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**RAFAEL LANDIVAR UNIVERSITY
INSTITUTE OF ENVIRONMENTAL
SCIENCES AND AGRICULTURAL
TECHNOLOGY (ICATA)**

ENVIRONMENTAL PROFILE OF GUATEMALA

Executive Summary

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**U.R.L./AID-GUATEMALA/ROCAP Contract
No. 596-0000-C-00-3060-00**

Guatemala city, november, 1984

IV -- ENVIRONMENTAL PROFILE

REPUBLIC OF GUATEMALA

Environmental Profile

Executive Summary

U.R.L./AID-GUATEMALA/ROCAP
Contract No. 596-0000-C-00-3060-00

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developed express the opinions
of the authors.

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PRESENTATION

The government of Guatemala, interested in having an ample frame of reference on matters related to the environment, entered into a technical cooperation agreement through the General Secretariat of the National Planning Council, with the U.S. Agency for International Development (USAID). The Institute of Environmental Sciences and Agricultural Technology of Rafael Landívar University, was designated as the Executor Unit of said agreement under contract U.R.L./AID-GUATEMALA/ROCAP No. 596-0000-C-00-360-00.

This study is part of a series of similar works that have been conducted in other Latin American countries under the sponsorship of AID. As a whole, it points out the conspicuous characteristics of the Guatemalan environmental situation. This study is a cooperative venture comprised of the contributions of each of the professionals who formed part of the work group to produce the document titled *Environmental Profile of the Republic of Guatemala*, fruits of many months of constant effort. This profile composes an approximation to contiguous factors which determine and impose conditions of the national environment, compiles disperse information, presents a synthesis and interpretation of documents, and provides criteria and diagnoses for elaborating specific programs and projects bearing upon the environment. The short time limit assigned to each professional, 15 to 30 man/days, dictates the depth and extent of the profile.

The document clearly illustrates that our country's natural resources form an extraordinary symphony of abundance and color of which, broadly speaking, the principal compo-

nent is man himself. It is also obvious that the progressive deterioration of these resources and the source of ecological degradation unfortunately affect Guatemalan prosperity. Therefore, the undertaking of rational utilization and management of resources, environment maintenance and improvement, and correct and specific actions to cope with conflicts between the aim of economic development and environmental conservation are addressed to each and every Guatemalan. From this stems the imperative need of arousing an environmental awareness which will modify man's conduct and cast the responsibility of living in a close, harmonious relationship with nature. To attain this objective, we must educate every social level, most of all, our youth, under the efficient and genuine guidance of our human resources who have the capacity to impart their wisdom.

On the other hand, due to the difficulty of renouncing present indiscriminated benefits for bettering the future generation's destiny, both public and private entities should encourage improvement to plan, project, analyze, and conduct programs concerning the country's welfare according to Guatemala's unique style of development.

Finally, Rafael Landívar University wishes to acknowledge the previous efforts made by concerned individuals who also continue to work towards the preservation of a healthy environment. We offer them our encouragement and respect so that they will continue to diffuse their concern and awareness of the importance of protecting our natural resources.

Mario A. Martínez Gutiérrez
Director
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and Agricultural Technology

FOREWORD

Guatemala is richly endowed with natural, cultural and human resources. In very few parts of the world can one find, within only a hundred thousand square kilometres, such a diversity of luxuriant species and richness of soils, such vocation for forest species and variety of climates, so many physiographic contrasts and assortment of landscapes, and such a great potential for tourism development.

Formerly, Guatemala was represented by one of the greatest civilizations of antiquity—the Meso-American civilization—and presently manifested in innumerable archeological sites representing the pre-Classic Olmec culture of the southern coast, the magnificence of the Mayan Classic era of the northern lowlands, and the martial austerity of the highlands post-Classic era. This past survives in the native indian groups who provide a characteristic physiognomy to the human resources of the country, and in the ladinos or interbreeds of the former with the Spanish-Christian culture of the XV and XVI centuries.

Guatemala today, portrayed by the struggle of its inhabitants to fulfill their needs, yearnings, and ideals in a developing country whose economic activity has been historically governed by agricultural exports, introduces new factors and trends which, if they are not carefully channeled, could, in the future, revert the level of wealth to which we have been accustomed in the past.

