THE PHILIPPINE ENVIRONMENT IN THE EIGHTIES

Department of Environment & Natural Resources

Environmental Management Bureau

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6th Floor, Philippine Heart Center Bldg.
East Avenue, Diliman, Quezon City

DEPARTMENT OF
ENVIRONMENT AND
NATURAL RESOURCES

Memorandum for the President

November 19, 1990

MEMORANDUM

FOR : **Her Excellency**
The President
CORAZON C. AQUINO

FROM : **The Secretary**
Department of Environment and
Natural Resources

SUBJECT : **REPORT ON "THE PHILIPPINE ENVIRONMENT IN THE EIGHTIES"**

Transmitted herewith is the Report on **"The Philippine Environment in the Eighties"**. The report presents an assessment of the situation of the country's various ecosystems. It also identifies important environmental problems/issues and future actions.

This report is submitted in accordance with the powers and functions of the Environmental Management Bureau of this Department as defined by Executive Order No. 192.

FULGENCIO S. FACTORAN, JR.

FOREWORD

The past decade brought more sharply into focus raging environmental issues which first attracted national attention in the late seventies. The continuous decimation of our forests; deterioration of our seas, oceans and coasts; fouling of our rivers and lakes; and, rapid transformation of our cities into quagmires of human misery due to population growth outstripping basic services, have become even more pronounced in the eighties. While such developments have not exactly catapulted the environmental cause to the very top of the national agenda, they have served to galvanize many sectors of society into action. The eighties,therefore, was a crucial period which saw more militant environmental groups come into existence as a result of the country's environmental problems and a people more determined to preserve what's left of their natural heritage for their children and future generations.

The just concluded decade was also a period of hope for it opened up new options of healing the earth and undertaking development with minimum environmental destruction. The concept of sustainable development, which has become increasingly accepted worldwide, has also started to take root locally. The formulation and recent adoption by the Cabinet of the Philippine Strategy for Sustainable Development augurs well for the environmental cause. But it is only the beginning of a mammoth task which requires the cooperation and efforts of all segments of Philippine society. This book is our humble contribution to this consolidated effort. Hopefully, it will provide a more solid basis for coming to grips with our environmental dilemma.

DELFIN J. GANAPIN, JR.
Director

PREFACE

In 1977, the first attempt to document the state of the Philippine environment was undertaken by the National Environmental Protection Council, a body created to oversee environmental protection efforts in the country. Yearly thereafter, it produced environmental status reports until 1985. Ten years later, this task was charged to the Environmental Management Bureau. In keeping with tradition, therefore, we have come up with the latest situationer on the state of the country's environment.

But more than just providing the latest statistics and information, "The Philippine Environment in the Eighties" chronicles developments in the nation's various ecosystems for the past decade, identifying problems and important issues in the process. Prospects for future actions are likewise presented, arising from the gaps in past and current environmental management efforts. Hopefully, these would be taken up by decision-makers and entities who are in a position to implement these recommendations.

The document is divided into nine sections: Atmosphere and Climate; Marine Environment; Inland Waters; Forests; Agricultural Lands; Mineral Resources; Energy Resources; Population, Human Settlements and Environmental Health; and, Environmental Administration. The first seven sections of the report deals with sectors of the physical environment, while the section on Population, Human Settlements and Health deals with the human situation, discussing population distribution and growth, changing patterns of health and diseases and human settlements. Environmental Administration discusses not only government policies and structures on environmental management but also the growth of the environmental movement through the non-governmental organizations. Each section provides sectoral trends, problems and issues, management efforts and prospects for action in the sector. Most of the problems and issues discussed in this document were already identified in the late seventies and the portion on management efforts is therefore an attempt to document measures undertaken to confront these problems.

With the help of sectoral experts, we have exerted efforts to quantify changes. A most perplexing problem encountered, however, was the dearth of reliable and updated data in almost all of the sectors. The proliferation of conflicting data on the same subjects were also not uncommon. Care was therefore taken, to obtain data from their original sources. Data in earlier decades are cited in the report to place in proper context the environmental data of the eighties.

We are very much indebted to our colleagues within the Bureau, in other government agencies and the academe whose names appear in the following page, for providing data and information, as well as, reviewing initial manuscripts for the report. This document represents the collective endeavor of a motley of individuals and institutions. For its shortcomings, however, we accept final responsibility.

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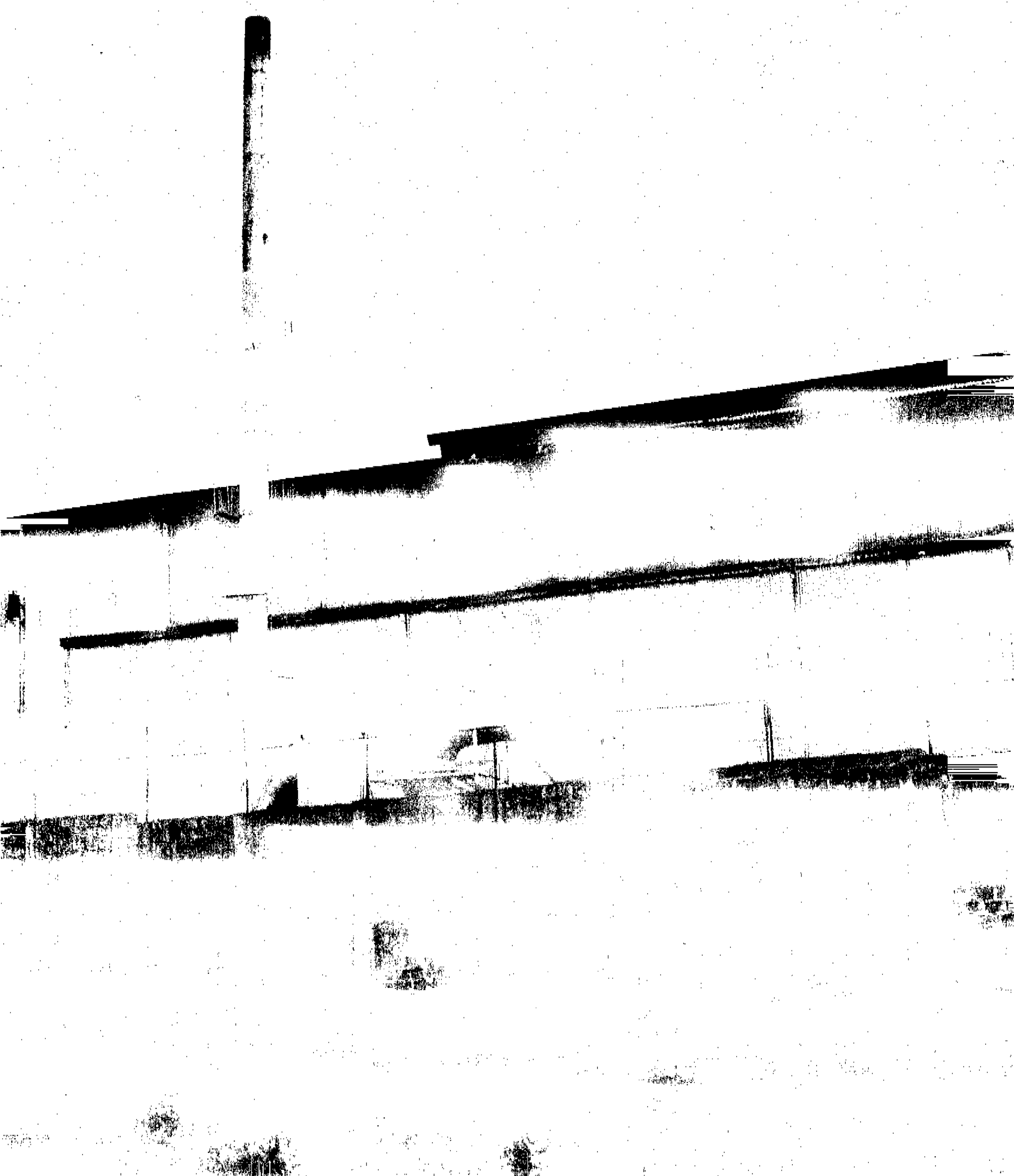
ABBREVIATIONS OF AGENCIES AND ENTITIES

ADB	-	Asian Development Bank
AF	-	Association of Foundations
AFC	-	Atlas Fertilizer Corporation
ANGOC	-	Asian NGO Coalition for Agrarian Reform and Rural Development
ARDP	-	Artificial Reef Development Program
ARIS	-	Agro River Irrigation System
ASEAN	-	Association of South East Asian Nations
BCFTPP	-	Batangas Coal-Fired Thermal Power Plant
BFAR	-	Bureau of Fisheries and Aquatic Resources
BFD	-	Bureau of Forest Development
BMGS	-	Bureau of Mines and Geo-Sciences
BPI	-	Bureau of Plant Industry
CBCP	-	Catholic Bishops Conference of the Philippines
CBPNI	-	Community-Based Project for Nutrition Improvement
CHEMPHIL	-	Chemical Industries of the Philippines
CITES	-	Convention on International Trade of Endangered Species of Wild Flora and Fauna
CRMF	-	Conservation and Resources Management Foundation, Inc.
CRMP	-	Coastal Resources Management Program
CVRP	-	Central Visayas Regional Project
DA/DAF	-	Department of Agriculture/Department of Agriculture and Food
DEWMS	-	Drought Early Warning and Monitoring System
DECS	-	Department of Education, Culture and Sports
DENR	-	Department of Environment and Natural Resources
DEENR	-	Department of Environment, Energy and Natural Resources
DNR	-	Department of Natural Resources
DOH	-	Department of Health
DOST	-	Department of Science and Technology
DOTC	-	Department ofTransportation and Communication
EENP	-	Environmental Education Network of the Philippines
EMB	-	Environmental Management Bureau
EMS	-	Environmental Management Sector
ERDB	-	Ecosystems Research and Development Bureau
FAO	-	Food and Agriculture Organization
FINNIDA	-	Finnish International Development Agency
FMB	-	Forest Management Bureau
FORI	-	Forest Research Institute
FORPRIDECOM	-	Forest Products, Research and Industries Development Commission
FPA	-	Fertilizers and Pesticides Authority
GAA	-	General Appropriations Act
GASP	-	Groups Against Smoke Pollution
GOs	-	Government Organizations
HMOs	-	Health Maintenance Organizations

HUDCC	-	Housing and Urban Development Coordinating Council
HLURB	-	Housing and Land Use Regulatory Board
IACEP	-	Inter-Agency Committee on Environmental Protection
IACC-NPPM	-	Inter-Agency Coordinating Committee for National Programs and Projects in Metro Manila
ICLARM	-	International Center for Living Aquatic Resources Management
UP-IESAM	-	UP-Institute of Environmental Science and Management
IFO	-	Inventory of Forest Occupants
IFDC	-	International Fertilizer Development Center
IPMP	-	Integrated Pest Management Program
IRRI	-	International Rice Research Institute
ISFP	-	Integrated Social Forestry Program
IWEP	-	Industrial Waste Exchange Project
LATRIS	-	Lower Agno Totonoguen River Irrigation System
LLDA	-	Laguna Lake Development Authority
LREP	-	Land Resources Evaluation Project
LTC	-	Land Transportation Commission
LTK	-	Lingkod-Tao Kalikasan
MADECOR	-	Mandela Development Corporation
MASIPAG	-	Magsasaka at Siyentipiko para sa Ika-uunlad ng Agham Pang-Agrikultura
MGB	-	Mines and Geo-sciences Bureau
MBRLC	-	Mindanao Baptist Rural Life Center
MCFC	-	Maria Cristina Fertilizer Corporation
MMC	-	Metro Manila Commission
MNR	-	Ministry of Natural Resources
MP/RDP	-	Marine Parks/Reserves Development Program
MPFD	-	Master Plan for Forestry Development
MSBF	-	Manila Seedling Bank Foundation
MSC	-	Marine Science Center
MUFFLER	-	Monitor Unhealthy Fumes for Lesser Environmental Risk
MWSS	-	Metropolitan Waterworks and Sewerage System
NAMRIA	-	National Mapping and Resource Information Authority
NAPOCOR	-	National Power Corporation
NAWAPCO	-	National Air and Water Pollution Control Commission
NCR	-	National Capital Region
NDCC	-	National Disaster Coordinating Council
NEDA	-	National Economic and Development Authority
NEPC	-	National Environmental Protection Council
NFAC	-	National Food and Agricultural Council
NFRIP	-	National Forest Resources Inventory Project
NHA	-	National Housing Authority
NHMFC	-	National Home Mortgage Finance Corporation
NMP	-	National Mangrove Program
NO NUKES	-	National Organization Against Nuclear Power and Weapons
NPCC	-	National Pollution Control Commission
NPDC	-	National Parks Development Committee
NRMC	-	Natural Resources Management Center
NSDB	-	National Science Development Board

NWRB	-	National Water Regulatory Board
OECF	-	Overseas Economic Cooperation Fund
PAB	-	Pollution Adjudication Board
PAEC	-	Philippine Atomic Energy Commission
PAGASA	-	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PBSP	-	Philippine Business for Social Progress
PCAMRD	-	Philippine Council for Aquatic and Marine Research Development
PCHRD	-	Philippine Council for Health Research Development
PAWB	-	Protected Areas and Wildlife Bureau
PEACE	-	Public Education and Awareness Campaign for the Environment
PEAN	-	Philippine Environmental Action Network
PEJI	-	Philippine Environmental Journalist, Inc.
PEN	-	Philippine Ecological Network
PCARRD	-	Philippine Council for Agricultural Research and Resources Development
PC-INP	-	Philippine Constabulary -Integrated National Police
PFEC	-	Philippine Federation for Environmental Concerns
PHC	-	Primary Health Care
PHILPHOS	-	Philippine Phosphate Fertilizer Corporation
PHILDHRRA	-	Philippine Development for Human Resources in Rural Areas
PICCS	-	Philippine Inventory of Chemicals and Chemical Substances
PICOP	-	Paper Industries Corporation of the Philippines
POPCOM	-	Population Commission
PNOC	-	Philippine National Oil Company
PPI	-	Planters Products, Inc.
PROFEM	-	Program for Forest Ecosystem Management
PSDC	-	Philippine Social Development Council
PSSD	-	Philippine Strategy for Sustainable Development
PTA	-	Philippine Tourism Authority
PURC	-	Philippine Uplands Resource Center
RBAPMON	-	Regional Background Air Pollution Monitoring Station
RVIP	-	Rice Varietal Improvement Program
SAGIP	-	Sectors Against the Geothermal Irosin Project
SAVE	-	Solid Alliance of Vigilant Environmentalists
SSC	-	Swedish Space Corporation
SUML	-	Silliman University Marine Laboratory
SWAMDP	-	Solid Waste Management Assistance and Development Program
SWIP	-	Small Water Impounding Projects
TTEM	-	Technology Transfer and Energy Management Project
UAP	-	Unified Azolla Program
UNDP	-	United Nations Development Programme
UP	-	University of the Philippines
UP-ISMED	-	UP-Institute of Science and Mathematics Education Development
USAID	-	U.S. Agency for International Development



ATMOSPHERE AND CLIMATE

1. PROFILE

The deterioration of atmospheric and climatic conditions has never been more noticeable than it was in the past decade. In the country's major urban road systems, pollution from vehicle emissions plagued pedestrians and commuters alike. Industries continued to spew impurities into the air. Climate has likewise become increasingly unpredictable, reflecting the impending global warming crisis and the growing frequency of occurrence of the oceanographic-meteorological phenomenon called the 'El Nino.'

Air Quality

During the past decade, air quality monitoring has been primarily confined to certain localities within the Metro Manila area. Monitoring stations were established along major thoroughfares and thus, most information or data collected concerned traffic-related situations. Government utilized the same monitoring set-up established in the seventies for the early eighties. By the middle of the decade, however, some of the original stations were abandoned and new ones set up, using different methods of sampling and analysis.

Although changes in methodologies and other problems in the monitoring process hindered the precise characterization of Metro Manila's air pollution problems during the eighties, certain trends in air pollutants were observed.

Total Suspended Particulates (TSP). These are primarily comprised of small solid particles such as dust, metallic and mineral particles, smoke, mist and acid fumes. Suspended particulate matter has been specified by government regulations not to exceed concentrations of 180 micrograms/scm for a 24-hour exposure period or 250 micrograms/scm for a one-hour exposure period.

The average readings from four monitoring stations in Metro Manila **(Figure 1)** showed total suspended particulates to be between 60-80 $\mu g/m^3$ at the end of the 70s, with the range increasing to 80-100 $\mu g/m^3$ during the first few years of the eighties (1980 to 1983).[1]

After a three year gap, monitoring of TSP resumed in Pasay, Ermita and Quezon City and later in five other stations. Notably higher TSP levels were recorded but these were partly attributed to the change in sampling methods used from the light scattering method using automatic samplers to the gravimetric method using high volume manual samplers. The gravimetric method gave higher concentration readings than the light scattering method; approximately two to three times higher.

The highest annual average particulates concentration of 340 $\mu g/m^3$ was observed in the Valenzuela Station, which was located in a commercial-residential area where industries were also prominent. Readings in Malate, Ermita and Pasay were likewise high, registering between 205-250 $\mu g/m^3$. Stations which continued monitoring up to 1989 showed a definite upward TSP trend towards the end of the decade.

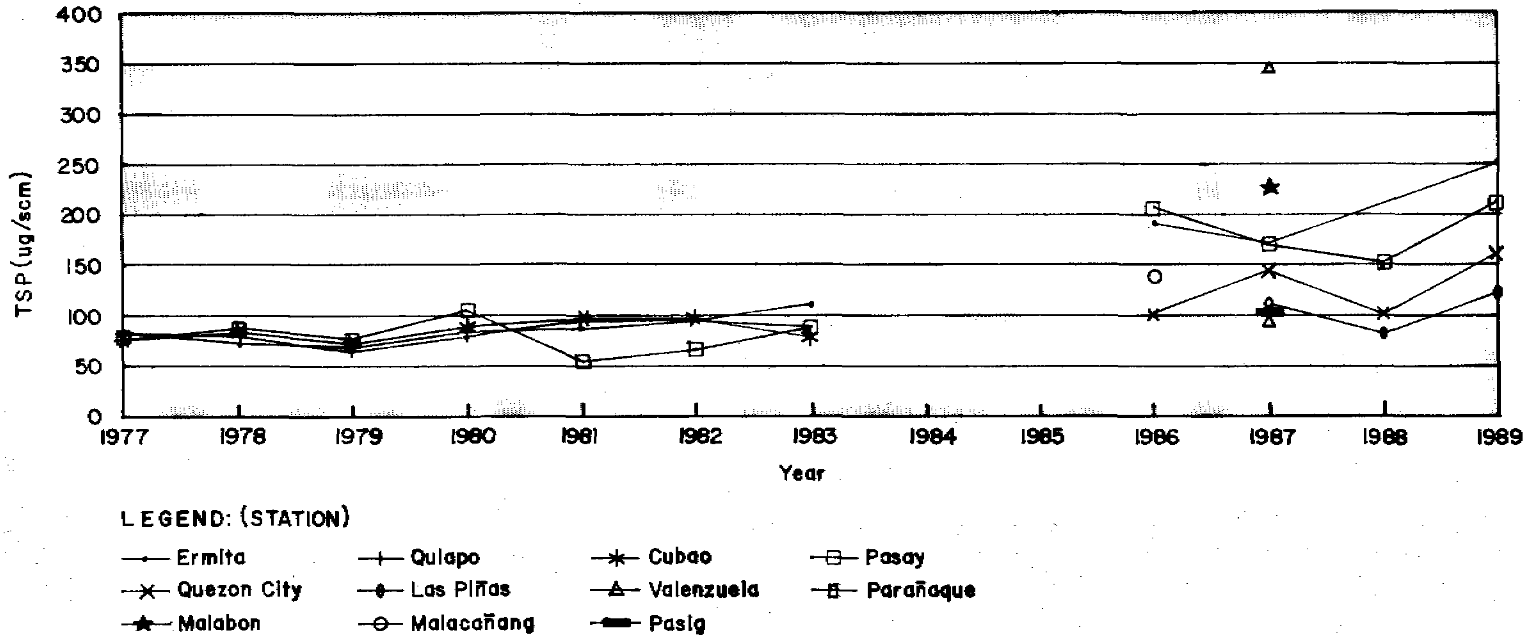


Figure 1. Total Suspended Particulates in Metro Manila, 1977-1989

Assuming a certain percentage of error or inaccuracy in measurements, the data nevertheless indicate that the amount of suspended particulates to which people are being exposed has risen and is becoming a serious concern in the metropolis.[2] This is a fact which daily commuters are not likely to disagree with.

While the lack of equipment limited air quality determinations in other regions of the country, government has tried monitoring other cities' total suspended particulates, revealing levels which also raise concern. Data from Iloilo, for example, showed that its ambient air had an average TSP concentration of 191.92 $\mu g/m^3$ in 1988 and 151.82 $\mu g/m^3$ in 1989.[3] In Davao City, some monitoring stations showed samples with exceedingly high TSP levels.[4]

Sulfur dioxide (SO_2). This is a gas which is very irritating to the respiratory system and which, when released in massive amounts, may increase the atmosphere's acidity. Results show that levels in the four monitoring stations were between 0.015 to 0.038 ppm for the period 1981-1983 (**Figure 2**), way below the ambient air quality standards which specify allowable levels of up to 369 micrograms/scm or 0.14 ppm for 24 hour exposures and 850 μg/scm or 0.30 ppm for one hour exposures.

The interval between 1981 to 1983, however, has been pinpointed as a period of unreliable readings due to the gradual breakdown of equipment.[5] By 1986, measurement had to be done using manual samplers and analysis had to be changed from acidimetry to the colorimetric method. This resulted in a seemingly drastic decline in SO_2 levels measured since.

In 1986-87, readings in Quiapo, Pasay and Ermita, as well as, those additionally measured in Malabon, Las Pinas, Quezon City, Pasig, Paranaque and Valenzuela, were equal to or below 0.01 parts per million. These rose slightly at the start of 1988, and then decreased to below 0.02 ppm by 1989. On the whole, these findings thus indicate that SO_2 seems to be a less alarming pollutant in Metro Manila.

Carbon Monoxide (CO) is a colorless gas which depletes the supply of oxygen to vital organs. Its maximum level in ambient air has been set at 10 micrograms/scm or 9 ppm for every 8 hour exposure, and 35 micrograms/scm or 30 ppm for every 1 hour exposure period.

As shown in **Figure 3,** monitoring of CO concentrations was confined to only four stations, namely Ermita, Quiapo, Cubao and Pasay. In both the Ermita and Pasay stations, readings registered a rise at the very start of the decade. However, while samples from Pasay showed a decline from 1981 to 1983, those in Ermita reflected a continuous increase from 4.2 ppm in 1980 to 8.6 ppm in 1983. Sampling of this pollutant lasted only up to 1984. Monitoring data are unavailable, however, for that particular year. The established trends indicate the increasing significance of Carbon Monoxide as a pollutant in Metro Manila.

Other Pollutants. A study on the composition of suspended particulates which was started in 1983 was resumed in 1987, resulting in the measurement of other pollutants, mostly heavy metals. As seen in **Table 1,** of the 8 areas monitored, Valenzuela has the highest concentration of **lead at 4.35 $\mu g/m^3$** , followed by Malabon at 3.04 $\mu g/m^3$.

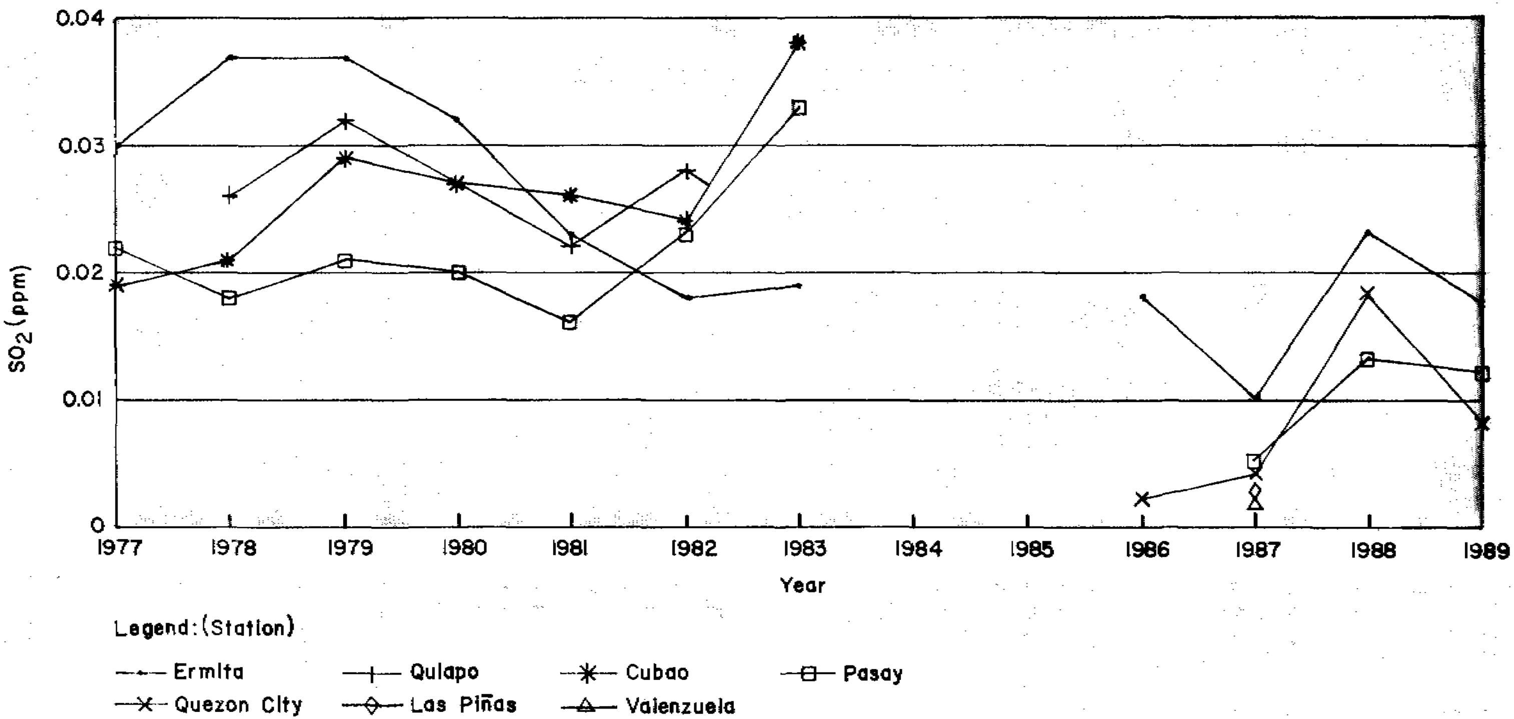


Figure 2. Sulphur Dioxide in Metro Manila, 1977-1989

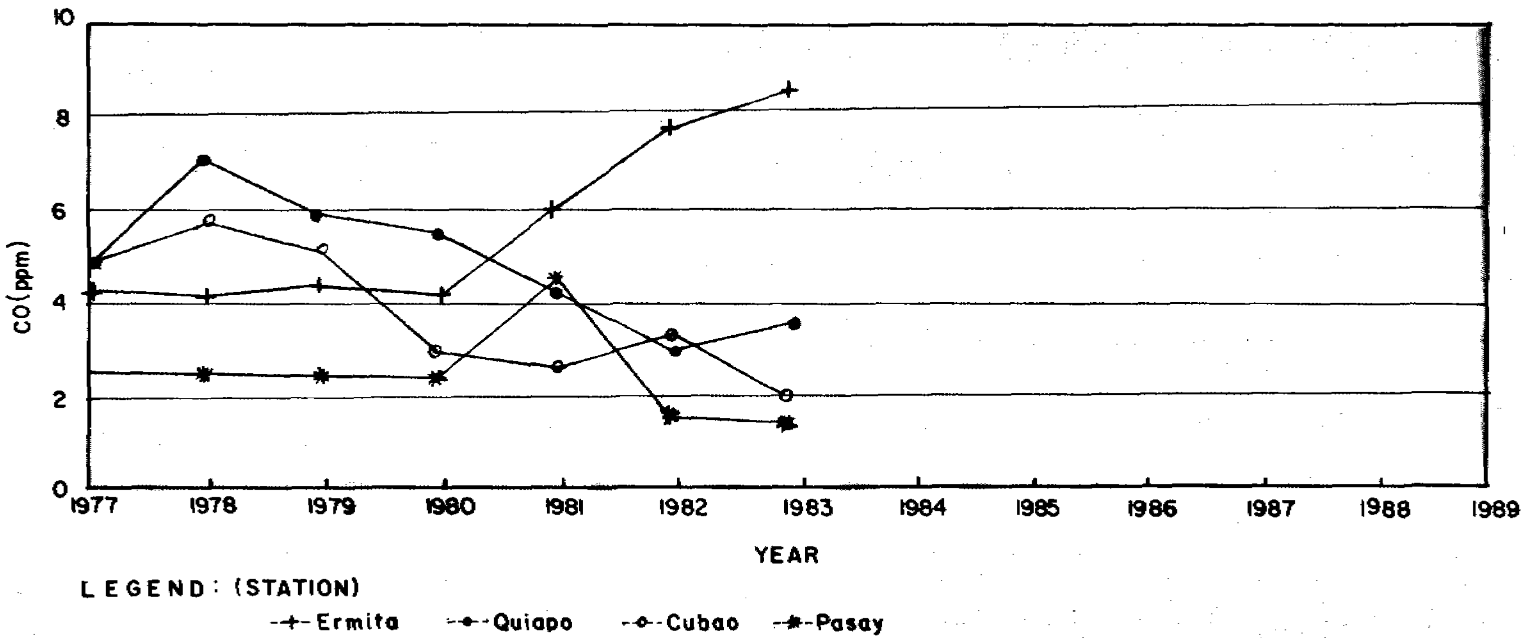


Figure 3. Carbon Monoxide in Metro Manila, 1977-1989

Table 1. Annual Arithmetic Mean of Hourly Average Concentrations of Various Pollutants in Major Thoroughfares in Metro Manila, 1987

(micrograms/m3)

	Pollutants					
	Lead	Copper	Iron	Zinc	Cadmium	Nitrogen Dioxide
Ermita	0.63	0.05	4.28	1.46	nil	*0.058 **0.037
Pasay	0.57	0.07	5.8	0.87	nil	
Pasig	0.26	0.37	1.58	1.24	-	
Quezon City	0.85	0.54	3.04	0.94	nil	
Malabon	3.04	0.15	6.45	6.29	0.02	
Paranaque	0.25	0.10	1.42	0.80	nil	
Las Pinas	0.31	0.10	2.13	1.14	nil	
Valenzuela	4.35	0.18	8.28	1.14	0.28	

Source: NPCC, 1987
* - 1986
** - 1987

Copper was present in smaller quantities, the highest being 0.54 $\mu g/m^3$ in Quezon City and 0.37 $\mu g/m^3$ in Pasig. **Iron** and **zinc** were detected in higher levels in all stations, Malabon having almost equally large measurements for both and Valenzuela showing an annual average of 8.20 $\mu g/m^3$ for iron and 4.82 $\mu g/m^3$ for zinc. Notably high concentrations of iron were also monitored in Pasay and Ermita. **Cadmium** was present in trace quantities of 0.02 $\mu g/m^3$ in both Malabon and Valenzuela. **Nitrogen Dioxide,** measured only in Ermita, was found to be 0.058-0.037 $\mu g/m^3$.

The maximum permissible ambient concentrations for 30-minute samples are, for lead: 0.02 mg/m^3 ; copper: 0.01 mg/m^3 ; cadmium: 0.01 mg/m^3 ; and NO_2 : 0.3 mg/m^3. Based on this study, high levels of heavy metals in at least two stations (Valenzuela and Malabon) could prove to be a grave problem in the long run.

In 1987, in response to alarms raised over possible high levels of mercury pollution in Davao del Norte, air quality in working areas and vicinities was monitored closely. Mercury is a component of the amalgam from which gold is vaporized through heating. Monitoring in Tagum from December, 1987 to March 1988, showed some samples with extremely high levels of mercury in working areas where blowtorching of the mercury-copper amalgam were conducted. Some readings ranged from 82.560 $\mu g/m^3$ to 136.095 $\mu g/m^3$ within the blowtorch areas to 0.518-15.831 $\mu g/m^3$ a few feet from the blowtorch areas, decreasing to 0.96-0.32 $\mu g/m^3$ farther away, and so on, reaching nil at about 300 meters from the reference point.[6]

Out of the samples collected in various stations from May to December, 1989, a considerable number exceeded the allowable standard of 0.015 ppm, with the different stations reflecting a yearly average of 0.02127-0.0627 ppm. While these findings were not sufficient to accurately assess the levels of pollution in the province, the exposure of persons to these vapors, particularly in the working areas, places them at high risk.

Rainfall Acidity. The emission of certain pollutants into the atmosphere can lead to the formation of acids which are washed back to earth through rain. The consequences of acid rain are felt most in industrialized countries where both aquatic and terrestrial ecosystems are threatened by the backlash of massive sulphur dioxide and nitrogen oxide emissions. The dynamics of global atmospheric movement, however, poses the problem of possible long-range transfer of pollutants even for less developed countries.

In 1988, the PAGASA instituted a monitoring project for rainfall chemistry through a station in Mt. Sto. Tomas, Benguet, as part of a worldwide effort to generate reliable trends in pollutant concentration and deposition. The project is part of a global programme spearheaded by the World Meteorological Organization and the United Nations Environment Programme. Under the programme, other Regional Background Air Pollution Monitoring Stations (RBAPMON) were established in strategic places globally.

For a one year sampling period (August,1988 - July,1989), analysis revealed that rainfall in the study area had a pH value of 6.02, a level which is below normal. Samples contained chloride, calcium, magnesium, sodium and potassium.[7] It was observed that the elements, especially chloride, were present in larger quantities during the northeast monsoon when the air flows towards the Philippines from some industrialized countries. Inspite of the interesting findings, however, further analysis in more sampling stations were recommended to confirm initial results.[8]

General Sources of Air Pollution

The major sources of air pollution have traditionally been classified as either mobile (motor vehicles) or stationary (industrial plants). In 1987, an inventory was conducted to determine actual sources of emissions and their relative contributions to air pollution in Metro Manila. Although the results of the study were only ballpark estimates, they established a more concrete relationship between certain pollutants and emissions from stationary sources, mobile sources and area sources.[9] Area sources refer to dispersed sources of emissions that individually emit small amounts of pollutants but in aggregate, may be significant.

a) Motor Vehicles

Based on the inventory, motor vehicles accounted for majority of the CO and NO_x. Both stationary and mobile sources release large amounts of particulate matter with the motor vehicles releasing slightly lower amounts. Industries accounted for much of the SO_2. **Figure 4** illustrates the percentage contribution of these sources to the air pollution in Metro Manila.

Motor vehicles continued to contribute 60% of the air pollution in Metro Manila. Diesel vehicles were particularly a problem, emitting highly visible black smoke, while gasoline engines generated significant, though undetermined amounts of lead into the atmosphere.

Industries increasingly contributed SO_2, CO, Flyash and NO_x into the air for the past decade.

Diesel vehicles are a source of highly visible black smoke, the amount of which depends on engine condition, tuning and load. The largest component of this smoke is soot, with unburned or thermally modified fuel and fuel additive residues. The gaseous wastes also contain carbon monoxide, nitrogen oxides and sulfur oxides.

Gasoline engines emit soot in lesser amounts, but generate unburned fuel and, if badly maintained, lubricants. Since 'leaded' gasoline is predominantly used in the country, lead is a significant component of air pollution from gasoline-fed vehicles. Carbon monoxide is the most abundant gaseous emission, emitted at higher rates per unit of fuel than in diesel exhaust. Nitrogen oxides, however, are emitted in smaller amounts than in diesel exhaust.

The Emission Source Inventory of 1987 was also able to estimate and construct a matrix of emissions by vehicle type in tons per year. (**Table 2**). It showed that diesel-fueled utility vehicles and trucks and, to some extent, buses, were responsible for the emission of most particulate matter, sulfur and nitrogen oxides. Cars, motorcycles and utility vehicles, on the other hand, were main sources of carbon monoxide and total organic gases.

b) Industries

Combustion of fossil fuels for industrial processing, power plants, factories and other commercial uses, constitutes another main source of atmospheric pollution in the Philippines. Coal, for instance, is used in power generation, steel and cement industries, among others. Bunker oil fuel and other waste materials are also utilized.

The sulfur content of most bunker oil fuel and coal used by industry exceeds 3%, according to estimates by the NPCC. Because of this, the amount of SO_2 emitted into the air during combustion was estimated to be quite high.

Combustion-derived pollutants include soot, CO, flyash and NO_x, the first two being symptoms of inefficiency in operation. Emissions also vary from aerosolized fat from food processing to other minerals from the metallurgical and aggregate industries.

Table 3 provides a list of air pollutants emitted by industrial establishments in Metro Manila. It shows particular industrial groups and their relative roles in the discharge of particulate matter (PM), carbon monoxide (CO), sulfur oxides (SO_x), nitrogen oxides (NO_x) and total organic gases (TOG).

Electrical services/thermal power generating plants are shown to be leading sources of air pollutants, especially sulfur and nitrogen oxides. Lumber and wood product industries are main contributors of particulate matter and CO to the atmosphere. Stone, clay, glass products, textile, and food manufacturing are also significant producers of all the pollutants.

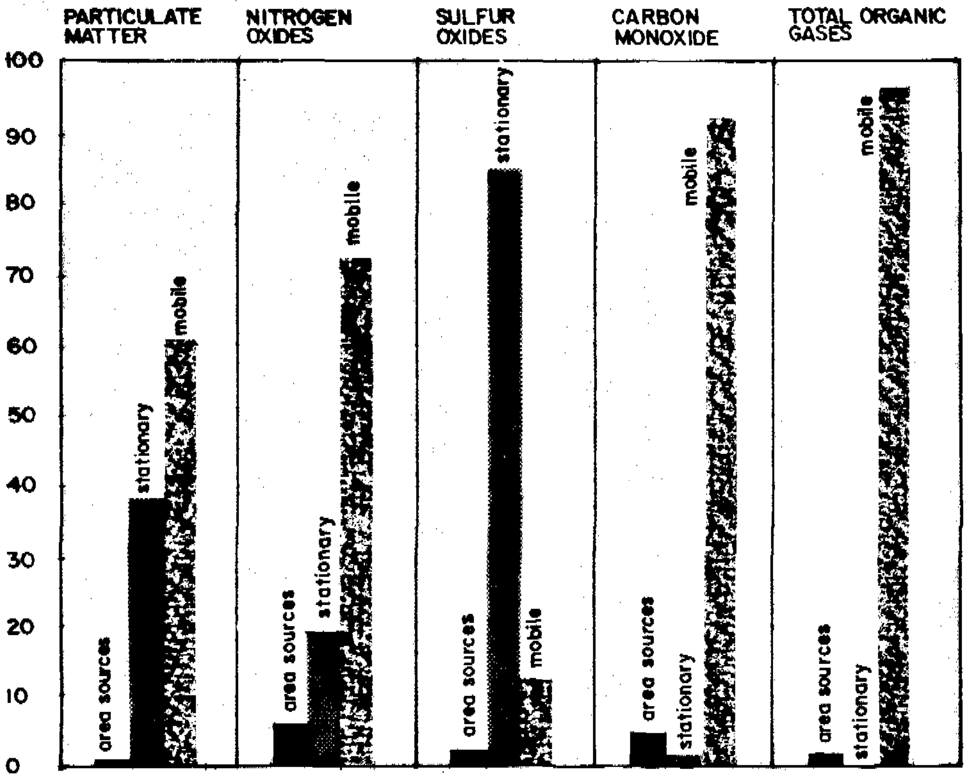


Figure 4. Percentage of Emissions: Various Pollutants from All Sources in Metro Manila, 1987

Source: Emissions Source Inventory, EMB, 1987

Table 2. Motor Vehicle Emissions by Vehicle Type, 1987 (in tons/year)

		Cars	UV	Trucks	Buses	MC/TC	Total
PM	a	1,181.41	780.93	41.08	5.14	848.51	2,857.07
	b	1,835.01	32,310.56	14,085.44	2,036.12	1,136.12	54,405.65
SOx	a	1,181.41	780.93	41.08	5.14	848.51	2,857.07
	b	1,100.99	19,386.42	8,451.27	1,221.69	683.16	30,843.53
CO	a	212,721.78	140,614.65	7,402.22	919.65	152,776.53	514,434.83
	b	978.67	17,232.35	7,385.13	1,085.93	607.20	27,289.28
TOG	a	35,836.47	23,690.95	1,246.33	156.05	25,737.73	86,667.53
	b	1,350.01	32,310.56	14,085.44	2,036.12	1,138.52	51,405.65
NOx	a	1,814.23	7,809.52	410.89	51.46	8,484.97	28,571.07
	b	2,711.73	47,748.01	20,815.19	3,008.95	1,682.50	75,966.38

Source: Emission Source Inventory, EMB, 1987.
Legend: a - gasoline b - diesel

Table 3. Summary of Metro Manila Air Pollutant Emissions from Stationary Sources, 1987

Emission Source	PM	CO	SOx	NOx	TOC
Agricultural production-Livestock	0.11	0.01	1.51	0.16	0.00
Non-metallic minerals except fuels	6.16	0.82	85.68	0.92	0.02
Heavy construction	0.98	0.19	2.64	1.07	0.01
Food products manufacturing	168.35	171.56	1,545.17	225.40	1.73
Tobacco manufacturing	35.84	10.65	474.30	77.89	0.67
Textile mill products	146.63	180.47	1,259.79	207.92	16.88
Lumber and wood products	4,789.18	1,511.47	9.11	101.10	8.21
Furniture and fixtures	0.44	1.26	0.24	3.69	0.01
Paper and allied products	99.89	10.60	225.07	24.60	0.06
Chemicals and allied products	46.19	23.33	602.71	121.95	1.20
Petroleum and coal products	21.13	59.57	49.36	47.00	0.60
Rubber/miscellaneous Plastic products	50.52	8.19	652.85	78.19	0.20
Stone/clay and glass products	888.88	27.45	793.16	189.33	0.90
Primary metal products	65.90	14.36	313.17	88.13	3.05
Fabricated and metal products	27.54	37.73	106.32	28.06	0.29
Machinery except electrical	0.02	0.01	0.30	0.03	0.00
Electrical/electronic equipment	0.38	1.17	0.37	0.43	0.45
Transportation equipment	0.07	0.06	0.19	0.88	0.01
Instruments/related products	0.90	0.84	2.74	12.64	0.01
Miscellaneous manufacturing Industries	0.30	0.10	3.91	0.69	0.00
Electric services	5,960.93	793.91	82,963.39	8,732.99	44.99
Wholesale trade	0.02	0.08	0.02	0.35	0.00
Hotel/loging services	8.39	1.17	116.43	12.83	0.02
Personal services	3.99	7.98	18.23	2.50	0.05
Auto repair/services	0.09	0.01	1.25	0.13	0.00
Total	12,322.83	2,862.99	89,227.91	9,996.98	79.36

Source: Emission Source Inventory, EMB, 1987

Table 4. Total Emissions From Area Sources, 1987
(in tons/year)

	PM	TOG	NOx	SOx	CO
Aircraft Operation	133.62	5990.28	4121.34	368.00	12,685.59
Structural Fires	22.72	29.2	8.12		336.95
Marine Transfer		4490.0			
Dry Cleaning		1178.95			
TOTAL	156.34	11,688.43	4,129.46	368.00	3,042.54

Source: Emission Source Inventory, EMB, 1897

c) **Area Sources**

Most emission sources classified under area sources are responsible for much of the TOG. **Table 4** shows that aircraft operations are capable of releasing large amounts of Carbon Monoxide and Nitrogen Oxides.

Climate

While Philippine climate can be generally described as tropical, with wet and dry seasons, climatic conditions in the country are varied, depending mainly on land forms, local air currents resulting from the general air stream, island position and the usual storm tracks.

The distribution of climate types in the country are presented in **Figure 5**, based on ratios of dry months (less than 60 mm) to wet months (more than 100 mm).

Tropical Cyclones and Related Calamities

Geographically, the Philippines is in a region with the highest frequency of tropical cyclone occurrence in the world. Tropical cyclones normally start occurring during the month of June and end in December, reaching peak activity in August.

A fully mature tropical cyclone is called a typhoon with maximum winds of 118 kph or more near the center. Those affecting the Philippines mostly originate from the northwest Pacific Ocean with a general movement in a west northwest direction.

A map prepared by the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) in 1985 shows the relative frequency of typhoons in various regions of the country (**Figure 6**).

An average of 19 tropical cyclones enter the Philippine area of responsibility every year. Although only a percentage of these are classified as destructive, the total cost of damages and number of persons affected by strong rain and violent winds could reach millions annually.

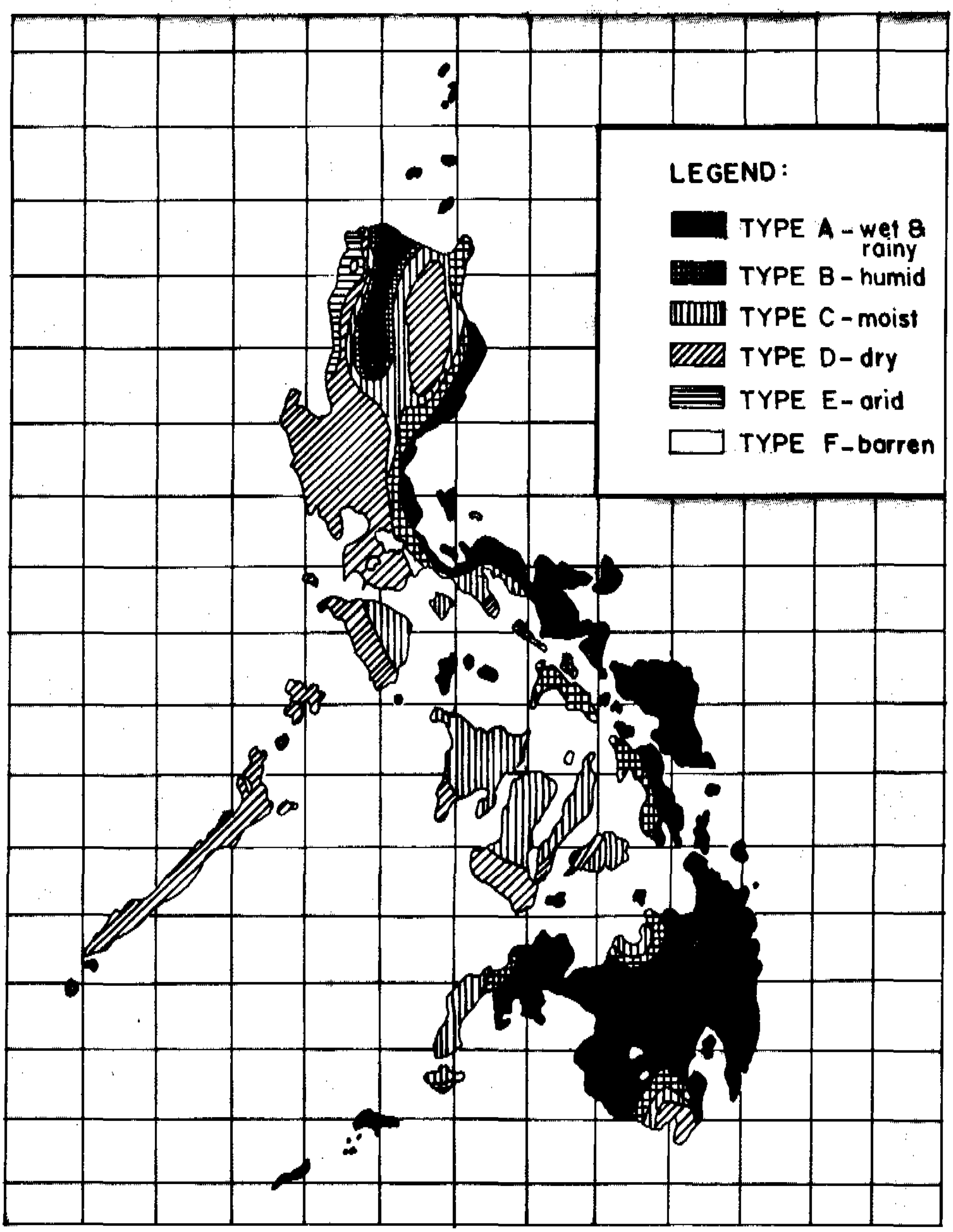


Figure 5. Climate Map of the Philippines based on Modal Yearly Ratios of Number of Dry Months to Number of Wet Months (1951-1980)

Source: PAGASA

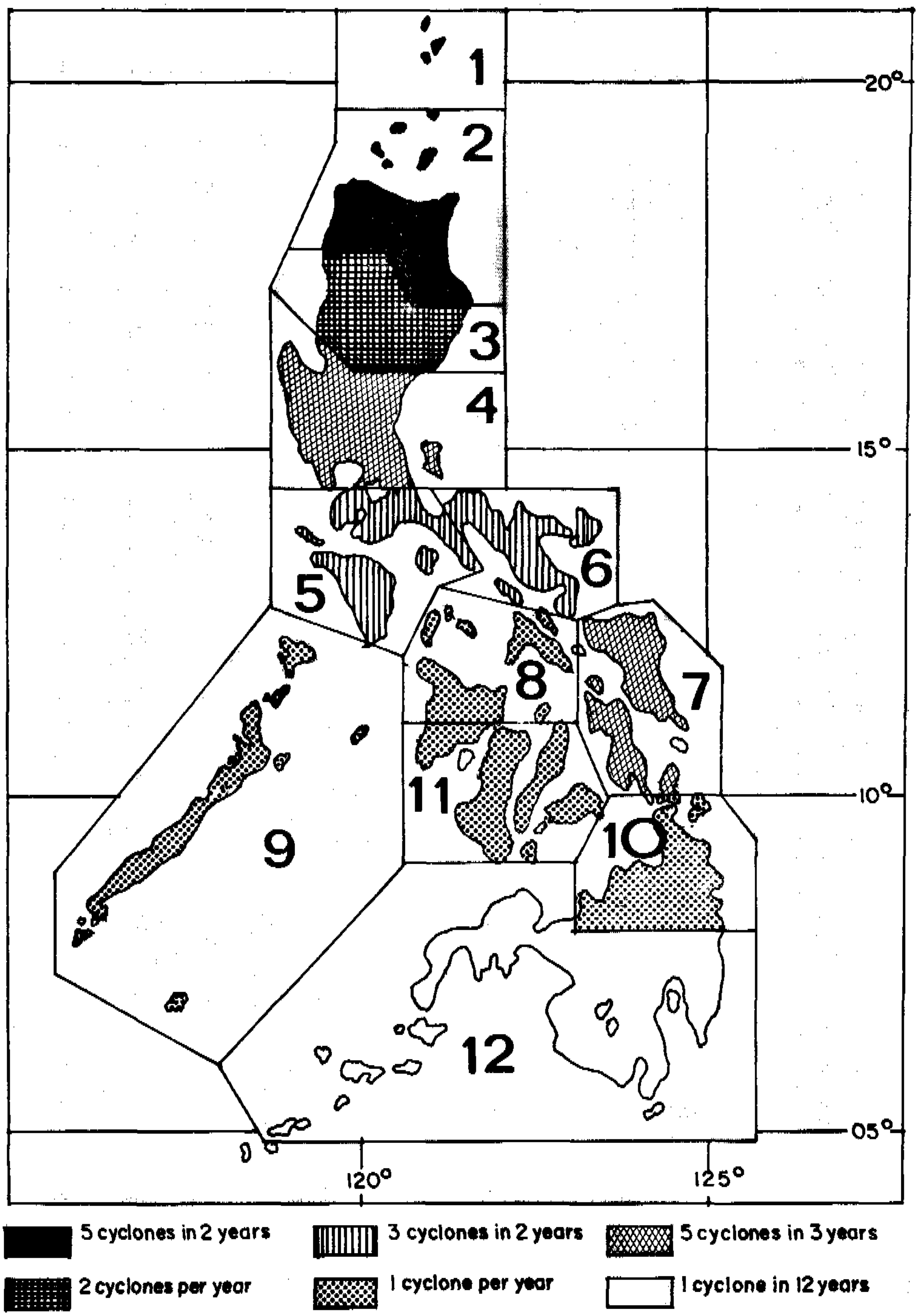


Figure 6. Frequency of Tropical Cyclone Passage Over Each Geographical Zone in the Philippines

Source: PAGASA

Table 5. Incidence of and Damages from Typhoons, 1980-1989

	Number of Tropical Cyclones	Destructive	Persons Affected	Dead	Casualties Missing	Injured	Estimated Cost of Damages (million pesos)
1980	23	9	1,666,498	143	29	55	1,465
1981	21	7	1,472,417	484	264	1,922	1,275
1982	23	8	1,569,022	337	223	347	1,659
1983	14	4	747,155	126	28	168	522
1984	20	4	4,048,805	1,979	732	4,426	5,869
1985	17	4	1,643,142	211	17	300	2,725
1986	21	6	1,414,188	171	43	151	1,816
1987	16	6	3,882,534	1,020	213	1,455	4,083
1988	20	5	6,081,566	429	195	468	8,676
1989	19	7	2,582,822	382	89	1,087	4,494

Source: National Disaster Coordinating Council (NDCC).

Ave. no. of typhoons, 1970s: 19.6
Ave. no. of typhoons, 1980s: 19.4

The average number of typhoons in the 80s has increased slightly compared to the seventies. Table 5 shows these, along with the estimated cost of damages and the number of persons affected. Particularly severe damages were incurred by the country in 1984 when typhoon 'Nitang' hit the Visayas and Northern Mindanao with center winds of 220 kph and in 1988, when typhoon 'Unsang' severely affected no less than nine regions and two provinces.

Floods are described as the inundation of land areas not normally submerged in water due to excessive rainfall usually accompanying typhoons. As regular seasonal occurrences, they affect both urban and agricultural areas.

Table 6 shows that the highest costs of damage from major floods were incurred in 1980 and 1989, when P366.287M and P392.203M, respectively, worth of property and crops were lost, affecting hundreds of thousands in the entire Regions X and XI and in the Agno River Basin. In 1982, damages amounting to P115.06M and affecting 532,602 persons were again incurred in these two regions, along with Region XII and Maguindanao.

While no trends are apparent from the figures in the Table, certain areas have been identified as flood-prone. Aside from low-lying areas located near the sea, cities with concentrated urban structures also render themselves vulnerable to flooding because of the loss of natural drainage mechanisms and the clogging of waterways from misuse. Water levels in the 20 major river systems throughout the country are also easily raised by torrential rains, thus flooding adjoining lands and inflicting damages.

Storm Surges, also known as storm tides, are transient, localized disturbances which occur when sea water accumulates due to wind stress and pressure effects such as when a tropical cyclone approaches and reaches the coast. Because it is frequented by typhoons and has an extensive coastline, the Philippines is a natural surge-prone area.

Figure 7 shows several coastal areas in the country which have been affected by disastrous storm surges since 1897. The National Disaster Coordinating Council reported 14 incidents of storm surges from 1981-1984 (**Table 7**). The two storm surges in 1984 affected coastal areas in Cebu and Surigao. Since 1984, information on storm surge occurrences have been incorporated into reports on flooding.

Table 6. Damage Caused by Major Floods, 1980-1989

Year	Areas	No. of Persons Affected	Casualties			Estimated Cost of Damage (in million pesos)
			Dead	Missing	Injured	
1980						
December	Entire Region X & XI	762,686	336	48	14,298	366.287
1981						
August	Maguindanao, Davao	3,732	125	122	95	4.214
October	del Norte					
1982	Region X, XI & XII	532,608	27	1	21	115.061
January	Maguindanao					
1983						
September	Lanao del Sur,	32,808	41	-	45	12.577
November	North Cotabato, Bohol					
1984						
February	Carmen & Monkayo,	36,254	-	-	-	2.5
July	Davao del Norte, Cebu					
1985	Davao del Norte, Sultan					
December	Kudarat, Maguindanao	82,857	59	13	-	7.334
October	and Lanao del Sur					
1986	Region XI, Agusan del Norte	122,015	4	2	4	9.145
Janury	Surigao del Norte,					
	Misamis Or. & Occ.					
1987						
June-October	Bicol and Cagayan	1,723	2	2	2	-
December						
1988						
October	Bicol River Basin	3,192	2	-	-	-
November						
1989						
July	Agno River Basin	459,730	101	148	79	392.203
August						

Source: National Disaster Coordinating Council (NDCC)

Droughts

Drought is generally described as the deficiency of moisture in an area, the extent and duration of which severely affects agricultural or water supply interests. Droughts occur when the normal cycles bringing about the rainy season and a relatively sufficient amount of rainfall during the rest of the year, are disrupted.

During the eighties, there were two major drought events in the Philippines. These occurred in 1982-1983 and in 1986-1987. A third occurrence started during the last quarter of 1989 and continued to affect the country up to the first half of 1990. Based on climatological studies, such occurrences are attributable to a global phenomenon called 'El Nino.'[10]

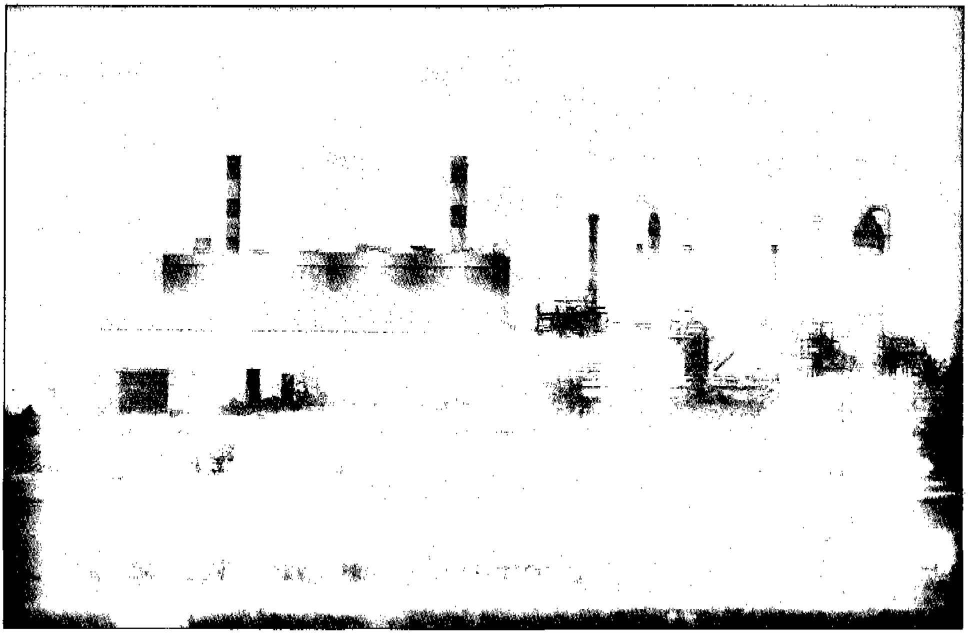
El Nino is a spectacular oceanographic-meteorological phenomenon that develops in the Pacific, mostly off Peru and is associated with extreme climatic variability, specifically torrential winds and rainfall in the Eastern Tropical Zone (off the coast of South America) and a corresponding lack of rainfall on the opposite side of the Pacific Ocean (including Australia, Indonesia and the Philippines). During a severe El Nino, sea surface temperatures are measurably higher than normal over a large expanse of the equatorial Pacific which can prevail for more than a year.

In recent years, El Nino has become a major concern to scientists, policy-makers, world press and politicians because of the global adverse impact of the unusual world-wide climate anomalies that occur simultaneously during an El Nino episode. The occurrence of 1982-1983, for example, caused world-wide economic losses in the order of more than 10 billion dollars.[11]

In the Philippines, the situation was reflected in the drought of 1982-83, which was the most severe in 30 years. The shortage of rainfall lasted from October, 1982 to April, 1983 affecting, in varying degrees, several regions including Regions I, II, III, IV, V, X, and XI.

A total of 987,380 hectares of agricultural lands were damaged, and estimated production losses reached P763,144 million. To alleviate the suffering of the 22,765 farmers affected, the government had to extend assistance through cereal loans, seed rehabilitation programs and relief provisions, the total worth of which was P100,819M.[12]

In 1986, the story repeated itself, as November and succeeding months went by without sufficient rainfall to sustain the planting season and water levels in reservoirs. Also attributed to 'El Nino,' the drought affected 12 Regions or 44 provinces, 26 of



Increasing complaints from communities surrounding industrial plants have been registered, particularly concerning health effects of plant emissions.

The drought events of 1982-1983 and 1986-1987 which were primarily attributed to the El Niño phenomenon, cost the country millions of dollars in terms of agricultural production and other losses.

Table 7. Occurrence and Damages: Storm Surges
1981 - 1989

	1981	1982	1983	1984	1985	1986	1987	1988	1989
No. of Occurrences	9	2	1	2	Data was	2	4	-	6
Casualties:					incor-				
Dead	7				porated	-	-		3
Injured					into	-	-	-	-
					reports of				
Affected:					flooding				
Families	945	362	10	830		5	894	-	1650
Persons	4725	1847	60	1106		40	5018	-	8061
Houses				611					
Estimated Damage (million pesos)	0.159	0.209	0.014			0.02	45	-	0.28

Source: National Disaster Coordinating Council, 1986.

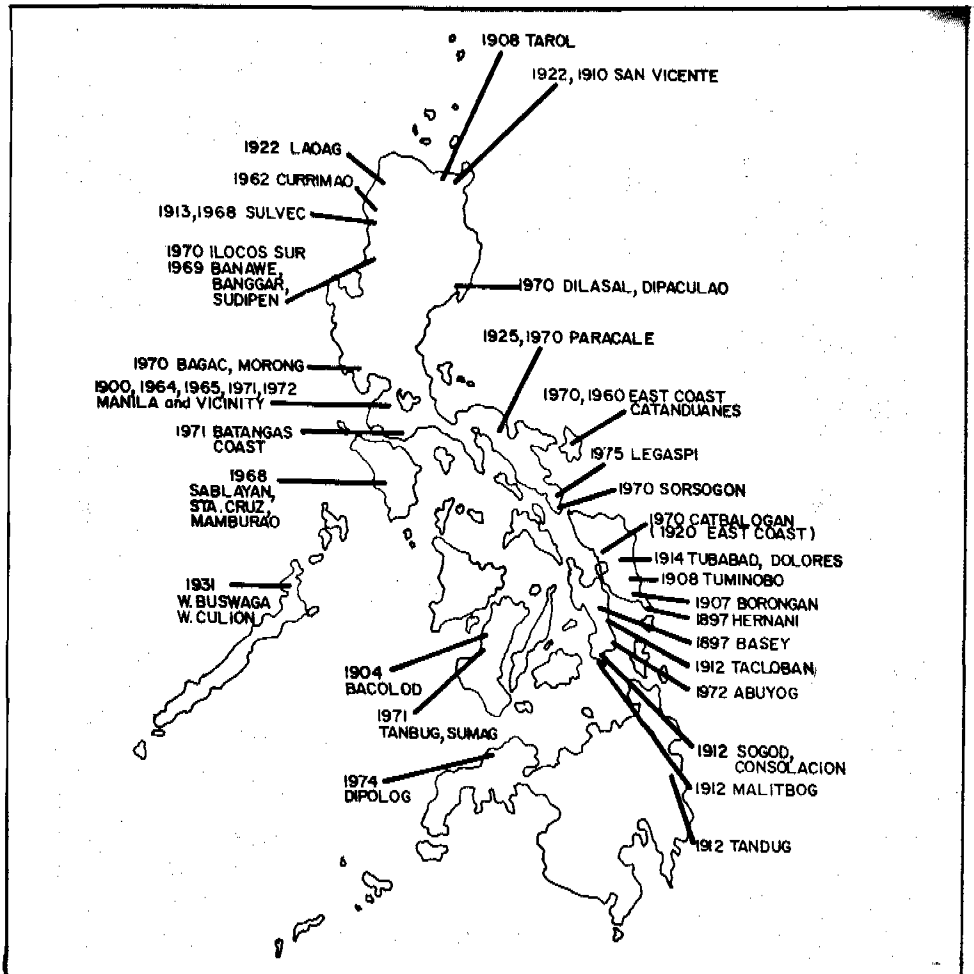
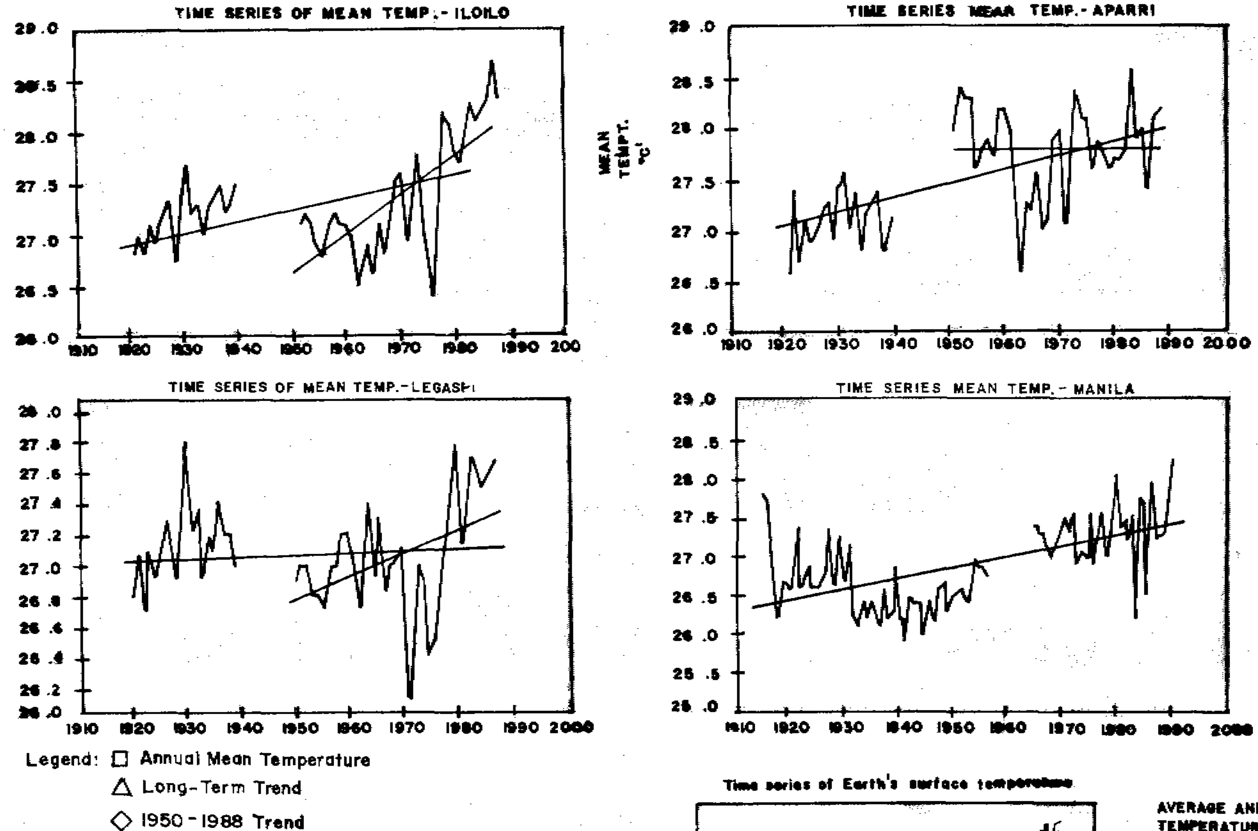


Figure 7. Storm Surge Inundations, (1897-1975)



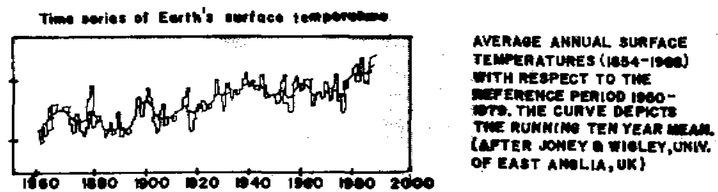


Figure 8. Time Series of Mean Temperature in Four Areas
Source: PAGASA

which were declared calamity areas by May, 1987. These included Lanao, North and South Cotabato, Pangasinan, Cagayan Valley, Isabela, Nueva Viscaya, Nueva Ecija, Bulacan, Pampanga, Zambales, Quezon, Bicol, Negros Occidental and Oriental, Northern and Western Samar, Zamboanga del Sur, Bukidnon, Misamis Oriental, Davao del Norte, Albay, Sorsogon, Camarines Norte and Sur, Catanduanes, and Antique.

Rice and corn lands, totalling 183,600 hectares were damaged, incurring estimated losses of P170 million for corn and P260 million for palay or a total of P 430 million. A P 9.6 million calamity fund was allotted for seed loans, relief provisions and debt restructuring for farmers who could not afford to repay their loans for the previous planting.[13]

The latest reports received from the affected regions indicated that the drought, which started in the second half of 1989, affected six regions covering 15 provinces: Cagayan, Isabela, Nueva Viscaya and Quirino (Region II); Bulacan, Pampanga, Nueva Ecija and Tarlac (Region III); Iloilo Province and Guimaras (Region VI); Zamboanga del Sur (Region IX); Bukidnon (Region X); Davao del Norte, Davao del Sur and General Santos City (Region XI). A total of 134,454 families or 740,208 persons were reportedly affected as of early 1990.[14]

Other climatic variations have also been attributed to the El Nino. A recent assessment of climatic variability during El Nino events from 1935 to 1983 indicated that about 80% of the most disastrous tropical cyclones in the Philippines occurred during the El Nino years.[15] Thus, there seems to be an interesting correlation between tropical cyclones, flooding and drought and the occurrence of El Nino not only during the 80s but even before this period.

Global Warming and Temperature Rise in the Philippines

When solar radiation enters the earth's atmosphere every day, it is radiated back into space. Normally occurring gases, notably carbon dioxide (CO_2), trap some of the reflected heat and re-radiate it back to the earth. Known as the 'greenhouse effect,' this natural function is important in keeping our planet warm and habitable.

Recent findings indicate, however, that increased amounts of greenhouse gases which include nitrogen oxides, methane and chlorofluorocarbons, have been infused into the atmosphere from various human activities in considerable amounts, threatening to over-heat the earth's surface and consequently, its temperature and climate.

The carefully predicted warming rates for the next 60 years is between 1.5° C to 4.5° C. The warming will not be globally uniform but will differ significantly between geographical regions and may vary during different seasons.[16] In the Philippines, preliminary analysis has shown that the country is now warming by 1-3 degrees celsius.[17]

A study of mean temperature readings in some areas of the country revealed that there has been a notable increase in temperature readings in the past several decades (**Figure 8**). In Iloilo, mean temperature from 1920 to the 80s has risen by at least 0.5° C, while Legaspi exhibited a lesser but still notable increase. Temperature in

Aparri has increased by close to 1° C since the 1920s, a trend similar to that of Manila's from 1880 to the 1980s.

Developments in mean temperature from the 50s to the 80s in all four areas showed a consistent increase in temperature readings, with Iloilo exhibiting the most drastic rise from 26.6° C to 28.0° C.

These preliminary studies significantly follow the trend of temperature rise at the global scale since 1860 (See **Figure 8**).[18]

Ozone Depletion and the Use of CFCs in the Country

Chlorofluorocarbons (CFCs) also play another role in adverse atmospheric changes. Aside from their being greenhouse gases, CFCs released into the atmosphere are also responsible for the depletion of the ozone layer which functions as a vital barrier against ultra-violet rays from the sun.

CFCs do not occur naturally. These are manufactured gases used as aerosol propellants, coolants in refrigerators and air-conditioners, foam-blowing agents in the plastic industry, solvents and cleansing agents for electronics or metal parts, in sterilizing medical equipment, fire-extinguishing and other miscellaneous uses. These compounds remain unchanged until they reach the atmosphere and react with ozone, destroying the earth's only protection from extreme dosages of ultraviolet rays.

The Philippines does not manufacture CFCs. It imports these for local use largely because no acceptable substitutes have been found. Records from the Bureau of Food and Drugs (BFAD) show an increase in the importation of CFCs from 1.16 million kilograms in 1984 to 2.21 million kilograms in 1986.[19] The amount decreased to 1.64 in 1987. Estimates made by the Motor and Industrial Products Company, Inc., a private company, however, reflect an increase in CFC imports from 2,430.94 MT in 1986 to 4,037.22 MT in 1989.[20]

Ozone observations in the Philippines, which were conducted in the Manila Observatory at the Ateneo de Manila from 1979 to 1988, have shown only cyclic movement.[21] While in-depth analysis showed a decreasing trend of ozone values, this was not statistically significant or sufficient to formulate general conclusions. Analysis elsewhere, however, show a decrease over tropical areas bounded by 19° North and South latitudes ranging from 1.6 - 3.1%.[22] In latitudes between 0 - 19° North, where the Philippines lies, the ozone layer decreased by 1.6%.

2. PROBLEMS AND ISSUES

2.1 Deteriorating Air Quality due to Intensified Industry and Transport Activities in Urban Areas

Despite the limited carrying capacities of urban areas, migrants continue to flock to them. The resulting congestion does not simply involve people but extends to the vehicles servicing them. Industries likewise locate as near to cities as possible because of the economic advantage derived from the arrangement.

In Metro Manila alone, more than 7 million people crowd its 636 square kilometer land area. Data from the Land Transportation Office show that almost half of the country's one million registered vehicles operate in the metropolis. In addition to this, a considerable percentage of the country's pollutive firms are also found in Metro Manila's jurisdiction.

Due to the country's tight economic situation, proper maintenance of vehicles is seldom a priority. Most of the public utility vehicle engines being used are generally dilapidated, being second-hand imports or rejects from other countries. Vehicle owners and transport operators usually scrimp on maintenance costs resulting in inefficient fuel use leading to pollution.

2.2 Health Hazards from Motor Vehicle Emissions

Various health effects are associated with pollution from diesel and gasoline driven motor vehicles. The carbon monoxide content of exhaust gases, especially from gasoline-fueled engines, decrease the transport of oxygen to tissues and deprive vital organs of their oxygen supply. The heart, central nervous system and the fetus stand to be most at risk.[23]

Tetraethyl lead, which is added to gasoline to prevent engine knocking, is a well known toxic substance. Mental development in children and the central nervous system of adults are vulnerable to high concentrations of lead. Functional disorders in the gastro-intestinal tract, kidneys and reproductive system may also result.

Also among the dangerous pollutants are oxides of nitrogen and sulfur, which are toxic by inhalation in certain dosages; particulates; and, hydrocarbons which settle in the lungs and irritate its inner linings.

While the risks to public health are inherent in the increasing amount of pollutants, there were no conclusive studies in the Philippines establishing the relationship between pollution from vehicle emissions and the incidence of diseases and poor health among those exposed to it during the decade.

2.3 Constraints in Air Quality Monitoring

In 1981, Japanese equipment manufacturers stopped producing the 1973 air sampling models installed at the monitoring stations in Metro Manila. In succeeding years, the lack of spare parts and the high cost of maintenance forced the then NPCC to stop operating equipment for monitoring NO_2, hydrocarbons and oxidants, leaving only TSP, CO, and SO_2 as the parameters under study. By 1983, the equipment began to break down. In the first semester of 1984, the number of stations was reduced to three and before the end of 1985, all operations were suspended.

