The State of the Environment

Unfortunately for too many Filipinos, past economic growth has only been characterized by poverty, inequity, unsustainability, and ecological instability. These conditions have deprived them of the means to meet their basic needs and constricted the opportunities for realizing their human potential.

In the past, growth heavily relied on agriculture and natural resources. Even the first phase of industrialization (import-substitution) was financed by agricultural and natural resource exports. The economic benefits from this growth pattern have been limited because entry into the key sectors was restricted through quotas, licenses, concessions, other government-established mechanisms, and the use of capital-intensive technologies. Concentrated in resource-rich processing sites, or in the metropolitan centers, economic activities associated with these sectors did not foster linkages and did not generate full employment opportunities for a significant portion of the labor force. Consequently, the growth process did not substantially reduce poverty and inequality.

Furthermore, economic benefits generated by the growth process could not be sustained. Sustaining the growth process became an undeniable problem after 1982, when average incomes fell dramatically and continued to remain below the peak income level, but this unsustainability already marked even the earlier decades. For instance, the acceleration of timber and mineral extraction and processing from the postwar years to the early 1970s, and the limited forest regeneration efforts then, resulted in the reduction of the stock of potentially renewable resources (timber) and in a slump in the prices of nonrenewable ones (ore). Thus, this sector was unable to maintain their contribution to growth.

The unsustainability of the growth process is also manifested in the accompanying social costs and ecological instabilities which adversely affected local communities. While the extensive logging and mining of substantial forest lands in the natural resources sector provided economic benefits to the wood and mining industries, it displaced entire communities which depended on the forest for their habitat, subsistence, and cultural reproduction. Those living outside the resource sites were also subject to soil erosion, landslides, siltation of rivers and reservoirs, floods, receding ground water levels, and droughts.

Economic activity and population have become concentrated in the cities, such as Metro Manila and Cebu. However, the state's financial, organizational and planning capacity has been extremely limited, especially in establishing resettlement and public housing schemes, garbage disposal, sewerage, waste-water treatment, and public transport facilities. As a result, the existing infrastructure has been wholly inadequate, and the environment and human well-being were severely threatened. In particular, the air and inland bodies of water have become heavily polluted to the detriment of the urban population. It is possible that the urban centers have already exceeded their carrying capacity.

An equitable and sustainable economy and a productive, stable, and healthy environment are needed for human development. To safeguard and promote the people's physical well-being, the access to natural resources and environmental services must be made more equitable, efficient, and adequately maintained and reproduced. Only in this way, to paraphrase the Brundtland Report, can "the needs of the present [be met] without compromising the options for future generations." In the end, a deteriorating environment will also be reflected in human measures — such as longevity and health, knowledge, and incomes. Therefore, there is a special need to monitor the state of the environment since the effects of environmental damage are typically cumulative, long-acting, and difficult to reverse. For example, even if the deleterious effects of the destruction of rain-forests are now generally recognized (e.g., flooding and siltation of dams), there is nothing much that can be done now to immediately reverse the trend. The people must live with the consequences for many years.

There is, therefore, a need to monitor the state of natural resources and environmental services, their efficient use and distribution, and the impact of economic activities on their productivity and sustainability. Given these concerns and the complexity of the environment, a number of indicators are required. Such indicators should supplement the indices used to monitor human development, since these indices are generally confined to longevity, education, and per capita income.

This chapter discusses the status of the environment and how this affects human development. The next section provides a conceptual framework for determining the state of the environment along particular indicators. Natural systems are intrinsically interconnected and, hence, cannot be physically isolated. However, for ease of exposition, the environment is assessed for each ecosystem. The indicators of the status of each ecosystem relate to their ability to perform their functions and provide both economic and environmental services. Based on available data and using the indicators developed in the next section, the actual state of each ecosystem, the extent of its degradation, and the implications for human development are discussed.

Framework for Constructing Indicators

Environmental conditions in the Philippines can be represented by the state of various ecosystems. At least five kinds of ecosystems can be found in the archipelago, namely: forests and mountains, freshwater areas, croplands, marine or coastal areas, and urban areas.

An *ecosystem* is "any spatial or organizational unit made up of living organisms and nonliving substances or conditions that interact to produce an exchange of materials or energy" (Odum 1971). It is a representative unit of the environment, whose state can be defined by the status of functions and services of each ecosystem. It will be self-sustaining and stable as long as enough of its living organisms and nonliving components are present to interact, supply nutrients, or exchange materials and energy. The capacity of the ecosystem to perform its functions depends on the continuity of this interaction, or the maintenance of energy flows or nutrient cycles. In a forest, for example, the nutrient cycle involves animals feeding on plants and on other animals, and the transfer of nutrients from plants and animals to the soil, and from the soil back to the plants.

Tables 37 to 40 present matrices of the four major ecosystems in the country and their respective functions and services. Although all of these ecosystems are interrelated and dependent on the sun and air, each has particular functions that are critical to the survival and development of living organisms, especially humans.

An ecosystem has specific *functions* that, in turn, provide services crucial to human development. However, it also has limits dictated by its distinctive carrying capacity. Columns 1 and 2 of the tables list the functions and services for each type of ecosystem. Column 3 shows the indicators that define the state of each ecosystem, measures that relate to the ability of such ecosystems to continue providing these functions and services. As discussed in this chapter, the ecosystem's overall inability to function sustainably owing to strains exceeding its carrying capacity takes its toll on people as well. This is seen in column 4. It is, therefore, important to realize that the state of the ecosystem eventually has an impact on people, and one has to learn how to read the signs of environmental stress. These relationships are illustrated in Figure 14.

Table 37
FOREST, UPLANDS, MONTANE ECOSYSTEM

Function	Service	Status Indicators	Impact on People
1. Providing a habitat for various species and maintaining diversity of life (habitat complexity)	• Sustenance through nutrient cycle • Gene bank • Life cycle link	• Remaining primary forest • Inventory of indicator species • Number of species	• Foregone potential for health, food and other products • Displacement of indigenous communities • Loss of subsistence or livelihood
2. Maintaining productivity of the forests	• Materials for food, clothing and shelter, medicine, fuel, and other products • Raw materials for industrial uses, e.g., timber, gums, resins, oil, poles, pitprops paper, pulp wood, dyes	• Levels of supply • Forest area by type • Inventory of timber and other forest resources • Rate of decline of species stock • Seedling survival • Area reforested	• Reduced potential for health, food and other products • Reduced supply and higher prices for products
3. Soil stability	• Prevention or minimization of soil erosion • Maintainance of soil fertility • Control of run-off	• Soil erosion rate • Understory regeneration	• Loss of productive lands • Landslides • Threats to life and property
4. Water conservancy	• Adequate and clean water for drinking, irrigation, washing, recreation and others • Watershed	• Water quality • Stream flow and ground water level • Humidity	• Scarcity of potable water; changing water classification • Floods and drought
5. Atmospheric integrity	• Carbon-doxide absorption • Oxygen production • Clean air • Climate regulation	• Air pollution indicators • Climate change	• Pulmonary diseases • Change in sea-level • Desertification • Temperature change

