THE PHILIPPINE ENVIRONMENTAL AND NATURAL RESOURCES ACCOUNTING PROJECT (ENRAP PHASE II)

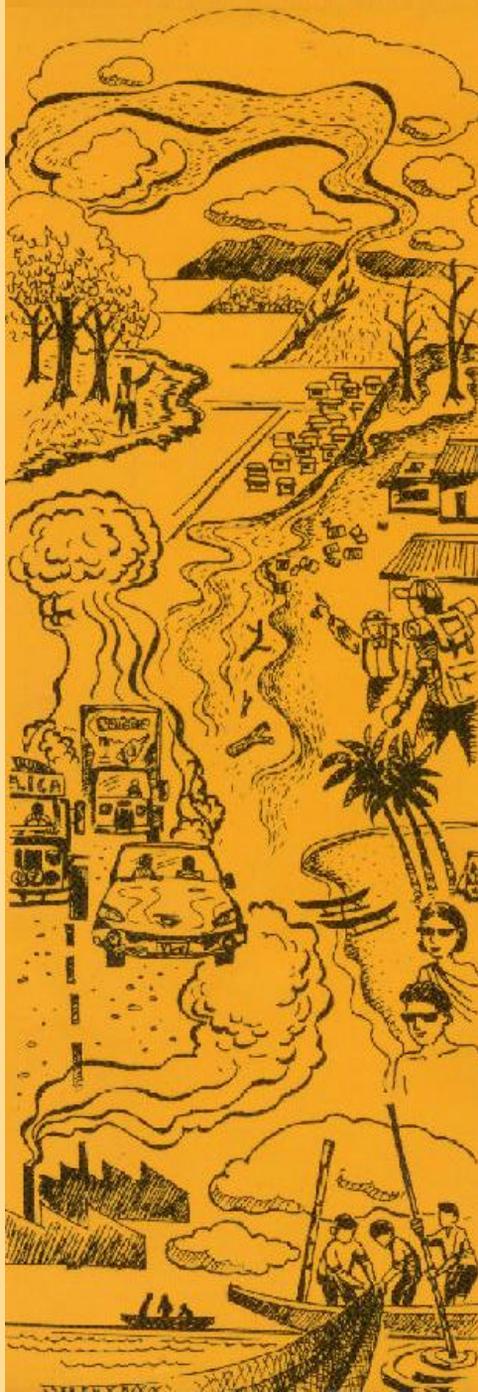## MAIN REPORT

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(ENRAP PHASE II)

MAIN REPORT

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EXECUTIVE SUMMARY

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ENRAP is a major Philippine effort to modify the conventional national economic accounting system in order that the accounts can better reflect interactions between the economy and the natural environment. Economic values of such interactions were estimated in terms of: the waste disposal services provided by air and water resources to households, industry and government; depreciation of dipterocarp forests, small, surface-dwelling fisheries, copper and gold, and upland soils; environmental damages from air and water pollution; direct nature services for coastal and forest-based recreation, and unmarketed production of upland agriculture and fuelwood.

The empirical findings to date show little difference between conventional and "green" GDP indexes of social performance. However, the data generated in the process of building the modified accounts can usefully support environmental policy management.

For example, specific findings challenge conventional assumptions about the relative importance of industrial pollution and the general view that all pollution should be controlled. Overall, the value of waste disposal services, equivalent to pollution abatement costs, greatly exceed pollution damages; this implies that it is not desirable to eliminate *all* pollution. An initial step at prioritizing pollution control should draw from the finding that while industry is the leading source of air pollutants, non-industrial sources generate most of water pollution.

Philippine renewable resources, forests, and fisheries are losing more of their value than non-renewable resources. This result justifies long-standing concerns in the country about deforestation and losses in fisheries and the potential implications of these losses for long-run sustainability.

Unmarketed production of agricultural crops and fuelwood is a significant household activity. Failure of the conventional accounts to reflect this activity could have serious consequences: underestimation of the true economic costs of development projects that require labor particularly from upland agricultural regions, and understatement of the potential contribution of households to environmental degradation.

Further improvements in the system of national accounts and the successful incorporation of natural and environmental resource concerns into the governmental policy structure will require the development of more skills in the application of benefit-cost analytical techniques. Monitoring should receive higher priority as part of the Philippine environmental program. This should include improved data on ambient environmental conditions and on pollution generation.