When monitoring resumed in 1986, manual samplers had to be utilized for sulfur dioxide and particulates through improvised monitors using materials from the discarded equipment. The lack of uniformity in the frequency and methods of collection and analysis have limited the amount of data which could be used to concretely define the metropolis' air pollution problems.

2.4 Problems in the Enforcement of Vehicular Air Pollution Control Laws

Although efforts have been exerted to implement the anti-motor vehicle pollution law for the past 10 years, vehicles, manpower, funds and equipment have always been limited, and implementing units have not been given enough support to match the task of enforcing a higher standard of air quality.

2.5 Poor Compliance with the Industrial Pollution Control Law

Although the NPCC has required pollutive industries to install anti-pollution facilities, monitoring statistics since 1980 show that a certain percentage do not comply with this requirement (**Tables 8 and 9**). The disparity between the number of fully complying firms, and those partially complying only shows that the regulatory measure has not been taken seriously.

When the Laguna Lake Development Authority was given the task of regulating pollution and its jurisdiction extended to Metro Manila, this posed problems in terms of overlapping functions with the then NPCC and now, the DENR. Coordination in the use of scarce resources became a constraint which has yet to be overcome.

2.6 Implications of Global Warming to the Country

The global greenhouse effect and the destruction of the earth's ozone layer have grave implications for the Philippines. In the tropics and sub-tropics, where the Philippines and most developing countries lie, more extreme changes in climate patterns are predicted. The PAGASA projects the scenario as one in which there will be heavier rainfall in already heavy rainfall months and lower rainfall in already dry months. The frequency of tropical cyclones may also increase and extend to areas where they are less common.[24]

Changes in rainfall patterns affect the Philippines' agricultural production and the fulfillment of remaining potentials for cropland development and food supply. The magnitude and frequency of problems already experienced such as flooding and drought, would also be compounded by climate changes.

The thermal expansion of the seas, in which ocean levels may rise by 30 cm. or more is another disruption expected from global warming within the next few decades. Being a country with innumerable seaside settlements and ports, the consequences of a rise in sea level may be disastrous for the Philippines. Evacuation of affected populations may be inevitable. Even if there would be more time to reinforce the most vulnerable regions from inundation and flooding, the over-all effort from research and planning to actual implementation of mitigating measures will entail a lot of the country's financial and technical resources.

Damages to drainage and irrigation systems may result, along with increased salinity in rivers, groundwater, estuaries and other freshwater bodies. Coastal erosion may be accelerated. The Philippines' mangrove and coastal ecosystems stand to be much affected, critical as they already are from pollution and misuse.

Table 8. Statistics on Industrial Air Pollution Control Facilities, 1980 - 1987

Year	Total Number of Firms Surveyed and Inspected			Total Number of Air Pollutive Firms			Total Number of Firms with APCD (Air Pollution Control Device)						Total Number of Firms without APCD		
	a	b	c	a	b	c	a		b		c		a	b	c
1980	1,179	2,110	3,295	693	589	1,228	536		364		900		103	225	328
1981	1,733	2,326	4,059	857	815	1,672	565		576		1,141		292	239	531
1982	2,165	3,574	5,739	1,043	1,716	2,756	841		1,403		2,244		202	313	515
1983	2,369	3,971	6,340	1,154	2,053	3,217	931		1,718		2,649		233	335	568
1984	2,436	4,085	6,521	1,005	2,284	3,289	919		2,038		2,957		86	246	332
							d	e	d	e	d	e			
1985	1,492	3153	4,942	782	2,313	3,095	606	142	1,234	839	1,840	981	34	240	274
1986	1,051	4,260	5,311	475	2,328	2,803	244	194	1,087	1,032	1,331	1,226	37	209	246
1987	1,177	4,720	5,897	496	2,562	3,058	287	169	1,218	1,128	1,505	1,297	40	216	256

Source: NPCC

Legend:
a) Metro Manila
b) Outside Metro Manila
c) Whole Country
d) APCD with Permits to Operate
e) APCD without Permits to Operate

Table 9. Percentage Compliance by Industries, 1980 - 1987
(Industrial Air Pollution Control Facilities)

Year	Number of Firms Complying						Number of Firms Not Complying		
	Metro Manila		Outside Metro Manila		Whole Country		Metro Manila	Outside Metro Manila	Whole Country
1980	83.9%		61.8%		73.3%		16.1%	38.2%	26.7%
1981	65.9%		70.7%		68.2%		34.1%	29.3%	31.8%
1982	80.6%		81.8%		81.3%		19.4%	18.2%	18.7%
1983	80.0%		83.7%		82.3%		20.0%	16.3%	17.7%
1984	91.4%		89.2%		89.9%		8.6%	10.8%	10.1%
	a	b	a	b	a	b			
1985	77.5%	18.2%	53.3%	36.3%	59.5%	31.7%	4.3%	10.4%	8.8%
1986	51.4%	40.8%	47.7%	44.3%	47.5%	43.7%	7.8%	9.0%	8.8%
1987	57.9%	34.1%	47.5%	44.0%	49.2%	42.4%	8.0%	8.50%	8.4%

Source: NPCC

Note: Starting 1985, a distinction has been made between firms with and without permits to operate.

Legend:
a. Full Compliance (APCD with Permit to Operate)
b. Partial Compliance (APCD without Permit to Operate)

In addition, the country's upland ecosystems, already beset with massive deforestation, may have even lesser chances of regaining ecological balance if confronted with harsh climatic conditions.

3. MANAGEMENT EFFORTS

3.1 Air Quality

Policies on Air Pollution Control

In 1977, P.D. No. 1181 provided for the prevention, control and abatement of air pollution from motor vehicles. The agencies tasked with its implementation were the then NPCC, the National Science Development Board (NSDB), and the Land Transportation Commission (LTC). The NPCC's Rules and Regulations in 1978 included standards for air quality at the emission source and ambient air.

Executive Order No. 927 dated 16 December 1983 mandated the Laguna Lake Development Authority to exercise control over all sources of pollution within its jurisdiction. This has been interpreted to include sources of air pollution in areas such as Manila, Quezon City, Pasay, Pasig, Taguig, Pateros, Marikina, Caloocan City and Muntinlupa.

Regulatory Efforts

Control of Pollutants from Motor Vehicles

Since 1981, Anti-Smoke-Belching Teams have been formed to go after mobile air polluters. Apprehended smoke-belching vehicles were issued subpoena tickets and ordered to report for confirmatory testing. Owners were not to resume operations until their vehicles conform with emission standards, the maximum limit of which is 67 Hartridge Smoke units. A fine of P200.00 was paid for the first offense, P500.00 for the second offense, and P1,000.00 for the third and succeeding offenses. A certificate of compliance was issued by the government if the apprehended vehicle met the emission standards.

In 1989, smoke-belching was identified as a major environmental problem by the DENR. Accordingly, institutional arrangements were strengthened and efforts were stepped up to address the problem. A Memorandum of Agreement between the DENR, DOTC, PC-INP and the MMC was signed in 1989. Composite apprehending teams led by the DENR-NCR and representatives of the participating agencies were fielded in key routes in Metro Manila.

The current system is essentially the same as the one established by the former NPCC except that after failing the street test, erring vehicles are stripped of their registration plates which owners can claim by reporting for testing at the designated center. Apprehending teams also conducted garage tests during off-hours.

To complement enforcement efforts, the inter-agency task-force Operation Clean Air also built up an extensive Information-Education-Communication Program to raise the level of awareness and knowledge of motorists and the general public on air pollution problems.

Tie-ups with local governments were also pursued and cooperation with non-government organizations committed to environmental protection strengthened. Lead collaborators included the local governments of Mandaluyong, Makati and Quezon City, and an umbrella group of NGOs called Groups Against Smoke Pollution or GASP!, together with the Manila Jaycees through their Project MUFFLER (Monitor Unhealthy Fumes for Lesser Environmental Risk).

The overall trend in apprehension since 1980 is shown in **Table 10.**

Control of Pollutants from Industrial Sources

In order to manage air pollution from stationary sources, government requires all pollution emitting industries to install and operate anti-pollution facilities or devices. To prevent the emergence of new sources of pollution, any new manufacturing or industrial establishment must have the appropriately built anti-pollution facilities before it commences operation.

Such pollution control equipment include any apparatus for separating air impurities from the gas medium in which they are carried and devices used to limit air pollution or to indicate, record and give warning when excessive pollution occurs.

Before issuing Permits to Operate, the DENR (previously the NPCC) conducts plant surveys, inspections and investigations to determine the extent of pollution and compliance with orders and directives and to evaluate the efficiency of pollution control facilities.

Preliminary arrangements have been made with officials of the LLDA, Metro Manila Commission (MMC) and the National Power Corporation (NPC) to coordinate efforts for the control of pollution from stationary sources.

Management Programs

Upgrading Equipment and Facilities

The effective control of air pollution from sources requires accurate and regular testing, hence, the need to upgrade equipment for measuring emissions. During the later part of the decade, the DENR and LTO commenced construction of Motor Vehicle Inspection Stations and testing centers in strategic locations in the country. Likewise, the LLDA exerted efforts to acquire equipment for monitoring of both source emissions and ambient air quality.

Monitoring

As explained previously, a number of continuous air monitoring stations with display boards were set up, displaying hourly information on the concentration of carbon monoxide and suspended particulates in the vicinity for the public. Not displayed on the boards were levels of other pollutants monitored such as sulfur dioxide, nitrogen oxides, hydrocarbons, and photochemical oxidants, together with meteorological data.

Table 10. Result of Anti-Smoke Belching Campaign in Metro Manila, 1980-1989

Year	No. of Vehicles Apprehended	No. of Vehicles that Reported for Testing	Percentage of Apprehended Vehicles Tested	No. of C O C's Issued to Apprehended/ Tested Vehicles	Percentage of Vehicles Tested and Issued C O C's
1980	3,096	-	-	809	-
1981	9,948	-	-	2,173	-
1982	18,054	-	-	3,543	-
1983	16,224	5,366	33.1	2,270	42.3
1984	12,584	3,160	25.1	1,907	60.3
1985	13,371	5,297	39.6	2,196	41.4
1986	7,520	1,726	23.0	1,225	71.0
1987	9,190	2,047	22.3	1,316	64.3
1988	3,436	1,465	60.14	1,227	83.7
1989	17,484	14,053	80.38	9,723	69.19

Source: DENR-NCR-EMS

At present, the existing air quality monitoring network in Metro Manila is composed of eight fixed sampling stations located in strategic areas where both ambient air pollution concentration and population exposure are expected to be high.

Efforts to reduce air pollution in all regions of the country were encouraged by the DENR since 1988. This has resulted in active campaigns to inspect industrial establishments and stepped-up apprehension of smoke-belching vehicles in key cities.

Research and Development

As cited in earlier discussions, the **Air Pollution Emission Inventory in Metro Manila for CY 1987** was completed by a team from the Environmental Management Bureau, the National Capital Region, Region III and Region IV Offices of the DENR, with assistance from the United Nations Development Programme.

As earlier discussed, the study tackled emissions of five air pollutants, leading to a better estimation of the magnitude of the air pollution problem in Metro Manila than in previous years. Due to inadequate data on the activity level and emission factors for the various emission sources, the inventory should be treated as primary source data on which other inventories could be built upon.

In 1983, the National Environmental Protection Council conducted a study on the **Uptake of Air Pollutants by Philippine Plants** to determine which local plants grow well under stressful conditions and are capable of removing sulfur dioxide and nitrogen dioxide from the air. The mechanisms used by these plants to detoxify the pollutants were also investigated.

Laboratory studies showed that resistant species like ipil-ipil, picara, moluccan sau, yemane and pandan were effective in removing gas from the test chamber atmosphere containing 0.06-0.20 ppm SO_2 and NO_2 . Species like ipil-ipil, yellow bell, chichirica, moluccan sau and lumbang were found to be good absorbers of NO_2 .

In 1986, the Environmental Management Bureau conducted an **Investigation on the Acidity of Rainfall and Particulate Matter in Metro Manila and Vicinity.** Rainwater samples were collected and analyzed for pH, SO_4 , NO_3 , TSP, TDS and acidity. Samples were collected in 16 stations covering the provinces of Bataan, Bulacan, Laguna and Rizal for two years.

3.2 Climate Change

The Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA) under the Department of Science and Technology (DOST) is the lead agency concerned with research and monitoring of weather and climate conditions in the country and their impact on aspects of national development.

In response to the drought which occurred for the second time in the decade, a drought advisory called the Drought Early Warning and Monitoring System (DEWMS) was released by PAGASA to other government agencies especially in the regions affected, indicating the levels to which rainfall had decreased. This led to the creation of a Cabinet Crisis Committee to monitor drought and its effects on water supply and agriculture.

The PAGASA participates in the World Climate Program of the World Meteorological Organization (WMO), which conducts climate system monitoring and reports on anomalies and climatic events worldwide. It measures and assesses, among other things, trends in greenhouse gas accumulation and pollution of air and rain, ozone depletion and other global climatic occurrences such as the El Nino and rainfall acidity. In the process, techniques in forecasting the above-mentioned occurrences are developed. The results provide early warnings to policy decision-makers on potential impacts of these occurrences.

In contrast to the notable decline in the global use of CFCs in the 70s, the 80s showed a rise in production. Efforts were thus intensified to draft and enforce an international agreement to protect the ozone layer from CFCs. The Philippines is a signatory to the Montreal Protocol for the Protection of the Ozone Layer, which was officially adopted in Montreal, Canada in 1987.

Efforts have also been initiated to form a National Committee on Climate Change and Ozone Depletion to include all concerned government agencies in actions to meet the effects of climate change in the coming years.

4. PROSPECTS

Inasmuch as human health is the ultimate parameter in gauging the impact of air pollution, the most important issue in air quality management in the coming years is the effect of vehicular air pollution on regular commuters, drivers and pedestrians, as well as, the effects of industry-based air pollution on laborers and communities who dwell near pollutive firms.

The broader consequences of continuous air pollution may extend to increasing levels of acidity in rainfall from SO_2 in coal and diesel combustion, and the build-up of CO_2 , CFCs and other greenhouse gases in the atmosphere. Although these have been concerns of highly industrialized countries, they will soon start to be ours, considering that we are following trends which will lead to extensive pollution problems.

The challenges in air quality management for the coming years encompass a broad spectrum of concerns. For one, the need to stem the build-up of industries, population and motor vehicles in already congested urban areas has never been more urgent than now. More research on the ill-effects of air pollution will have to be conducted in answer to the clamor for a more concrete picture of its threat to human health. More uniform and reliable ambient air quality monitoring schemes likewise need to be established.

Regulation of pollution from motor vehicles must be reinforced not only by stepping up apprehension of erring vehicle owners but also by looking into the fuel composition and engine conditions. The country's fuel and tariff policies need to be looked into and may need changes, to adequately address the pollution problems posed by leaded gasoline and inefficient re-conditioned engines.

Another management issue which needs to be resolved is the overlapping of functions of the DENR and LLDA in regulating air pollution. Experience in the past has shown how inter-agency conflicts can weaken the effectiveness of government in imposing stricter air pollution measures.

The impending global warming crisis is another major issue which looms in the coming decades. The drastic effects of severe droughts already felt in the eighties and the yearly toll from flooding and typhoons hint at the difficulties which lie ahead for the country from more erratic climatic changes as a consequence of global warming.

The nature of the global warming problem calls for no less than concerted action at both national and international levels. Even if deforestation and a small percentage of pollutant emissions are our country's only contributions to the overall causes of climate change, our future is tied to its world-wide consequences.

Continued participation in global climate monitoring and research should be ensured. Congressional approval of our being signatory to the Montreal Protocol for the Protection of the Ozone Layer should be hastened.

On the national level, institutional arrangements among both government and non-government/academe sectors should be intensified to increase the chances for success in our efforts to coordinate preparations and responses to the disasters expected from the greenhouse effect.

MARINE ENVIRONMENT

1. PROFILE

Increasing urbanization and industrialization have wrought rapid changes in the make-up of the country's coastal zone. The effects of these developments have already been noted with concern when changes in the state of the environment began to be documented in 1977. Among these were the rapid depletion of mangroves, decimation of coral reefs and rapid decline in fisheries yield.

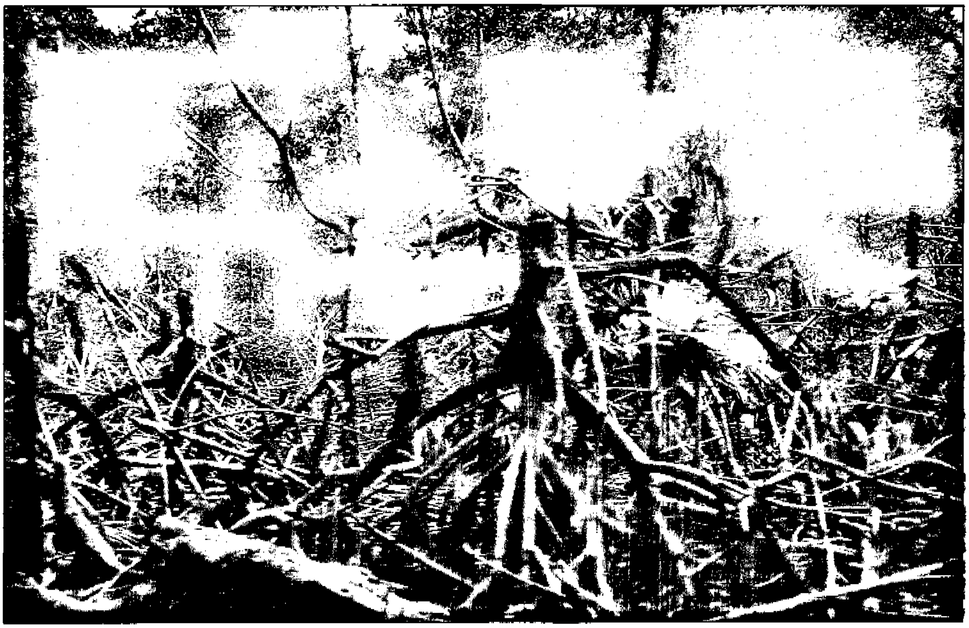
The role and importance of the coastal zone in the country's economic development and ecological survival could be gleaned from the fact that sixty (60) of the country's seventy three (73) provinces, as well as, 1,525 municipalities are located in it. Most cities hosting majority of the nation's economic activities are likewise sited in coastal areas. A sizeable chunk of the country's income is derived from its coastal resources, primarily fisheries. The total quantity of marine fish produced by the twenty-three (23) statistical fishing areas in 1985, for example, totalled 1.56 million metric tons. Value of other marine products (seaweeds, shells, etc.) reached P19.052 million in 1986. In 1988, the combined commercial and municipal fish production reached 1,704 million metric tons with a total value of P25.42 billion.[25]

Mangroves

The mangrove ecosystem provides a firm foundation for the country's coastal fisheries by serving as nursery ground for a variety of fish, prawns, crabs, bivalves and other invertebrates. Countless species of fish, primarily of the Mugilidae (mullet) and Carangidae (jacks) families abound in the Philippine mangroves. As of last count, 68 families of fish have been established to inhabit these areas. Mangroves are also a source of firewood, charcoal, tannin and dyebarks and serve as land builders and buffer zones against typhoons and wave actions.

In 1918, the country's mangrove forests were estimated to be 500,000 hectares. By 1970, this had been reduced to 288,000 hectares and then again to 242,000 hectares a decade later. BFD statistics in 1976 placed mangrove forests at less than one percent, by volume, of the total Philippine forest inventory. The annual rate of degradation then was established at 6.2 percent or 20,184 hectares. Excluding the residuals after cutting or "reproductive brush", the LANDSAT study of 1980 showed that only 175,000 hectares of old growth mangrove forests remained. In 1988, remaining mangrove cover was estimated between 139,100 to 142,400 hectares or 27.28% of the 1918 figures. These figures were a result of the assessment conducted by the Swedish Space Corporation (SSC), National Mapping and Resource Information Authority (NAMRIA) and National Forest Resources Inventory Project (NFRIP). Their comparative estimates per region are presented in **Table 11.**

Mangrove area measurements of the SSC were based on manual interpretation of 1:1000,000 scale S.P.O.T. satellite disposition data taken from 1987 to 1988, while the NAMRIA's area measurements were based on the re-interpretation of the 1987-1988 S.P.O.T. satellite data enlarged to 1:50,000 scale. The National Forest Resources



The continuous destruction of the country's mangroves has left it with about 139,999 to 142,000 hectares in 1988 or approximately 27% of the 1918 figures.

Corals have been one of the Philippines' most treasured resources. But pollution and destructive fishing practices have destroyed vast tracts of coral reefs, affecting the country's fisheries.

Table 11. Comparative Estimates of Mangrove Cover by Region, 1988

Region	SSC	NAMRIA	NFRIP
Luzon			
1	300	200	100
2	5500	3400	3800
3	1500	500	100
4	46500	51000	33400
5	10700	9900	900
Visayas			
6	2900	2825	4400
7	9400	9650	3500
8	26300	24850	64500
Mindanao			
9	24500	19300	21200
10	11000	8600	6100
11	8000	7100	200
12	1700	2400	
Total	142400	139725	139100

Source: ERDB, 1989.

Project which started in 1983 derived mangrove area measurements from LANDSAT, aerial photos and reconnaissance surveys. Figures were derived from trend extrapolation.

The S.P.O.T. data provided by the SSC also revealed that of the remaining stands, twenty two percent (22%) are concentrated in Palawan, thirty two percent (32%) in the east and southwest coasts of Mindanao and 23 percent in the Eastern Visayas and Bohol.

Areal measures do not reflect qualitative losses such as: 1) changes in species mix, with a rapid decline in extent of useful mangroves; 2) shift in age structure towards younger stands; and, 3) possible decline in timber productivity due to successive generations of mangroves being harvested. As early as 1980, LANDSAT statistics indicated that except for the approximately 10,000 hectares (of which two thirds were in Palawan and one third in Zamboanga del Sur), almost all of the old mangrove stands have been decimated.

Coral Reefs

Coral reefs constitute a very important component of the country's coastal zone. They are highly productive complex communities sustained primarily by a coral-algal symbiosis. They have historically been considered as one of the greatest natural treasures of the Philippines, being home to about 488 species of corals, 971 species of benthic algae and 2000 species of fish. Extensive exploitation and pollution, however, have taken their toll on this extremely vulnerable ecosystem, whose recovery may well take decades.

Philippine coral reefs are classified into: the fringing, atoll, barrier and shoal. A major portion of the country's 118,417 km. coastline is characterized by fringing reefs, with most atolls occurring in the Sulu Archipelago and the Sulu Sea and west of Mindoro. Barrier reefs are found in areas such as the northwest of Bohol, the southwest of Palawan and Tawi-Tawi, while shoal reefs occur mostly in the major shelf areas. Five principal shelf areas (Polillo, Visayas, Palawan, Leyte-Samar and Sulu) host majority of the coral reefs. Palawan has the highest concentration of reefs (37.86%), followed by Sulu (27.81%) Visayas (21.70%), Northern Luzon (7.63%), Central and, Southern Mindanao (3.2%) and the Turtle Islands (1.74%).

Figures on the areal extent of coral reefs vary. In 1977, a UP-Marine Science Center Study estimated coral reefs to cover a total area of 44,096.54 kms. However, a Bureau of Fisheries and Aquatic Resources (BFAR) study disputed the depth of 40 fathoms used by the UP-MSI team as limit of significant coral reef extent.[26] It contended that a 10-20 fathom contour would serve as a better basis for approximation, particularly in terms of fisheries resource assessment and that coral reefs could be more realistically estimated to occupy 30% of Philippine shallow marine areas. Within a 10 fathom contour, the study estimated total reef area to be 12,171 km^2 and 33,088 km^2 for the 20-fathom contour.

The first comprehensive assessment of the condition of the country's coral reefs was undertaken in 1976-1981 by the Marine Science Center of the University of the Philippines for the Ministry of Natural Resources. The MSC study established then that 32 percent of Philippine reefs were already considered to be in poor condition, (0 - 25% living coral cover), 39 percent fair (25 - 50% cover), 24 percent good (50 - 75% cover) and only less than 6 percent excellent (75 - 100 % cover) (**Figures 9 and 10**).

A more recent study under the ASEAN-Australian Coastal Living Resources Project (1989) has indicated further degradation of formerly pristine coral reef areas such as Bacuit Bay. The study also noted that the hard coral cover of North Bais Bay "appeared to be decreasing over time, from 47.17% during the first sampling to 40.18% seven samplings later". It also noted that in some impacted areas like Calancan Bay in Marinduque, coral cover remained essentially the same, but, with massive shifts in composition (e.g. from Porites-faviid to Porites dominated communities).

Fisheries and Other Marine Resources

Fisheries provide a substantial contribution to the country's economy. In 1988, for example, it contributed P 46.59 billion to the GNP. Value of production has increased markedly from P13.95 billion in 1981 to P46.59 billion in 1989 (**Figure 11**). It also directly employs an estimated one million fishermen and fish farmers. This does not include the indirect employment the sector provides to those engaged in fish marketing and distribution, fish processing, operation of ice plants and cold storage and people in allied industries such as production of nets, beat building, etc.

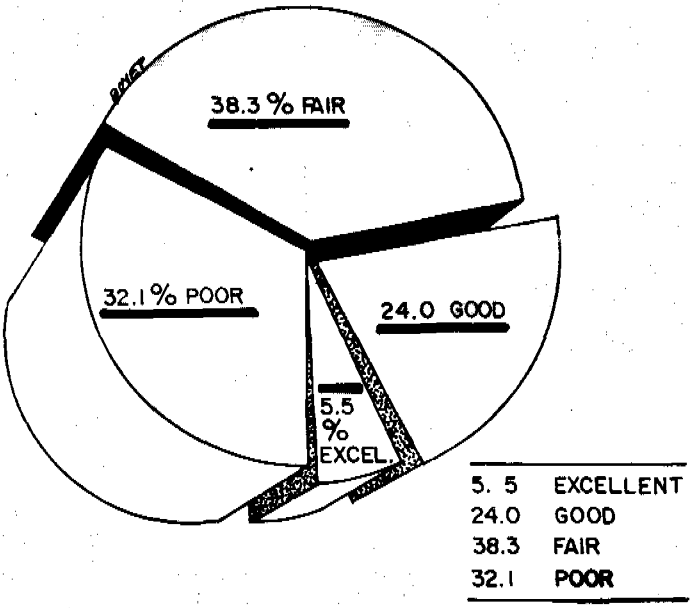


Figure 9. Status of Philippine Coral Reefs, 1982

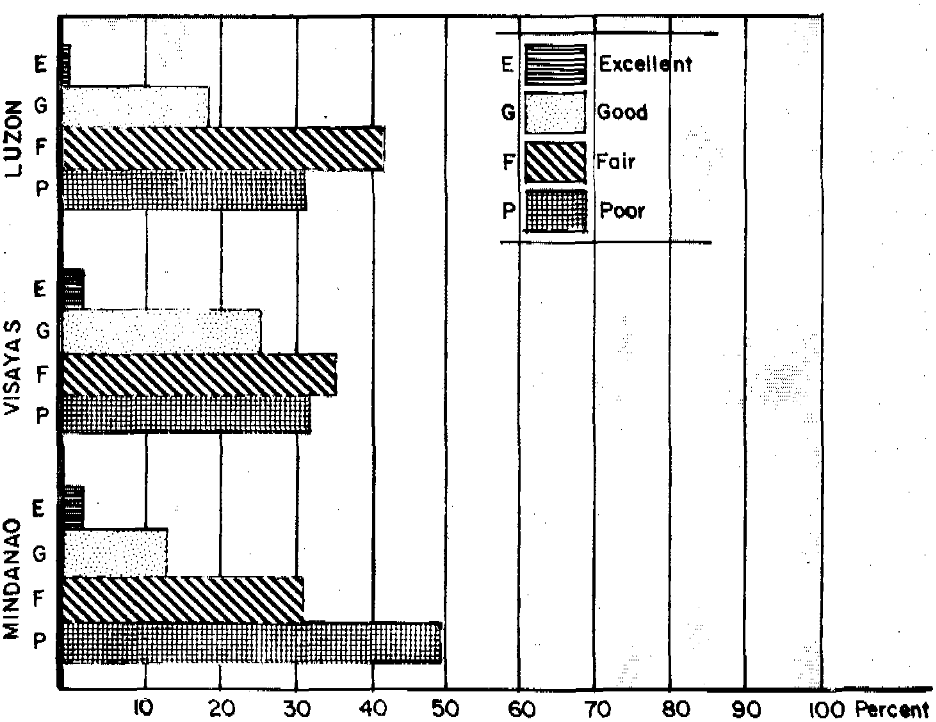


Figure 10. Status of Philippine Coral Reefs by Major Island Grouping, 1982

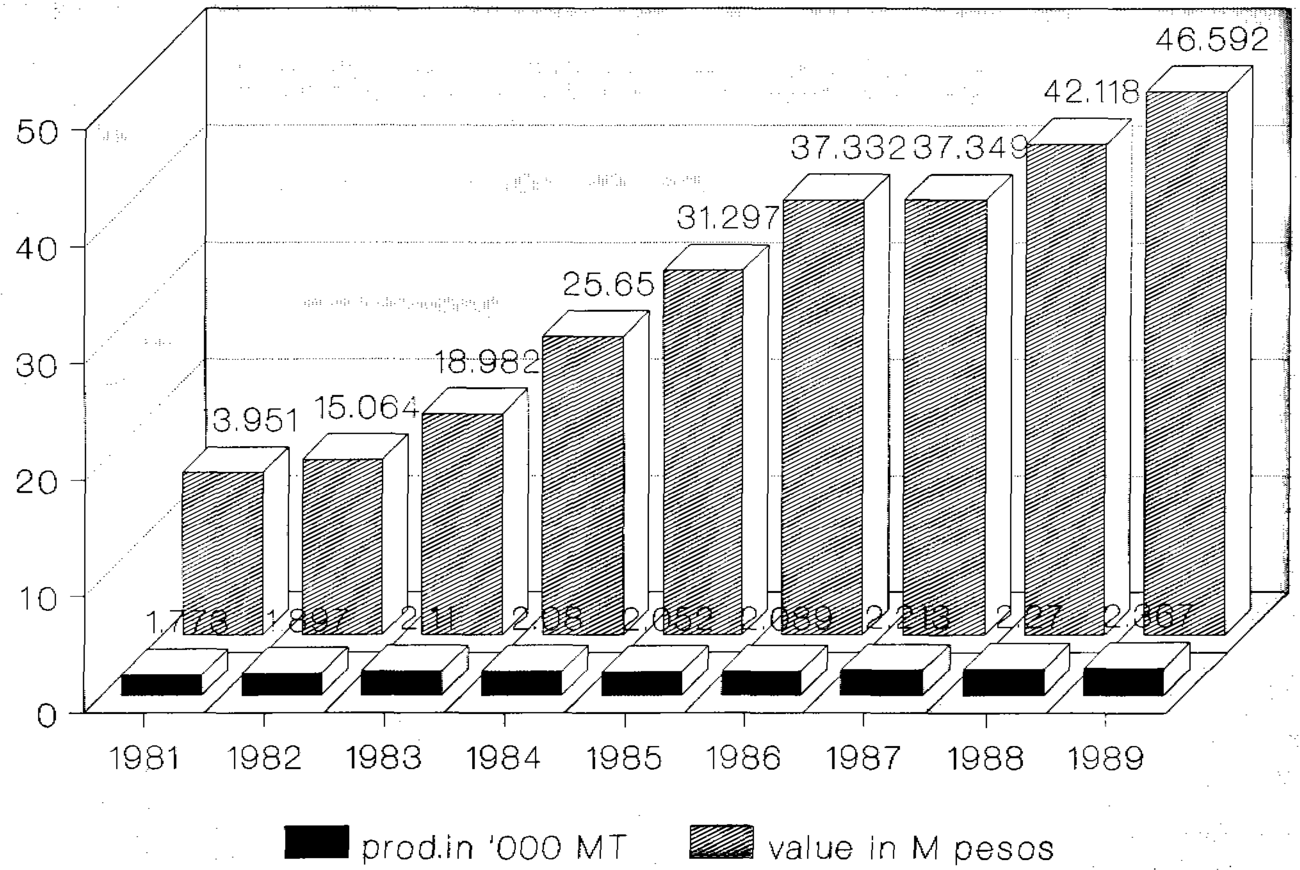


Figure 11. Total Fish Production by Quantity and Value, 1980-1989

The country's fisheries is divided broadly into marine and inland resources. For fish production purposes, fishery resources are further subdivided into marine and aquaculture. Commercial and municipal fisheries comprise the marine category while aquaculture refer to brackish water fisheries, freshwater fisheries and seafarming. The contribution of the different sectors to total fish production for the period 1981-1989 is given in **Table 12.**

Coral reefs contribute significantly to the country's commercial, municipal and sustenance fisheries. In 1977, estimates placed fish yield by Philippine reefs at 60,000 to 176,000 metric tons per year based on a probable maximum sustainable harvest of 5 tons/sq.km., instead of the earlier estimated 2-5 tons/sq.km.[27] More recent estimates use a weighted average yield of 7.0 t/sq.km. translating into fish production of 210,000 tons per year.[28]

More than half of the total fisheries harvest is contributed by municipal and sustenance fisheries. However, the full potential of reef fisheries have not been fully documented. This is borne out by specific information on the Sulu Sea, Bohol Sea and Moro Gulf and might partly account for the municipal and sustenance fisheries' contributing only 12.5% to total fisheries productivity.

Coastal Waters

The quality of the country's coastal waters have rapidly deteriorated over the past decade, primarily due to sewage and industrial effluents from urban areas, tailings from mining activities, oil from shipping operations and agricultural run-off. Monitoring of Manila Bay, for example, shows that bacterial count has increased through the years (**Figure 12**), rendering many beaches in its eastern part unfit for bathing.[29] Nearshore waters are also unfit for fisheries and growing of shellfish. Fecal coliform counts were particularly high in Baclaran, South Breakwater, Pasig River outlet and Bacoor.

In general, dissolved oxygen concentration (3.0 mg/li to 8.5 mg/li), pH values and heavy metals were still within acceptable levels for waters fit for fish and other aquatic life propagation for the past decade, except in 1985 when exceedances in some of these parameters were noted. Out of the ten stations monitored, two stations exhibited high oil and grease concentrations particularly near the port area of Manila for the same year.

Bays affected by mine tailings include Calancan Bay and Tanon Strait. Calancan Bay is an embayment north of Marinduque Island where a 4.2 kilometer causeway of mine tailings has been built up through the years due to the operations of Marcopper Mining Corporation. NPCC's analysis of Calancan waters from 1976-1978 revealed that heavy metals content already exceeded set standards. Copper ranged between 0.05 ppm to 0.67 ppm, exceeding the 0.02 ppm standard for Class SC waters. Cadmium concentration exceeded the 0.01 ppm standard at 0.06 ppm to 0.23 ppm, and lead, the 0.05 ppm standard for both Class SB and SC waters at 0.14 ppm to 0.64 ppm. Expectedly, Marcopper's monitoring results yielded copper concentrations ranging from beyond detectable limits (bdl) to 0.014 ppm for the period 1982- 1986.[30] It reported only one instance of the standard being exceeded at 0.060 ppm in September, 1983. Later monitoring data are unavailable.

Table 12. Fish Production by Sectors, 1981-1989

	Commercial	Municipal	Aquaculture	Total
1981				
a	495.0	939.0	340.0	1773.0
b	28.0	53.0	19.0	
1982				
a	526.6	978.4	392.3	1897.3
b	28.0	52.0	21.0	
1983				
a	519.3	1145.8	445.1	2110.2
b	25.0	54.0	21.0	
1984				
a	513.3	1089.2	477.9	2080.4
b	25.0	52.0	23.0	
1985				
a	512.0	1045.4	494.7	2052.1
b	25.0	51.0	24.0	
1986				
a	546.2	1072.4	470.9	2089.5
b	26.0	51.0	23.0	
1987				
a	591.2	1060.9	560.9	2213.0
b	27.0	48.0	25.0	
1988				
a	600.1	1070.2	599.5	2305.5
b	26.0	47.0	26.0	
1989				
a	624.7	1104.6	637.3	2366.6
b	26.4	46.7	26.9	

Source: Bureau of Agricultural Statistics, 1989.

legend: a - production in thousand metric tons

b - percentage

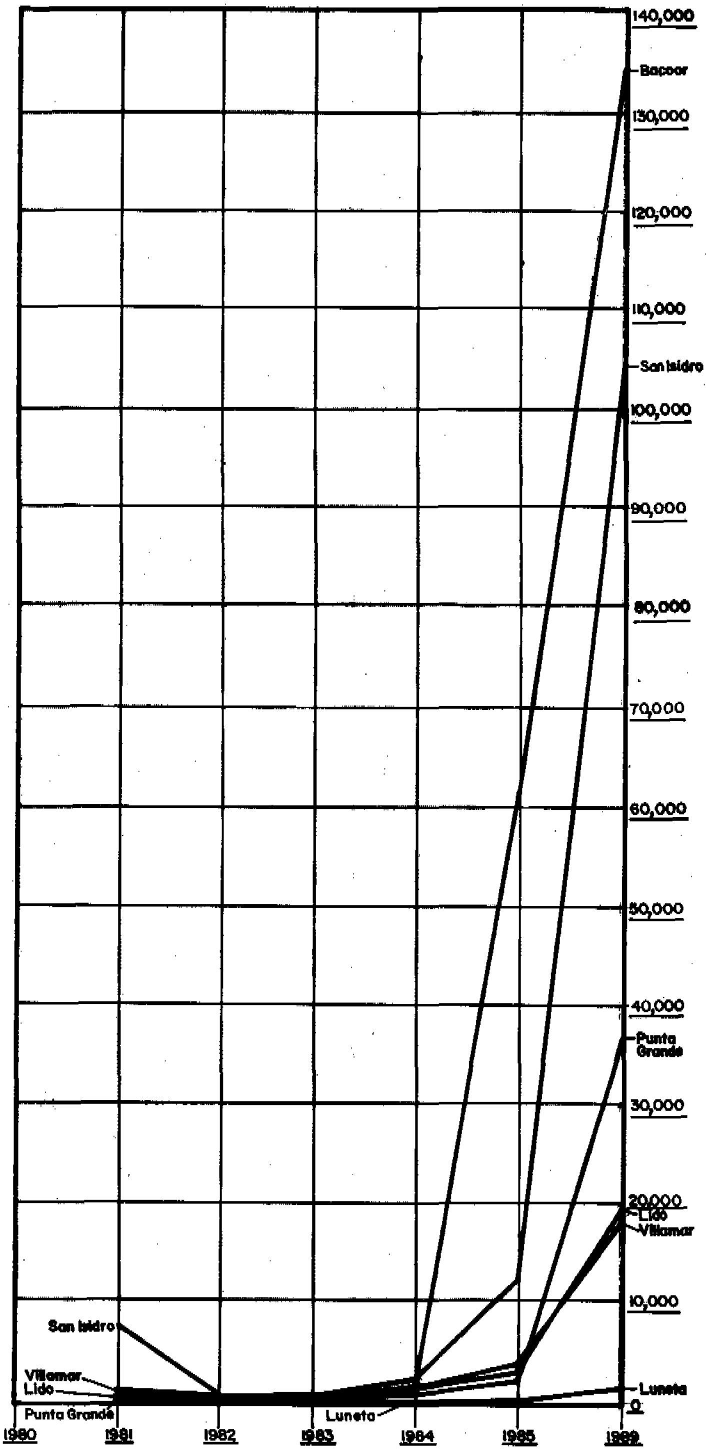


Figure 12. Geometric Mean of the Total Coliform Count (MPN/100 ml) of Eastern Manila Bay Beaches, 1981-1989

Other coastal waters also showed high heavy metals content during this period as exhibited by fishes caught from them (**Table 13**).

2. PROBLEMS AND ISSUES

2.1 Degradation/Conversion of Mangroves into Other Uses

Forest clearing to make way for fishponds; harvesting of mangroves for charcoal; and,fuelwood production and expansion of coastal communities,account for the steady reduction of mangroves. Conversion of mangroves into fishpond areas has been occurring at an average rate of 5,000 hectares/year in the seventies and early eighties, dropping slightly to 3,500 hectares per year until 1987, resulting in an increase in fishpond areas from 89,000 hectares in 1952 to 288,585 hectares in 1988.[31] Today, ninety-five percent (95%) of the total 288,585 hectares of fishponds are ascribed to converted mangrove areas.

Conversion does not automatically ensue. It occurs through a process which starts with the degradation and subsequent destruction of mangroves. Overharvesting has been established to initiate the process of degradation, which is aggravated by non-replanting of degraded areas. Local demands for mangroves as fuelwood, particularly, has encouraged over-cutting. As of 1982 for example, approximately 3.0 million cubic meters of mangrove timber were used for firewood and charcoal. As a result, soil erosion in affected areas has become more pronounced. In most instances, changes in soil composition also occur.

Mangrove areas undergoing conversions are quite difficult to establish accurately. Nor could decreasing extent of mangrove areas be directly correlated with increase in fishpond areas. In 1987, however, the sharp decline in mangrove cover (from 232,065 hectares in 1984 to 143,522 in 1987) was matched by a significant increase in fishpond areas with approved FLAs (**Figure 13**).

Aside from man-induced degradation, mangroves are also susceptible to damages from natural agents such as monsoon winds and storms. Typhoons, particularly, have proven to be devastating. In 1984, typhoon Nitang wiped out scores of young mangroves in the Central Visayas. Monsoon rains have been documented to destroy well-rooted seedlings of 3 to 6 months old. Government policies contributed, in most part, to the rapid degradation and loss of mangrove areas. Prior to the mid-1970s, government was totally apathetic to the adverse consequences of mangrove losses. Even with the explicit recognition of the problem in the late seventies, conversion of mangrove areas into fishponds continued unabated. Although this practice slowed down for a while starting 1975 due to the limitation on fishpond areas which could be leased-50 hectares for individuals and 500 hectares for corporations or associations, it started to pick up again due to the powerful lobby of fishpond operators. As a result, 28,000 hectares of mangroves were released for fishpond development.[32] Thereafter, there has been no clear-cut policy or plan to protect the remaining stands of old growth mangrove forest. At present, applications for fishponds covering some of these areas continue to be processed (**Table 14**).

Table 13. Average Concentrations of Heavy Metals In Common Food Fishes from Various Bays, 1985
(in ppm)

Name of Fish	Number of Samples	Copper	Zinc	Cadmium
A. Macajalar Bay				
1. Andohan	9	0.46	55.21	0.18
2. Bolis	5	0.88	82.17	0.17
3. Bariles	7	0.59	58.38	0.13
4. Pidlayan	7	1.31	11.81	0.14
5. Malatindok	8	0.51	42.64	0.15
B. Gingoog Bay				
1. Bolo	2	0.05	2.01	0.02
2. Timbangan	1	0.26	2.96	0.02
3. Danguit	2	0.16	2.87	0.02
4. Suacid	1	0.54	6.17	0.09
5. Kitang	1	0.78	10.09	0.04
6. Silay	1	0.13	0.74	0.03
7. Puti-an	2	0.29	0.89	0.02
8. Lagaw	1	bdc	1.46	0.01
9. Bagis	1	bdc	16.47	0.02
10. Malinal	1	0.04	1.80	bdc
11. Pidlayan	1	0.93	4.60	0.01
12. Rumpy Candobo	1	0.19	38.26	0.01
13. Bangsi	2	0.27	41.21	0.01
14. Malmol	2	0.11	1.44	0.03
15. Anduhaw	1	0.59	4.40	0.03
16. Borot	1	0.63	0.19	0.04

Source: 1985 NPCC Annual Report.

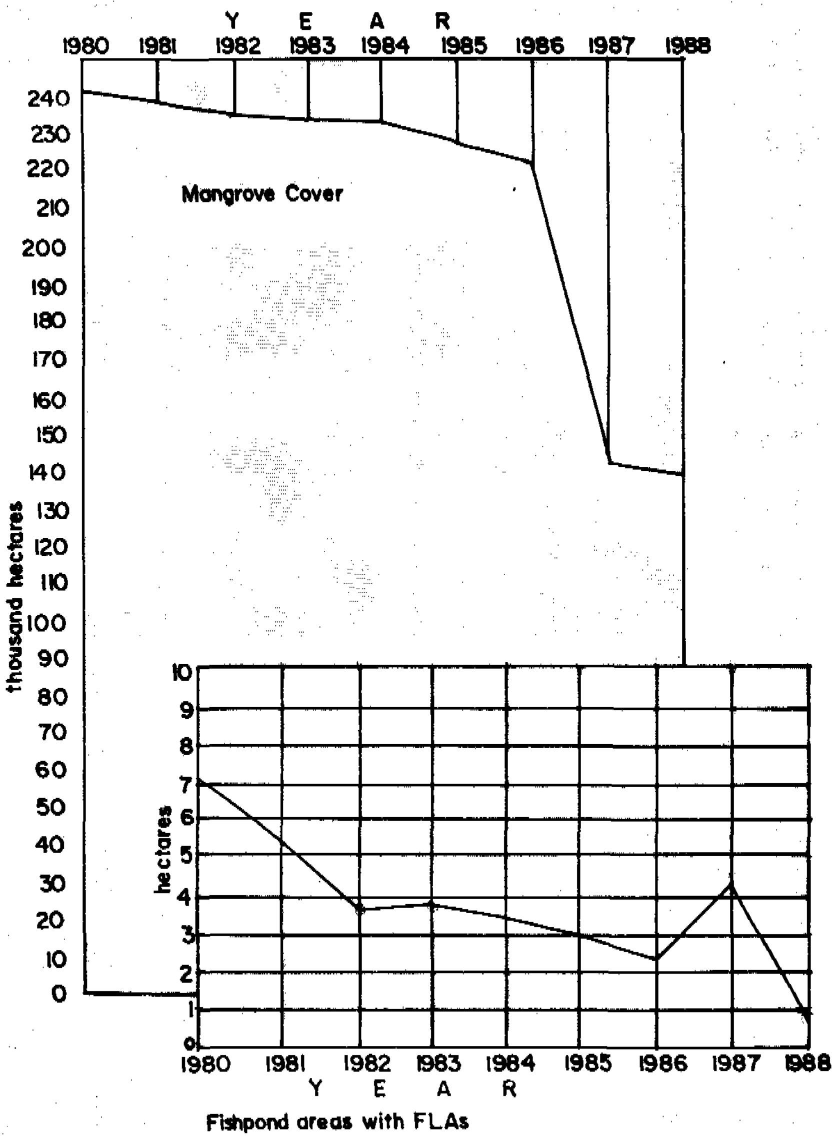


Figure 13. Fishpond Applications vs. Mangrove Cover

Table 14. FLAs Issued by Region, 1980 - 1988

	1980		1981		1982		1983		1984		1985		1986		1987		1988		Total/Region	
Region	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
1	14	120.27	5	25.96	9	77.27	5	20.92	12	61.78	15	80.82	3	26.16	9	82.48	2	11.64	74	507.3
2							1	14			1	6.97							2	20.97
3	6	98	1	1.1	1	10.76	1	8.88	1	28.18			1	29.61	3	28.08			14	204.6
4	74	2163.13	59	1486.8	43	761.81	21	492.93	24	421.84	31	751.56	20	470.53	37	723.69	7	64.29	316	7336.24
5	54	1149.15	51	912.2	40	570.94	15	285.17	22	361.23	25	430.36	18	345.85	14	209.26	6	209.87	245	4474.03
6	71	1062.39	60	1095.09	34	438.15	49	1179.45	70	1229.71	46	681.4	53	706.65	118	1494.6	26	299.46	537	8187.51
7	19	362.79	20	283.27	27	268.33	12	375.87	26	289.2	18	231.71	11	178.62	22	301.07	12	154.51	167	2445.37
8	22	674.94	9	471.6	28	420.9	11	524.65	9	293.09	11	312.23	12	423.79	18	496.36	5	65.4	125	3682.96
9	30	485.95	30	731.27	42	1119	37	727.61	36	475.2	28	460.71	22	349.72	32	696.78	14	147.26	271	5193.5
10	16	417.95	12	307.67	7	103.81	1	33.15	6	106.43	3	43.38	4	30.15	6	106.46			55	1149
11	13	269.17	14	336.56	6	131.69	16	243.26	11	268.73	3	50.12	2	18.96	2	28.36	4	45.09	71	1391.95
12	5	329.9	2	139.76	4	38.64	5	50.83	4	70.19	1	110			3	185.01			24	924.33
Sub-Total	324	7133.64	263	5791.9	241	3941.3	174	3956.92	221	3605.58	182	3159.26	146	2580.04	264	4352.17	86	997.52		
Grand Total																			1901	35517.76

Source: BFAR

a - number of approved applications

b - areal coverage, in hectares

2.2 Coral Reef Destruction due to Pollution and Destructive Fishing Practices

As early as 1977, the country's coral reefs have been observed to be in progressive stages of degeneration. The causes of destruction are varied- siltation, natural calamities, destructive fishing practices,collection of corals for ornamental, handicraft and construction purposes, and industrial and agricultural pollution.

Siltation results in either complete destruction of corals or reduction of diversity. The effect of siltation on fringing reefs around large islands has been serious and extensive. A study of Bacuit Bay in Northern Palawan established a loss of 50 percent coral cover. Extensive reef stretches along the coastline of Bataan are silted over. Siltation has been caused by widespread forest denudation and aggravated by slash and burn agriculture.

Destructive fishing practices like blast, cyanide and muro-ami fishing have also been largely responsible for the current state of our corals. Blast fishing has been singled out as one of the major causes of direct damage to corals, often killing circles of corals one to three meters in diameter. The method, unfortunately, has been accepted by many fishing communities as a normal and natural fishing technique. Cyanide is usually used by tropical fish collectors because of the high rate of collection success. It has been established that hard and soft corals are killed within three months after application of sodium cyanide.[33]

Muro-ami fishing, which involves the coordinated efforts of groups of swimmers to scare fish towards a bag or gill net by using vertical scare lines festooned with streamers, break up brittle hard corals due to the impact of scare line weights on the sea bottom. The popularity of the muro-ami technique lies in its high catch per unit effort. Compared to other fishing methods using a variety of gear, it definitely shows an advantage in terms of catch. In the 1988 F-Farm Study at Selinog Island, the following data on fish catches were gathered: bamboo trap-0.15 kg/man-hr.; spear gun 1.9kg./man-hr.; hardline - 2.1 kg/man-hr.; gill net, 6.8 kg./man-hr.; and, muro-ami, 52 kg/man-hour. Muro-ami, however, severely affects sustainability of reef fisheries because it destroys the coral reef which serves as breeding and feeding ground of fish and other marine life. Fortunately, commercial Muro-ami fishing was officially banned in December, 1986.

A variety of contaminants such as organic wastes, trace metals, organochlorines, pathogens and oil find their way into marine waters. Mine tailings pollution was already known to endanger coastal resources as early as 1977. The effects of copper mine tailings on coral reefs were already extensively studied and established in 1982, in the vicinity of Toledo City, the east coast of Cebu and Southern Negros.

Oil pollution too, has become a significant threat to our coral reefs. Oil levels in many areas have exceeded standards in many instances (**Table 15**). Oil contamination are contributed by natural seepages in the ocean floor, industrial discharges from refineries, depots, trade centers, etc...,loss from offshore oil production, deballasting operations and tank washing; and, shipping accidents (**Table 16**). Offshore oil drilling and extraction have been shown to exact their toll on coral resources. Studies

Tailings from mining activities, such as that dumped into Calancan Bay, likewise continued to be one of the main causes of coastal degradation.

Among the first efforts of government under its Integrated Protected Areas System (IPAS) was the declaration of Tubbataha Reef as a national park.

Table 15. Oil Levels in Selected Philippine Marine Waters (ppm)

Location	Oil Content	Year
1. South Harbor	0.2 - 14.5	1980
2. North Harbor	0.25 - 8.0	1980
3. Cavite	0.14 - 6.0	1980
4. Cebu	0.66 - 5.05	1980
5. Davao	1.24	1980
6. Manila Bay	0.01 - 11.32	1985

Source: NOCOP, NPCC

conducted in the Masinloc area in 1981, revealed that operations heavily damaged coral communities (coelobite) within a radius of 40 meters from the well heads and slightly damaged those within 75 to 100 meters.[34]

Ornamental coral trade and construction industry have also been responsible for coral reef degradation in many areas. While a ban on coral exportation has been imposed since 1976, they continue to be extracted in alarming amounts. Extraction of corals for tilemaking has caused coastal erosion around Cebu, the Pag-asa Islands off Palawan and portions of Bicol.[35] The construction of foundations, roads and fishpond dikes in Pangasinan have made use of entire coral reefs from the Hundred Islands and Bolinao.

2.3 Overfishing

The problems plaguing the country's fisheries stem from a variety of causes spawned primarily by the grossly inadequate management of the sector. Inequitable fishery policies have discriminated against municipal and sustenance fisheries in favor of commercial fishing operations.[36] Such policies have failed to take account of the fact that half of the country's total fish production are derived from municipal and sustenance fisheries. Reef fisheries, which contribute 15% of the country's total production has been channeled primarily into the development of aquaculture and commercial fisheries. Small-scale reef fisheries have not been given importance such that they have been subjected to a variety of stresses.

Commercial fishing vessels have intruded into shallower waters reserved for municipal fishermen despite a law banning this (P.D. No. 705). This has resulted in overfishing of approximately eleven of the fifty major fishing grounds-San Miguel Bay, Lamon Bay, Lingayen Gulf, Manila Bay, the Batangas coastline, Ragay Gulf, the Visayas Sea, Pacific Side of Bohol, Moro Gulf, Davao Gulf and Samar Sea. There is an emerging consensus among the country's fishery experts that the limits of sustainability of marine fisheries have already been reached or even exceeded. Actual marine catch, estimated at 1.3 million tons per year is nearing total potential catch which is 1.45 to 1.85 million tons per year.

Table 16. Oil Spill Incidents in the Philippines, 1980-1989

Name of Vessel/Company	Location	Date	Quantity (li)	Cause
1. Caltex	Caltex Refinery, Batangas	1- 06 - 80	18,527-22,712	Not specified
2. Caltex	Caltex Refinery, Batangas	1- 17 - 80	18,937	Discharge to nearby river:overflow of oil-water separator due to malfunction of desalter
3. M/T Phil. Hero		8 - 08 - 80	200	
4. LB 1010		9 - 08 - 80	200	
5. M/T Delsan VI		3 - 12 - 81	10,500	
6. M/T Insular de Negros			477	
7. M/V Lorenzo Con. II		7 - 21 - 81	100	
8. M/R Delsan VI	Caltex Oil Depot, Iloilo City	12 - 03 - 81	1,050	Worn-out hose
9. M/T Gulf Ace	Poro entrance,San Fernando,L.U.	12 - 19 - 81	127,190-158,987	Vessel went a ground
10. P. N.O.C.	Calumpang,Gen. Santos City	4 - 28 - 82	10,410-14,573	Storage tank pipe ruptured
11. M/T Camrahn	Calumpang, Gen. Santos City	4 - 28 - 82	10,500	submarine pipeline leakage
12. NPC Storage Tank		4 - 28 - 82	7,948	Leakage
13. Caltex Oil Depot	Lapu-lapu City, Cebu	4 - 28 - 82	11,128	Bottom hose of storage tank #5 ruptured
14. Caltex Oil Depot, Cebu	Lapu-lapu City, Cebu	6 - 15 - 82	346,674	Ruptured tank valve
15. M/T Anthony Jr.	Bgy. Lapaz,San Narciso,Zambales	8 - 27 - 82	not specified	Grounding
16. M/T Anthony, Jr.	Aringay, La Union	11 - 26 - 83	not specified	Sinking of tanker after catching fire
17. M/S La Carlota & MIS Hortencia	Iloilo Anchorage	12 - 15 - 83	497,597	Collision involving two vessels Sinking of vessel
18.	Pandacan, Metro Manila	9 - 01 - 84	8,000	
19. M/T Regina Gracia	Mobil, Pandacan, Metro Manila	9 - 21 - 84	140,000	Loading
20.	Baliwasan, Zamboanga City	9 - 27 - 85	625	Bunker oil tank of coco oil factory cracked
21.	Sual, Pangasinan	10 - 26 - 85	not specified	Sinking of vessel due to typhoon
22. M/V Dona Josefina	Isabel, Leyte	5 - 10 - 86	30,000	
23. Iloilo City		5 - 26 - 86	1,041	Torn hose
24.	Iloilo City	6 - 30 - 86	477	Sudden rupturing of discharge hose
25. M/T Maysun	Negros Occidental	8 - 16 - 86	2,225,580	
26. M/T Petron II	Iloilo City	5 - 26 - 86	1,041	Accidental
27.	Iloilo City	6 - 30 - 86	477	Accidental
28. M/T Maysun	Nogos Island, Panay,Dipolog, N.O.	8 - 16 - 86	1,400	Typhoon
29. M/T Charlie Diane	Puerto Galera, Oriental Mindoro	1 - 16 - 88	1,300	Typhoon "Asyang"
30. PN Vessel LT 506	Lower Calarian Pier, Zamboanga	10 - 24 - 88	4,000-5,000	Typhoon "Unsang"
31. AH81 (Hospital Ship)	Lower Calarian Pier, Zamboanga	10 - 24 - 88	800	Typhoon "Unsang"
32. M/T M.Y.	Pasig River near Ayala Bridge	5 - 25 - 89	4	Accidental
33. Sea Oil Petroleum, Corp.	Pasig, Metro Manila	6 - 12 - 89	300	Heavy Rainfall
34. NPC Tank No. 2	San Pascual, Batangas	8 - 19 - 89	1,500	Deteriorated tank shell
35. HPCG Wharf	Back of Manila Hotel	11 - 03 - 89		Allegedly discharged by Mla Hotel swimming pool
36. M/T Fernando J-1	Bgy. Lamao, Limay, Bataan	1 - 25 - 90	200,000	Cracked hull

Source: National Operations Center for Oil Pollution-PCG.

Note : There was no reported incident for the year 1987

The problems affecting mangroves and coral reefs are translated into problems for fisheries. Destruction of mangroves and corals means destruction of the breeding, feeding and nursery grounds of fish and other marine life.

2.4 Red Tides

"Red tide" is a marine phenomenon which involves the bloom of floating minute marine plants or phytoplankton known as dinoflagellates with characteristic orange brown or red color. The proliferation of these dinoflagellates is manifested in the red discolorization of the sea. Usually, these plankton blooms are quite harmless. However, in sheltered bays with restricted outflows, the vast quantity of algae and the bacteria decomposing them deplete all the available oxygen dissolved in the water killing fish and other types of marine life. In some cases, the causative organisms may possess toxic substances which are harmless to fish but which would be fatal to man.

The exact causes of toxic dinoflagellate blooms have not been fully determined up to this time. Numerous factors seem to account for the occurrences, including enrichment from land run-off, upwelling of colder nutrient-rich oceanic water and temperature rises. But toxic red tides are becoming an increasing concern because of their health and economic impacts.

The earliest reported toxic red tide occurrence was in Bataan in 1908. Although red tide outbreaks occurred almost yearly after that, they were all non-toxic. It was only in 1983 that another toxic red tide occurred for a period of three months (June-August), this time, in Maqueda Bay, Villareal Bay and Samar Sea. The causal organism was identified as Pyrodinium bahamense var. compressa. A total of 278 paralytic shellfish poisoning (PSP) cases, with 21 deaths were reported.[37]

The next toxic red tide incident took place in 1987 in the coastal waters of Zambales, and again in Samar. Only nine cases were reported in Zambales but the incident lasted four months - from April to August. Reported cases of PSP in Samar totalled 211, six of which were fatal. The greater concentrations of the causal organism Pyrodinium were observed in the areas between Biliran and Canahauan Islands and Carigara Bay. The incident lasted for about four months - from May to August.

Sixty-five cases of PSP were validated in Limay, Bataan, Navotas and Cavite City in 1988. The red tide had broken out again, this time in the waters of Bataan and Manila Bay, for an estimated period of five months from August to December. Results of toxicity tests on green mussels from Limay showed a very high toxin level of 1,005 μg toxin per 100g of shellfish meat.

Western Samar also experienced toxic Pyrodinium blooms for the third time, starting in Cagduyong Island in September, then spreading to Carigara Bay in November, Biliran Strait (until March, 1989), San Pedro Bay in January, 1989, Leyte Gulf, San Juanico Strait and Ormoc Bay. Total red tide area was estimated at 300 hectares by the Red Tide Monitoring Team of the Department of Agriculture. Reported cases reached seventy-seven (77), with eight (8) deaths. An outbreak of PSP was also reported in Negros Occidental and Capiz in the early part of 1988, with 109 confirmed cases.

The incidents triggered a red tide scare which proved costly for the fisheries/shellfish industry. Prices of fish and invertebrates dropped from the usual P800 (US$38) per tub (35 kg) to 200-300 pesos (US$9.52- 14.28) per tub. Commercial fishing boat operators were estimated to have lost P17 million pesos for a four-day period of the incident in Manila Bay. The shellfish industry had an estimated minimum loss of P50 million or US$ 2.38 million.

3. MANAGEMENT EFFORTS

The Philippines is not wanting in legislations and policies covering aspects of coastal zone management. Despite these, however, its marine environment continue to be degraded at an alarming rate. Among these policies and laws are the following:

- P.D. No. 704, as amended, Section 33 of which, prohibits fishing with the use of explosives, obnoxious or poisonous substances, use of electricity; and, dealing in illegally caught fish;

- LOI No. 1328 which prohibits operation of commercial trawl and purse seine within seven (7) kilometers from the shoreline in all provinces;

- Fisheries Administrative Order No. 155 which prohibits the use of fine meshed nets (mesh size less than 3 centimeters when stretched);

- P.D. Nos. 1219 and 1688 which prohibit the sale and exportation of ordinary, precious and semi-precious corals;

- Proclamation No. 2151 which declares certain mangrove areas as wilderness areas, therefore prohibiting any form of activity therein;

- Proclamation No. 2152 which declares other mangrove areas as mangrove swamp forest reserves,hence only sustainable activities are allowed;

- DENR Administrative Order No. 76, series of 1987, which establishes certain mangrove areas in some coastal provinces as buffer zones, thus giving protection to the coastal communities and inland road networks from destruction caused by strong winds and high waves;

- DENR Administrative Order No. 8, series of 1987, which disallows the processing of applications on areas covered by Proclamation No. 2152; and,

- A DENR radiogram dated June 13, 1986 which bans the cutting of mangrove timber species even in areas with approved Fishpond Lease Agreements.

3.1 Coral Reefs

A number of programmes were initiated when problems plaguing the country's coral reefs first gained national attention in 1978. Coastal zone research was intensified but no agency/institution took responsibility for over-all management. A Coastal Zone Management Programme was started by the NEPC at the time and a Marine Parks/Reserves Development Program (MP/RDP)was established by the Ministry of Natural Resources.

The MP/RDP was conceptualized to formulate guidelines and management procedures for a nationwide marine parks system to efficiently preserve the country's reefs and shorelines. Under the Coastal Zone Management Programme, a Master Plan for Coastal Zone Management was formulated and completed in 1985, and was recommended for inclusion in the coastal town planning guidelines of the Housing and Land Use Regulatory Board (then the Human Settlements Regulatory Commission).

Establishment of marine parks and reserves constituted direct attempts at reef management. A few areas have been the subject of such efforts - Apo Reef in Southwestern Mindoro Island, Calauit Island Game Preserve and Wildlife Sanctuary of the Calamian Group of Islands, Bacuit Bay Marine Turtle Sanctuary, Carbin Reef in Northern Negros and Apo, Balicasag, Pamilacan and Sumilon Islands in Central Visayas.

Various institutions have spearheaded management and protection of these areas at varying periods and intensity. The Philippine Tourism Authority (PTA) in coordination with the Bureau of Fisheries and Aquatic Resources (BFAR), took charge of the 680 - hectare Apo Reef from the late 1970s to the early eighties primarily for fisheries management purposes. The Conservation and Resource Management Foundation (CRMF) took care of the 3,400 - hectare Calauit Island Game Preserve and Wildlife Sanctuary while the Task Force Pawikan of the former DNR managed the 10,000 - hectare El Nido Resort. Carbin Reef, Apo Island, Balicasag Island and Pamilasan Island were all managed by local communities by virtue of a municipal ordinance, in cooperation with Silliman University under its Marine Conservation and Development Program. This approach has been described as the Municipal Park Strategy.[38] From 1974 to 1984, Sumilon Island Fish Sanctuary was managed by Silliman University, in cooperation with local communities of Oslob, Cebu. The BFAR took over after that time. As of June, 1988, however, the Reserve ceased to be properly managed or protected. The management of the first three reserves and Sumilon Island is a study in contrast. The failure of management in Sumilon Island, has been attributed largely to lack of support from the local community of Oslob, fishermen and local authorities. In contrast, Apo, Balicasag and Pamilacan, continue to produce a considerable number and variety of fish within the reserves precisely because of the involvement of concerned sectors in conservation efforts.

With the 1987 reorganization of the DNR into the DENR, the Marine Parks Program has been entrusted to the newly created Protected Areas and Wildlife Bureau. The PAWB was mandated to formulate policies, guidelines, plans and programs for the establishment, development and management of the Integrated Protected Areas System (IPAS), which includes national and marine parks. Upon the endorsement of PAWB, two marine protected areas have been established, to date. These are the Tubbataha Reef in Palawan, the country's first national marine park and Taklong Island in Guimaras, Iloilo as a national marine reserve. Initial management plans for Tubbataha Reef have been drafted by PAWB while those for Taklong Island are currently being prepared.

3.2 Mangroves

Like coral reefs, the problems confronting the country's mangrove forests hit national consciousness in 1978, prompting government to institute measures for their proper management. To this effect, a National Mangrove Program (NMP), was established and a National Mangrove Committee constituted under the then newly-created Department of Natural Resources, specifically to:

a. Conduct an inventory of mangrove areas through remote sensing and ground truth measurements;

b. Identify mangrove areas of immediate environmental concern and assess their conditions;

c. Study environmental, socio-economic and political aspects of development and management programs; and

d. Provide a framework for research and means for its implementation.

Two components comprised the NMP - the Research Component, which initially had 34 priority research concerns and the Resource Development Component with 10 priority concerns. From the Special Projects Office of the DNR, the Program was transferred to the NEPC in 1978 and then to the Natural Resources Management Center in 1979. In 1987, with the reorganization of the DNR into the Department of Environment and Natural Resources (DENR), the Program became the responsibility of the Ecosystems Research and Development Bureau (ERDB).

Limited institutional resources, however, hampered concerned institutions from making great strides in mangrove areas management. Significant areas in management, environmental effects and bioenergetics have not been given ample time and attention over the years. To date, only eleven of the research studies initiated mostly in the late seventies have been completed (**Table 17**).

Currently, a number of projects are being implemented, mostly in resource assessment and reforestation (**Table 18**). Mangrove reforestation has been incorporated into the regular reforestation program of the Forest Management Bureau (FMB). Contract reforestation projects are being implemented in areas such as Catanauan, Quezon and the Alobo and Bathala mangrove areas in Sta. Cruz, Marinduque. In Region VII, the World Bank assisted project, Central Visayas Regional Project (CVRP) has started to rehabilitate an initial 650 hectares of critically degraded mangrove areas through community efforts.

3.3 Fisheries

Regulatory Efforts

Implementation of fishery laws, as evidenced by the number and fate of the illegal fishing cases filed over a seven year period, does not appear intensive. For the period 1981-1987, only 378 cases have been filed against entities/ individuals engaged in illegal fishing. Of these, nineteen (19) were convicted, fourteen were fined and 24 have been dismissed. The rest (321 cases) are still pending with the fiscal offices/courts. **Table 19** gives the number of illegal fishing cases by region for the year 1981-1987.

Table 17. Completed Studies on Mangroves as of January, 1989

Title	Date Started	Date Completed
1. Study on the feasibility of growing selected mangrove species along lowland creeks.	February, 1978	December, 1981
2. Species association, growth and regeneration by area stratification.	February, 1978	December, 1979
3. Storage and germination of selected mangrove species.	February, 1978	December, 1979
4. Growth and survival of selected mangrove species wildlings as affected by potting media and type of manure.	February, 1978	February, 1980
5. Influence of site factors and planting techniques on the establishment of mangrove plantation.	February, 1978	December, 1982
6. MNR-FORI Plantation Development Project for Nipa	July, 1981	December, 1987
7. Control of faunal predators affecting bakauan at establishment stage.	July, 1981	December, 1987
8. Study on the stand structure and species combination of existing mangrove forest in Pollilo, Alabat Island and selected municipalities of Quezon.	July, 1985	June, 1988
9. Establishment of bakauan plantation in Negros Oriental.	July, 1975	June, 1985
10. The effects of thinning on the growth of bakauan species in Bohol Province	July, 1981	June, 1988
11. Effects of various methods of selected cutting on natural regeneration of mangrove forest.	1976	December, 1981

Source: Ecosystems and Research Develop

Table 18. Current Projects on Mangroves

Project Title	Implementing Agency	Budget (in pesos)
1. Development of socially-oriented utilization of mangrove resources.	ERDB	109,064
2. Soil survey and site characterization of beach forest area.	ERDB	89,826
3. Establishment of bakauan plantation in mangrove swamps in the Bicol region.	ERDS - Region 5	25,000
4. Bio-ecological assessment of coastal inland ecosystem.	ERDB	95,986
5. Provenance studies of various mangrove species in Tunglan.	ERDS - Region 6	72,960
6. Resource assessment of natural mangrove and dipterocarp forest in Region IX.	ERDS - Region 9	52,000
7. Community-based, small-scale utilization and management of coastal/mangrove forest in Palawan.	ERDB	137,512
8. Development of aqua-silvicultural pilot project in Regions IV, V and VII.	ERDB	292,974
9. Mangrove development and rehabilitation of Alabat, Quezon.	ERDS - Region 4	82,000
10. Response of selected mangrove species to vegetative propagation.	ERDS - Region 5	21,864
11. The effect of thinning on the growth and development of bangkaw species in Bohol province.	ERDS - Region 7	43,000
12. Stabilization of environmentally critical area in/or sensitive portions of the Manila-Cavite Coastal Road.	ERDB	225,000
13. Project on the impact of mangroves on the reproductivity of aquatic resources.	DENR/PCARRD-RRDP	
13.1 Study 1 - Reforestation of denuded mangroves.	ERDS - Region 7/PCARRD-RRDP	82,000
13.2 Study 2 - Hydrographic/physico-chemical assessment of mangrove before and after reforestation	ERDS - Region 4/PCARRD-RRDP	60,804
13.3 Study 3 - Impact of reforestation on the density and diversity of aquatic resources.	ERDS - Region 4/PCARRD-RRDP	66,840

Source: ERDB

Table 19. Illegal Fishing Cases Filed by Region, 1981-1987*

Region	No. of Cases	Action: Preliminary Investigation (Fiscal's Office)	Action: Prosecution (In Court)
I	52	25	30
II	24	-	24
III	35	5	30
IV	59	13	46
V	29	15	14
VI	14	-	14
VII	29	-	-
VIII	4	-	4
IX	23	2	21
X	17	1	16
XI	31	11	20
XII	4	-	4
TOTAL	321	69	252

Source: BFAR

* Dismissed cases not included.

Management Programs

Operation Bantay Dagat

One of the most direct attempts at arresting the deteriorating state of our coastal and fishery resources is the Operation Bantay Dagat. Bantay Dagat is both an organization and a program, based on the "bayanihan" concept. It involves government and non-governmental organizations in the supervision and control of marine resources utilization and specifically aims to:

1. Assist government agencies in the implementation of fishery laws;

2. Develop public awareness on the importance of conserving and protecting our marine and aquatic resources; and

3. Undertake and support studies/researches on marine and aquatic resources.

The Bantay Dagat works through a Composite Task Force composed of several committees (Operations and Intelligence, Research, Anti-Pollution, Rehabilitation and Monitoring, etc.) and Municipal/Barangay Task Forces. The organization is administered by a Chairman (usually the governor) and an over-all coordinator.

The Bantay Dagat concept was first put into practice by the province of Cebu in 1982, followed by the provinces of Bohol, Cavite and most recently, Palawan. Palawan's Bantay Dagat program is waging an all out war against illegal fishing. Bantay Dagat Sugbo (Cebu) concentrates on awareness campaign through periodic seminars and radio programs, organization of fishermen's associations, patrol operations and implementation of a medical assistance program for fishermen and their families.

ASEAN Coastal Resources Management Project

To promote sustainable economic development through the proper management of coastal resources in the ASEAN region, the ASEAN Coastal Resources Management Project (CRMP) was established in 1986. The ASEAN- CRMP is being administered by the International Center for Living Aquatic Resources Management (ICLARM) for the period 1986-1991 with funding from the USAID. The CRMP entails preparation of integrated coastal resources management plans and issue driven action plans in six pilot sites (Brunei Darussalam; Cilacap, Indonesia, South Johore, Malaysia; Lingayen Gulf, Philippines; Singapore and Upper South, Thailand.

In the Philippines, the CRMP addresses fisheries, marine parks, aquaculture, tourism and water quality management issues. To date, the following action plans have been formulated to address identified issues in the pilot area:

1) Fisheries Management Plan - aims to promote sustainable fishery within the Lingayen Gulf, primarily through enforcement of regulations on municipal and commercial fishing boundaries, gear size, etc . ;

2) Environmental Management Plan - addresses water quality, waste disposal and treatment, mine tailings and coastal water standards;

3) Aquaculture Management Plan - aims to increase pond production through appropriate technology transfer, mariculture of oysters, seaweeds and cage culture of finfishes;

4) Community Mobilization Management Plan - involves establishment of associations or cooperatives in coastal communities, formulation of a CRM public awareness program for the gulf population and providing alternative livelihoods for them;

5) Tourism Management Plan - addresses tourism development and promotion of nature-based tourism and local community involvement; and,

6) Coral Reef and Marine Parks Management Plan - promotes conservation and preservation of coral reefs, seagrasses and other critical habitats and their alternative uses for sustainable development.

Research and Development

Artificial Reef (AR) Development

An "artificial reef" is a natural or man-made object intentionally placed in a selected area of the aquatic environment for purposes of improving the habitat characteristics considered advantageous for the survival and growth of many fish and invertebrates.

Although artificial reefs were utilized by government for fisheries management purposes only during the last decade, the concept was already practiced in some areas of the country prior to World War II. Sustenance fishermen utilized bamboo, "rama" or goo" branches in piles, as artificial or temporary habitats for fish in estuarine areas or tidal flats. Sunken ships also served as artificial reefs in Manila Bay after the second world war.

The first recorded artificial reef construction was that of Silliman University Marine Laboratory (SUML) in June, 1988.[39] The AR was made of discarded tires and was constructed in a sandy area in Dumaguete City, Negros Oriental, at a depth of 20 meters. This was followed by the 300-tire reef of the University of the Philippines Marine Sciences Laboratory in February, 1978. Other artificial reefs were established thereafter by the Bureau of Fisheries and Aquatic Resources (BFAR), in cooperation with other entities (local governments and civic organizations) and the other aforementioned universities. **Figure 14** shows the progress of AR building activities while **Table 20** lists sites of the artificial reefs already established.