Table 38
FRESHWATER ECOSYSTEM

Function	Service	Status Indicators	Impact on People
1. Habitat complexity	• Fisheries and food biodiversity	• Fish supply level and reproduction • Biological displacement change in species composition or disruption of migration	• Pollution-related diseases • Flooding
2. Water distribution	• Water supply (e.g., irrigation, power generation) • Conveyance	• Salt-water intrusion • Water braiding • Water availability or volume • Water quality	• Relocation of individuals and families • Reduced water supply • Drought • Power outages • Fish kills • Poor state of public health and safety

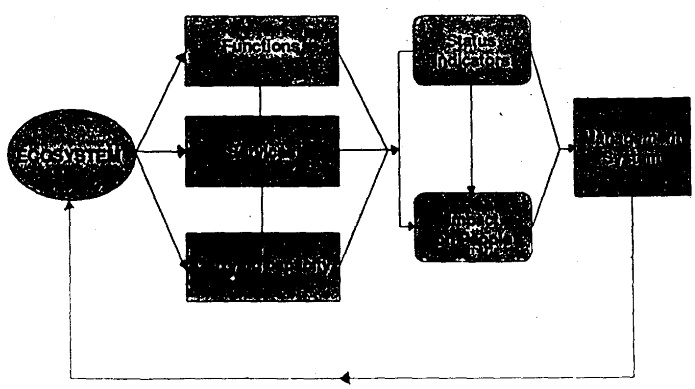
Table 39
CROPLANDS ECOSYSTEM

Function	Service	Status Indicators	Impact on People
1. Soil fertility	• Nutrient recycling • Crop production	• Level of crop production • Biomagnification	• Price levels and fluctuations • Low income
2. Habitat complexity	• Biological pest control providing sustenance and livelihood	• Number of strains and • species resistant to pesticides	• Pesticide-related diseases • Infestation

Table 40
MARINE AND COASTAL ECOSYSTEMS (wetlands, mangroves, seagrass, seaweeds, coral reefs, and soft bottom)

Function	Service	Status Indicators	Impact on People
1. Coastline stability	• Sedimentation trap • Wind- and wave-breaker • Fuel wood supply	• Mangrove forest cover • Seagrass area • Coral area	• Threats to life and property in coastal communities
2. Marine productivity	• Indigenous and commercial uses	• Fish yield	• Low productivity and income • Poorer health and nutrition among communities
3. Atmospheric integrity	• Carbon sink	• Marine pollution levels	• Diseases and poisoning (e.g., red tide) • Fish kills
4. Habitat provision and biological diversity	• Sustenance and livelihood • Gene bank • Life-cycle link	• Lower yields • Species diversity	• Lower productivity and income • Poorer health and nutrition • Reduced potential for pharmaceutical, food, and other consumption or industrial products

Figure 14
ENVIRONMENTAL STATUS INDICATORS



For example, functions of soil stability and water conservancy in the forest may be measured by the rate of soil erosion and water quality. In turn, what is felt by people may either be loss of productive lands or the damage to property and lives because of landslides, a consequence of the forest's inability to perform its job of holding the soil. People realize this when there is marked decrease in crop productivity, scarcity of potable water, or uncommon cyclical occurrences of drought and flash floods in the area, although there may be other reasons for these. A changing global climate may also contribute to this situation. Still, this relates indirectly to the reduction of *global* forest resources.

To ensure that the ecosystem's carrying capacity is not exceeded, people and institutions intervene through resource rehabilitation and management. So, while services like clean air and water are derived from the forest, these must be offset to maintain a balance and sustain the provision of such services. Management allows people to compensate nature for her services. Ecologically, this points to the principle that, in nature, there is no free lunch, or to the second law of thermodynamics.

A common function shared by different ecosystems is the provision of a *habitat* or home to a set of species. The range, composition, and relative dominance of particular species that can be supported will differ from one ecosystem to the next. For instance, forests and marine ecosystems have greater biological diversity than croplands or urban ecosystems.

Each ecosystem has its own energy flows and nutrient cycles and can, therefore, support life. However, some ecosystems are more diverse, and this allows them to perform natural productive functions. For example, the forest and mountain, freshwater, and marine-coastal ecosystems support a more diverse collection of species and they function as integrated, self-sustaining production zones that ensure the reproduction and physical growth of species.

If renewable resources are allowed to regenerate in their respective ecosystems, their stock can increase. Their growth, however, is limited by what is called the *carrying capacity* of the ecosystem. Carrying capacity is simply the maximum number of individuals of a given species that can be supported by a particular environment (Odum 1971). When the environment is damaged, or becomes unproductive or unstable, an ecosystem's carrying capacity becomes severely limited.

Apart from its role in production, an ecosystem performs other critical functions and services that provide stability to itself and the immediate and global environment. The forest-mountain and marine-coastal ecosystems, for instance, protect and stabilize the soil and mountain slopes and the coastlines, respectively. Trees protect the soil by absorbing and deflecting radiation; they prevent erosion by sheltering the soil from strong winds and cushioning the impact of heavy rains and storms.

In contrast to other ecosystems, forested mountains and watersheds also perform a special function. Given the root system of the trees and the soil's organic composition and porosity, forests in a watershed can hold and store underground water, prevent evaporation and excessive flows, and ensure a steady water supply. In effect, this forest function has both a productive and an environmental content: it supplies a basic resource (water), on the one hand, and minimizes the occurrence of ecological instabilities like floods and droughts, on the other.

Environmental stability, particularly the maintenance of atmospheric integrity, is also one of the specific functions of the forest and marine-coastal ecosystems. They help maintain atmospheric integrity because they can absorb carbon dioxide, release oxygen, provide clean air and regulate the climate.

Ecosystem functions and services, thus, refer to the generation and availability of resources and the maintenance of environmental stability. Both functions are complementary. The environment is stable when the ecosystem is productive, and when its overall productivity level is at its best in a stable ecosystem. The purpose of conserving and maintaining the ecosystem is to prevent the disruption of particular environmental functions and services.

