statisticians include in the accounts, but also the value of the non-marketed goods and services of the environment. However, valuation methods stem from economic analysis rather than statistical methods, and there is substantial debate about how those methods should be used. Statisticians building the environmental accounts often do not know how to value non-marketed goods and services. Moreover, because of the methodological debate, there is no consensus on the results, and it would be difficult to establish the standardized accounting rules that would allow all countries to value environmental goods and services in uniform ways. Consequently,

statisticians argue against including valuation of non-marketed goods and services in the accounts. (They are, however, often willing undertake the more rule-based valuation of natural assets, and to estimate rent from the use of those assets, as recommended in the 1993 SNA.)

For this reason, the accounts being produced by most statistical offices do not meet the ambitious goals set for them by sustainability advocates. The valuation, modeling, and other analytical work required to assess the sustainability of economic decisions is done outside the accounting framework, in research institutions. Sometimes that work has significant impacts on policy decisions or public opinion, but it does not have the authority that comes of being part of the official statistical system. The data that do have that authority do not directly address the issues that are really crucial to evaluating the sustainability of the country's development path.

SECTORAL POLICY ANALYSIS

The situation with respect to sectoral policy analysis is much more encouraging. The environmental accounts and the data underlying them are used extensively to analyze sectoral and economy-wide policy questions. For the most part, this work is carried out by government analysts or by consultants working for government. In some countries, elected officials have asked staff analysts to address specific policy questions that could be answered thanks to the availability of the accounting data. In a number of countries, analysts in academic and research institutions have also relied on the data, in order to develop complex models of the interactions between environmental policies and economic growth or structure. Thus this goal of the accounts is met by the existing systems. Were the underlying data more comprehensive, or data compatibility issues more fully resolved, the accounts would be applied more fully for sectoral policy analysis; however even in their current state they are clearly very useful.

ENVIRONMENTAL ADVOCACY

Environmental advocacy groups appear to make little or no use of the accounts or the underlying data. Since these groups have sometimes lobbied for the development of environmental accounts, and particularly for the calculation of environmentally adjusted macroeconomic indicators, this is an interesting finding. Several factors might explain it. Environmental advocates sometimes object to the use of GDP and other conventional indicators in foreign investment and aid decisions, and call for alternate measures that would better reflect the sustainability of economic growth. Few of the countries studied calculated green GDP or other adjusted indicators. Where such indicators have been estimated, as in the Philippines, the differences between them and conventional indicators are not dramatic. They offer little evidence to support environment groups' argument that disregard for the environment undermines conclusions drawn from conventional economic data.

Environmentalists and economists focused on sustainable development are often interested in estimates of the monetary value of non-marketed environmental goods and services. With few exceptions, these figures are not included in the accounts. National statisticians and accountants are typically reluctant to estimate these values, because the methods used depend on techniques

of economic analysis rather than statistics. This suggests that environment groups don't use the accounts because the accounts don't provide the information they seek. The Sierra Club example in the United States supports this hypothesis. In that case environmentalists used the accounts to the extent that they accounts actually did get at the issues of concern to them, and went beyond them to locate additional valuation estimates where the accounts were insufficient. This has not occurred in countries whose forest accounts do not estimate the value of recreation or permit comparisons between marketed forest products and non-marketed environmental services of the forests.

One other factor may contribute to environmental advocacy groups' lack of interest in using the accounting data that are available. Such groups are not often engaged in the analytical work to which environmental accounts and the data underlying them are well suited. More often – although certainly not in all cases - their use of data involves using indicators to argue for positions that they support on moral, philosophical, or ideological grounds, rather than developing their positions based on their analysis of the data.

IMPACT OF ACCOUNTING ON DATA AVAILABILITY AND COMPATIBILITY

The development of environmental accounts depends on access to basic data about the environment. The development of those data constitutes the major cost entailed in building the accounts; the costs of compiling secondary data, adjusting them, and putting them into the accounting format are relatively minor in comparison.

The links between primary data collection and accounting can be perceived as a chicken-and-egg problem; does the existence of the data make it possible to build the accounts, or do the accounts create demand for the data and willingness to invest in them? The cases here clearly show that most accounting is based on data collected for other purposes, usually to fulfill regulatory obligations such as setting and enforcing pollutant discharge standards or collecting fees based on resource use. Only rarely, as in some of the Canadian work, are primary data collected by the accounting staff without being primarily intended for some other purpose. The statisticians building the accounts are not focused on increasing willingness to invest in primary data collection. However, they often do point to the process as one that leads to better organization and standardization of data already being collected, as users recognize that presentation in the accounting framework can make the data more useful for policy purposes. This is an explicit objective of the Philippines ENRAP project, but shows up as an unintended result in other countries as well.