This study is only a profile of the environmental situation in Guatemala and addresses some relevant issues such as: the present state of its natural resources, how they are presently being used, the legal, programming, and administrative infrastructure that support this use, and the available resources for proper management of the environment. Nevertheless, it also has a temporary dimension which delves into the past in search of an explanation for the present situation and guidance for future proposals which are considered as a necessary balance between the level and quality of life for present and future generations.

Recommendations are offered from a realistic viewpoint, suggesting action that tends to place the solid foundations on which and environ-

mental program can be structured for safeguarding the sustained use of the country's resources. This affords the only way to bequeath future generations the natural wealth inherited from the past.

The first chapters consists of an abridged version of the profile containing the principal elements needed for readily visualizing the global concept of the problem and the proposed solutions. Chapters two and three* describe in detail the potential of the natural resources of the country, the manner in which they are being used, and the social and economic factors that influence these patterns of usage. Chapter four gives a detailed account of the main environmental issues that have arisen as a result thereof. If timely measures are not taken, these problems will not only lead to an irreversible loss of resources, but also to the loss of development opportunities for the country which are emphasized in chapter five.

Based on the material of the preceding chapters, chapter six presents a critical diagnosis of the situation by identifying and assigning ranking priorities to groups of problems within the environmental development interaction, with a view to clarify the search for solutions and the proposal of actions to be taken. The actions are presented in chapter seven as an ensemble of long-term policy outlines (year 2,000), intermediate-term objectives and measures (year 1986), and immediate inception actions. These latter actions will serve as sound foundations for developing an environmental management plan for Guatemala which should lead to concrete benefits.

Four appendices describe the background and the general operational methodology of the study, the terms of reference, the principal limitations encountered, and the people interviewed in the course of the work. The corresponding acknowledgements are also given. Finally, all detailed information which was not convenient to include in the text, but was deemed important, is presented in a series of annexed chapters.

*Only Chapter one is translated into English

VIII — ENVIRONMENTAL PROFILE

We must keep in mind that this study is only a profile. Nevertheless, we should not underestimate the projects in the last two chapters since they are the result of serious discussions among the Work Group whose members are convinced that the future can be guided towards what it should be through what it is at present. Perhaps this realistic approach is the principal feature that distinguishes this effort

from others made in the past. These past efforts, although they have gone beyond a profile, have, from the beginning, projected ideal situations that are difficult to attain in an immediate term.

In this case, environmental awareness is the cornerstone for all future programs and actions, and little can be accomplished if it is not present at all levels of action.

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LIST OF ACRONYMS AND ABBREVIATIONS USED IN THIS STUDY

CIDA	Canadian International Development Agency.
AID	Agency for International Development
AGMIP	Asociación Guatemalteca de Manejo Integrado de Plagas (Guatemalan Association for Integrated Pest Management).
ANACAFE	Asociación Nacional del Café (National Coffee Association)
BANDESA	Banco Nacional de Desarrollo Agrícola. (National Agricultural Development Bank).
BANGUAT	Banco Nacional de Guatemala (Guatemalan National Bank)
BANVI	Banco Nacional de la Vivienda. (National Housing Bank).
CABEI	Central American Bank for Economic Integration
IDB	Inter-American Development Bank
AIDRB	International Bank for Reconstruction and Development (World Bank)
CARE	Comité Americano de Remesas al Exterior (American Committee of Foreign Remittances).
CB	Canasta Básica (Basic household basket).
CBMC	Carboxymethylcellulose.
CARITAS	Servicio Católico de Socorro (Catholic Aid Service)
CECON	Centro de Estudios Conservacionistas de la Universidad de San Carlos (Conservation Study Center of the University of San Carlos).
CEPAL/ILPES	Economic Commission for Latin America.
CETEFOR	Centro Técnico de Evaluación Forestal (Forest Evaluation Technical Center).
CICON	Centro de Información para la Construcción (Información Center for Construction).
CIF	Cost, Insurance and Freight.
IDRC	International Development Research Centre (Canadá).
CIDREE	Centro de Información, Documentación y Referencias de Educación Extraescolar (Information, Documentation, and References Center for Extraschool Education).
CITES	Convenio Internacional de Comercio de Especies en Peligro de Extinción (International Trade Agreement on Species in Danger of Extinction).
COGUANOR	Comisión Guatemalteca de Normas (Guatemalan Standards Commission).
CORFINA	Corporación Financiera Nacional (National Financing Corporation)
DALAI	Dirección de Asuntos Límites y Aguas Internacionales del Ministerio de Relaciones Exteriores de Guatemala (Administration of Limits and International Waters of the Guatemalan Ministry of Foreign Affairs).
OBD	Oxygen Biochemical Demand
DDT	Dichlorodiphenyl-Trichloroethane (1,1,1-trichloro-2,2-bis-(p-chlorophenyl) ethane).
DGC	Dirección General de Caminos (General Administration of Highways).
DGOP	Dirección General de Obras Públicas (General Administration of Public Works).
DIAAPS	International Drinking Water Supply and Sanitation Decade.
DIGAETH	Oficina General de Antropología e Historia (General Administration of Anthropology and History).