Ecosystem carrying capacity and environmental indicators

The health, sustenance and growth of diverse species, including human beings, depend on the natural productivity and stability of the environment. Therefore, it is important to monitor the supply of natural resources, the stability of the ecosystem, or the status of its serv-

Table 41
PHILIPPINE FOREST COVER, 1920-1991

Year	Area (million ha)	[illegible]
1920	18.70	62.33
1934	17.00	56.60
1968	16.00	53.30
1969	10.40	34.00
1976	8.50	28.00
1980	7.40	24.60
1983	7.30	24.30
1988	6.46	21.50
1990	6.20	20.70
1991	6.01	20.03

Source:

Task Force-Total Commercial Log Ban. *Forest Primer,* 1992; BFD, *Philippine Forestry Statistics,* 1990; BFD. "Master Plan for Forestry Management," 1990; DENR.. "Report on the Philippine Environment in the Eighties," 1990.

ices. For this purpose, particular indicators are useful.

Ecosystems can yield only a particular volume or output of resource supplies. Two major types of resources are drawn directly from particular ecosystems, depending on the time it takes for them to develop: (1) "stock" or *nonrenewable* resources, such as exhaustible fossil fuels, gas, geothermal, earth materials, and metallic and elemental minerals; and (b) "flow" or renewable resources, such as plants, animals, soil, ground water, marine resources, and microbial organisms.

The extraction or use of stock resources results in their reduction or depletion. For potentially renewable resources, the existing stock will not be sustained if the rate of exploitation exceeds the natural growth rate. For these reasons, the extraction levels for both kinds of resources must be monitored. This requires an indicator of the existing stock of various natural resources relative to earlier stocks, or a measure of the extent of resource degradation or loss.

In particular, it is important to have an indicator of the availability and rate of loss of the critical resources, such as trees in forests and mangroves, sea grasses and coral reefs in marine and coastal ecosystems, and oxygen in freshwater systems. These resources represent the essence of a particular ecosystem, without which its existence is imperiled. The stock of critical resources must be monitored, not only because their diminution affects the nutrient cycle and biodiversity in a particular ecosystem, but also because their loss destabilizes the ecosystem and prevents it from performing its environmental services.

While an ecosystem's carrying capacity sets a limit to the growth of renewable resources, there is also a limit to the amount of waste it can absorb. Waste is inevitably generated in the process of extracting natural resources, economic production, and consumption.[1] Hence, net of recycling, economic growth results in an accumulation of waste in the environment. Much of the increasing waste, however, is not benign. They can transform the physical and chemical character of the environment, destroy existing resources, and make it acidic or detrimental to the health of living species, including humans, and the overall quality of life.

State of the Major Ecosystems and Impact on People

Forests

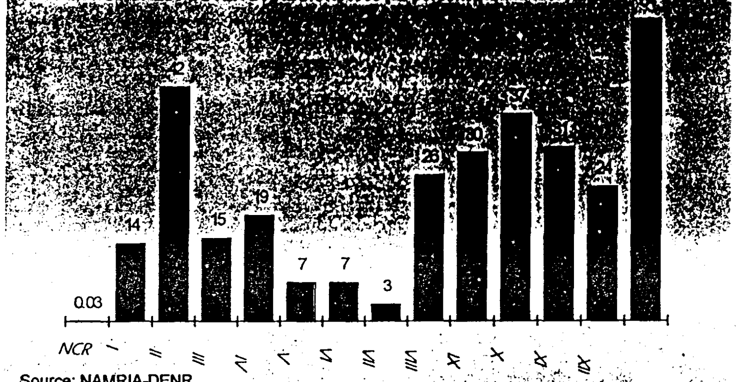
In continental Asia, approximately 115.41 million hectares of forest were denuded in the 1980s alone (WRI 1992). Worldwide today, only about one-fourth of the world's total land area is covered by forest, while only a decade ago, the world's forests were estimated to be one-third of the world's land area.

Ideally, the forest cover for the country should be 54 percent of its land area.[2] Using this as basis, the Philippine forest cover is 34 percentage points below ideal. There is no region and only one province in the country that is within the standard of the ideal forest cover. Only Palawan in 1988 had 54 percent forest cover. Figure 15 shows the extent of forest cover per region, while Table 41 shows the national forest cover through the years.

[1]This is a consequence of the second law of thermodynamics.

[2]Dr. Percy Sajise et al. in "State of the Nation Reports: Saving the Present for the Future" (UPCIDS 1992).

Figure 15
REMAINING FOREST COVER BY REGION, [illegible] (as percent of land area)



Source: NAMRIA-DENR

From a deforestation rate of 119,000 hectares yearly as of 1990, the DENR cites a deforestation figure of 100,000 hectares for 1991. Government figures claim that the ratio between reforestation and deforestation is one-to-one (TCLB 1992). This is too optimistic, however, since it fails to consider the number of planted seedlings that fail to survive. In 1990, Environmental Management Bureau-Department of Environment and Natural Resources (EMB-DENR) reported a total of 191,663 seedlings planted for reforestation, but the actual number of seedlings used was only 50 percent of this. Net deforestation continues to occur at 14,169 hectares annually (Figure 16).

The world's tropical forests covered only about nine million square kilometers, or one-sixteenth of the earth's surface. This area houses two-thirds of all the species of plants and animals in the world (Myers 1984). About 13.8 percent of the global floral species alone can be found in 10 "hotspot" areas in tropical forests including the Philippines. Table 42 lists the 10 areas and the corresponding original forest, the present primary forest and plant species, and the total identified and percentage of endemic species (i.e., unique to the area). Biological resources have been recognized as providing the basis of all life on earth, and it fulfills a very basic requirement for existence. The tropical rain