**THE PHILIPPINE ENVIRONMENTAL AND NATURAL RESOURCES
ACCOUNTING PROJECT (ENRAP)
Phase II**

MAIN REPORT

1.0   INTRODUCTION

The Philippine Environmental and Natural Resources Accounting Project (ENRAP) is a major effort to improve the ability of the conventional national economic accounting system to reflect interactions between the market economy and the natural environment. ENRAP has three objectives: (1) to develop mechanisms for examining economy-environment interactions; (2) to generate improved information on specific sectors of the economy of importance to natural resource and environmental policy; and (3) to provide better measures of a nation's growth and development as recommended by Agenda 21 of the Rio Conference and by the recent (1993) United Nations Revised System of National Accounts.   While similar accounting efforts underway in several nations share many of these same objectives,[1] the Philippine approach has several unique features:

● the adoption of an accounting framework that conforms closely to economic theory and the basic principles of optimal environmental management;

● an emphasis on the use of accounting as a support for policy formation and not just a means of generating alternative measures of social performance;

● the recognition that the *process* of accounting is as important as the production of the accounts themselves;

and, most importantly,

● a firm belief that *the effort will not be fully* successful unless it becomes institutionalized within the Philippine policy-making structure.

This report covers *the second phase of* a three-phase program. In Phase I, the focus was on the depletion of certain natural resources of historical importance to the Philippine economy - primarily forests. The second phase, in contrast, focused on a general accounting of all natural resource and environmental *services used by the* Philippines, including waste disposal services. Thus, the interest was not only in natural resource depletion but also in the deterioration of air and water quality. In the forthcoming third phase, the *emphasis is on refinement of* preliminary Phase II estimates, disaggregation of the accounts to regional detail, and further enhancement of the institutionalization objectives through training and simulations of policy.

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[1] See Lutz, 1993, which contains a survey of these efforts in various industrialized countries. Similar efforts are underway in several developing countries such as China, Brazil, Costa Rica, and Indonesia.

1.1   Background

Early efforts at resource and environmental accounting grew out of a dissatisfaction with the perceived failure of the conventional national economic accounts and, in particular, the Gross Domestic Product (GDP), to provide a meaningful measure of social performance in the face of environmental degradation. Indeed, GDP could increase in the face of environmental degradation due, say, to efforts to clean up an oil spill or to increased health expenditures necessitated by poor air quality.

Besides concerns about the conventional GDP as a measure of national well-being   a deficiency that has been noted by economists for many years[2]   two other weaknesses are also apparent. First, the conventional accounts apparently treat reproducible wealth and natural wealth inconsistently in the calculation of a nation's net domestic product (NDP), a measure of a nation's "sustainable" income - i.e., income that allows for replacement of losses in the capital stock. While the depreciation of reproducible wealth is subtracted from GDP to obtain NDP, there is no parallel calculation for any depreciation in the stock of natural resources.

Second, the conventional national accounts overlook important inputs and outputs that characterize a nation's "production function" - inputs and outputs that have economic significance but are neglected because they lack market-determined values and prices. Typically neglected environmental inputs to production processes are the waste disposal services provided by water bodies and air sheds. Typically neglected outputs are recreational and ecological services provided "free" by nature. Because they lack prices, they are not measured by conventional economic accounts.

These deficiencies in the conventional national economic accounts reflect a failure to attain two principal objectives of accounting: scorekeeping and *management*. Scorekeeping refers to the calculation of statistics - such as GDP or NDP - measuring the performance of a business or an economy. Management refers to the body of data generated by the accounting process that supports the formulation and implementation of business or economic policy.   Various approaches to resource and environmental accounting differ in the emphasis placed on rectifying either the scorekeeping or management weaknesses in the conventional economic accounts.

These approaches can be grouped under four headings.

1. Pollution expenditure accounting

One of the first reactions to perceived weaknesses in the conventional economic accounts was to develop data series on pollution abatement and other environmental expenditures. Such data series have been maintained in the United States since 1972 and are available in other countries such as the OECD members.

As these data refer to measured expenditures already incurred, either due to policy or to standard business and household practice, they are actually a re-specification of information already in the conventional accounts. While some have argued that such environmental expenditures should be deducted from conventional GDP to generate an appropriate "green" GDP, such adjustments have never been made

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[2] A classic discussion of the issues may be found in Hicks, 1940.

in the United States. The motivation (in the United States at least) for a statistical series on pollution abatement expenditures appears not to be for better scorekeeping but rather for better management of economic and environmental policy. Specifically, the data have been used in models and analyses of how the costs of environmental policy affect productivity.[3]

2. *Physical accounting*

Another approach, followed especially by Norway and France, is to measure physical changes in the stock of environmental assets over time. Of course, a decision must be made as to the appropriate physical measure that is relevant to some environmental policy concerns. A forest, for example, can be physically measured in terms of its area, the volume of its timber, the variety of its biota, the stock of non-timber resources such as firewood and grasses, etc. The appropriate choice will depend on relevant policy objectives: commercial timber management, assurance of firewood supply, adequate species diversity, etc.

The accounting amounts to the specification of an "opening" stock of the physical amount of the asset at the beginning of the accounting year; the amount of the stock depleted due to use or to natural causes; the amount increased due to discoveries or, if appropriate, natural growth; and the resulting "closing" stock. This basic framework can be elaborated by linking the amount depleted to economic activity, usually through an input-output model.