The experimental projects established ARs as potential supplementary fishing areas for sustenance fishermen, prompting the BFAR to launch a four-year nationwide AR Development Program (ARDP) in 1985 which aimed to:

1. Coordinate all artificial reef programs in the Philippines;

2. Support the government's food productivity, environmental protection and enhancement efforts;

3. Establish an artificial reef in each of the coastal municipalities and expand existing ones to support sustenance fishery;

4. Establish pilot ARs to enhance and restore habitats within municipal marine reserves or sanctuaries;

5. Facilitate transfer of AR technology to all coastal municipalities for coastal fishery management; and

6. Organize an ARDP team in all the regions.

The program basically utilized the community-based approach, with the village fishermen organized into formal associations to plan, construct, install, maintain and manage AR projects. Benefits of AR establishment have been documented in the

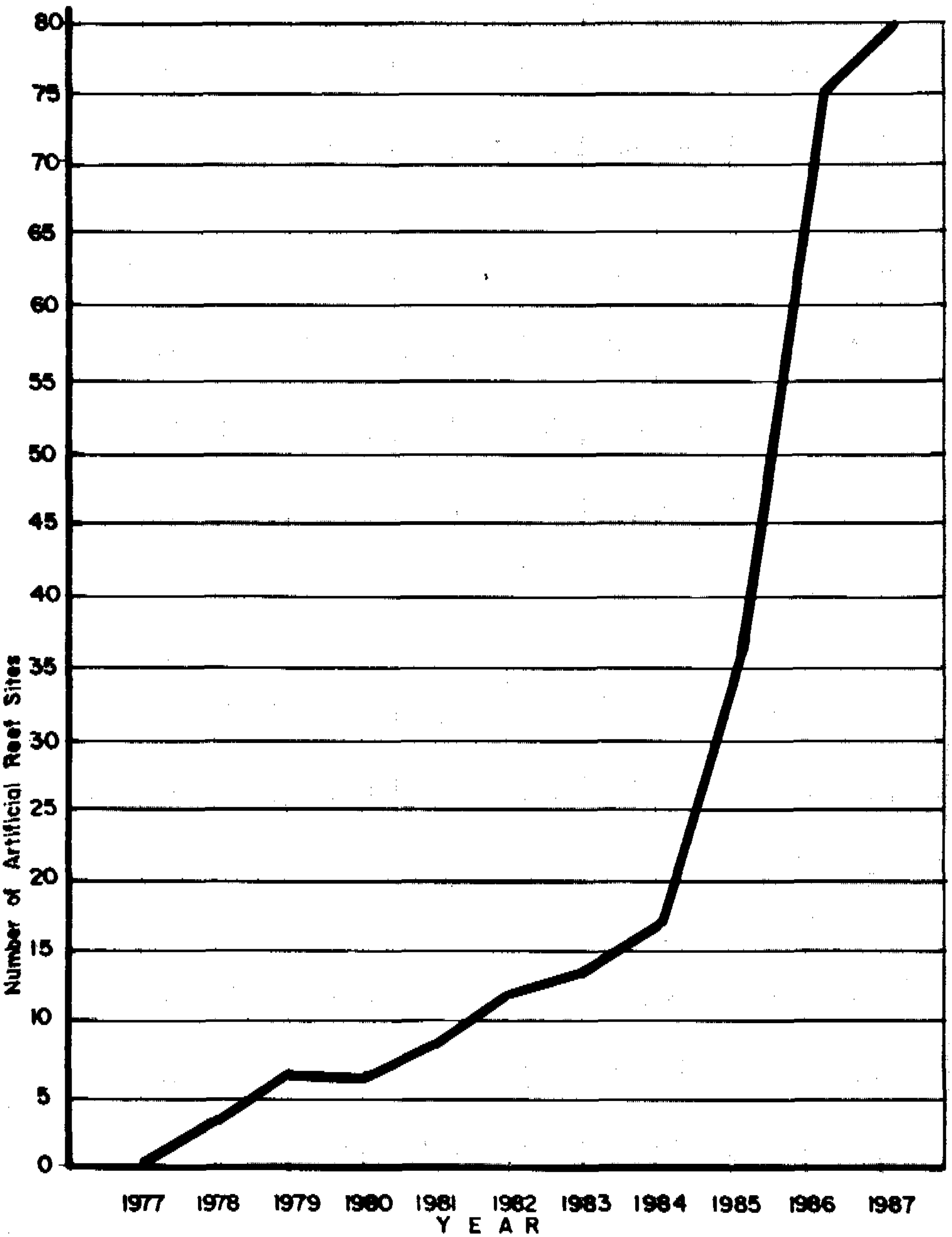


Figure 14. Progress of Artificial Reef Building Activities in the Philippines

Table 20. Artificial Reef Sites Under the Artificial ReefDevelopment Program

Region	Sites Province/Municipality	Date of Installation	Kind
I	Ilocos Norte		
	Calayab, Laoag City	March, 1986	10 tire modules
	Puypuyan, Pacuquin	February, 1986	10 tire modules
	Ilocos Sur		
	Salomague, Cabugao	December, 1982	15 bamboo modules
	Salomague, Cabugao	December, 1983	2 units midwater bamboo and tire-AR
	Becques, Tagudin	January, 1986	7 tire modules
	Pilar, Sta. Cruz	February, 1986	8 TM
	Calongbuyan, Candor	February, 1986	8 TM
	Katipunan, Sinait	June, 1986	10 TM
	Pung-os, Cabugao	June, 1986	10 TM
	Namruangan, Cabugao	July, 1986	10 TM
	San Pedro, Vigan	July, 1986	9 TM
	Pantoc, Narvacan	July, 1986	8 TM
	La Union		
	Casantaan, Damorlis	November, 1981	15 units
	Baluarte, Agoo	January, 1982	800 tire AR
	Bani, Rosario	October, 1985	6 TM
	Dulao, Aringay	June, 1986	10 TM
	Mindoro, Bangar		
	Pangasinan		
	Canal Bay, Alaminos	December, 1981	15 units
	Tabuan, Labrador	November, 1981	800 units
	Baquioen, Sual	November, 1985	10 TM
	Centro Toma, Bani	August, 1985	6 TM
	Boboy, Aguo	October, 1985	13 TM
	Pandan, Alaminos	October, 1985	13 TM
	Cabungan, Anda	January, 1986	10 TM
	Carot, Anda	January, 1986	10 TM
	Sunip, Bani	October, 1985	14 TM and 1 BM
	Cato, Infante	June, 1986	14 TM
	Victoria, Alaminos	February, 1987	10 TM
II	Cagayan		
	San Vicente, Cagayan	December, 1986	10 TM
III	Zambales		
	Nacon, Candelaria	June, 1985	5 TM

Table 20. (continued)

Region	Sites Province/Municipality	Date of Installation	Kind
NCR	San Nicolas, Shoal, Manila Bay	February, 1981	15 TM
	Manila Bay Fish Sanctuary	May, 1985	8 TM
IV	Batangas		
	Calubcub II, San Juan	September, 1982	8 BM
	Calubcub II, San Juan	October, 1984	6 TM
	Calubcub II, San Juan	September, 1984	2 tire units
	Calubcub II, San Juan	October, 1985	8 BM
			36 TM with 5 payao
	Romblon		
	Canduyong, Odiogan	August, 1985	13 TM and 1 BM
	Quezon		
	Hondagaea, Lopez	June, 1986	13 TM
	Caridad, Atimonan	June, 1986	10 TM
	Lumutan, Atimonan	August, 1986	3 TM
	Sabang, Calauag	August, 1986	4 TM
	Camhaguin, Gumaca	August, 1986	3 TM
	Concepcion, Plaridel	August, 1986	3 TM
	Palawan		
	Tagburos, Puerto	December, 1985	tire units
V	Alimsog, Sto. Domingo	February, 1983	4 TM and 4 BM
	Caricara, Bacon	June, 1985	Tire bamboo
	Bato, Bacon	October, 1985	10 TM
	Gatbo, Bacon	June, 1986	8 TM
	Bon-ot, Bacon	February, 1986	11 TM
	Sta. Lucia, Bacon	June, 1986	10 TM
	Sawanga, Bacon	February, 1986	11 TM
	Cauit, Casiguran	February, 1986	11 TM
	Masbate		
	Washington, San	1984	4 TM and 4 BM
	Negros Occidental		
	Sangwa, Dangus	January, 1986	10 TM
	Banago, Bacolod	January 1986	10 TM
VI	Iloilo		
	Bungol, Gumibal	May, 1985	Tire

Table 20. (continued)

Region	sites Province/Municipality	Date of Installation	Kind
VII	Cebu		
	Mactan Island, Lapu-lapu City	October, 1982	8 TM
	Caubian Island, Lapu-lapu City	October, 1979	10 TM
	Tabunok, Tabuclan	April, 1986	50 units
	Cantuba-on, Tabuclan	April, 1986	50 units
	Calajo-an, Minglanilla	April, 1986	50 units
	Bohol		
	Manga, Tagbilaran City	December, 1979	15 TM and 10 BM
	Cogtong, Candijay	April, 1986	14 TM
	Negros Oriental		
	Poblacion, Zamboanguita	April, 1986	42 units
	San Jose, Sinta	April, 1986	45 units
VIII	Leyte		
	East and West Visoria, Carigara	June, 1986	6 TM
	East Samar		
	Lalawigan, Borongan	June, 1986	6 TM
IX	Zamboanga		
	San Pedro, Dapitan	February, 1987	TM and BM
	Palo	March, 1987	TM and BM
	Talisay	March, 1987	TM and BM
X	Misamis Oriental		
	Initaw	November, 1986	TM
XI	Davao City	October, 1986	TM
XII	Lanao del Norte		
	Kawit Oriental, Kanswagan	October, 1986	5 BM
	Dalicanan, Kanswagan	October, 1986	6 TM and 4 BM
	Maguindanao		
	Sugud Bay, matanog	October, 1986	TM

Source: "Country Paper of R. Miclat, Regional Workshop on Artificial Reef Development and Management, Penang, Malaysia, September, 1988 various AR sites, notably, the small-scale bamboo reef and large-scale tire reef in San Juan, Batangas. One year after installation, the 254 sq. meter-bamboo reef exhibited a return of 88 fish species and generated a catch amounting to P11,264.79 (US$ 563.24). The 1000-sq. meter tire reef recorded 112 species and a total annual catch of 804.5 kilos (valued at P 24,000 or US$ 1,200.00).

Additional findings indicate that ARs promote growth and biomass accumulation, thereby contributing to fish production. They relieve some of the fishing pressure off existing coral reefs and reduce cost of fishing operations because of their proximity to the shore. Artificial reef establishment is a promising concept and has been adopted as a component in many government coastal resource management programmes such as the CVRP, ASEAN-US Coastal Resources Management Project and the Sorsogon Integrated Area Development Project, among others. It is, however, plagued by problems like ownership, management and even technology.

ASEAN-Australian Coastal Living Resources Project

The Coastal Living Resources Project, with financial assistance from the Australian government, involves several agencies - the Marine Science Institute of the University of the Philippines, the Silliman University Marine Laboratory, the Bureau of Fisheries and Aquatic Resources and the National Mapping and Resource Information Authority. Phase I of the project commenced in January, 1986 and ended in June, 1989. It involved several individual studies on coral reefs, reef fish, mangrove forests, seagrass beds, soft bottom communities and remote sensing. Study sites included Pangasinan, Negros Oriental, Bohol, Batangas, Quezon, Mindoro Oriental and Palawan.

Survey results showed "a broad zonation of benthic assemblages and their associated fish communities as a function of their location within embayments". The project's coral and fish studies "highlighted the negative effects of anthropogenic impact on these resources, as in the case of fishing with the use of destructive techniques such as blasting and muro-ami". Notable decreases in fish abundance were observed in some areas during the course of the studies. Some of the studies also indicated that species diversity, productivity, diameter at breast height, density of seedlings/saplings and sand-silt ratios were important parameters that could be utilized for assessing status of mangrove resources. Mangroves and seagrass beds have been found to be "extremely productive in terms of their support and yield of economically important species of fish and invertebrates". The project has particularly contributed to the understanding of the nearshore soft bottom communities, which have up until then, been the least studied of the coastal systems.

3.4 Water Quality Management

Monitoring of pollutants in the country's coastal waters was highly localized and limited during the decade in review. Projects which actively monitored the quality of the coastal waters were the Manila Bay Monitoring Program, the Calancan Bay Rehabilitation Project and the ASEAN CRMP pilot project in Lingayen Gulf.

Manila Bay Monitoring Program

Envisioned to support the implementation of the Sewerage and Sanitation Master Plan for Metro Manila, the MBMP primarily aims to determine the degree and extent of pollution in the 54-kilometer long Manila Bay. It was tasked to undertake the following: monitoring of water quality in Manila Bay; monitoring of the MWSS discharge zone; and, conduct of physical oceanographic studies for the southern bay outfall. It commenced in 1982 and ended in 1986, but was extended for another two years. Extension work, however, officially started June, 1989.

Calancan Bay Rehabilitation Project

Spurred primarily by the problems caused by the discharge of mine tailings in Calancan Bay off Marinduque Island, the five-component Calancan Bay Rehabilitation Project was initiated in 1989. Its monitoring component is specifically tasked to conduct surveillance of beach and bathing water quality and bioassay of fish and other crustaceans to determine heavy metals content.

4. PROSPECTS

Despite the repeated articulations of concern from various sectors, the country's marine environment continues to be degraded. Certainly, sectoral efforts have been initiated but a lot remains to be done, particularly by government. The commercial value of our marine resources calls for their maximum utilization but their ecological importance also requires conservation and restraint.

Coastal areas need to be more carefully managed, starting with clear-cut policies about development of coastal resources and formulation of an integrated and comprehensive national program on coastal zone management. Such a program should cater to the needs of the various users of coastal resources. Also, the proper administrative machinery should be established to ensure that such program will be implemented. Eventually, it might be effective to place coastal management in the control of coastal communities with demonstrated capability to adequately manage coastal resources. But this would require intensive training and awareness campaigns.

In the meantime, increased scientific studies and regulatory action are necessary to arrest the rapid degradation of our coastal zone. Monitoring of pollution and marine ecosystems, which heretofore had been confined to a few localities, should be intensified and made more comprehensive. The dismal record of combatting illegal fishing should be improved through strict enforcement of fishery laws. The rules and regulations on the utilization of mangroves should also be strictly enforced. There might be need for a moratorium in the conversion of mangroves into fishponds. Also in the short and medium-term, incorporation of coastal management in the development planning of coastal communities should be encouraged; more protected areas should be established under the IPAS system; and, awareness campaigns on the importance of coastal resources should be intensified.

Mangroves

Specific recommended actions for mangroves include:

- Assessment of policies on jurisdiction, administration and management of remaining mangrove areas;
- Continuing inventory and assessment of remaining mangrove areas;
- Development of techniques for sustainable extraction and harvesting of mangroves;
- Research on regeneration/silvicultural technologies and biological control of mangrove pests and diseases;
- Development of reforestation strategies and continuing reforestation of deforested areas;
- Development and evaluation of models for technology and information delivery system for mangroves.

Coral Reefs and Fisheries

- More baseline studies on the ecological characteristics of corals, diversity and reef fish productivity;
- Continuing assessment of coral reef distribution and quality;
- Studies for reef derived products;
- Massive extension campaigns aimed at teaching coastal communities basic ecological concepts and proper exploitation techniques;
- Establishment of more marine nature reserves; and
- Increased construction of artificial reefs.

FORESTS

1. PROFILE

The forestry sector plays an important role in the Philippine economy and environment. It provides lumber, fuelwood, and other wood-based products for export and domestic consumption. It is also a rich source of food, clothing material, medicine, and other raw materials for various uses. The forest ecosystem plays a very critical ecological role in soil and water conservation.

Contribution to the National Economy

Logs and lumber products rank among the country's top ten exports. In 1982, lumber ranked sixth as export earner while logs ranked ninth. In 1987, the country raked in $245.4 million from the export of wood-based products. During that year, forest products were the second largest foreign exchange earners among traditional Philippine exports. Forest-based industries employ about 16,000 people and contribute $500 million per annum to the country's foreign exchange. Around 6.7 million rural households use fuelwood daily for cooking, and about half of these come from forest lands.[40]

Biodiversity and Other Contributions to the Environment

The Philippine forests also host rich and diverse plant and animal species. Altogether, the Philippines is estimated to harbour about 8,120 species of flowering plants, 3,500 species of indigenous trees, 33 species of gymnosperms, 640 species of mosses, 2,400 species and sub-species of fish, 240-250 species and sub-species of reptiles, 950 species and sub-species of birds, and 230-240 species and sub-species of mammals. The current number of terrestrial species endemic to the Philippine archipelago is very high (i.e. found nowhere else in the world). For instance, 3,800 species of plants are endemic to the country.[41] Such biodiversity offers vast potentials as irreplaceable sources of food, fuel, fibers, medicine, and materials for industrial, aesthetic and scientific purposes.

Forests also have varied ecological values. They help conserve soils and regulate water. Forests also moderate local climate. The adverse effects of forest depletion are manifested in such ecological imbalances as floods, widespread soil erosion, sedimentation of waterways, landslides and droughts.

Trends and Status of Forest Cover

Over the past years, there had been varying statistics on the extent of forest cover in the Philippines due to: a) lack of a national-scale inventory in recent years; and, b) the high rate of extra-legal deforestation. Official estimates/updates of forest cover up to the late 1970s and even the early 1980s were based on trend extrapolation. **Table 21** shows the status of land classification from 1980 to 1988 based on provincial ground surveys of the Forest Management Bureau (FMB).

Table 21. Status of Land Classification from 1980 - 1988
(thousand hectares)

Land Classification	1980	%	1981	%	1982	%	1983	%	1984	%
Alienable & Disposable	13,269	44.23	13327	44.42	13,371	44.57	14,468	48.22	14,515	48.38
Unclassified Forest	7,025	23.42	5,847	19.49	5,553	18.51	5,060	16.86	1,827	6.09
Classified Forest Land	9,705	32.35	10825	10.86	11,076	36.92	10,472	34.90	13,657	45.52
a) Forest Reserves/ Timberland	8,744	29.14	8,792	54.54	8,985	30.35	8,455	28.18	11,920	39.73
b) National Park	519	1.73	1,591	5.41	1,648	5.50	1,571	5.23	1,265	4.21
c) Civil Reservation	313	1.04	313	1.04	313	1.04	306	1.02	306	1.02
d) Military Reserve	130	0.44	130	0.43	130	0.43	130	0.43	130	0.43
e) Fishpond					1	0.003	9	0.003	36	0.0012

Table 21. (continued)

Land Classification	1985	%	1986	%	1987	%	1988	%
Alienable & Disposable	14,660	49.0	13,852	46.00	14,108	47.00	14,118	47.06
Unclassified Forest	1,320	4.0	1,187	4.0	881	3.0	881	2.94
Classified Forest Land	14,020	47.0	14,961	50.00	15011	50.00	15,001	52.94
a) Forest Reserves/ Timberland	12,277	40.92	13,191	43.97	13,296	44.32	13,287	41.40
b) National Park	1,264	4.21	1,268	4.22	1,343	4.47	1,342	4.48
c) Civil Reservation	306	1.02	321	1.07	166	0.55	166	0.55
d) Military Reserve	130	0.43	130	.43	130	0.43	130	0.43
e) Fishpond	42	0.0014	51	.0017	75	0.0025	75	0.0025

Source: FMB

The country's forests have been depleted at a very fast annual rate of 210,000 hectares between 1969 and 1988.[42] The then Bureau of Forest Development (BFD), together with the University of the Philippines at Los Banos and the former Natural Resources Management Center, agreed to undergo an ambitious project to determine actual forest cover in the early 1980s but were limited to selected areas only due to financial constraints. However, the output of these agencies paved the way for the BFD to initiate a better ground and physical inventory of forest resources on a national scale, through the Philippine-German National Forest Resources Inventory (NFRI) in 1983. This project developed a two-stage inventory design using aerial photographs or satellite imageries for obtaining an area frame and clusters of angle-count samples, together with concentric circles for collecting stand and stock dates of the most important forest stratum. All regions, except Regions 10 and 11, were inventoried from 1984 to 1988 using this methodology. Meanwhile, Regions 10 and 11 were inventoried between 1979 and 1983 with FAO's assistance using systematically-distributed clusters of strip samples.[43] A separate and intensive survey was conducted since approximately 75% of the total forest resources are concentrated here.

The results of this inventory have been extrapolated to the year 1988 using yearly changes since the first nationwide forest inventory in 1969. For 1988, the status of land classification, total forested land, and forested land within classified forest lands are shown in **Tables 22 to 24**. The figures are all indicated on a per region basis. The forest area (without brushland) amounts to 6.46 million hectares, equivalent to 21.5% of the total land area of the country. Only 40% of the 15.9 million hectares certified forest land are actually covered with trees. The main forest types are:

Dipterocarp forests	-	4.4 million hectares
Mossy forests	-	1.1 million hectares
Submarginal forests	-	544,000 hectares
Pine forests	-	239,000 hectares
Mangroves	-	139,000 hectares
Brush lands	-	2.5 million hectares

Dipterocarp forests are, commercially, the most important forest type, not only in terms of timber production, but also as a source of minor forest products. As of 1988, they totalled 4.4 million hectares. Dipterocarp old-growth forests covered almost 1 million hectares, that is, 22.5% of all dipterocarp forests. Residual forests comprised 3.4 million hectares, thus making up more than 50% of the total forest area.

Mossy and submarginal forests represented together 26% of the total forest area. Although not commercially exploitable, these two forest types fulfill vital roles in the protection of watershed areas.

Pine forests are concentrated at higher elevations (above 800 meters) in the Central Cordillera mountain range of Regions 1 and 2, totalling about 239,000 hectares (130,000 hectares closed, 109,000 hectares open stands). Their commercial use (timber and resin) is only of local importance.

The distribution of land use and forest types by Region is shown in **Table 25** and **Figure 15.**

Table 22. Status of Land Classification as of December 31, 1988
(thousand hectares)

Region	Total Area	Alienable or Disposable Certified	%	FORESTLANDS Total	%	Unclassified	Timberland/ Forest Reserve	Watershed	National Parks/ GRBS	Civil and Military	Fishpond
1	2,157	1,045	48.4	1,112	51.6	54	819	217	19	2	1
2	3,640	1,066	29.3	2,574	70.7	146	2,288	102	28	9	1
3	1,823	1,052	57.7	771	42.3	27	374	213	34	118	5
4	4,756	2,210	46.5	2,546	53.5	175	1,251	35	1,030	49	6
5	1,763	1,222	69.3	541	30.7	30	455	28	25	-	3
6	2,022	1,409	69.7	613	30.3	2	563	-	24	-	24
7	1,495	959	64.1	536	35.9	70	421	26	15	-	4
8	2,143	1,024	47.8	1,119	52.2	39	1,059	10	4	1	6
9	1,869	865	46.3	1,004	53.7	118	857	11	3	3	12
10	2,833	1,067	37.7	1,766	62.3	51	1,528	114	56	6	11
11	3,169	1,212	38.2	1,957	61.8	117	1,660	104	54	19	3
12	2,330	987	42.4	1,343	57.6	53	1,146	2	52	89	1
Total	30,000	14,118	47.1	15,882	52.9	882	12,421	862	1,344	296	77

Source: FMB

Table 23. Forested Land by Region as of December, 1988

	FOREST					
	Without Brushlands			With Brushlands		
Region	Area (ha)	Proportion (%)	Forest Cover (%)	Area (ha)	Proportion (%)	Forest Cover (%)
1	436,000	6.70	20.20	867,300	9.60	40.20
2	1,565,100	24.20	43.00	1,829,500	20.40	50.20
3	239,800	3.70	13.20	309,100	3.40	17.00
4	1,184,400	18.30	24.90	1,775,000	19.80	37.30
5	70,700	1.10	4.00	129,500	1.40	7.30
6	95,900	1.50	4.70	175,700	2.00	8.70
7	38,400	0.60	2.60	45,500	0.50	3.00
8	364,200	5.60	17.00	507,700	5.70	23.70
9	256,100	4.00	13.70	361,700	4.00	19.40
10	950,600	14.70	33.60	1,185,700	13.20	41.80
11	868,500	13.50	27.40	1,259,600	14.00	39.70
12	390,300	6.10	16.80	539,400	6.00	23.20
Total	6,460,600	100.00	21.50	8,985,700	100.00	30.00

Notes: 1. Projections based on the results of the 2nd National Forest Resources Inventory conducted by the then Bureau of Forest Development (BFD) and Food and Agriculture Organization of the United Nations (FAO) in Regions 10 and 11 and BFD and Federal Republic of Germany (FRG) in Regions 1-9 and 12.

2. These figures represent total forest lands, both classified and unclassified.

Table 24. Forested Land by Region Within Classified Forest Lands
(as of December, 1988)

	FOREST					
	Without Brushlands			With Brushlands		
Region	Area (ha)	Proportion (%)	Forest Cover (%)	Area (ha)	Proportion (%)	Forest Cover (%)
1	429,000	6.8	38.6	710,700	8.5	63.9
2	1,528,600	24.1	59.4	1,723,800	20.5	67.0
3	238,200	3.8	30.9	295,900	3.5	38.4
4	1,168,600	18.4	45.9	1,614,300	19.2	63.4
5	67,100	1.1	12.4	114,500	1.4	21.1
6	94,300	1.5	15.4	171,500	2.1	28.0
7	38,400	0.6	7.2	44,300	0.5	8.3
8	355,300	5.3	31.7	472,400	5.6	42.2
9	248,000	3.9	24.5	343,100	4.1	33.9
10	943,100	14.9	53.4	1,162,100	13.8	65.8
11	861,400	13.6	44.0	1,234,300	14.7	63.1
12	379,700	6.0	28.3	510,100	6.1	38.0
Total	6,351,900	100.0	40.0	8,397,000	100.0	52.8

Notes: 1. Based from the results of 2nd National Forest Resources Inventory conducted by the then BFD and FAO in Regions 10 and 11 and BFD and FRG in Regions 1-9 and 12.

2. Classified forest lands are areas that had been surveyed under existing criteria and are legally declared forest lands.

Table 25. Land Use and Forest Types by Region (Total Area), 1988
(hectares)

Land Use/Forest Type	Region I	Region II	Region III	Region IV	Region V	Region VI	Region VII
FOREST	436,000	1,565,100	239,800	1,184,400	70,700	95,900	38,400
Dipterocarp Old Growth Forest	50,900	418,300	25,300	149,100	12,400	1,500	0
Dipterocarp Residual Forest	103,300	630,900	151,700	525,200	46,100	54,900	12,100
Pine Forest, Closed	94,500	34,400	700	0	0	0	0
Pine Forest, Open	88,600	18,800	900	900	0	0	0
Submarginal Forest	17,300	167,200	18,900	316,800	1,900	100	12,500
Mossy Forest	81,300	291,700	42,200	159,000	9,400	35,000	10,300
Mangroves	100	3,800	100	33,400	900	4,400	3,500
BRUSHLAND	431,300	264,400	69,300	590,600	58,800	79,800	7,100
OTHER LAND USE	1,298,545	1,810,800	1,513,982	2,981,016	1,633,749	1,846,611	1,449,642
TOTAL	2,156,845	3,640,300	1,823,082	4,756,016	1,763,249	2,022,311	1,495,142

Table 25. (continued)

Land Use/Forest Type	Region VIII	Region IX	Region X	Region XI	Region XII	Total
FOREST	364,200	256,100	950,600	868,500	390,900	6,460,600
Dipterocarp Old Growth Forest	48,400	15,200	126,400	118,400	22,400	988,300
Dipterocarp Residual Forest	302,600	172,600	577,000	601,600	234,800	3,412,800
Pine Forest, Closed	0	0	0	0	0	129,600
Pine Forest, Open	0	0	0	0	0	109,200
Submarginal Forest	5,700	3,800	0	0	0	544,200
Mossy Forest	6,600	0	226,000	142,400	133,500	1,137,400
Mangroves	900	64,500	21,200	6,100	200	139,100
BRUSHLAND	143,500	105,600	235,100	391,100	148,500	2,525,100
OTHER LAND USE	1,635,469	1,506,814	1,647,074	1,909,675	1,789,923	21,014,300
TOTAL	2,143,169	1,868,514	2,832,774	3,169,275	2,329,323	30,000,000

Source: FMB

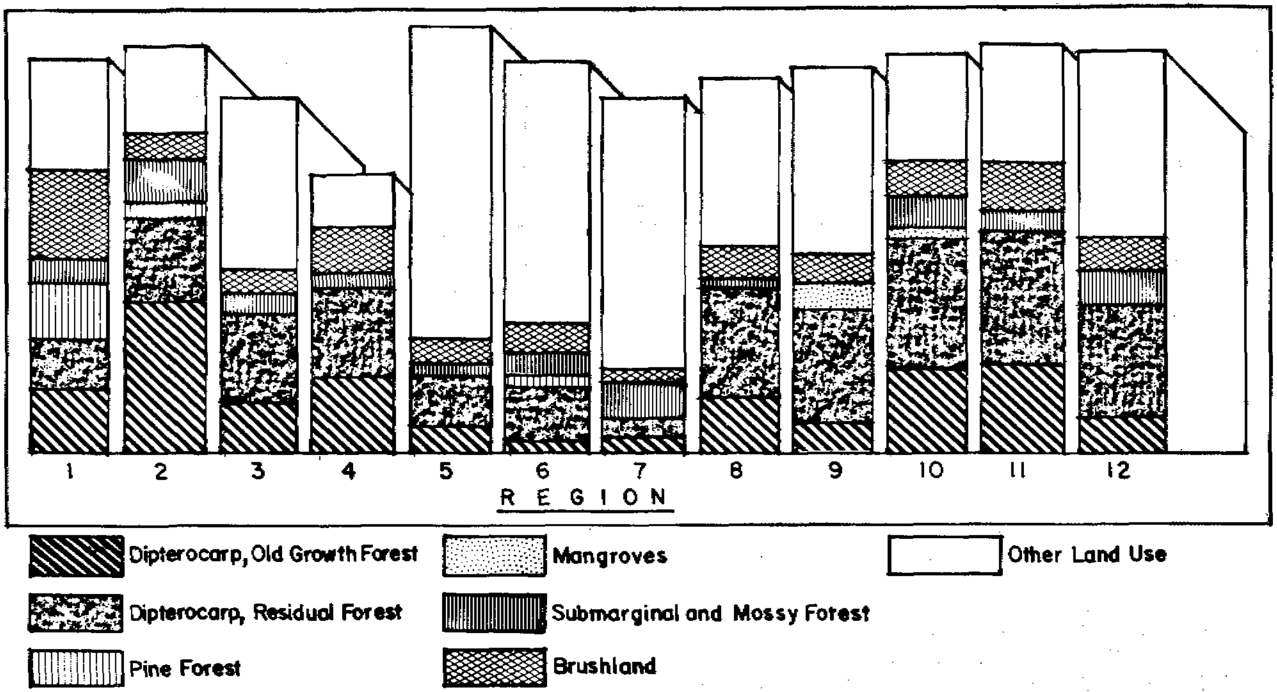


Figure 15. Land Use and Forest Types by Region, 1988
Source: Forest Management Bureau

Region 2 has always been considered the most important timber region of the Philippines with more than 1.5 million hectares representing one fourth of the national forest resources. Forests still occupy 43 percent of its land area, the highest among all regions. Other large forest areas are found in Region 4 (1.18 million ha.), Region 10 (10.95 million ha.) and Region 11 (0.87 million ha.).

More than 40% of all dipterocarp old-growth forests are located in Region 2 (418,300 ha.), 15% or 149,100 ha. in Region 4 (although often low volume), 13% or 126,400 ha. in Region 10 and 12% or 118,400 ha. in Region 11. Large dipterocarp residual forests are located in Region 2 (630,900 ha.), Region 11 (601,600 ha.), Region 10 (577,000 ha.) and Region 4 (525,200 ha.).[44]

Pine forests are confined to Region 1 (183,100 ha.) and Region 2 (53,200 ha.). Mossy forests stock mainly at higher elevations in the mountain ranges of Region 2 (291,700 ha.), Region 10 (226,000 ha.), Region 4 (159,000 ha.), Region 11 (142,400 ha.) and Region 12 (133,500 ha.).

Submarginal forests are found on poor and/or excessively drained sites in Region 4 (316,800 ha., mainly in Palawan) and Region 2 (167,200 ha., mainly in the Sierra Madre mountain range). Large mangrove areas are located in Region 9 (64,500 ha.) and Region 10 (21,200 ha.). In Regions 5, 6 and 7, only very little forest is left. The forest cover in these regions is below 5%.

One indicator characterizing the wood supply of a region is the potential area available per capita. The production forests (dipterocarp and pine) per capita is shown in **Table 26** for all 12 Regions and the National Capital Region (NCR). The demographic data have been extrapolated from the national census of 1980.

Table 26. Estimates of Potential Area Available Per Capita, 1988

Region	Production Forests (ha)	Population	Potential area Available Per Capita (ha)
1	337,300	3,976,000	0.085
2	1,102,400	2,666,000	0.414
3	178,600	5,749,000	0.031
4	675,200	7,567,000	0.089
5	58,500	3,930,000	0.015
6	56,400	5,134,000	0.011
7	12,100	4,429,000	0.003
8	351,000	3,119,000	0.113
9	187,800	3,296,000	0.057
10	703,400	3,471,000	0.203
11	720,000	4,360,000	0.165
12	257,200	3,133,000	0.083
NCR	0	7,456,000	0.000
Total	4,639,900	58,266,000	0.080

Source: FMB (with revisions supplied by the writer on table headings)

Region 2 (0.41 ha.), Region 10 (0.20 ha.) and Region 11 (0.17 ha.) have rather high potential area available per capita, indicating high potential supply of resources to meet the present timber demand on a sustainable basis. Regions 3, 5, 6 and 7, on the other hand, have less than 0.05 hectare production forest per capita, an indication that their present timber demand cannot be met by their own resources.

Table 27 shows the area changes between the first and second inventory by region for all forests, dipterocarp forests and for dipterocarp old growth-forests. **Figure 16** compares the 1969 and 1988 areas by Region.

Figure 17 illustrates the area development of dipterocarp forests in the last 50 years.

A comparison with the first nationwide inventory shows an average forest loss of 210,000 hectares annually or 2 hectares for every 5 minutes. During the past 20 years from 1988, dipterocarp forests have been converted into other land uses at a rate of 190,000 hectares per year. Only a change in this trend, coupled with various forestation and watershed management strategies, would enable the country to maintain enough forest resources for timber production and environmental benefits.

National Parks and Other Protected Areas

The country's protected areas such as national parks, game refuge and wildlife sanctuaries and other nature reserves have not been spared from the massive exploitation of a population in search of commercial and economic benefits. This situation threatens to deplete the country's endangered living species and destroy the aesthetic value derived from them.

As of 1989, 60 national parks with a total area of 467,648 hectares; 8 game refuge and bird sanctuaries with a total area of 958,687 hectares; 10 wilderness areas with 18,856 hectares; 62 municipal forest parks with 391.95 hectares and 93 barangay forest parks with 232.38 hectares have been listed by the Protected Areas and Wildlife Bureau. **Table 28** shows a summary of these parks on a per-region basis.

In addition to these protected areas, there are also areas maintained by such agencies as the Philippine Tourism Authority, the National Parks Development Committee, and the National Power Corporation. A summary of these parks is shown on **Table 29.**

Profile of Forest User Groups

Forest user groups are principally classified as timber license agreement (TLAs) holders, and upland occupants. **Table 30** shows the number of TLAs and the area covered by the same.

Meanwhile, estimates of upland population made by various institutions at different periods are provided in **Table 31.**

The BFD census of 1980 showed 156,000 kainginero families living within public forest lands. They occupied about 568,000 hectares of forest lands, particularly

Destruction of Philippine forests is threatening the country's genetic resources, putting many species like the majestic Philippine eagle, on the endangered list.

The increasing incidence of flash floods has also been attributed to forest denundation.

Table 27. Forest Area Comparison, 1969 and 1988
(hectares)

	All Forests				Dipterocarp Forests				Dipterocarp Old-Growth Forests			
Region	a	b	c	%	a	b	c	%	a	b	c	%
1	554,000	436,000	6,200	-1.3	237,900	154,200	4,400	-2.3	72,600	50,900	1,100	- 1.9
2	1,871,300	1,565,100	16,100	-0.9	1,355,400	1,049,200	16,100	-1.3	919,700	418,300	26,400	- 4.1
3	429,200	239,800	10,000	-3.0	361,500	177,000	9,700	-3.7	142,600	25,300	6,200	- 8.7
4	1,988,800	1,184,400	42,300	-2.7	1,276,900	674,300	31,700	-3.3	822,100	149,100	35,400	- 8.6
5	228,100	70,700	8,300	-6.0	178,200	58,500	6300	-5.7	61,700	12,400	2,600	- 8.1
6	227,700	95,900	6,900	-4.4	142,400	56,400	4,500	-4.8	74,300	1,500	3,800	-18.6
7	102,900	38,400	3,400	-5.1	80,200	12,100	3,600	-9.5	31,200	0	1,600	NA
8	810,600	364,200	23,500	-4.1	684,700	351,000	17,600	-3.5	407,800	48,400	18,900	-10.6
9	634,000	256,100	19,900	-4.7	527,400	187,800	17,900	-5.3	306,300	15,200	15,300	-14.6
10	1,442,000	950,600	25,900	-2.2	1,227,800	703,400	27,600	-2.9	674,500	126,400	28,800	- 8.4
11	1,353,300	868,500	25,500	-2.3	1,222,900	720,000	26,500	-2.7	711,400	118,400	31,200	- 9.0
12	814,600	390,900	22,300	-3.8	723,600	257,200	24,500	-5.3	432,400	22,400	21,600	-14.4
Total	10,456,500	6,460,600	210,300	-2.5	8,018,900	4,401,100	190,400	-3.1	4,656,600	988,300	192,900	-7.8

Source: FMB

Legend:

a - area 1969

b - area 1988

c - Annual Rate of Change (hectares and %)

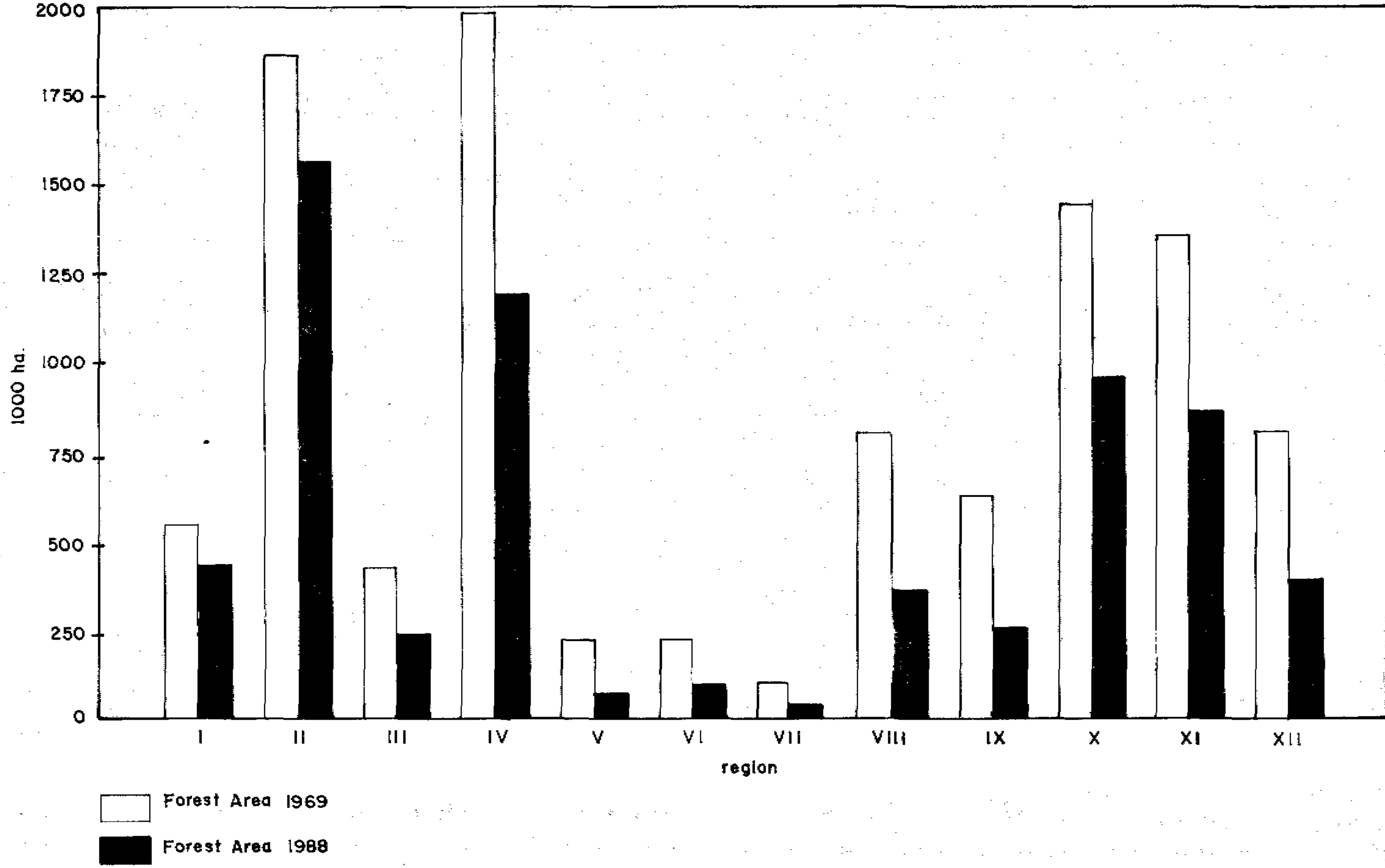


Figure 16. Forest Area Comparison by Region, 1969-1988

Table 28. Summary of National Parks, Barangay Parks, Wilderness Areas And Game Refuge and Bird Sanctuaries for 1989

Region	Total		National Parks		Game Refuge and Bird Sanctuaries		Wilderness Parks		Municipal Forest Parks		Barangay Forest Parks	
	No.	Area (has.)	No.	Area (has.)	No.	Area (has.)	No.	Area (has.)	No.	Area (has.)	No.	Area (has.)
Philippines	233	1,445,815	60*	467,648	8	958,687	10	18,856	62	391.95	93	232.38
Region I	11	13,047	5						3	44.08	3	4.02
CAR	11	15,804	4	15,795					2	4.00	5	5.00
Region 2	22	9,353	2	3,673	1	4,554	2	1,095	6	11.07	11	19.79
Region 3	22	35,647	7	35,611					7	17.01	8	19.01
Region 4	17	1,094,882	10	191,025	4	903,423	1	430	1	2.00	1	1.60
NCR	1	24	1	24								
Region 5	9	25,275	6	24,811	3	465						
Region 6	2	23,506	2	23,506								
Region 7	7	36,713	4	480	2	12,656						
Region 8	6	4,064	5	4,060					1	3.88		
Region 9	5	3,332	3	3,323					1	2.00	1	6.84
Region 10	41	57,637	2	53,319			1	4,195	19	80.78	19	42.55
Region 11	68	53,814	2	53,643			1	15	20	22.45	45	133.57
Region 12	11	72,717	7	22,282	2	50,230			2	204.68		

Source: PAWB

* Includes Tubbataha Reef National Marine Park

Table 29. National Parks of the Philippines Under Other Agencies

Name of National Park	Location	Establishment Legislation	Establishment Date	Area (Hectares)	Remarks
1. Hundred Islands	Alaminos, Pangasinan	Proc. No. 667 Proc. No. 1816 Proc. No. 2183 P.D. No. 189	01-18-40 01-30-79 03-27-82 05-11-73	(1,844.00) 1,676.30	Placed under the Philippine Tourism Authority
2. Tirad Pass	Cervantes, Ilocos Sur	Proc. No. 294 Proc. No.433	07-20-38 07-23-68	6,320.00	Transferred jurisdiction to National Historical Institute
3. Luneta Park	Ermita, Manila	Proc. No. 234 Exec. Or. 69	12-19-55 02-07-64	16.24	Reserved the area as Rizal Park under the jurisdiction of National Parks Development Committee
4. Manila Bay Beach Resort	Cities of Manila and Pasay and Paranaque, Metro Manila	Proc. No. 41 P.D. 1085	07-05-54 02-04-77	464.66	Transferred jurisdiction to Public Estates Authority
5. Mt. Makiling	Los Banos and Calamba, Laguna and Sto. Tomas, Batangas	Proc. No. 552 Proc. No. 692	02-23-33 08-02-60	3328.65	Transferred jurisdiction to UP at Los Banos
6. Pagsanjan Gorge	Cavinti and Lumban, Laguna	Proc. No. 392 Proc. No. 1551	03-28-39 05-31-76	152.64	Transferred jurisdiction to Philippine Tourism Authority
7. Sta. Cruz Island	Zamboanga City	P.D. No. 654 Proc. No. 1801	02-04-75 11-10-78	Undetermined	-do-
8. Tiwi	Tiwi, Albay	Proc. No.47 Proc. No. 739	07-10-54 08-14-70	-do-	Part of Tiwi Geothermal Reservation under the jurisdiction of Department of Energy-NPC
9. Tongonan Hotspring	Ormoc City, Leyte	Proc. No. 161 Proc. No. 1112	06-14-37 02-21-73	272.00	Part of Tongonan Geothermal Reservation under the jurisdiction of Department of Energy-NPC
			Total	12,230.49	

Source: PAWB

Table 30. Total Number of Timber License Agreements, 1980-1988

Year	Total No. of TLAs	Area (thousand has.)	AAC (thousand cubic meters)	Logs Production (million cubic meters)
1980	191	6500	13699	-
1981	184	6539	13322	-
1982	186	6709	12879	-
1983	125	5392	9228	-
1984	142	5878	9027	-
1985	148	6093	8903	-
1986	142	5675	8231	3.06
1987	137	5404	8204	3.36
1988	110	4,421	6,913	3.06

Source: FMB

Table 31. Estimates of Upland Population by Different Sources

Population	Estimated Number (million)	Source
Ethnic	3.5	Episcopal Commission on Tribal Filipinos (1985)
	5.7	ECTF (1986 Projection)
Hilly Tribes	6.6	Office of Muslim Affairs and Cultural Communities (1985)
Forest Occupants	0.156 kainginero families	BFD (1980)
	1.15	BFD (1984)
	1.25	BFD (1985)
Within ISF Barangays	2.2	Agrarian Reform Institute - UPLB (1986)
All Upland Communities	7.5 (5.5 cultural communities; 2.0 non-cultural communities)	BFD Upland Development Working Group (1983)
	14.4	Philippine Institute for Development Studies - 1986 Report by C. Cruz (1980 Estimates)

Sources: ARI-UPLB

Social Forestry in the Philippines: Policy Issues, Problems and Recommendations, MNR. 1987, as cited in Umali, R.M. 1988. Forest and Other Land Use Policies of the Department of Environment and Natural Resources logged-over areas, or logging areas where TLAs had either been cancelled or suspended.

To date, forestry monitoring officials and the academe seem to agree that there are about 18 million upland dwellers scattered all over the country, of which 6 to 8 million live within the forest zones.

2. ISSUES AND PROBLEMS

In the 1930s, the BFD estimated virgin forest cover to be about 12 million hectares or approximately 40 percent of the total land area of the country.

Within the last 20 years, the national forest cover decreased annually by 2.5%, about three times the tropical average. Extensive clearings occurred mainly during the 1970s. The biggest forest losses took place in Region 4 (804,000 hectares), Region 10 (491,000 hectares), Region 11 (485,000 hectares), Region 8 (446,000 hectares) and Region 12 (424,000 hectares).[45]

In the early 1980s, Southern Tagalog and Southern Mindanao had the smallest forest areas. Palawan, an island province, ranked first with 75.1% or 1.12 million hectares of forest lands. Mindanao ranked second with 45.2% or 4.61 million hectares of forest lands. Luzon had 26.4% or 1.64 million hectares of forest lands.

As of 1988, forestry statistics show forest cover to be about 6.46 million hectares or 21.5% of total land area. The country's virgin forests have been reported to be only 1 million hectares.

Hence, virgin forest growth was depleted by around 21% since the early 1930s up to the present. This rate of deforestation is certainly very fast and alarming. It is even projected that dipterocarp old-growth forest will be fully exploited by 1995.

Forest Destruction: Causes

There are many factors, natural and man-made, which cause the depletion of forest cover. The FMB, in its annual forestry statistics reports, estimated forest loss of about 181,795 hectares due to forest fires from 1980 until 1988. In addition to these losses, 27,061 hectares of forest land were denuded by logging; 25,208 hectares were converted into kaingins; 3,607 hectares destroyed due to other causes; and, 2,164 hectares lost due to pests and diseases, for the same period (**Table 32**).[46]

Forest fires

Forest fires which could either be man-made (such as a forest being set on fire by a disgruntled worker of a reforestation project) or set off by natural causes (such as the fusion of brushlands during hot season), are one cause of forest loss. The greatest percentage of forest destruction attributable to forest fires was in 1983, with forest fires accounting for 97% of the destruction of the forest.

Table 32. Forest Destruction: 1980-1988
(hectares)

Year	Total	Forest Fires	Logging	Kaingin	Pest & Diseases	Others
1980	32,640	18,324	7,348	6,302	112	554
1981	24,605	12,471	6,108	5,826	200	-
1982	16,654	8,063	4,954	3,286	351	-
1983	121,326	117,951	1,015	2,241	119	-
1984	4,895	3,177	478	1,137	6	97
1985	14,632	11,743	1,918	941	30	-
1986	7,682	4,257	90	1,991	1,344	-
1987	7,146	5,386	676	570	2	512
1988	10,255	423	4,474	2,914	-	2,444
Total	239,835	181,795	27,061	25,208	2,164	3,607

Source: FMB

Logging

Logging, whether legal or not, contributes even more to the depletion of forest cover and soil erosion. Illegal and violative logging are particularly a problem. On the one hand, illegal logging is undertaken without any permit from government. Violative logging, on the other hand, is done with valid permit or Timber License Agreement (TLA) issued by the government. However, the stipulation or requirements in the TLA, in terms of allowed volume of cut per unit area, minimum tree size to be harvested, forest restoration work, replanting scheme, etc. are seldom strictly adhered to. Kaingin follows illegal and violative logging operations. Indirectly, this leads to the permanent loss of forests. In 1988, there were 110 holders or concessionaires of Timber License Agreements (TLAs) as against 191 TLAs in 1980 (**Table 30**). Concessionaires who violated conditions had their TLAs either suspended or cancelled. They have significantly contributed to the deterioration of forest resources. Illegal logging during this period continued unabated and uncontrolled. While there are no exact data available on this matter from the FMB, the DENR has apprehended a considerable number of logs, cut timber and lumber, which are sometimes lost or undervalued during the clearing process.

Several other factors have been cited as excacerbating the logging problem and wasteful exploitation of forest resources. Foremost of these are the underpricing of logs and political interventions.

Resource economists have reported that current charges for manifested forest products are too low. The system of fixed forest charges first adopted since the 1910s "valued timber resources at such an artificially low level (only 1 to 3 percent of real market value in log form)", that the industry had no incentive to log efficiently.[47] A situation exists, therefore, where exploiters pay very little of the economic rent due for these exploitation activities. The World Resources Institute, for instance, reported that only about 20% of the more than P20 billion rent from logs harvested from 1979 to 1982, went to the Philippine government.

From the estimated 12 million hectares in the 1930s, the Philippines' virgin forests have been reduced to one million hectares in 1988 and about 900,000 hectares in 1989.

Underpricing of logs and political intervention have exacerbated the wasteful exploitation of forest resources.

Meanwhile, accounts had been written about political favoritism and corruption in the forestry sector. These took the forms of logging companies including in their Board of Directors influential politicians; political leaders as stockholders of companies; political cronies and leaders getting their own licenses and renting such to legitimate logging companies; and, political leaders having financial interest in the concessions within their political units through pay-offs or royalties.[48]

Kaingin

Legitimate TLA holders blame the slash-and-burn farmers or "kaingineros" for forest destruction. These kaingineros migrate to marginal forest areas, cut the growing young trees and other vegetation, burn these places and convert them into arable agricultural lands. The converted areas are initially fertile because of accumulated humus in the top soil. The first two years, then will be bountiful. After another year, due to soil erosion and exposure to degrading elements, the kaingineros móve to other areas and do the same thing. This is why such practice has been known as "shifting agriculture". With this type of activity, destroyed forest areas increase with the growth of the kainginero families.

Permanent loss of forest cover results from human interference in the forest succession process. Logging opens up the forest, and in the process, makes it easier for shifting cultivators to take over. The succeeding burning and cultivation activities prevent the resurgence of forest vegetation. Soil losses invariably accompany the conversion of forest land to grassland. Without grassfire, grasslands are known to grow back to forest vegetation.

Two types of kaingineros reside in the forests. The first are forest zone farmers who contribute to deforestation. The second group are those who contribute to forest conservation. The latter are indigenous to the land which they have occupied for generations. Most possess a wealth of local knowledge and concerns that include a reverent attitude toward the natural bounty around them.

Pests and Diseases

Pests and diseases accounted for 17% of forest destruction in 1986. They particularly affected plantations and agro-forests.

In 1978, apitong trees were already reported dying due to unknown "pathogen" infestations in Cagayan. A varicose borer infested the native, as well as, the Papua New Guinea species of Eucalyptus deglupta in PICOP, Surigao del Sur. A canker disease also affected its Albizia falcataria plantations. A bark beetle threatened the resin-rich Benguet pine forest of Northern Philippines. In 1979, almaciga stands in Kalinga-Apayao mountains were reported attacked by a heart rot pathogen identified as a fungus; a basidiomycete which belongs to the genus Fomes. Psyllid infestation wiped out most of the giant ipil-ipil plantations throughout the country.[49]

Other Causes

Mining operations also pose destruction to the nation's forests. Surface and strip mining, for instance, hasten soil erosion and clog the rivers with their mine tailings, killing living things in the process.

Strong typhoons and storms coupled with heavy rains also contribute to the depletion and destruction of trees.

Forest Destruction: Effects

Physical

Because of forest denudation, at least 22 of the country's provinces are already badly eroded, many of which are major producers of agricultural products. Leading the list of provinces with more than 50 percent of their land area eroded are Batangas and Cebu. Both have serious degrees of erosion (80 - 85 percent), closely trailed by Marinduque at 75-80 percent.

Ilocos Sur and La Union both have 60 to 70 percent of their lands without top soil. Other provinces in this situation are Bukidnon, Misamis Oriental, North and South Cotabato, Davao del Norte, Davao Oriental, Davao del Sur, Lanao del Norte, Lanao del Sur, Zamboanga del Sur, Zamboanga del Norte, Negros Oriental and Occidental, Antique, Capiz, Iloilo and Aklan.

Soil erosion results in loss of soil nutrients, the top soil, or even the entire soil to river channels and the open sea. It also results in the sedimentation of rivers, lakes, dams, irrigation canals and other waterways. Lowland farms also suffer low crop yield or destruction of crops as a result of siltation.

Logging activities in Palawan continue unabated while logging in Cagayan and Isabela resulted in severe soil erosion that has caused the shallowing of the Bued, Cagayan and Agno Rivers. Siltation and turbidity of major coastal areas such as Manila Bay, Lingayen Gulf, the Batanes Islands, Cebu, Negros, Panay, Leyte and Samar have been increasing.

Aside from soil erosion, the capacity of the soil to hold water deteriorated with forest destruction. Further, forest destruction has been speculated to reduce groundwater in various areas throughout the country, inducing saltwater intrusion in low-lying regions in many instances. In Cebu, where forests have been almost totally lost, underground water coming out of private wells have become brackish.

Biological

The destruction of much of the Philippine forests and over- exploitation of particular plant groups have threatened the country's genetic resources, putting many species on the endangered list, and bringing some to the verge of extinction. Other species are vulnerable and may become endangered in the future. The rest, though not immediately endangered, are at risk because they are rare. With every disappearing plant species, several other plants and animals dependent on it are threatened and may eventually disappear, too.

In 1976, the Philippines became a signatory to the Convention on International Trade of Endangered Species of Wild Flora and Fauna (CITES). The list of Philippine species included in the CITES is shown in **Table 33.**

Table 33. List of Philippine Species Included in CITES

Appendix No.	Scientific Name	Common Name
	A. Fauna	
	CLASS AVES:	
	Pithecophaga jefferyi	Philippine Eagle
Appendix I-	*Falco peregrinus*	Peregrine Falcon
No trade is	*Polyplectron emphanum*	Palawan Peacock Pheasant
allowed for these species	*Tringa guttifera*	Spotted green shank
except for scientific pro-	*Caloenas nicobarica*	Nicobar pigeon
pagation and educational	*Ducula mindorensis*	Mindoro Imperial Pigeon
purposes.	*Pitta kochi*	Koch's pitta
	Otus gurneyi	Giant scops owl
	CLASS MAMMALIA:	
	Dugong dugon	Dugong
	Bubalus mindorensis	Tamaraw
	CLASS REPTILIA:	
	Eretmochelys imbricata	Hawksbill turtle
	Lepidochelys olivacea	Olive-backed or Pacific Ridley's logger head
	Chelonia mydas	Green Sea Turtle
	Crocodylus porosus	Saltwater or Estuarine Crocodile
	B. Flora	
	Alocasia sanderiana	Sander's alocasia
	Alocasia zebrina	Striped alocasia
	Nepenthes rajah	Pitcher plant

Table 33. (continued)

Appendix No.	Scientific Name	Commom Name
	A. Fauna	
	CLASS AVES:	
Appendix II- These species are not necessarily threatened but may be so if trade is not controlled. This means that the country of origin has the responsibility of controlling trade.	*Falconiformes* spp.	Falcons
	Numenius minutus	Pygmy Curlew
	Gallicolumba luzonica	Bleeding Heart Pigeon
	Psittaciformes spp.	Parrots (all species)
	Strigiformes spp.	Owls
	Buceros hydrocorax	Rufous hornbill
	CLASS MAMMALIA:	
	Manis javanica	Pangolin
	Tarsius syrichta	Philippine Tarsier
	Macaca fascicularis	Philippine monkey
	CLASS REPTILIA:	
	Varanidae spp.	Monitor Lizards
	Boidae spp.	Python
	CLASS INSECTA:	
	Parnassius apollo	Mountain
	Trigonoptera spp.	Butterflies
	Troides spp.	Birdwing butterfly
	B. Flora	
	Orchidaceae	Orchids
	Areca ipot	Bungang ipot
	Phoenix hanceana var. *philippinensis*	Voyavoi
	Salacca clemensiana	Calakab/Dalubi
	Hedychium philippinense	Tagbak (Phil. camia)
	Cycadaceae spp.	Cycas or pitogo (all species)
	Cyatheaceace spp.	Ferns (all species)
	Aloe spp.	Aloe or Sabila
	Cactaceae spp.	Cactus

Meanwhile, on July 9, 1985, the ASEAN Ministers, on the occasion of the Second Ministerial Meeting on the Environment, signed in Kuala Lumpur, Malaysia, the ASEAN Agreement on Nature Conservation. The Agreement was entered into by the six-member states of the Association of Southeast Asian Nations for individual and joint action to conserve and manage their living resources and other natural elements on which they depend. **Table 34** shows a partial list of endangered/threatened Philippine fauna included in the ASEAN Agreement on Nature Conservation.

The more popular among these threatened animal species are the Philippine eagle, Palawan peacock pheasant, tamaraw, tarsier, Calamian deer,and the Philippine crocodile. There are no local data, however, about the magnitude of loss in biodiversity for every unit of cleared forest areas.

Climatological

With increasing degraded watershed areas, the hydrologic cycle is disturbed and, hence, flash floods and droughts were noted to be more frequent resulting in unquantifiable losses to lives and property. These phenomena are discussed more extensively in the chapter on Atmosphere and Climate of this report.

Socio-Economic

Socio-economic effects of forest destruction involve, among others, displacement of cultural communities and economic losses from foregone benefits and damages to life and property.

Roughly 3.5 to 6.6 million inhabitants belonging to cultural communities reside in the uplands. Displacement from their ancestral lands has haunted not a few of these communities. In 1977, the T'bolis, a Mindanao ethnic group, feared encroachment upon their ancestral home with the Cotabato-Agusan River Basin Development Project. At about the same time, the Remontados of Tanay, Rizal, who practiced ecologically- sound kaingin, were pushed farther away from the town proper, to withdraw from migrants. In the early 1980s, the Kaliwa River Basin project had threatened to submerge barrios that were their ancestral lands. Macli-ing Dulag of the Butbut tribe of Kalinga, Apayao, was killed as he was defending his tribe's customary rights during the Chico dam construction.[50] The same issue was the cause of conflict in the case of the Cellophil Resources Corporation, and Pantabangan Dam events. Forces which opened up these once tranquil ancestral lands have meant dislocation to the cultural communities.

The inequities in access to the country's forest resources is dramatized by **Table 30** which indicates how much of the Philippine forest is controlled by a handful of loggers (110 TLAs covering 4.42 million hectares) in contrast to ISF participants totalling 152,528 beneficiary families who control a mere 447,814 hectares of the forests, as of 1988.

Converting a hectare of old-growth forest amounts to a loss of about 100 cu.m. of commercial quality logs plus the potential for sustained yield at an expected annual incremental growth rate of about 2.4 cu.m./ha. At the current price of P2000/cu.m., this is equivalent to about P99,990/ha. net profit; assuming profit amounts to about 50% of gross revenue.[51]

Table 34. Partial List of Endangered Species/Threatened Philippine Fauna included in the ASEAN Agreement on Nature Conservation, 1985

	Scientific Name	Common Name
Endangered (and not to be traded)	Class Aves:	
	Pithecophaga jefferyi	Philippine Eagle
	Ducula mindorensis	Mindoro Imperial Pigeon
	Polyplectron emphanum	Palawan Peacock Pheasant
	Pitta kochi	Kock's Pitta
	Class Mammalia:	
	Bubalus mindorensis	Tamaraw
Threatened (subject to trade restriction/ conditions)	Class Aves:	
	Spizaetus philippinensis	Philippine Hawk Eagle
	Otus gurneyi	Giant Scops Owl
	Class Mammalia:	
	Macaca fascicularis	Long-Tailed or Crab-eating Macaque
	Felis bengalensis	Leopard Cat

Source: ASEAN Agreement on Nature Conservation, 1985

In 1988, some 119,000 ha. of natural forest vegetation were destroyed, i.e. taken out of forest production. This amounted to a gross loss of P 23,800 million/year or a loss in net profit of P11,902 million. Even if these areas had been previously logged according to recommended practices, the loss of future revenues would amount to P 5.7 billion or a total of P285.56 million net a year.[52]

The economic costs that go with soil erosion and sedimentation are also serious enough to warrant environmental concern in the upland areas.

A study in 1988 by W.D. Cruz et al. on the "On-site and Downstream Costs of Soil Erosion in the Magat and Pantabangan Watersheds," estimated annual erosion rate per hectare for open grasslands at 88 tons, and for other land uses at 28 tons. Since sheet erosion of the top soil is only about 40 percent of the gross erosion rate (Madecor, 1985) gross annual erosion per hectare was estimated to be 219 tons for the open grasslands and 71 tons for the other land uses.[53]

The Magat Watershed study, as shown in **Table 35**, established that each ton of eroded soil per year is equivalent to 3.08 kg of urea, 0.79 kg of solophos, and 0.57 kg of muriate of potash, or an estimate of about P 15.00 per ton. On a per hectare basis, the combined loss is about P1,068.00. Using the annual gross soil erosion estimate of 219 tons per hectare, total loss is about P3,392 per hectare.

Table 35. Fertilizer Losses Due to Soil Erosion in the Magat Watershed

Fertilizer	Quantity (kg)	Valuation with Use of Nominal Price (pesos)	Shadow Price (pesos)
1. Urea			
- price		3.60/kg.	9.86/kg.
- amount of lost/ton of soil eroded	3.08	11.09	30.37
- amount lost/ha. of affected land	118.13	677.23	1854.96
2. Solophos			
- price		2.50/kg	6.20/kg
- amount lost/ton of soil eroded	0.79	1.98	4.90
- amount lost/ha. of affected land*	70.65	176.63	438.03
3. Muriate of Potash			
- price		4.20/kg.	8.28/kg.
- amount lost/ton of soil eroded	0.57	2.39	4.72
- amount lost/ha. of affected land*	51.07	214.49	422.86
4. All fertilizers			
- amount of lost/ton of soil eroded		15.46	39.99
- amount lost/ha. of affected land*		1,068.35	2,715.85

Source: W. Cruz, et al. Journal of Philippine Development. 1988.

* Note that although the average sheet erosion rate of Magat Watershed is about 88 tons/ha. for the various land mapping units where the soil analyses were available, erosion rates in tons/ha. differed.

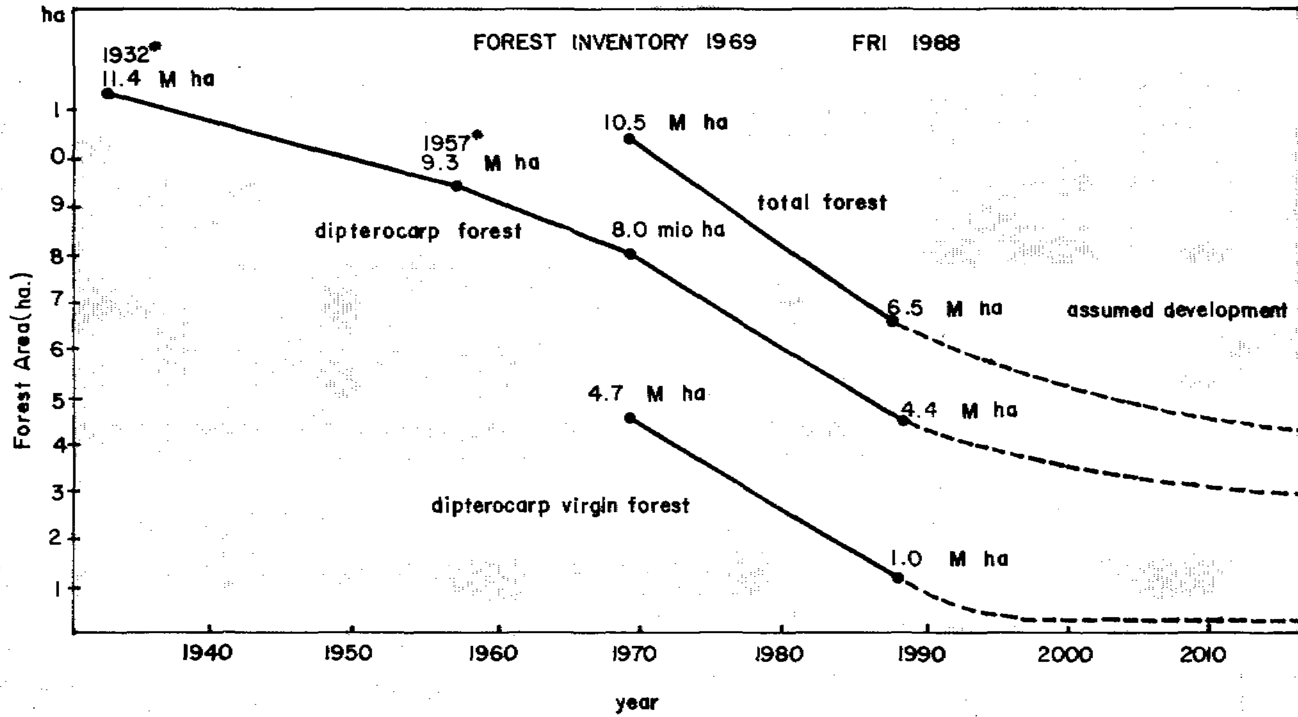


Figure 17. Forest Area Development, 1940-2010
Source: Severo, Asidao, Reyes, 1962 as cited in
Natural Forest Resources of the Philippines, 1988

The study likewise assume an annual average deforestation loss of 100,000 hectares per year; soil and soil nutrient loss per year had been computed to reach about P339,200,000.

The figures provided above are even an underestimation of total costs, because they do not include the effects of deterioration in the soil structure and the water-holding capacity of the soil.

Meanwhile, **Tables 36 and 37** show comparable trends of erosion and replacement costs of lost nutrients per ton of eroded soil from the Pantabangan watershed.

On the downstream cost of soil erosion, sedimentation is the process that should be taken into account. Where the watershed drains into a major dam and reservoir system providing irrigation, hydro- electricity, and flood control services, the heavy impact of sedimentation becomes all the more evident.

For the two watershed projects, from an ex-post project perspective, sedimentation reduces potential benefits by shortening reservoir and dam service life, and reducing its useful storage capacity. **Tables 38** and 39 illustrate the value of foregone benefits associated with the reduction in the reservoir's service life. The massive sedimentation of the Ambuklao Dam in Luzon has resulted in the reduction of its useful lifespan from 60 to 32 years, yielding an estimated loss of P500 million in 1985. To these costs should also be added benefits foregone from lost biodiversity with potential economic value as food, medicine, fuel, fiber and material of industrial usage.

3. MANAGEMENT EFFORTS

3.1 Regulatory Efforts

Before the 1987 Constitution, the disposition of natural resources was done through the issuance of leases, licenses and permits by the state. Under this system, the duty of the State was primarily regulatory.

The 1987 Constitution, however, drastically changed a number of State policies regarding natural resources use. One of the most important changes is the introduction of policy placing exploration, development and utilization of natural resources under the full control and supervision of the State (Article XII, Sec. 2). To implement this, the State may directly undertake such activities, or it may enter into co-production, joint venture or production-sharing agreements with Filipino citizens, corporation or association at least sixty per cent of whose capital is owned by such citizens.

Among the more recent pertinent legal issuances on forest resources utilization are:

Executive Order No. 278, which prescribes the interim procedure in the processing and approval of applications for the development or utilization of forest lands and/or forest resources. This Order implements the provisions in Art. XII, Sec. 2 of the 1987 Constitution. It sets among the minimum terms and conditions, the restoration and protection of the forest;

Table 36. Land Use and Erosion Rates by Slope Classes in the Pantaba..gan Watershed

Slope Class/ Erosion Rate	Slope Range (%)	Land Use Type: Kaingin/Diversified Croplands (has.)	(%)	Grassland/ Savannahs (has.)	(%)	Primary/Secondary Fores* (has.)	(%)	Irrigated Rainfed Ricelands (has.)	(%)
S1	0.0 to 3.0	-	-	-	-	3469.74	12.66	3510.08	89.63
S2	3.0 to 8.0	-	-	-	-	-	-	406.04	10.37
S3	8.0 to 15.0	-	-	356.36	1.53	-	-	-	-
S4	15.0 to 25.0	1119.96	49.50	1300.92	5.58	74.09	0.27	-	-
S5		36.04	1.59	6732.27	28.89	-	-	-	-
S6	>40.0	1106.58	48.91	14914.94	64.00	23854.02	87.07	-	-
Total[1]		2262.58	100.00	23304.49	100.00	27397.85	100.00	3916.12	100.00
Average Erosion[2] Rate (t/ha/yr.)		428.59		197.80		2.15		0.28	

Notes: 1 - Based on total areas of sample SMUs for each land use

2 - Does not include riverwash, reservoir, and residential lands

Table 37. Replacement Costs of Lost Nutrients Per Ton of Eroded Soil From Pantabangan Kaingin and Grassland Areas
(pesos)

Soil	Kaingin/Diversified Cropland				Grassland/Savannah			
Depth	Urea	Solophos	Muriate of Potash	Total	Urea	Solophos	Muriate of Potash	Total
0-5	4.98	0.24	1.78	7.00	5.45	0.13	1.54	7.12
5-10	4.92	0.24	1.78	6.94	5.37	0.12	1.54	7.03
10-15	4.84	1.78	1.78	6.83	5.00	0.10	1.23	6.33
15-20	4.63	1.47	1.47	6.31	4.72	0.06	1.07	5.85
20-25	2.66	1.03	1.03	3.76	3.59	0.06	0.87	4.52
25-30	2.62	0.96	0.96	3.65	3.53	0.06	0.82	4.41
30-35	2.54	0.07	0.96	3.57	3.36	0.06	0.82	4.24
35-40	2.54	0.07	0.96	3.57	3.36	0.06	0.82	4.24
40-45	2.54	0.07	0.96	3.57	3.32	0.06	0.82	4.24
45-50	2.54	0.07	0.66	3.57	3.32	0.06	0.82	4.24

Source: W. Cruz, et al., Journal of Philippine Development, 1988

Table 38. Present Value of Foregone Benefits Associated with the Reduction in the Magat Reservoir's Service Life
(000 pesos)

Year	Total Cost	Total Benefit	Net Benefit
64 - 65	10,256	275,903	265,647
66	26,042	275,903	294,861
67 - 85	10,256	275,903	265,647
86	29,356	275,903	246,647
87 - 103	10,256	275,903	256,647

Source: W. Cruz, et al. Journal of Philippine Development, 1988.

Net Present Value (at 15% interest) = P262,623

Notes:

1. The undiscounted irrigation and power benefits remain the same for the years before Year 64.
2. There is no change in the operating and maintenance expenses.
3. The second replacement for pumps, transformers, and electrical equipment will take place in Year 66, and that of turbines and generators will take place in Year 86.

Table 39. Summary of Estimated Costs of Sedimentation in the Pantabangan and Magat Reservoirs

Source	Annual Sedimentation Cost (pesos) Per Hectare		Per Ton	
	Pantabangan	Magat	Pantabangan	Magat
Reduction in service life*	1.11	0.10	0.02	0.01
Reduction of active storage*				
a) for irrigation	12.99	n.a.	1.19	n.a.
b) for hydropower	2.91	n.a.	0.15	n.a.
Opportunity cost of dead storage for irrigation	575.55	365.61	28.78	18.00
Total	592.56	365.71	30.14	18.01

Source: W. Cruz, et al. Journal of Philippine Development, 1988.

* The Pantabangan estimates are based on the assumption that 75% of sediment settle in dead storage and 25% in active storage. For Magat, the assumption is that all sediments go to dead storage.

** The prices used for Pantabangan are late 1970 prices. For Magat, early 1980 prices are used.

DENR Administrative Order No. 78, series of 1987, allows the cutting/gathering of narra and other premium hardwood species in private lands, allowable clearings within civil or military reservations/resettlement or settlement areas, and in allowable clearings inside forest lands covered by timber licenses/permits limited to fifteen percent (15%) for skidding/truck logging and yarding based on the logging area under operation;

DENR Administrative Order No. 74, series of 1987, imposes a nationwide ban on the cutting of almaciga trees. This regulation aims to save the trees, safeguard the livelihood of almaciga resin gatherers, and assure a continuous supply of resin export in the international market;

DENR Administrative Order No. 79, series of 1987, enjoins the TLA holders to pay a deposit of P80.00 per cubic meter, apart from the payment of forest charges, for the Forest Renewal Trust Fund (FRTF). The amount in the FRTF will be used to finance the reforèstation of logged-over areas of the concessionaire if the licensee fails to reforest the area by contract reforestation.