Figure 16
THE DECLINE IN FOREST COVER

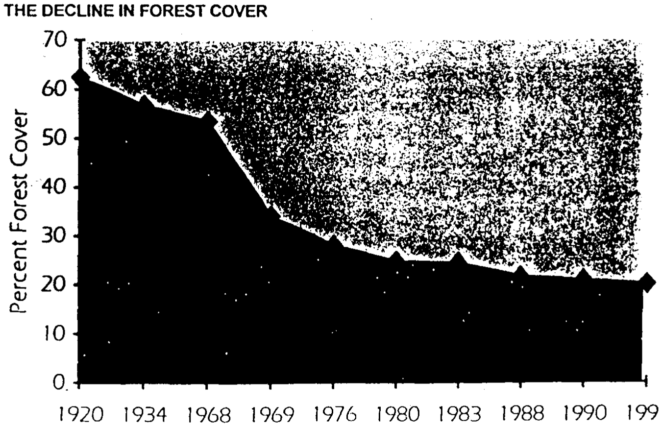


Table 42
SOME "HOTSPOT" AREAS IN TROPICAL FORESTS, 1988

Area	Original extent of forest	Present primary forest (1,000 ha)	Plant species in original forest	Number of endemic species in original forest
Madagascar	6,200	1,000	6,000	4,900 (82)
Atlantic forest	100,000	2,000	10,000	5,000 (50)
Western Educador	2,700	250	10,000	2,500 (25)
Colombian Choco	10,000	7,200	10,000	2,500 (25)
W. Amazonian Uplands	10,000	3,500	20,000	5,000 (25)
Eastern Himalayas	34,000	5,300	9,000	3,500 (39)
Peninsular Malaysia	12,000	2,600	8,500	2,400 (28)
Northern Borneo	19,000	6,400	9,000	3,500 (39)
Philippines	25,000	800	8,500	3,700 (44)
New Caledonia	1,500	150	1,580	1,400 (89)
TOTAL	220,400	29,200		34,400 (13.8)

Note: Figures in parentheses represent the percentage of flora endemic to that region; the total 13.8 is the percentage of the world's flora endemic to these ten regions.
Source: N. Myers (1984).

forest is one of the most biologically diverse ecosystems in the world.

Biological diversity is an umbrella term for the degree of nature's variety. It may be observed at three levels: the ecosystem, the species, and the genetic levels. What is most familiar to many is the species diversity. Although the Philippines has a relatively lower number of identified species compared to other countries, the variety and potential for genetic diversity are greater owing to the island formations. Much of the country's biological diversity is still being inventoried. The most complex ecosystems in the world are represented in the Philippines.

Habitat loss is an indicator of the loss of diversity of species. In tropical Asia, only Hongkong, Bangladesh, Sri Lanka, Vietnam and India have a rate of habitat loss worse than that of the Philippines (Table 43). At the local level, *biogeographic regions* based on land species are shown and birds may be used as one indicator. These are shown in Figure 17. The forests of Sierra Madre are currently considered the most important area in the Philippines endemic to birds. For the diversity of its bird species, Region II can be ranked first in the country. NCR has the least forest cover and ranks last among the regions. Even the Sulu archipelago or Region IX-A ranks higher than NCR, based on bird species diversity. This means the potential for using natural resources is higher for Regions II and IX-A than for NCR.

The rate of habitat loss indicates not only the loss of "natural products" that people can trade in but also the level of non-income use values, options values, and existence values.

Freshwater ecosystem

The country has approximately 421 major and principal rivers and similar water systems, with a total area of 569,000 hectares (PEDR 1992). The Bureau of Mines in 1980 (Table 44) estimated the capacity of ground water resources in the country to be 251,158 million cubic meters, which can still be harnessed to around 260,000 million cubic meters for domestic, industrial, and agricultural uses. The impact of poor watershed management on ground water resources is clear in the case of salt water intrusion in the islands with poor forest cover, such as Cebu, and the dwindling potable

Table 43
WILDLIFE HABITAT LOSS IN TROPICAL ASIA

Rank	Country	Original Wildlife Habitat ('000 ha)	Habitat Remaining	Habitat Loss %
1	Brunei	576	438	24
2	Bhutan	3,450	2,277	34
3	Malaysia/ Singapore	35,625	21,109	41
4	Indonesia	144,643	74,686	49
5	Nepal	11,707	5,385	54
6	Japan	32	14	57
7	China	42,307	16,500	61
8	Burma	77,482	22,598	71
8	Laos	23,625	6,866	71
8	Taiwan	3,696	1,072	71
9	Thailand	50,727	13,004	74
10	Kampuchea	18,088	4,341	76
11	Pakistan	16,590	3,982	75
12	Philippines	30,821	6,472	79
12	India	310,701	61,509	80
12	Vietnam	33,212	6,642	80
13	Sri Lanka	6,470	1,100	83
14	Bangladesh	14,278	857	94
15	Hongkong	107	3	97

Source: McNeely, J. et al. (1990)

Table 44
ESTIMATED STORAGE CAPACITY OF GROUNDWATER RESOURCES, 1980 (in million cubic meters)

	Region	Storage Capacity
I	Ilocos	1,866
II	Cagayan Valley	11,850
III	Central Luzon	54,700
IV	Southern Tagalog	37,000
V	Bicol	4,500
VI	West Visayas	55,242
VII	Central Visayas	1,700
VIII	East Visayas	8,400
IX	Southwestern Mindanao	14,700
X	Northern Mindanao	15.950
XI	Southeastern Mindanao	9,750
XII	Southern Mindanao	36,000
PHILIPPINES		**251,158**

Source: DENR. "Philippine Environment in the Eighties." (1990)

water supply for the NCR and other urban centers, especially during the summer months.

In relation to fish production, freshwater ecosystems include those developed into fishponds, fish cages, and major fishing grounds, e.g., lakes covering over 13,000 hectares. The area developed for fishpond culture increased from 176,000 to 229,000 hectares between 1976 and 1987. The conversion has primarily affected the mangrove ecosystems.

Environmental concerns and issues for this particular ecosystem include the stress brought about by population pressure, sedimentation, increased industrial development, and run-off from agricultural lands.