In Norway, where this approach has been followed for many years, there is no scorekeeping or "green" GDP objective. Rather, the intent is to generate information and analyses to support the nation's economic planning process.

3. *"Green" indicators*

A third approach, and perhaps the one with the longest history, is to replace conventional GDP or NDP measures with some alternative social indicators. This work has proceeded along two parallel paths. First, there has been the relative ambitious effort to replace the GDP and NDP with entirely new indicators of social well-being, perhaps by altering one or more of the components of the conventional aggregates (subtracting out pollution abatement expenditures would be an example) or by adding some new components (such as a factor measuring the negative effects of urbanization). The best known example of this approach is the Nordhaus-Tobin MEW (Measure of Economic Welfare) indicator.[4] Similar indicator approaches have been developed by the Japanese (the Net National Welfare or NNW)[5] and, more recently, by Daly and Cobb.[6]

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[3] See, for example, Denison, 1979; Jorgenson and Wilcoxen, 1990.

[4] Nordhaus and Tobin, 1973.

[5] Japan Economic Council, 1973.

[6] Daly and Cobb, 1989.

A more conservative approach has been promoted by Robert Repetto and his colleagues at the World Resources Institute.[7]   The thrust of this effort is to modify the conventional measures of net product, such as NDP, by accounting for the conventionally neglected depreciation of natural assets such as forests, mineral stocks, fish stocks, and soils. Such adjustments have been made on an experimental basis in Indonesia, Costa Rica, China, Brazil, and in the Philippines as part of the ENRAP Phase I effort.

4. Extensions of SNA-type systems

The fourth group of approaches builds upon the existing systems of national accounts, principally the United Nations System of National Accounts (SNA).   The attempt is to introduce sufficient modifications to account for all environmental-economic interactions.   This approach is the most ambitious of the four groups and, in fact, covers all the information needed for the other three. While it can serve scorekeeping objectives, the main purpose of adopting this approach is its generation and systematic assembly of data needed to support an environmental and resource policy that will be consistent with overall economic objectives.

Examples of SNA-type systems are the UN Satellite System for Integrated Environmental and Economic Accounting approach[8] and the framework adopted in the Philippines for ENRAP.[9]

2.0   THE ENRAP FRAMEWORK

The basic principle of the ENRAP framework is that the services of *economically* valuable environmental assets - natural resources, air sheds, water bodies - should be treated in an accounting system just like the services of reproducible marketed assets such as factories and machines. Services of the environment and natural resources will in fact have economic value if they are scarce in an economic sense: when demand for the services is limited by available supply. If such services were traded in markets, they would have observable market prices, and thus would be included in the conventional accounts. However, they are typically not marketed in spite of their economic value, either because property rights to the assets have not been established or because the "owner" of the property right (often the government) chooses not to act as a seller of the services.

Consistent with this focus on economic values is the related emphasis on the *economic* depreciation of environmental assets, where economic depreciation is defined as the change in the asset *value* over time. *Physical* degradation of environmental and natural resource assets is not of importance in the accounting system unless the physical decline implies economic losses in the value of these assets. While the physical condition of a natural resource influences its value, other factors - particularly, the likely value of future services generated by the asset - can play a significant role. In particular, ENRAP

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[7] Repetto et al., 1989.

[8] See UN Handbook, 1993.

[9] This framework was initially developed by Peskin, 1976. It has been implemented for the United States (see Peskin, 1981) and for the Chesapeake Bay region of the United States (see Michaels et al., 1993).

estimates of resource depreciation are generally lower than they would be if non-economic depreciation estimates, based primarily on physical decline, were used.[10]

A unique feature of the framework is that it allows for two values to be placed on pollution: one from the point of view of the polluter and one from the point of view of the injured party. Specifically, pollution is shown to result from the use of the waste disposal service provided by the natural environment. This service, which is of value to the polluter, may compete with other services provided by the natural environment such as health, recreation, and support for animal and plant species. As a result of this competition, waste disposal service also leads to environmental damage. The numerical value of the damage usually will not equal the value of the disposal service - thus the need for a dual valuation.[11]

The ENRAP framework also accounts for environmental services other than waste disposal that are directly consumed by Philippine society. These include recreation services, esthetic services, and the support of ecological systems. Because of the dual valuation, the accounting framework requires a balancing entry equal to the difference between the value of all services provided by the environment - for waste disposal and for all other purposes - and any resulting environmental damages.

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

Table 1 displays a modified national account consistent with the ENRAP framework and consolidated over all economic sectors in the Philippines. The top part of the figure represents the conventional GDP account. The lower portion contains the ENRAP adjustments. The first adjustment shown is for household production of fuelwood and upland (mountain region) agricultural crops not measured in the conventional GDP. Since ENRAP values household production at its input cost, the input and output entries are the same. Waste Disposal Services are next shown to enter the input side of the ledger and, as a matter of convention, are valued negatively since they can be viewed as "free" subsidies of nature. Resulting Damages are entered on the output side and are also valued negatively since they may be considered as negative output or environmental "bads." Also shown on the output side are the (positive) non-disposal services of the environment entered as Direct Nature Services. Turning again to the input side is the balancing entry, Net Environmental Benefit. Final adjustments are for Natural Resource Depreciation, subtracted from both sides of the accounts to produce the modified NDP figure. Both conventional and natural resource depreciation must be added back to yield a modified GDP figure.