MNR Memorandum Order No. 8, series of 1986, imposes a total ban on log exportation. This order is expected to slow down, if not totally halt, the destruction of the forest by logging activities.

Executive Order No. 277, which amended Presidential Decree No. 705, provides incentives to informants of forestry law violations equivalent to the proceeds of the confiscated forest products.

DENR, PC-INP Memorandum of Agreement, renders PC-INP personnel available to DENR to boost the drive against illegal logging and timber smuggling.

BFD Circular No.13, series of 1986, orders the total stoppage in the processing of applications for lands within the mangrove areas, watershed reservations, wilderness areas, national parks, wildlife sanctuaries and experimental forests.

There are also bills on the following:

A bill prohibiting logging in provinces with less than 40% forest cover;

A bill on the establishment of an Integrated Protected Areas System;

A bill recognizing and delineating ancestral lands of indigenous cultural communities; and,

A bill increasing forest charges to 20% of output

3.2 Management Programs

In 1916, the Reforestation Administration had an annual average rate of reforestation of 1,000 hectares. From 1960-1975, the Reforestation Administration accelerated its reforestation program to an average annual rate of 9,500 hectares. For the period 1976 to 1988, the Program for Forest Ecosystem Management (PROFEM) and the Communal Tree Farm (in 1978) continued to reforest selected denuded areas with an annual average rate of 29,500 hectares. **Tables 40 and 41** show the number of seedlings propagated by both government and private sectors for the reforestation program, as well as the reported reforestation accomplishments. From 1989 up to the year 1995, an annual reforestation rate of 100,000 hectares is targeted under the National Forestation Program.

Reforestation efforts had always been hampered by mobilization and construction of access roads/trails, establishment of nurseries (seedlings and saplings), and maintenance funds after the establishment of such. While FMB reports no data available on survival rates of seedlings from 1980 - 1989, mortality rates of the seedlings planted had been speculated to range from 30 to 40%, excluding forest plantation damages that may arise from fires, floods and typhoons.

Cost of seedlings then were pegged at P1.50 to P2.00 per seedling and a maximum of P 3.00 for the better plant species like narra. Common fast-growing reforestation species like the "giant ipil- ipil" were piloted by the then BFD in its regular reforestation programs nationwide. The purpose was to achieve immediate forest cover for selected areas in preparation for soil conditioning and intermediate forest products. Tree farms were introduced, and fast-growing species like Albizzia falcataria for pulp and paper had been common. In tropical countries like the Philippines, however, monoculture plantations are subject to pest attacks and diseases and these were not spared from these occurrences.

Table 40. Number of Seedlings Propagated by the Government and Private Sector for the Reforestation Program, 1980 - 1988

Year	Sector and Total Number of Seedlings Propagated		Grand Totals
	Government	Non-Goverment Sector	
1980	154,234,080	43,501,920	197,736,000
1981	163,020,000	45,980,000	209,000,000
1982	132,829,000	57,900,000	190,729,000
1983	90,536,000	49,868,000	140,404,000
1984	52,487,000	No Data	52,487,000
1985	12,684,000	11,547,000	24,231,000
1986	46,067,000	No Data Available	46,067,000
1987	55,256,000	No Data Available	55,256,000
1988	27,205,000	37,568,000	64,773,000

Source: FMB

Table 41. Target Areas for Reforestation versus the Actual Reforested Areas, 1980-1989*
(hectares)

Year	Annual Target for Reforestation			Actual Reforested Areas		
	Totals	Government	Non-Government	Totals	Government	Non-Government
1980	-	-	-	60,516	39,881	20,635
1981	-	-	-	64,541	33,296	31,245
1982	-	-	-	63,262	35,201	28,061
1983	-	-	-	78,538	42,239	36,299
1984	-	-	-	38,935	16,088	22,847
1985	-	-	-	24,231	12,684	11,547
1986	-	-	-	32,[illegible]8	24,426	8,572
1987	-	-	-	39,811	28,843	10,968
1988	100,000	50,000	50,000	64,183	31,226	32,957
1989	100,000	84,000	16,000	131,404	89,452	41,952

*Notes:

1. The 1988 Philippine Forestry Statistics does not report any data on the Annual Target for Reforestation from 1980-1987.
2. Figures for 1980-1987 were obtained from the 1988 Philippine Forestry Statistics.
3. Figures for 1988-1989 were provided by the DENR Planning and Policy Office.
4. As per FMB-DENR records, there are no data available on survival rates of seedlings from 1980-1989.

For these problems, agro-forestation, which is the integration of agriculture and afforestation, had become better accepted. This came about when ISF programs were conceived, which emphasized the socio- economic aspect and livelihood program for the upland dwellers. Contract reforestation, either by legitimate contractors or by a small group, were encouraged to create a wider awareness and involvement in the restoration of our depleted forest covers.

The Forest Management Bureau (FMB), together with other institutions like the Manila Seedling Bank (MSB) and interest groups, agreed to come up with operations and financial guidelines for interested reforestation contractors. On a per hectare basis, the cost of labor for reforestation was computed at P12,000.00 to P15,000.00/hectare in 1986, for interested parties who wished to enter into contract agreement with the government. This basic estimate does not include the cost or value of seedlings which the government will supply as incentives. Overall, reforestation may cost from P15,000 to P35,000 per hectare.

In 1986, the National Forestation Program of the DENR was launched, with a loan fund of US $240 million from the Asian Development Bank and the Overseas Economic Cooperation Fund, payable in 35 years at 1% interest rate. The Program's target is to reforest 1.4 million hectares of denuded areas from 1987 up to 2000.

The Integrated Social Forestry Program

The Integrated Social Forestry Program (ISFP) was launched in 1983 to uplift the socio-economic conditions of upland dwellers and occupants to forest land prior to January 1, 1982. The program was designed to maximize land productivity and enhance ecological stability. Under the program, a kainginero family of five members, is given a 25-year stewardship certificate contract for continued occupancy of present clearings, but not to exceed three to seven hectares with specific requirements such as protecting the forest ecosystem, provided further that areas within national parks or reservations and areas under leasehold agreements are not covered. These stewardship contracts can be renewed for another 25 years.

As of 1988, ISF projects monitored by the FMB numbered around 803, with 152,528 beneficiary families.

In 1989, the FMB pursued the Inventory of Forest Occupants (IFO), which involves the complete inventory of forest occupants (kaingineros, squatters, cultural minorities and other residents) actually occupying and/or developing portions of forest lands. The results of the IFO will hopefully provide data for effective planning and implementation (particularly the ISFP under the Comprehensive Agrarian Reform Program and other community-based forestry projects).

Master Plan for Forestry Development (MPFD)

The MPFD, which was meant to be a comprehensive assessment of the forestry sector, is a joint project of the Department of Environment and Natural Resources, Asian Development Bank and the Finnish International Development Agency or FINNIDA. The project started in January 1989, with consultancy services provided by

Jaakko Poyry Oy of Finland and MADECOR of the Philippines. Expected to terminate in June 1990, the project is expected to come up with a 10-year plan which will include priority programs, investment needs, and implementation proposals to be incorporated in the Medium- Term Development Plan.

The MPFD's goal is to bring, within ten years, the dipterocarp forests to a condition of sustainable yield. The seven-fold objectives of the Master Plan are as follows:

1. to establish a permanent natural forest estate;
2. to protect the natural forest estate;
3. to enhance forest productivity;
4. to improve economic stability and promote social equity and employment;
5. to enhance and maintain environmental stability;
6. to conserve biodiversity; and
7. to ensure the prior rights of ethnic cultural communities.

The Plan proposes the following major changes in forest policy in order to achieve the goal and objectives outlined above.

"Firstly, the remaining virgin dipterocarp forests, the pine forests of Mindoro and the mossy forests should be preserved and incorporated into a national protected areas system.

Secondly, the remaining logged-over forests should be identified as part of a permanent forest estate dedicated primarily to timber production and other forest products compatible with the primary purpose, and be brought under management for sustained production without unnecessarily disrupting the log supply to existing industry.

Thirdly, in bringing management to the logged-over forests, best use will be made of existing institutions but with an emphasis to having local and regional communities directly assist and benefit from the products of these forests. In this respect, it is suggested that a broad range of institutions, private organizations and local community organizations be contracted by DENR to manage presently unallocated production forest lands for regional, provincial and local development objectives.

Fourthly, the fees for forest products need to be raised to a level whereby the management of the forest (including its protection and rehabilitation) can be carried out. It is suggested that these be raised from P30 per cubic meter of logs to 20% of the wholesale price in Metro Manila, an increase to about P 500 per cubic meter. For other forest products, the suggested rise is 10%. These fees should be used in part by the government to take over some of the present responsibilities of the concessionaires.

Fifthly, using the existing concessionaire system, a smooth transition from logging in the old-growth forest to logging in the logged-over forests is proposed. There is no doubt that in some instances, this may not be possible but the DENR does have resources to soften the blow, e.g. there are still some 1.6 million hectares of unallocated forest, some of which could be reallocated, especially to TLA holders who have faithfully followed good management practices.

Lastly, after the situation of illegal logging and further destruction of the forest has been brought under control in various provinces where the logging ban has already been imposed, and depending upon the state of the forests, the reintroduction of harvesting could be allowed, absolutely dependent upon the establishment of forest management which includes protection and silvicultural improvement measures".

3.3 Research and Development

In 1978, the government commissioned the Manila Seedling Bank Foundation (MSBF) to conduct intensive research and development to investigate the over-all desirability of the role of legumes in reforestation and afforestation; the biomass energy plantation; and biomass energy conversion systems.

Subsequent studies of the MSBF showed viable alternatives for the conversion of wood biomass into energy.

Since 1975, the Forest Research Institute (now the Ecosystems Research and Development Bureau) of the DENR, has been conducting various forest researches. To contain the dwindling stock of timber in the Philippines, studies on the improvement of logged-over forests (timber stand improvement), enrichment planting of poorly-stocked stands, and the determination of growth structure and composition of second-growth forests were conducted by the ERDB and are being continued up to the present.

Efforts are also continuing to improve germination of common fuelwood species, premium hardwood species, fast-growing species, as well as, conditions to produce vigorous stocks for reforestation and plantation establishment.

Among the researches of the FORI were:

1. Forest Protection

- Bio-ecology and control of <u>Poecilips fallax</u> and <u>Coleoptera</u> infesting mangrove (<u>Rhizophora</u>) seedlings
- Biological control of <u>Ips calligraphus</u> infesting the Benguet pine stands
- The control of pine bark borer infesting Benguet pine stands
- Determination of the cause of infection of canker disease affecting <u>Albizia falcataria</u> in Bislig, Surigao del Sur

- Identification of the Varicose borer infesting the native, as well as the Papua New Guinea species of Bagras, the pathogen infesting apitong trees in Cagayan

- Infestation by defoliators of young Kiri trees in Kalinga-Apayao

2. Non-Timber Products

- Suitability of bamboo cuttings and seedlings for reforestation of openlands and watershed areas

- Improvement of germination and early growth and development of rattan

Various FORI researches were also conducted on agroforestry, particularly the improvement of hillside farming through schemes that were labor-intensive and low-capital. The schemes also involved planting of short, medium and long-term crops alongside farming techniques that promote soil and water conservation.

Socio-economic research projects had also been initiated, particularly on perception and attitudes towards forest conservation, burning, kaingin and exploitation of forest resources.

Currently, the ERDB engages in researches no longer on a "commodity" basis, but using the ecosystems approach. Hence, the related researches on the forest ecosystems, the grassland and degraded areas ecosystems, and the upland farms ecosystems, with primordial concern on ecological balance.

Forest researches were likewise conducted by the Forest Products Research and Industries Development Commission (FORPRIDECOM), the UPLB College of Forestry, the Philippine Council for Agriculture and Resources Research and Development. These entities later formed the Inter-agency Group for Forestry Research Application to coordinate researches and adoption of results.

3.4 Information and Training

The recognition of formal forestry education as vital to the well-being of the Philippines came to the forefront only in the 1960s. In 1972, the forestry course was professionalized. As of the early 1980s, at least 30 universities and colleges in the Philippines offered curricular programs in forestry.[54]

While the College of Forestry in the University of the Philippines at Los Banos spearheaded formal forestry education, primarily for the ranger, undergraduate and graduate programs in forestry, forest products engineering, social forestry, wildlife management, forestry business management and the like, a host of other institutions such as the FMB, the UPLB Forestry Development Center, ERDB, the ASEAN-US-Watershed Program and other universities/ entities followed suit with multiple seminars, workshops, short training courses, symposia and community assemblies on varied concerns of forestry. Such had been targetted to different audiences such as policy makers, planners, implementors of government and private programs, forest guards and the general public.

4. PROSPECTS

The principal challenge to the Philippine forestry sector is the conservation of remaining forests and the revegetation of the severely denuded ones.

The following should be included in the agenda for forest protection and management in the Philippines:

- Immediate declaration of all virgin dipterocarp forests outside existing Timber License Agreements with more than 50% of slope as protected areas and formulation of regulations with severe penalties for violations.

- Formulation and adoption of a national land use plan, to guide decision-makers on the most beneficial use of land resources, as well as, proper conservation of management of such for future use.

- Implementation of the Integrated Protected Areas System. Related to this concern will be the review of the status of existing forest reservations in terms of their meeting intended objectives vis-a-vis shortage of land for production purposes and the need to address social objectives.

- Research and development support on the biotic inventory of the Philippine forest ecosystems, including the different formations and habitats; effects of human activities on the diversity of selected biotic groups; and, assessment of changes in biotic diversity through time.

- Strengthening of the capability of the local population to conserve, develop and manage the forests. Areas where logging activities had either been banned or suspended may be jointly managed by skilled communities and the government.

- Genuine democratization of access to the uplands to provide incentives for forest protection practices.

- Research and development of sustainable upland farming systems.

- Research and development on the protection and regeneration of critical watershed areas of the country.

- Research and development on the optimum use of forest products to reduce pressure on the forest resources.

- Assignment of proper prices to forest resources, or proper resources pricing reform, as in the hastening of the passage of the draft bill increasing forest fees to 20% of the market price. There is also a need for consideration of a series of forest charges to increase revenue for forest protection and management.

- Speeding up of action on pending bills designed for forest protection.

- Intensification of efforts towards public awareness and education on the adverse effects of forest destruction, and an increasing appreciation of the value of forest resources.

INLAND WATERS

1. PROFILE

The Philippine's inland waters are quite diverse, comprising primarily of rivers and lakes. It has over 421 rivers with drainage areas ranging from 40 sq. km. to 25,000 sq. km., 58 natural lakes and more than 100,000 hectares of freshwater swamps. With its annual average precipitation of 2,269 mm. and average annual run-off of about 256,980 million cubic meters (MCM), the country is theoretically assured of enough water supply to meet its domestic, agricultural and industrial needs.[55] Seventy percent (70%) of available water are utilized by urban dwellers for domestic purposes, by farmers for irrigation and the rest by industry. **Table 42** gives the available water supply of natural run-off at various percent dependability. However, problems spawned by rapid population growth and increasing industrial and economic activities are severely straining the country's inland water resources and hindering the realization of their full potential.

Surface flows are augmented by groundwater sources. In 1980, total amount of groundwater was estimated at approximately 260,000 MCM and rate of net groundwater inflow at 33,000 MCM/year.[56] Groundwater storage was also estimated four to ten times the net inflows. The estimated storage capacity of the country's groundwater resources is given in **Table 43**. **Table 44** also shows an assessment of groundwater sources in selected areas throughout the Philippines. Shallow wells constitute 17 percent of total land area or 51,787 hectares, while deep wells cover 123,064 sq. km. or 41 percent. Groundwater is primarily used for domestic water supply, serving 28% of the Philippine population. Total groundwater withdrawal for domestic use is estimated at 2,000 MCM per year.

Increase in population translates into increased domestic water demand. An increase of 25% in Metro Manila's population during the period 1970-1975, for example, was accompanied by a concomitant increase in domestic water consumption of 47%.[57] Total domestic water demand is expected to rise from the current 2.846 MCM/day to 10.43 MCM/day in the year 2000 (**Table 45**). Per capita municipal water requirement is projected to rise from 0.025-036 cubic meters per day (CMD) to 0.04-0.05 CMD. The sectoral percentage of industrial water demand is likewise expected to increase by the year 2000 (**Figure 18**).

Increased water demand has grave implications on water quantity and quality. It is expected to tax already heavily burdened water amenities. In 1980, only about 25.2 million or 53% of the total population was served by public water supply facilities.[58] By 1987, coverage went up to 63% of the total population or 35.76 million.[59] Water supply services covered 86% of Metro Manila and adjoining urban areas, 55% of the other urban areas and only 62% of rural areas. The rest of the population depended on dug wells, rainwater, cisterns, lakes and streams, which are vulnerable to contamination. This situation is projected to improve somewhat in 1992, at which time 79% of the people would be able to avail of water supply services. However, this will mean an intensive development of water resources and their coordinated management for optimum utilization.

Table 42. Available Water Supply of Natural Runoff at Various Percent Dependability (million cubic meters)

Water Resource Region	Percentage 50	75	90
I Ilocos	27,000	17,100	12,100
II Cagayan Valley	65,500	51,400	39,300
III Central Luzon	32,500	21,100	14,900
IV Southern Tagalog	91,500	56,000	39,900
V Bicol	29,100	18,000	14,700
VI Western Visayas	17,000	12,000	11,600
VII Central Visayas	16,600	11,200	8,700
VIII Eastern Visayas	59,000	38,300	33,900
XI Southwestern Mindanao	27,000	20,200	17,100
X Northern Mindanao	37,900	28,400	24,000
XI Southeastern Mindanao	39,000	25,300	18,700
XII Southern Mindanao	37,200	29,300	22,000
Philippines	479,300	328,300	256,900

Source: NWRC, 1980

Table 43. Estimated Storage Capacity of Philippine Groundwater Resources (million cubic meters)

Water Resource 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 Western Visayas	55,242
VII Central Visayas	1,700
VIII Eastern Visayas	8,400
XI Southwestern Mindanao	14,700
X Northern Mindanao	15,950
XI Southeastern Mindanao	9,750
XII Southern Mindanao	36,000
Philippines	251,158

Source: Bureau of Mines, 1980

Table 44. Assessment of Groundwater Resources in Selected Areas of the Philippines (hectares)

	Potential Shallow Water Table	Groundwater Area	Percent
LUZON	15,900	26,800	47.69
Central Luzon	8,600	9,200	16.37
Cagayan	3,500	10,200	18.15
Others	3,800	7,400	13.17
MINDANAO	10,000	18,000	33.45
Cotabato	4,900	6,000	10.68
Agusan	2,500	8,600	15.30
Others	2,600	4,200	7.47
OTHERS	5,100	10,600	18.86
Mindoro	2,100	2,300	4.09
Panay	1,300	2,200	3.91
Negros	800	1,800	3.20
Camotes	900	1,600	2.85
Tanan	0	1,600	2.85
Bohol	0	1,100	1.96

Source: NWRC, 1980

Table 45: Domestic Water Demand in the Year 2000 (MCM per day)

Water Resource Region	
I Ilocos	0.563
II Cagayan Valley	0.256
III Central Luzon	0.564
IV Southern Tagalog	5.350
V Bicol	0.435
VI Western Visayas	0.551
VII Central Visayas	0.561
VIII Eastern Visayas	0.311
XI Southwestern Mindanao	0.365
X Northern Mindanao	0.478
XI Southeastern Mindanao	0.604
XII Southern Mindanao	0.392
Phillippines	10.43

Source: Philippine Environmental Quality Report, NEPC, 1980

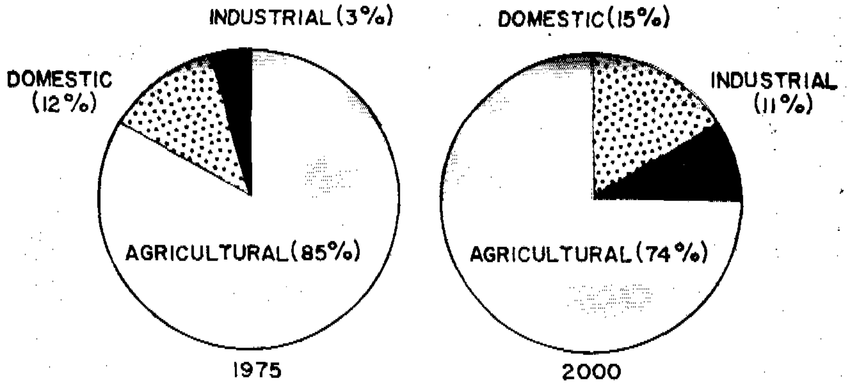


Figure 18. Sectoral Percentage of Total Water Demand
Source: NWRC, 1980

2. PROBLEMS AND ISSUES

2.1 Increasing Siltation and Pollution of Surface Waters

Pollution has become an issue of increasing concern for the country's inland waters as far back as the late sixties. Given the rapid increase in the nation's population and increased economic activities, however, it is hardly surprising that pollution is a growing problem. Sewage, sediments, pesticides, heavy metals and toxic chemicals account primarily for the pollution of the country's waters.

Rivers

Out of the country's 421 rivers, a very small number (112 in 1978 and no significant increase in this during the past decade) have been classified according to their best usage and not regularly monitored as to water quality. But from what limited data had been gathered from these monitoring activities, there is no doubt that they have rapidly deteriorated.

a) Metro Manila

Water pollution in Metro Manila and the country's other major urban centers has been estimated as early as 1971, to come mainly from domestic sources (70%) and only secondarily from industry (30%).[60] This is primarily due to the fact that the wastes generated by the general public are simply either allowed to flow or discharged into the various river systems. Only 13% of the Metro Manila's populace is currently served by a sewerage system.[61] The rest are dependent on improperly maintained septic tanks.

Although no recent studies were conducted concerning this situation, domestic sources contribution has probably increased due to rapid population growth in the Metropolis while industrial contribution decreased due to dispersal of industries to outlying areas like Batangas, Bataan and others.

The water pollution problem is aggravated by wastewater from industries. An assortment of chemical factories, paper mills, tanneries, alcohol distilleries, food manufacturing plants and other industries are located in Metro Manila. As of 1989, the DENR-NCR reportedly regulated 1195 of these industries while 986 were under the Laguna Lake Development Authority.[62] Majority of them discharge either untreated or partially treated wastewater into the Metropolis' different river systems. As a result, four major river systems - the Pasig, Tullahan-Tenejeros, San Juan and Paranaque - Zapote rivers have become biologically dead. It is interesting to note that the former National Pollution Control Commission classified four of these as Class C waters (capable of sustaining aquatic life) in 1978 and one (upper Marikina River) as Class A or good as source of water supply requiring complete treatment.

All five rivers discharge into the Manila Bay and now have mean concentration of dissolved oxygen (DO) well below the DENR criteria for Class C rivers (ranging from 0.07-4.5 mg/li.). The biochemical oxygen demand (BOD) of these rivers have also become quite high, rendering them fit for nothing else but navigation. The DO and BOD levels for these rivers for the period 1980 - 1989 are depicted in **Figures 19 to 23** and **Figures 19A to 23A**. The rivers are also contaminated by heavy metals and pesticides. Concentration of some heavy metals (copper and mercury) in the Marikina, Pasig and Paranaque rivers exceeded standards for Class C waters in 1985 (**Tables 46 to 49**). Results of pesticides monitoring of Metro Manila rivers over a five-year period (1981-1985) are presented in **Tables 50 to 53.** Class C waters are fit only for propagation of fish and other aquatic resources.

The pollution of Metro Manila's rivers come from a variety of sources. An estimated 55% of the total organic load of the Pasig River, for instance, come from domestic sewage and garbage.[63] Municipal sources of pollution include public markets and slaughter houses. In addition to the pollution from industries, oil spills from more than 300 gasoline stations, oil depots and barges, tankers and boats aggravate the situation in the 58 sq. km. Pasig River basin. Agriculture contributes pesticides, causing acute and chronic health problems, as well as, environmental risks.

As per observations, all five Metro Manila rivers cannot empty all their pollution load into the Manila Bay except during low tides.

b) **Outside Metro Manila**

As early as 1971, various riverine systems in other parts of Luzon, the Visayas and Mindanao have likewise been considered polluted in varying degrees. For example, the Angat, Apo and Bicti Rivers have shown signs of pollution even at that time. Their waters have become turbid, containing large amounts of suspended solids. Also observed to have rapidly deteriorated are the qualities of several Bulacan rivers (Balagtas, Marilao and Meycauyan), the Pampanga River, the Palico River in Batangas, Jala-ur and Ulian Rivers in Iloilo, Minulan, Lupit, Salamanca and Ponte-vedra Rivers in Negros Occidental and Panamangan River in Negros Oriental.

Figure 19. Dissolved Oxygen Content of Marikina River*
(milligrams per liter)

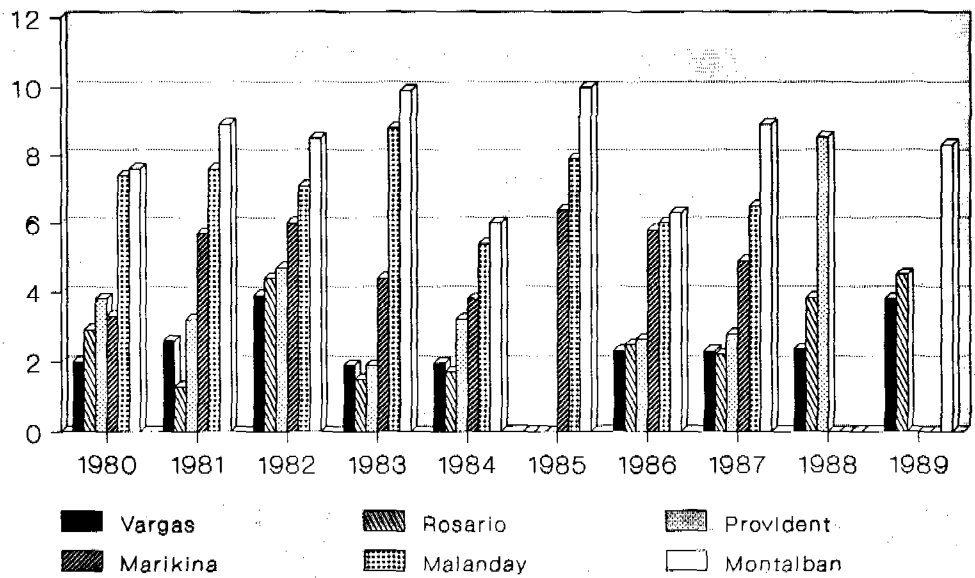
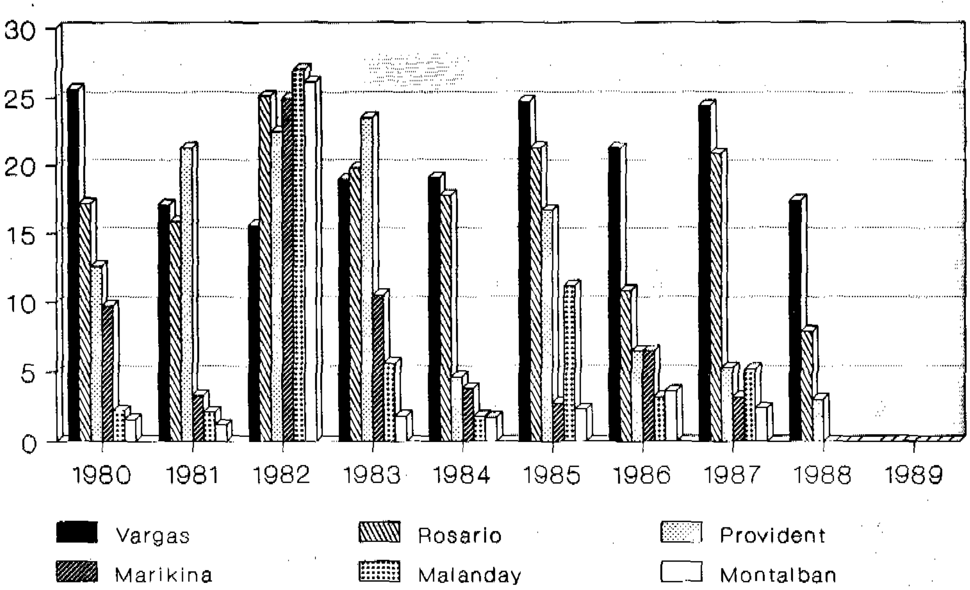


Figure 19-A. Biochemical Oxygen Demand of Marikina River*
(milligrams per liter)



* Annual Mean Concentration

Figure 20. Dissolved Oxygen Content of Pasig River*
(milligrams per liter)

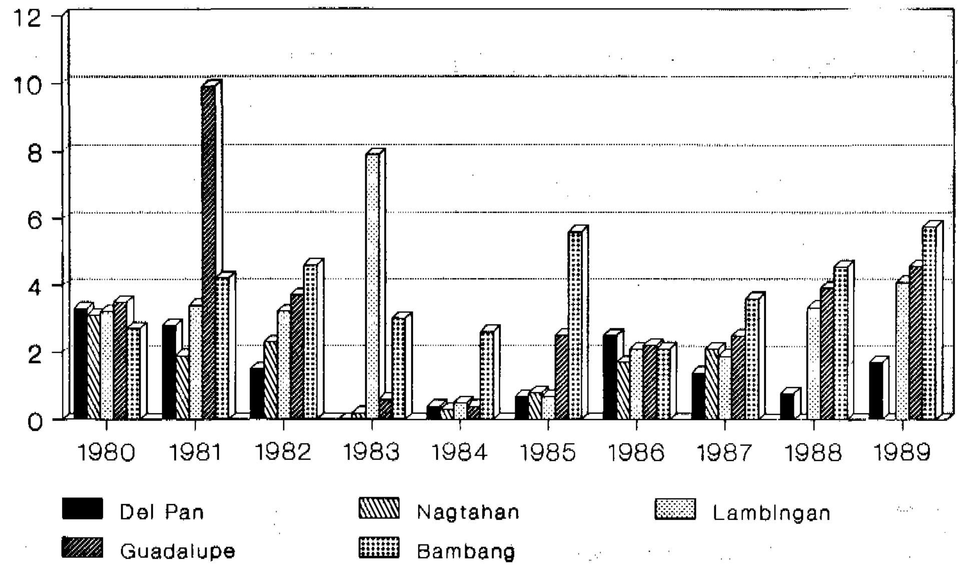


Figure 20-A. Biochemical Oxygen Demand of Pasig River*
(milligrams per liter)

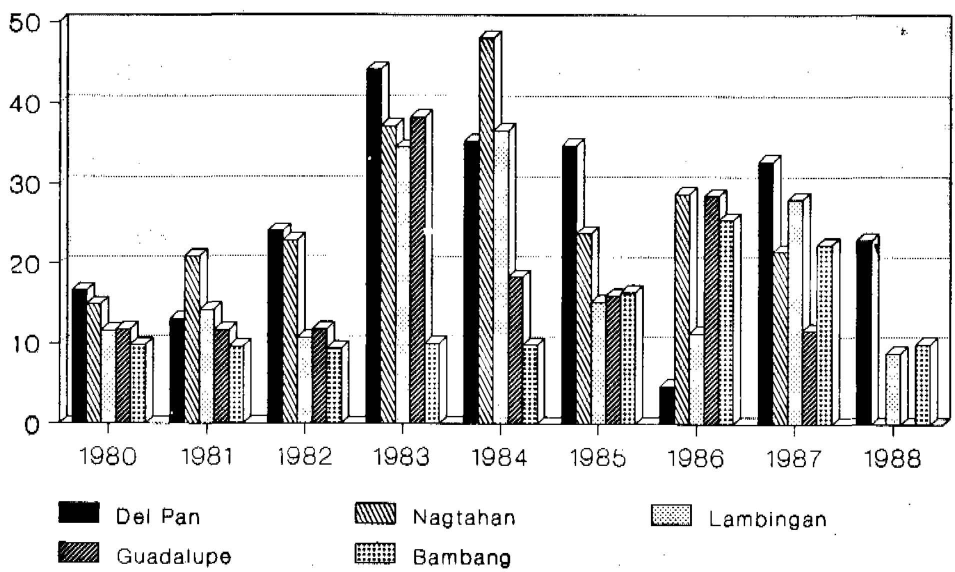


Figure 21. Dissolved Oxygen of Parañaque-Zapote River*
(milligrams per liter)

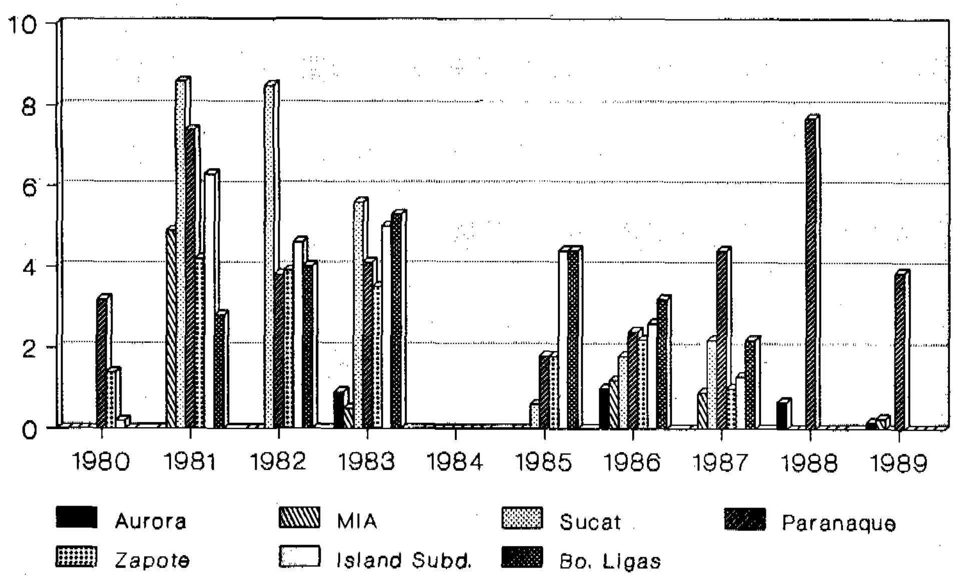


Figure 21-A. Biochemical Oxygen Demand of Parañaque-Zapote River*
(milligrams per liter)

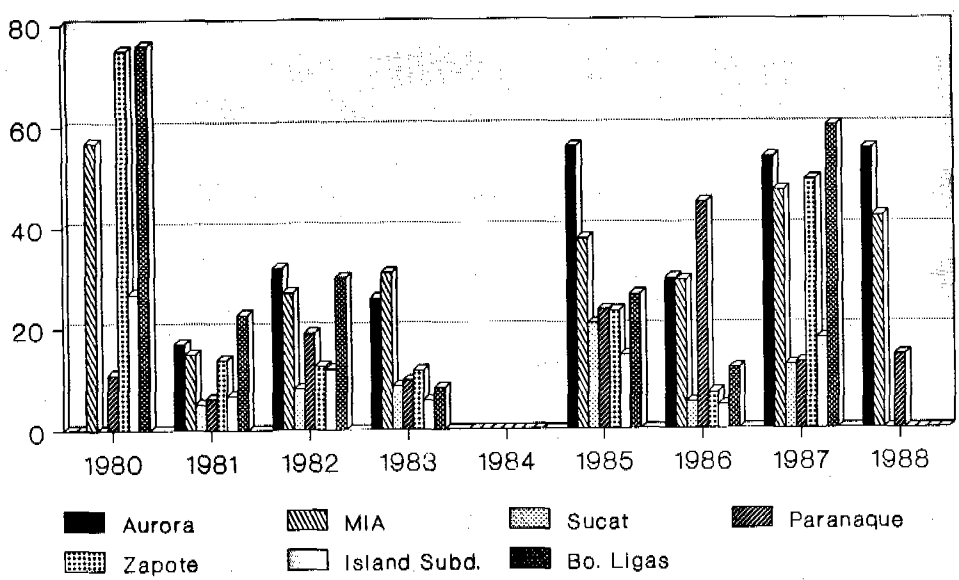


Figure 22. Dissolved Oxygen Content of Tullahan, Tenejeros River*
(milligrams per liter)

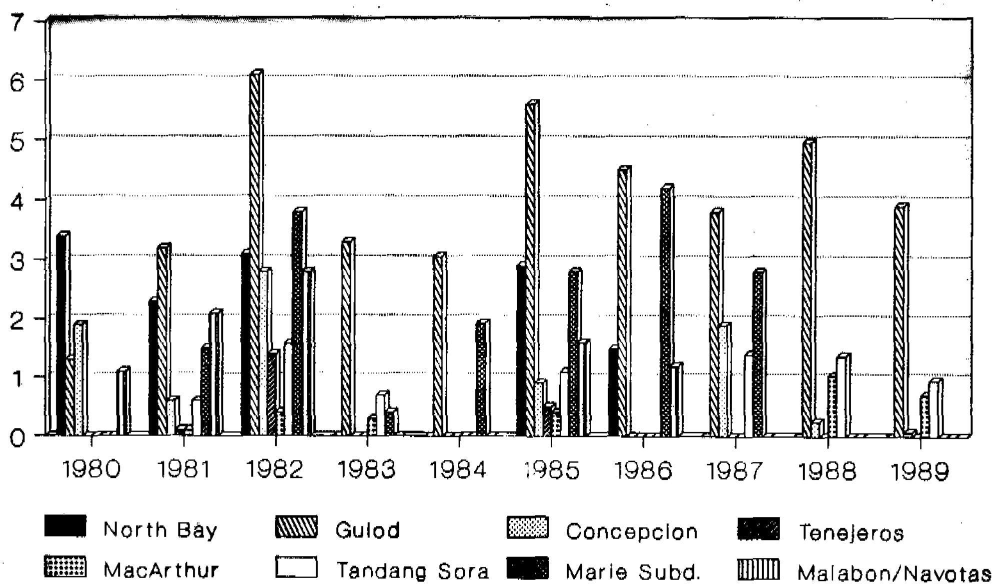


Figure 22-A. Biochemical Oxygen Demand of Tullahan, Tenejeros River*
(milligrams per liter)

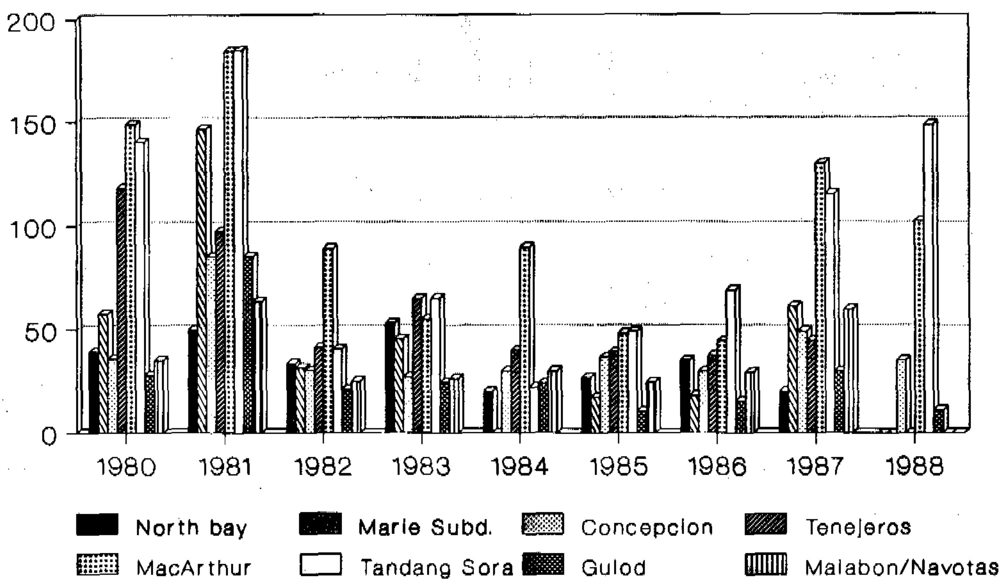


Figure 23. Dissolved Oxygen Content of San Juan River*
(milligrams per liter)

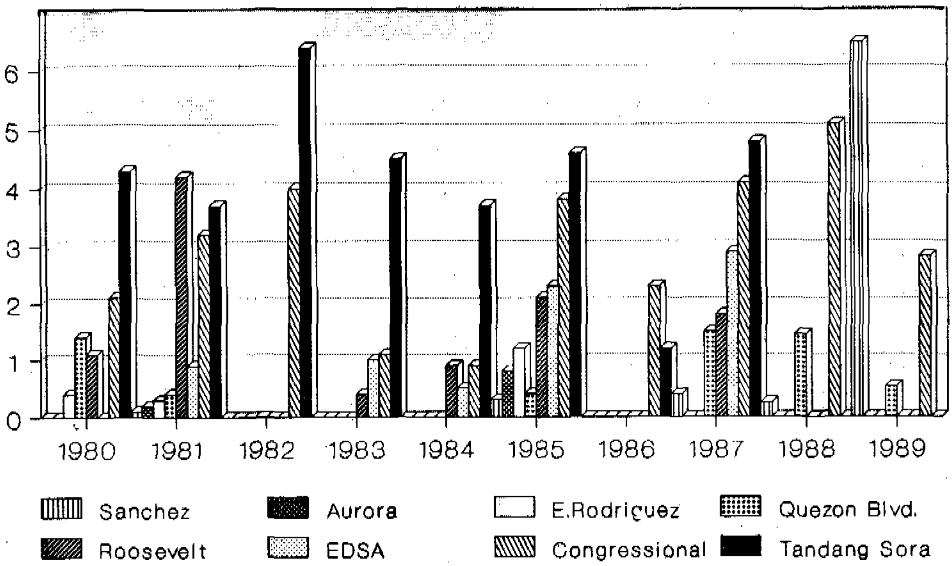


Figure 23-A. Biochemical Oxygen Demand of San Juan River*
(milligrams per liter)

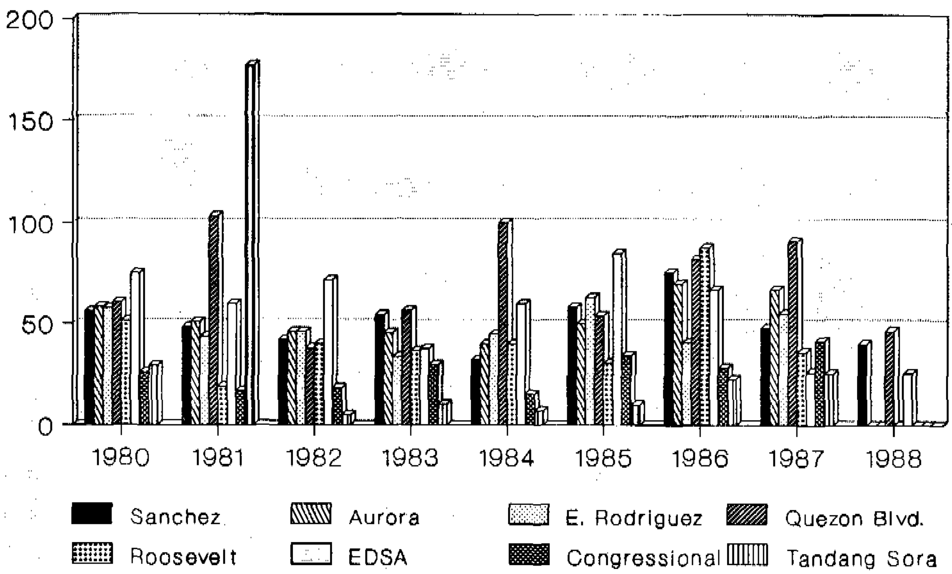


Table 46. Concentration of Heavy Metals in the Pasig-Marikina River, 1980-1985 (parts per million)*

Heavy Metal	1980	1981	1982	1983	1984	1985
Mercury	bdc**-1.2	-	bdc-0.8	bdc-0.25	bdc	0.05-0.6
Copper	bdc - 0.14	0.01-0.85	bdc-0.08	bdc-1.42	bdc-1.63	bdc-0.04
Cadmium	bdc - 0.06	bdc-0.02	bdc-0.06	bdc-0.06	bdc	bdc
Zinc	bdc - 4.0	-	bdc-0.78	bdc-0.88	bdc-0.48	bdc-0.14
Lead	bdc - 0.22	-	-	-		

Source: NPCC Annual Reports, Various Years.

Notes:

* except mercury which is in ppb.

** below detectable concentration.

Table 47. Concentration of Heavy Metals in the Paranaque-Zapote River, 1980-1985 (parts per million)*

Heavy Metal	1980	1981	1982	1983	1984	1985
Mercury	bdc**- 0.2	-	bdc - 0.9	bdc - 0.2	-	-
Copper	bdc - 0.2	bdc - 0.06	0.01 - 0.1	bdc - 0.55	-	bdc - 0.06
Cadmium	bdc - 0.08	bdc - 0.02	bdc - 0.08	bdc - 0.07	-	bdc
Zinc	bdc - 2.84	-	0.02 - 0.48	-	-	
Lead	bdc - 0.27	-	-	bdc - 2.92	-	

Source: NPCC Annual Reports, Various Years.

Notes : * - except mercury which is in ppb

** - below detectable concentration

Table 48. Concentration Of Heavy Metals in the San Juan River, 1980-1985
(parts per million)*

Heavy Metal	1980	1981	1982	1983	1984	1985
Mercury	-	-	bdc**- 0.65	bdc - 0.3	bdc - 0.72	-
Copper	-	bdc - .44	bdc - 0.09	bdc - 1.38	bdc - 0.02	-
Cadmium	-	bdc	bdc - 0.01	bdc - 0.04	bdc	-
Zinc	bdc - 2.84	-	0.02 - 0.48	bdc - 2.92	-	0.12 - 0.4
Lead	bdc - 0.4	-	-	-	-	-

Source: NPCC Annual Reports, Various Years.

Notes:

* - except mercury which is in ppb.

**- below detectable concentration.

Table 49. Concentration of Heavy Metals in the Tullahan-Tenejeros River, 1980-1984
(parts per million)*

Heavy Metal	1980	1981	1982	1983	1984
Mercury	bdc - 0.6	-	bdc - 0.04	bdc - 0.32	bdc - 0.23
Copper	bdc - 1.3	bdc - 0.14	0.02 - 0.08	bdc - 1.48	bdc - 0.12
Cadmium	bdc - 0.08	bdc - 0.14	bdc - 0.03	bdc - 0.06	bdc - 0.05
Zinc	bdc - 1.3	-	0.01 - 0.22	0.02 - 2.31	bdc - 0.19
Lead	bdc - 0.4	-	-	-	-

Source: NPCC Annual Reports, Various Years.

Notes:

* - except mercury which is in ppb.

** - below detectable concentration.

Table 50. Concentration of Pesticides in the Pasig-Marikina River, 1980-1984
(milligrams/liter)

Pesticides	1980	1981	1982	1983	1984
Alpha BHC	0.004 - 0.009	0.021 - .093	nil - 0.022	0 - 0.024	0.012 - 0.026
Gamma BHC	0.012 - 0.015	-	nil - 0.024	nil - 0.02	0.013 - 0.024
Heptachlor Epoxide	0.003 - 0.006	-	-	nil - 0.001	trace - 0.026
Aldrin	0.01	-	nil - 0.027	0 - 0.009	trace - 0.014
Dieldren	trace	-	trace	0 - 0.012	-

Source: NPCC Annual Reports, Various Years.

Table 51. Concentration of Pesticides in the Paranaque-Zapote River, 1980-1984
(milligrams/liter)

Pesticides	1980	1981	1982	1983	1984
Alpha BHC	0.003	-	nil-0.016	0-0.032	nil-0.028
Gamma BHC	0.008	-	nil-0.013	0-0.021	0.014-0.024
Heptachlor Epoxide	-	-	-	-	0.006-0.012
Aldrin	-	-	nil-0.01	0-0.02	trace-0.012
Dieldren	trace	-	nil-0.005	0-0.001	trace-0.012

Source: NPCC Annual Reports, Various Years.

Table 52. Concentration of Pesticides in the San Juan River, 1980-1984
(milligrams per liter)

Pesticides	1980	1981	1982	1983	1984
Alpha BHC	-	0.021-0.043	nil-.02	0 - .02	.012-.026
Gamma BHC	-	-	nil-.018	0 - .02	.016-.022
Heptachlor Epoxide	-	-	-	0 - .009	trace-.014
Aldrin	-	-	nil-.012	0 - .009	.00-.012
Dieldren	-	-	-	0 - .006	-

Source: NPCC Annual Reports, Various Years.

Table 53. Concentration of Pesticides in the Tenejeros-
Tullahan River, 1980 - 1983
(milligrams per liter)

Pesticides	1980	1981	1982	1983
Alpha BHC	.007	-	nil - .2	0 - .019
Gamma BHC	.017	-	nil - .018	0 - .012
Heptachlor Epoxide	trace	-	-	-
Aldrin	trace	-	*nil - .1*	-
Dieldren	-	-	-	-

Source: NPCC Annual Reports, Various Years.

The Pampanga River, which has multiple beneficial uses, is currently threatened by pollution from point and non-point sources. Its dissolved oxygen content is at saturation levels from 6.5 to 7.2 milligrams per liter.[64] BOD is still within the criteria set for all beneficial uses, except for a reach of 5 kilometers in Apalit, which receives industrial discharges.

River systems (Agno, Bued, Amburayan) in the Baguio mining district have also been experiencing pollution problems even way back in the seventies. Siltation due to mine tailings of companies in the area have significantly reduced the water conveyance capacity of these rivers, resulting in reduced crop yield and other losses. The Sipalay River in Negros Occidental, Lawis River in Masinloc, Zambales and Taft River in Samar are experiencing the same problems.

Heavy metal pollution in the above river systems have posed health threats for almost two decades now. Sediments from the Agno River have been found to contain copper ranging from 155 to 1,968 mg/kg. Effluents of mining companies which contain zinc, arsenic and nickel have found their way into the surrounding waterways. Lead content of the Patalan, Dagupan and Agno Rivers ranged from 1.0 mg/li to 5.4 mg/li, exceeding the set standard for Class C waters of .05 mg/li. Cadmium concentrations too (.01 - 041 mg/li) exceeded the acceptable standard of 0.01 mg/li. **Table 54** gives results of the heavy metals monitoring of said rivers at various months of the year 1987. Monitoring of various rivers such as the Hijo and Liboganon in Tagum, Davao del Norte, yielded mercury levels higher than the set standard of 0.002 mg/li. Monitoring results for the period 1987 to 1988 are given in **Table 55**. Such high mercury concentrations in various water bodies in several provinces in Mindanao (**Table 56**) are attributed to the rampant use of mercury for recovering gold from the ores.

Other rivers, like the Cagayan de Oro River, although able to maintain parameters like DO, BOD, TSS, etc. within standards set for Class A waters, has exhibited increasing septicity, as evidenced by increasing total coliform count (**Table 57**). Various rivers in the province of Cebu such as the Mananga, Cotcot, Canamucan and Sapang Daku also registered high coliform counts (ranging from 5,000 to 170,000 MPN/100 ml.).

In the Visayas region, sugar mills and alcohol distilleries were among the main culprits causing the deterioration of rivers. They have been responsible for the generation of large amounts of organic wastewaters primarily containing molasses, cane juice and malt.

As in Metro Manila, pesticides from agriculture have found their way into these water sources and occur in significant concentrations in fish samples from these water bodies.

Lakes

The water quality of the country's 58 lakes, except Laguna de Bay, have not been monitored on a regular basis for the past decade. Nor have schemes for their utilization and management been drawn up. The numerous problems such as pollution and eutrophication, which have surfaced with alarming frequency and intensity,

Table 54. Concentration of Heavy Metals in Various Rivers of Region II, 1987
(milligrams/liter)

Heavy Metals	Patalan River			Dagupan River			Agno River		
	a	b	c	a	b	c	a	b	c
April 1987									
Zn				0.068	0.010	0.010	0.081	0.097	0.081
Pb				4.680	1.000	1.000	5.400	5.640	5.400
Cd				0.032	0.031	0.014	0.041	0.041	0.049
July 1987									
Zn	0.039	0.010	0.010	0.092	0.010	0.010	0.092	0.130	
Pb	6.580	1.770	2.080	5.400	2.710	1.000	4.920	4.920	
Cd	0.024	0.052	0.039	0.010	0.040	0.010	0.032	0.049	
October 1987									
Zn	0.105	0.010	0.039	0.064	0.080	0.126			
Pb	5.880	3.480	1.000	4.920	3.970	4.680			
Cd	0.041	0.010	0.010	0.032	0.010	0.091			

Source: DENR-EMS Region II

Legend: a - Offshore

b - Mouth

c - Upstream

Table 55. Mercury Levels in Sediment Samples from Various Water Bodies in Tagum, Davao del Norte: December, 1987 - March, 1988 (ppm)

Sampling Station	Location	Range
1	Confluence of Tagum River and Davao Gulf	0.006 - 0.026
2	Confluence of Madaum Creek and Davao Gulf	0.006 - 0.075
3	Confluence of Hijo River and Davao Gulf	0.89 - 4.651

Source: DENR-EMS, Region XI

Table 56. Mercury Levels in Various Rivers in Mindanao, 1987-1989 (ppb)

Sampling Stations	1987	1988	1989
Agusan del Sur			
Agusan River			
Sta. Josefa	.04 - .08	0.24	1.01
Veruela	.01 - .06	0.205	0.22
Talacogon	nil	0.07	nil
Esperanza	nil	0.09	0.275
Solibao River	0.12	0.095	0.275
Limbatongon Creek	nil	0.14	0.205
Baubo Creek	nil	0.09	0.18
Bin-aran Creek	nil	0.01	0.08
Burawan Creek	nil	0.225	0.12
Sumilao Creek	0.1	nil	-
Wawa River	nil	0.045	0.62
Surigao del Norte			
Alipao Creek	0.2	0.005	nil
Maagad Creek	0.09	0.73	1.12

Source: DENR-EMS, Region X

Table 57. Annual Mean(s) of Various Water Quality Parameters of Cagayan River, 1987-1989

Parameter	1987	1988	1989
Temperature (C)	25.98	25.35	25.0
Dissolved Oxygen (mg/li)	7.77	8.13	8.22
BOD (mg/li)	0.92	0.84	0.61
Total Coliform (MPN/100 ml)	7,654	6,589	13,457
Total Alkalinity (mg/li)	65.75	63.46	53.64
Chlorides (mg/li)	6.4	14.92	5.45
COD (mg/li)	18.94	10.67	-
Total Suspended Solids (mg/li)	40.61	48.67	44.67

Source: DENR-EMS, Region X.

underscore the need for continuously monitoring the status of the country's lakes, as basis for their management.

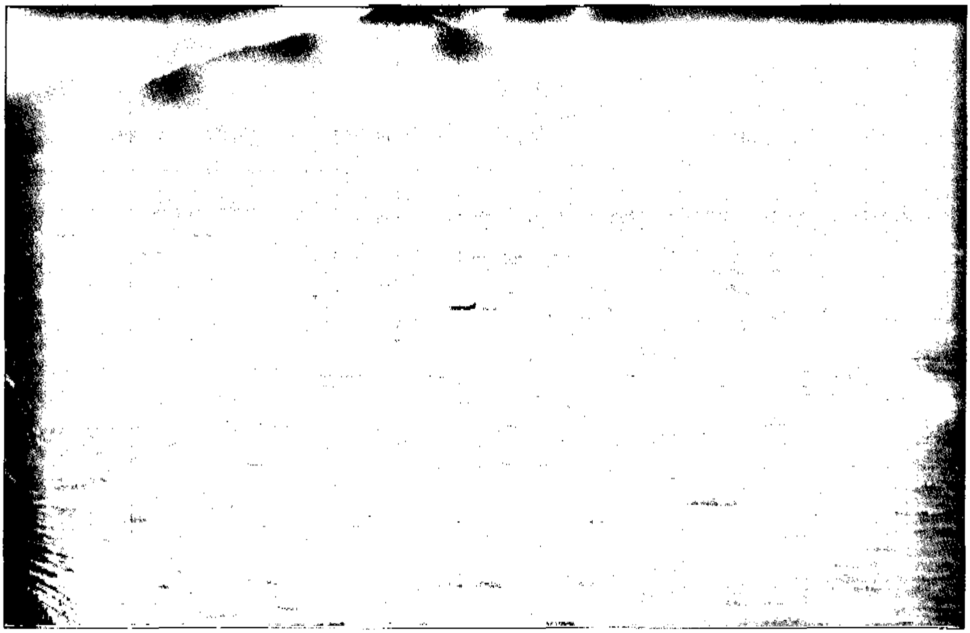
Laguna de Bay

The 90,000-hectare lake has long been subject to ecological stresses. Approximately 986 factories generate effluents which ultimately drain into the lake. A certain amount of fertilizers and pesticides from agricultural activities in the surrounding areas also find their way into the Laguna de Bay, as well as, garbage and domestic sewage. Siltation from the surrounding deforested areas and eroded banks of its river tributaries has resulted in a shallower Laguna de Bay. Lake depth has been reduced from 7 meters to 2.8 meters.[65] It has likewise been the object of numerous social and political conflicts. In 1986, approximately 15,000 fishermen and 1,300 fishpen operators were reported to be in direct confrontation over the use of the lake.

In 1978, it was reported to be in semi-eutrophic condition, although classified then as a Class C body of water (suitable for propagation of fish and other aquatic resources). Actual uses then and now, however, also include irrigation, industrial cooling, power generation and navigation (indicating an actual range of Class C to Class E). With the advent of the eighties, the lake was already considered hyper-eutrophic. Diatoms and green algae populations have been estimated at 20,000 - 30,000 cells per milliliter during the period January to March.[66] From May to August, blue green algae predominates often reading 100,000 cells per ml.

Important water quality parameters for each of the lake's uses (**Table 58**) have been established and were monitored regularly over the past ten years. A water quality index (Sn) is used to consolidate monthly observations in pH, DO, total coliforms, phosphate, nitrate, turbidity, temperature and TDS. High index values are indicative of high pollution.

Oil spills from tankers and oil depots have likewise aggravated the water pollution problem, such as that of the Pasig River.



The 90,000 hectare Laguna de Bay has long been subject to ecological stresses. Numerous problems such as pollution and eutrophication, which have surfaced with alarming frequency and intensity, underscore the need for the continuous monitoring and management.

Table 58 . Important Parameters for the Laguna de Bay's Water Uses

Water Use	Parameter
Fishing	Dissolved oxygen, pH
Irrigation	Dissolved solids
Industrial Water Supply	pH, Dissolved oxygen
Navigation	pH

Source: Laguna Lake Development Authority, 1989.

Monitoring trends for each of the parameters are presented in **Figures 24** to 30. Daytime dissolved oxygen values were found to be either equal or greater than 5 mg/li, the ambient standard for Class C waters. For dissolved solids (TDS), which is the quality parameter for irrigation (Class D), the standard of 1000 mg/li was exceeded fourteen times in the three stations (West Bay, East Bay and Central Bay) for the same period. pH values over a ten year period (1979-1988) were in the range of 6.5 - 9.0. High phosphate values were observed regularly during the last quarter of each year. The lake exhibited peak turbidity during the months of December and January. For total coliforms, the Class C standard of 5000 MPN/100 ml. was exceeded 10 percent of the time in all stations for the period covered. Over-all, pollution in the lake usually becomes more prominent when the year is ending, as evidenced by higher index values.**(Figure 31)**

Such condition has been claimed to aggravate or increase occurrences of fish diseases such as "kitong or korikong" which affects freshwater fishes like hito, dalag, kanduli and tilapia. The disease is characterized by the formation of lesions on the different parts of the fish's body. The primary causative organism has been identified as Aeromonas hydrophila and the phenomenon naturally occurs in polluted waters and fishponds. It is triggered by relatively low temperature (10° C below normal temperature). Occurrences in the Laguna de Bay have been recorded in the 1980s, particularly during the El Nino years and when water level was low (1982 - 1983; 1986 - 1987).

Lake Buhi

Lake Buhi is a freshwater lake in Camarines Sur comprising a total area of approximately 1,800 hectares and having an average depth of 7.3 meters. It is home to one of the country's endangered fish species - the Mistichthys luzonensis or more commonly known as the Sinarapan, a little larger than the Pandaka pygmea (smallest fish in the world) with an average length of 12.5 millimeters. Like the Laguna de Bay, Lake Buhi has recently become vulnerable to a host of problems, undermining its many existing and potential uses such as fishing, irrigation, power generation and recreation, among others.

Factors which cause disturbances to the system include sulfur water inflows, domestic sewage, proliferation and decay of water hyacinth, siltation and agricultural chemicals.[67] Severe siltation occurs in its eastern side due to the great number of creeks and rivers emptying into it. Agricultural activities, primarily rice production, also contribute to the degradation of water quality due to the pollution generated by fertilizer and pesticides application. The lake's southern part, which is highly urbanized, contributes to the pollution load through domestic sewage. Thiodan and tuble fishing in its northeastern side also severely affects the lake's system. In addition, sulfur water from a spring connected to the Iraya river system, flows into the lake, greatly affecting fisheries. Due to these various complicating factors, the Sinarapan population has been reported to be on the decline since 1979 and even on the verge of extinction.

The lake has never been officially classified, thus, it is difficult to determine levels of parameters characterizing lake quality. Recent monitoring conducted at seven sampling points (Marayang, Sapa, Iraya, Malait, Ibayugan, Ibayugan-Iraya boundary and Marayang-market site boundary) tended to show, however, that the lake barely meets water quality criteria for Class E (for navigational use) waters, based on its dissolved oxygen content. Data gathered revealed that its dissolved oxygen content range from 0.88 to 2.52 ppm. Values of other parameters are given in **Table 59.**

Lakes Sebu, Lahit and Silutan

Three lakes within the municipality of Lake Sebu, South Cotabato, have gained increasing attention due to their strategic significance in the development of communities in the area, particularly the T'boli tribes which comprise 60% of the current population. The largest is Lake Sebu, with a water area of 360 hectares, followed by Lake Silutan at 80 hectares. The smallest is Lake Lahit, with an area of 24 hectares. All are shallow, averaging 3 meters in depth.[68]

A 1982 study conducted by the BFAR revealed the relative absence of pollution in the lakes. A strong influx of settlers and high population growth towards 1984, however, have generated problems, predominantly siltation. For Lake Silutan, particularly, siltation has already reached an advanced stage. Deforestation, agriculture and mining activities have been primarily responsible for the occurrence of siltation.

Table 59. Water Quality Parameters for Lake Buhi, July-October 1989

Station	Temp. (C)	pH	Dissolved Oxygen (ppm)	Total Phosphorous (ppm)	Total Suspended Solids (ppm)
1 Marayang	28.75	6.64	0.88	0.34	19.32
2 Sapa	28.92	6.85	2.25	0.22	18.15
3 Iraya	30.42	6.72	1.88	0.32	16.7
4 Malait	31.25	6.94	1.4	0.35	13.88
5 Ibayugan	32.42	6.58	1.78	0.43	18.25
6 Ibayugan-Iraya boundary	30.62	8.0	2.52	0.30	16.3
7 Marayang-Market site boundary	31.15	8.08	2.15	0.2	15.22

Source: DENR-EMS, Region V.

2.2 Salinization of Groundwater Resources

Saline water intrusion of ground water resources is affecting some areas in the Philippines. In the early seventies, the Bureau of Mines' chemical analysis of well water samples from various areas throughout Metro Manila showed that groundwater quality was already generally saline. In 1984, the National Environmental Protection Council's Saline Water Intrusion Study also revealed increasing groundwater salinity intrusion in various areas of the country. Approximately 480,802 hectares were reportedly affected (excluding Metro Manila), with Cagayan, Bulacan and Cebu as the most heavily affected provinces. Affected areas in Metro Manila total 19,611 hectares.

Significant increases in the salinity of wells in the coastal areas of Metro Manila, averaging 4 km. from the bay, have been detected (**Figure 32**). Advances and retreats of the saline front have been recorded in Metro Cebu. Its aquifers have been found to be less capable of preventing seawater intrusion than those of Metro Manila. Bulacan's southeast portion has also been established to be susceptible to saline intrusion, primarily induced by the adjacent aquifer depressions of Metro Manila. Hydrochemical data of Metro Manila and Bulacan indicated an increase in TDS values from 200-250 mg/li in the 1960s to 1000-2000 mg/li in 1984[69] and chloride content from 50 mg/li to 400-500 mg/li. The underlying shallow aquifers of the coastal areas of Capiz are saline because of the seawater fishponds. Roxas City water supply is affected by tidal salinity during low river flows from the Panay River.

Saline water intrusion has affected domestic water supplies, public utilities, agriculture and industry. The economic impact of salinity on domestic water supplies is in the form of the need for alternative potable sources such as a public piped water supply. For public water utilities, economic impacts are in the form of lost revenue and replacement costs for wells. In agriculture, economic losses due to saltwater intrusion have been cited. An example is Bulacan which experiences a P10,731,649.25 per year economic loss in this sector due to this phenomenon.[70]

3. MANAGEMENT EFFORTS

Water quality management efforts for the country's inland waters have been concentrated in its premier Metropolis - Metro Manila and immediate environs because of the rapid degradation of waterways in these areas due to burgeoning population and industrial activities. Despite these efforts, the condition of Metro Manila rivers continue to deteriorate, primarily because the Metropolis' growth is outpacing clean-up efforts. Meanwhile, the country's other surface waters and groundwaters are also being degraded for lack of proper management.

3.1 Regulatory Efforts

Industrial Pollution Control

The start of the eighties still saw the former National Pollution Control Commission (NPCC) at the forefront of the battle against water pollution. Together with such agencies as the Laguna Lake Development Authority (LLDA), which was and still is primarily responsible for the regulation and control of pollution in the

Laguna Lake region, the Philippine Coast Guard, which takes charge of protecting Philippine seas from pollution caused by oil spills, dumping of organic wastes and other toxic materials, and the Department of Health, among others, the NPCC strove to arrest the pollution of our waters through various activities which included strict enforcement of pollution control laws, research on pollution control schemes and intensive information and educational campaigns. The National Environmental Protection Council, too, contributed to the pollution prevention efforts through its Environmental Impact Statement (EIS) System and various researches which included the Bliss Wastewater Treatment Study and Saltwater Intrusion Study.

From 1987 onwards, the various duties and functions of the NPCC were taken over by the Pollution Adjudication Board (PAB) within the DENR, the Environmental Management Sector of the Department's Regional Offices and the Environmental Management Bureau. The PAB is composed of the DENR Secretary as Chairman, two (2) DENR Undersecretaries, the Director of the Environmental Management Bureau and three (3) other members designated by the Secretary. It assumed the powers and functions of the Commission/Commissioners of the defunct NPCC with respect to the adjudication of the pollution cases under Republic Act No. 3931 and P.D. 984.

Despite increased efforts at making industries comply with pollution control requirements, there was an erratic compliance trend with respect to the installation of pollution control facilities. Compliance are categorized into: a) full compliance - firms with pollution control equipment also possess permits to operate; and, b) partial compliance - firms possess pollution control equipment but without permits to operate. Surveys which aimed to determine the existence and efficiency of pollution control equipment revealed an increasing compliance trend from 1980 to 1984 and slightly decreasing and levelling off from 1985 onwards. Full compliance drastically dropped after 1984. **Table 60** provides the percentage compliance of water pollutive firms for the period 1980 to 1988. Monitoring activities were at a lull after 1985, accounting for the lack or absence of updated data on the state of the country's inland water resources.

Revision of Standards

In view of the country's level of development, state of water pollution control technology and present environmental conditions, environmental standards, particularly for receiving water quality and effluents, have been considered stringent in many instances, particularly by industry. This catalyzed the review and eventual revision of the standards. The DENR, through the Environmental Management Bureau and with the assistance of an inter-agency Technical Committee, started to revise the standards in 1988. Revision has been completed and the new standards issued by the DENR Secretary (DENR Administrative Order Nos. 34 and 35). The standards took effect thirty days after publication (March 17, 1990) in the Official Gazette and newspapers of general circulation.

Among the major amendments are the following:

1. Water Quality Criteria (Section 68 - 69, Chapter III of the Rules and Regulations)

   1.1 Water quality criteria and classification for groundwater have been omitted inasmuch as such have never been used or invoked since 1967.

   1.2 The new classifications took into consideration other beneficial uses such as tourist zones, national marine parks and reserves, coral reef parks and reserves and spawning areas for commercial fish species.

   1.3 A set of new procedural requirements for the classification of water bodies has been added.

   1.4 A provision on applicable method(s) of analysis for each parameter and a guide for significant pollutants to be monitored for certain types of industries was incorporated.

   1.5 The number of water pollution parameters was reduced from 50 to 24.

2. Effluent Standards (Section 4-6 of the Effluent Regulations of 1982)

   2.1 Existing effluent standards were made more flexible by introducing separate limits for each of the four classifications in fresh and marine waters.

   2.2 New parameters like COD and settleable solids, were added.

   2.3 For a period of time, not to exceed ten (10) years, existing industries will be required to comply with less stringent interim standards than new industries.

   2.4 Less stringent standards will be applied to industries with very strong wastes (greater than 5,000 mg/li. BOD) for a period of four years, during which time they are required to conduct studies to improve their existing methods of treatment and to enable them to make plans for meeting standards in the long term.

   2.5 Dischargers who cannot comply with the interim effluents standards will be required to obtain temporary permits to operate provided they pay a penalty fee.

Tables 61 to 63 summarize the required BOD concentrations for the concerned classes of industry at certain periods after the revised standards take effect.