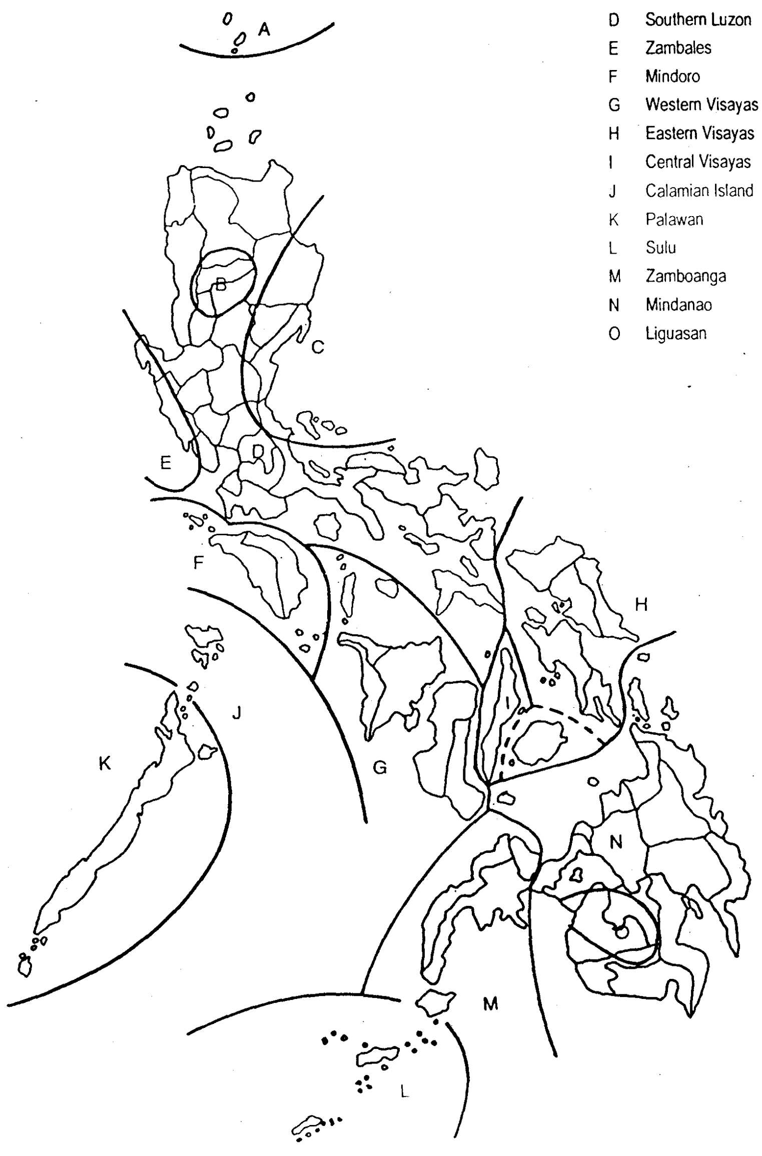
Agricultural ecosystems

More than one-fifth (26 percent or 7.92 million hectares) of the country's total land area is allotted to crops. For Southeast Asia, this is second only to Thailand's 38 percent (WRI 1992). Agriculture remains a primary contributor to the economy through output and exports. Although the share of agriculture in output has slowly declined, more than half of the population still live in the rural areas and depend to a greater or lesser extent on agriculture for employment and livelihood.

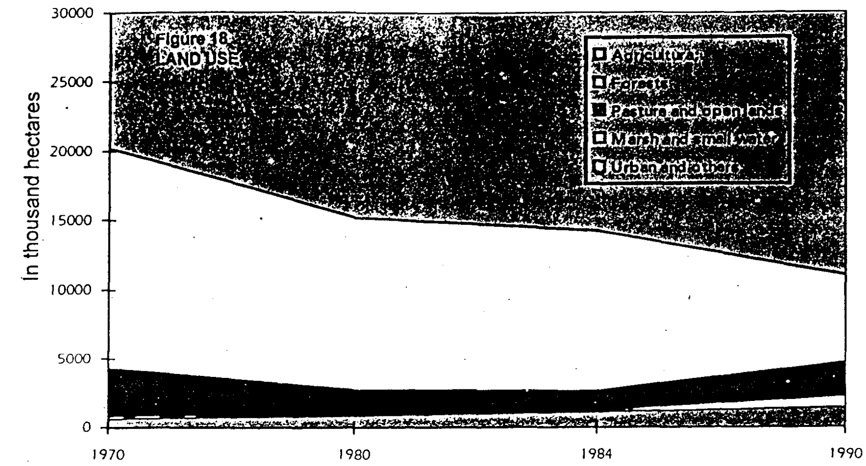
Even now, rich agricultural lands are being lost due to increasing urban pressures. Throughout the 1980s, croplands were converted into residential subdivisions and industrial estates. As fertile lands were lost upon conversion, lowland farmers turned to cultivate the marginally productive upland areas, further reducing the country's already scarce forest resources (PEDR 1992). Figure 18 and Table 45 show trends in land use for the past 20 years, indicating an increase in croplands and a decrease in forest areas.

The aggressive use of agricultural chemical inputs, such as fertilizers and pesticides, has also taken its toll on croplands by degrading soil quality and water bodies

Figure 17
BIOGEOGRAPHIC ZONES OF THE PHILIPPINES



- A Batanes
- B Cordillera
- C Sierra Madre
- D Southern Luzon
- E Zambales
- F Mindoro
- G Western Visayas
- H Eastern Visayas
- I Central Visayas
- J Calamian Island
- K Palawan
- L Sulu
- M Zamboanga
- N Mindanao
- O Liguasan



[e]Estimate based on constant 1970-84 growth rates of urban use

through chemical loading. Between 1973 and 1983, annual fertilizer consumption increased by an average of 4 percent; 1988 figures recorded fertilizer consumption at about 1.2 million metric tons. On the other hand, pesticide use registered a threefold increase between 1980 and 1987, from 4,725 to 15,901 metric tons (EMB 1990). These chemical inputs eventually end up in the rivers and oceans. How toxic any substance is depends on dosage or concentration, as well as on the ability of the natural cycles to break it down into elements. Reports of pesticide poisoning have been on the rise, but according to the Department of Health, more are unreported. The health implications of chemical fertilizers and pesticides on humans must not only consider current concentration levels, but also the phenomenon of biomagnification.