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[10] The Phase I ENRAP Main Report and Phase II Technical Reports 5,6 and 7 provide comparisons of alternative natural resource depreciation estimates, including those that rely solely on physical-loss considerations. Estimates based solely on physical losses can be over 17 times larger than estimates based on true economic depreciation.

[11] Indeed, according to the economic theory of environmental management, the value of the marginal unit of pollution to the polluter and to any injured party will be the same only if the services of the environment are allocated between all users in an economically efficient manner. In the absence of markets or of optimal governmental pollution policy, such efficient allocations are not likely.

Table 1

MODIFIED NATIONAL INCOME AND PRODUCT ACCOUNTS

Input	**Output**
Compensation of Employees	Personal Consumption
Indirect Taxes	Government Consumption
Depreciation (Produced Asset)	Capital Formation
Net Operating Surplus	Exports
	Imports (-)
	Statistical Discrepancy
CHARGES AGAINST GROSS DOMESTIC PRODUCT	GROSS DOMESTIC PRODUCT
Capital Depreciation (-)	Capital Depreciation (-)
CHARGES AGAINST NET DOMESTIC PRODUCT	NET DOMESTIC PRODUCT
Natural-resource Inputs to Unmarketed Household Prodn (+)	Unmarketed Household Prodn (+)
a. Upland agriculture	a. Upland agriculture
b. Fuelwood	b. Fuelwood
Env'l. Waste Disposal Services (-)	Environmental Damages (-)
a. Air	a. Air
b. Water	b. Water
Net Environmental Benefit (Disbenefit)	Direct Nature Services (+)
Natural Resource Depreciation (-)	Natural Resource Depreciation (-)
a. Forests	a. Forests
b. Fisheries	b. Fisheries
c. Minerals	c. Minerals
d. Soils	d. Soils
CHARGES AGAINST MODIFIED NET DOMESTIC PRODUCT	MODIFIED NET DOMESTIC PRODUCT
Capital Depreciation (+)	Capital Depreciation (+)
Natural Resource Depreciation (+)	Natural Resource Depreciation (+)
CHARGES AGAINST MODIFIED GROSS DOMESTIC PRODUCT	MODIFIED GROSS DOMESTIC PRODUCT

Source: Peskin, H.M. (1989). "Accounting for Natural Resource Depletion and Degradation in Developing Countries." Environment Department Working Paper No. 13.   World Bank, Washington, D.C.

The consolidated account shown in **Table 1** serves to summarize large amounts of detailed data that can be disaggregated to individual industries and economic sectors. While the GDP and NDP totals in the consolidated account are useful for scorekeeping purposes, the detailed information, much of which are contained in appendices to this report, are usually more important for serving the management objectives of the accounting process.

3.0   IMPLEMENTATION PRINCIPLES

Details on the procedures used to estimate the various entries shown in **Table 1** are discussed in the appendices to this report. This section will provide a brief overview of the principles involved.

In keeping with the economic foundations of the framework, the environmental service entries shown in **Table 1** should reflect what consumers of these services would be willing to pay for them. In the case of damages, the values should reflect what affected parties would be willing to pay to avoid them. Techniques for ascertaining these values are well documented in the technical literature on benefit and cost measurement.[12] However, in practice it is not possible to apply these techniques for the full scope of environmental services used in the Philippines.   Rather, ENRAP investigators developed preliminary estimates, drawing on available studies and data.

The value of waste disposal services was estimated by the likely costs faced by polluters if they were denied these services. The assumption is that prospective pollution control costs approximate the value of waste disposal. In general, engineering studies, many done in the United States to assess the costs of pollution control measure, provided the data. Efforts were made to adjust the numbers for Philippine conditions.

Environmental damage estimates were primarily confined to estimates of health damage due to air and water pollution, damage to marine fisheries, and damage to reservoirs. While, in principle, the valuations of health damages should reflect society's willingness-to-pay to avoid these damages, in practice, the health effects were valued by the costs of lost incomes and direct medical outlays. Damages to fisheries reflect the value of estimated losses in fish catch while damages to reservoirs (primarily due to siltation) reflect the loss in their useful lives.

As with waste disposal services, the value of direct nature services should reflect what users of these services would be willing to pay for them. Using data drawn from foreign studies, the ENRAP estimates largely reflect the amounts divers and users of beaches would be willing to pay for these recreational services.

The estimated value of household production of fuelwood equals the estimated amount of labor required for its gathering times an assumed wage rate. Other household production of agricultural crops were valued using available prices for similar crops that were marketed.