Regulation of Water Use

To achieve optimum utilization of the country's surface and groundwaters, the National Water Resources Board "was tasked to regulate water use through: a) Issuance of water permits; b) Settlement of water use controversies; c) Issuance of

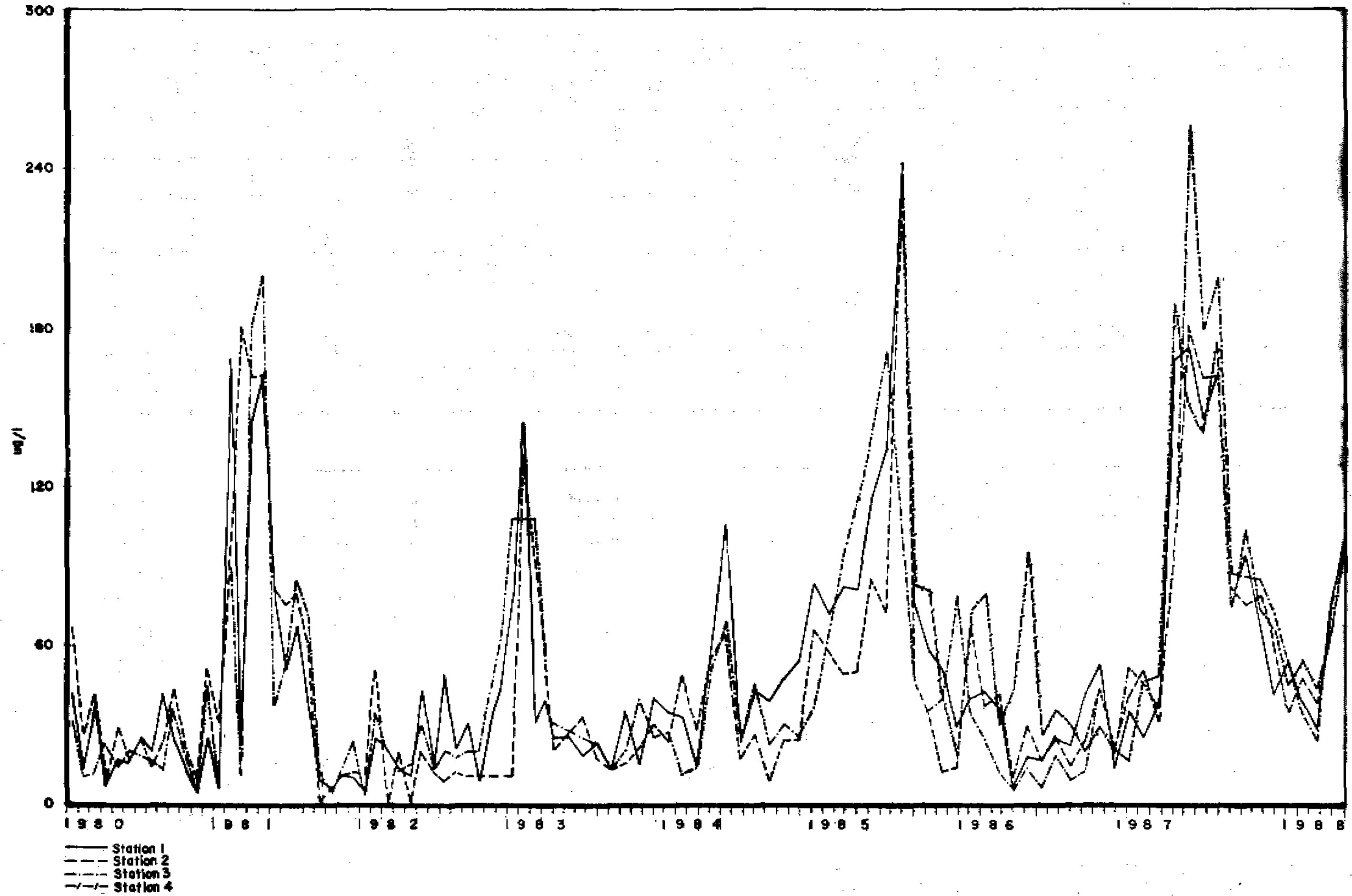


Figure 24. Phosphate Concentration of the Laguna de Bay, 1980-1988
Source: LLDA

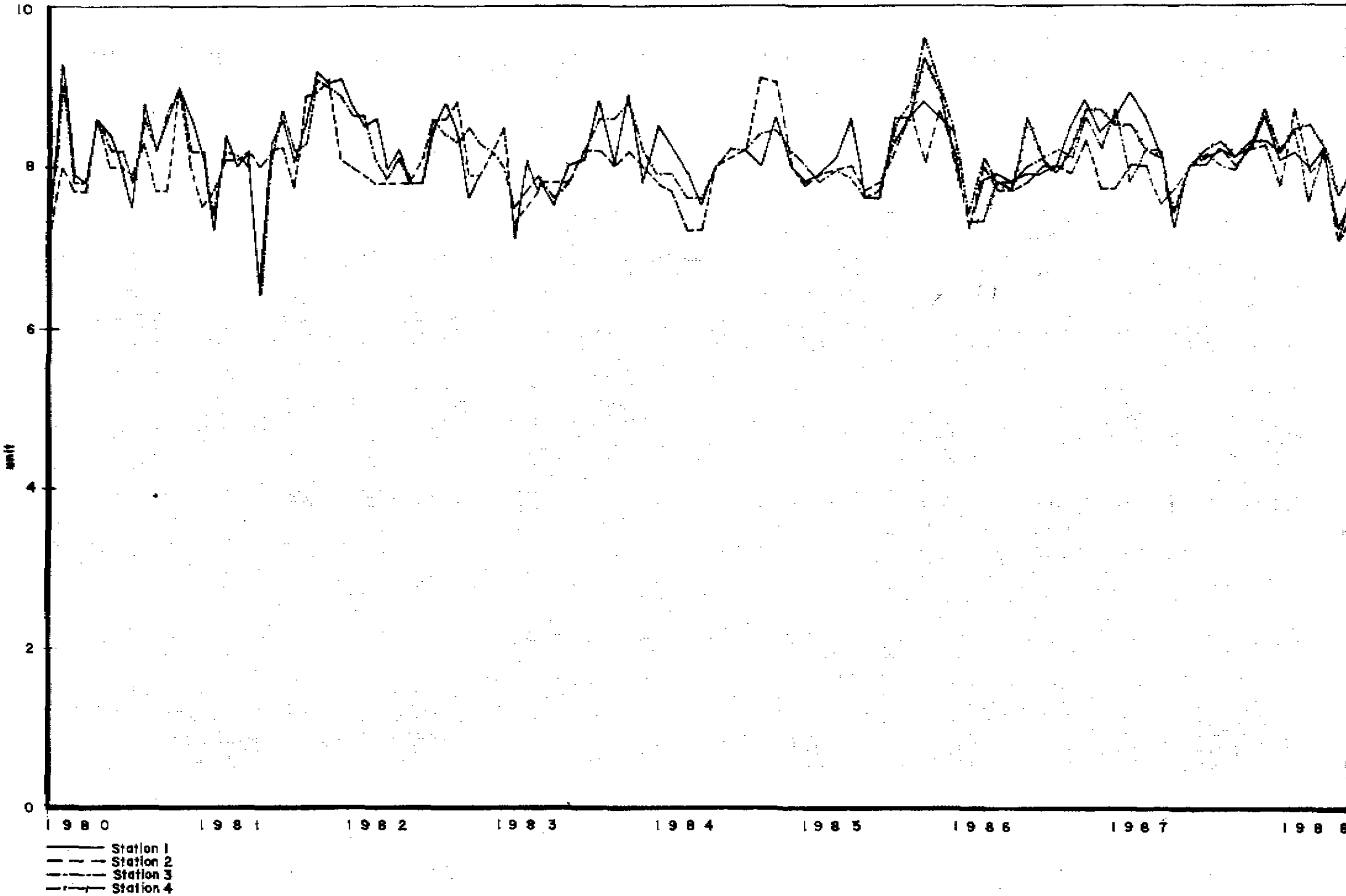


Figure 25. pH of the Laguna de Bay, 1980-1988
Source: LLDA

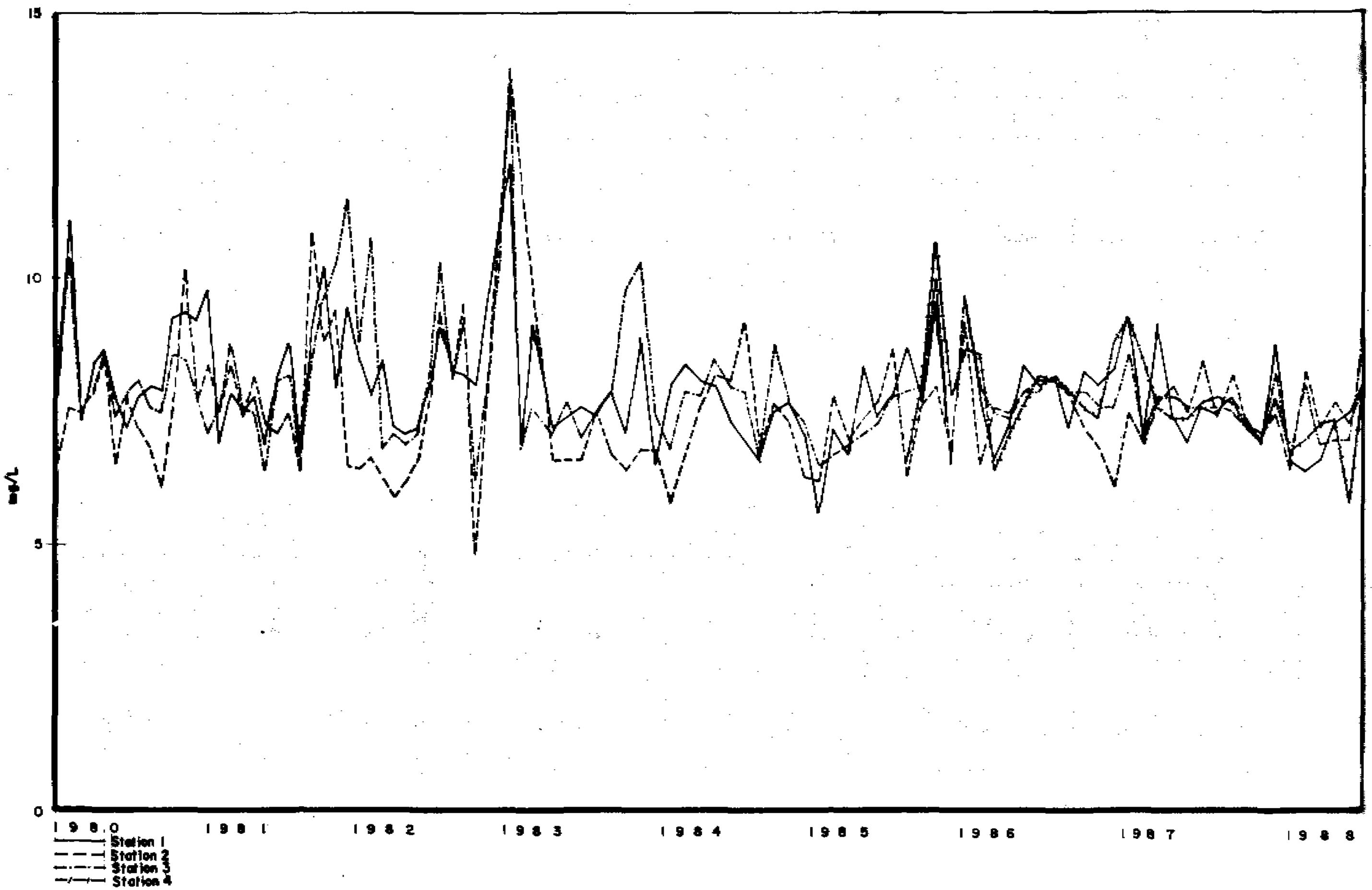


Figure 26. Dissolved Oxygen of the Laguna de Bay, 1980-1988
Source: LLDA

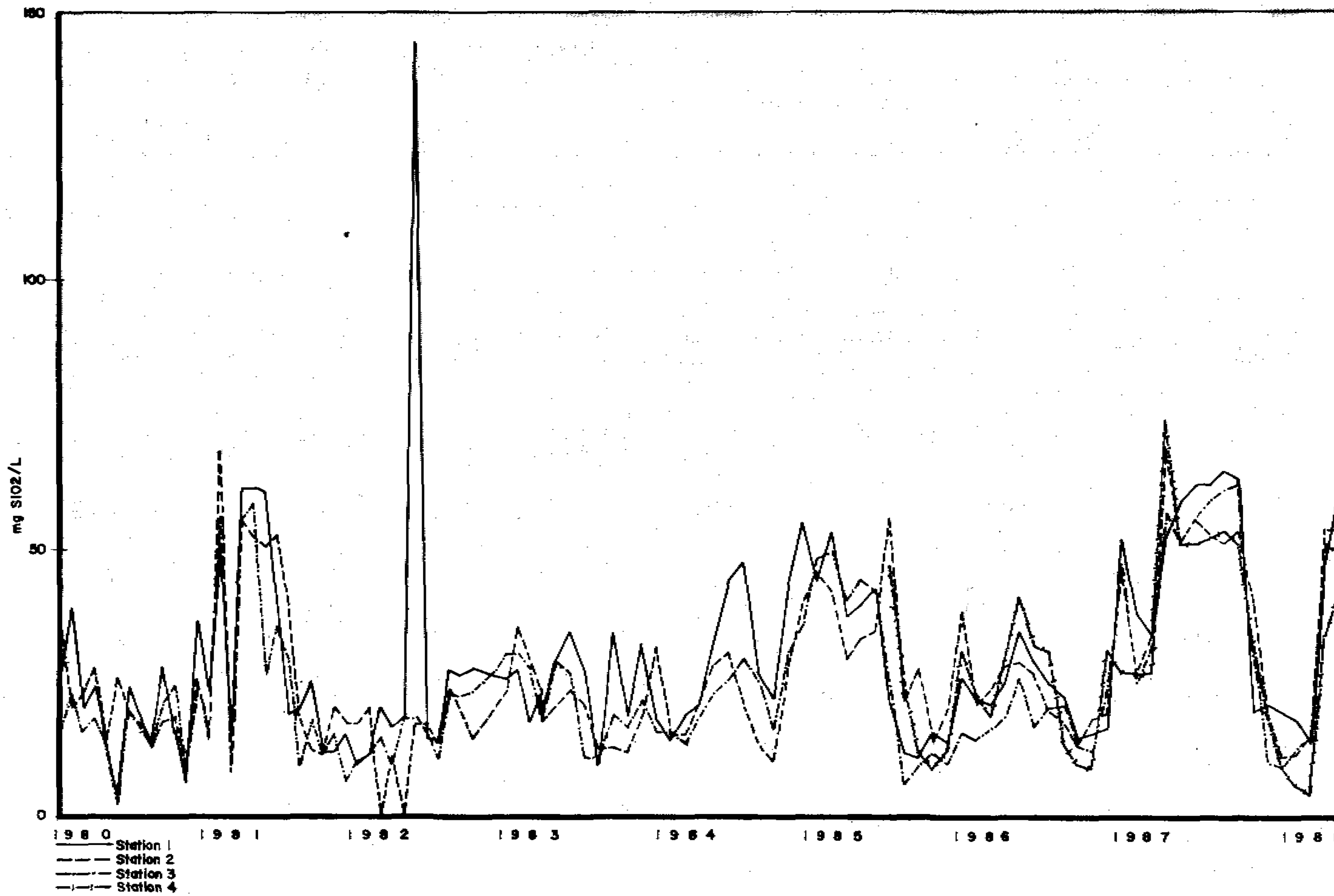


Figure 27. Turbidity of the Laguna de Bay, 1980-1988
Source: LLDA

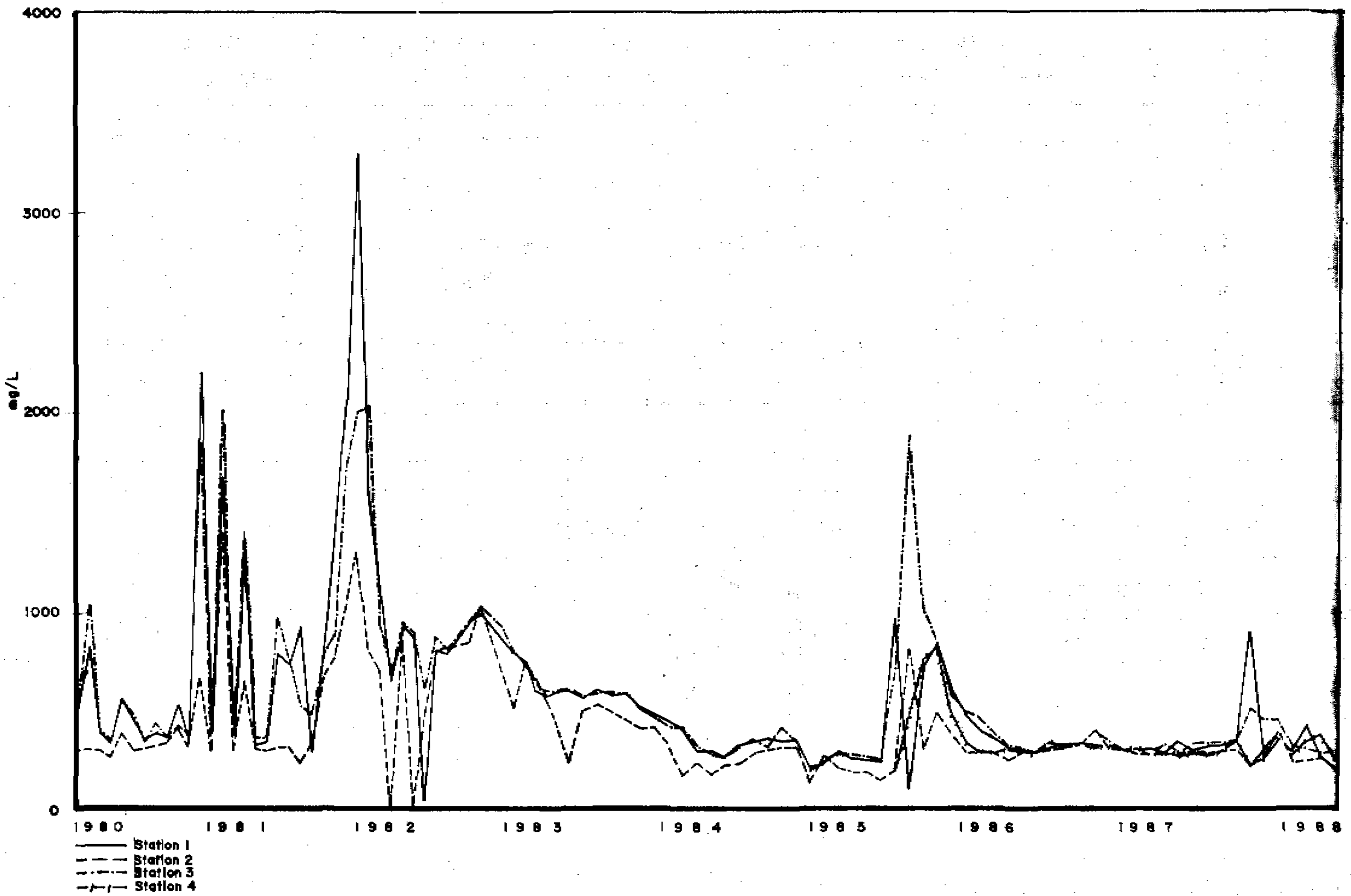


Figure 28. Total Dissolved Solids of the Laguna de Bay, 1980-1988
Source LLDA

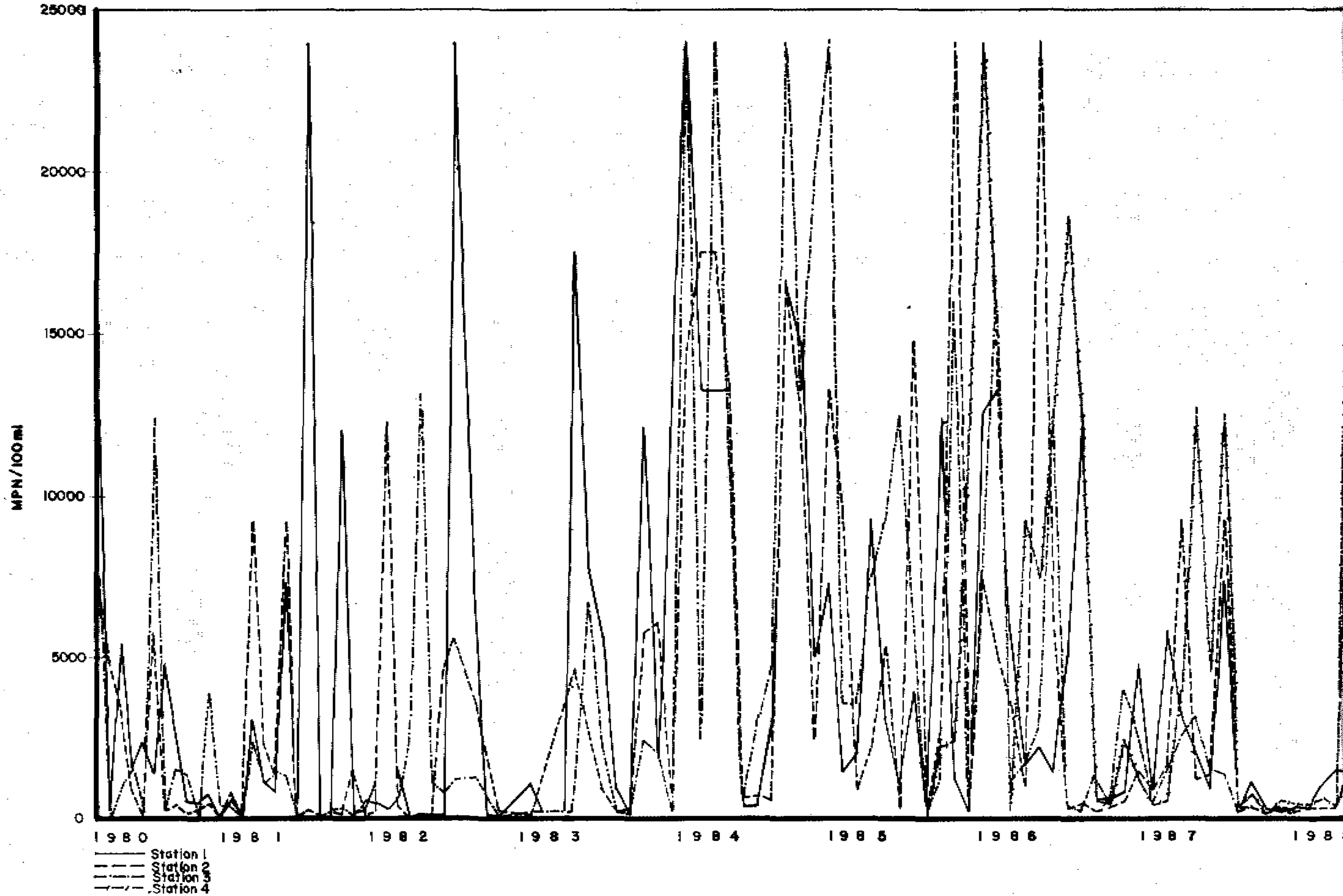


Figure 29. Coliform Count of the Laguna de Bay, 1980-1988
Source: LLDA

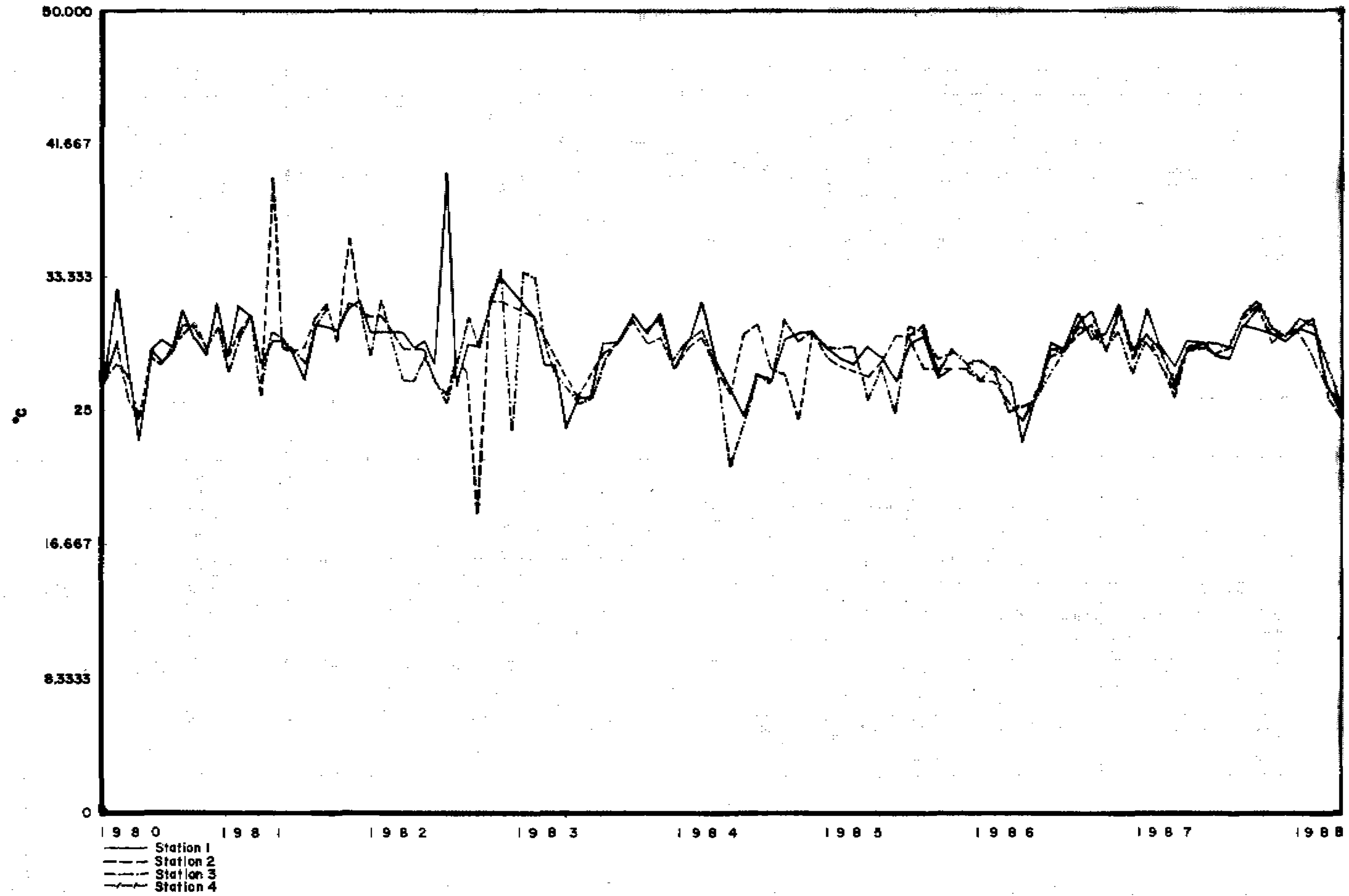


Figure 30. Average Temperature of the Laguna de Bay, 1980-1988
Source: LLDA

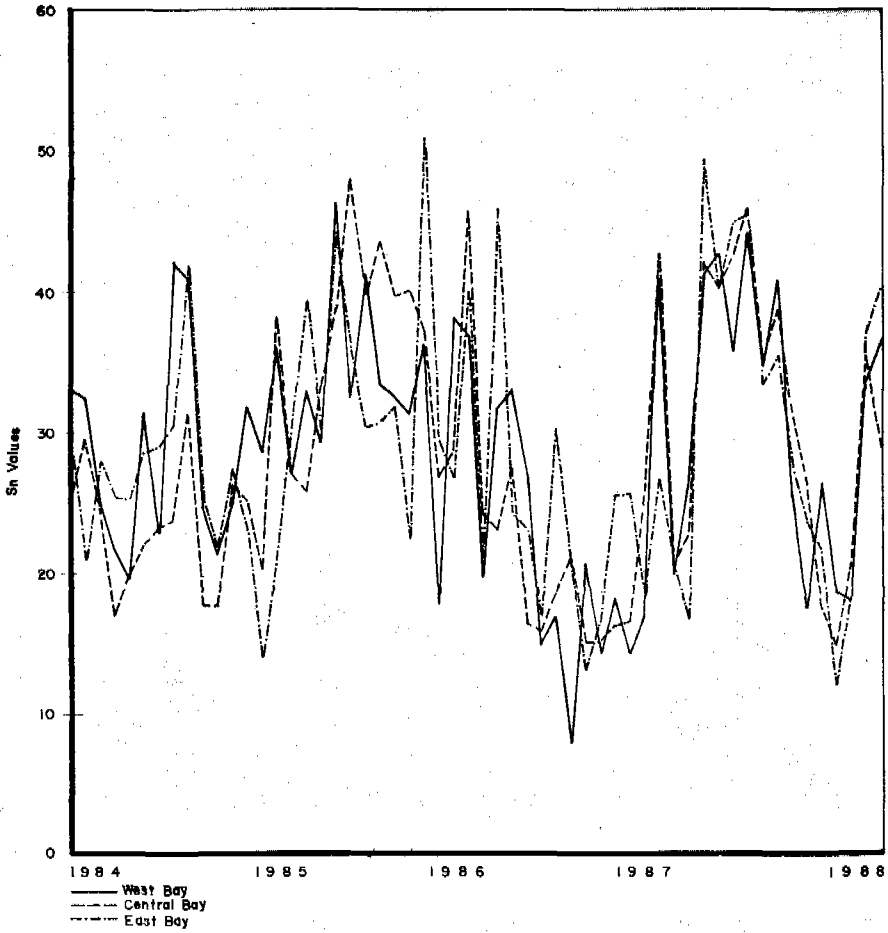


Figure 31. Water Quality Index of the Laguna Lake, 1984-1988
Source: LLDA

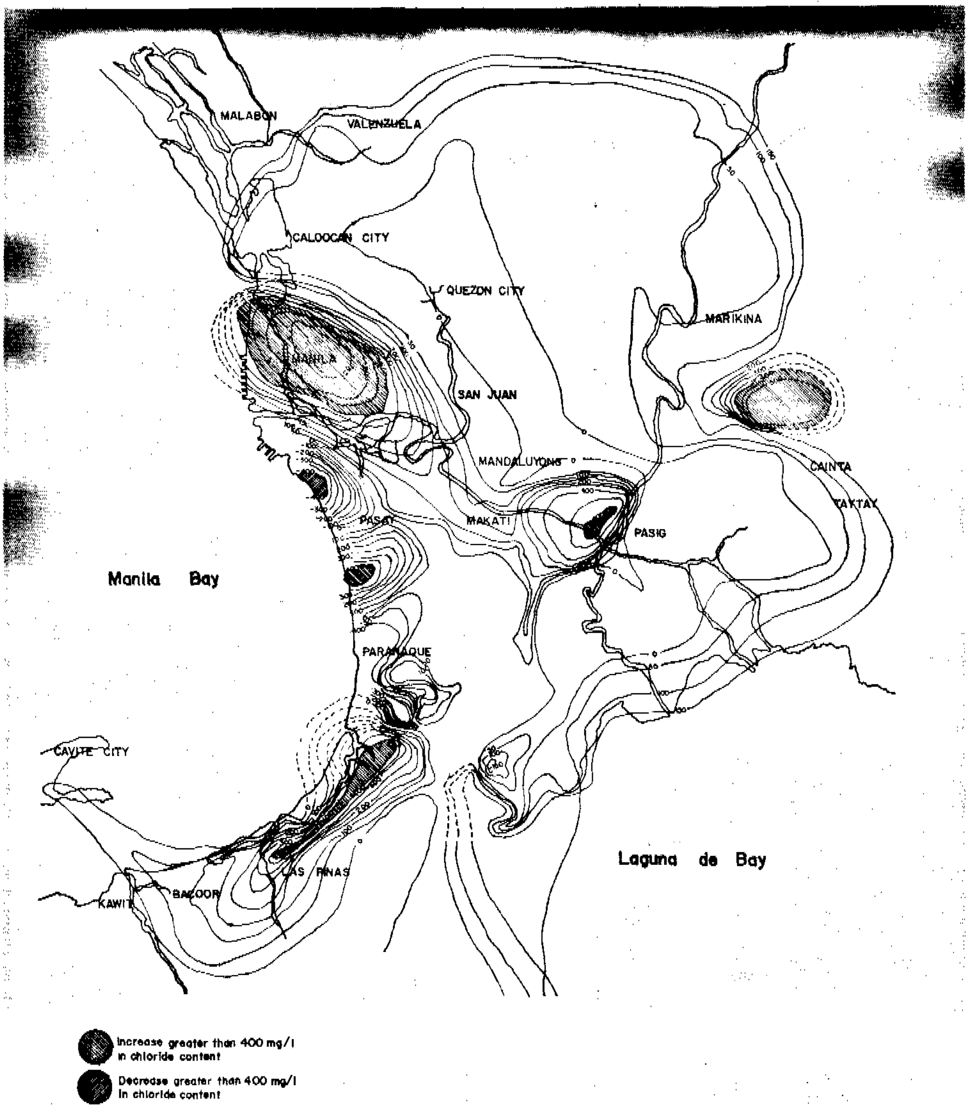


Figure 32. Changes in the Chloride Content of Groundwater in Metro Manila from 1981--1983 (in mg./l)

Source: MWSS

Table 60. Percentage Compliance of Water Pollutive Firms, 1980 - 1987

	1980			1981			1982			1983			1984			1985			1986			1987		
	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c
Metro Manila	5	44		56.1	43.9		52.0	48.0		49.3	50.7		67.9	32.1		34.7	29.6	36.2	20.6	36.7	42.7	21.7	35.9	42.4
Outside Metro Manila	4	57		64.7	35.3		55.5	44.5		60.3	39.7		70.1	29.9		29.6	31.8	38.7	23.7	33.0	43.3	25.8	33.8	40.4
National	4	51		61.4	38.6		54.2	45.8		56.2	43.8		69.4	30.6		30.9	31.1	38.0	23.0	33.8	43.2	25.0	34.2	40.8

Source: E M B

Legend:

a - Full compliance; firms with pollution control devices, permits to operate

b - Non-compliance; firms with no pollution control device(s) and no permits to operate

c - Partial compliance; firms with pollution control devices with no or expired permits

Table 61. BOD Effluent Standards for Old/Existing Industries
(milligrams/liter)

Initial BOD Range	A	B	C	D	SB	SC	SD
below 1,000	50	50	80	150	50	120	150
1,000 - 3,000	50	50	80	200**	50	200**	200*
3,000 - 10,000*	50	50	320 - 200**	320 - 200*	50	650 - 320**	650 - 320*
10,000 - 30,000*	50	50	1,000 - 600**	1,000 - 600*	50	2,000 - 1,000**	2,000 - 1,000*
above 30,000*	50	50	1,500 - 900**	1,500 - 900*	50	3,000 - 1,500**	3,000 - 1,500*

Source: Environmental Management Bureau
Note: * - Interim requirements for the periods 1990-91 and 1992-94
* - When initial BOD is below median, percentage removal is used in accordance with Table 63.

Table 62. BOD Effluent Standards for New/Proposed
Industries or All Industries after 1994
(milligrams/liter)

Initial BOD Range	A	B	C	D	SB	SC	SD
below 1,000	30	30	50	50	30	100	120
1,000 - 3,000	30	30	50	50	30	200*	200*
3,000 - 10,000	30	30	130*	130*	30	200*	200*
10,000 - 30,000	30	30	200*	200*	30	600*	600*
above 30,000	30	30	300*	300*	30	900*	900*

Source: Environmental Management Bureau
* - When initial BOD is below median, percentage removal
is used in assistance with Table 63.

Table 63. Percentage Removal for Old/Existing and New/Proposed or All Industries after 1994

Initial BOD Range	C	D	SC & SD	C & D	SC & SD
below 1,000	-	-	-	-	-
1,000 - 3,000	-	90%	90	90	90
3,000 - 10,000	95 - 97%	95 - 97%	90 - 95	98 - 98	97
10,000 - 30,000	95 - 97%	95 - 97%	90 - 95	99 - 99	97
above 30,000	95 - 97%	95 - 97%	90 - 95	99 - 99	99

Source: Environmental Management Bureau

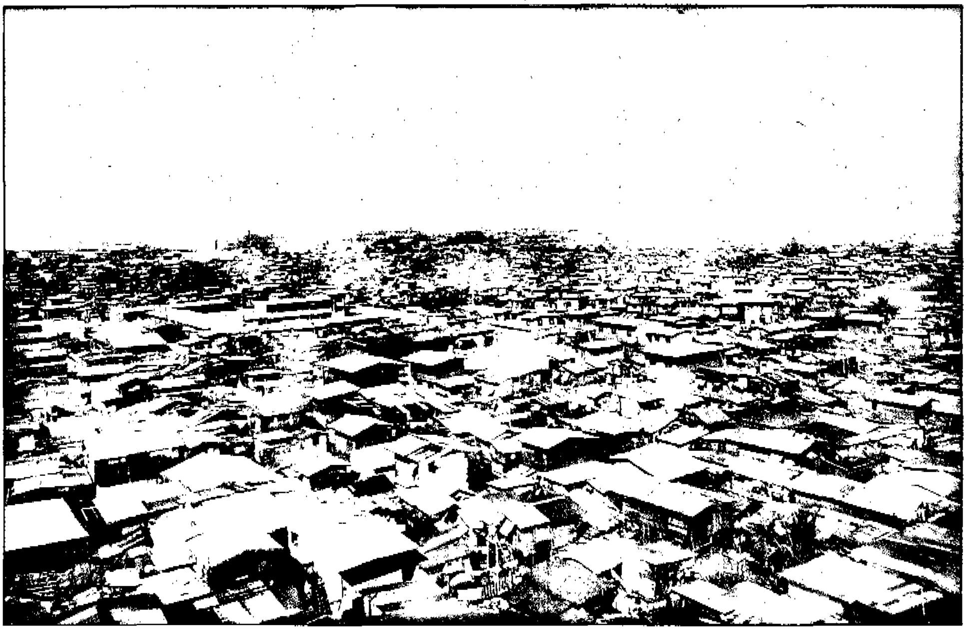
permits to drill groundwater wells; and, d) Review and approval of rules and regulations prescribed by any government agency concerning the utilization, exploitation, development, control and conservation of the country's water resources".

Through its Water Permit System the NWRB evaluates, among other things, protests filed, if any; prior permits granted; availability of water; water supply needed, possible adverse effects of water withdrawal, and land use economics". From the inception of the Water Code in 1976 up to December, 1988, a total of 10,304 grantees received water permits for withdrawal of approximately more than 4 million liters per second of groundwater as of December, 1988. A summary of water right grants by source, as of December, 1989 is given in **Table 64**. Under its monitoring program, the NWRB also conducted field inspection of waterworks structures to determine compliance to provisions of Water Permits and Certificates of Public Convenience (CPCS), including field monitoring of water withdrawals. These were undertaken to ensure efficient and beneficial use of water and actual discharge of wells.

3.2 Management Programs

Rivers Revival Program

The alarming rate at which the country's surface waters continue to deteriorate prompted the implementation of the Rivers Revival Program in 1987. The first project under this program was the Ilog Ko, Irog Ko, a multi-agency undertaking aimed at lowering the pollution load of the Navotas-Malabon-Tenejeros-Tullahan river system by 50% in 1992. Under the project, the Metropolitan Waterworks and Sewerage System (MWSS) is committed to implement a basin-wide septic tank cleaning program, which is expected to lower the sewage load from the current 26,608 kg. BOD/day to 9,978 kg. BOD/day in 1992. The National Housing Authority (NHA) will relocate all squatter shanties along the 26-kilometer waterway. The Department of Public Works and Highways is tasked to dredge the waterway and build two roads parallel to it. The Department of Environment and Natural Resources (DENR), as the lead agency, is responsible for industrial pollution control, a strategy designed to reduce the pollution load of the waterway by 60%, from its present load of 38,777 kg. BOD/day to 15,510.8 kg. BOD/day.



Rapid population growth and increased economic activities are putting tremendous pressure on the country's inland waters such as rivers and lakes.

Domestic sewage and garbage continue to pollute Metro Manila's rivers, making many of them fit only for navigation.

Table 64. Summary of Water Rights Grants as of December, 1988

Source of Water Supply	Domestic a	Domestic b	Irrigation a	Irrigation b	Power a	Power b	Industrial a	Industrial b	Livestock a	Livestock b	Recreation a	Recreation b	Fisheries a	Fisheries b	Total a	Total b
Groundwater	2339	12759.301	1118	17478.82	6	1167	219	5427.98	57	121.9	18	125.85	37	555.33	3794	37636.37
Surface Water	131	94855.830	6034	1742214.06	100	2412924.3	143	62379.17	4	42.5	8	154	90	2301.1	6510	4314870.9
Total	2470	107615.13	7152	1759692.8	106	2414091.35	362	67807.15	61	164.4	26	279.85	127	2857.43	10304	4352507.3

Source: National Water Resources Board, 1988.

Legend: a - number of grantees

b - volume in LPS

Sewerage and Sanitation Master Plan (Year 2000 Plan)

As early as 1979, the MWSS already started to implement the Sewerage and Sanitation Master Plan which is basically comprised of two components:

a) the Sewerage Development Program, designated as METROSS 1-V (Metropolitan Sewerage System, 1-V) which aims to rehabilitate the central sewerage system in Metro Manila, expand the collection system, construct monitoring facilities for wastewater disposal, and monitor programs and complementary works; and

b) the Sanitation Program, designated as PROGRESS (Program to Reduce and Eliminate Sewage from Streets) which aims to improve the health situation in densely populated, low-income areas.

METROSS I-V, which was envisioned to improve the water quality of Manila Bay, the Pasig river and its tributaries, streams and esteros, was planned to be implemented in five progressive construction stages. PROGRESS was projected to be completed in two stages over a period of eight years.

METROSS I covers the central service area of the MWSS and involves construction of a 3.8 km. long outfall into Manila Bay, a new collection system in Pandacan and Dagupan; a new main pumping station at Tondo; rehabilitation of seven lift stations; and, rehabilitation of the existing collection system. This was initiated in 1980 and completed in 1988.

METROSS II aims to expand the sewerage system to the southern portion of Metro Manila, thereby reducing wastewater discharges from the South Manila and Guadalupe basins. Preliminary engineering of the collection system, lift and pump stations and outfall into Manila Bay have been completed. Detailed engineering of the outfall and portions of the collection system and main pumping stations were finished in 1984. Actual implementation was supposed to have commenced in 1985 but has been deferred due to funding constraints and other priorities (water supply) of the MWSS.

METROSS III involves expansion of the sewerage system to the northern portion of Metro Manila for purposes of reducing wastewater discharges to the Tullahan-Tenejeros River and the Pasig's northern shore. METROSS IV will expand METROSS II from the Paranaque basin and will entail construction of a new sewer system servicing the Marikina and Laguna basins, to reduce wastewater discharge to the Marikina and Pasig rivers and Laguna de Bay. The last stage, METROSS V will expand the central system to the San Juan and northern Malabon basins.

PROGRESS, the sanitation component of the Year 2000 Plan, is a minor drainage scheme to reduce health problems caused by sewage in ponds and open ditches in Metro Manila. In its first phase, Metro Manila and its environs were surveyed and graded using a four-point scale relative to health hazards. Classification were as follows: "Class I - no hazard area where likelihood of human contact with untreated sewage is almost nil; Class 2 - moderate hazard area where minor human contact with untreated sewage is possible; Class 3 - significant hazard area where the public has difficulty in avoiding contact with raw sewage running over open ground surface". According to the survey, Class 4 totalled 812 hectares and Class 3, 2,563 hectares throughout Metro Manila, San Mateo, Taytay and Cainta.

Pasig River Rehabilitation

In the late seventies, a Pasig River Development Council was established, which implemented the Pasig River Development Program in 1979. The program involved relocation of squatter families, dredging a portion of the 25-km.river and relocation of two large sewers in Manila Bay.

In the late eighties, the Sub-Committee for the Rehabilitation of the Pasig River, under the Inter-agency Coordinating Committee for National Programs and Projects in Metro Manila (IACC- NPPM), formulated the Pasig River Rehabilitation Plan which aims to transform the Pasig River into a Class C waterbody through domestic and industrial waste control, flood control, removal of channel obstructions, squatter relocation and resettlement and public information and education. A mass transport system and fishing port were also contemplated under the plan.

Multiple Use/Joint Management Responsibility Programme

The Region 3 Environmental Management Sector (EMS) of the DENR has entered into a cooperative endeavor with industries in the area, to manage the Pampanga River through the Multiple Use/Joint Management Responsibility Programme. The Programme fosters the holistic approach to managing major river basins and primarily aims to protect the aquatic ecosystem without curtailing developmental and recreational uses. One of the strategies adopted by the Programme is the managed and scheduled discharge of effluents coupled with prior notification to downstream users. Continuous monitoring of river water quality before and after discharge is undertaken. Other strategies include river bank stabilization with bamboo plantations, technology transfer on on-site wastewater disposal systems and advocacy for shift in pesticide use from persistent to biodegradable ones.

Maximum Protection Program

The Region 3 DENR-EMS also embarked on a Maximum Protection Program for pristine waters. This involves strict enforcement of the prohibition of any kind of discharge into Class AA and A waters, as provided for in the Effluent Regulations of 1990.

3.3 Research and Development Efforts

Numerous research programs and projects on the status of the country's inland waters, particularly concerning pollution,have been conducted by the different sectors, primarily government and the academe. However, recommendations arising from these researches have not been translated into more concrete management efforts.

Among the more recent researches conducted by the Environmental Management Bureau which tried to address the problem of domestic and industrial wastes are the Bliss Wastewater Treatment Study and the Industrial Waste Exchange Project. Actually, the latter aims to address not only the problem of water pollution but other types of pollution as well.

To help find alternative means of sewage treatment for small communities, the former National Environmental Protection Council embarked on the Bliss Waste Treatment Project in 1983 but completed it only in 1989. Specifically, the project aimed to design and construct a low-cost aerated facultative pond treatment facility for small communities. The pilot site was the University Housing Complex in Diliman, Quezon City. Pollutant removal efficiency of the facility was observed as follows: BOD - 88% coliform - 99.8%; phosphate - 68%; nitrate - 38%; and ammonia - 32%. Although the results show promise for replication in small communities throughout the country, the methodology needs fine tuning in order to achieve 100% removal of coliform, which in turn, would enable effluents to meet standards for Class C waters.

The Groundwater Salinity Intrusion Control Study conducted by the NEPC in 1984 assessed the extent and gravity of saltwater intrusion in several areas throughout the country - Metro Manila, Metro Cebu, Bulacan, Pampanga, Capiz and Sorsogon. The study established that Metro Manila and Cebu are experiencing progressive saltwater intrusion due to overpumping; the coastal areas of Bulacan and Pampanga have been subjected to long-standing, naturally-occurring salinity; and Roxas City in the province of Capiz is experiencing tidal salinity in its water supply river intake.

4. PROSPECTS

Fresh water is increasingly becoming a scarce commodity for many areas in the Philippines. The still large number of people with limited or no access to safe, clean water and sanitary services simply underscore the fact that the potential of the country's inland water resources have not been fully harnessed. And given the current rate at which such resources are degraded, the realization of such potential may never come to pass. There is, therefore, a need to change the traditional notion of water as an abundant and free commodity to one which must be conserved and utilized wisely.

The decade ahead demands recognition of water as an essential resource with an important role to play in national development. As such, its utilization requires careful, long range planning based on demand projection, comprehensive river basin planning and water economy budgets. A pre-requisite to this is the generation,storage and retrieval of more and better data. Also, there is a need to review and perhaps revise, administrative and statutory arrangements on water rights, control, pollution and waste disposal.

Specific actions needed include:

- Enhancement of research in basic processes and upgrading of hydrologic measurement methodologies;

- Continuing comprehensive assessments of water resources;

- Upgrading capability to cope with floods and water shortage through structural and non-structural means;

- Arresting pollution by endorsing waste water treatment and recycling technologies in the country;

- Stepping up rehabilitation measures; and

- Enforcement of standards and regulations and provision of incentives.

AGRICULTURAL LANDS

1. PROFILE

Agriculture remains one of the largest single contributors to the national economy, generating 36% of the country's export earnings and 28% of its Gross National Product (GNP).[71] It provides livelihood for approximately three-fourths of the population and employs half of the nation's labor force. Its importance to the country's economy is incalculable. The sector served as a pillar of stability even during unstable economic conditions. Even amidst the general economic slump of 1985, for example, the sector grew 0.5 percent, resulting in an over-all 4.0 percent growth in 1986.[72] For that year, agriculture was primarily responsible for the growth of the combined sectors of agriculture, fishery and forestry, accounting for 19.27 percent of the GNP. Agricultural crop production posted an increase of 4 percent. The livestock and fishery subsectors posted gains of 7.99 percent and 2.92 percent, respectively. Although statistics show a decline in 1987 (-1.48%), sectoral growth was again 3.42% in 1988. The sector's GVA from 1981 to 1989 are given in **Figure 33**.

Volume of crop production dropped steadily within the period 1981 to 1987 but rose again in 1989. Value of production, however, rose steadily from P47,819.1 million in 1981 to **P147,853.5 million in 1989 (Figure 34)**. The percentage share of ten major crops in total production value are given in **Table 65**. Livestock production steadily increased from 855,470 metric tons in 1982 to 1,307,740 metric tons in 1989.[73] Poultry production also grew substantially from 490,000 metric tons in 1982 to 532,980 metric tons in 1989. Fishery production, too, posted a steady increase throughout the period, from 1,897,300 MT in 1981 to 2,366,600 MT in 1989. Value of production for all three sub-sectors increased, in general.

From 1982-1985, value of agricultural exports dropped but rose again from 1986 to 1988 (**Figure 35**). Value of agricultural imports followed basically the same trend (**Figure 36**). Among the country's ten principal agricultural exports, sugar and coconut oil were the leading contributors. Volume of the ten agricultural exports are provided in **Table 66**. Cereals and cereal preparations constituted the major portion of the country's importation (**Table 67**).

Developments in the sector are reflected not only in the volume of crops and livestock produced but also in the increasing land area devoted to agricultural production.[74] Of the Philippine's total land area of 30 million hectares, croplands currently comprise 13.143 million hectares or 43%, a marked increase from 7.488 million hectares in 1977. The change in crop area from 1982 to 1989 is given in **Figure 37**. There was a slight drop in harvest area from 13.077M hectares in 1982 to 12.386M hectares in 1983. This increased steadily to 13.300M hectares in 1986 and then decreased again to 12.986 M hectares in 1987. The last two years of the decade again saw an increase in crop production area. Of the 13.143 million hectares presently devoted to crop production, 7.086 million hectares are planted to palay and corn, 4.721 million hectares to other food crops (coconut, sugarcane, coffee, cacao, fruits, nuts and vegetables) and 1.235 million hectares to non-food crops.

Figure 33. GVA in Agriculture

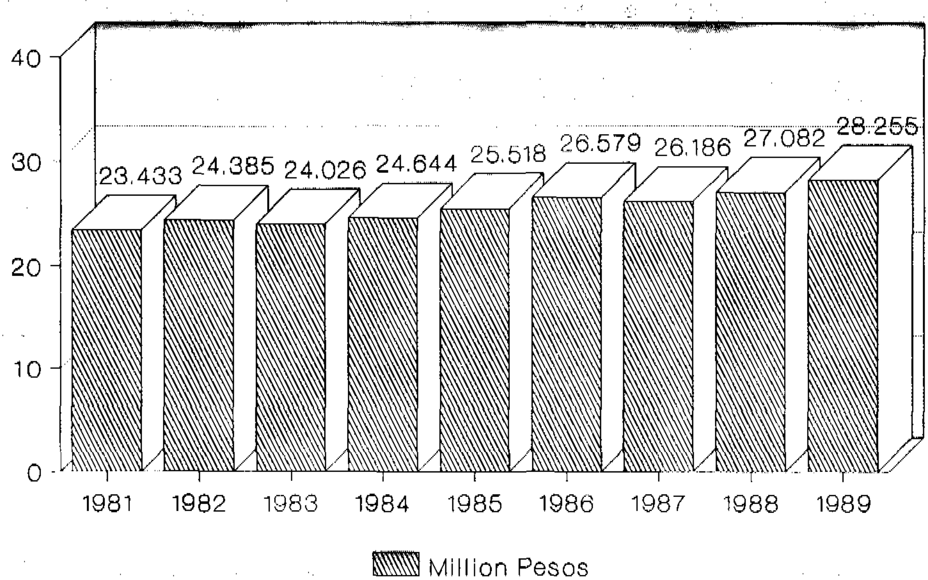


Figure 34. Crop Production

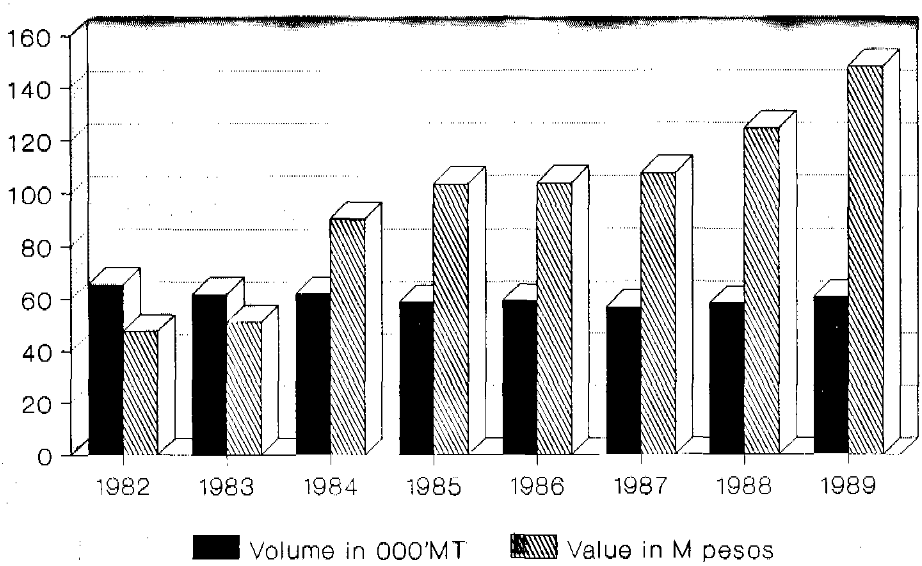


Table 65. Percent Share of Ten Major Crops in Total Production Value

Agricultural Crop	1982	1983	1984	1985	1986	1987	1988	1989
1. Palay	24.3	22.1	21.8	27.8	25.4	24.3	24.6	26.8
2. Corn	9.1	8.5	8.5	10.4	9.9	11.3	10.1	11.8
3. Coconut	13.0	16.0	24.6	17.4	11.9	13.9	15.4	15.2
4. Sugarcane	9.7	9.4	7.4	5.6	4.9	5.8	6.7	6.9
5. Pineapple	5.2	5.6	5.2	5.0	5.0	4.5	3.8	3.4
6. Banana	2.0	2.0	1.9	1.7	2.2	2.7	3.0	3.6
7. Mango	3.4	3.4	3.4	2.8	4.0	3.7	4.0	2.6
8. Cassava	1.8	1.5	1.7	1.9	2.0	1.7	1.8	1.8
9. Camote	1.5	1.4	1.2	1.2	1.3	1.1	1.0	1.0
10. Rubber	0.5	0.7	0.9	0.6	0.7	0.9	0.7	0.6
Sub-Total	70.5	70.6	76.5	74.4	67.3	69.9	71.1	73.7
All Other Crops	29.5	29.4	23.5	25.5	32.8	30.0	28.8	26.4

Source: Bureau of Agricultural Statistics, 1989

Figure 35. Value of Agricultural Exports

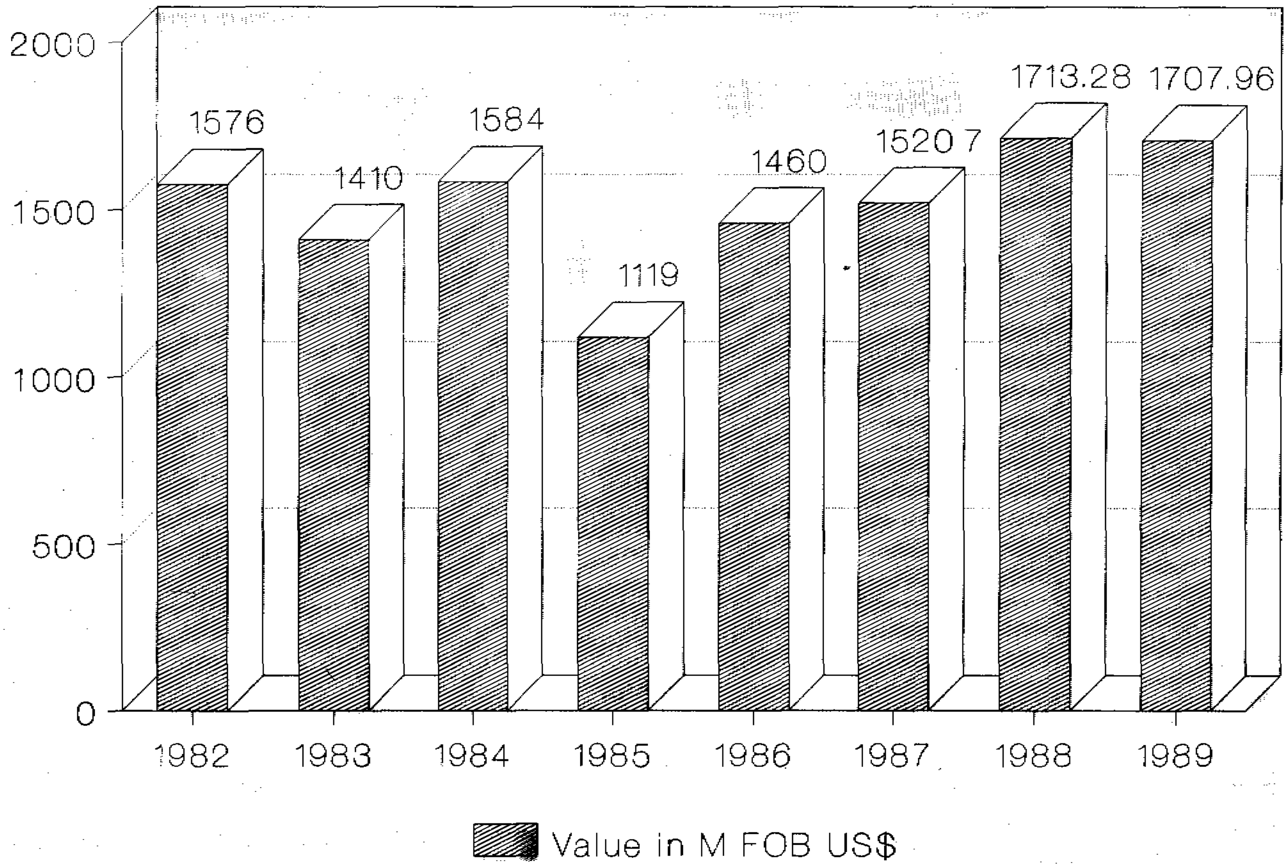


Figure 36. Value of Agricultural Imports

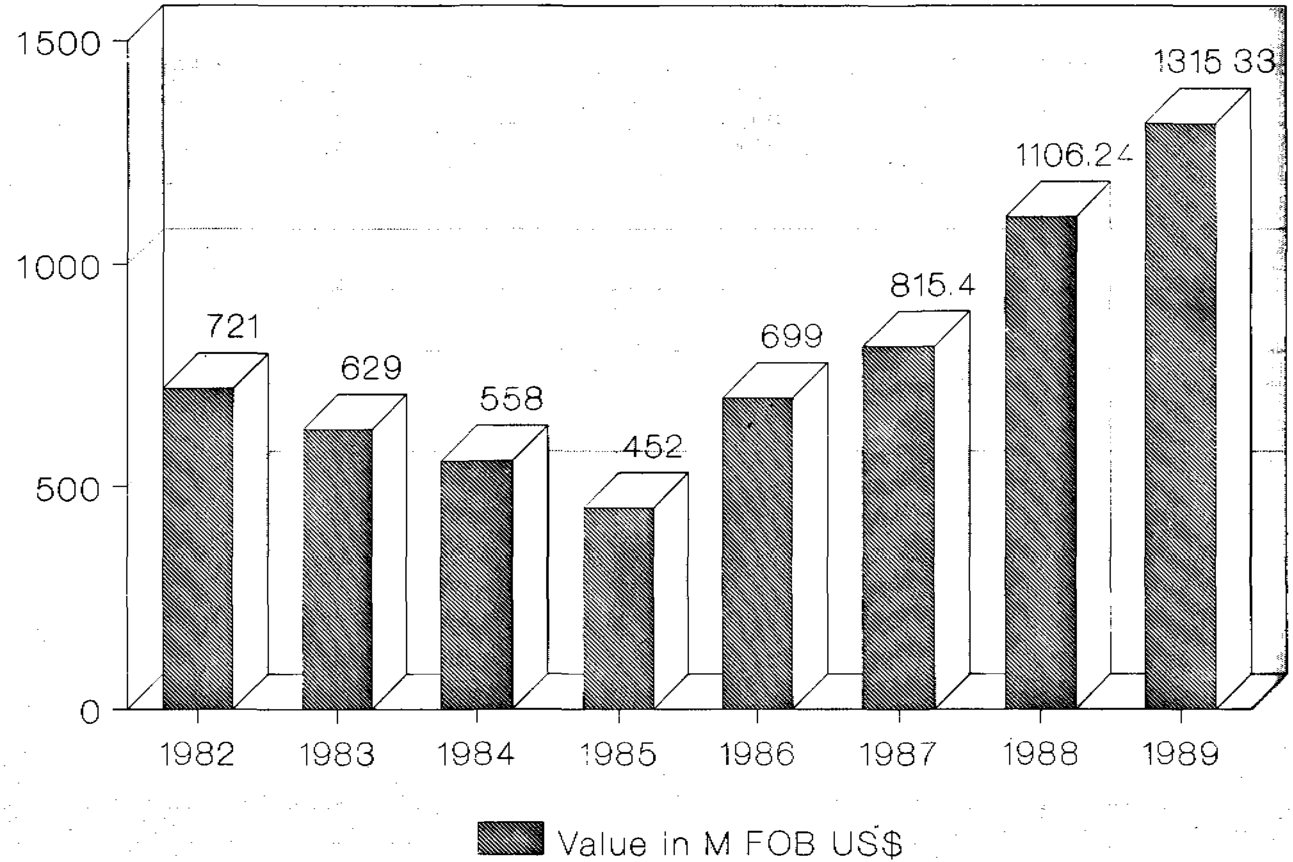


Figure 37. Change in Agricultural Crop Area, 1982-1989

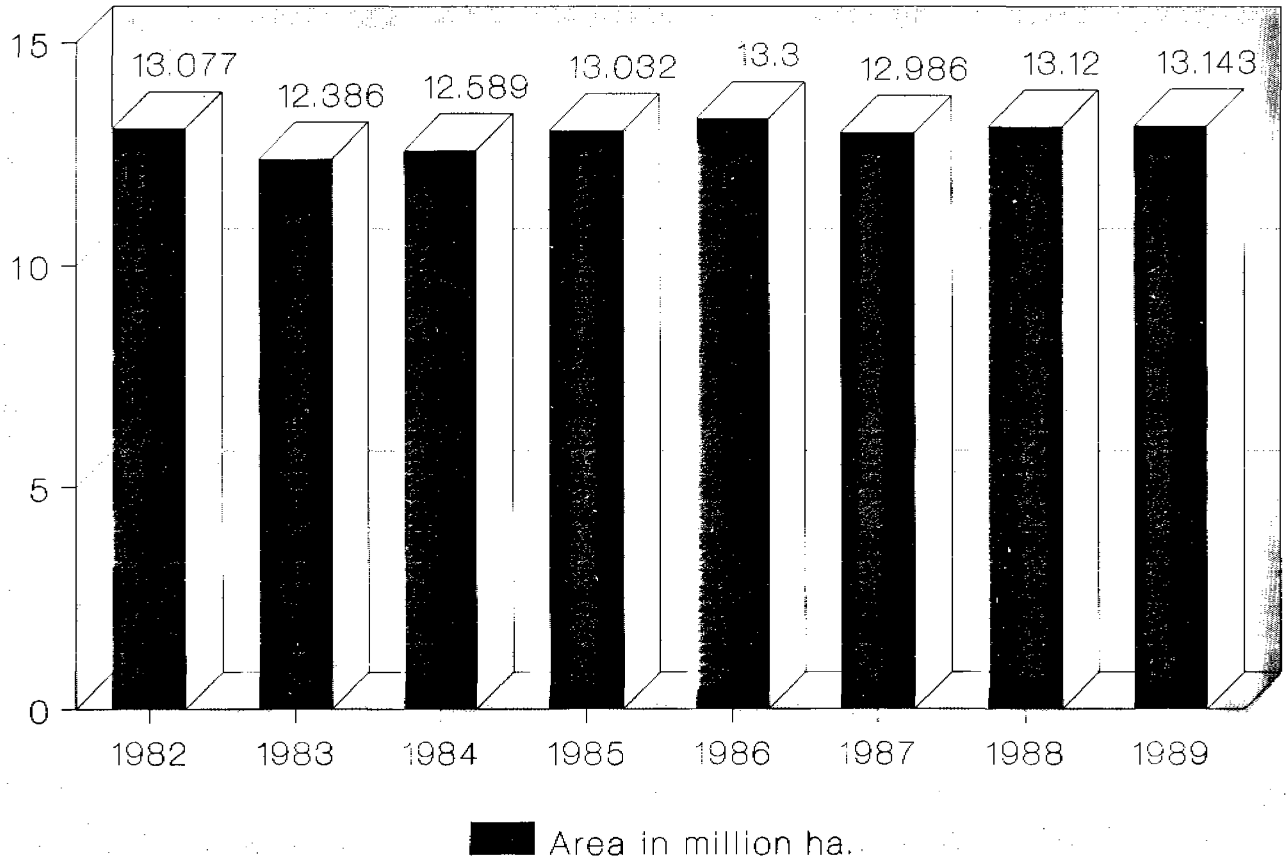


Table 66. Ten Principal Agricultural Exports, 1982-1989
('000 MT)

	1982	1983	1984	1985	1986	1987	1988	1989
Sugar	1247.5	962.8	877.2	571.6	1249.4	162.9	142.6	210.26
Coconut Oil	921.2	998.3	587.6	650.6	855.7	1031.2	792.9	763.49
Bananas	926.7	643.4	799.6	789.3	172.1	775.0	866.8	851.05
Pineapple in Syrup	170.9	145.7	170.9	185.1	821.6	183.7	182.8	191.49
Copra Oil-Cake or Meal	588.6	550.8	364.4	443.7	67.9	743.3	531.1	477.12
Desiccated Coconut	90.3	89.4	76.6	64.8	35.6	95.2	88.1	94.52
Tuna, Frozen except Fillets	34.3	37.7	35.2	37.4	42.6	37.3	47.4	57.06
Coffee, Raw or Green, not Roasted	24.6	21.5	32.9	30.7	125.3	16.5	26.5	24.97
Copra	177.7	16.1	-	-	197.2	128.7	80.3	79.47
Abaca (in '000 bales)	270.0	239.4	251.4	195.3		184.3	191.5	197.64

Source: Bureau of Agricultural Statistics

Table 67. Volume of Agricultural Imports, 1982-1989
(000 MT)

	1982	1983	1984	1985	1986	1987	1988	1989
Cereals	340.945	528.448	372.118	819.280	2.217	55.846	260.582	296.080
Rice	0.000	0.007	189.717	538.102	2.058	0.032	181.410	195.180
Corn	340.945	528.441	182.401	281.178	0.159	55.814	25.172	100.900
Livestock	8.44	5.11	0.91	2.13	2.92	5.50	8.81	0.68
Beef	7.45	4.43	0.68	1.68	2.52	4.35	5.61	0.68
Pork	0.99	0.23	0.23	0.45	0.40	1.15	2.58	
Poultry ('000 head)	713.36	902.04	683.15	644.57	728.21	1450.03	1161.0	1064.39
Chicken	705.18	885.35	677.27	644.57	728.21	1448.03	1161.0	1058.38
Duck	8.18	16.69	5.88	0.00	-	2.00	-	6.01
Fishery	83.44	23.04	6.09	28.75	69.09	104.93	164.57	197.94
Fish Meal	41.05	14.10	4.82	23.25	36.18	37.47	47.78	56.47
Canned	36.20	5.40	0.01	0.21	0.60	0.89	2.90	3.82
Fresh/Frozen Chilled	6.18	3.52	1.26	5.28	32.27	66.54	113.88	136.88
Salted/Dried/Smoked, etc.	0.01	0.02	0.00	0.01	0.04	0.03	0.01	0.77

Source: Bureau of Agricultural Statistics

Table 68. Agricultural Land Use
(million hectares)

Class	1960	1971	1980
Temporary Crops	3.7	3.8	4.3
Idle	1.1	0.7	0.8
Permanent Crops	1.8	2.5	3.5
Meadows and Pastures	0.3	0.6	0.5
Covered with forest	0.5	0.4	0.3
All from other lands	0.1	0.1	0.1

Source: Bureau of Agricultural Statistics, 1989.

In 1960, the Philippines had 2.17 million farms, taking up a total area of 7.77 million hectares. Ten years later, the number of farms rose to 2.35 million, occupying an area of 8.49 million hectares. As of 1980, another million farms were established, bringing the total to 3.42 million, accounting for 9.73 million hectares of the country's total land area. Average farm size, however, shrank from 3.61 hectares to 2.63 hectares during the same period. **Table 68** provides a breakdown of the area of farms by land uses for the years 1960, 1971 and 1980. Land planted to permanent crops increased from 1.8 million hectares in 1960 to 3.5 million hectares in 1980.

Total area planted to palay remained constant for the period 1982-1989. Irrigated farmland planted to palay, however, posted increases from 1.741 million hectares in 1982 to 2.064 million hectares in 1989. A detailed breakdown of the irrigated and rainfed areas planted to palay is given in **Table 69.** Palay production did not significantly go up within this period (**Table 70**). Despite the increasing fertilizer and pesticide use, there was no significant increase in rice yield/hectare from 1982 to 1989. **Figure 38** shows the fertilizer supply and use from 1982 to 1989 while **Table 71** shows the total quantity and value of pesticide inputs, which are also taken to be an indication of pesticides use in the country.

Agricultural land use opportunities are fast disappearing. Initial work under the Department of Agriculture's **Land Evaluation Project** in 1984 revealed that approximately 14.7 million hectares or 49% of the country's total land area were suitable for agricultural uses. Of these, 11,612,121 hectares (38.7%) were already fully utilized for various agricultural activities at the time. Idle or underutilized land with potential for agricultural uses were established at 3,129,728 hectares or (10.4%) then (**Table 72**).[75] Agricultural expansion accelerated such that 91% or 13,387,700 hectares of the total area originally identified as suitable for agriculture have been used up, without the expected complementary increase in volume of agricultural production.

Despite the significant contribution of agriculture to the national economy, a very minimal portion of the benefits it generates go back to the farm workers. Poverty is rife in the rural areas. Families of corn and coconut farmers, subsistence fishermen and landless laborers constitute four-fifths of households in the bottom 20% of the income scale. Although farm wages increased substantially from 1982 to 1989, (**Table 73**) rural incomes significantly lagged behind urban incomes. In recent years, for example, the average rural family income is only 40% of the urban income level compared to 60% in 1970 and 75% in 1975.[76]

2. ISSUES AND PROBLEMS

Over the past decade, the Philippines' agricultural lands have been subjected even more to growing pressures from various quarters. Erosion, salinization and misuse of chemicals have combined to degrade some of the country's best soils. Conversion to

Agriculture is still a premium industry in the Philippines, generating 28% of the gross national product.

Over the past decade Philippine agricultural lands were subjected to growing pressures from various factors. Erosion, salinization, and misuse of chemicals have combined to degrade some of our best soils.

Table 69. **Area Planted to Palay, 1982 - 1989**
(million hectares)

Area	1982	1983	1984	1985	1986	1987	1988	1989
Total	3.35	3.054	3.162	3.306	3.465	3.255	3.393	3.497
Irrigated	1.741	1.668	1.755	1.838	1.879	1.852	1.956	2.064
Rainfed	1.611	1.386	1.407	1.469	1.586	1.404	1.437	1.433

Source: Bureau of Agricultural Statistics

Table 70. Palay Production, 1982 - 1989
(million metric tons)

	1982	1983	1984	1985	1986	1987	1988	1989
Total	8.334	7.295	7.829	8.806	9.247	8.540	8.971	9.459
Irrigated	5.343	4.888	5.136	5.821	5.980	5.809	6.106	6.586
Rainfed	2.99	2.406	2.693	2.985	3.267	2.730	2.865	2.872

Source: Bureau of Agricultural Statistics

Figure 38. Fertilizer Supply and Use

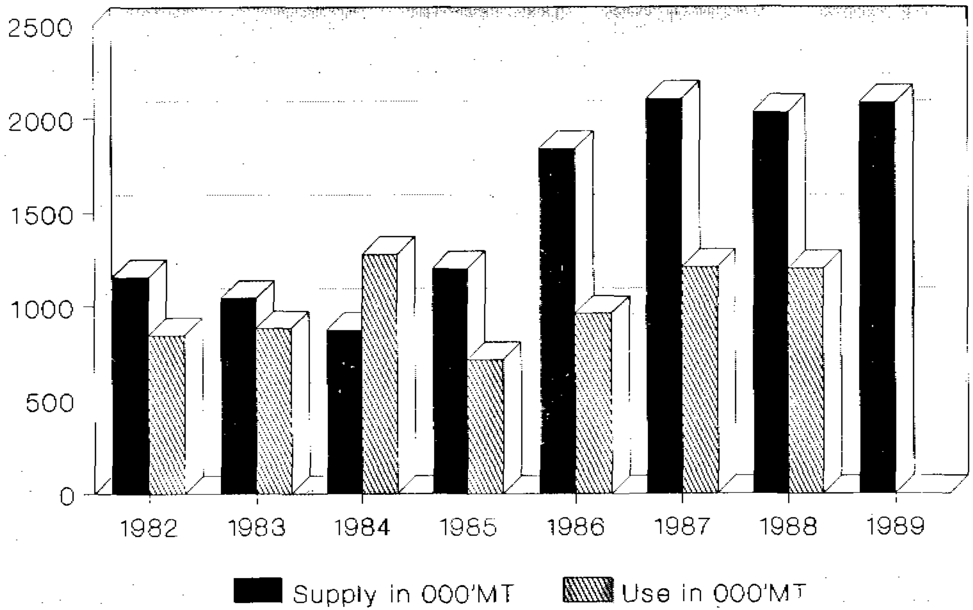


Table 71. Quantity and Value of Farm Chemical Imports, 1980 - 1987

	1980		1981		1982		1983		1984		1985		1986		1987	
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
Insecticides	1,589	5,033	1,275	5,963	2,220	6,039	1,046	4,436	2,017	14,097	2,078	12,151	2,496	16,379	3,007	23,270
Fungicides	2,375	3,792	2,468	4,781	3,951	4,678	3,208	5,521	5,923	11.528	4,346	7,953	4,784	9,691	5,571	10,589
Herbicides	674	2,495	979	3,494	767	3,125	137	760	1,375	4,562	1,230	4,016	1,574	6,042	1,843	7,139
Rodenticides	65	108	70	137	48	162	197	785	53	134	12	138	6	62	2	23
Fumigants	22	87	17	55	6	39	31	203	29	88	-	-	77	204	105	329
Total	4,725	11,515	4809	14043	6,992	14,043	4,619	11,705	11,098	35,397	10,909	30,853	12,908	40,443	15,901	52,424

Source: Fertilizers and Pesticides Authority

a = Quantity in metric tons

b = Value in 1000 US$

Table72. Land Use Opportunity by Region, 1983

		Agriculture				Forestry			
		1		2		3		4	
	Total	Agricultural		Expansion		Preservation		Rehabilitation	
Region	Hectares	Has.	%	Has.	%	Has.	%	Has.	%
Philippines	30,000,000	11,612,121	100	3,129,728	100	11,740,298	100	3,517,853	100
	100		38.7		10.4		39.1		11.8
I	2,156,845	578,202	5.0	367,102	11.7	691,169	5.9	520,370	14.8
II	3,640,300	1,102,171	9.5	919,268	29.4	1,571,600	13.4	47,261	1.3
III	1,823,082	919,568	7.9	168,283	5.4	589,505	5.0	145,726	4.2
IV	4,756,016	1,927,717	16.6	73,695	2.4	2,590,297	22.1	164,305	4.7
V	1,763,249	894,860	7.7	88,905	2.8	707,813	6.0	71,667	2.0
VI	2,022,311	954,824	8.2	117,357	3.7	503,604	4.3	446,526	12.7
VII	1,495,142	649,360	5.6	80,891	2.6	262,513	2.2	502,376	14.3
VIII	2,143,169	801,729	6.9	119,513	3.8	904,513	7.7	317,414	9.0
IX	1,868,514	644,983	5.6	395,765	12.6	440,417	3.6	387,349	11.0
X	2,832,774	1,023,081	8.8	272,968	8.7	1,293,919	11.1	242,806	6.9
XI	3,169,275	908,228	7.8	354,771	11.3	1,451,395	12.4	454,879	12.9
XII	2,329,323	1,207,398	10.4	171,210	5.6	733,535	6.3	271,162	6.2

Source: Bureau of Soils

1 - Land fully utilized for various agricultural activities.

2 - Idle or underutilized lands with potentials for agricultural uses.

3 - Includes: a(areas with dense growth or trees that should be preserved and protected against human destruction; and b) brackish and freshwater fishponds that should be preserved to maintain a well-balanced and productive aqua-marine ecology.

4 - Lands within critical watershed areas seemingly subjected to various forms of land abuses.

Table 73. Wage Rate Indices, 1982 - 1988

	1982	1983	1984	1985	1986	1987	1988
Nominal	50.49	59.44	79.65	180.80	108.80	115.99	131.91
Real	102.79	110.02	98.06	100.08	108.80	110.93	117.24

Source: Bureau of Agricultural Statistics

non-agricultural uses has likewise caused the loss of some of its prime agricultural lands. Although production losses due to these factors have not been fully documented nor quantified, there is no doubt that these issues have to be addressed if sustainability of the country's agricultural base is to be ensured.

2.1 Soil Erosion

Soil is a crucial life-support system. In the tropics, soil erosion is often much worse than on temperate farmlands because of their kind of soils and nature of rainfall, which are often torrential. Soil erosion in the Philippines is particularly very pronounced due to its rough topography, heavy rainfall intensities, improper land use and poor soil and farm practices.

No recent and thorough survey of the country's land condition has been undertaken. The latest figures on the extent of soil erosion still date back to 1983. But there is no doubt that large amounts of topsoil continue to be washed away annually. Every year, an equivalent of 50 tons soil per hectare per year is estimated to be washed into the sea.[77]

The surveys conducted in 1983 identified 8.25 million hectares of alienable lands as severely eroded and thirteen (13) provinces with more than half of their areas eroded (**Figure 39**). Forty-five percent (45%) of the 5.78 million hectares classified then by the Bureau of Soils as suitable for crop production have been established to be susceptible to erosion in varying degrees. Deforestation has been singled out as the major cause of soil erosion in the uplands. Excessive run-off due to deforestation and marginal upland cultivation reduces groundwater recharge. This translates to reduced water supply to rivers, particularly during the dry season, which in turn, translates into reduced agricultural production. In 1985, fifty percent of the nation's seasonally cropped areas were believed to be subject to soil erosion. The Central Visayas was established to be the most critical area, with 71% of its croplands eroded.