Beyond regulatory obligations, the willingness to invest in primary data collection is, not surprisingly, related to the costs that might be incurred if the data were not available. Data investments are frequently made when there is a perceived crisis, when the costs of not having reasonably good information would be high. In energy-dependent developed countries such a crisis occurred with the oil price shocks of the 1970s. At that time, countries quickly began investing in energy data and building energy accounts. Because energy is such a critical input in all industrial economies, countries continued collecting energy data even when the immediate crisis had passed. A few, such as Norway, built the energy accounts into environmental

accounting systems at the time. All of them, however, were able to build on their energy accounts in order to build data systems on air pollutant emissions in the 1990s, when faced with the need to meet the greenhouse gas emissions targets set under the Kyoto Protocol. Had the 1970s energy crises not occurred, the extensive work now underway to build NAMEA systems or other air pollutant emissions systems, and to model the costs of complying with the Kyoto Protocol, would be much more difficult.

The fact that data development is driven by crises creates a problem for environmental accounting. When the crisis arises, decision-makers want answers immediately – but if they have not been investing in time series data all along, that will not be feasible. The climate change data situation is lucky, since at least some of the relevant data were collected for other reasons and happened to be available in time to respond to the Kyoto Protocol. This suggests that if we could anticipate now the crises likely to arise in fifteen years, we should begin developing the time series data now to respond to them. However this is not a very practical solution to the problem of increasing willingness to pay for primary data collection. The approach of the ENRAP project in the Philippines and the NRA project in Namibia, producing many policy studies and ensuring that policy-makers see and use them, may help in creating an appreciation of the value of long-term investments in broad data development.

The situation in the developing world is somewhat different from the developed world. Developing countries often do not have the financial resources to fund their own primary data collection, and depend instead on foreign aid donors. Foreign aid donors also respond to crises – for example, much of the environmental data collected in the Sahelian region of Africa in the past twenty years relates to rainfall and food production, as the funding was a response to drought and starvation in the 1970s. However, funders' motivations may be somewhat different from those of local public authorities. Because foreign aid often involves relatively short-term projects (3-5 years), funding ongoing time-series data is harder than it would be in the donors' home countries. One response to this situation is to ensure that the policy studies produced based on accounting data respond to questions of specific interest to foreign funders as well as national decision-makers. If donors see the benefits of having such data, they may be willing to provide the resources needed to ensure that the work can continue.

Aside from the willingness to invest in primary data development, the accounting process can help to sort out and strengthen data that already exist. The work involved in building the accounts forces statisticians to scrutinize underlying data and to reconcile discrepancies that might otherwise have gone unnoticed. The resulting databases are stronger, more reliable, and more useful than the data of which they are comprised, a point that was made in a number of the cases. The account-building process highlights the difference of focus between conventional environmental statistics and accounts. Technically, the key issue concerns how to link conventional data to the sectoral breakdown of the SNA, while at the same time ensuring compatibility with the data structures used by important international groups such as the Intergovernmental Panel on Climate Change. It is also an institutional issue, because in order to resolve the technical issues, the accountants must collaborate with conventional environmental statisticians. This is working well in a few cases, such as the Norwegian air emissions data, but in more countries there is still much work to be done to effectively link environmental statistics with environmental accounting.

The source of funding for environmental accounting does affect the way the work is done. In Europe, EU financial support has led countries such as Sweden to work in some areas to which they indicated they would not give highest priority otherwise. In the developing world, many countries have received UNDP funds and UN Statistical Department technical assistance specifically in order to implement the SEEA. In contrast, European national accounting departments funding their own work had more flexibility to choose the elements of the SEEA that they found useful and develop their own approaches in other areas (some of which have since been incorporated into the SEEA). On the ENRAP project, USAID chose to work with Henry Peskin and follow his approach; this was not a Philippine government decision. On a more limited basis, the economic policy analysis focus of the Namibian work may reflect in part the orientation of the principal technical advisor on the NRA project, who is an economist rather than a statistician.

This influence of outside funders is a mixed blessing. On the one hand, it may lead some countries to undertake activities to which they do not give high priority and may shift the emphasis of some countries' work away from what they might choose to do on their own. On the other hand, it ensures that work will be done that would not occur otherwise. It can also strengthen international standardization, since aid provided by multilateral donors is often given for the purpose of testing or implementing methodologies being developed by the donors themselves for international use.

SO WHAT?

The lessons learned study has sometimes been viewed as the "so what?" study. We have invested our time and resources in building environmental accounts – has it been worth the effort? The conclusion is yes, it has. Environmental accounts have not fulfilled everyone's hopes for them; they do not guarantee a sustainable development path, nor have they replaced conventional macroeconomic indicators with "green" indicators that ensure that we will not degrade the environment or deplete our natural resources. However they are being widely used to inform a wide range of policy debates in both developed and developing countries. That is enough to justify continuing in the effort to build and use them.

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