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[12] See Freeman, 1993, for a good overview of these techniques as applied to the benefits and costs of environmental policies.

Finally, ENRAP's estimate of natural resource depreciation relied on a number of methods depending on the specific resource being considered. In principle, all these estimates should reflect the change in capital value of the resource over the accounting year (1988).

Table 2, which follows the framework shown in **Table 1**, summarizes the estimates for the Philippine economy as a whole. More detailed sector information can be found in the appendices to this report.

4.0   IMPLEMENTATION PRACTICE

Fulfilling ENRAP's policy and institutionalization objectives requires more than the assembly of data needed to support the resource and environmental accounts. Five features of the program are central to its institutionalization objectives:

1. ENRAP is a Philippine project.

Philippine nationals conduct and manage ENRAP activities. Foreign participation is limited to technical consultancies, which account for a small percentage of the total personnel budget. ENRAP has thus trained a number of Philippine nationals capable of undertaking resource and environmental accounting without the need for foreign involvement. The ENRAP staff consists of eight individuals, many of whom have advanced degrees.

2. Policy makers participate in the ENRAP process.

To establish the usefulness and credibility of the accounting process, ENRAP has sought the involvement of policy makers as well as those who influence policy. A Steering Committee provides guidance to the program.   This committee includes high level officials from the Department of Environment and Natural Resources (DENR), the National Statistical Coordination Board (NSCB), the National Economic and Development Authority (NEDA), the Department of Agriculture (DA), the Laguna Lake Development Authority (LLDA), and the United States Agency for International Development (USAID). A representative from the non-governmental community is also included. In addition, senior staff members attend ENRAP workshops and staff meetings.

3. ENRAP develops the accounts iteratively.

The Philippine economy and environmental condition is sufficiently complex that it would be unrealistic to believe that a complete set of accurate environmental and resource accounts could be established in the near term.   The accounting approach chosen by ENRAP attempts to maintain the completeness required by a national accounting system but does not attempt high accuracy in the early phases of the project. ENRAP thus attempts to provide a complete accounting of environmental-economic interactions for all significant economic sectors, albeit with fairly crude estimates. However, these rough calculations often provide information of policy significance that is unlikely to change with further data refinement. In addition, the estimates often indicate where data are in most need of refinement. Thus, ENRAP has adopted an iterative accounting approach: early, preliminary sets of accounts serve to point the way towards more accurate and refined accounts in the future.

Table 2

MODIFIED PHILIPPINE NATIONAL INCOME AND PRODUCT ACCOUNTS, 1988
(in million pesos)

Input			Output		
Compensation of Employees		278,874	Personal Consumption		558,765
Indirect Taxes		56,736	Government Consumption		72,183
Depreciation (Produced Asset)		67,162	Capital Formation		147,515
Net Operating Surplus		399,747	Exports		226,431
			Imports (-)		(215,292)
			Statistical discrepancy		12,917
CHARGES AGAINST GROSS DOMESTIC PRODUCT		802,519	GROSS DOMESTIC PRODUCT		802,519
Capital Depreciation (-)		(67,162)	Capital Depreciation (-)		(67,162)
CHARGES AGAINST NET DOMESTIC PRODUCT		735,357	NET DOMESTIC PRODUCT		735,357
Natural-resource Inputs to					
Unmarketed Household Prodn (+)		6,250	Unmarketed Household Prodn (+)		6,250
a. Upland agriculture	1,950		a. Upland agriculture	1,950	
b. Fuelwood	4,300		b. Fuelwood	4,300	
Env'l. Waste Disposal Services (-)		(17,666)	Environmental Damages (-)		(3,108)
a. Air	(3,317)		a. Air	(381)	
b. Water	(14,349)		b. Water	(2,727)	
Net Environmental Benefit (Disbenefit)		16,138	Direct Nature Services (+)		1,580
			a. Diving (coral reefs)	1	
			b. Visits to National Forest Park	13	
			c. Beach use	1,566	
Natural Resource Depreciation (-)		(2,541)	Natural Resource Depreciation (-)		(2,541)
a. Forests	(936)		a. Forests	(936)	
b. Fisheries	(838)		b. Fisheries	(838)	
c. Minerals	(387)		c. Minerals	(387)	
d. Soils	(380)		d. Soils	(380)	
CHARGES AGAINST MODIFIED NET DOMESTIC PRODUCT		737,538	MODIFIED NET DOMESTIC PRODUCT		737,538
Capital Depreciation (+)		67,162	Capital Depreciation (+)		67,162
Natural Resource Depreciation (+)		2,541	Natural Resource Depreciation (+)		2,541
CHARGES AGAINST MODIFIED GROSS DOMESTIC PRODUCT		807,241	MODIFIED GROSS DOMESTIC PRODUCT		807,241

Notes:

      Charges against Modified Net Domestic Product without Unmarketed Household Production   =   P 731,288 M
      Charges against Modified Gross Domestic Product without Unmarketed Household Production   =   P 800,991 M.