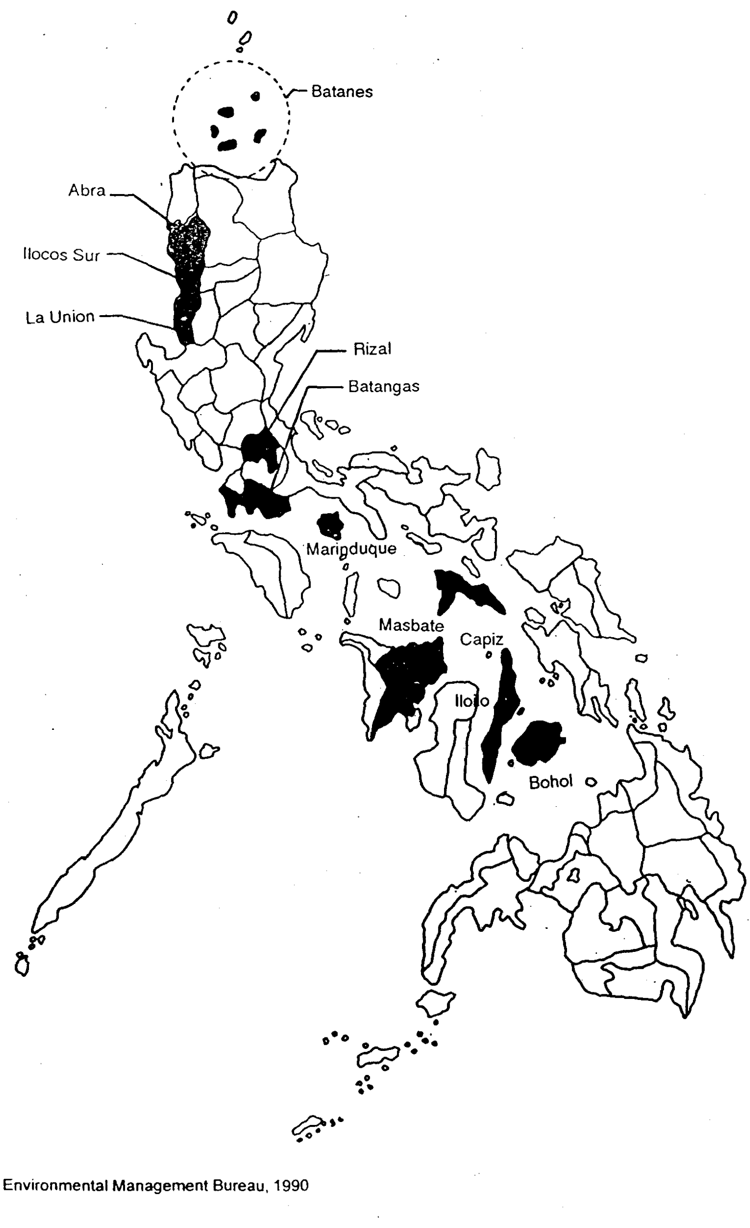
Another problem plaguing Philippine agricultural lands is *soil erosion*. About half (49.5 percent or 3.8 million hectares) of agricultural lands are subject to moderate to severe erosion (PEDR 1992). Ten provinces already have more than half of their cropland areas eroded, causing an estimated average loss of 74.5 million tons of fertile topsoil annually. Figure 19 shows the extent of soil erosion per province. Most erosion is due to improper land use (e.g., monoculture, shifting cultivation) and the deforestation of sloping areas due to indiscriminate logging and firewood gathering.

Table 45
TRENDS IN LAND USE, 1970-1990 (in 1,000 ha)

	1970		1980		1984		1989-1990	
Land Use	Area	(%)	Area	(%)	Area	(%)	Area	(%)
Agricultural	9,795	33	14,795	49	15,782	53	18,927[e]	63
Pasture and open lands	3,486	12	1,790	6	1,466	5	2,490	8
Marsh and small water	215	1	115	0	106	0	813	3
Forests	15,899	53	12,457	42	11,556	39	6,307	21
Urban and others	605	2	843	3	1,090	4	1,463[e]	5
Total	30,000	100	30,000	100	30,000	100	30,000	100

[e]Estimate based on constant 1970-1984 growth rates of urban use

Figure 19
SOIL EROSION IN THE PHILIPPINES
(Provinces with more than half their area eroded)



Source: Environmental Management Bureau, 1990

Box 4.1
LOST FOREST, GRAVE FLOODS

Advocates of the environment have said much about now deforestation worsens the effects of natural calamities, such as typhoons. Anyone familiar with the water cycle would appreciate the functions of tropical forests in retaining water and stabilizing the soil. These functions are critical in the face of the torrents and strong winds characteristics of typhoons.

Because of the many intervening factors, however, there is at present no simple way to "document" this aspect of the consequence of deforestation. For example, one cannot learn much by simply correlating typhoon damage and forest cover. Palawan, of course, has never really been devastated by typhoons, and its forest cover of 54 percent of land area is highest among all the provinces. Yet the provinces in Region X and XI — regions with the third- and fourth-highest forest cover, respectively — suffered the most damage from typhoons during the years 1982 and 1989, according to figures from the National Disaster Coordinating Council. On the other hand, in 1992, Region III, with only 16 percent forest cover, bore the brunt of typhoon damage which amounted to P681 million. Similarly, Northern Leyte, of the infamous Ormoc tragedy, was one of the provinces most affected by typhoons in 1989 and 1991; its forest cover was only 13.6 percent.

Obviously, a number of other considerations must be made when relating forest degradation and typhoon destruction in the same breath. Some of these other factors are frequency of typhoons, their comparative intensity, and human preparedness. However, a basic knowledge of the earth's natural processes should suffice to make one realize that forests should be conserved. For this, certainly, the proof of a thousand lives lost is superfluous.

Marine and coastal ecosystem

The Philippine coastline measures 22,540 kilometers, and its exclusive economic zone covers 1,786 square kilometers (WRI 1992). The coastal zone is rich in fish and other aquatic products. It serves as a major human settlement area and is an outstanding feature of the country's topography. The coral reefs and mangrove forests are two of the principal features of this ecosystem.

Philippine coral reefs belong to what is known globally as the "Coral Triangle." They constitute one of the country's more resplendent coastal resources, with around 400 out of the world's 500 known coral species found in Philippine coastal waters. Unfortunately, even as early as 1981, one-third of the country's coral reefs were already in poor condition (Table 46), while only 5.5 percent still had intact coral cover. The destruction of coral reefs is caused largely by ruinous fishing methods, collection for ornamental or construction purposes, and silting, natural calamities, and pollution.

Mangrove forests are also a foundation for the country's fisheries. In 1918, there were approximately

Figure 20
ESTIMATES OF MANGROVE COVER BY REGION, 1988 (in hectares)

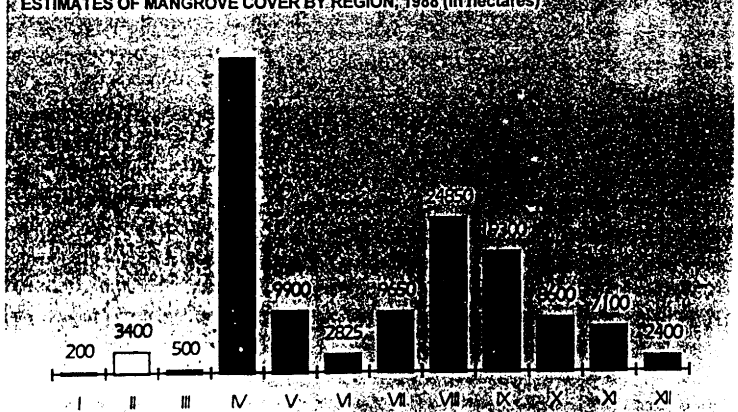


Table 46
CONDITION OF PHILIPPINE CORAL REEFS
(percent of total reefs)