DIGESEPE	Dirección General de Servicios Pecuarios (General Administration of Cattle Services).
DIGESA	Dirección General de Servicios Agrícolas (General Administration of Agricultural Services)
DIRENARE	Dirección de Recursos Naturales Renovables (Renewable Natural Resources Administration).
DIRYA	Dirección Técnica de Riego y Avenamiento (Irrigation and Drainage Technical Administration).
DITEPESCA AES	Dirección Técnica de Pesca (Technical Office of Fishing). Agroeconomic Space.
ACID	Centro de Estudios Centroamericanos de Integración y Desarrollo (Central American Study Center for Integration and Development).
EEM	Empresas Eléctricas Municipales (Municipal Electric Companies).
US	United States
EEGSA	Empresa Eléctrica de Guatemala, Sociedad Anónima (Electric Company of Guatemala).
EMPAGUA	Empresa Municipal de Agua de la Ciudad de Guatemala (Municipal Water Company of Guatemala City).
ERIS	Escuela Regional de Ingeniería Sanitaria y Recursos Hidráulicos, USAC (Regional School of Sanitary Engineering and Hydraulic Resources).
EXMIBAL	Compañía Explotadora y Exportadora de Níquel (Exploiting and Exporting Nickel Company).
FAO	Food and Agricultural Organization of the United Nations.
FEDECOCAGUA	Federación de Cooperativas de Café de Guatemala (Guatemalan Coffee Cooperative Federation).
FEGUA	Ferrocarriles de Guatemala (Guatemalan Railways).
FOB	Free On Board.
FTN	Franja Transversal del Norte (Northern Transversal Strip)
FYDEP	Empresa de Fomento y Desarrollo Económico del Petén (The Petén Company for Promotion and Development).
GNZ	German Agency for Technical Cooperation.
GWh	Gigawatts-hour (million of kilowatts-hour)
ICAITI	Instituto Centroamericano de Investigación y Tecnología Industrial (Central American Research Institute for Industry).
ICTA	Instituto de Ciencia y Tecnología Agrícola (Institute of Science and Agricultural Technology).
ICATA	Instituto de Ciencias Ambientales y Tecnología Agrícola (Institute of Environmental Sciences and Agricultural Technology).
IDAEH	Instituto de Antropología e Historia (Anthropology and History Institute).
INFOM	Instituto de Fomento Municipal (Municipal Development Institute).
INGUAT	Instituto Guatemalteco de Turismo (Guatemalan Tourism Institute).
IGN	Instituto Geográfico Nacional (National Geographic Institute (today IGM)).
IGSS	Instituto Guatemalteco de Seguridad Social (Guatemalan Institute of Social Security).
IIAC	Interamerican Institute for Agricultural Cooperation.
INACOP	Instituto Nacional de Cooperativas (National Institute of Cooperatives)