Erosion accounts for major losses in agricultural productivity although these have not really been systematically quantified. Soil erosion costs are generally divided into the upstream and downstream costs. Upstream costs are usually measured in terms of decline in the productivity of the soil as nutrients are lost and structural properties (e.g. moisture retention) are degraded. Downstream costs consist of current and future reductions in agricultural and industrial production due to the siltation of reservoirs and channels used for irrigation and power generation. These also include losses in the coastal areas due to damage to coral reefs from siltation. For selected watersheds, however, the monetary cost of the loss due to soil erosion have been established. For the Magat Watershed, annual erosion through nutrients replacement costs is pegged

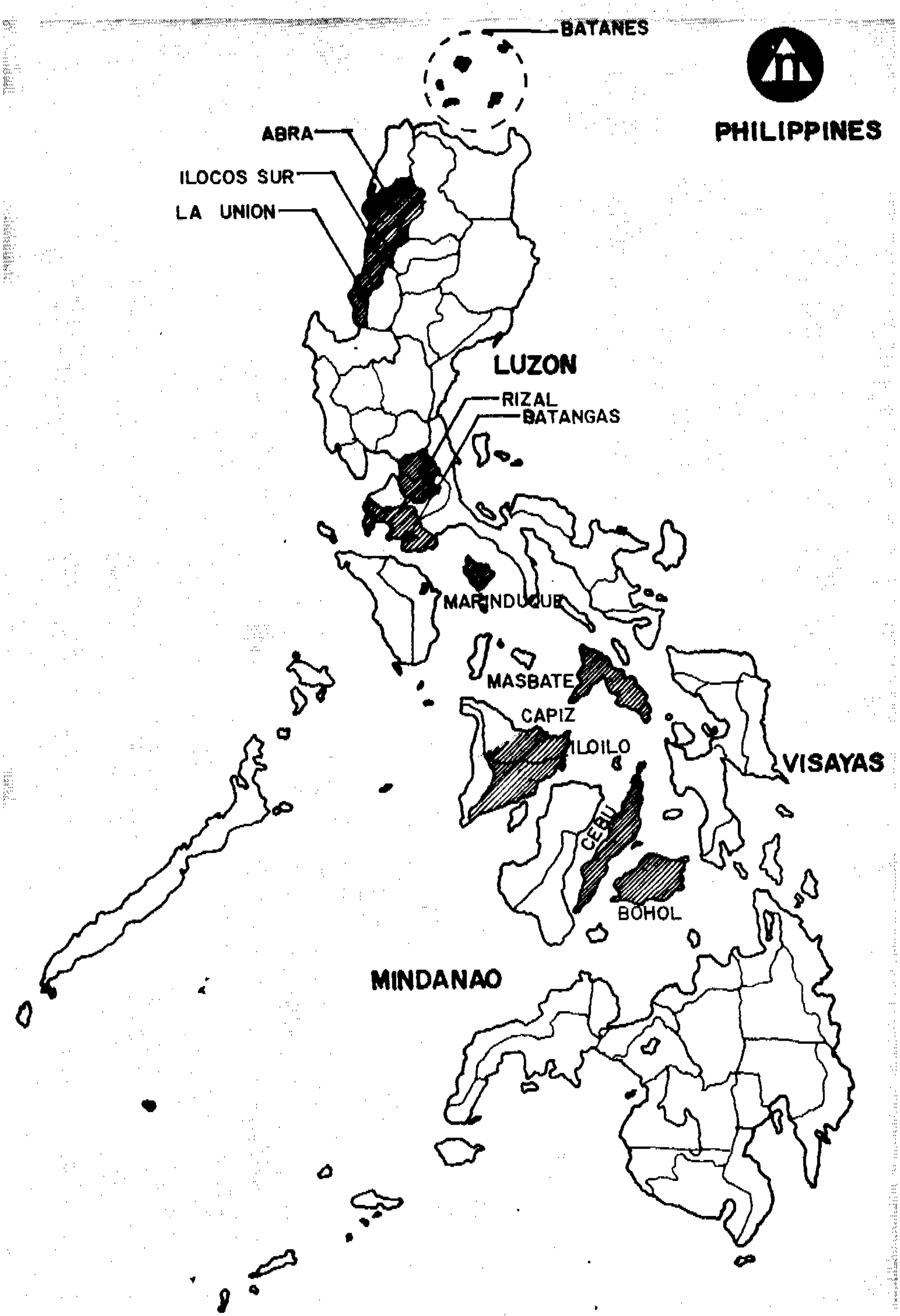


Figure 39. Provinces With More Than Half Their Area Eroded

at 219 tons per hectares for open grassland and 71 tons per hectares for other land uses, translating to actual economic costs of soil nutrient loss of P 1,068 to P 3,392 per hectare per year. Soil nutrient loss for the Pantabangan watershed has been estimated at P2,541 per hectare (with erosion occurring from the first 5 cm.layer of the top soil).

2.2 Misuse of Agricultural Chemicals

Some chemicals used in agriculture to enhance production or control pests have side effects on wildlife, aquatic ecosystems or humans. Also, pollutants generated by industrial processes or combustion can damage crops and trees and reduce production.

Since the 1960s, with the onset of the Masagana 99 program, the Philippines has embarked on an all-out effort to industrialize its agricultural sector. In its bid to increase farm production, raise incomes of farmers and attain food self-sufficiency, the country has become increasingly reliant on chemical fertilizers and pesticides. As shown by recent findings, Philippine agriculture is not exempted from the shortcomings of modern chemical technologies.

Fertilizers

Agricultural production has increasingly relied on chemical fertilizers starting in the 1960s. This was primarily spurred by the introduction of high yielding varieties of rice which needed increasing amounts of fertilizer and pesticides every year. The annual total potential demand for fertilizer has been estimated at 394,375 metric tons of plant nutrients equivalent to 921,699 metric tons of finished fertilizer.[78] Of this amount, about 65-70% are imported by the Philippines.

An average annual increase of 4% in fertilizer consumption was recorded for the period 1973-1983. In 1975, however, consumption dropped by approximately 20% because of overstocking in 1974 and a drastic increase in price ceilings.[79] Consumption again declined to 665,200 metric tons in 1984 due to price increases. The succeeding years saw increases in fertilizer consumption, reaching 1,199,900 metric tons in 1988. Fertilizer consumption (1970-1984) by finished product is provided in **Table 74**.

From 1966-1972, over 50% of the fertilizer consumed in the Philippines was supplied by four private companies: Planters Products, Inc. (PPI), Atlas Fertilizer Corporation (AFC), Maria Cristina Fertilizer Corporation (MCFC) and Chemical Industries of the Philippines (CHEMPHIL). Domestic production increased from 29,200 MT in 1956 to 306,200 MT in 1976. Production dropped to 126,000 MT in 1982 due to high maintenance costs. With the operation of the Philippine Phosphate Fertilizer Corporation (PHILPHOS) in 1985, production increased to 500,000 MT and has been steadily increasing. It reached 696,200 metric tons in 1986 but dropped slightly again to 689,400 MT in 1989. A considerable amount of the country's fertilizer needs, however, is still supplied by imports. The Philippines' fertilizer importation and production for the period 1982-1989 are given in **Table 75.**

Table 74. Fertilizer Consumption by Finished Product, 1970 - 1984
(1000 MT)

Year	Urea	Ammonium Sulfate/ Ammonium Chloride	NP/P	NPK	Potash	Total
1970	121.6	116.1	83.1	84.2	49.0	454.0
1971	159.0	130.0	73.9	82.5	46.0	491.4
1972	132.7	134.6	89.2	88.6	47.4	492.5
1973	153.0	210.0	129.4	116.3	68.2	676.9
1974	212.4	200.5	130.7	126.9	68.0	738.3
1975	143.8	167.5	105.5	102.1	58.7	577.6
1976	174.8	185.4	116.0	108.0	59.7	643.9
1977	229.3	177.7	106.1	124.1	48.4	685.6
1978	287.1	171.2	125.3	147.2	60.8	791.6
1979	320.4	175.4	124.2	159.5	59.8	839.3
1980	329.2	143.6	131.8	158.2	56.8	819.6
1981	307.3	126.5	124.2	163.7	63.7	785.4
1982	342.0	140.3	143.1	161.6	58.8	845.8
1983	371.5	137.7	145.2	150.5	73.4	878.3
1984	256.3	118.6	121.9	134.3	34.0	665.2

Source: IFDC

Table75. Fertilizer Importation and Production, 1982 - 1989 (000 MT)

[illegible]	1982	1983	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Production	125.8	164.2	103.4	499.8	696.2	792.1	759.4	689.4
Import	765.4	613.4	626.4	557.5	876.0	974.4	1063.7	959.8

Source: Bureau of Agricultural Statistics

High rates of fertilizer application have had unfavorable impacts on soil fertility. Such practice has increased soil acidity in many parts of the country and caused soil structure deterioration.[80] It has also spawned other problems, primarily water pollution. In many instances, the growth of algae blooms in some of the country's waters have been attributed to inorganic fertilizers containing nitrates.

Pesticides

Improved crop production for the past two decades was made synonymous with increased pesticide usage. Pesticide use for the past ten years (actually estimated from the quantity of pesticides imported) indicated a three-fold increase from 4,725 metric tons in 1980 to 15,901 metric tons in 1987.

The key pesticides used in the Philippines are monocrotophos, endosulfan, phenamiphos, tridemorph, chlorothalonil, mancozeb, butachlor, azinphos-ethyl, chlopyrifos, BPMC and parathion-methyl.[81] Insecticides account for 55 percent of the total pesticides used, fungicides account for 20 percent and herbicides, 16 percent. Although the older generation broad-spectrum insecticides are generally preferred because of their even distribution and relatively low unit price, the newer generation insecticides such as pyrethroids, are being increasingly utilized, particularly on small-scale farms.

Forty six percent of all insecticides used in the country is applied to rice.[82] Small-scale farmers increasingly use herbicides, such as 2, 4-D and butachlor, for pre and post emergent control of broadleaves and grasses. Twenty percent (20%) of total insecticide usage is for vegetables because they are prone to diseases. Fungicides, primarily dithio-carbamates, are also used. Plantation crops such as banana, pineapple and sugar also use up a large amount of herbicides.

The private sector controls the pesticide industry in the Philippines, mostly local organizations representing the major multi-national companies. There are currently 31 formulation and repackaging plants in operation. Nineteen of these produce agricultural-related pesticide products. Total production capacity of these plants reached 24,000 metric tons in 1983, which did not substantially change until 1985.[83] Sixty two percent (62%) of the formulations comprised of insecticides.

Over application of pesticides pose health risks to consumers in the form of high accumulation of pesticide residues in food. A study by the National Crop Protection Center for two production seasons (1986-1987) in Calamba, Laguna, revealed alarming farmer's practices concerning insecticide application. The study revealed that the subject farmers tended to spray more frequently when harvesting neared.[84] Analysis of the samples showed that they contain endosulfan residues of about 0.06 mg/kg., which is way above set limits (acceptable daily intake is 0.008 mg/kg body weight).[85] Also, samples sprayed with fenvalerate (sumicidin) had high residue content even six days after spraying.

In Benguet, vegetable samples analyzed have been found with different kinds of pesticides, some of which are banned, e.g., diazinon, lindane, endosulfan, methyl parathion, heptachlor and dieldren.[86] Pesticide residue of diazinon in cabbage ranged from 0.01 to 0.08 mg./kg. High residues of parathion in tomatoes were also detected. DDT residues have been detected in vegetables like stringbeans, eggplants, onions, carrots, sweet peas, etc., at a level of 1.8 mg./kg.

Increased pesticide use has also spawned problems of pest resistance. A large number of formerly effective compounds have been rendered useless against many insect pests. While comprehensive documentation on cases of resistance in the Philippines is currently unavailable, there are approximately 450 insect species worldwide which are resistant to insecticides, showing the gravity of the problem. Resistance, locally, is particularly pronounced in fruit and vegetable insects.

Currently, no national network exists which would enable government to monitor effectively user compliance with guidelines on importation, manufacture, sale and use of chemical inputs, specifically, pesticides. The problem of pesticides poisoning is aggravated by the lack of medical personnel adequately trained on diagnosis and treatment and inadequate understanding of farm folk of the nature and proper handling of farm chemicals.

Pesticide poisoning cases are largely monitored by government hospitals only. Such a situation results in scanty and incomplete data, particularly on chronic poisoning cases. For the period 1980-1987, only 4,031 poisoning cases were reported, 15% of which were fatal.

2.3 Conversion of Agricultural Lands Into Other Uses

Conversion of farmlands to other uses is irreversible and therefore means a permanent loss of agricultural resources. Agricultural land converted to urban and industrial uses account for the growing loss of the country's best soils. While the present rate of conversion is not particularly high, the hectarage of land lost are croplands of immeasurable value.

For the past ten years, conversion of agricultural lands to urban uses has been most evident at the periphery of large cities and fast growing towns such as Metro Manila, Cebu, Iloilo and Davao.

Residential subdivisions seem to be the most extensive users of land. The predilection of most new residential developments for suburban locations and their low and medium density have resulted in the outward expansion and suburban sprawl

Conversion of agricultural lands into urban and industrial uses account for the loss of the country's best soils.

Despite the significant contribution of agriculture to the national economy, a very minimal portion of the benefits go back to the farm workers.

of cities and major towns. From 1982-1988, a total of 1,583 residential subdivision projects were granted development permits, equivalent to 12,047.606 hectares.[87] Of these, 7,266 hectares or 60.31% were formerly agricultural areas as per tax declaration or an annual average of 1,211 hectares. Further, 475 hectares of these were irrigated agricultural land. A breakdown of the area and number of residential subdivision projects granted development permits for the period 1982-1988 is given in **Table 76.** Region IV ranks first as to number and area of subdivision projects granted development permits, followed by Region III (**Table 77**).

The extensive magnitude of land use change in the surrounding areas of Metro Manila is to be expected, considering that they are the logical catch basins for the Metropolis' growth overspill. Other than Negros Occidental, for example, most of the provinces where the extent of land conversion seem to be widespread are those surrounding Metro Manila, Cavite, Pampanga, Rizal, Laguna, etc.(**Table 78**). All together, they account for almost 70% of the total agricultural conversions to residential uses.

But while total converted agricultural lands appear insignificant compared to existing agricultural lands, the trend in land use change is quite disturbing. Taking into consideration the annual average land area (1,075 hectares) needed to meet housing requirements up to 1992, agricultural lands surrounding Metro Manila and other urban areas may not be able to resist the pressure of urbanization.[88] For in the process of conversion to higher category of land uses, agriculture invariably loses out to urban uses. Oftentimes, this translates into another problem. Agriculture, deprived of traditionally rich farmlands, tend to encroach upon marginally productive hilly forest areas. The over-all effect is a misappropriation of land resources. Fertile agricultural lands are lost to activities not requiring fertile soil, marginally productive upland areas are cultivated and forest areas continue to decrease in size.

2.4 Loss of Biodiversity

Prior to the onset of the Green Revolution, the Philippines had several hundred varieties of rice, including some wild species. Such diversity served as an insurance for survival against pests and natural calamities. Increased genetic uniformity through the planting of a limited number of high yield varieties (in the case of the Philippines, IRRI bred varieties or IR series) has threatened the country's genetic diversity and increased the likelihood of crop vulnerability to pests and diseases.

High yield varieties (HYVs) or more aptly, high response varieties because they can only increase yields with high fertilizer and biochemical inputs, had proven unstable in the face of new virulent insect attacks. Heavy tungro infestations have been recorded. The first miracle rice, IR-8, was wiped out by tungro in the 1970s.[89] In 1982, Palawan ricefields were infested with the Malaya rice bug, Scotinophara coarctata in epidemic proportions, forcing the IRRI and the DA to respond with a new variety, IR-1314. The variety IR-40 is likewise proving susceptible to tungro virus infestation, triggering attempts to replace it with IR-60. The latter, however, will require heavy insecticide applications.

Even with the substitution of more resistant varieties, pest infestation of HYVs was not totally eradicated. The second recorded disaster involved brown plant hopper

Table 76. Area and No.of Residential Subdivision Projects
Granted Development Permits by Region,
1982 - 1988

Region	Area (hectares)	No. of Projects
1	250.695	60
2	133.742	16
3	2,469.518	325
4	5,011.770	731
5	263.017	54
6	2,239.258	138
7	106.438	31
8	94.985	14
9	133.380	19
10	144.261	14
11	999.573	140
12	200.966	41
Total	12,047.606	1583

Source: HLURB

Table 77. Ranking of Regions as to Area and Number of Subdivision Projects Granted Development Permits

Rank	As to Area	As to Number
1	IV	IV
2	III	III
3	VI	XI
4	XI	VI
5	V	I
6	I	V
7	XII	XII
8	X	VII
9	II	IX
10	IX	XI
11	VII	VIII & X
12	VII	

Source: Housing and Land Use Regulatory Board

Table 78. Ten Leading Provinces as to Area and Number of Subdivision Projects Granted Development Permits, 1982 - 1988

Provinces	Residential Subdivision Projects Granted Development Permits					
	Area (ha.)	% Distribution	Ran	Number of Projects	%Distribution	Rank
Negros Occidental	2,013.64	16.71	1	94	5.94	5
Rizal	1,567.68	13.01	2	290	18.32	1
Cavite	1,386.79	11.51	3	128	8.09	4
Laguna	1,211.33	10.05	4	186	11.75	2
Pampanga	1,157.52	9.61	5	131	8.28	3
Batangas	621.71	5.16	6	67	4.23	9
Bulacan	626.49	5.20	7	73	4.61	7
Davao del Sur	542.88	4.51	8	77	4.86	6
Bataan	326.35	2.71	9	68	4.30	8
South Cotabato	293.06	2.43	10	37	2.34	10

Source: HLURB

outbreaks which wiped out extensive crops of HYVs. It remains one of the single most serious pests today. Stemborers, too, are turning out to be a very serious problem.

3. MANAGEMENT EFFORTS

Past governmental policies severely undermined the country's agricultural base. The adoption of western/temperate-based technologies that were heavily dependent on chemical inputs, mechanization and technical manipulative methods; excessive government intervention and monopolies; and, the neglect of rural infrastructure and support services were simply some of the onerous factors which left farmers with much lower net incomes than before and even unpaid loans in many instances.

3.1 Regulatory

Pesticides regulation, particularly regarding the health of formulation plant personnel, farmers, applicators and other pesticide users, is the concern of the Fertilizers and Pesticides Authority (FPA). Toxic waste disposal, siting and effluents discharge of formulation plants are regulated by the DENR, Laguna Lake Development Authority (LLDA) and the Housing and Land Use Regulatory Board (HLURB).

For the period 1980-1989, the FPA monitored pre-harvest pesticide residue limits but had not come up with conclusive results. Other agencies like the Bureau of Plant Industry (BPI), the LLDA and the NPCC the (DENR from 1988 to present) likewise conducted pesticide residue monitoring but their results have been inconclusive.

3.2 Management Programs

__Sloping Agricultural Land Technology (SALT)__

During the mid-80s, the Mindanao Baptist Rural Life Center or MBRLC developed the Sloping Agricultural Land Technology or SALT, a farming system for areas with slopes of 8% or more using soil erosion control devices. The MBRLC has served as the Technology Resource Center for SALT ever since. Recognizing the technology's multifarious benefits, the Department of Agriculture encouraged its adoption by thousands of low-income farmers living in the marginal hillsides.

The technology was actively promoted in 1988 in the municipalities of Damalog, Cabanglasan, San Fernando, Talakong and Malaybalay in Bukidnon. Currently, there are 136 SALT projects in the province covering an area of 1,600 hectares, with the biggest in the Monastery of Transfiguration, in San Jose, Malaybalay. SALT holds great promise for soil erosion prevention, increasing soil fertility and improved land capability.

__Small Water Impounding Projects (SWIP)__

Mandated initially by Letter of Instructions No. 408 in 1975 as "the first line of defense against floods", the Small Water Impounding Projects or SWIPs have since then been recognized by government as playing an important role in the conservation, Magsaysay. From these, parent materials were selected from which will result new rice varieties with resistance to insects and diseases and generate high grain yield of good quality but requiring low inputs.

Land Resources Evaluation Project (LREP)

To generate and update data on land resources needed in agricultural development activities, the Department of Agriculture, in cooperation with the various provincial governments, undertook the Land Resources Evaluation Project or LREP. The project specifically assesses "land forms, soil, climate, hydrologic regimes, erosion and land degradation, existing land use and vegetation". Crops, farm management practices, farm productivity levels, features of farming households and communities, status of social and institutional services, are also studied by the project.

4. PROSPECTS

The past decade simply brought to the fore environmental and other issues confronting the agricultural sector. All these issues underscore the fact that for sustained productivity of the country's agricultural lands, certain basic criteria must be met such as the maintenance of soil stability and fertility; assurance of adequate water supply; protection of land and water resources against pollution; and, regulation of cropping systems for optimal sustainable yields.

The government's Strategy for Rural Development, which takes cognizance of "the mutually reinforcing complementation of agriculture and industry" in the country's achievement of sustained economic growth, promises to directly tackle some of these concerns. It advocates correction of certain policies which have heretofore worked against agriculture. Of particular relevance here are the policy statements on resource use and management. The Strategy states: "The proper management and conservation of the country's natural resources will ensure their sustainability for productive use. This entails the promotion of cultivation methods which build in judicious use of land, forest and marine resources, along with more effective enforcement of conservation laws. These are essential if we are to sustain the viability and productivity of the natural resource base over the longer term".

In addition, the Strategy explicitly takes cognizance of the security of tenure for the small farmer as the key to increased agricultural growth. To this end, agrarian reform, "which will ensure equitable access to land and its benefits and consequently encourage the judicious use of these resources", has been made an important element of the strategy.

The Strategy likewise stresses the following:

- Promotion and use of technologies that enhance and preserve the environment such as the Integrated Pest Management method;

- Provision of alternative livelihood opportunities for the landless, shifting (slash-and-burn) cultivators in the uplands, illegal occupants of forest and pasture areas, and subsistence fishermen in overfished coastal waters; and

- Conduct of an intensive educational campaign to motivate the citizenry to assume greater responsibility for the protection of the environment.

Coupled with trade, taxation, macroeconomic and exchange rate and transport policy reforms, among others, the above are envisioned to bring about change in the agricultural sector and sustainable development in the rural areas. What is needed now is the political will to see through the Strategy's implementation.

MINERAL RESOURCES

1. PROFILE

The Philippines is endowed with vast mineral resources and is considered to be one of the highly mineralized countries in the world in terms of minerals per unit area of land.

Currently, the country has sufficient amounts of mineral reserves to support the growth of the mining industry. In 1987, total mineral ore reserves were estimated at 31.27 billion metric tons, 6.11BMT for metallic and 25.16BMT for non-metallic mineral ores. The most abundant among the metallic ore reserves is copper which accounts for 61%, followed by nickel, iron and gold at 27%, 8% and 1%, respectively. Of the non-metallic ore reserves, limestone accounts for 36%, cement raw materials for 25%, marble for 16% and silica rock for 5% (**Table 79**). Minerals, however, unlike some of the other natural resources, are non-renewable. Projections made a decade ago show that the country's copper reserves could be depleted by the year 1996, gold by 2020, iron by 2065 and chromium by the year 2014 unless new deposits are found.

The mining industry continues to be a major contributor to the national economy despite the fluctuating economic trends it has been experiencing locally and abroad. Presently, there are 10 primary producers of gold, 17 producers of silver, 7 producers of copper concentrate, 1 producer of metallurgical chromite concentrate and 2 producers of beneficiated nickel ore (**Table 80**). The industry has modestly contributed to the economy in terms of foreign exchange, taxes and employment opportunities. From 1980 to 1988 the industry's contribution to the gross domestic product averaged P1,852.22 million with the highest contribution recorded in 1980 at P2,236 million and the lowest in 1987 at P1,547 million (**Figure 40**). The industry also employed an average of 121.75 thousand people from 1981 to 1988.

Total exports of mineral products have decreased from $1.031 billion in 1980 to $.224 billion in 1987 but showed a significant increase of 71% or $.383 billion in 1988. The only other time that the industry realized positive growth was in 1986 when exports increased by 10%, from $.243B in 1985 to $.267B in 1986. The combined effects of worldwide recession and the softening of metal prices in the latter part of 1980 dampened the overall growth of the mineral sector.[90]

Other than diminishing reserves, the mining sector is facing and actually creating problems affecting other environmental sectors. Mineral extraction and utilization, for example, have detrimental consequences on the country's ecological conditions. Environmental quality deteriorates due to the air and water pollution generated by mining, panning, and milling activities.

2. ISSUES AND PROBLEMS

The government is currently in a predicament on how to balance the effects of stringent environmental control requirements vis-a-vis the impact(s) such action would have on the national economy.

Table 79. Mineral Ore Reserves, 1981-1989
(000 MT)

Kind of Ore	1981	1982	1983	1984	1985	1986	1987	1988	1989
Total	34,650,919	34,781,294	33,876,975	30,669,245	31,104,817	31,211,443	31,272,626		
Metallic	10,248,615	10,314,690	9,910,498	6,219,016	6,366,518	6,253,960	6,113,822		
Cadmium	47	47	47						
Chromite	96,716	91,576	93,106	32,941	32,072	30,115	29,824		27510
(Metallurgical)	87,599	8,106	8,474	12,701	12,365	10,443	11,884	11,392	
(Refractory)	9,117							4,168	
(Chemical)				3,318	3,242	3,226	2,800	2,800	
Copper	4,333,813	4,310,620	4,212,316	3,997,674	4,092,439	4,017,190	3,881,255		4105662
Gold	1,933,140	2,108,260	1,840,610	100,637	101,048	101,920	101,557		108968
Iron	1,319,391	1,331,093	1,303,447	474,362	474,362	474,362	474,362		
(Aluminum laterite)	292,011	292,011	292,010	292,010	292,010	292,010	292,010	292,010	292010
(Laterite)	783,878	798,679	769,849						
(Lump ore)	123,278	120,179	121,364	80,732	80,732	80,732	80,732	80,732	80732
(Magnetic sand)	120,224	120,224	120,224	101,620	101,620	101,620	101,620	99,110	101619
Lead	9,237	9,318	9,472	6,313	6,313	6,313	6,313	6,313	6313
Manganese	7,535	7,537	7,536	1,397	1,396	1,179	1,396	1,287	
Mercury	15,897	15,897	15,897	16,243	16,243	16,243	16,243	16,243	16242
Molybdenum	765,515	670,980	658,390	30,608	30,608	30,608	30,608	30,608	30608
Nickel	1,751,007	1,752,120	1,753,132	1,552,678	1,605,874	1,569,867	1,566,101		1585536
Platinum	942	942	942						
Uranium	90	90	90						
Zinc	15,285	16,210	15,513		6,163	6,163	6,163	6,163	

Table 79. (Continued)

Kind of Ore	1981	1982	1983	1984	1985	1986	1987	1988	1989
Non-Metallic	24,402,304	24,466,604	23,966,477	24,450,229	24,738,299	24,957,483	25,158,804		
Asbestos	24,498	24,498	24,498	24,498	24,498	24,498	24,498	24,498	24497
Barite	174	180	153	163	163	163	163	163	163
Cement raw materials	6,350,588	6,249,970	6,178,482	6,399,211	6,204,710	6,508,301	6,507,569	7,348,168	7348167
Clay	1,088,073	1,076,390	1,068,749	1,088,504	1,117,880	1,121,967	1,121,963	1,126,965	1126964
Coal									
Construction materials	655,607	656,710	649,932	687,882	691,003	689,487	689,011	698,280	689280
Diatomaceus earth	3,903	3,903	3,903	3,903	3,903	3,903	3,903	3,903	3902
Dolomitic limestone	264,578	271,672	267,832	256,577	488,388	489,107	488,758	259,816	259816
Feldspar	30,038	32,298	31,148	29,393	29,392	29,388	29,380	29,380	29380
Gypsum	1,884	1,884	1,884	1,883	1,883	1,883	1,883	1,883	1882
Limestone	9,633,627	9,770,269	9,748,973	9,217,285	9,217,440	9,304,599	9,308,072		8923823
Magnesite	26,535	26,536	26,536	26,534	26,534	26,534	26,534	26,534	26534
Marble	3,955,039	3,970,772	3,942,974	4,155,251	4,154,944			4,047,024	4047024
Peat	2,016	2,016	2,016						
Perlite	18,518	18,526	18,748	18,513	18,509	18,509	18,509	18,509	18508
Pumice and pumicite	21,878	21,878	21,878	21,878	21,878	21,878	21,878	21,878	21878
Pyrite	987,257	987,470	987,757	987,120	987,016	988,584	988,482	991,530	971530
Quartz	511,267	510,390	511,734					9,733	
Rock asphalt									
Saprolite									
Silica rock	13,876	13,876	13,876						
Silica rock form					1,207,922	1,007,912	1,207,840	1,207,840	1207840
Silica sand	782,992	797,410	435,448	92,403	107,921	114,605	113,717	133,717	113716
Sulphur	29,453	29,453	29,453	29,453	29,454	44,011	44,011	44,011	44010
Talc	503	503	503	503	503	503	503	503	502
Silica pebbles/cobbles				6,822	6,818	6,806		6,804	
Bauxite				82,650	82,650	82,650	82,650	82,650	82649
Bentonite				667	1,182	1,382	1,381	1,380	1381
Guano				815	815	1,014	1,014	1,014	1013
Limestone for agriculture				310,547	310,545	312,458	312,949	312,949	262448
Rock phosphate				2,346	2,346	2,407	2,407	2,407	2407

Source: Philippine Statistical Yearbook, 1989

Table 80. Mineral Producers

Producers	Product
Abcar Paragon Mining Corp. 1/	Gold
Apex Mining Company Inc.	
Atok Big Wedge Mining Co., Inc. (BC)	
Benguet Corporation	
Benguet Exploration Inc.	
Itogon-Suyoc Mines Inc.	
Manila Mining Corporation	
Masbate Gold Operation (ACMDC)	
Paracale Gold Operation (BC) 2/	
Siana Gold Project (Suricon)	
Abcar Paragon Mining Corp.	Silver
Amacan Copper Project (NDMC)	
Apex Mining Company, Inc.	
Atlas Cons. Mining and Dev. Corp.	
Atok Big Wedge Mining Co. Inc. (BC)	
Benguet Corporation	
Benguet Exploration Inc.	
Dizon Copper-Gold Opn. (BC)	
Itogon-Suyoc Mines Inc.	
Lepanto Cons. Mining Co., Inc.	
Manila Mining Corporation	
Marcopper Mining Corporation	
Maricalum Mining Corporation	
Masbate Gold Operation (ACMC)	
Paracale Gold Project (BC)	
Philex Mining Corporation	
Siana Gold Project (Suricon)	
Amacan Copper Project (NDMC)	Copper
Atlas Cons. Mining and Dev. Corp.	
Dizon Copper-Gold Opn. (BC)	
Lepanto Cons. Mining Co. Inc.	
Marcopper Mining Corporation	
Maricalum Mining Corporation	
Philex Mining Corporation	
Zambales Chromite Project (ACOJE)	Metallurgical Chromite Conc.
Hinatuan Mining Corp.	Nickel (Beneficiated Ore)
Rio Tuba Nickel Mining Corp.	

Source: MGB

Notes: 1/ Started production in August 1988.
2/ Started production on May 1, 1988.

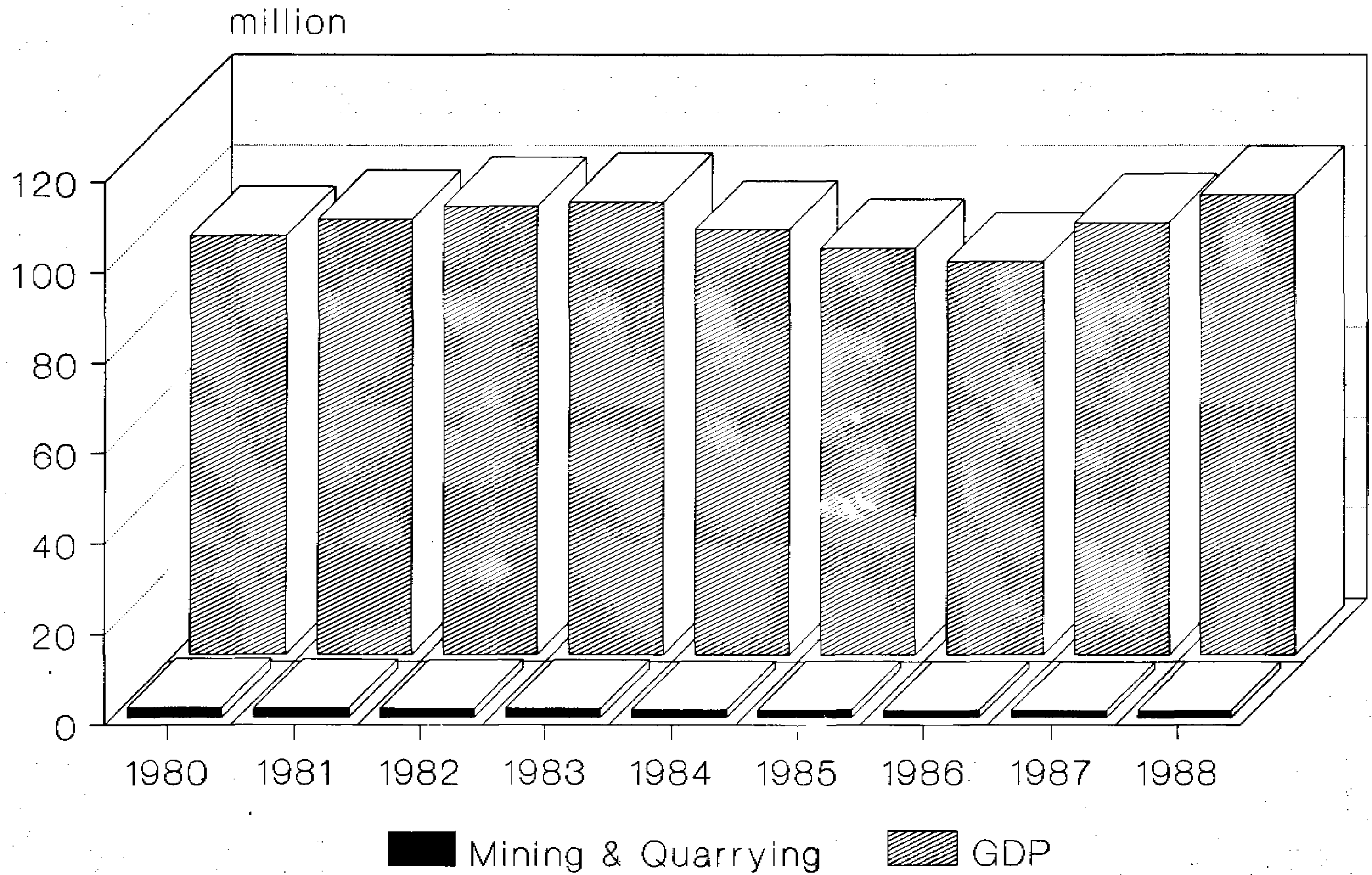


Figure 40. Contribution of the Mining Industry to the Gross National Product, 1980-1988

It is uncertain how many irreversible reactions were triggered by mining activities. It cannot be denied that the mining industry causes pollution and contributes to the general degradation of the environment and shall continue to do so even after mining operations have ceased. These problems can be observed in various places throughout the country. Land, sea and freshwater resources have been pressured continuously due to the extraction and processing of mineral ores and the disposal of mine tailings and wastes.

2.1 Mine Wastes and Tailings Disposal

The problem of tailings disposal has existed since the early 1950s. In 1977, the annual generation of tailings by mining firms was about 65.7 million dry metric tons (DMT). In 1985, mine wastes and tailings generated by all mining firms totalled 145.59 million MT. In 1986, mine wastes and tailings produced decreased by 37.6% to 90.8 million MT. A slight increase of 2.76% and 1.05%, however, were observed in 1987 and 1988 respectively (**Table 81**). Although the volume of mine tailings and wastes have been significantly reduced from 1985, their subsequent release into the environment continue to make them the main sources of land and water pollution.

This can best be exemplified by the volume of wastes and tailings discharged by the Baguio mining district. In 1985, mining companies in the district produced about 14.56 million DMT of mine tailings and mill wastes. These contributed significantly to the siltation of irrigation canals and paddy fields in the low lying areas of Ilocos Sur, La Union and Pangasinan. Mine effluents, placed in retaining areas like ponds and dams, are washed away during typhoons and heavy rainfall and eventually find their way into river systems resulting in the deposition of large quantities of silt which affect prime agricultural land, river systems and aquatic life.

Coastal resources are also affected by the disposal of mine tailings. In Marinduque, the build-up of the Calancan Bay causeway from Marcopper Mining Corporation's mine tailings has caused considerable damage to the bay's coastal resources. It is estimated that close to 113 million MT of tailings and wastes have been discharged into the bay from 1975 to 1986, covering about 45-50 sq. km. of the sea floor. This is equivalent to an area of 4500-5000 hectares.[91] Mill tailings discharged into the bay were also found to contain variable concentrations of mercury(Hg), silver(Ag), copper(Cu), zinc(Zn), nickel(Ni), lead(Pb), and cadmium(Cd).[92]

Table 81. Total Mine Wastes and Tailings
(metric tons)

Year	Mine Wastes	Tailings	Total	%
1985	76,284,765	69,312,589	145,597,354	
1986	35,707,400	55,149,293	90,856,693	-37.60
1987	40,267,282	53,100,997	93,368,279	2.76
1988	43,575,166	50,771,619	94,346,785	1.05

Source: MGB

From 1975 to 1980, the quality and quantity of the flora and fauna of the bay have been reduced significantly due to the continuous dumping of mine tailings. A Calancan Bay survey report by Synergistics Consultants, Inc. indicated that the dumping of mine wastes and tailings into the bay caused the degradation of the habitat of marine fishes and that a total destruction of the environment takes place in the inner vicinity of the tailings outfall. This can be exemplified by the decrease of invertebrate species from 26 in 1975 to 10 in 1980. Farther away from this total destruction zone, some species still thrive although they are mostly juveniles and immature.[93]

2.2 Siltation

A report by the National Irrigation Administration (NIA) in 1985 showed that in the irrigation systems of Regions I and II, 9,600 hectares (49%) out of 19,597 hectares, and 8,738(61%) out of 14,244 has. were affected by mine tailings during the wet and dry seasons, respectively. The communal irrigation systems (CIS) affected during the wet season totalled 457 has. of the irrigated 746 has. and 368 has. out of 568 has. during the dry season (**Table 82**).

The Agno river irrigation system (RIS) in Pangasinan suffered the worst siltation problem. The San Fabian RIS, Lower Agno Totonoguen RIS in Pangasinan and the Amburayan RIS in La Union, all in Region I, also encountered varying degrees of pollution due to mine tailings.

In Region II, the mine tailings coming from the Batong-Buhay gold mines in the early eighties polluted the river from which the Chico River irrigation project in Kalinga-Apayao diverts water for irrigation.[94]

NIA also reported in 1985 that out of the 1,173 kilometers of canals used for irrigation purposes, 84% or 993 km. were affected by mine tailings (**Table 82**). The heavy volume of silt coming from the tailings of mining companies upstream enters the system at the diversion works and is distributed throughout the facilities. The entire canal system, even if desilted completely at any stage in time, becomes heavily silted after one cropping season.[95] Desilting costs about P6,000 per kilometer for main canals and about P4,000 per kilometer for lateral canals. At these rates, it is estimated that desilting of affected canals every cropping season would cost around P6 million notwithstanding the losses incurred by low crop yield in affected areas.

2.3 Heavy Metals Pollution of Irrigation and River Systems

Heavy metals pollution is another problem posed by the disposal of mine wastes and tailings. A water quality evaluation made on the Agno river irrigation system (ARIS), Lower Agno-Totonoguen river irrigation system (LATRIS) and Agno river irrigation system extension (EXTN), showed that the trace heavy metals in the water were boron(B) and copper(Cu)[96]. The high rate of sediment deposition at ARIS, which was established at 56.5 tons per hectare per year as against that of LATRIS and EXTN which was 9.6 tons/ha/yr and 6.3 tons/ha/yr, respectively, showed that the concentrations of Cu in ARIS soil is higher at 36.85 ppm compared to LATRIS and EXTN which have less than 1.0 ppm (**Table 83**). The continued sediment deposition could build up the concentration of copper in the soils being serviced by ARIS, posing

Table 82. Irrigated Areas and Canals Affected by Mine Tailings in Regions I and II, 1984-1985

Irrigation Systems	Location	Region	Irrigated Area(ha)		Affected Area(ha)		Total Length of Canal (km)	Length of Canal Affected (km)	
			WS*	DS**	WS	DS		WS	DS
A. National Systems									
1. Agoo	Urdaneta, Pangasinan	I	10,037	4,786	3,683	3,683	226	226	226
2. Amburayan	Sudipen, La Union	I	3,489	2,120	3,489	2,120	51	23	23
3. Chico	Tabuk, Kalinga-Apayao	II	6,071	7,338	2,428	2,935	488	436	436
	Sub-Total		19,597	14,244	9,600	8,738	1,143	963	963
B. Communal Systems									
1. Baluyot	San Nicolas, Pangasinan	I	93	93	93	2	2	2	2
2. Bued	Agoo, La Union	I	578	400	289	200	25	25	25
3. Carabucob	San Nicolas, Pangasinan	I	75	75	75	75	3	3	3
	Sub-Total		746	568	457	368	30	30	30
	Grand Total		20,343	15,812	10,057	9,106	1,173	993	993

Source: NIA

* Wet Season

** Dry Season

the probability of reaching toxic levels in 20 years time. Zinc, arsenic, nickel, lead and cadmium were also detected in other rivers around the Baguio Mining District such as the Patalan and Dagupan (See **Inland Waters**).

Mindanao rivers such as the Hijo, Tagum, Agusan and Ngan rivers exhibited high mercury content ranging from nil to 1.01 ppb, exceeding set standards in many instances.

In Pagsanjan, pollution also affected the Balanac River due to sand and gravel quarrying. Results of the laboratory analyses made in September, 1989, showed that the firm's final effluent had a value of 5,000 units for color and 2,190 mg/li for suspended solids, way above the 1982 effluents regulation standard. Analyses made by the Environmental Management Bureau showed that dissolved iron was 147 mg/li and manganese was 288 mg/li, again exceeding the effluents regulation standards. The presence of these trace elements was attributed to the mineral composition of the raw materials.

2.4 Effects of Small-Scale Mining

Another problem generated by the industry which affects the environment is the continuing proliferation of small-scale mining activities nationwide. Unregulated small-scale mining has proven to be detrimental not only to the miners but also to the different ecosystems wherein they are undertaken. The problems correlated with this activity are the uncontrolled use of toxic chemicals, deforestation and soil erosion.

The discovery of gold in Mindanao in the early 1980s, particularly in the province of Davao, encouraged thousands of people to abandon their traditional livelihoods to seek fortune in gold rush areas. While the industry has decidedly upgraded the economic conditions of many of the miners, it has generated attendant problems particularly concerning health and the environment. Gold miners process the ore using the crudest method of gold extraction, amalgamation. They improperly use mercury during gold smelting and wantonly dispose mercury wastes into the environment. It has been estimated that about 26 tons of mercury are dumped annually into bodies of water which drain to the Agusan river and ultimately into Butuan Bay in the northern part of Mindanao and into Davao Gulf in the south.[97] These areas are considered rich fishing grounds. The rampant use of mercury poses not only a direct health threat to gold processors but to the general population, as well.

Landslides, although intermittent, have devastated several of these mining areas. In 1985, more than 200 miners and dependents have been killed by a landslide in Diwalwal, Davao del Norte. The cause was attributed to the movement of water-saturated soil along mountain slopes destabilized by small-scale mining operations, deforestation and heavy rains.[98] In 1988, another major landslide occurred in adjacent Balete District, also in Diwalwal, and buried some 200 to 250 miners and traders under 8,000 to 10,000 cubic meters of soil, mud and debris.

2.5 Degradation of River Systems by Sand and Gravel Quarries

Sand and gravel quarrying is another extractive activity which causes considerable damage to the environment. Extraction of materials from the river banks removes the barrier that protects outlying areas from sudden and abrupt onrush of floodwaters.

Many rivers and coastal waters have been silted due to eroded soil from strip-mining operations and improperly discharged tailings. Also, landslides from stripped areas often make roads impassable for long periods.

Mining has likewise spawned problems of heavy metals pollution, particularly from tailings of big mining companies and mercury used by small-scale gold panners.

The country's various river systems, pockmarked by sand and gravel quarrying operations, are witness to this wanton degradation. The situation is aggravated by the proliferation of persons and even companies, engaged in illegal sand and gravel extraction.

In Talisay, Cebu, the Mananga River and its immediate environs deteriorated as a result of the indiscriminate sand and gravel quarry operations in 1982. The riverbank has been extensively widened and the depth of the extraction which has been predetermined at 3 meters, extended by about 8 meters from the surface and the river embankments encroached towards private lands. The unsystematic extraction of the sediments resulted to the sporadic distribution of potholes in the Jaclupan area, the site of extensive sand and gravel excavations. Changes in the flow of the river became noticeable because of its turbulent nature.

In 1983, the whole stretch of the Lower Mananga River was recommended for declaration as a "danger zone" where all sand and gravel projects should be banned. As a consequence, the Lower Mananga River was recommended for closure to sand and gravel permit applications and processing operations like crushing and washing from that year until the present.

In 1989, the sand and gravel quarry operations of a company undertaken in Concepcion, Marikina, was found to have significantly altered the natural conditions of the mining site. Even after quarrying was suspended, the operations left behind craterlike holes, some of which were 50 meters in diameter and 5 meters deep. The quarrying resulted in the formation of an uneven streambed, giving rise to stream turbulence and flooding. It also resulted in the scouring of the banks, thereby increasing the probability of the river changing its direction and the possibility of affecting nearby and outlying agricultural and residential lands.

In Naugsol, Subic, Zambales, an inspection made by the monitoring team of the Environmental Management Bureau and the DENR Region III Office in 1988, on the sand and gravel quarry of a construction corporation in the Matain River, showed that its wastewater was being discharged directly to the river without any form of treatment, totally deteriorating water quality downstream. Deep excavations at the Matain riverbank were also noted and were expected to destroy its embankments unless rehabilitation measures were implemented. Another potential problem noted was the existence of a dam erected by the National Irrigation Administration which could be adversely affected by silt due to sand and gravel operations in the area.

3. MANAGEMENT EFFORTS

3.1 Policies and Regulatory Efforts

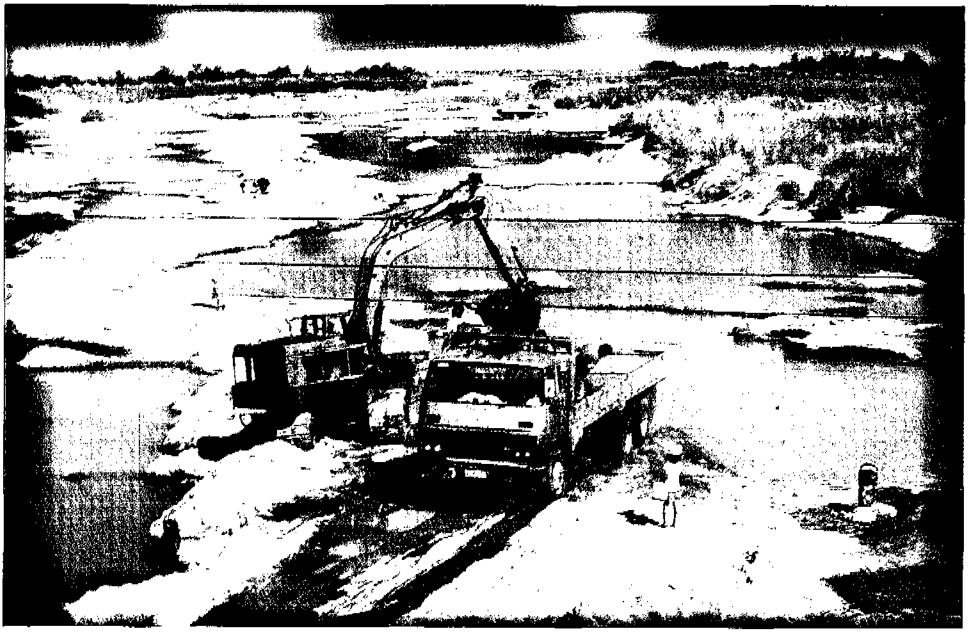
Environmental Impact Assessment

Several presidential decrees were issued in the late 70s which gave emphasis to the protection of the environment and conservation in the mineral resources sector. It particularly stressed the protection of life and property, economy of operations, prevention of pollution, environmental protection and mineral conservation. Preventive planning strategies were also adopted, foremost of which was the Environmental

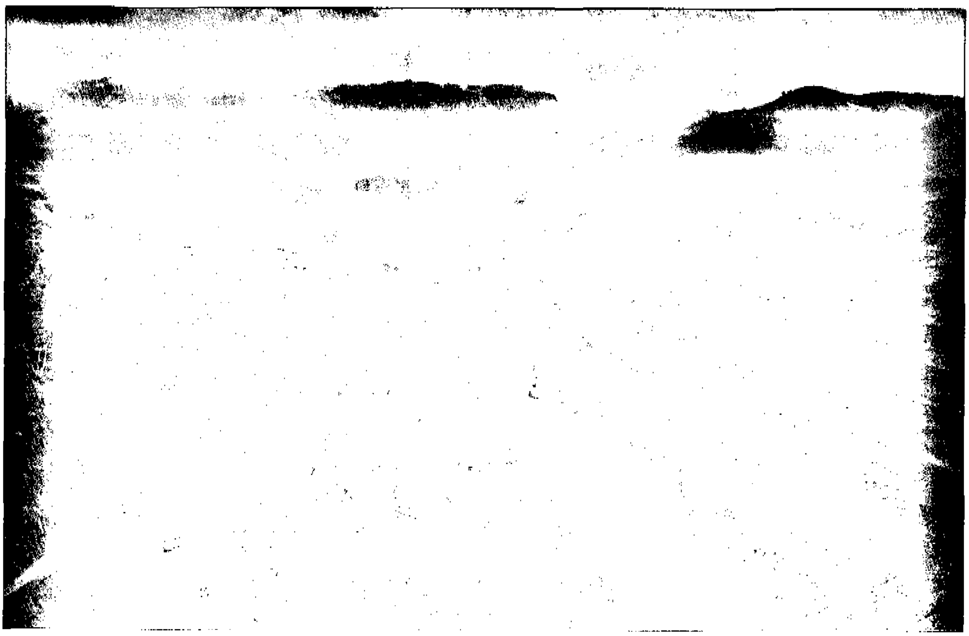
Table 83. Characteristics of Soil in ARIS, LATRIS and EXTN

	Characteristics						
	Physical			Chemical			
	Soil Condition	Seepage & Percolation (mm/day)	Infiltration Rate Ca (mg/kg)	Salinity Electrical Conductivity of Soil	Fertility Total N (%)	Available P (ppm)	Toxicity Cu (ppm)
ARIS	Silty clay loam	7.5	8.9	0.72	0.097	1.28	36.85
LATRIS	Silty clay	8.5	10.4	0.23	0.121	8.43	0.69
EXTN		12.2	16	0.67	0.143	8.63	0.37

Source: Castaneda A.R. and S.I. Bhuiyan. 1988. Industrial Pollution of Irrigation Water and its Effects on Riceland Productivity. Philipp J. Crop Sci. Vol. 13, No.1.



The damage wrought by sand and gravel activities has become more pronounced during the past decade, forcing government to ban quarry operations in many river systems.



Open pit mining operations have stripped vast tracts of lands of their vegetation, causing soil erosion.

Table 84. Summary of Processed Claims for Damages (1981-1989)

Year	No. of Claims Processed	No. of Claims Compensated	Total Amount of Compensation (pesos)	No. of Claims Denied
1981	104	53	211,173.67	51
1982	108	101	208,352.77	7
1983*	NO	RECORDS	AVAILABLE	
1984	128	127	213,682.56	1
1985	1,004	999	2,026,245.60	5
1986	145	36	109,625.64	109
1987	553	407	333,563.00	146
1988	270	253	925,705.91	17
1989	265	237	1,333,027.44	29
Total	2,577	2,213	5,361,376.59	336

Source: MGB

* No data for 1983 due to the burning of records in a fire that gutted the MGB building on August 10, 1984. 1981-1982 data were taken from the 1981, 1982 National Pollution Control Commission's unpublished Progress Reports.

Impact Assessment (EIA). Presidential Decree No. 1151 or the Environmental Policy Decree of 1977 and P.D. No. 1586, required proponents of development projects with significant impact on the environment to conduct environmental impact assessments and submit a report of their findings in the form of environmental impact statements.[99]

From 1980-1989, metallic and nonmetallic mining projects subjected to the EIA process totalled 519 while the number of sand and gravel projects reviewed reached 4366.

Mineral Resources Development Decree of 1974

P.D. No. 463, otherwise as the "Mineral Resources Development Decree of 1974" requires conservation measures to be undertaken by lessees or mine operators to optimize mineral resources extraction, minimize wastage and prevent pollution in accordance with the most modern practices. It also requires that mined or leased areas be placed in a condition suitable for habitation or agriculture and free from dangers of cave-ins, slides and other risks due to mining operations.

Mines Administrative Order No. 20, Series of 1977

The Mines and Geosciences Bureau, aware of the negative consequences of mining operations promulgated Mines Administrative Order No.20, Series of 1977. This complements government efforts to protect the environment especially on the mineral extraction sector. The salient features of this order are the restoration and rehabilitation of mined-out areas, creation of an environmental enhancement unit in mining companies and setting up of other industries in mining communities so as to provide people with livelihood even after the cessation of mining operations.

Mine Wastes and Tailings Decree

P.D. No. 1251, also known as the "Mine Wastes and Tailings Decree", imposes mine wastes and tailings fees on operating mining companies to compensate for the damage caused on private lands, crops and infrastructure by the said materials. This was implemented through Ministry Code No.1, series of 1979, by the former Ministry of Natural Resources (currently the DENR). The fees range from P0.05 to P0.10/MT of mine tailings, for companies with tailings ponds and dams and P1.00/MT for those without ponds or dams. As for mine wastes, the fee is P0.05/MT. From 1981 to 1989, the P.D. 1251 Executive Committee, which is charged with implementing the Decree, processed 2,577 claims and compensated 2,213 claimants for a total of P5,361,376.59 (**Table 84**).

3.2 Research and Development

From 1980 to 1987, the national government appropriated a total of P556,781,000 for the development of the mineral resources sector. Of this, however, only P13,167,000 or .02 percent was allotted for environmental research (**Table 85**).

Table 85. Budgetary Allocation for the Mineral Sector
(thousand pesos)

Year	Annual MGB Appropriations	Annual Appropriations for Environmental Protection	% Increase/ Decrease
1980	56,406	533	0.0094
1981	56,445	1,182	0.0209
1982	63,072	1,290	0.0204
1983	70,438	1,409	0.0200
1984	63,141	1,279	0.0202
1985	70,093	1,289	0.0183
1986	85,561	1,473	0.0172
1987	91,620	3,190	0.0348
1988	40,772	-	-

Source: GAA, DBM

Calancan Bay Rehabilitation

In 1988, Marcopper Mining Corporation was ordered by the Pollution Adjudication Board (PAB) of the DENR to cease and desist from dumping its tailings into Calancan Bay. Upon appeal by Marcopper to the Office of the President the PAB order was not implemented. Marcopper, however, was ordered to rehabilitate the causeway in Calancan Bay at a cost of not less than P30,000/day, under the supervision of the DENR-EMB and experts hired by the Department whose fees are to be borne by Marcopper. Following the order from Malacanang, PAB issued Resolution No.9 establishing the guidelines which Marcopper should follow in the preparation of the workplan for the rehabilitation of Calancan Bay. In accordance with Resolution No.9, Marcopper submitted to the Board its proposal for the rehabilitation of the bay. However, the proposal was found technically wanting by the Board, thus, an interagency group composed of Marcopper, DENR Region IV, Bureau of Fisheries and Aquatic Resources, Philippine Council for Aquatic and Marine Research Development (PCAMRD) was created to review and finalize the work program for the rehabilitation activities. The final work program is composed of five sub-projects namely: Project 1 - Mine Tailings Rehabilitation and Mangrove Reforestation, Project 2 - Seagrass Transplantation and Artificial Seagrass Systems, Project 3 - Artificial Reef Construction, Project 4 - Fish Yield Studies, Project 5 - Environmental Quality Monitoring (Water Quality and Bioassay). All the activities commenced on April, 1989, and are currently ongoing.

Task Force on Mercury Surveillance (Gold Mining in Davao)

The incidences of mercury poisoning and pollution particularly in Davao resulted in the creation of the Task Force on Mercury Surveillance in 1987. The Task Force, composed of the Department of Environment and Natural Resources, Department of Health, Department of Science and Technology and the Department of Agriculture, is currently undertaking an information, education and communication campaign in the identified troubled areas. Ten thousand posters in the vernacular were distributed and billboards posted in strategic places in the mining areas of Davao del Norte. The Mines and Geosciences Bureau of the DENR distributed retort units for field demonstration in all regions where the use of mercury were most prevalent. An Administrative Order to control the sale and distribution of mercury for smallscale mining operations has also been drafted.

4. PROSPECTS

Complementary to the development efforts in the mineral resources sector, the government, through the Department of Environment and Natural Resources, is pursuing an integrated approach to environmental management. For more than the attainment of its immediate goals for economic development, the government is committed to protect and conserve non-renewable resources in order that their utilization and exploitation can be sustained for future generations.[100]

Need for a New Mining Code

In 1986, the ratification of the Constitution paved the way for new policy directions in the administration of mineral lands and utilization of these resources. New modes of mineral resources management were introduced in the Constitution which, in effect, abolished the leasehold system being advocated by P.D. No. 463, otherwise known as the Mining Act of 1977. Congress, however, has yet to spell out the mechanics of these modes in the proposed New Mining Code. Policy ambiguities spurred by the absence of the Code or an enabling law necessitated the passage of Executive Order Nos. 211 and 279. E.O. No. 211 protects the existing mining rights under P.D. No. 463 and E.O. No. 279 and authorizes the Secretary of the Environment and Natural Resources to implement the constitutional provisions in behalf of the President when necessary. But such legislations are only viewed as shortterm measures. The New Mining Code is seen as a measure which offers more lasting solutions. One salient feature of the proposed Mining Code is its recognition of the high risk being posed by mining to the environment in terms of land disturbances, pollution of water bodies, contamination of groundwater aquifers and others. In this respect, the proposed mining code carries provisions for the strict implementation of environmental laws pertaining to mines.[10]

Minahang Bayan of 1987

Another pending legislation is House Bill No. 461, otherwise known as Minahang Bayan of 1987, which aims to establish a new program to encourage the judicious utilization of small mineral deposits through small-scale mining. The Bill is currently being deliberated upon by Congress.

ENERGY RESOURCES

1. PROFILE

The Philippine energy situation has been characterized by a high increase in total energy requirements averaging 2.23% from 1980 to 1989. The country's energy' situation is primarily characterized by its large dependence on imported oil.

The country's primary energy sources are oil, coal, hydropower and non-conventional sources like bagasse and agri-waste. Sixty four percent (64%) of oil is imported, and the remaining thirty-six percent (36%) is supplied by indigenous production (**Table 86**).

In 1980, the country's total energy consumption stood at around 97 million barrels of fuel oil equivalent (MBFOE). This decreased to 94 MBFOE in 1984. It started to increase in 1987 and by 1989, energy consumption was 119 MBFOE (**Figure 41**). Imported energy include oil and coal. There was a decreasing trend in the use of imported energy from 1980 to 1985. This trend reversed when imported energy use increased from 51.93 MBFOE in 1986 to 76.09 MBFOE in 1989 (**Figure 42**). Oil use in 1988 reached its highest level in years due to the combined effects of increased economic activities and price rollback. The period 1981-1986 witnessed an increase in the use of domestic energy. A decrease was registered in 1987 while the highest peak was in 1989 (**Figure 43**).

During the decade, there was a consistent positive relationship between the country's gross national product (GNP) and energy consumption. The annual GNP and energy consumption growth rate were almost at the same level except in 1980-1981 where there was a slight variation. Energy consumption during this period dropped while the GNP rose. In 1988, GNP and national energy consumption were of record levels (**Figure 44**).

From 1980 to 1989, cumulative crude oil production from Nido, Cadlao, Matinloc and Tara South oil fields amounted to 29.32 million barrels (**Table 87**).

The country's coal reserves had been placed at 354 million metric tons. From 328,786 metric tons in 1980, domestic coal production drastically increased to 1,019,594 metric tons in 1983 (**Table 88**). This could be primarily attributed to the mandated conversion to coal by industries. Total coal consumption reached its peak in 1985 at 4,450 MMBFOE of total energy consumption. Coal importation also increased at an average rate of 84% per year since 1983. The current industry and electric power generators are the major users of coal. Coal consumption continued to increase reaching 2.4 metric tons or 8.05 MBFOE in 1985, up by 4.4 percent from the previous year's level of 1.7 million (Table 89). The full conversion of the country's 17 cement plants to coal and the start of the operation of the 300 MW Batangas Coal-Fired Power Plant in September, 1987 were mainly responsible for increased coal consumption.[102]

Since 1972, a total of four geothermal power plants with a total capacity of 894 megawatts, have been installed. To date, there are four producing geothermal fields

Table 86. Historical Energy Mix
(million barrels of fuel oil equivalent)

	1980		1981		1982		1983		1984		1985		1986		1987		1988		1989	
	Vol.	%	Vol.	%	Vol.	%	Vol.	%	Vol.	%	Vol.	%	Vol.	%	Vol.	%	Vol.	%	Vol.	%
Indigenous Energy	27.42	28.31	26.31	28.15	30.21	31.65	34.02	34.55	39.11	41.70	40.58	44.08	41.35	44.33	38.16	38.06	40.27	37.24	42.94	36.06
I. Conventional	13.91	14.36	13.41	14.35	16.96	17.77	19.43	19.73	24.10	25.70	24.39	26.49	25.13	26.94	22.83	22.77	25.84	23.89	26.32	22.11
Oil	3.51	3.62	1.37	1.47	2.95	3.09	4.65	4.72	3.54	3.77	2.41	2.62	2.85	3.08	1.75	1.75	1.91	1.76	1.73	1.45
Coal	0.96	0.99	0.91	0.97	1.11	1.16	2.63	2.67	3.65	3.89	3.84	4.17	4.02	4.31	4.27	4.26	4.78	4.42	4.19	3.52
Hydro	5.94	6.13	6.38	6.83	6.65	6.97	5.12	5.20	9.10	9.70	9.61	10.44	10.37	11.12	9.00	8.98	10.80	9.99	11.26	9.46
Geothermal	3.50	3.61	4.75	5.08	6.25	6.55	7.03	7.14	7.81	8.33	8.53	9.26	7.89	8.46	7.81	7.79	8.35	7.72	9.15	7.68
II. Nonconventional	13.51	13.95	12.90	13.80	13.25	13.88	14.59	14.82	15.01	16.01	16.19	17.58	16.22	17.39	15.33	15.29	14.43	13.35	16.62	13.97
Bagasse	5.90	6.09	6.22	6.65	7.35	7.70	5.47	5.55	6.57	7.01	4.36	4.74	4.09	4.38	3.54	3.53	4.59	4.24	6.14	5.16
Agriwaste	7.60	7.85	6.34	6.78	5.82	6.10	9.05	9.19	8.25	8.80	11.63	12.63	11.65	12.49	11.23	11.20	9.33	8.62	9.92	8.34
Others	0.01	0.01	0.34	0.36	0.08	0.08	0.07	0.07	0.19	0.20	0.20	0.22	0.48	0.51	0.56	0.56	0.52	0.48	0.56	0.47
Imported Energy	69.45	71.69	67.16	71.85	65.25	68.35	64.45	65.45	54.67	58.30	51.49	55.92	51.93	55.67	62.09	61.94	67.87	62.76	76.09	63.92
Oil	69.45	71.69	67.16	71.85	65.25	68.35	63.54	64.53	52.64	56.13	47.28	51.35	49.76	53.34	59.58	59.43	64.13	59.30	72.47	60.88
Coal	-	-	-	-	-	-	0.91	0.92	2.03	2.16	4.21	4.57	2.17	2.33	2.51	2.50	3.74	3.46	3.62	3.04
Total Energy	96.87	100.00	93.47	100.00	95.46	100.00	98.47	100.00	93.78	100.00	92.07	100.00	93.29	100.00	100.25	100.00	108.14	100.00	119.03	100.00
Growth Rate, % over previous yr.		-0.56		-3.51		2.13		3.15		-4.76		-1.82		1.32		7.46		8.79		10.07

Source: Office of Energy Affairs, 1989

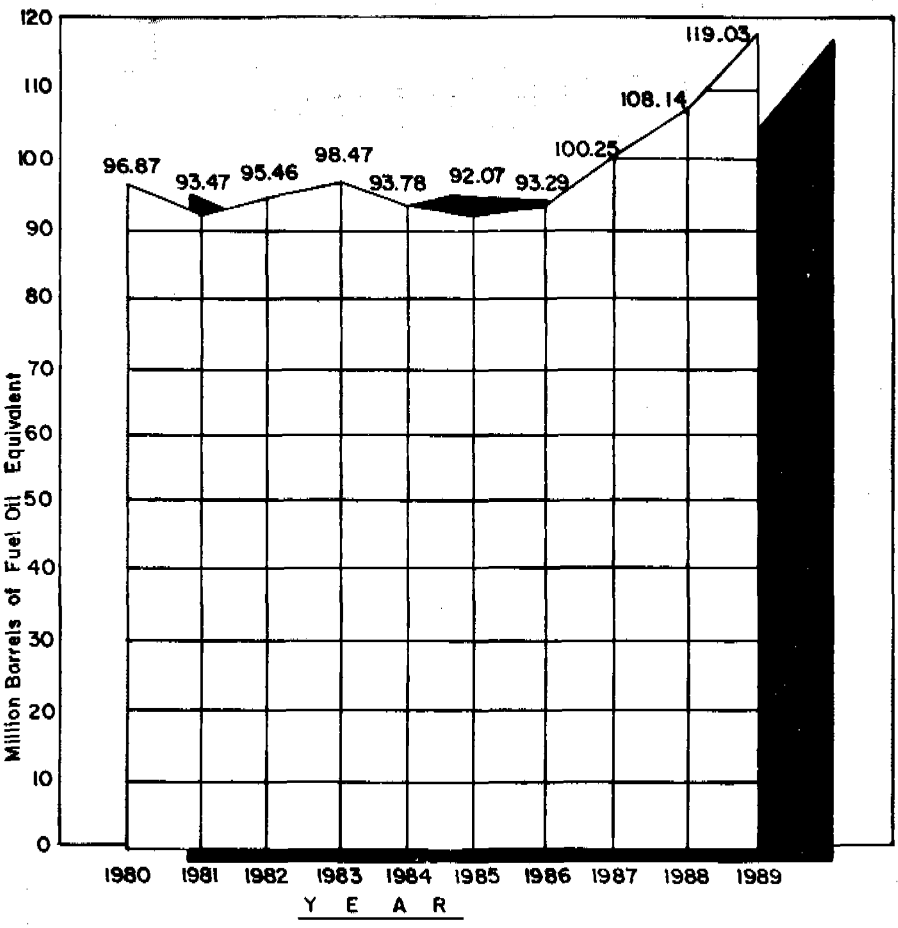


Figure 41. Energy Consumption, 1980-1989

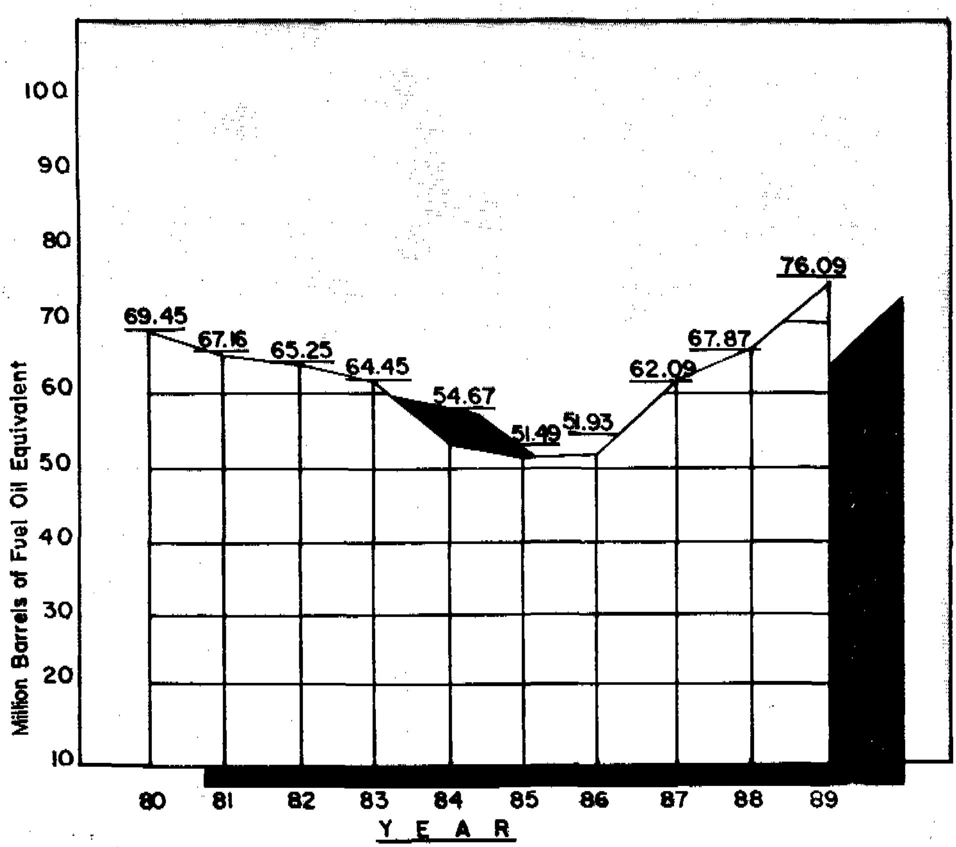


Figure 42. Imported Energy Consumption, 1980-1989

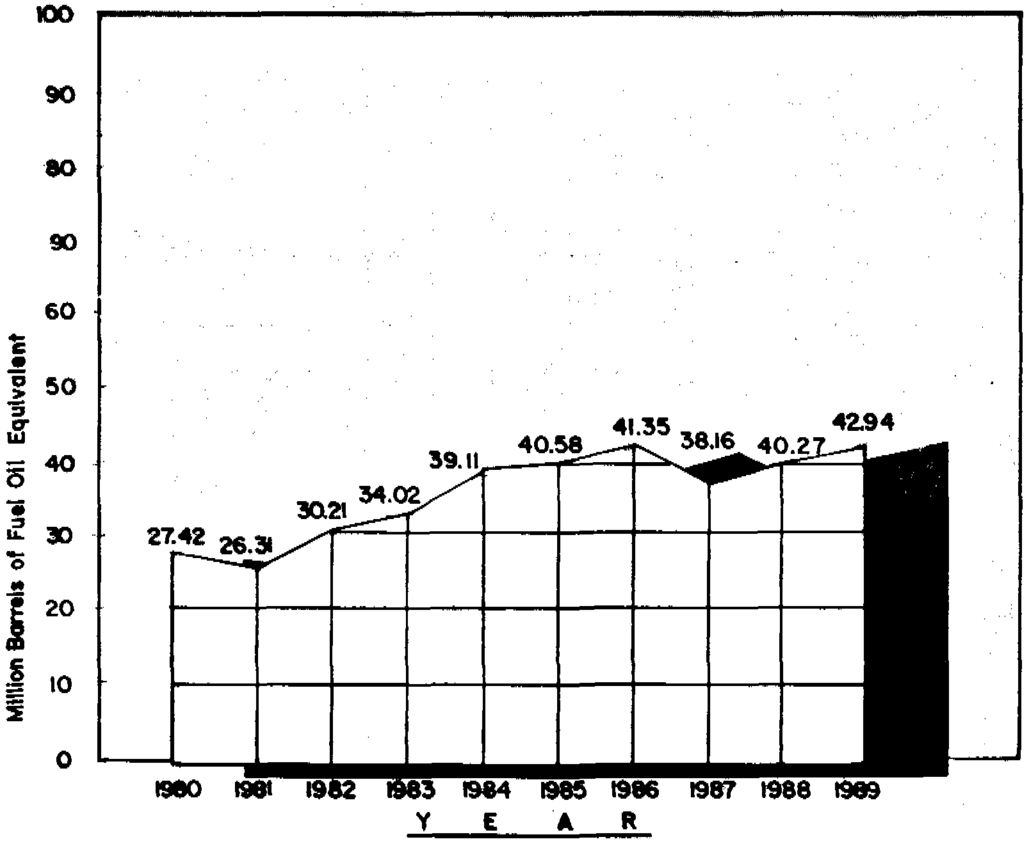


Figure 43. Indigenous Energy Consumption, 1980-1989

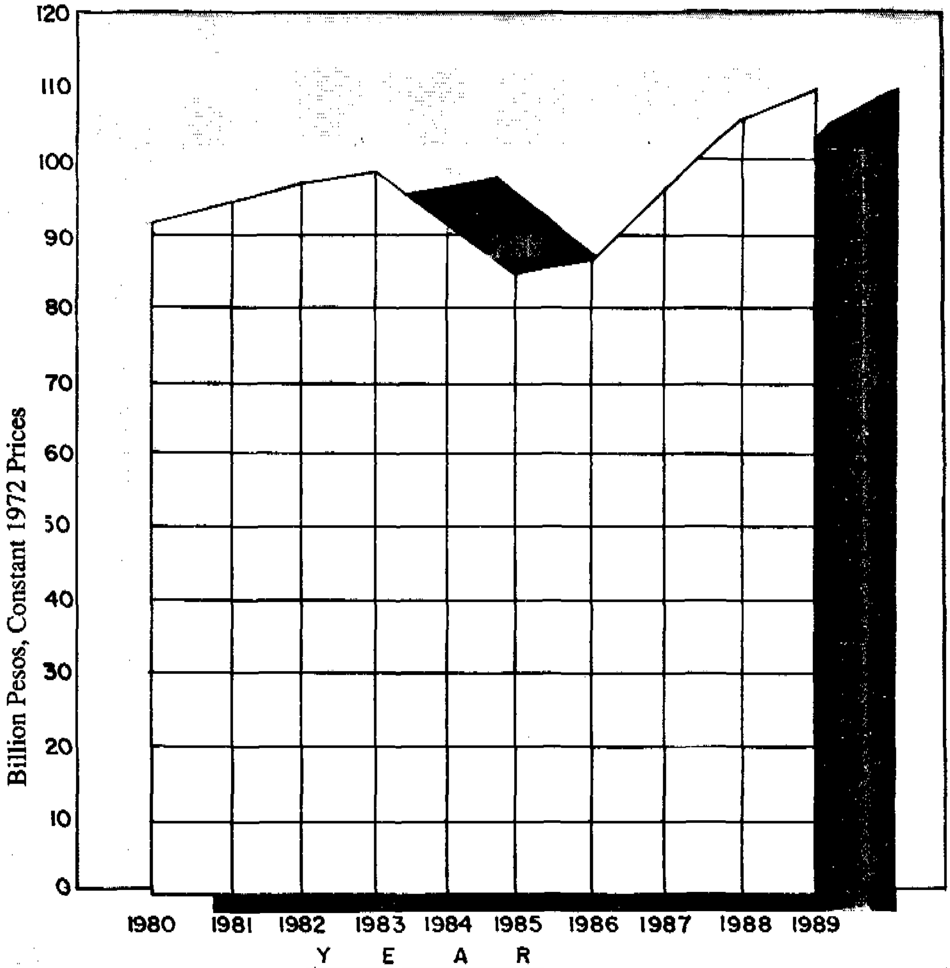


Figure 44. Gross National Product, 1980-1989

Table 87. Crude Oil Production
(MMBLS)

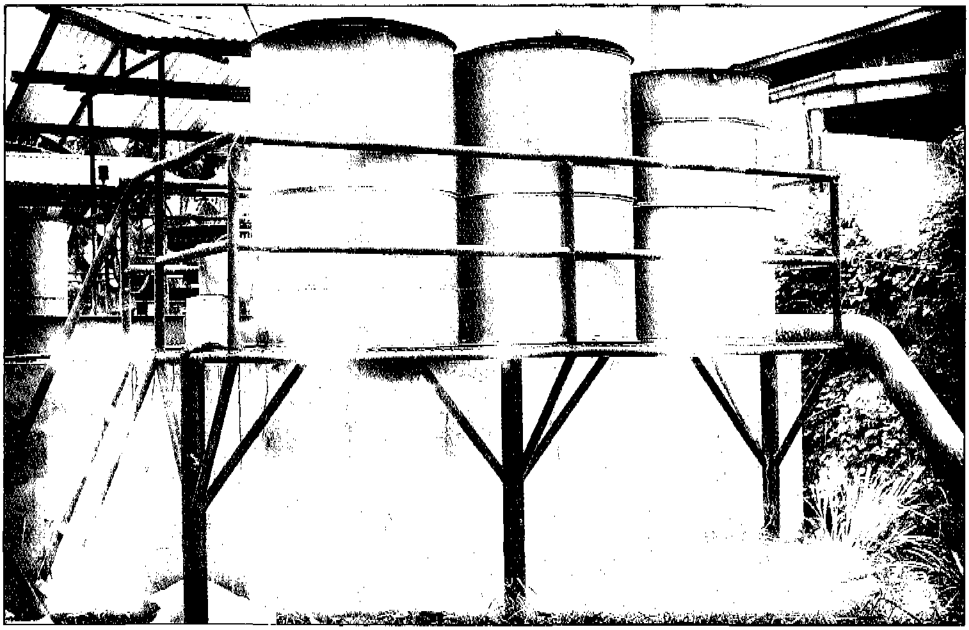
Year	Production
1980	3.62
1981	1.86
1982	3.57
1983	4.87
1984	3.89
1985	2.89
1986	2.52
1987	2.04
1988	2.18
1989	1.88
TOTAL	29.32

Source: The Philippine Medium Term Energy Plan 1988 - 1992

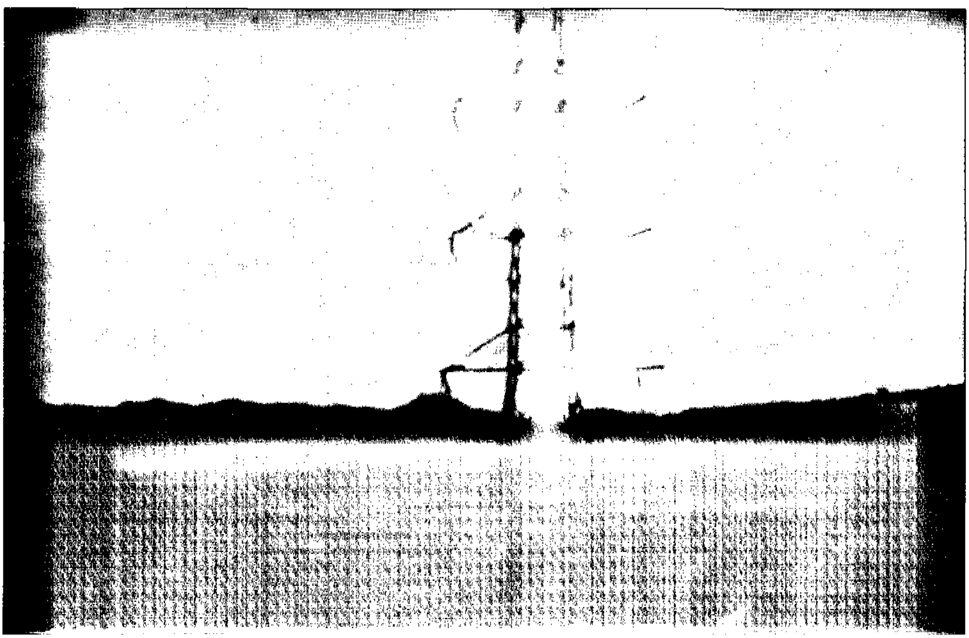
Table 88. Annual Coal Production and Reserves

	Annual Production (MT, r.o.m.)	**Reserves (million MT)** proven	potential
1980	328,786	186	1,690
1981	330,720	220	1,753
1982	557,983	263	1,538
1983	1,019,594	312	1,506
1984	1,216,388	337	1,535
1985	1,261,564	354	1,558
1986	1,235,503	354	1,558
1987	1,208,072	354	1,558
1988	1,335,687	354	1,558
1989	1,327,971	354	1,558
Total	9,821,818	354	1,558

Source: Philippine Medium Term Energy Plan 1988-1992



Biomass accounts for a significant portion of the country's non-conventional energy sources.