Location	Excellent	Good	Fair	Poor
Region I				
La Union	0	20.0	40.0	40.0
Pangasinan	0	21.6	37.8	40.5
Region II				
Cagayan	0	50.0	50.0	0
Isabela	0	66.7	33.3	0
Region III				
Bataan	0	0	0	100.0
Zambales	0	16.7	25.0	58.3
Region IV				
Batangas	0	24.0	44.0	32
Cavite	0	0	66.7	33.3
Marinduque	0	0	80.0	20.0
Occ. Mindoro	3.2	25.8	48.4	22.6
Or. Mindoro	9.1	18.2	36.4	36.4
Palawan	12.2	34.7	40.8	12.2
Quezon	0	50.8	—	0
Region V				
Region VI				
Antique	16.7	83.3	0	0
Iloilo	14.1	28.1	42.2	15.6
Negros Occidental	5.6	11.1	27.8	55.6
Region VII				
Bohol	0	36.4	36.4	27.2
Siquijor	0	29.0	29.0	41.9
Negros Or.	5.1	20.4	41.8	32.6
Apo Is.	0	100.0	0	0
Cebu	9.4	21.9	42.2	26.0
Hilutanyan Island	0	25.0	0	75.0
Mactan Island	6.7	20.0	20.0	53.3
Sumilon Island	0	75.0	0	25.0
Olango Island	0	14.3	57.1	28.6
Region VIII			—	—
Region IX				
Zamboanga del Norte	5.6	16.7	33.3	44.4
Aliquay Island	25.0	37.5	25.0	12.5
Sinog Island	0	0	14.3	85.7
Region X				
Misamis Occidental	0	0	44.4	55.6
Misamis Oriental	0	0	0	100.0
Regions XI and XII	—	—	—	—
TOTAL	5.5	24.0	38.3	32.1

Source: *Southeast Asia Regional Consultation on People's Participation in Environmentally Sustainable Development*, Vol. 11, National and Regional Reports. Asian Nongovernment Organization Coalition (ANGOC), 1991.

* Excellent (75-100%); Good (50-74%); Fair (25-49.9%); Poor (0- 24.9%)

500,000 hectares of mangroves in the country; in 1988 there were only between 139,725-149,000 hectares.[3] The regional picture is suggested in Figure 20, with Region IV having the highest, and Region I having the lowest mangrove cover. The Asean region accounts for 26 percent of the world's mangrove forests, and Philippine mangroves comprise only 1.1 percent of this figure. Mangrove deterioration is attributed to the expansion of fishponds and coastal communities and the harvesting of fuel wood.

The average annual marine fish catch is 1,478,100 metric tons, while the average annual freshwater fish catch is 554,500 metric tons. These are second and third highest, respectively, among Southeast Asian countries. If the destruction of coral reefs and mangrove forests continues at historical rates, however, it is highly doubtful whether these levels of production can long be sustained.

[3]The lower figure is from ERDB-NAMRIA-DENR (1989); the higher one from Chua and Scura (1990).

Box 4.2
AIR POLLUTION: THE HEALTH IMPACT ON METRO MANILANS

Air pollution is a major and increasingly worsening environmental problem in Metro Manila and other urban centers in the country. The progressive deterioration of air quality is exacting a toll on the health of the urban people, often without them being aware of it. Fortunately, there are two studies on urban air quality that illustrate the direct impact on people of a degenerating environment.

In 1990, the University of the Philippines College of Public Health conducted a study that monitored the levels of specific air pollutants among jeepney drivers, air-conditioned bus drivers, and jeepney commuters who are daily exposed to vehicle emissions. The study showed that **levels of ingested pollutants, such as particulate matter (PM), lead (Pb), carbon monoxide (CO), and sulfur dioxide (SO_2) were *100 percent higher* among the subjects, with jeepney drivers suffering the most exposure owing to their work. Jeepney drivers were also found to have the highest incidence of lung diseases, compared to commuters or air-conditioned bus drivers. Among other major aggravating factors were cigarette smoking, age and duration of employment.**

In an earlier study on the effects of air and water pollution among children and adult residents of Metro Manila (Santos and Cunanan 1978), the incidence of acute upper respiratory infection was 57 percent among children and 36 percent among adults surveyed; 9 percent had asthma and 3 percent had chronic airway diseases.

Urban ecosystem

The strain on the urban ecosystem is primarily manifested in the deteriorating quality of air and water due to pollution.

Air pollution

A good deal of the world's total carbon emissions still comes from the developed countries, but their share has declined through time. In 1950, the developed countries of North America and Western Europe accounted for 71 percent of world carbon emissions, but this had declined to 56 percent in 1965 and 42 percent in 1983. On the other hand, the share of air pollution by the developing countries had grown rapidly. In 1950, the South and Southeast Asian regions accounted for only 1.7 percent of world carbon emissions; this rose marginally to 2.7 percent in 1965 and to 5.3 percent in 1983 (WRI 1992).

Air pollution comes from stationary sources, such as industrial firms, and mobile sources, such as motor vehicles. Most data on air pollution in the country are from Metro Manila. The Asian Development Bank and DENR study (1992) reveals that 60 percent of air pollution in Metro Manila comes from vehicles, and 40 percent from industries (Box 4.2). Air pollution levels in Metro Manila exceed the guidelines proposed by the World Health Organization in four important aspects (Table 47).

The Land Transportation Office reported an increase of 9.57 percent in motor vehicles registered between 1991 and 1992. As of end 1992, a total of 799,754 to 1,879.563 motor vehicles were registered throughout the country. Of this, 42.6 percent were to be found in Metro Manila and 30.6 percent were diesel-fed. The census of 1988 reported a total of 17,000 firms located around the Pasig River, with 315 of them considered most polluting.

Water pollution

The EMB-DENR reported that water pollution in Metro Manila and other urban centers has been estimated to come mainly from household sources (70 percent) and only secondarily from industry (30 percent). Waste generated by the general public is simply allowed to flow or to discharge into various river systems. Despite

Table 47
EMISSION OF POLLUTANTS BY MOBILE SOURCE
(National Capital Region)

Pollutants	198[illegible] (Extrapolated)	1992 (Estimated)	WHO Standard
CO	18.13	20.60	30.00
NO_2	0.21	0.24	0.14
SO_2	0.035	0.04	0.07
PM^{10}	275.44	313.00	150.00
Pb	29	33.00	15.00

Sources: ADB. 1992 and URBAIR: Urban Quality Management in Asia, June 1993

Table 48
COLIFORM COUNTS IN SELECTED COASTAL AREAS IN THE PHILIPPINES (mpn/100 ml)