4. Policy relevance is continuously demonstrated.

Integral to the project are a number of independent policy analyses that rely on ENRAP data. These studies cover a number of resource policy issues of concern to the Philippines: losses of upland soils, declines in fish stocks, depletion of mineral stocks, problems of changing land use, and pollution implications of future growth. Studies completed under Phase II are appended to this report (see **Appendices D through J**). In addition to the studies formally supported by ENRAP, outside investigators also use ENRAP framework or data. Examples of this use are the Trade and Environment study of the Philippine Institute for Development Studies (PIDS), the Laguna de Bay Economic Valuation study of the Metropolitan Environmental Improvement Program of the World Bank, and the Forest Resources Accounting for Palawan Province of the Economic and Social Commission for Asia and the Pacific (ESCAP).

The policy studies serve a two-fold purpose. They demonstrate the usefulness of ENRAP data, quite apart from their contribution to the accounts. They also help set priorities over which economic sectors should receive relatively more attention by the ENRAP investigators.

5. ENRAP has a continual outreach program.

ENRAP makes an active effort to keep policy makers and the general public informed. During Phase II, the staff conducted 13 workshops and briefings. The staff was represented in international conferences, four in Asia, one in Canada, and one in the Netherlands. ENRAP findings were cited in a number of newspaper articles. Finally, ENRAP sponsored a major international conference on the contribution to policy of ENRA in Tagaytay City, Philippines, in January 1994.

Such outreach efforts are crucial if resource and environmental accounting is to be eventually accepted by and, thus, institutionalized within the Philippine policy-making system. A five-year institutionalization plan to ensure that the ENRA process is sustained beyond the lifetime of the current project was prepared under Phase II (**Appendix K**).

5.0   PROJECT FINDINGS

This report classifies project findings under two headings: *empirical findings*, those which follow directly from the data collected, and *procedural findings*, those which depend on the experience gained in the process of developing the accounts.

Empirical findings

Although all the data, many of which were developed with fairly crude techniques, are preliminary and subject to revision, there are a number of findings that are unlikely to be greatly altered even with improved information.

• There is little difference between conventional GDP or NDP measures and the environmentally modified (or "green") measures. As indicated in **Table 2**, there is less than one percent difference between the modified GDP and the conventional GDP. The difference is even smaller if the effects of household production are removed. As these differences are less than the conventional statistical discrepancy entry, one could conclude that there is no statistical difference between modified and unmodified income measures in the Philippines.

While this result may seem surprising, it is consistent with applications of the ENRAP framework elsewhere.[13] Other investigators,[14] using alternative approaches, have shown larger differences (up to 4 percent), but in every case these approaches do not credit the economy with any benefit from waste disposal services. As long as the adjusted GDP includes a positive credit for waste disposal, the observed small difference between conventional GDP (or NDP) and their versions, modified for environmental factors, is likely to remain.[15]

• Overall, the value of waste disposal services, equivalent to pollution abatement costs, greatly exceed pollution damages, equivalent to pollution control benefits. This finding does *not* imply that it is not worthwhile to reduce pollution in the Philippines. However, it does imply that it is not desirable to eliminate *all* pollution or, equivalently, to realize all benefits from waste disposal. This finding is perfectly consistent with the modern theories of environmental management, which argue that the incremental costs of complete pollution reduction are very high while the incremental benefits of such reduction are low. For this reason, the optimal level of control (where the incremental costs and benefits are equal) is usually less than the 90 to 100 percent control assumed for the waste disposal service calculations.

However, while the relative sizes of the costs and benefits are not unexpected, there are two principal reasons why the absolute difference between costs and benefits of complete control are larger in the Philippines than in industrialized countries. First, pollution levels (or use of the waste disposal services) are much larger in the Philippines than in more industrialized countries. Therefore, the total costs to attain 90 to 100 percent control are much larger than in the case of, say, the United States, which starts from a cleaner baseline. Second, the calculated value of pollution control benefits is heavily influenced by the low incomes of the Philippines while control costs are largely influenced by the high costs of imported pollution abatement equipment. For both these reasons, one would expect that the difference between costs and benefits (and the associated Net Environmental Benefit figure) would fall as the Philippine economy becomes more developed.

• While industry is the leading source of air pollutants, non-industrial sources generate most of the water pollution in the Philippines. Inspection of **Appendix A** indicates the importance of industry as a source of air pollution. **Table 3** summarizes the shares by sector. However, the importance of non-industrial sectors as a source of water pollutants is clear from **Table 4** For the pollutants shown, industry is a minor contributor compared to households, urban runoff, and agriculture.[16]

These results are consistent with empirical studies elsewhere. The importance of households and both rural and urban non-point sources is increasingly recognized even in industrialized nations. The household sector as a major contributor of BOD (an indicator of oxygen-depleting nutrients) is characteristic of less developed nations with minimal sewerage systems.