Electricity generation is dominated by oil, which supplies 43.21%. There was a significant increase in the use of coal for electric power generation in 1984.

Table 89. Coal Consumption by Major User: 1980-1989

User	1980	1981	1982	1983	1984	1985	19[illegible]
Total	553,028	515,657	331,728	1,056,287	1,692,310	2,393,547	1,238,853
Cement/Kiln Firing	155,003	145,322	152,004	435,838	802,918	663,710	449,333
Apo Cement Corp.	17,799	15,692	17,024	27,795	25,261	36,816	21,603
Bacnotan Const. Ind. Inc	15,270	29,727	24,997	22,397	58,147	34,229	37,540
Pacific Cement Corp.	37,549	35,652	49,220	53,005	56,437	38,338	21,819
Universal Cement Corp.	84,385	64,251	52,559	62,380	22,637	4,716	-
Central	-	-	-	4,010	25,747	20,076	18,691
Continental	-	-	-	13,573	31,212	25,029	20,500
Davao	-	-	-	17,818	56,519	68,653	53,632
Filipinas	-	-	-	2,750	74,756	31,163	-
Floro	-	-	-	25,451	47,241	47,324	17,376
Fortune	-	-	-	-	31,487	41,781	39,695
Hi-Cement	-	-	-	7,764	14,022	40,359	31,690
Iligan	-	-	8,204	39,594	50,917	47,099	29,271
Island	-	-	-	93,144	68,968	91,749	35,888
Midland	-	-	-	13,894	57,745	-	-
Northern	-	-	-	42,157	80,762	48,035	39,448
Republic	-	-	-	7,280	41,061	45,913	39,484
Rizal	-	-	-	2,826	60,001	42,430	42,696
Electric Power Generation	102,517	93,974	163,184	615,358	878,500	1,728,075	783,673
Atlas Mining	26,839	11,871	8,883	186,784	354,642	320,979	102,647
Lydu & Lu Yu Corp.	9,737	7,237	60,219	63,143	47,312	45,743	45,094
Visayas Elec. Corp.	52,378	51,477	34,770	26,278	32,998	6,767	6,021
Universal Cement	13,563	19,489	41,059	53,999	28,315	11,022	-
Bais	-	3,900	-	-	-	-	-
NPC	-	-	18,253	54,680	196,093	704,714	509,522
NMIC	-	-	-	230,474	219,140	614,606	105,011
Philphos	-	-	-	-	-	24,244	15,378
	-	-	-	-	-	-	-
Chemical/Metallurgical	271,801	245,267	-	-	-	-	-
Victorias Sugar	-	-	-	-	-	-	-
MCCI	7,115	12,494	-	-	-	-	-
Electro Alloys	3,443	5,202	-	-	-	-	-
Phil. Sinter	261,243	227,571	-	-	-	-	-
Industrial/Direct Process	23,707	31,094	16,540	5,091	10,892	1,762	5,847
Biophil(2)	23,707	31,094	16,540	5,091	10,892		

Source: Bureau of Energy Utilization

Note: From 1982 to 1984 users include those for energy generation purposes only; Chemical/metallurgical users are not included anymore.

1 - As of August.

2 - Prior to 1982, Biophil is included in electric power generation.

Table 90. Non-Conventional Energy Sources (million barrels of fuel oil equivalent, MMBFOE)

Resource/Technology	1980	1981	1982	1983	1984	1985	1986	1987	1988
Bagasse	5.90	6.22	7.35	5.47	6.57	4.36	4.09	3.54	43.50
Agriwaste	7.61	6.67	5.89	9.12	8.44	12.19	12.12	11.23	73.27
Coconut Husk Shell	1.71	1.74	1.22	3.50	3.15	5.52	6.92	6.22	29.71
Rice Husk	n.a.	n.a.	0.10	0.70	0.71	0.93	0.84	0.77	4.05
Wood/Woodwaste	5.40	4.16	4.18	4.43	3.99	5.17	3.89	4.24	35.46
Others	0.01	0.33	0.07	0.07	0.21	0.19	0.22	0.56	1.66
Black Liquor	0.49	0.44	0.32	0.42	0.38	0.38	0.25	0.34	3.02
Alcohol	0.01	0.02	0.03	0.02	0.03				0.11
Coconut Oil		0.30	0.03	*	*			*	0.33
Biogas	*	0.01	0.01	0.02	0.03	0.03	0.03	0.00	0.13
Producer Gas	*	*	*	0.03	0.15	0.16	0.19	0.01	0.54
Solar Water Heater	*	*	*	*	*	*	*	0.00	
Windmills	*	*	*	*	*	*	*	0.00	
Dendrothermal								0.19	0.19
Total	13.52	13.22	13.31	14.66	15.22	16.74	16.43	15.33	191.49

Source: Philippine Medium Term Energy Plan, 1988-1992

n.a.- not available

* - minimal

in the country: Tiwi in Albay, Makiling-Banahaw (Mak-Ban) in Laguna, Tongonan in Leyte and Palinpinon in Southern Negros. Geothermal energy contributed significantly to the total energy sources, displacing a total of 53.57 MMBFOE from 1980 to 1987.Hydroelectric power emerged as the country's single biggest conventional source of domestic energy in 1984, supplying about 9.10 MMBFOE or 9.62% of total energy demand. From 1980 to the present, hydropower plants with a total capacity of 1,204 megawatts have been installed. Among the country's noted hydropower plants are the Ambuklao, Bokod in Benguet, Angat in Bulacan, Caliraya-Lunot in Laguna and Maria Cristina in Iligan, Lanao del Norte.

The country's non-conventional energy sources include bagasse, agri-waste, alcohol, coconut oil, biogas, solar, windmill and dendrothermal. Biomass energy accounts for a significant 61.2% of total non-conventional energy used. It is composed primarily of bagasse (23%) and agri-industrial waste (38.2%). **Table 90** gives a breakdown of the non-conventional energy sources.

The largest consumer of energy is the industrial sector which accounted for 44% of the total in 1989, followed by the transport sector at 35%, and the residential/commercial sector at 17% (**Table 91**).

Petroleum products consumption was highest in 1980 (53,623 thousand barrels) and lowest in 1985 (33,102 thousand barrels). An increasing trend in petroleum consumption could be noted from 1985 to 1988 (45,071 thousand barrels). The power industry is the largest consumer of petroleum products (**Table 92**).

Electricity generation is dominated by oil, which supplies 43.21%. Hydropower accounts for 25.18%, geothermal 20.45%, coal 9.62% and non-conventional energy sources, 1.52% of the country's electricity production in 1989. There was a significant increase in the use of coal for electric power generation in 1984 (**Table 93**).

2. ISSUES AND PROBLEMS

2.1 Adverse Environmental Impacts of Energy Development and Utilization

Geothermal

Geothermal development usually occurs in mountainous areas, with primary and secondary forest growth and river systems supporting lowland communities, which are likely to be impacted. Potential effects from geothermal development include both short and long term impacts. Short term impacts arise from the exploration, drilling and construction phases while the long term impacts are generated by the energy production and operation phase of the project. The short term environmental impacts of geothermal projects include devegetation of the area, soil erosion and land alteration. The latter's effects could be significant, considering the coverage involved. For example, the actual surface area utilized by existing geothermal projects like Tiwi is 81 has., Southern Negros Geothermal Plant, 60 has., and Bacon-Manito Geothermal Plant, 90 has. Four hundred and fifty hectares (450 has.) is proposed to be utilized for the Mt. Apo Geothermal project.[103]

Table 91. Sectoral Energy Consumption: 1980-1989

	Residential/ Commercial	Industry	Transport	Others	Non-Energy	Total
1980	13.3	46.9	34.6	0.9	4.2	100
1981	13.7	46.7	34.4	1.0	4.2	100
1982	13.9	44.7	36.5	1.1	3.8	100
1983	14.0	47.7	33.5	0.9	3.9	100
1984	15.5	42.4	37.3	1.3	3.4	100
1985	15.8	44.4	34.8	1.6	3.3	100
1986	15.1	46.6	34.2	1.4	2.7	100
1987	14.3	51.1	31.5	1.4	1.7	100
1988	17.0	47.3	32.2	1.3	2.2	100
1989	17.4	43.8	35.4	1.3	2.1	100

Source: Office of Energy Affairs, 1989

Table 92. Petroleum Products Consumption by Industry
(thousand barrels)

	1980	1981	1982	1983	1984	1985	1986	1987	1988
Cement	3,362	3,030	3,186	2,117	319	116	160	396	547
Sugar	1,167	1,166	1,119	952	630	602	704	812	904
Coco and Vegetable Oil	1,026	983	772	653	185	201	200	256	281
Mining	4,244	3,788	3,248	2,385	1,201	2,022	1,557	2,285	2,520
Power Generation	17,068	16,726	17,778	19,442	14,619	11,637	12,548	15,562	16,400
Fertilizer	495	527	158	372	155	41	38	49	66
Logging/Wood Products	1,397	1,220	1,058	1,041	821	687	464	611	617
Paper Processing	1,599	905	725	998	777	465	807	954	1,003
Lube Refining	794	472	428	605	395	472	526	502	580
Textile Mills	940	859	754	763	507	480	520	783	926
Land Transport	1,548	1,622	1,942	2,101	1,784	1,653	1,708	1,859	1,870
Domestic Marine	2,076	1,817	1,872	1,732	1,446	1,317	1,211	1,373	1,487
Domestic Aviation	908	801	778	820	777	834	840	970	978
Fishing Trade	714	702	743	925	857	830	983	1,182	1,363
Glass Manufacturing	702	642	504	536	425	353	459	561	616
Steel/Metal/Nickel Proc.	5,305	4,524	2,894	2,230	737	565	442	643	789
Contractors	1,439	1,116	1,235	1,263	595	472	446	4009	473
Ceramics	204	178	157	125	70	56	106	172	167
Rubber and Tires	179	154	163	148	118	99	118	158	143
Chemicals	576	520	523	501	380	364	453	597	897
Tobacco	90	99	95	105	91	92	83	105	93
Food Processing	626	567	639	1,082	1,180	904	939	1,240	1,419
All Others	3,881	4,674	4,730	6,521	7,533	6,742	7,897	4,873	8,161
Refinery Fuel and Loss	3,283	2,847	2,993	2,853	2,479	2,098	2,139	2,415	2,771
Total Industry	53,623	49,939	48,494	50,270	38,081	33,102	35,348	38,767	45,071

Source: Office of Energy Affairs,1988

Table 93. Power Generation by Source
(Gwh)

	Oil	Diesel	Hydro	Geothermal	Coal	Noncoventional	Total
1980	12103		3522	2077	181		17883
1981	8926	2690	3725	2771	128	343	18583
1982	8937	2379	3773	3540	433	344	19406
1983	10171	2817	2968	4077	568	853	21454
1984	7962	1498	5278	4532	1083	827	21180
1985	5907	2040	5553	4929	3347	990	22766
1986	7565		6017	4576	2643	996	21797
1987	9815		5220	4532	3097	1188	23852
1988	10471		6264	4844	2582	377	24538
1989	11204		6531	5305	2497	394	25931

Source: Office of Energy Affairs, 1989

Developmental activities induce significant disturbance in forest cover thereby disturbing the natural habitat and the breeding and reproduction processes of animals within the area. Clear-cutting of trees could also cause wildlife migration. Conservationists claim that geothermal exploration in Mt. Apo would affect the Philippine Monkey Eating Eagle which is indigenous to the area.

Serious water pollution problems could occur during well testing and power generation. Toxic components of geothermal effluents and drilling fluids could contaminate surface and groundwater in the area. The ambient water quality monitoring results of the Visitang Naga River, receiving discharge from the outfall canal area of the Tiwi Geothermal Plant, revealed that the following parameters exceeded the standards: arsenic (0.068 to 8 mg/li), barium (1.2 to 44 mg/li), cadmium (0.01 to 0.08 mg/li), chromium (0.06 to 0.11 mg/li), copper (0.04 to 0.11 mg/li) and lead (0.06 to 0.57 mg/li) (Table 94). The concentration set as standard for each parameter is 0.05 mg/li for arsenic, barium, chromium and lead; 0.02 mg/li for copper and 0.01 mg/li for cadmium. Biological samples (fish and shellfish) were likewise analyzed and were found to contain mercury and iron. Mercury was detected in all the samples and iron registered high values ranging from 6 to 510 ug/g in the different samples.[104]

Adverse impact on farm productivity may also arise from effluent discharges. Geothermal effluent discharges have been reported to adversely affect farm productivity. Farm land owners in Tongonan claimed that their rice yield declined from 29 cavans per hectare to as low as 4 cavans per hectare due to the Tongonan Geothermal Plant wastewater discharges.[105] Such, however, could not be totally attributed to geothermal wastewater pollution because of the general downtrend in rice production during the period. High concentrations of hydrogen sulfide and sulfur dioxide in the steam emissions pose the most serious air pollution problem from geothermal operations. Although the link between geothermal emissions and respiratory diseases could not be directly ascertained, an upsurge in the latter was noticeable. At the Tongonan geothermal area, the health and demographic survey data of 1982 showed that respiratory diseases were the leading cause of morbidity. However, H_2 S and $S0_2$ emissions from the power plant operations cannot be directly pinpointed as the cause. An investigation of the Tiwi Geothermal Plant was conducted by the former NPCC in 1986, in response to alarming reports published in different newspapers. The stories alleged that residents within the project sites suffered from respiratory ailments caused by sulfur emitted from the power plant. The NPCC investigation report revealed that the concentration of H_2 S, ranging from 0.61 to 2.04 ppm, exceeded the maximum allowable ambient standard of 0.02 ppm.

Field observations at the Southern Negros geothermal area showed that some trees near the well sites and separators/silencers, have shedded their leaves. The real cause of the damage has not been ascertained although it is a well-known fact that $S0_2$ greatly affects plants and animals and that defoliation of trees near hot springs could be due to either or both heat and gaseous emissions. Damages to the forest adjacent to the power plant were also noted. Rusted tin roofs of houses and other buildings were also observed and reported by people interviewed in the Southern Negros geothermal reservation.

Table 94. Monitoring Results for the Visitang Naga River, 1981
(milligrams/li)

Sampling Stations	[illegible]	Standard*	Monitored Value
R1	Arsenic	0.05	0.035
	Barium	0.05	1.2-33
	Chromium	0.05	0.11-0.06
	Lead	0.05	0.06-0.53
	Copper	0.02	0.05-0.04
	Cadmium	0.01	0.12-0.08
R2	Arsenic	0.05	0.08-8
	Barium	0.05	1.8-35
	Chromium	0.05	0.09-0.11
	Lead	0.05	0.14-0.56
	Copper	0.02	0.02-0.05
	Cadmium	0.01	0.01-0.12
R3	Arsenic	0.05	0.2-2.3
	Barium	0.05	2.1-3.1
	Chromium	0.05	0.09-0.11
	Lead	0.05	0.06-0.55
	Copper	0.02	0.05
	Cadmium	0.01	0.02-0.10
R4	Arsenic	0.05	0.068-2.6
	Barium	0.05	1.9-44
	Chromium	0.05	0.11
	Lead	0.05	0.08-0.57
	Copper	0.02	0.05
	Cadmium	0.01	0.02-0.11

Source: National Power Corporation, 1982.
* Class SC Standards

The land use conflict issue has also arisen in some geothermal undertakings. A case in point is the geothermal exploration project in Mt. Apo, Davao del Norte. The tribal communities of Mt. Apo strongly opposed the construction of the geothermal project area by the PNOC in 1989, on grounds that the area is an ancestral land. They contended that exploration activities will destroy and desecrate their cultural heritage, dislocate residents, destroy wildlife, forests and rivers and cause respiratory diseases to the people living in the area.

Coal

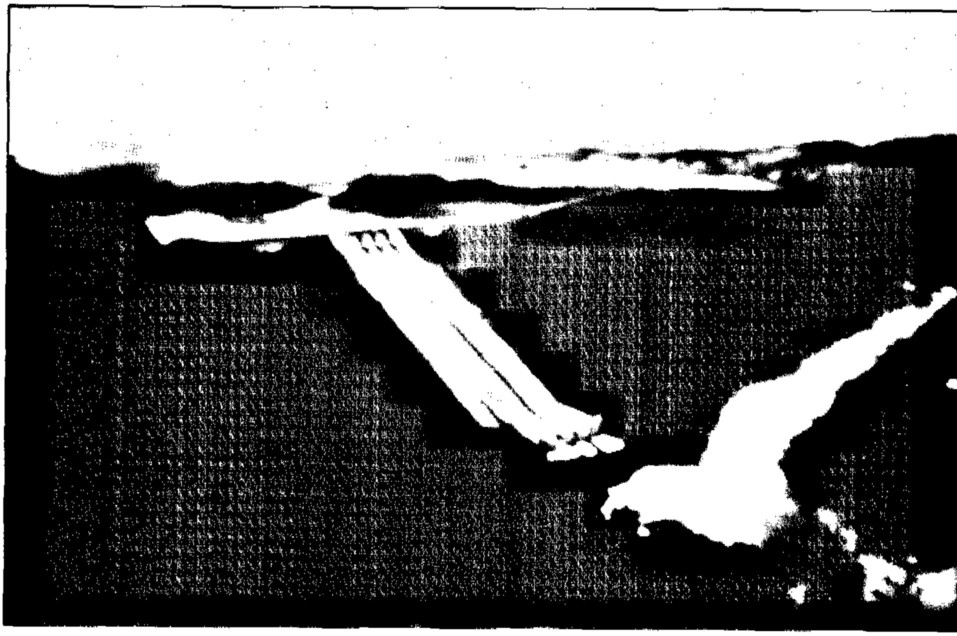
The direct use of coal for combustion purposes gives rise to a number of potentially serious environmental impacts. Combustion emissions include sulfur oxides, nitrogen oxide, carbon dioxide and monoxide, particulates, organic compounds, trace elements and radionuclides.

A coal-fired thermal plant's major impact is on air quality, which is affected by the discharge of coal combustion products from the stack. Coal-fired power plants in the country, like the Batangas Coal-Fired Thermal Power Plant, have manifested these impacts in varying degrees. Specifically, $S0_2$, flyash emissions and dust coming from the stockpiled coal of BCFTPP have been subjects of numerous complaints from surrounding communities. The National Power Corporation's stack emission monitoring results for November, 1984 - April, 1990 revealed that the $S0_2$ levels were at the 788 ug/scm - 1,552.46 ug/scm. range, exceeding the set standard of 250 ug/scm. NPC claimed, however, that high $S0_2$ levels already prevailed in the area even before the plant's construction. This was the reason for the re-designing of the plant's stack from 90 to 120 meters. Ambient suspended particulate matter was, however, generally within the standards except in monitoring stations near the plant, specifically in the meteorological station/San Rafael resettlement area. Although the ambient air quality monitoring results were found to be within the standards, residents of areas surrounding the BCFTPP reported in 1989 that there had been incidences of upper respiratory diseases, with the majority of the afflicted being children. Statistics gathered from the municipal health center and NPC reports seem to substantiate these claims (**Table 95**). The upper respiratory tract infection cases in Balayan RHU I were found to be increasing, from 85 per 1,000 population in 1984 to 618 per 1,000 population in 1989.[106]

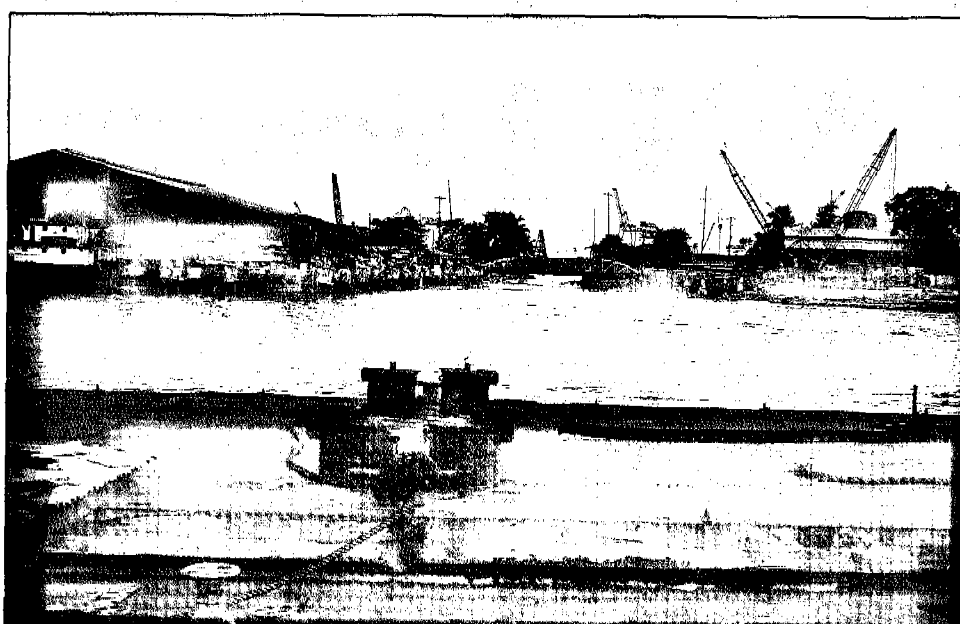
Hydropower

Hydroelectric power projects are not free from environmental impacts. Hydroelectric plants entail large impounding areas, displacement of inhabitants in inundated areas and pose constant risk to the public in the form of bursting dams.

The development of large hydropower plants have dislocated a large number of population. Hectares of agricultural lands were destroyed. Devegetation and displacement of wildlife were also some of the evident impacts of developmental activities. In the Magat Project, about 500 inhabitants were resettled and a total of 4,460 hectares of land with different types of vegetation were inundated.[107] Sedimentation of nearby water systems was also documented (See **Forests**). Changes in the hydraulic regime of rivers in the area have resulted in perceptible changes in the local aquatic environment.



Among the country's noted hydropower plants are the Ambuklao, Bokod (Benguet), Angat, Caliraya-Lunot, and Maria Cristina in Iligan.



The country has only limited energy resources, particularly oil. Supply is further limited by the recurring increase in oil prices which significantly limits its purchase and availability.

Table 95. Upper Respiratory Tract Infection Cases and Incidence

	1984	1985	1986	1987	1988	1989
Calaca RHU #1						
a. No. of cases	3100				3839	1780
b. Population	20018	21595	22204	21390	22827	23309
c. Rate of incidence per 10,000 population	1549				1682	764
Calaca RHU #2						
a. No. of cases			4504	4796	7032	3623
b. Population	19027	19648	20040	20215	20598	21034
c. Rate of incidence per 10,000 population			2248	2372	3414	1722
Balayan RHU #1						
a. No. of cases	266	597	711	447	2128	2274
b. Population	31368	34361	35207	35380	36038	36798
c. Rate of Incidence per 10,000 population	85	174	202	126	590	618
Balayan RHU #2						
a. No. of cases	1912	2313	1569	1305	515	2979
b. Population	13435	14719	15092	15216	15499	16131
c. Rate of Incidence per 10,000 population	1423	1571	1040	858	332	1847

Source: National Power Corporation, 1989

Oil

Offshore oil exploration activities are undertaken in Nido, Cadlao, Matinloc and Tara in Palawan. Environmental impact of oil exploration in Matinloc, Palawan has been evident in the destruction of coral communities. Coral communities within a radius of 40 meters from the well heads were heavily damaged. Those within the 75 - 100 meters radius were, however, only slightly damaged. Destruction of these coral areas have resulted in the reduction of fish catch (See **Marine Environment**).

The most important environmental impact of oil combustion is air pollution. Relevant pollutants are mainly SO_2, NO_x CO_2 and particulate matter. In Metro Manila, the total estimates of emissions from power plants are 6.05% for particulate matter, 0.81% for carbon monoxide, 84.23% for sulfur oxide, 8.87% for nitrogen oxide and 0.04% for TOG.[108] In 1988, the percentage of sulfur oxides emission from all sources in Metro Manila was highest from power plants at 84.7%; followed by mobile sources at 12.1%; and, industrial plants, 3.2%.(**Figure 45**). Particulate matter was highest from mobile sources at 69.7%, followed by power plants at 22% and industrial plants at 8.4% (**Figure 46**).

2.2 Limited Energy Supplies

The country has only limited energy resources, particularly oil. Supply is further limited by recurring increases in oil prices which significantly limit the purchase and availability of oil. Currently, there are four oil fields in Palawan, but these are small and their recoverable oil will be exhausted quickly. Renewable sources of energy are targeted as alternatives to oil, as well as, non-conventional sources of energy. But the only significant non-conventional source of energy now in use is biomass (e.g. bagasse, agri-waste). There is, as yet, no significant contribution from solar, wind, biogas or other sources although considerable attention is given to these potential sources through research and development. Rapid siltation and degradation of dams and reservoirs have reduced the lifespans of some hydroelectric plants, further reducing the country's energy sources. Based on a 1984 survey, the sedimentation rate of Magat Reservoir was 11 x 10 cubic meters per year, twice that of the design rate.[109] In the 1985 Pantabangan Survey, sedimentation rate was observed at 6.3 MCM as compared to the 1.3 MCM design rate. The nuclear power plant which was planned to provide 620 MW power for Luzon, was mothballed in 1986 due to an overwhelming opposition by non-governmental organizations. Safety and environmental aspects of plant were questioned. The main objection was to the siting, specifically, the location of the plant at the base of Mt. Natib, near fault lines. Issues raised concerned reactor safety, waste disposal and environmental impacts.

2.3 Limited Research and Development

More research and development are needed for environment technologies specific to various energy options. Presently, there is insufficient local technology in the country for the abatement and monitoring of pollution, not only of energy projects but also other industrial developments. The cost of using imported technology for pollution abatement is very expensive. The desulfurization of flue-gas from coal-fired power plants is an effective way of reducing sulfur dioxide content but the method is very expensive both in capital and annual operating costs.

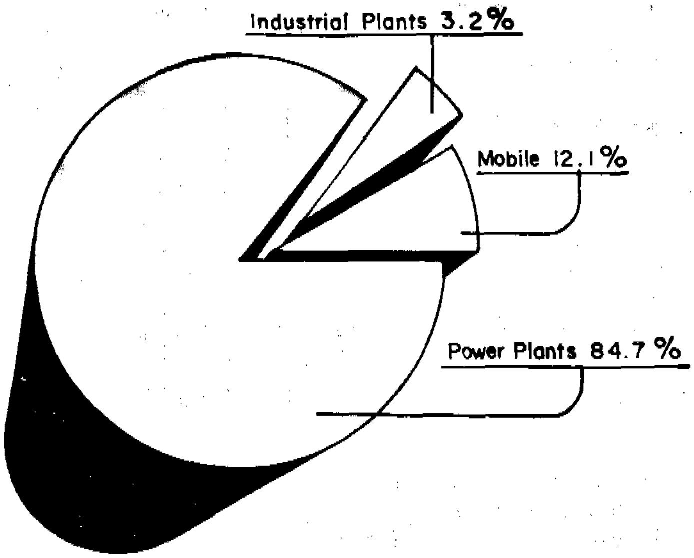


Figure 45. Percentage of SO_x Emissions From All Sources in Metro Manila, 1988

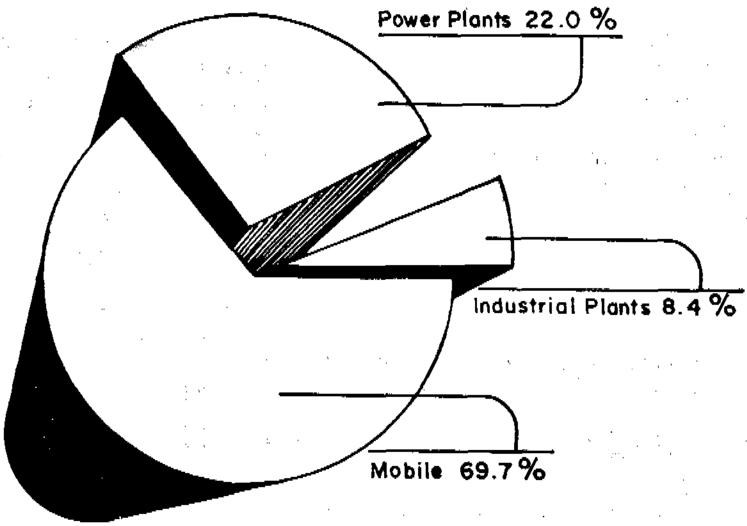


Figure 46. Percentage of PM Emissions From All Sources in Metro Manila, 1988

At the moment, the government could not adequately validate environmental quality monitoring results submitted by project proponents due to the limited number of monitoring equipment available. The equipments' high cost has constrained government from expanding its monitoring capability.

3. MANAGEMENT EFFORTS

3.1 Regulatory Efforts

The energy policy and strategies of the government for 1988-1992 focus on the promotion of energy self-reliance, rationalization of energy prices, encouragement of energy conservation, participation of the private sector in energy projects and maintenance of environmental safety measures for energy projects.

The increasing problem due to the environmental impacts of energy projects made government aware of the need to consider environmental factors in the planning and implementation of development projects. As such, environmental considerations began to be integrated into the national energy policies starting in the late seventies. This was in accordance with the provision of the Philippine Environment Code (P.D. 1152) which requires the energy sector to undertake comprehensive and integrated energy programs covering and regulating the exploration, development, exploitation and utilization of conventional sources of energy consistent with environmental protection policies. The Code further requires all power plants to provide safety devices to insure the health and welfare of their personnel and surrounding communities.

Environmental impacts of energy projects were also examined under the environmental impact statement (EIS) system, which was established under P.D. 1586. As of 1989, there were about 25 energy projects subjected to the system. Environmental impact statements identify probable impacts of energy projects and include proposed mitigating measures. Where possible, the Philippine National Oil Company (PNOC) tried to implement mitigating measures from the early exploration phase to the production stage of its geothermal energy development projects. Some of these measures were: use of directional drilling to minimize opening up of areas; rehabilitation of disturbed areas; screening of non-toxic drilling additives; regulation of discharges to maintain safe levels of critical parameters; reinjection of waste fluids into deep-lying geothermal resources; construction of wastewater treatment and gas abatement facilities and regular monitoring of air and water quality and biota. The National Power Corporation has also instituted measures to mitigate environmental impacts of its project. These are: the installation/construction of pollution abatement/control equipment; regular environmental quality monitoring; regulating the sulfur content of fuel used by thermal plants; and, watershed management.

In line with the institutionalization of the EIS system, energy agencies installed environmental units in their respective offices in 1979. The Philippine National Oil Company has an environmental management group that facilitates the preparation of EIA reports for all its energy projects. From 1979 to 1989, the group prepared about 21 EIA reports for various PNOC projects. These include EISs for geothermal exploration and development, coal development and oil and gas exploration. The National Power Corporation has also an Environmental Management Department which conducts regular environmental monitoring of all NPC power plants and ensures compliance of power projects/plants to environmental laws, including the preparation of the EIS. The Watershed Management Division of the NPC is primarily tasked with the enforcement of forestry laws, rules and regulations, afforestation, reforestation and physical rehabilitation measures and the promotion of the development and conservation of existing vegetation cover. The Ambuklao, Binga, Mak-Ban, Buhi-Barit, Tiwi, Angat and Caliraya watersheds are areas under NPC jurisdiction.

3.2 Management Programs

Energy Conservation

After the oil crisis of 1973, the energy sector policy thrust encouraged energy conservation measures to promote efficiency. The energy conservation program thrust of the government for the decade in review was primarily directed towards the industry, transport and commercial sectors, in view of their large shares in the total energy consumption. Several energy conservation programs/ projects were initiated by the government such as:

- **Energy Management Training Courses and Seminars.** This program, which was initiated in 1979, is designed to impart to the participants, tools and techniques which would enable them to design, initiate and implement energy management and conservation programs and to equip them with various operational measures and practices which would help achieve fuel economy in high-energy consuming equipment/processes.

- **Technology Transfer and Energy Management Project (TTEM).** The project provides industrial and commercial enterprises with technical assistance and technology demonstration financing designed to stimulate investment in energy conservation on a large-scale basis. This was started in 1987.

- **Rational Use of Energy.** This project, which was started in 1987, provides Energy Management Advisory Services to government and private establishments nationwide.

3.3 Research and Development

Researches in energy were focused on the search for other non-conventional energy sources. As of 1988, a total of 23 projects were undertaken by the Non-Conventional Energy Development Program of the Office of Energy Affairs. Almost all of these projects were in the R & D stage at that time, with the exception of the Pilot Solar Power Plant Project, which has gone to the commercialization level. Researches on the use of biomass for heat and power were also completed in 1988. Research results showed that biomass resources, primarily waste materials, can be effectively utilized as alternative sources of energy.

On conventional sources, government has initiated the following projects:

- Coal-Oil Mixture Project
- Fluidized Bed Fueled by Coal and Garbage
- Feasibility of Coal Briquetting in the Philippines

- Coal Supply and Distribution System
- Petroleum Supply and Distribution System

Of these, the Fluidized Bed and Coal Briquetting projects have been completed.

Special studies, particularly on the effects of geothermal effluents on biota, have been undertaken by the PNOC. Most of these were completed at the start of the decade (**Table 96**).

In 1989, energy resource development expenditures amounted to P2,020,194,367.2. This includes expenditures for oil and gas, geothermal and coal exploration, development and production.

4. PROSPECTS

The government's goal of accelerating the development and exploration of indigenous energy resources should take into consideration environmental requirements and precautions to minimize adverse environmental impacts. It is essential to integrate environmental concerns more fully into the development and implementation of energy policies and plans.

Environmental damages or pollution control and rehabilitation costs directly attributable to energy development and use should be integrated into the pricing scheme.

Maximum encouragement should be given to private sector participation in developing and spreading non-conventional applications, local technology for pollution abatement, as well as, undertaking energy research. Encouragement should include financial and tax incentives. Incentives should, specifically, be provided to firms installing anti-pollution control devices.

Energy conversion and use have been principal causes of environmental pollution. Thus, a policy should be formulated to require power plants, as well as, other industries to use low-sulfur fuel and the transport sector to slowly shift to unleaded gasoline use to minimize air pollution.

Data/research networking by environmental institutions and the private sector for exchange of information should be established.

Direct benefits to community affected by energy projects should be provided.

Table 96. Special Studies Conducted by the PNOC-EMD For PNOC-Energy Projects

	Project		Status
1.	Radiotracer Testing of Reinjection Wells (TGP)		Completed March 1980
2.	Effects of Geothermal Effluents on Kangkong (Ipomoea reptans) (SNGP)		Completed August 1980
3.	Inventory of Lichen/Moss Air Pollutant Indicators (TGP)		Completed February 1981
4.	Food Crop Protection During Geothermal Development (SNGP)		Completed June 1981
5.	Radiotracer Testing of Reinjection Wells (SNGP)		Completed September 1981
6.	Rice Experiments (TGP)		
	a.	Effects of Geothermal Effluents on the Seed Germination and Seedling and Seedling Growth of Rice	Completed September 1981
	b.	Effects of Geothermal Effluents on Rice Yield	Completed September 1981
7.	Inventory of Lichen/Moss Air Pollutant Indicators (SNGP & BMGP)		Completed December 1981
8.	Isolation of Pathogenic Organisms on Geothermally-affected Rivers (TGP, SNGP and BMGP)		Completed February 1982
9.	Rice Experiments (TGP)		
	c.	Screening of Rice Varieties Tolerant to Geothermal Ions	Completed December 1982
	d.	Isolation of Vector of Rice Crop Damage	Completed May 1983
	e.	Lime Treatment of Geothermally-affected Areas	Completed May 1983
10.	Toxicity of Pollutants from Geothermal Development Activities (TGP, SNGP and BMGP)		Completed September 1983
11.	Isolation and Identification of Petroleum-utilizing Marine Bacteria (Poro Point Coal Terminal)		Completed September 1983

Table 96 (continued)

	Project		Status
12.	Waste Slops Field Application (Manapla Distillery, Negros Occ.)		Completed September 1983
13.	Rice Experiment (TGP)		
	f.	Pot Experiment to determine causal vectors of rice damage	Completed 1984
14.	Sludge Waste Management (TGP)		Completed September 1985
15.	Post-utilization of Drilling and Geothermal Pond for Tilapia culture (SNGP and BMGP)		Completed December 1985
16.	Rice Experiment (BMGP)		
	g.	Soil Amelioration for Affected Geothermal Field	Completed 1986
17.	Rice Experiment (BMGP)		
	h.	Pot Experiment (Growth Performance of Rice at Varying Levels of Boron and other Toxic Elements in Geothermal Effluents)	Completed 1988
	i.	Field Experiment (Farm Management Trials for Geothermal Affected Field)	Completed 1988
	j.	Field Experiment on Farm Management/Amelioration Techniques	Completed August 1989
	k.	Greenhouse Experiment re: Validation of 2 ppm standard	Completed March 1990
	l.	Effects of Geothermal Effluent Sludging on Rice Growth and Yield	On-going as of Apr. 1990
18.	Cauayan River Tracer Study (BMGP)		Completed 1989
19.	Technical and Economic Feasibility of Boron and Arsenic Removal Using Cellulosic Materials (SNGP)		March-June 1990
20.	Acute Toxicity and Bio-accumulation of Arsenic in *Tilapia nilotica* (SNGP)		On-going as of May 1990
21.	Coal Dust Deposition (Determination of Coal Fraction in Dust Emissions) (Batangas Coal Terminal)		1989-1990

Source: PNOC, 1989

POPULATION, HUMAN SETTLEMENTS AND ENVIRONMENTAL HEALTH

1. PROFILE

Rapid population growth has posed serious constraints on the ability of the environment to sustain life, deliver basic services, and eliminate mass poverty. In areas which have become so overcrowded, critical problems of pollution, garbage, flooding, slums and traffic congestion have arisen. The incidence of environment-health related problems has also become increasingly common in view of scavenging, open dumping, insect and rodent breeding and pollution. With the rise in population, demand for shelter and related amenities has also gone up, outstripping the state's capacity to supply them. Housing had long been a major concern of the government and the private sector but it was only in recent years that problems in this area have reached crisis proportions. Unfortunately, efforts of both sectors cannot cope up with the growing demand for housing.

Population and Human Settlements

In 1989, the Philippine population was estimated at 60.09 million, 26% higher than the 1980 population level of 48.09 million. The eighties saw a slight decrease in population growth rate compared to the seventies. From 1972 to 1979, the average population growth rate was 2.6 percent, slightly higher than the 1989 population growth rate of 2.3 percent. Although the country has maintained an average growth rate of 2.4 percent from 1978 to 1989, the population increased by 32.5 percent, from 45.3 million in 1978 to 60 million in 1989, making the Philippines the fourteenth most populated country in the world and eighth in Asia.[110] **Figure 47** compares the estimated Philippine population for six decades. The country has also one of the highest population densities in Asia at 196 persons per square kilometer, even higher than the population densities of Indonesia and Malaysia combined, which are 89.87 and 49.32 persons per square kilometer, respectively.[111]

Philippine demography is basically characterized by birth and mortality rates. The birth rate is still higher than the mortality rate. The crude birth rate per 1,000 population in 1988 was 30.8, slightly higher than the 1980 rate of 30.3. For the same period, crude death rate per 1,000 population also increased by 17.74%, from 6.2 in 1980 to 7.3 in 1988.

The very slow deceleration rate of population growth can be partially attributed to the government's family planning program. Progress towards attaining small family size has slowed down. The declining trend in marital fertility rate has decelerated due to the reduction in the proportion of married women of reproductive age practicing family planning. The rate decreased from 37% in 1978 to 32% in 1983. The high fertility rate during the fifties and the sixties and the decline in the mean age of marriage for women from 24.4 years in 1975 to 23.3 years in 1980 partly explains the inability to sustain the rate of decline in fertility and the increase in the proportion of women in the childbearing ages.

After World War II, Philippine development was primarily characterized by growing urbanization. Urban populations have steadily increased their share of the national population (**Table 97**). For the past decade, a major proportion of the national population continued to aggregate in the country's urban centers in three regions: the National Capital Region, Region IV and Region III. In 1988, 7.692 million lived in Region IV, 7.561 million in the NCR and 5.863 million in Region III.

The country's premier cities continued to be the most populated at the close of the decade, with Manila having a population of 1.83 million and Quezon City, 1.5 million or 12.39% and 28.9%, respectively, higher than the 1980 levels. Together with the other cities and municipalities comprising the NCR, total population for Metro Manila reached a staggering 7.561 million in 1988, making it one of the megacities of the world. The ten highly populated urban centers are given in **Table 98.**

Manila registered the highest density at 47,832 persons per square kilometer, followed by Pasay City with 25,683 persons per square kilometer. These cities also had the highest densities in 1980 with 42,571.4 and 20,702 persons per square kilometer, respectively.

The dynamics and nearly self propelling nature of the urban economy accounts for the rapid migration of people into the country's cities. Lack of alternative income sources in marginal rural areas and security problems are likewise "push" factors for these migrations.

Marginalized conditions in urban areas have aggravated squatter problems. In 1980, an estimated 0.857 million persons comprised Metro Manila's squatter population. By 1987, this had risen to 2.5 million or approximately one third of the total population (**Table 99**). Urban poor population in other regional centers ranged from 215, 993 to 1,412,546 comprising approximately 44.4% to 69.4% of their total population (**Table 100**).

Housing supply was not able to keep up with rising demand during the decade. For the period 1987-1992, projected housing need was set at 3.4 million units, with the rural areas needing 1.8 milion (52.37%) and the urban areas, 1.6 million (**Table 101**).[112] In 1987, 20,818 units and in 1988, 51,971 units, totalling 72,789 were constructed under the National Shelter Program. This represents 2.14% of the projected demand.[113]

Urban refuse generation is expected to increase with increase in population and economic levels. This fact is, however, not reflected in currently available statistics. In 1977, Metro Manilans were already reportedly generating 3,600 tons of solid wastes per day. By the end of the decade, solid waste generation was still calculated at 3,339 tons per day, according to the most recent DPWH Solid Waste Feasibility Study for Metro Manila (**Table 102**).

According to the same study, approximately 3,089 tons/day or 93% of the generated garbage are collected and/or recycled, with the remaining 7% "indiscrimately burned, thrown into esteros/canals, dumped or deposited in sewers via run-off from streets. Of the 3,089 tons, 2359 tons or 71% are collected by the government (Environmental Sanitation Center of the Metro Manila Commission), 456 tons or 14% are collected by private haulers and the remaining 274 tons or 8% are recycled. The annual solid waste collection for Metro Manila, as of 1988, are provided in **Figure 49.**

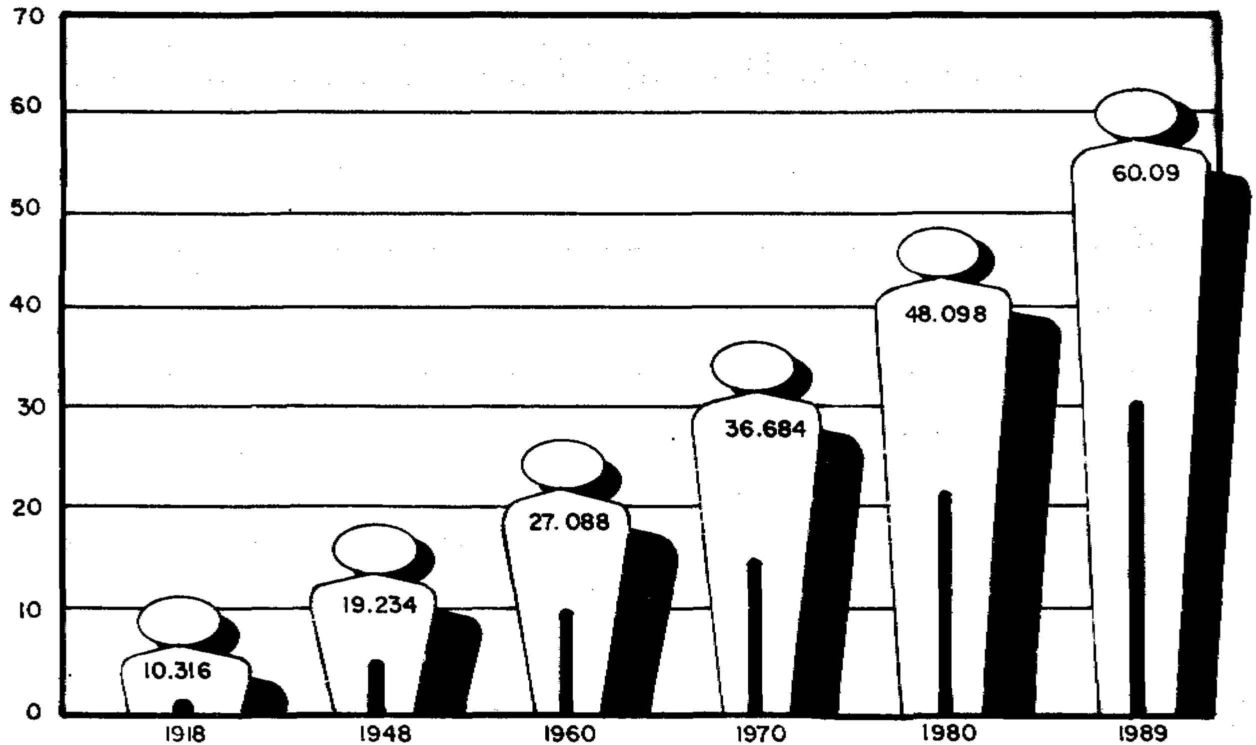


Figure 47. Estimated Philippine Population, 1918-1989.

Table 97. Percent Share of Total Population for Urban and Rural Areas by Census Years

Census Years	Urban	Rural
1970	31.8	68.2
1975	33.4	66.6
1980	37.3	62.7
1985	39.9	60.1
1988	(41.6)	(58.4)
1989	(42.2)	(57.8)

Source: PCUP

Table 98. Ten Highly Populated Urban Centers, 1980, 1985,1990

Cities	1980	1985	1990
Metropolitan Manila	5,925,884	6,942,204	7,974,002
Metro Cebu (Cebu, (Mandaue, Lapu-Lapu)	699,594	811,033	929,293
Davao	610,375	723,935	843,608
Zamboanga	343,722	393,721	443,279
Bacolod	262,415	299,115	336,006
Iloilo	244,827	268,662	292,422
Cagayan de Oro	227,312	283,028	345,011
Angeles	188,834	215,730	244,542
Butuan	172,489	197,601	223,683
Iligan	167,358	199,088	231,156

Source: National Statistics Office

Notes: 1. Data for 1985 amd 1990 are intercensal estimates.

2. A highly urbanized city has a population of at least 150,000.

Table 99. Metro Manila's Squatter Population, 1987

City/Municipality	Total Population	Squatter Population	Squatter Families
Manila	1,813,064	545,496 (30.1)	90,916
Caloocan	572,763	223,848 (39.1)	37,308
Malabon	231,492	73,374 (31.7)	12,229
Navotas	155,702	102,714 (66.0)	17,119
Valenzuela	325,958	52,682 (16.2)	8,781
Quezon City	1,462,327	516,000 (35.3)	86,000
Makati	439,747	81,612 (18.6)	13,602
Mandaluyong	244,687	108,380 (44.3)	19,300
Pasig	362,519	100,668 (27.8)	16,278
Pateros	51,605	25,530 (49.5)	4,255
San Juan	146,856	21,972 (15.0)	3,662
Marikina	279,729	61,692 (22.1)	10,282
Pasay	348,923	266.220 (76.3)	44,370
Paranaque	291,687	76,776 (26.3)	12,796
Las Pinas	242,716	37,578 (15.5)	6,263
Total	7,354,190	2,485,696 (33.6)	415,020

Source: Metro Manila Study, EMB, 1990, as cited by NSO, LGU.

Health

Environment strongly influences human health and the quality of life. However, environmental parameters have yet to be institutionalized as standard health indicators.

The Philippines' major environmental health problems are traceable to inadequate environmental sanitation. Poor or even lack of environmental sanitation, in some instances, is a major contributory factor to the high incidence of communicable diseases. Other factors include rapid population growth, inadequate water supply and malnutrition.

A slackening in the country's progress towards improved health and nutritional status was witnessed in the years following 1975. During the period 1975 - 1980, average life expectancy and child survival decreased. Life expectancy in 1980 was 62 years, infant mortality rate was 63 deaths per 1,000 live births, and one out of every 10 babies died before the age of five.[114]

Table 100. Urban Poor Population as Percentage of Regional Populations, 1985

Region	Regional Urban Pop.	Urban Poor Population	% of Urban Population
NCR	6,942,204	3,047,628	43.9
Region I	1,026,947	567,902	55.3
Region II	437,233	215,993	49.4
Region III	2,558,445	1,135,950	44.4
Region IV	2,825,091	1,412,546	50.0
Region V	932,855	583,967	62.6
Region VI	1,527,579	1,000,564	65.5
Region VII	1,435,596	871,407	60.7
Region VIII	717,494	497,941	69.4
Region IX	526,359	317,921	60.4
Region X	968,584	644,108	66.5
Region XI	1,363,896	822,429	60.3
Region XII	559,681	307,265	54.9
	21,821,964	11,425,621	52.4

Source: PCUP

In 1982, vital health indicators showed a slight uptrend in the health status of the populace. Crude birth rate decreased to 29 per 100,000 population from 30.5 in 1978, crude death rate from 6.5 to 6.1, infant death rate from 53.1 to 41.8, maternal death rate from 1.2 to 1.0 and neonatal death rate from 22.3 to 18.7. The health situation improved further by 1987. Life expectancy increased to 64.1 from 63.4 in 1986. Crude birth rate was 27.6, slightly higher than the 1986 level of 26.7. Crude death rate further decreased to 5.8, infant death rate to 32.1, maternal death rate to 1.0, and neonatal death rate to 13.5.

The ten leading causes of morbidity during the latter part of the decade were bronchitis, diarrheal diseases, influenza, pneumonias, tuberculosis, malaria, accidents, measles, diseases of the heart and malignant neoplasms. A comparison with 1978 figures shows that bronchitis has dislodged influenza as the number one leading cause by 1987 **(Tables 103 and 104)**.

Mortality causes by the year 1987 included pneumonias, diseases of the heart, diseases of the vascular system, tuberculosis, malignant neoplasms, measles, accidents, diarrheal diseases, avitaminoses and nephritis. The ten leading causes of mortality are compared for three decades in **Table 105**.

Communicable Diseases

Communicable diseases constituted the country's main health problem for the decade. Out of the ten leading causes of death for the period 1978-1987, five (5) were communicable diseases, namely: pneumonia, tuberculosis, gastroenteritis, bronchitis, and measles. Over the ten-year period, pneumonia remained the leading cause of death.

Figure 49 presents the death rate trend from communicable diseases as a group, in comparison with malignant neoplasms and diseases of the heart for the period 1937-1987. While the mortality rate of communicable diseases followed a generally decreasing pattern, those of diseases of the heart and malignant neoplasms showed distinctive increasing trends.

As to morbidity, communicable diseases constituted majority of the ten leading causes during the eighties. Of these causes, three (3) were respiratory diseases, namely: bronchitis, pneumonia and tuberculosis which ranked first, fourth and fifth, respectively. One was gastro-intestinal, namely: diarrhea, which ranked second.It may be noted that the total number of cases for diarrheal diseases continuously rose by 3.2% for the period. Two were viral diseases - influenza and measles, which occupied third and ninth places, respectively.

Table 101. Projected Housing Needs, 1987-1992
(thousand dwelling units)

	1987	1988	1989	1990	1991	1992	Total
Philippines	531	545	558	570	580	592	3,376
Rural Areas	285	290	294	297	299	303	1,768
Urban Areas	264	255	264	273	281	289	1,608
National Capital Region	91	93	96	98	98	100	576
Other Urban Areas	155	162	168	175	183	189	1,032
Region I	11	11	12	12	13	14	73
Region II	5	5	5	5	5	6	31
Region III	27	28	29	31	32	33	180
Region IV	31	32	34	35	36	37	250
Region V	9	10	10	11	11	11	62
Luzon	83	86	90	94	97	101	551
Region VI	15	15	16	16	17	18	97
Region VII	15	16	16	17	18	18	100
Region VIII	6	7	7	7	7	8	42
Visayas	36	38	39	40	42	44	239
Region IX	5	5	6	6	6	6	34
Region X	11	11	11	12	13	13	71
Region XI	14	15	15	16	17	17	94
Region XII	6	7	7	7	8	8	43
Mindanao	36	38	39	41	44	44	242

Source: NEDA

Table 102. Metro Manila Solid Waste Generation
(tons per day)

ESC Area	Solid Waste Generation	Percent Generation
North Sector		
Caloocan City	211	6.33
Malabon	128	3.83
Navotas	59	1.77
Valenzuela	164	4.92
Sub-Total	562	16.85
South Sector		
Pasay City	138	4.14
Makati	293	8.79
Mandaluyong	152	4.54
Paranaque	185	5.54
Las Pinas	130	3.88
Muntinlupa	90	2.69
Sub-Total	988	29.58
East Sector		
San Juan	76	2.26
Marikina	110	3.30
Pasig	133	3.99
Taguig	64	1.91
Pateros	24	0.71
Sub-Total	406	12.16
West Sector (Manila)	781	23.40
Quezon City	601	18.01
Grand Total	3,339	100.00

Source: DPWH

Vector-Borne Diseases

1. Schistosomiasis

Schistosomiasis is "a chronic or slow, progressive and debilitating disease caused by a parasitic worm called Schistosoma japonicum. It is transmitted through a certain type of freshwater snail called Oncomelania quadrasi and not directly from person to person .

As of 1987, there were 24 endemic provinces distributed in eight regions, namely: Oriental Mindoro (Region IV); Sorsogon (Region V); Bohol (Region VII); Leyte and the three Samar provinces (Region VIII); Zamboanga del Norte and Zamboanga del

Table 103. Ten Leading Causes of Morbidity in the Philippines
(number and rate per 100,000 population)

Cause	5-Year Average (1981-1985)		1986	
	Number	Rate	Number	Rate
Bronchitis	415477	798.5	602851	1076.4
Diarrheal Diseases	397933	764.8	552613	986.7
Influenza	320989	616.9	397715	710.2
Pneumonias	150424	289.1	190208	339.6
Tuberculosis, All Forms	127053	244.2	153129	273.4
Malaria	73819	141.9	124153	221.7
Accidents*	90661	168.1	105886	189.1
Diseases of the Heart	70417	130.6	78516	140.2
Measles	48991	94.2	59375	106.0
Malignant Neoplasms	25189	48.4	26985	48.2

Source: DOH

* Reported under notifiable diseases in 1984.

Table 104. Ten Leading Causes of Morbidity in the Philippines, 1978-1987

1978		1982		1986		1987	
Cause	Rate*	Cause	Rate*	Cause	Rate*	Cause	Rate*
Influenza	487.7	Bronchitis, Emphysema & Asthma	552.2	Bronchitis	1076.4	Bronchitis	1120.6
Gastro-enteritis & Colitis	462.6	Influenza	445.5	Diarrheal Diseases	986.7	Diarrheal Diseases	1058.5
Bronchitis, Emphysema & Asthma	455.6	Diarrheal Diseases	435.6	Influenza	710.2	Influenza	863.3
Tuberculosis, All Forms	260.5	Pneumonias	209.8	Pneumonias	339.6	Pneumonias	319.3
Pneumonias	248.8	Tuberculosis, All Forms	206.2	Tuberculosis	273.4	Tuberculosis	285.5
Malaria	77.7	Malaria	79.7	Malaria	221.7	Malaria	211.1
Measles	61.2	Measles	70.9	Accidents**	189.1	Accidents**	199.5
Dysentery	60.7	Dysentery	66.7	Diseases of the Heart	140.2	Measles	142.8
Malignant Neoplasms	43.6	Malignant Neoplasms	52.9	Measles	106.0	Diseases of the Heart	138.1
Whooping Cough	33.5	Whooping Cough	31.3	Malignant Neoplasms	48.2	Malignant Neoplasms	47.4

Source: DOH

* Rate per 100,000 population

** Reported under notifiable diseases starting 1985

Table 105. Ten Leading Causes of Mortality in the Philippines

1967 Cause	Rate *	1977 Cause	Rate	1987 Cause	Rate
Pneumonias	113.5	Pneumonias	105.1	Pneumonias	91.9
Respiratoy Tuberculosis	78.4	Tuberculosis, All Forms	70.7	Diseases of the Heart	67.7
Gastro-enteritis & Colitis	43.5	Diseases of the Heart	62.2	Diseases of the Vascular System	52.1
Bronchitis	35.4	Gastro-enteritis and Colitis	40.1	Tuberculosis, All Forms	50.0
Diseases of the Heart	33.9	Diseases of the Vascular System	35.0	Malignant Neoplasms	35.5
Diseases of the Vascular System	31.3	Malignant Neoplasms	31.1	Measles	21.7
Beri-beri	25.6	Accidents	25.2	Accidents	20.3
Malignant Neoplasms	23.7	Avitaminoses and Other Nutritional Deficiency	22.3	Diarrheal Diseases	18.5
Accidents	20.6	Bronchitis, Emphysema and Asthma	14.1	Avitaminoses and Other Nutritional Deficiency	9.1
Nephritis & Nephrosis	12.2	Measles	11.3	Nephritis, Nephrotic Syndrome and Nephrosis	9.0

Source: DOH

* Rate per 100,000 population

Environmental sanitation, inadequate water supply and malnutrition have been primarily responsible for the country's major environmental health problems.

The garbage problem continued to plague major urban centers like Metro Manila. This has been compoundedby the unreliable system of solid waste collection and lack of proper disposal.

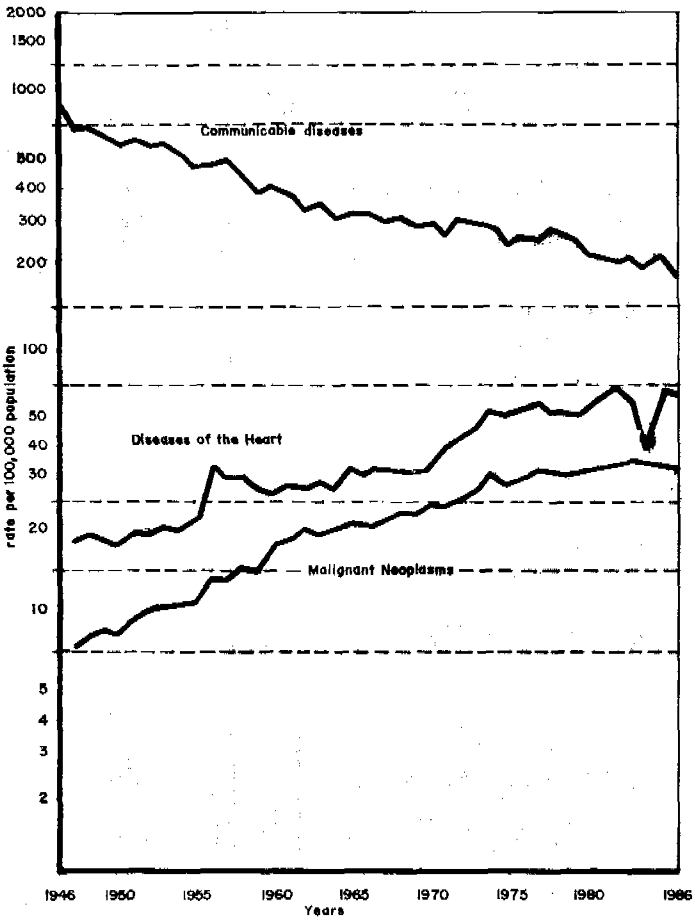


Figure 48. Mortality Trend for Communicable Diseases, Malignant Neoplasm and Diseases of the Heart in the Philippines, 1946-1986

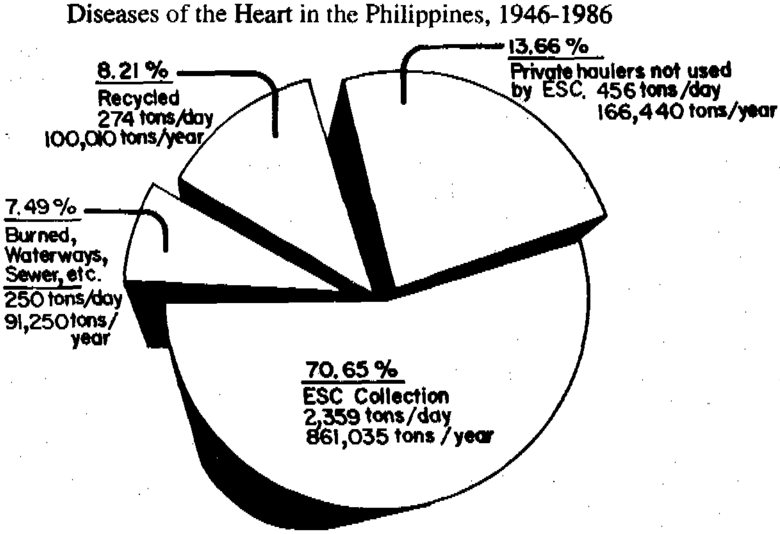


Figure 49. Solid Waste Collection for Metro Manila, 1988
Source DPWH

Sur (Region IX); Bukidnon, Misamis Occidental, the two provinces of Agusan, and Surigao del Norte (Region X); Surigao del Sur, the three Davao Provinces, and South Cotabato (Region XI); North Cotabato, the two Lanao provinces, Sultan Kudarat, and Maguindanao (Region XII).[115]

From 1978 to 1987, Schistosomiasis was reported as one of the ten leading causes of morbidity in Regions VIII and X. However, it was reported as the tenth leading cause of morbidity in Regions XI and XII, only in 1987 **(Table 106)**.

Out of a total exposed population of 5,103,524 in 167 municipalities in 1987, there were 335,379 estimated schistosomiasis cases.[116]

2. Malaria

Malaria is one of the country's leading causes of morbidity. The Department of Health records show that it has consistently ranked sixth among the ten leading causes of morbidity. Incidence rate per 100,000 population consistently rose from 71.4 in the 1973 - 1977 period to 168.5 for the 1982 - 1986 period. Incidence rate in 1987 was reported at 211.1 per 100,000 population **(Table 107)**. It affected mostly the hinterlands and newly opened settlement areas.

On a regional basis, Malaria has been established as one of the ten leading causes of morbidity in nine regions, namely: Regions I to V and Regions IX to XII **(Table 108)**.

Pollution-Related Diseases

Until the end of the decade, there was still relatively an absence of local information on the health impacts of pollution. Reports of mercury pollution in the gold rush areas of Mindanao prompted studies such as the one undertaken by the College of Public Health of the University of the Philippines in small-scale gold processing areas of Davao del Norte in 1988.[117]

Of the 230 subjects engaged in gold processing from Tagum, Nabunturan, Diwalwal and Compostela in Davao del Norte, thirteen (13) or 6.0% had elevated blood mercury levels, while eight of 214 subjects had elevated urine mercury values. One hundred six or 47% of the subjects had "elevated blood pressure and gray focal deposits in the gingiva". Also, thyroid enlargement was appreciated in 24 or 11% of the subjects.

Pesticide use was also linked to illness among farmers in certain areas of the country. In a study of socio-economic implications of pesticides use in Benguet, 59.4% of 106 respondents claimed experiencing illness (e.g. dizziness, vomiting, chest pains, coughing, eye pains and skin irritations, after spraying or using pesticides.[118] The study showed that "the longer the farmers were in vegetable production, the higher the incidence of illness as a result of using pesticides **(Table 109)**.

Although there was a marked uptrend in respiratory diseases in the country's urban centers, primarily Metro Manila, these could not be directly linked to increased vehicular and industrial emissions. Numerous complaints, however, have been lodged

Table 106 . Incidence of Schistosomiasis, 1978-1987

	1978			1982			1986			1987		
Health Region	a	b	c	a	b	c	a	b	c	a	b	c
8	1409	51.7	9	1884	64.5	9	6057	193.6	7	5338	167.6	8
10	1098	43.4	10	1144	38.9	10	1488	45.6	10	2963	88.4	10
11	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	1897	69.4	10

Source: DOH

a - number

b - rate per 100,000 population

c - rank in terms of being one of the ten leading causes of morbidity by the populace concerning the health impacts of air pollution, particularly those attributed to various power plants.

2. ISSUES AND PROBLEMS

Sustaining the basic needs of an increasing population is a problem of many developing countries. Any headway in productivity can be easily negated by increasing population pressures on land and natural resources. This situation has been prevailing in the Philippines since the population explosion of the fifties and the sixties. It has already strained the government's capability to provide basic services such as education, health care, food and shelter. Balancing the size of population and its rate of growth and available resources in relation to the capacity of the economy to provide the basic needs of the population is currently one of the major problems of government.

2.1 Population Growth Pressure on the Country's Ecosystems

Population growth poses new pressure on the Philippine ecosystems in terms of vulnerable land base. Over the past four decades, Philippine population has tripled from 19.2 million in 1948 to an estimated 60 million in 1989.

The increasing land requirements of an ever increasing population has led to intensified utilization of the country's limited productive lands and exploitation of vulnerable ecosystems. This has translated into problems like soil erosion, pollution, decreasing soil fertility and loss of genetic resources. Some of the country's best croplands are gradually lost due to conversion into residential, commercial and industrial uses (See **Agricultural Lands**). In areas where arable lands have become useless, farmers are shifting to marginal, less productive areas or even steep mountain slopes. Of course, other factors like inequitable distribution and lack of access to good agricultural lands, also account for their entry into other fragile ecosystems like forests. All these are undermining the country's agricultural and natural resources base.

Table 107 . Five-Year Average Incidence of Malaria in the Philippines (per 100,000 population)

	Five-Year Average	
Period	Number	Rate
1973 - 1977	30401	71.4
1977 - 1981	36176	77.0
1981 - 1985	73819	141.9
1982 - 1986	89826	168.5

Source: DOH

The growing concentration of people in the country's urban centers has generated socio-economic and environmental problems.

Housing supply was not able to keep up with rising demand, resulting in marginalized conditions and aggravated squatter problems.

Table 108. Incidence of Malaria, 1978-1987

Health Region	1978 a	1978 b	1978 c	1982 a	1982 b	1982 c	1986 a	1986 b	1986 c	1987 a	1987 b	1987 c
1	900	26.1	10	-	-	-	2669	67.1	9	2146	53.5	10
2	7558	361.7	4	3923	167.8	5	29051	1124.3	3	30873	1164.1	3
3	-	-	-	959	18.9	9	4860	86.9	9	6102	106.1	9
4	9881	175.3	6	13668	209.2	4	26113	358.3	4	21357	285.2	4
5	-	-	-	-	-	-	2559	63.8	9	2873	69.8	9
6	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-
8	1267	46.5	10	-	-	-	-	-	-	-	-	-
9	8411	379.1	4	11466	431.6	4	34514	1178.6	3	29584	988	4
10	1698	67.2	8	3435	116.7	7	7340	224.9	6	9657	288.3	5
11	3489	115.4	7	4122	114.9	7	12736	323.8	5	13410	332.6	5
12	971	44.4	9	1486	62.5	8	2971	111.5	8	2994	109.5	9

Source: DOH

a - number

b - rate per 100,000 population

c - rank in terms of being one of the ten leading causes of morbidity

Table 109. Survey Results on Incidence of Illnesses of Vegetable Farmers in Benguet, 1987

Number of Years	Total Responses	Incidence of Illness: Yes No.	Yes %	No No.	No %
1 - 10	55	29	53	26	47
11 - 20	25	16	64	9	36
21 - 30	19	12	63	7	37
More than 30 years	6	6	100	0	0
Total	105	63	60	42	40

Source: "Socio-Economic Implication of Pesticides Use in the Philippine Agriculture," A paper presented by Agnes C. Rola at the International Symposium on "Challenges for Health Development in the 90s", U.P. College of Public Health, Manila, May, 1988.

2.2 Uneven Geographical Distribution of Population

Migration strongly influences population change in an area, as much as the balance of births and deaths. In the Philippines, the most common type of internal migration is the flow of people from rural agrarian areas to urban industrial districts. This results in changes in demographic behaviour like fertility and mortality, as well as, changes in population structure.

Table 110 shows the number of inter-regional migrants by region of origin and destination for the period 1975-1980. Based on this, the National Capital Region (NCR) absorbed the highest number of in-migrants. Next to NCR were Southern Tagalog with 15.94 percent and Central Luzon with 8.89 percent of the total migrants. The continuing concentration of industries, services, employment opportunities, as well as, infrastructure facilities in the National Capital Region and its adjacent areas has accounted for the high net migration rate in these places.

The country's cities have continually attracted large numbers of rural folk who hope to avail of better economic opportunities. However, they often end up living in slums and find work as low-paid unskilled laborers due to limited opportunities.

From statistics gathered, there were as many migrating females as males for the period under review. This has been attributed to the fact that the Philippines is more westernized and modern compared to neighboring countries, and that Filipino women are more independent and more likely to pursue their careers independently.

Table 110. Inter-Regional Migrants by Region of Origin and Destination

Region of Destination	All Reg. of Origin	Region of Origin												
		NCR	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
All Regions of Destination	1,148,927	204,778	87,578	36,208	92,257	114,683	99,285	105,536	114,987	98,489	37,205	56,639	62,080	38,572
National Capital Region	378,878	-	42,682	16,002	51,246	75,386	51,573	44,158	22,990	48,999	4,933	6,944	8,612	5,353
I. *Ilocos*	35,588	12,447	-	6,567	6,761	3,597	1,156	867	871	936	538	581	748	519
II. Cagayan Valley	33,359	4,881	13,004	-	8,418	2,093	1,317	826	548	673	317	484	481	217
III. Central Luzon	101,844	42,388	12,937	3,908	-	13,664	8,708	4,509	3,506	8,162	-	1,423	1,191	635
IV. Southern Luzon	183,095	90,817	9,400	3,596	16,001	-	27,772	11,370	5,706	10,790	1,914	2,134	2,404	1,191
V. Bicol	36,939	15,957	1,195	568	3,284	9,648	-	1,009	1,773	1,846	326	472	604	257
VI. Western Visayas	33,523	11,128	779	465	1,436	3,154	1,544	-	7,391	857	979	1,339	2,943	1,508
VII. Central Visayas	51,757	6,181	975	1,079	721	1,765	2,261	7,730	-	7,215	4,148	8,639	8,721	2,322
VIII. Eastern Visayas	27,605	9,560	477	255	839	1,547	1,403	785	6,005	-	564	2,499	2,999	672
IX. Western Mindanao	28,143	1,213	588	726	501	432	313	3,139	8,943	869	-	6,658	2,278	2,483
X. Northern Mindanao	92,323	3,990	1,333	1,049	929	1,171	1,639	8,485	24,978	8,439	10,951	-	18,191	11,168
XI. Southern Mindanao	89,017	4,383	2,002	1,287	1,051	1,477	1,121	12,248	23,791	8,565	5,718	15,127	-	12,247
XII. Central Mindanao	56,326	1,833	2,206	706	1,070	749	478	10,410	8,485	1,138	6,004	10,339	12,908	-

Source: Philippine Yearbook, 1987

In the urban areas, increasing migration of people will continue to put pressure on limited land resources. It is projected that by the year 1990, about 43% of the population will be residing in urban areas. Metro Manila and Metro Cebu, the two top urban centers of the country, will be accommodating about one third of the entire urban population by the year 2000.