Location	1978	1982	1985
I. Manila Bay			
1. Punta Grande	760	373	3332
2. Villa Susana	1,200	1,400	12,960
3. Star Fish	900	616	19,892
4. San Agustin	1,000	1,468	10,679
5. San Isidro	1,400	1,212	1,2955
6. Villamar	760	257	3,128
7. Lido	800	272	3,431
8. Mabuhay	660	355	3,369
9. Future Seaside of MCCRRP		58,026	62,254
10. Baclaran	-	986,084	
11. Seaside of MCCRRP (CDCP)	-	16,782	22,504
12. Northwest of CCP	-	18,952	17,361
13. South Breakwater	-	-	
14. Holiday	-	299	3,522
15. Garden Coast	-	255	3,408
16. Pasig River Outlet	-	86,442	79,339
17. Luneta Grandstand	-	-	297,641
18. Vitas Navotas	-	-	512,120
II.			
19. Davao City	-	-	2,002
III.			
20. Cebu Harbour	18,139[a]	-	

[a]1977

Source: United Nations Environmental Programme. *Regional Seas Reports and Studies*, No. 120, 1990.

information on sources of pollutants, there are no available surveys on the effects of organic pollutants on public health on a regional basis. However the United Nations Environment Programme-Southeast Asia (UNEP-SEA) report says that "concentrations of coliform for selected bays exceed national standards, which may mean potential risk for exposure to human pathogens and consequent disease transmission."

The coliform count standard for recreational waters is a maximum allowable total of 1,000 mpn per 100 ml, while that for aquaculture is 5,000 mpn per 100 ml (Gomez et al. 1990). Table 48 shows that the waters of Davao City, Manila, and probably Cebu Harbor, exceed the coliform standard for recreational waters. The Navotas and Luneta Grandstand area, and the Pasig River outlet have the highest coliform counts for Metro Manila, exceeding the standard for aquaculture.

As early as 1971, various water systems in other parts of Luzon, the Visayas, and Mindanao have likewise been considered polluted in varying degrees. As in air pollution, the 315 most polluting industries around the Pasig River discharge waste water into the river either untreated or insufficiently treated.

Another major concern regarding water pollution is the mine wastes and tailings from mining industries throughout the country. About 300,000 tons of mine tailings are generated annually from metallic mining firms alone. Of these, around 145,000 tons are dumped directly into the sea through pipeline systems. Sedimentation smothers coral reefs and other marine life, but little is known about the effects of the toxic ions in these tailings on humans. Table 49 shows the level of specific heavy metal pollutants in some Southeast Asian countries. These heavy metals may have come from mine tailings and/or agricultural runoff.

Recommendations

It is difficult to empirically correlate the environment simply and directly with human development. The main reason is that data are unavailable. There have been very few case studies, for example, on specific pollutants and their direct impact on the health of the Filipino people. On the issue of air pollution, what is needed is a study across generations showing the effects of some air pollutants in the Philippines.

Table 49
CONCENTRATION (MG/KG) OF HEAVY METALS IN MARINE BIOTA

Locality		Cd	Cu	Hg	Pb	Zn	Remarks
Indonesian Waters							
Fish	(1979)	0.02	0.33	0.02	0.09	0.3	Polluted
		0.03	0.68	0.2	0.68	9.96	
Shellfish	(1979)	0.02	0.08	0.05	0.68	11.31	Polluted
		0.25	3.18	0.5		19.85	
Gulf of Thailand							
Fish	(1975)	0.01	0.5	0.01	0.01	6.2	Ambient
		0.06	1.25	0.1	0.09	11.8	
Pema viridis		0.13	2.97	0.001	0.54	78	Ambient
1984		1.05	11.48	0.025	2.05	201	
Crassostrea commercialis		0.76	70.9	0.002	1.5	424	Ambient
1984		5.02	185.7	0.03	5.19	1,347	
Philippine Waters							
Fish	(1974-1985)	Trace	Trace	0.01	0.01	0.2	Polluted
		0.36	4.43	1.1	0.08	58.4	
Shellfish	(1975-1982)	0.02	2.36	0.02	0.04	10.4	Polluted
		3.84	51.9	0.84	2.2	201	
Hong Kong Waters							
Fish	(1976-1979)	Trace	Trace	Trace	Trace	2.3	Ambient
		-	0.3	0.1		6.6	
		Trace	Trace	Trace	Trace	0.8	Polluted
		-	1.1	0.4	0.3	25.4	
Shellfish		Trace	1.1	Trace	Trace	10.1	Ambient
	(1976-1979)		35.2	0.1	3	105	
		Trace	6.3	Trace	Trace	13.5	Polluted
		5.4	309	1.3	0.4	662	

1. Values are expressed in terms of wet weight.
2. Minimum and maximum values.
3. Values expressed in terms of dry weight.
4. Including mollusks and crustaceans.
5. The above levels are compiled based on all the existing published data on metal levels in fin fish, oysters, crustaceans and other mollusks.

Similarly, local data have not been consistently generated for the use of local governments. This makes it difficult to compare ecosystem types across regions. In certain cases, varying sources present conflicting data. For example, in the table showing mangrove forest cover per region, there are large disparities in the figures of the data-gathering agencies. These discrepancies can be avoided by checking data through field verification. Just as there is a great need to gather more data, there is also a need to minimize overlaps in data-gathering efforts to develop efficiency and promote closer collaboration among agencies, projects or departments intending to produce such data.

There is a need to bring together all research institutions housed in the various government departments in order to share information, resources, and methodologies, such as formulating and using economic models. It is better for the government to come out with a single data set that reconciles all the sources, rather than show conflicting information that can confuse local and national policymakers.

Apart from concerns about information, the much greater need is to come up with decisive policies that address the most pressing environmental issues involving resource conservation, rehabilitation, and renewal. A minimal list of the most urgent issues alone will be formidable since it will involve questions on commercial logging rights, ancestral domains and rights of indigenous peoples, extraction of and trade in wildlife species, deleterious effects of mining, displacement of upland farmers, recycling, protection of coral reefs and mangroves, and renewed initiatives for environmental education.

Various social sectors have consistently demanded that the government officially subscribe to a strategy of sustainable resource management. In the end, however, this should be manifested in policies with a distinct preference for maintaining the resource base, while recognizing that resource degradation is affected by socio-economic complexities such as poverty, population growth, international trade and investment patterns, and indebtedness. Notwithstanding the publicity, interest, and funds devoted to the environment issue in recent years, it is clear that information gathering and monitoring are still at the most rudimentary levels. Efforts toward environmental policy changes and the will to enforce them are way below par, as indicated by the delay in the legislation of measures to protect forest resources, among other indicator.