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[13] See, for example, Grambsch et al., 1993 and Peskin, 1981.

[14] For example, Repetto et al., 1989.

[15] On the other hand, if the modifications were to include a *full* coverage of all household production especially the unmarketed services of households the differences could become quite large.

[16] Industry may be the leading source of dissolved solids. Estimates for this pollutant were incomplete.

Table 3

DISTRIBUTION OF AIR POLLUTION EMISSIONS, PHILIPPINES, 1988

Source	Pollutants (percentage distribution)				
	PM	**SOx**	**NOx**	**VOC**	**CO**
INDUSTRY (Mfg., mining, & other private services)	66	39	49	42	45
ELECTRIC POWER	4	58	21	5	6
HOUSEHOLDS (Vehicles & cooking activities)	24	1	15	30	35
PUBLIC TRANSPORT (inc. gov't.-owned vehicles)	6	2	15	21	13
AGRICULTURE (Crops, Livestock, Fishery, & Forestry)	neg.	neg.	neg.	1	1

Note: PM   Particulate Matter
         Co   Carbon Monoxide
         Sox   Sulfur Oxides
         Ox   Nitrogen Oxide
         VOC   Volatile Organic Compounds

Table 4

DISTRIBUTION OF WATER POLLUTION DISCHARGES, PHILIPPINES, 1988

Source	Pollutants (percentage distribution)			
	BOD5	**SS**	**N**	**P**
HOUSEHOLDS	59	10	12	44
URBAN RUNOFF	neg.	47	4	16
AGRICULTURE (Crops, livestock, fishing and forestry)	32	27	83	40
INDUSTRY (Manufacturing, mining, and other private services)	9	15	1	neg.
ELECTRIC POWER	neg.	1	neg.	neg.

Note: BOD5   Biochemical Oxygen Demand
         SS   Suspended Solids
         N   Nitrogen
         P   Phosphorus
         neg.   Negligible

• <u>Renewable resources are losing more of their value than non-renewable resources</u>.   From **Appendices D, E and F,** estimates of economic depreciation or the loss in asset value are as follows in 1988:

Natural Resource	*Depreciation (in pesos)*
Forests	936 M
Fisheries₱	838 M
Soils₱	380 M
Minerals₱	387 M

These results justify long-standing concerns in the Philippines about deforestation and loss in fisheries and the potential implications of these losses for long-run sustainability.

• <u>Unmarketed production of agricultural crops and fuelwood is a significant household activity.</u> As indicated earlier in **Table 2**, unmarketed household production effectively increases conventional GDP by about six billion pesos or by nearly 1 percent of GDP. Had this production been allocated to the agricultural and forestry sectors, it would have increased measured agricultural output by about 1.4 percent and forestry output by about 32.9 percent.

The failure of the conventional accounts to reflect this activity could have two serious consequences. In the first place, it could lead to the underestimation of the true economic costs of development projects that require labor, especially from upland agricultural regions. Second, neglect of this activity could understate the potential contribution of households to environmental degradation. As these productive activities largely occur in erosive upland areas, the consequences for environmental damages may be severe.

Procedural findings

• <u>There is poor information on the costs and benefits of prospective environmental policies in the</u> <u>Philippines</u>. A key source of data used for previous implementations of ENRAP-style resource and environmental accounts is quantitative cost and benefit information used to support prospective policies. (The cost information is used to develop estimates of waste disposal services while the benefit information is used to estimate damages.) Unfortunately, the regulatory process in effect in the Philippines has not forced proponents and opponents of environmental policy to develop such information. The process is apparently far more cooperative and far less contentious than in, say, the United States.

While the non-confrontational Philippine approach has merit, it fails to generate the full body of information needed to ascertain whether or not individual regulations or the entire body of Philippine environmental policy is economically efficient. In the absence of such information, it is impossible to know whether Philippine environmental objectives could be more inexpensively met by a re-focus of the regulatory effort. A secondary result is that it makes it far more difficult and expensive to generate a full set of resource and environmental accounts.

• Access to international literature on the costs and benefits of environmental policies in other countries needs improvement. Relevant literature on the use of environmental services in other countries can provide parameters that, with adjustments for income differences, could be used to improve Philippines estimates of environmental control costs, pollution damages, and direct nature services, especially recreational services. Linkages with various researchers and access to recent literature need to be improved.

• Skills in environmental cost and benefit estimation techniques need sharpening. There appear to be Philippine professionals with adequate theoretical knowledge of the techniques of benefit and cost estimation. However, because of the lack of a need to support legislation and regulation with benefit-cost analyses and because of weak library resources, there are few in government with practical experience in applying benefit-cost estimation techniques. While ENRAP investigators do have the requisite skills, weakness in this knowledge elsewhere will affect the eventual institutionalization of the effort within the Philippine governmental system.