The uncontrolled expansion of urban areas due to increasing population creates a number of environmental problems. Most prevalent among these are air and water pollution (See sections on **Atmosphere and Climate** and **Inland Waters**) and the generation and disposal of solid wastes. Large concentrations of people and the continuous and intense nature of activities in these areas result in the generation of large amounts of solid wastes. Metro Manila currently produces 3,339 tons of refuse daily, which is expected to reach more than 5,000 tons by the year 2000. While 93% of this is claimed to be collected and/or recycled, there is still the remaining 7% which is either burned or dumped into esteros and canals. The problem is compounded by the unreliable system of solid waste collection and the lack or non-existence of proper disposal sites. The rapid growth of population in urban areas also resulted in the worsening of water supply and sanitation conditions.

2.3 Inadequate Housing

The past decade saw the rapid growth of slums and squatter areas in the country's urban centers, particularly Metro Manila. To a certain degree, this represents the state's inability to house a growing population at reasonable standards. Despite the major efforts of both government and the private sector, the housing problem remains daunting.

The country's housing problem is two-fold. First, there is the problem of quantity, which means that there is a need for new housing stock for the natural population and household growth. Second, there is the problem of quality, meaning that there is a need to upgrade the existing stock of makeshift and light material housing.

Economic conditions, social circumstances and cultural norms and values influence the housing situation. The spiralling land prices have placed housing units beyond the purchasing capability of most people, resulting to their squatting on idle public and private properties.

Proliferating slum and squatter settlements have posed various negative environmental impacts. The low-lying, poorly drained nature of most existing slum/squatter areas render the residents extremely vulnerable to health and safety hazards. The settlements, which are often situated along and within rivers and waterways, are contributory causes of water pollution, flooding and drainage problems. They also present a physical obstacle to the successful implementation of environmental improvement projects.

2.4 Poor Environmental Sanitation and Inadequate Potable Water Supply

Poor environmental sanitation continued to be a problem throughout the decade. Until the end of 1986, only 63% of total households had sanitary toilets, 15% had unsanitary toilets and 16% had no toilets at all. For the same year, approximately 93%

of Metro Manila, 73% of other urban areas and 62% of rural areas had toilet facilities (**Figure 50**). Only 9.2% of Metro Manila's population, however, were served with latrine facilities connected to piped sewerage systems. The rest had latrines connected to private septic tanks. Rural areas had to make do with "pit privies" or on-site toilets apart from homes.

Only 63% of the Philippines' total population were served by public water supply systems at the end of 1987. The remaining 37% obtained water from open dug wells, rainwater cisterns, lakes and streams. Service coverage included 86% of Metro Manila and immediate vicinities, 55% of other urban areas and 62% of the rural areas. Out of the 86% covered by the Metropolitan Water and Sewerage System in Metro Manila, however, only 57% were directly served through ambulant vendors, public stand pipes and private wells.

These factors have contributed to the proliferation of water and vector-borne diseases. It is interesting to note that diarrheal diseases in Metro Manila increased steadily from a rate of 242 per 100,000 population in 1978 to 289.3 in 1982, 299.0 in 1986 and 349.3 in 1987. Over-all, diarrheal diseases ranked second as cause of morbidity and its five-year average rate (1982-1986) increased from 911.0 per 100,000 population to 1120.6 in 1987.[119]

2.5 Inadequate Studies on Environmentally-Related Diseases

There is a dearth of data and studies on environmental health. Unfortunately, these are basic requirements without which sound policies and actions could not be effected. Studies are needed to establish the environmental determinants of diseases. The health impacts of pollution, particularly, need to be looked into. Potentially hazardous substances are reaching the general population daily through air, water and food but these are not seriously monitored or studied. This could be attributed, in part, to the low priority assigned to this concern, as reflected in government's budgetary allocations. From 1980-1987, for example, only a very small portion of the Department of Health's budget went to research on environmentally-related diseases. Only schistosomiasis control and research had a definite budget (**Table 111**).

3. MANAGEMENT EFFORTS

3.1 Policies

Population

To achieve the objective of attaining and maintaining a population level conducive to national welfare, several policies were adopted over the decade. One such policy covers the whole spectrum of social sectors catering to the population's basic needs. This policy had three integral components, namely: a) a demographic policy influencing fertility, mortality, migration and social mobility; b) a manpower policy defining the limits of the economically active age, the rate of labor force participation of the economically active population, length of the working day and the working week, professional training, job counselling, etc.; and, c) a welfare policy influencing wages and income, economic security, housing conditions, health and education services,

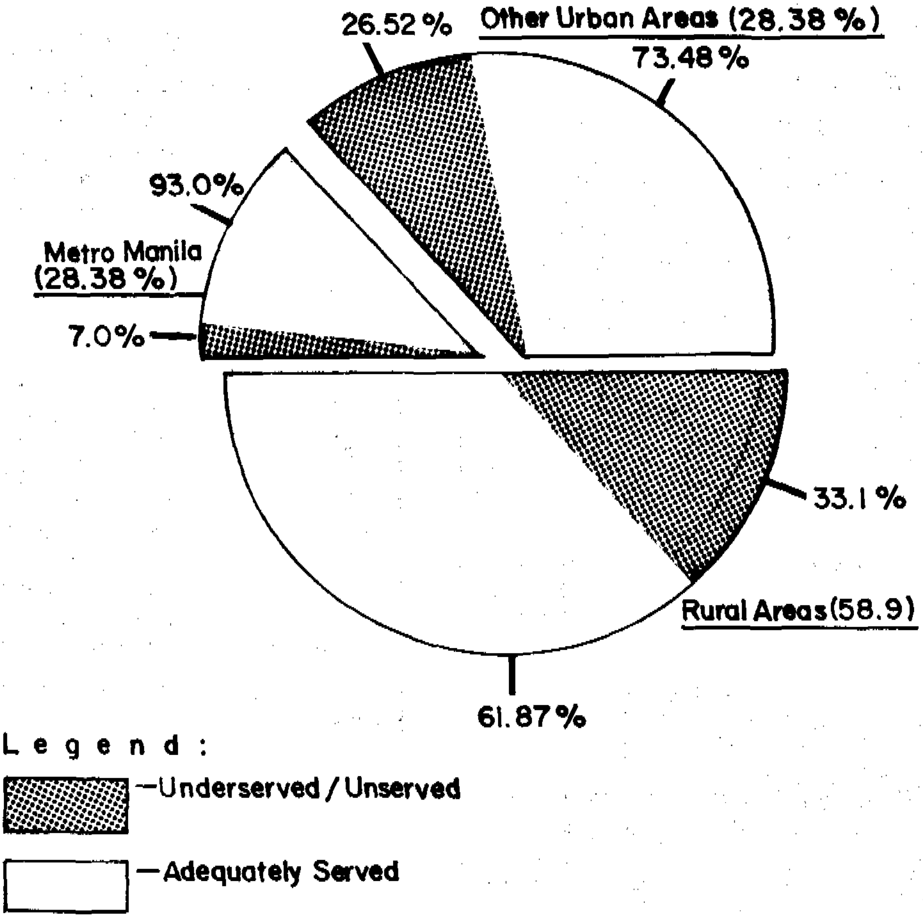


Figure 50. **National Profile of Sanitation** Facilities, 1986
Source: MWSS Sewerage Master Plan

Table 111. Budgetary Allocation for Schistosomiasis Control and Research (thousand pesos)

	Annual Allocation for Schistosomiasis Control and Research	DOH Budget	% of DOH Budget
1980	17501	1357097	1.29
1981	23216	1715521	1.35
1982	20965	2051737	1.02
1983	21343	2540599	0.84
1984	1536	2187099	0.07
1985	1888	2341919	0.08
1986	5431	3272270	0.16
1987	5811	4147565	0.14

Source: General Appropriations Act, 1980-1987 cultural amenities, etc. The early part of the eighties saw the adoption of a total population policy geared towards individual and family welfare. It targetted a demographic turning point, i.e. a replacement level of two children per family, as an indicator of population welfare enhancement. Also, more emphasis was given on the continuing development of rural urban communities and the social and economic advancement of workers, cultural communities and disadvantaged groups. Towards the latter part of the decade, however, a new policy was adopted which respected the rights of individuals and families to make their own decisions regarding population matters, i.e. determine the number of children they would have.

Institutional changes occurred in this sector in 1988. Among these was the transfer of the service delivery component of the Population Program from the Population Commission (POPCOM) to the Department of Health (DOH). The DOH then became the lead agency in family planning service delivery and, correspondingly transferred the technical supervision of the outreach structure from POPCOM to DOH. POPCOM, on the other hand, was left with the population development aspect, which includes population education, women in development and development planning. In recognition of the expertise and experience of POPCOM, however, it was tapped to provide technical assistance to DOH in the areas of information and education communication (IEC) training, service delivery and research and development.

Human Settlements

Human settlements development received priority attention during the latter part of the seventies. As a "people-centred "approach, focus was not only on shelter provision but also on the development of a viable community, complete with employment and income opportunities, a guarantee of health and hygiene, and a total regard for the urban environment in order that food, nutrition, education, administrative institution, recreation, and culture will all be integrated into the residents' lives.

Among the policies adopted during the period in review were : a) the rationalization of government rules and regulations in housing; b) intensification of production activities in housing; and, c) strengthening of the shelter finance system.

The policy governing rationalization of government rules and regulations in housing relaxed the standards which made housing very expensive and beyond the reach of the low and middle-income groups. It encouraged the use of innovative land acquisition and disposition techniques aimed at lowering land and development cost per unit of housing, and eventually, attract private developers to actively engage in low-cost housing projects.

Under the second policy, all housing activities were programmed towards reduction of the per unit cost of housing through research and development programs. The government likewise encouraged the construction materials industry to produce at maximum capacities and lower cost by ensuring a ready market for their products.

To make housing available and within reach of the people, the government encouraged the banking system to actively participate in the National Shelter Program by providing development financing to developers and buyers' financing to housing beneficiaries/housing borrowers.

During the latter part of the decade, policies adopted focused on problems related to urban housing such as land tenure, congestion and blighted areas. A comprehensive approach towards the solution of the land tenure problem and congestion was pursued to include the following: access to financing, expansion of housing stock, revision of standards for site selection and upgrading control of land speculation, and simultaneous encouragement of employment opportunities in the rural areas as a step towards decongesting areas. Efforts to alleviate the plight of squatters within the framework of existing laws were also pursued.

Eviction procedures were discouraged. The improvement of existing blighted areas were also undertaken through better roads and the provision of services such as water, sanitation, and drainage.

Health

Considering that the population is one of the country's vital resources, promotion of health welfare has become one of the the continuing concerns of the government. With this, the government has adopted policies which broadened access to health and nutrition through: a) full-scale implementation of Primary Health Care; b) greater coverage of health insurance to develop the uncovered segments of the population; and, c) the integration of health and nutrition into the related sectors of the economy. Target beneficiaries were the poor, underserved, unserved, and high risk groups.

3.2 Management Programs

Population

Programs and projects on population that have been undertaken during the period were geared towards the reduction of fertility and population growth rate. These were continuously implemented and innovative ones developed for succeeding years.

One of the major programs under this sector is **Family Planning**. This program ensures the availability, accessibility and quality of family planning and FP-related services to all those who wish to limit their family size. Its outreach project, which fields full-time Outreach Workers, provides family planning services to all married couples of reproductive age through the Barangay Supply Points. The project has been well-entrenched in the plans and programs of local governments, thereby ensuring the participation of people in the grassroots level.

Since the population problem cannot be isolated from other development problems, family planning has been integrated into existing programs in health, education, social welfare, community development and other government programs. Such integration will enable the program to utilize existing structures, systems, manpower and resources of different agencies.

The **Adolescent Fertility Program**, meanwhile, addresses the fertility-related needs and problems of the Filipino adolescent. It hopes to reduce the incidence of early marriages and teenage pregnancies through counselling information and education communication (IEC) and research activities.

The promotion of positive social and cultural values supportive of the population program was and still is being undertaken through the **Population Education Program.** Among the values inculcated are responsible parenthood, size and family welfare, and delayed marriage.

In support of the information dissemination nad motivational work, trainings on inter-personal skills were provided to motivators and field workers while clinic personnel were extended FP courses. At the same time, information/education and communication activities were implemented.

New projects were likewise conceptualized during the latter part of the decade. These included a project of the Department of Education, Culture and Sports to increase population awareness among the out-of-school youth and adults, particularly women, through a literacy and livelihood education approach.

Despite positive developments in this sector, programs suffered from institutional, financial and manpower constraints. The effective integration of the service delivery networks for health, nutrition and family planning still remains to be operationalized. The absence of integration among these subsectors resulted in the overlapping of functions and services at the community level, which led to undue wastage of already scarce resources.

Progress towards attaining small family size has also slowed down due to a reduction in the proportion of married women of reproductive age practicing family planning. This may be partly due to the program's failure to provide access to information, supplies and services to the growing number of women of reproductive age.

Human Settlements

Human settlements became a priority concern during the seventies and the early part of the eighties as a result of the increasing problems related to housing, particularly in the urban areas.

In the implementation of the human settlements scheme of the Multi-Year Human Settlements Plan, the government adapted a 3-pronged approach, namely: countryside development, which emphasized the balanced growth of the different regions in the country; regional integration, which necessitated an improvement in the linkages within and among regions and settlements; and, resource utilization and management, which involved the mobilization and harnessing of the untapped resources of the country.

Program thrusts of the human settlements scheme then, were all addressed at five major human settlement concerns: a) adequate shelter which consists of production of housing units, slum improvement, sites and services development and housing finance; b) inter-dependence among self-reliant communities, involving the establishment of model communities complete with livelihood schemes in each of the 1,553 cities and municipalities. These communities were called the urban and rural Bagong Lipunan

Sites and Services (BLISS); c) optimum land use program which entails the formulation and enforcement of human settlements plans to optimize the use of the country's land resources; d) environmental protection which aimed for a balanced ecology through the maintenance of land, water and air quality; and, e) use of appropriate technology, technology utilization and ventures development aimed at effective technology transfer to industries to improve their competitiveness and production efficiency. The technology dissemination services, meanwhile, involved field extension and information campaigns for the acceptance of technology in the rural areas. The human settlements approach was encouraged until the change in administration in 1987. It was fostered by the Ministry of Human Settlements which was disbanded in late 1986.

During the middle part of the period in review, efforts centered not only on direct housing and housing finance but also on the socio-economic conditions of residents in housing communities. In view of this, a socio-economic program was also undertaken. This consisted of projects designed to help residents uplift their quality of life through community development programs in nutrition, health, sanitation, family planning, youth development, skills training, cooperative management, and other related activities.

Health

One of the foremost health projects of government undertaken during the decade which was and still is being implemented is the **Primary Health Care (PHC) Program.** It provides essential health care which is community based; accessible and acceptable to individuals and families in the communities through their participation; sustainable at a cost which the community and the government can afford; aimed at developing self-reliance or individual and community health; and, part and parcel of the total socio-economic development effort.

Among its objectives are: a) the promotion and maintenance of health among the greatest number of Filipinos, especially those in remote and economically depressed communities; b) development of community leadership and initiatives in the identification of community health problems, needs and solutions; and, c) provision of relevant health-related services to complement community efforts.

In the barangay level, PHC activities include organization of the barangay for PHC, survey of basic health, social and economic needs and health-related activities such as: providing safe water supply; clearing and maintaining water canals; compost-making, construction and use of water-sealed toilets, backyard gardening, herbal gardens, income-generating projects and maintenance of health facilities.

Another vital and on-going program during the decade in review is the **Maternal and Child Care Program**, which is concerned with the protection and care of children from conception to adolescence and expectant and nursing mothers. It was implemented through the service facilities of the Department of Health such as hospitals, rural health units (RHUs) and puericulture centers, in cooperation with the private sector and the community, through the primary health care approach. It has four sub-projects, namely: Hilot Training Project, Perinatal and 0-6 Child Care; Promotion of Breastfeeding; and, Expanded Program on Immunization.

The **Pilot Rural Environmental Sanitation Project,** tried to uplift the health standards and practices of the Filipino people through the construction of water supply facilities and the distribution of one sanitary toilet in each of fifty-two (52) selected public elementary schools. The project was and is still being implemented in sixty (60) sites located in Bulacan, Pampanga, Batangas and Cavite. It is a joint effort of the DPWH and the DOH.

To control diarrhea and its complications, particularly among infants and children, the **Diarrhea Control Program** was carried out. Its objective was to reduce mortality from dehydration by early use of oral rehydration and reduce morbidity of diarrhea through intervention schemes such as environmental sanitation, promotion of breastfeeding, and correct feeding and weaning practices of lactating mothers.

To control malaria in endemic areas of the country, the **Malaria Control Program** was implemented. It aimed to reduce the annual parasitic incidence from 4 per thousand population in 1988 to 1.5 in 1992. The program is directed to individuals who live in highly endemic areas.

Another major program implemented under the health sector during the decade was the **Schistosomiasis Control Program.** It was undertaken to bring down the incidence and prevalence of Schistosomiasis through case finding and treatment, together with health information dissemination.

Researches on health were primarily spearheaded by the Philippine Council for Health Research and Development. Under the Department of Science and Technology, the PCHRD was created on March 17, 1982 to enhance the systematic coordination of research and development efforts in health and the allied sciences. The Council seeks to optimize the use of human and material resources to answer defined needs and problems of national development. Among its functions are: a) to formulate a comprehensive plan for research and development in the health sector; b) to rationalize resource allocation and investment in health science and technology; c) provide leadership and direction in health research and development; and c) evolve systems needed to support and enhance national policies and priorities.

4. PROSPECTS

The current administration's pronouncements, particularly the President's, on the high priority to be accorded to family planning and responsible parenthood, is a positive development for the country's Population Program. However, it must clarify once and for all, its stand on fertility and population growth moderation.

The emphasis on primary health care is also an encouraging sign for the health sector. But more private sector involvement should be elicited and existing collaborative efforts strengthened, particularly in such areas as sharing of resources and technologies, health education, propagation of herbal medicine use, and community health services. More resources should also be allocated for health research, particularly on the health effects of pollution which, until now, has been a much neglected area.

The human settlements problem should not be confronted with piecemeal solutions like upgrading of amenities alone. It requires a holistic approach which would involve influencing migration patterns to decongest and relieve pressure on already crowded human settlements. The Strategy for Rural Development is a step towards this direction and must, therefore, be made fully operational as soon as possible.

1. GOVERNMENT INSTITUTIONS

1.1 Structures and Functions

The prevailing environmental administrative machinery had several forerunners. Foremost of these was the National Water and Air Pollution Control Commission (NAWAPCO), which was created in 1964 by virtue of Republic Act No. 3931, to maintain reasonable standards of quality for the country's air and water. It was subsequently transformed into the National Pollution Control Commission (NPCC) through Presidential Decree No.984, which was created with more regulatory powers than the NAWAPCO.

The mid-seventies brought on the realization that industrial pollution was not the country's sole environmental problem. Environmental problems took on a wider perspective since practically all aspects of the natural environment were subjected to varying degrees of abuse and degradation. A national consensus emerged as to the need for an integrated approach to confronting and solving environmental problems. This led to the creation of the Inter-Agency Committee on Environmental Protection (IACEP) under the Department of Natural Resources (DNR) on July 6, 1976.[120] It was tasked to assess the environmental situation prevailing at the time, particularly government policies and programs on environmental protection. The Committee's findings on the status of environmental protection efforts in the country showed that there was an uncoordinated implementation of activities by at least 22 government agencies with specific sectoral responsibilities on environmental protection. Furthermore, the lack of adequate legislations and regulatory powers hindered the environmental protection efforts of the various agencies. Also, there was no mechanism to assess the environmental impacts of development projects. Consequently, the IACEP recommended the integration of environmental programs through inter-agency coordination and the creation of a national coordinating agency on environmental protection.

These recommendations were operationalized with the creation of the National Environmental Protection Council (NEPC) on April 18, 1977, under Presidential Decree No. 1121. The Council, which was chaired by the President, had fourteen members including the Commissioner of the NPCC, and was assisted by a Secretariat. It was charged among others, with the task of rationalizing the functions of government agencies for an effective, coordinated and integrated system of environmental protection, research and implementation/enforcement of laws. This was effected by the Council through the creation of inter-agency committees to take care of specific concerns - e.g. the Environmental Officers Committee, Coastal Zone Committee, Inter-agency Committee on the Proliferation of Toxic and Hazardous Wastes.

The political events of the early eighties, which culminated in the formation of a new government in February of 1986, also saw the abolition and reorganization of various government agencies, including the NEPC and NPCC. In January, 1987, Executive Order No. 131 was promulgated, reorganizing the Department of Natural Resources (DNR) into the Department of Environment, Energy and Natural Resources (DEENR).[121]

Six months later, Executive Order No. 192 was issued, reorganizing the DEENR into the Department of Environment and Natural Resources (DENR). It was tasked to "ensure the sustainable use, development, management, renewal and conservation of the country's forest, mineral lands, offshore areas and other natural resources, including the protection and enhancement of the quality of the environment".

The DENR is composed of the Department Proper, the Staff Offices, the Staff Bureaus, and the Field Offices which are composed of the regional, provincial and community natural resources offices. **Figure 51 depicts the DENR Organizational** Structure.

Under this organizational set-up, all the line bureaus of the defunct Department of Natural Resources and three (3) newly created bureaus were placed under the Department proper as its staff sectoral bureaus. These are:

1. Forest Management Bureau (the merger of the Bureau of Forest Development and the Wood Industry Development Authority, DNR);

2. Lands Management Bureau (formerly the Bureau of Lands, DNR);

3. Mines and Geo-Sciences Bureau (the merger of the Bureau of Mines and Geo-Sciences, Mineral Reservations Development Board and the Gold Mining Industry Development Board, DNR);

4. Environmental Management Bureau (the merger of the National Environmental Protection Council and the National Pollution Control Commission);

5. Ecosystems Research and Development Bureau (the merger of the Forest Research Institute and the National Mangrove Committee, DNR); and

6. Protected Areas and Wildlife Bureau (formerly the Division of Parks and Wildlife and the Marine Parks Program, of the Bureau of Forest Development, DNR).

Each bureau is administered by a Director and an Assistant Director, who also advise the Secretary on matters pertaining to their respective areas of responsibility.

In line with the government's policy of decentralization, field offices for the 13 regions of the country were also established. Section 21 of E.O. No. 192 mandates the Regional Offices to implement the laws, policies, plans and programs, and promulgate the rules and regulations of the Department. Among the major functions of the Regional Offices are to "conduct a comprehensive inventory of the natural resources in the region and formulate regional short-term and long-term development plans for the conservation, utilization and replenishment of natural resources". Under the same provision it was mandated that "an Environmental and Natural Resources Office shall be established in every province and a Community Environment Office in municipalities, whenever necessary".

A prominent feature of the newly re-organized Department is the Pollution Adjudication Board (PAB) which "assumed the powers and functions of the Commissioners of the National Pollution Control Commission with respect to the adjudication of pollution cases under Republic Act No. 3932 and P.D. No. 984". The cases handled and acted upon by the PAB for the period 1988-1989 are provided in **Table 112.** As of 1989, a total of the 160 cases were filed with the body. Of these, it had deliberated on 57 cases. Fourteen (14) respondents were fined while twenty-three (23) had their Cease and Desist Orders (CDOs) temporarily lifted.[122] **Table 113** gives the pollution cases acted upon by the NPCC from 1979-1985.

1.2 Budgetary Allocations

The annual budgetary appropriations reflect the government's stance toward certain sectoral concerns like environmental protection. Although the total amount of financial resources appropriated for all environmental management efforts is difficult to determine because these are spread over a number of agencies, the effective total budgetary allocation for pollution control, which is a vital component of the government's environmental management program, could be easily ascertained.

From 1980 to 1987, these figures could be taken from the combined budgetary allocations of the National Environmental Protection Council (NEPC) and the National Pollution Control Commission (NPCC), the two acknowledged environmental protection agencies at the time. In 1988 and 1989, the allocation of the Environmental Management Bureau and the Environmental Management Sector of the Regional Field Offices of the DENR represent the government's effective expenditure for pollution control.

As could be seen from **Table 114,** the combined NEPC-NPCC budgets increased, on the average, from 1980 to 1983, decreased in 1984 and 1985 and increased again by 47% in 1986. These figures represent an average of 0.03% of the total national budget. In 1988, the combined budgetary allocations of the EMB and the Environmental Management Sector, Regional Offices of the DENR was lower than the 1987 combined budgets of the NEPC-NPCC (only 0.009% of total national budget), a drop of approximately 14%. Although this rose again to P 41,574,000 in 1989, an increase of approximately 98%, allocation for pollution control remained a mere 0.035% of total national budget (**Table 115**).

Regular budget allocation by government for forest protection are reflected in the combined budgets of the Bureau of Forest Development and the Forest Research Institute from 1980 to 1987 and from 1988 to present, by the Forest Management Bureau, Ecosystems and Research Development Bureau, Protected Areas and Wildlife Bureau and the Forestry/Ecosystems Research and Development Sectors of the DENR Regional Field Offices. **Table 116** gives the combined budgets of the BFD and the FORI while **Table 117** shows the budgetary allocations of the FMB, ERDB, PAWB and the Forestry/Ecosystems and Research Development Sector of the DENR Regional Offices for the period under review.

From an average of 0.376% of the total national budget, the combined BFD and FORI budgets increased to 0.402% in 1982; dropped steadily to 0.29% in 1986 and then rose again to 0.938% in 1987. Government allocation for forest protection dropped drastically to P426.73 million (or 0.184% of the national budget) in 1988 but recovered again in 1989. The amount, however, simply paralleled 1983 levels at 0.377% of the national budget.

2. IMPLEMENTATION OF MAJOR ENVIRONMENTAL POLICIES

Landmark environmental legislations were formulated in the late seventies and were operationalized in the eighties. Among these were Presidential Decree No. 1151, otherwise known as the "Philippine Environmental Policy ", and Presidential Decree No. 1152 or the Philippine Environment Code.

Presidential Decree No. 1151 states that "it shall be the policy of the state (a) to create conditions under which man and nature can thrive in productive and enjoyable harmony with each other; (b) to fulfill the social, economic and other requirements of present and future generations of Filipinos;and, (c) to insure the attainment of an environmental quality that is conducive to a life of dignity and well being". P.D. No. 1152, otherwise known as the Philippine Environment Code tried to address the total environment by requiring the establishment of standards for air and water quality, and prescribing guidelines for land use management, natural resources management and conservation, utilization of surface and groundwaters and waste management.

2.1 The Philippine Environmental Policy

One of the most important provisions of P.D. No. 1151 (Section 4) was the requirement for "all agencies and instrumentalities of the national government, including government-owned or controlled corporations, as well as, private corporations, firms and entities, to prepare an environmental impact statement(EIS) on their every action, project or undertaking which significantly affects the quality of the environment". The requirement was formally administered with the establishment of the Philippine EIS system through Presidential Decree No. 1586.

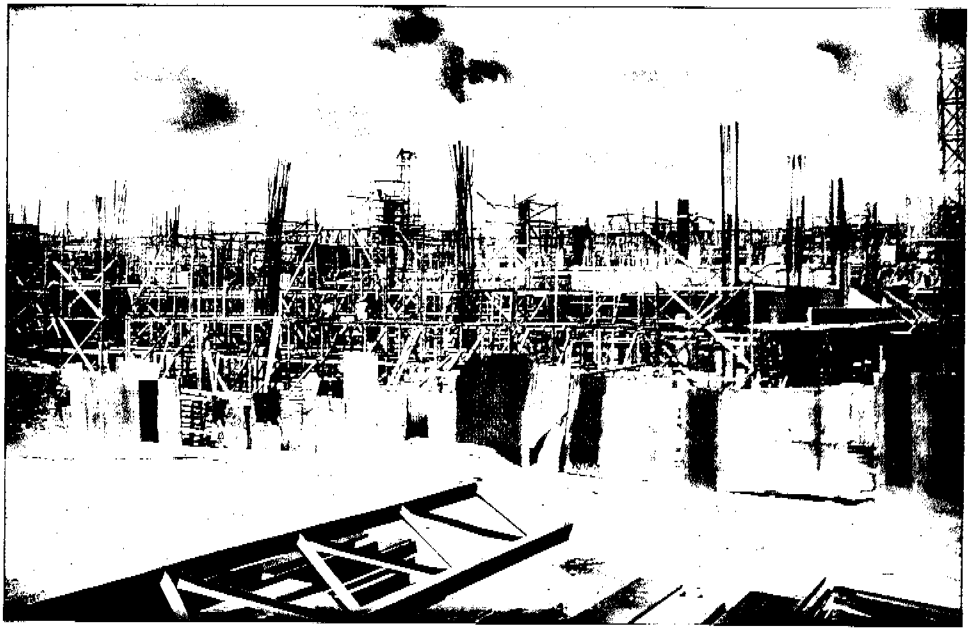
Environmental Impact Assessment

Environmental impact assessment (EIA) was primarily introduced by government to forecast the impacts of development projects on the environment and to determine preventive or mitigating measures for their adverse consequences.

The initial EIA system established by the Implementing Guidelines of P.D. No. 1151 on May 2, 1978, was a "decentralized process" wherein all projects were virtually covered by the requirement and lead agencies (sectoral departments and agencies) were given the responsibility to review and approve environmental impact statements. The National Environmental Protection Council acted primarily as a coordinating body for the system's implementation. Under this system, however, majority of development projects were implemented without benefit of EIAs.[123]

In June, 1978, another legislation, P.D. No.1586, formally established the Philippine EIS system, this time, with sanctions for non-compliance with the EIA requirement. The system's scope was also delimited to "environmentally critical projects or projects to be located in environmentally critical areas" (identified in Proclamation No. 2146). P.D. No. 1586, however, became operational only in 1982.

Prior to this, the system underwent transition from a decentralized process to a centralized one, starting December 23, 1979 by virtue of an NEPC Council Special Memorandum. From the lead agencies, processing of EIS documents and issuance of



Despite procedural problems, the EIA requirement became increasingly institutionalized within the decade.

Environmental education, which has been singled out as one important strategy to attain development for the country, slowly gained ground during the eighties.

Table 112. PAB Cases by Type of Industry, 1988-1989

Industry	Number
Leather/Tanneries	9
Steel	4
Chemicals	5
Mining	6
Pulp and Paper	4
Food*	45
Rubber	7
Cement	5
Distilleries	4
Metal	4
Poultry/Piggery	24
Ricemills	4
Garment/Textile	22
Electronics	1
Petroleum	2
Oil	1
Power	1
Others**	12
Total	160

Source: Environmental Management Bureau

* - Includes canning, sugar, fishmeal and noodles manufacturing

** - Includes real estate, shipping, junkshops

Table 113. Pollution Cases Acted Upon by the NPCC, 1979 - 1985

Year	Number
1979	237
1980	313
*1981**	-
1982	64
1983	190
1984	134
1985	106

Source: NPCC Annual Reports, Various Years

* - Figures unavailable.

Table 114. Budgetary Allocation of the NEPC and NPCC, 1980-1987
(000 Pesos)

	1980	1981	1982	1983	1984	1985	1986	1987
NEPC	7,001	7,878	8,650	9,305	7,893	7,392	8,149	7,876
NPCC	6,132	7,580	8,650	9,460	9,102	9,603	16,771	16,034
Combined Budget	13,133	15,458	17,436	168,765	16,995	16,995	24,920	23,910
Total National Budget	37,894,032	50,319,032	57,091,994	61,837,776	53,450,490	58,328,941	67,409,045	79,321,042
% of National Budget	0.035	0.0307	0.0305	0.0303	0.0318	0.0291	0.037	0.0301

Source: General Appropriations Act, 1980-1987

Table 115. Budgetary Allocations of the EMB and the Environmental Management Sector of the DENR Regional Field Offices, 1988-1989

(thousand pesos)

	1988	1989
1. Environmental Management Bureau	17,082	13,625
2. EMS Sector, Regional Field Offices		
2.1 National Capital Region	-	3,319
2.2 Region 1	331	3,052
2.3 Cordillera Autonomous Region	-	1,685
2.4 Region 2	-	2,266
2.5 Region 3	-	1,552
2.6 Region 4	646	3,257
2.7 Region 5	-	2,032
2.8 Region 6	697	1,348
2.9 Region 7	735	1,438
2.10 Region 8	-	2,092
2.11 Region 9	-	1,208
2.12 Region 10	781	1,462
2.13 Region 11	697	1,322
2.14 Region 12		
Total (EMB + EMS, Regional Offices)	20,969	41,574
National Budget	231,900,000	117,012,067
Percentage of National Budget	0.009	0.035

Source: DENR, General Appropriations Act, 1988-1989.

Table 116. Budgetary Allocations of the BFD and FORI, 1980 - 1987*
('000 pesos)

	1980	1981	1982	1983	1984	1985	1986	1987
BFD	141,402	179,877	227,101	231,211	156,788	166,912	196,811	719,407
FORI	7,892	2,882	2,614	2,989	2,444	2,424	3,417	24,674
Combined Budget	149,294	182,759	229,715	234,200	159,232	169,336	200,228	744,081
Total National Budget	37,894,032	50,319,975	57,091,994	61,837,776	53,450,490	58,328,941	67,409,045	79,321,042
% of National Budget	0.394	0.363	0.402	0.379	0.298	0.290	0.297	0.938

Source: General Appropriations Act, 1980 - 1987.

*Regular budget appropriations; do not include special funds like loans and grants.

Table 117. Government Expenditure for Forest Protection, 1988-1989*
(thousand pesos)

	1988	1989
1. Forest Management Bureau	45,839	24,507
2. Ecosystems and Research Development Bureau	29,130	22,041
3. Protected Areas and Wildlife Bureau	14,611	13,525
4. Forestry and Ecosystems Research and Development Sectors, DENR Regional Field Offices		
4.1 National Capital Region		3,319
4.2 Region 1	30,478	24,895
4.3 Cordillera Autonomous Region		10,197
4.4 Region 2	37,905	41,146
4.5 Region 3	28,343	29,515
4.6 Region 4	51,818	67,340
4.7 Region 5	17,139	19,758
4.8 Region 6	18,779	20,660
4.9 Region 7	29,069	26,617
4.10 Region 8	21,325	25,914
4.11 Region 9	21,225	21,616
4.12 Region 10	26,687	30,537
4.13 Region 13	31,283	36,296
4.14 Region 12	23,098	23,488
Sub-Total	426,729	441,371
National Budget	21,900,000	117,012,067
Percentage of National Budget	0.184	0.377

Source: DENR, General Appropriations Act, 1988 - 1989

*Regular budget appropriations; do not include special funds like loans and grants.

Environmental Compliance Certificates (ECCs) for projects which have satisfactorily complied with the EIA requirement, was centralized in the NEPC.[124]

Compliance Trends

The number of Environmental Impact Documents (EIDs) submitted and processed from June, 1978 to December, 1979, is quite difficult to establish due to the decentralized nature of the EIS system then and the erratic reporting procedure of the lead agencies. December, 1979 to December, 1980 was still a transition period during which some agencies were still processing EIS documents although the authority to process and review such was already lodged with the NEPC.

From January, 1981 to December, 1989, a total of 5,231 environmental impact documents were submitted to the implementing agency. Of these, 4,366 or 83% constituted of sand and gravel projects, which were reviewed based on their cumulative impact and existing guidelines on sand and gravel extraction drawn up by the NEPC and the BMGS. **Table 118** provides the number of environmental impact documents processed from 1981- 1989, excluding sand and gravel projects. Of the 865 EIDs, 840 were issued Environmental Compliance Certificates. A break-down of EIDs submitted to the EMB by project type for the same period is given in **Table 119**. Non-metallic mining had the highest number of applications, followed by subdivision and metallic mining.

Table 118. Environmental Impact Documents Processed, 1981-1989*

Year	EIDs Submitted (PDs & EISs)	Projects Granted ECC (PDs & EISs)
1981	139	100
1982	126	123 **
1983	113	116
1984	97	101 **
1985	72	68
1986	19	36 **
1987	74	77
1988	118	107
1989	107	112 **
Total	865	840

Source: Environmental Management Bureau

Legend:

* Excludes EIDs for sand and gravel projects.

** Includes ECC for projects whose EIDs were submitted the previous year.

Table 119. Environmental Impact Documents Submitted to EMB by Project Type, 1981 - 1989

	1981	1982	1983	1984	1985	1986	1987	1988	1989	Total
1. Non-Ferrous					2		1	1	1	5
2. Ferrous	1							2		4
3. Petroleum/Petrochemical	1	2	2	1	4	1			1	12
4. Chemical	1			2		1		1	1	5
5. Cement									2	15
6. Food										4
7. Agrichemical	3			4	5		3		1	11
8. Oil mills/Soap and Detergent		2			1		2	2	1	4
9. Pulp and Paper				4	2				2	4
10. Rubber					2		2		1	3
11. Plastics				1	1			2		1
12. Intermediates/Dyes				2				1		6
13. Breweries/Fermentation				2			2		2	8
14. Synthetic Fibers/Textile				2				1	2	22
15. Poultry and Piggery		1			1	1	1	10	4	6
16. Electronics		1			1		4	1	2	1
17. Abrasives					1	1				3
18. Cottage Industries					1				1	1
19. Hydro-electric Power Plant				2			1	1		3
20. Thermal Power Plant		1						1		5
21. Geothermal							2	2	1	
22. Other Power Plants		1						4		5
23. Major Roads/Bridges			1	1	1					3
24. Major Dams					1					1
25. Major Reclamation Projects		1		1						2
26. Subdivisions				1	1		34	52	18	106
27. Dumpsites									3	3
28. Memorial Parks								4	2	6
29. Port Facilities							2	1		1
30. Metallic Mining	38	33	8	11	1		9	2	4	99
31. Non-Metallic Mining	87	81	101	71	45	12		12	2	420
32. Logging									1	1
33. Major Wood Processing	1						2			3
34. Fauna/Flora Intro/Breeding		1					1	1	1	4
35. Commercial Fishing	7	4								12
36. Mine Tailings Disposal							1			1
37. Others				1		3	7	17	54	82
Total	139	126	113	97	72	19	74	118	107	865

Source: EMB

Problems

Problems of poor compliance plagued the system until the change in administration in 1986. This has been attributed to the fact that environmental impact assessment had not gained wide acceptance for its utility and value. Rather, developers viewed it as another regulatory imposition by government which they had to hurdle. Planners, in general, still have to accept the value of EIA and environmental safeguards prescribed as a result of the assessment exercise.[125]

Another of the system's problems, from its inception up to the present, has always been its scope. Under the decentralized process, the problem was screening out the small projects with insignificant impacts on the environment in the absence of clear guidelines as to what "significant impacts" on the environment meant. With the centralized process and even with Proclamation No. 2146, the problem persisted due to the fact that environmentally critical areas covered almost 80% of the country's geographical area and inevitably, subjected small and insignificant projects to the EIA requirement.[126]

Many of the early EIAs were conducted late in the planning process, often leading to confrontational situations, not only between the developer and regulatory agencies, but also between the developer and the general public. Such timing has greatly affected the kind of results and recommendations presented in the EIA. Alternatives to the proposed development were oftentimes not studied nor considered. The lack of baseline data, too, has resulted in vague predictions and subsequently, EIS documents of poor quality.

Lack of training on the part of the assessors and reviewers within the implementing agency has resulted in the inadequate identification and evaluation of environmental issues of projects under review. Although the quality of environmental impact assessments has somewhat improved over the years, the documents still leave a lot to be desired.

2.2 The Philippine Environment Code

For the past decade, government exerted efforts to implement provisions of P.D. No. 1152 or the Philippine Environment Code. Such efforts were on concerns like waste management, air and water quality management, environmental education, environmental research and tax incentives, among others. While these efforts were limited they, nevertheless, laid down the groundwork for subsequent environmental management undertakings in the nineties.

Toxic Chemicals and Hazardous Wastes Management

Toxic Substances Control

The industrialization of the early fifties spurred the entry of toxic chemicals into the country and the dumping of hazardous wastes into the environment. Control and management responsibilities over toxic chemicals and hazardous wastes were and still are dispersed among various government agencies such as the Bureau of Food and Drugs for food and drugs; the Fertilizer and Pesticides Authority for pesticides and fertilizers, the Department of Environment and Natural Resources for mine tailings, and, the Philippine Nuclear Research Institute (formerly PAEC) for radioactive materials, etc. No integrated system is in place to take care of monitoring problems on toxic chemicals and hazardous wastes.

It is in response to this need that the Toxic Substances Control Act was drafted in 1988, empowering the Department of Environment and Natural Resources " to control, supervise and regulate activities on toxic chemicals and hazardous wastes ". It was introduced in Congress as House Bill No. 18383, otherwise known as the Toxic Substances Control Act of 1989 but has not been passed up to this time.[127]

In anticipation of the passage of the Act, however, the Environmental Management Bureau has started to implement certain activities such as the Philippine Inventory of Chemicals and Chemical Substances (PICCS).This involves the listing of all existing manufactured and imported chemical substances in the country to form the basis for the bill's implementation.

Hazardous Wastes Management

Interim implementing guidelines for the handling and management of solid and hazardous wastes were also formulated during the latter half of the decade and were issued as DENR Memorandum Circular No. 3, Series of 1987. The guidelines specifically prohibit hazardous waste importation without prior notice to the DENR. Such also prohibit the storage, transport, collection, processing and disposal of hazardous wastes in a manner that would "cause or present potential risk of injury to health and the environment." Again, two bills have been filed in Congress on this subject but have not been approved until now.

Toxic chemicals and hazardous wastes surveys have been conducted by both the EMB and the Laguna Lake Development Authority to serve as basis for monitoring and control of toxic substances and hazardous wastes. The Industrial Waste Exchange Project (IWEP) of the EMB, which was initiated in 1987, promotes waste transfer and utilization among industrial firms through a clearinghouse (EMB), which facilitates data sharing, technical assistance and waste transfer among industries.

Incentives

Considered by industry to be one of the more positive programs of government, the Tax Incentives Program authorized under Section 56 of the Code, granted tax exemptions, credits or deductions for the procurement, installation, utilization and manufacture of pollution control equipment, devices, spare parts and accessories. Incentives ranged from fifty percent of tariff duties and compensating tax to fifty percent of expenses actually incurred for research projects undertaken to develop technologies for manufacture of pollution control equipment. The Program was administered by the NEPC in 1980 but was terminated in 1985, when the prescription period for the incentives lapsed. Efforts were made to extend the effectivity of the incentives but the legislative branch of government has not come up with laws to this effect. Only a little more than twenty (20) industrial firms were able to avail of tax incentives under the program. Among these were the San Miguel Corporation, Kimberly Clark Philippines, La Tondena Inc., Franklin Baker Corp., etc.

Air and Water Quality Management

Implementation of the Code's provision on water quality management did not register any significant headway during the last decade, except for the revision of the standards (See **Inland Waters**) and efforts at rehabilitating the country's most polluted river system, the Tenejeros- Tullahan. Classification of Philippine waters and water quality monitoring and surveillance were not actively pursued, primarily due to manpower and financial constraints.

Air quality monitoring efforts expanded, although still very insignificantly. The Anti-Smoke Belching Campaign, however, was given a new slant, through more aggressive information dissemination and law enforcement efforts (See **Atmosphere and Climate**).

Solid Waste Management

Solid waste management continued to be lack-lustre during the past decade due to the usual resources and institutional constraints. Efforts were made, however, to operationalize the intent of the Code's provision on waste management through the implementation of the Solid Waste Subsidy scheme. The scheme, which was implemented under the Solid Waste Management Assistance and Development Program (SWMADP) of the NEPC (now the EMB), was conceptual-ized to improve the collection, transport, recovery and disposal of solid wastes. The SWMADP specifically provides assistance in resource recovery, sanitary landfill establishment, biogas systems construction, acquisition of garbage equipment and facilities, and preparation of solid waste management plans.

Environmental Education

Environmental education efforts slowly gained ground during the past decade with more activities undertaken in the formal education sector. In 1984, soil conservation concepts were integrated into the school curriculum at all levels, through the initiatives of the NEPC, DECS, DA and other institutions. In 1985, instructional materials for the schools were analyzed as to environmental concepts content. Some institutions like the U.P.- ISMED developed the "Philippine Environmental Science Series."

In the tertiary level, some universities like the U.P. in Los Banos offered courses in ecology and environmental studies. As of 1988, about 12 inter-disciplinary undergraduate degree programs on the environment were offered by colleges and universities. These were, however, concentrated only in the Southern Tagalog and the National Capital Region. Universities and colleges consolidated efforts to form the Environmental Education Network of the Philippines.

To integrate and provide direction to existing environmental education efforts, the EMB, with assistance from the UNDP, the DECS, academic institutions and their respective organizations, and, non-governmental organizations, initiated the development of the "Environmental Education Strategy" in 1989. The strategy aims "to develop an environmentally literate and responsible citizenry who shall ensure the protection and improvement of the Philippine environment in order to promote and implement sustainability, social equity and economic efficiency in the use of the country's natural resources." Key and critical environmental programs for the formal and non-formal sectors were drawn up under the strategy which the EMB and other collaborating institutions and organizations have started to implement. Government, however, needs to pour in more resources into this effort in order to intensify and widen the scope of activities.

Environmental Research

Continuing studies and research programs on environmental management were also mandated under the code. A motley of environmental research activities were undertaken during the past decade. But these were dispersed over a wide array of institutions and were, therefore, largely uncoordinated. Although a lot of ground had been covered, ranging from pollution to natural resources degradation control and rehabilitation, these efforts have been largely unmonitored up until 1988, during which time the Ecosystems and Research Development Bureau attempted to inventory all environmental research and development programs of the DENR. As a result, it was able to come up with the "Integrated Research and Development Plans and Programs of the DENR, 1989-1993" which will serve as guide for future research activities of the various units under the Department. Government resources allocated in this field up to the present, have remained very minimal.

Conservation of Natural Resources

In the area of conservation of natural resources, the former Bureau of Forest Development launched in 1969 a conservation program for the Tamaraw, the Philippine eagle and the Pawikan or Green Turtle to prevent the extinction of these endangered animals.

The proclamation of national parks was spurred primarily by the extinction of rare and endangered wildlife species. The national parks' areal coverage increased through the years: 22,408 hectares in 1972; 298,633 hectares in 1975; 316,092 hectares in 1977; 447,594 hectares in 1988.

Besides national parks, portions of government-owned lands were proclaimed Game Refuge and Bird Sanctuaries, which were closed to hunting and fishing to allow their animal population to re-stock. These totalled 398,233 hectares in 1973; 1,685,990 hectares in 1975; 1,700,390 hectares in 1976 and 939,886 hectares in 1988.

Current environmental, socio-economic, administrative, management and tourism-recreation factors have given rise to the need for rationalizing national parks and equivalent reserves through the Integrated Protected Areas System. The IPAS is expected to determine existing protected areas which will continue to be protected and identify additional sites to be proclaimed as protected areas.

Forest occupancy management was recognized to have implications on natural resources conservation, forcing the government to embark on programs like the Census of Forest Occupants and the Integrated Social Forestry Program.

In the ASEAN region, nature conservation was identified among the priority areas of concern since December, 1978 which led to the adoption of the ASEAN Convention on Nature Conservation in 1980.

2.3 The Philippine Strategy for Sustainable Development

Government took cognizance of the need for a National Conservation Strategy specifically through Section 16 (h) of Executive Order No. 192. Pursuant to this mandate, the Environmental Management Bureau initiated a series of consultations with the different sectors of society. On May 23-24, 1988, the EMB convened a multi-sectoral national workshop, the participants of which issued a formal resolution urging the President and Congress of the Republic of the Philippines to adopt and implement a Philippine Strategy for Sustainable Development (PSSD). The Workshop also generated the first draft of a conceptual framework for the PSSD. Subsequent consultations, such as the Symposium held on June 6, 1988, the Senior Officials' Consultative Forum on February 17, 1989 and regional multi-sectoral consultations, served to further crystallize and refine the framework. In its Resolution No. 37, dated November 29, 1989, the Cabinet approved the Conceptual Framework of the Philippine Strategy for Sustainable Development.

The PSSD is basically the country's response to the world-wide call for undertaking development without destruction and "meeting the needs of the citizens of today without limiting the options of future generations to fulfill their needs". Specifically, "it aims to achieve and maintain economic growth without depleting the stock of natural resources and degrading environmental quality".

At its core are ten major strategies aimed at resolving and reconciling the diverse and sometimes conflicting environmental, demographic, economic and natural resources use issues. These strategies are:

1) Integration of Environmental Considerations in Decision-Making

    This will involve a fundamental re- alignment of development planning objectives to enable the merger of environmental and economic considerations in decision-making. Analytical tools and methodologies such as natural resource accounting, environmental impact assessment and land use planning will be utilized.

2) Proper Pricing of Natural Resources

    A price reform strategy will be employed which will take into consideration pricing of environmental resources which have heretofore been considered free (air and water); proper pricing of grossly underpriced resources such as timber and minerals; and, payment for damages to the environment, among others.

3) Property Rights Reform

    At the heart of the strategy is security of tenure for small-holder farmers and forest occupants over primary resources. This is envisioned to result in self-regulation by the concerned community or individual in their exploitation of natural resources. The Strategy would involve utilization of such instruments and schemes as stewardship contracts, small holder timber concessions, artificial reef licenses, community forests, community fishing grounds and mining cooperatives.

4. Conservation of Biodiversity

This is simply an explicit recognition of the importance of preserving the country's wild species and genetic diversity through the establishment of protected areas. It is seen as a means to increase the country's capacity to deal with future questions on survival and development.

5. Rehabilitation of Degraded Ecosystems

Deliberate rehabilitation efforts are deemed necessary in view of the massive destruction of the country's ecosystems. A concerted action is planned involving massive reforestation of denuded watersheds, mangrove re-plantation, clean-up and control of pollution and revival of biologically dead rivers.

6. Strengthening of Residuals Management

The Strategy, rather than merely concentrating on "end-of-pipe" control systems, will be primarily concerned with the introduction of recent innovations in industrial process design aimed at reducing waste streams. It will also entail resource recovery through re-cycling and utilization of economic incentives to encourage installation of pollution control facilities by industry.

7. Control of Population Growth and Human Resources Development

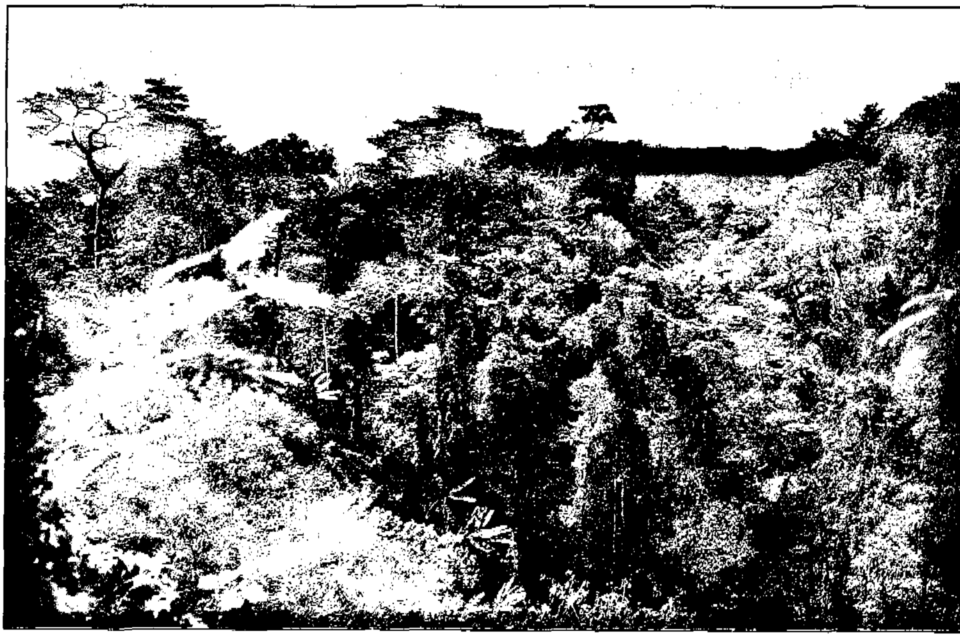
The planned population control program will not only be limited to controlling numbers but will include health, education and rural development projects which will be implemented at the regional and community levels.

8. Inducing Growth in the Rural Areas

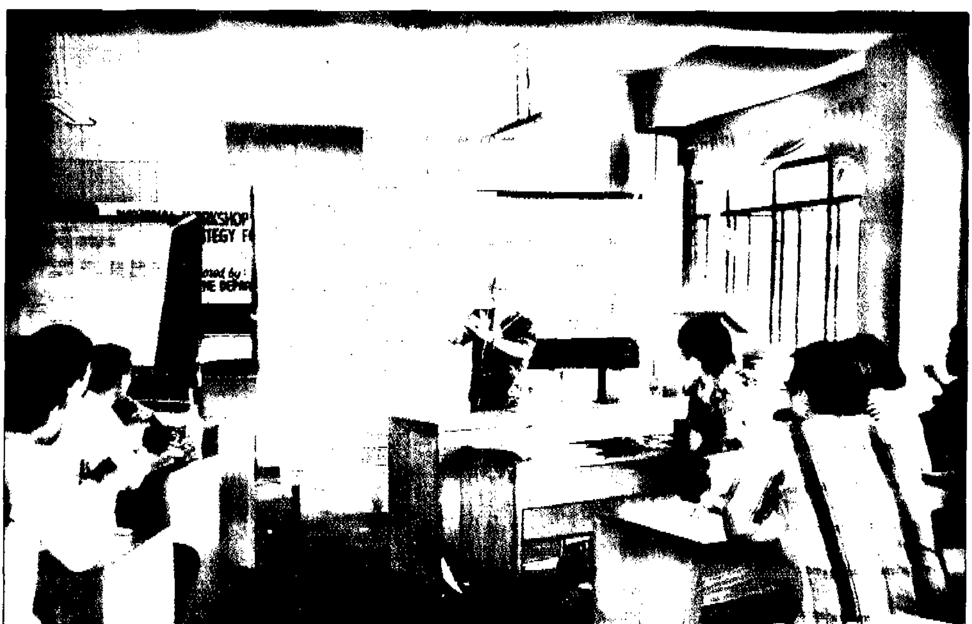
Premised on the notion that economic recovery and long-term stability depend on increasing incomes and employment in the rural areas where majority of the country's population reside, the seven-pronged strategy will basically involve: a) empowerment of the rural poor through participation in policy-making and project implementation; b) accelerated implementation of land reform; c) grant of equitable access to the rural poor to natural resource use and benefits; d) removal of economic and public investment biases against the rural sector; e) provision of infrastructure and support services; f) establishment and reinforcement of "growth centers"; and, g) strengthening of social services such as education, health and nutrition.

9. Promotion of Environmental Education

Environmental education is envisioned to enable citizens to understand and appreciate the complex nature of the environment and its role in economic development, as well as, to develop social values which will create the commitment and political will to deal with difficult environmental and social issues.



Protection of the country's remaining gene pools was a major concern of the government during the decade. The Integrated Protected Areas was seen as the most feasible scheme of effecting rational use of national parks and equivalent reserves.



The NGOS became a potent force for the management, restoration and protection of the environment in the eighties.

10. Strengthening of Citizen's Participation

Non-governmental organizations will be employed to mobilize the citizenry and make them active participants in environmental management. The specific strategy to be employed is the formation of a network among NGOs and among NGOs and government organizations, to organize communities, conduct public information campaigns, conduct research/situation assessments; undertake environmental surveillance and monitoring and other similar activities.

3. NON-GOVERNMENT INSTITUTIONS AND ORGANIZATIONS

3.1 Church

The Catholic Church has played a steady role as an influential social institution in the country. During the past two decades, it has been actively espousing contrary views on artificial means of birth control. In the 1986 People Power uprising, the Church became more prominent in citizens' mobilization for national interests. It was only in January, 1988, however, that the Catholic Bishops Conference of the Philippines (CBCP) expressed, in very strong terms, its concern for the deteriorating state of the environment. The Pastoral Letter on Ecology entitled "What is Happening to Our Beautiful Land?" was read in all Churches and became a milestone in the history of the environmental movement in the Philippines.

In its reflections, the ten-page paper called upon all people to defend life, and particularly on communities, to organize and act directly on environmental issues as they encounter them. It urged government not to pursue short-term economic gains at the expense of long-term ecological damage and to put together an independent Department to deal with pressing ecological issues in close coordination with existing sectoral departments of the Cabinet.

By condemning the prevailing exploitative mentality of the few in power, the Church has effectively advanced the cause of the "environmentally marginalized sectors." The responses it elicited from NGOs, communities and government, best indicate the Church' potent role in the country's pursuit of environmentally-sound development during the past decade.

3.2 Academe

During the pre-1986 revolution period, some academic institutions were already undertaking environmental education through the incorporation of ecological issues in natural and social science subjects at different curriculum levels.

After 1986, more and more academic institutions took it upon themselves to include environment and ecology in their range of academic and non-academic concerns. The Maryknoll - P.E.A.C.E. (Public Education and Awareness Campaign for the Environment), for example, which was established to incorporate environmental principles at all school levels and disciplines, has expanded its role as advocate and worker for current environmental issues. The Philippine Uplands Resource

Center (PURC) was set up at the De La Salle University Research Center, in cooperation with the College of Forestry and the IESAM of the UPLB, the Ateneo Institute for Philippine Culture and the Bureau of Forest Development to serve as a center for information and networking for upland issues.

In June of 1988, an Environmental Education Network of the Philippines was founded from some 20 colleges, universities and NGOs who believed in the value of environmental education in re-directing the nation's thrusts towards sustainable development. The network's secretariat is based in U.P. Los Banos.

3.3 People's Organizations /Non-Government Organizations

The past decade marked a major change in the participation of people's organizations and NGOs in environmental protection. Although most organizing efforts during the last years of the Marcos government were directed towards socio-political and economic concerns of marginalized sectors, these often already touched on environmental issues. Protests by small fishermen in Laguna de Bay, for example, were directed towards operations of large fishpen owners which deprived them of an adequate supply of fish because of the ecologically destructive impact of too many fishpens in the lake.

The intense struggles against the encroachment of the Igorot people's ancestral lands in the Cordilleras clearly had underlying environmental tones, particularly in the case of the Cellophil Resources Corporation's 100,000-hectare forest concession in four provinces of the Cordillera; and the Chico Dam controversy in which vast upland areas covering ancestral domains of the Kalingas would be inundated. Resistance of local communities to these developments led to the death of key figures. The situation, however generated massive support from other sectors until the termination of the projects at the end of the Marcos administration.

One of the forerunners of community environmental activism in the late seventies was the protest launched by the Concerned Citizens of San Juan, Batangas, against the installation of the Pasar Copper Smelter Complex in their town. The campaign succeeded, forcing the project's proponents to put up the copper smelter complex in Leyte instead.

Another well-known, long-running people's campaign is the protest against the Marcopper Mining Corporation which has, through a period of 20 years, dumped its mine tailings into Calancan Bay in Marinduque Island. The most visible figures in this protest are the environmentalists belonging to a non-governmental organization called Lingkod Tao-Kalikasan. Established as a secretariat for "ecologically sound human development", the LTK undertakes community organizing and environmental education to enable local communities to assess and respond to environmental problems in their areas. Their efforts to put an end to the Bay's pollution paid off finally in 1988, when the DENR ordered Marcopper to adopt a less destructive disposal scheme. Victory was short-lived, however, since the decision was reversed barely a month after its implementation.

The biggest issue which paved the way for less sporadic and more organized environmental activism was the building of the nuclear power plant in Morong, Bataan.

Starting from the complaints aired by the Concerned Citizens of Morong, Bataan, the protest movement grew into the Nuclear Free-Philippines Coalition. The National Organization Against Nuclear Power and Weapons (NO NUKES) was also established, sustaining the campaigns and mobilization even after 1986. The issue brought together a broad spectrum of support groups and advocates. It was a key issue in the first national environmental congress in 1979, which launched the PFEC (Philippine Federation for Environmental Concerns.

During the post-1986 revolution period, NGO activism and concern for the environment rapidly heightened. Not only did the number of environmental NGOs increase drastically all over the country, other civic or professional and social development organizations also took up environment as a priority concern. Based on preliminary studies of NGOs which have environmental concerns today, about 20% were found to have been organized to directly address environment and natural resources issues.

Issue-based environmental advocacy continued to flourish. In 1987, for example, a group of professors and engineers under the Philippine Institute of Chemical Engineers protested successfully against the adoption of a major incineration scheme in Iligan City. The scheme entailed utilization of wastes imported from industrialized countries to fuel the incinerators, and was feared to cause emission of unknown pollutants into the atmosphere.

NGOs have also been highly vocal about commercial logging issues. Major groups have signified their support for the log export ban. In the Senate's raging debates on a selective versus total logging ban, NGOs have been an important force on the side of those advocating the protection of the remaining virgin forest stands. In September 1989, residents and religious leaders from San Fernando, Bukidnon fasted for days in front of the DENR Central Office in Diliman to protest the destruction of forests in their province. They enjoined the national government to impose a total ban on logging to maintain their land's ecological balance on which their food and livelihood depend. It was the culmination of a series of mass actions at the provincial level against specific logging companies since 1987.

Explorations for geothermal energy in Irosin, Sorsogon and at the Mt. Apo National Park in Mindanao, generated objections not only from local communities but also from other sectors i.e. local church, academe, environmental groups and some segments of government. In 1989, residents and organizations of Irosin banded together and took a common stand rejecting the proposed geothermal project, contending that it would adversely affect the environment. The umbrella group, called Sectors Against the Irosin Geothermal Project or SAGIP continues to campaign for a people-centered development.

In April, 1988, tribal leaders of six ethno-linguistic groups in Mindanao performed a ritual called a "dyandi" or blood compact before hundreds of Mindanao Lumads and guests. Through the solemn ceremony, they reiterated their reverence for Mt. Apo, which they consider their god, and swore to defend it "to the last drop of their blood." This resistance has prevented the development of the area's geothermal fields. The move to halt the construction of geothermal plants has been strongly backed by environmental groups.

In late 1988, a broad alliance of Metro Manila- based NGOs launched a campaign against smoke-belching in the metropolis. Called the Groups Against Smoke - Pollution (GASP!), this was spearheaded by the Bishops'-Businessmen's Conference for Human Development and a host of other private associations. Although the campaign had to give way to the transport problem crisis, the mobilization of NGOs and private corporations for the campaign was able to prove vital points about networking for environmental issues.

Beyond advocacy, NGOs in the eighties have shown much potential to work on actual management, restoration and protection of the environment. The campaign against the Bataan Nuclear Power Plant, for example, was supported by detailed economic and technical analysis. In place of the Pasar Industrial Complex, citizens initiated soil analysis to determine what trees would grow best in their area. Presently, the people of Morong enjoy the benefits of the fruit- bearing trees they planted more than ten years ago.

The Kilusang Mambubukid ng Pilipinas, a militant farmers' group, has also started to go into scientific research for better agriculture. Since July 1986, a partnership called Magsasaka at Siyentipiko para sa Ika-uunlad ng Agham Pang-Agrikultura or MASIPAG, has worked on a rice variety which will be high-yielding yet not dependent on chemical fertilizers and adapted to tropical conditions.[128]

Vital conservation projects have been managed by private organizations in coordination with government. The Conservation and Resource Management Foundation, for example, has been handling the Tamaraw Conservation Program in Mindoro and the Calauit Wildlife Sanctuary in Palawan, along with a complementary livelihood assistance program for communities displaced by the sanctuary. The Philippine Eagle Conservation Program Foundation likewise manages the protection and captive breeding of the world renowned Philippine Eagle in the Mt. Apo National Park in Mindanao.

The evolution of environmental NGO concerns is also reflected in the history of the Haribon Foundation for the Conservation of Natural Resources. Starting as a bird-watching and wildlife conservation society in the 70s, it evolved into a natural resources foundation in 1984, handling environment and natural resources projects of broader scope. In 1988, it launched the "Boto Para sa Inang Bayan" (Vote for the Motherland) campaign confronting, as its first issue, the annihilation of Palawan's ecosystems. One million votes were collected for a ban on commercial logging, collection and trading of wildlife and the declaration of Palawan as a protected area under the Integrated Protected Areas System. By 1989, Haribon was initiating stronger multi-sectoral action as the convenor of the Green-Forum-Philippines, a coalition of a large number of organizations under a sustainable development framework.[129]

The number of networks and alliances formed between 1986 and 1989 may be an indication of the increased level of NGO concern for the environment. As early as 1979, environmental congresses began to be held among NGOs of various orientations. After the 1986 revolution, the Philippine Federation for Environmental Concern (PFEC) was joined by the Solid Alliance of Vigilant Environmentalists (SAVE), the Philippine Ecological Network (PEN), the Philippine Environmental Action Network (PEAN), the Public Education and Awareness Campaign for the Environment

(PEACE), the Environmental Education Network of the Philippines (EENP), the Philippine Environmental Journalists, Inc. (PEJI) and the Green Forum-Philippines, among others.

Even among sectors not traditionally working on environmental issues, not a few major NGO networks also begun take more interest in environment. Among others, these groups include the Association of Foundations (AF), Philippine Business for Social Progress (PBSP) Philippine Partnership for the Development of Human Resources in Rural Areas (PHILDHRRA), Asian NGO Coalition for Agrarian Reform and Rural Development (ANGOC), PSDC, and PHILSSA.

This development occurred both at the network level and as collective actions among networks. ANGOC, for example, has conducted studies and published materials on peoples participation in environmentally sustainable development. National Consultations on Ecology and Sustainable Development were conducted in early 1990 using resources pooled together in late 1989. Likewise, joint efforts by the Center for Social Policy, Haribon and LTK resulted in the conduct of an Ecology Forum in Mindanao in 1989.[130]

Since 1986, the relationship between government and environmental NGOs has also taken a new turn. While this was initially characterized by wariness and general distrust from both sides, it has gradually changed for the better. Barriers are gradually being broken down to give way to possible avenues of cooperation, particularly in rebuilding degraded critical ecosystems such as the uplands and the coastal zone. This was specifically institutionalized in the Department of Environment and Natural Resources with the creation of the NGO Desk in August, 1989.

3. PROSPECTS

The years of environmentalism simply hammered home the message that it makes long-term economic sense to pursue environmentally-sound policies. Of late, this concept was neatly captured in the term "sustainable development". In the administrative framework, however, the following imperatives still need to be addressed for the concept to be operationalized:

- The need to translate national articulations of support for sustainable development concerns into greater budgetary allocations for pollution control and overall environmental management.

- The need to strengthen the institutions for environmental management so that leadership, advice, guidance, monitoring, assessment and reporting on environmental management concerns are clearly defined.

- The need for coordinated and integrated macro and micro planning that will direct the identification and conduct of scientific and technological research, monitoring and education on critical environmental protection issues. The tendency for "quick-fix" solutions and reactionary/short- sighted approaches to environmental catastrophes, will have to be supplanted with pragmatic long- term, pro-active frameworks on environmental management concerns.

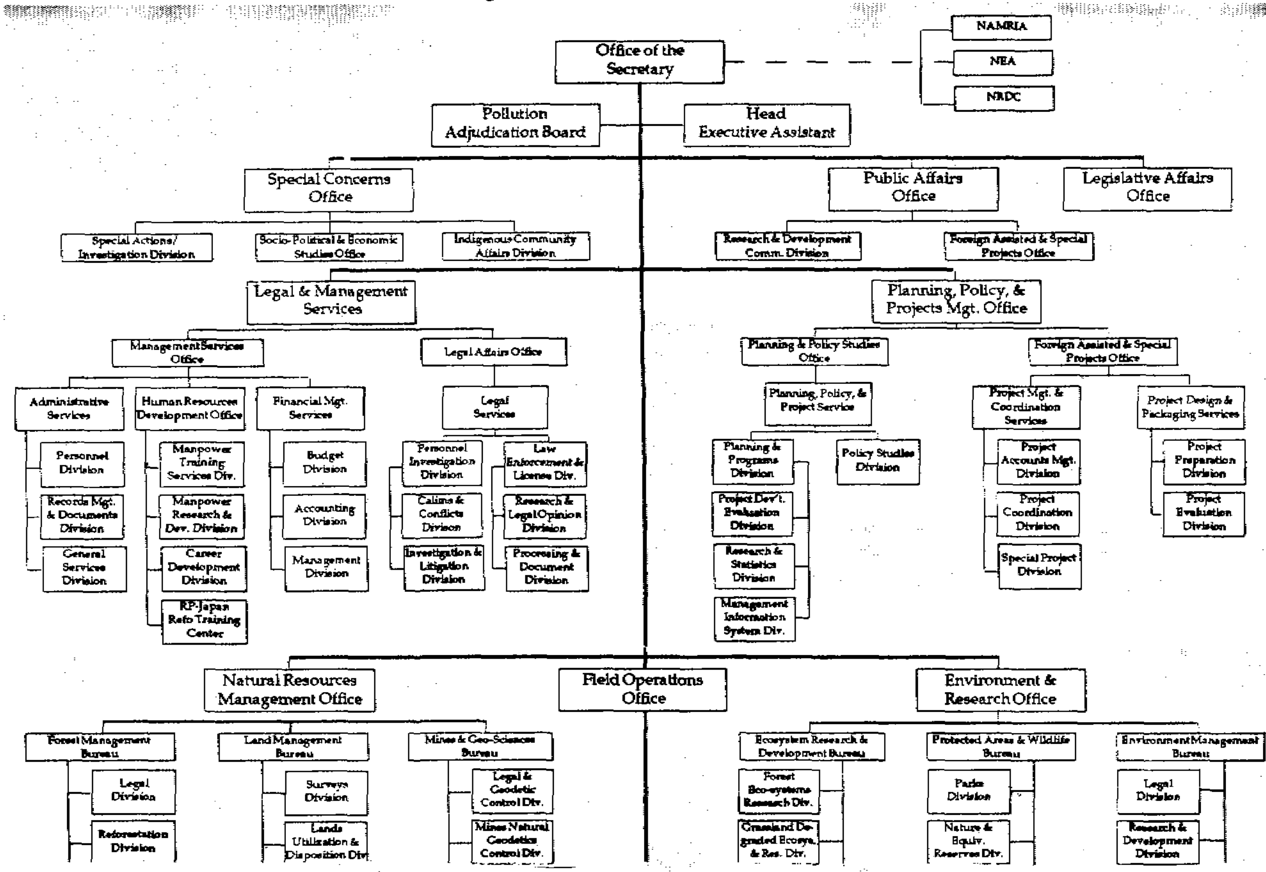
- The need for the generation of reliable and accurately synchronized data bases and the strengthening of information exchange systems for various environmental concerns that will be crucial in informed decision-making activities.

- The need for the radical review of policies that govern the National Economic Development Authority, the various sectoral line agencies, other government and

- The need for the radical review of policies that govern the National Economic Development Authority, the various sectoral line agencies, other government and private instrumentalities, in terms of their adherence to goals that promote environmental integrity.
- The need to strengthen the enforcement of major environmental policies already in place, and the active initiation of revisions and/or new legislations whenever necessary, to make them more attuned to the changing times.

- The need to optimally harness cooperation with the scientific community and the non-governmental organizations as cost-effective partners in environmental management.

Department of Environment and Natural Resources
Organizational Structure



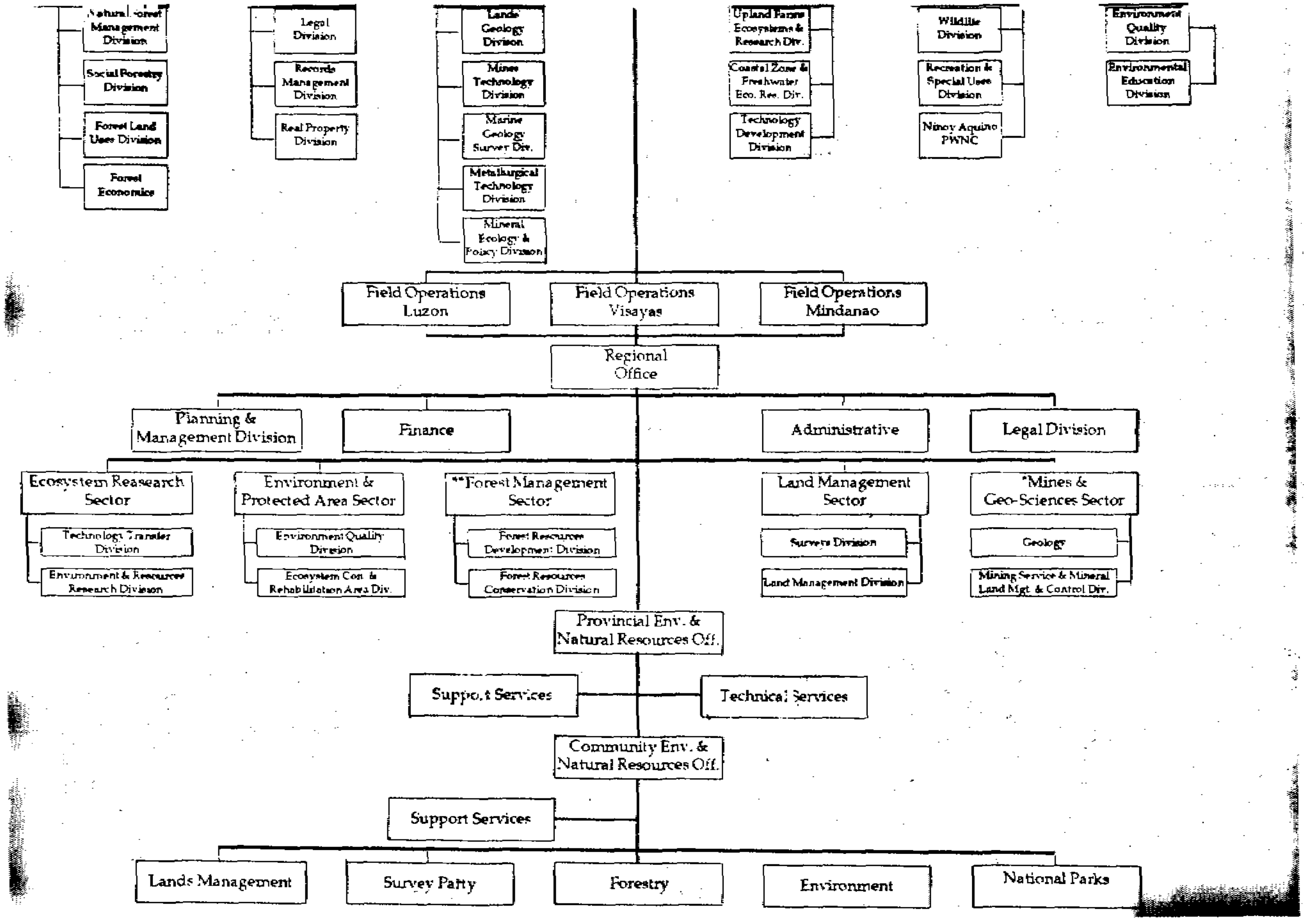


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Figure 51. DENR Organizational Chart

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