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INAFOR	Instituto Nacional Forestal (National Forest Institute).
INAP	Instituto Nacional de Administración Pública (National Institute of Public Administration).
INCAP	Instituto de Nutrición de Centroamérica y Panamá (Institute of Nutrition of Central America and Panamá)
INDE	Instituto Nacional de Electrificación (National Institute of Electrification).
INDECA	Instituto Nacional de Comercialización Agrícola (National Institute for Agricultural Marketing).
INDERENA	Instituto de Recursos Naturales y del Ambiente (Institute of Natural Resources and the Environment).
INTA	Instituto Nacional de Transformación Agraria (National Agrarian Transformation Institute).
INTECAP	Instituto Técnico de Capacitación y Productividad (Technical Institute for Training and Productivity).
IPGH	Instituto Panamericano de Geografía e Historia (Panamerican Institute of Geography and History).
IRENAT	Instituto de Recursos Naturales (Natural Resources Institute).
IRCA	Ferrocarriles Internacionales de Centroamérica (Central American International Railways).
IGM	Instituto Geográfico Militar [Military Geographic Institute (formerly IGN)]
IRTRA	Instituto de Recreación de Trabajadores (Workers Recreational Institute).
INSIVUMEH	Instituto de Sismología, Vulcanología, Meteorología e Hidrología (Institute of Seismology, Volcanology, Meteorology and Hydrology).
ITA	Instituto Técnico de Agricultura (Technical Agricultural Institute).
ICZ	Intertropical Convergence Zone.
IUCN	International Union for Conservation of Nature and Natural Resources.
kWh	Kilowatts-hour
LAMI	Consortium Lahmeyer, Motor Columbus and International Engineering Co., Consultants.
LANDSAT	Satellite for Investigation of Natural Resources.
LPG	Liquid Petroleum Gases (propane, butane).
LSF	Consortium Lahmeyer, Salzgitter, Fichtner, Consultant Firms.
MAB	UNESCO Program on Man and Biosphere
MAGA	Ministerio de Agricultura, Ganadería y Alimentación (Ministry of Agriculture, Livestock and Food).
CMC	Central American Common Market.
TTOE	Thousand Tons Oil Equivalent.
IPM	Integrated Pest Management.
MW	Megawatts (thousand kilowatts).
NGO	Non Governmental Organization.
OCREN	Oficina Controladora de las Reservas de la Nación (National Reserves Control Office).
OAS	Organization of American States.
ILO	International Labour Organization.
OLADE	Latin American Energy Organization.
WHO	World Health Organization.
PSO	Panamerican Sanitary Office.
ECP	Economically Active Population

PEICA	Programa Energético del Istmo Centroamericano (Energy Program of the Central American Isthmus).
Pc	Petacalories (calories x 10 ¹⁵).
PHCA	Proyecto Hidrometeorológico Centroamericano (Central American Hydrometeorological Project).
GIP	Gross Internal Product.
PLAMABAG	Plan Maestro de Abastecimiento de Agua a la ciudad de Guatemala (Water Supply Master Plan for Guatemala City).
WFP	World Food Programme.
UNDP	United Nations Development Programme.
PREALCA	Programa Regional de Empleo para América Latina y el Caribe (Regional Employment Programme for Latin America and the Caribbean).
UNEP	United Nations Environment Programme.
ppm	Parts per million.
RDG	Republic of Guatemala.
SGNPE/SGEPLAN	Secretaría General del Consejo Nacional de Planificación Económica (General Secretariat of the National Economic Planning Council).
SIECA	Secretaría de Integración Económica (Secretariat of Central American Economic Integration).
SNI	Servicio Nacional Interconectado (National Interconnected Service).
ASL	Above sea level.
APS	Agricultural Public Sector.
ACRFPS	Agricultural livestock and Food Public Sector.
t	Metric ton (SI symbol)
ADAT	Annual Daily Average Traffic.
UFCO	Compañía Frutera Unida (United Fruit Company)
UNEPAR	Unidad Ejecutora del Programa de Acueductos Rurales (Executive Unit of the Rural Waterworks Program).
UNESCO	United Nations Education, Science and Culture Organization.
UNICEF	United Nations Children's Fund.
URL	Universidad Rafael Landívar (Rafael Landívar University).
USAC	Universidad de San Carlos de Guatemala (University of San Carlos of Guatemala).
USDA	United States Department of Agriculture.
USPADA	Unidad Sectorial de Planificación Agropecuaria y de Alimentación (Sectorial Unit for Livestock and Food Planning).