• There is a need for increased environmental monitoring. ENRAP investigators were hampered by their inability to apply conventional methods for benefit and cost estimation because of poor data on ambient environmental quality, lack of pollutant discharge data, and spotty information on other users of the environment such as recreationists. This lack of monitoring information seems typical of developing countries, due primarily to the costs involved and partially to a reluctance to strongly enforce environmental regulations. However, without such information, it is extremely difficult to target environmental regulations towards economic sectors and geographical areas where they are most needed, and it is equally difficult to determine whether existing regulations are effective.

6.0   RECOMMENDATIONS AND FUTURE DIRECTIONS

The above findings suggest a number of actions for the ENRAP staff and for the Philippine government.

• ENRAP should continue its focus on the management, rather than the scorekeeping, benefits of resource and environmental accounting. One motivation for ENRAP's decision to emphasize the management benefits of resource and environmental accounting was uncertainty concerning the policy implications of any calculated differences between conventional and "green" GDP.[17] The empirical findings reinforce this concern about the policy relevance of the modified GDP numbers. The calculated differences appear too small to have any policy or statistical significance.

• The general perception of achieving a goal of 100 percent control of pollution is not in the Philippines' best interest. While the theory of environmental management suggests that such stringent levels of control are never in any nation's best interest, such a goal is especially undesirable in countries in the early stages of industrialization. The social benefits of such a target are far outweighed by the social costs. However, a more modest objective, consistent with the economic principle of balancing incremental environmental control benefits against incremental control costs, is still in order.

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[17] The issues are discussed in Peskin, 1994.

• The current exclusive focus on industrial sources of pollution is not warranted. While industrial activity may be an extremely important source of certain pollutants (especially air pollutants and toxic chemicals) and industries may be the sole source of pollution in certain geographical areas, the findings clearly demonstrate the importance of households, agriculture, and the runoff from urban streets. Given the amounts of pollutants generated by these sources, it is unlikely that even modest environmental quality objectives can be met without addressing one or more of these sources.

• The attention paid to the maintenance of renewable resources in the Philippines is warranted. Renewable resources, such as forests, are depreciating (that is, losing economic value) at a faster rate than non-renewable resources, such as minerals. Unless it can be shown that exploitation of renewable wealth is more than offset by increases in other forms of wealth, further loss in these resources will lower Philippine sustainable income. The same can be said for the exploitation of non-renewable resources. However, the non-renewable resources appear to be losing value at a much slower rate.

• There should be further efforts to measure household production activities. The data appear to indicate that unmarketed household production is a significant portion of total Philippine production. One approach to obtaining better measures of household activity is through carefully conducted surveys of household expenditures and use of time. Such surveys have the added benefit of providing general information of relevance to environmental policy, such as data on leisure activities and on energy use.

• The government should encourage efforts to make careful assessments of the benefits and costs of prospective environmental policies. These assessments could, as is the case with major regulations in the United States, be required by law. Such a drastic approach may not be necessary if debate over the merits of proposed regulations were more open to public scrutiny and legal review. In such an environment, proponents and opponents might be encouraged to support their arguments with factual and, perhaps, more quantitative information on likely benefits and costs.

• The Philippine government should establish an environmental management library. The library could house, in a central location, all relevant materials pertaining to efficient environmental management. Included would be theoretical and empirical literature on engineering solutions to environmental problems, on environmental control costs, and on the benefits of environmental policies. Both the Philippine and the international literature would be covered. The materials would be accessible to governmental policy makers, the private sector, and the Philippine research community.

• Programs intended to train policy makers in the techniques of environmental management   particularly cost and benefit analysis - should be pursued. A modest training activity for these purposes is being planned as part of ENRAP Phase III.

• Monitoring should receive a higher priority as part of the Philippine environmental program. Information on ambient conditions, on pollution discharges, on the conditions of plant and animal species, and on use of the environment by the general public needs strengthening. While monitoring is expensive, it is essential to the formulation and implementation of meaningful environmental policy. International funding agencies could be a source of support.

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Annex 1

LIST OF TECHNICAL APPENDICES

A   - Estimation of Direct Environmental Waste Disposal Services

B   - Estimation of Environmental Damages

C   - Estimation of Philippine Direct nature Services

D   - Upland Soil Resources of the Philippines: Resource Assessment and
        Accounting for Soil Depreciation

E   - Fishery Resources Accounting in the Philippines: Applications to the
        Small Pelagics Fishery

F   - Depletion Concepts and Application to the Copper and Gold Industries
        of the Philippines

G   - Input-Output Modelling

H   - An Assessment of Land Resources and Land Use

I   - Economic Framework for Philippine Land Use Decision Making: Cost-
        Benefit Analysis of Various Land Uses

J   - Economic Framework for Philippine land Use Decision Making:
        Exploration Using Linear Programming

K   - Towards Institutionalization of Environmental and Natural Resource
        Accounting (A Five-Year Period Project Proposal)

Annex 2

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