1. EXECUTIVE SUMMARY

1.1 NATURAL RESOURCES

1.1.1 Physical Resources

Guatemala is characterized by a very wide variety of nature resources. The country, although located within the tropical strip, is confined between latitudes 13°44' N and 18°30' N, and longitudes 87°30' W and 92°13' W.

The main topographic features and geographic sites mentioned in this study are shown in Figures 2.1.1 and 2.1.2.

The topographic structure of the country is defined by ten physiographic provinces, namely: The Pacific Coastal Plain, the Recent Volcanic Slope, the Volcanic Range, the Crystalline Highlands, the Sedimentary Highlands, the Motagua and Izabal Depression, the Interior Lowlands of Petén, the Lacandón Folded Belt, the Yucatán Plateau and the Caribbean Coastal Plain. Four of the country's 33 volcanoes are active.

The general climatic conditions vary from mild to very hot and from wet to very wet tropical zones. There are also local variations which define micro-climatic conditions. The average annual temperature varies from 28°C along the coastal lowlands to 10°C in the mountains. Maximum and minimum temperatures of 42°C and -7°C are also recorded. Average annual rainfall in the highlands amounts to 1 600 mm, but there are zones of annual precipitation as low as 500 mm and as high as 6 000 mm. Intertropical convergence is the main phenomenon causing rainfall, although tropical storms and cold fronts are also influential factors. The orographic conditions also play an important role in the formation of micro-climatic zones.

The country is divided by three major watersheds: The Pacific Watershed with 19% of the total runoff; the Atlantic Watershed with 34% of the total runoff (14% of this runoff corresponds to Belize); and the Gulf of México Watershed with 47% of the average annual total runoff. More than 300 lakes and lagoons are spread over the landscape. The largest lake is Izabal with 589.6 km². The Usumacinta River has the greatest body of water with an annual average flow of 1776 m³/s. Other important rivers are the Motagua (189 m³/s) and the Cahabon (166 m³/s). Available ground water is concentrated on the Pacific coast, in the volcanic valleys of the highlands and the valleys of the largest rivers such as the Motagua and the Polochic.

According to the classification system of FAO/UNESCO, the largest percentage of soil corresponds to "Camisoles" (20%), "Luvisoles" (22%), "Rendiznas" (14%), "Acrisoles" (10.5%), and "Nitosoles" (9.3%). Almost 26% of the country corresponds to the highlands, 21% to the interior plains of Petén and northern Lowlands, 19% to karstic lands, and 16% to the Pacific and Atlantic coastal flatlands where the most fertile soil of the country is found.

1.1.2 Biological Resources

The biological resources of Guatemala are also diverse. Estimations of the extension of wooded areas in the country are between 27% and 41%. This woodland varies from conifers and mild climate fast growing vegetation to rapid growing vegetation in the warmer lower areas. Between 1975 and 1982 woodlands covered 49 914 hectares. In 1955, Guatemala implemented a system for protecting wild zones, although only six areas are included in the IUCN list. These zones are Tikal, Lake Atitlán, Río Dulce, El Rosario, the Pacaya Volcano, and the Biotopo (Cloud-Forest-Reserve) earmarked for the conservation of the Quetzal bird. The former four are classified as National Parks and vary from 1 030 Ha to 57 600 Ha. The latter two have been declared National Monuments with areas of 2 000 and 900 Ha, respectively. According to the IUCN, Tikal is the only classified area that receives adequate protection, since the Biotopo for the Conservation of the Quetzal is considered too small. The richness of the Guatemalan fauna is impressive since it is an overlapping zone between the northern Neo-Artic fauna and the southern Neo-Tropical fauna. Among the vertebrates, 1 453 reported species exist, excluding the marine fish fauna. Unfortunately, many of those are included in the list of CITES as species in great danger of extinction.

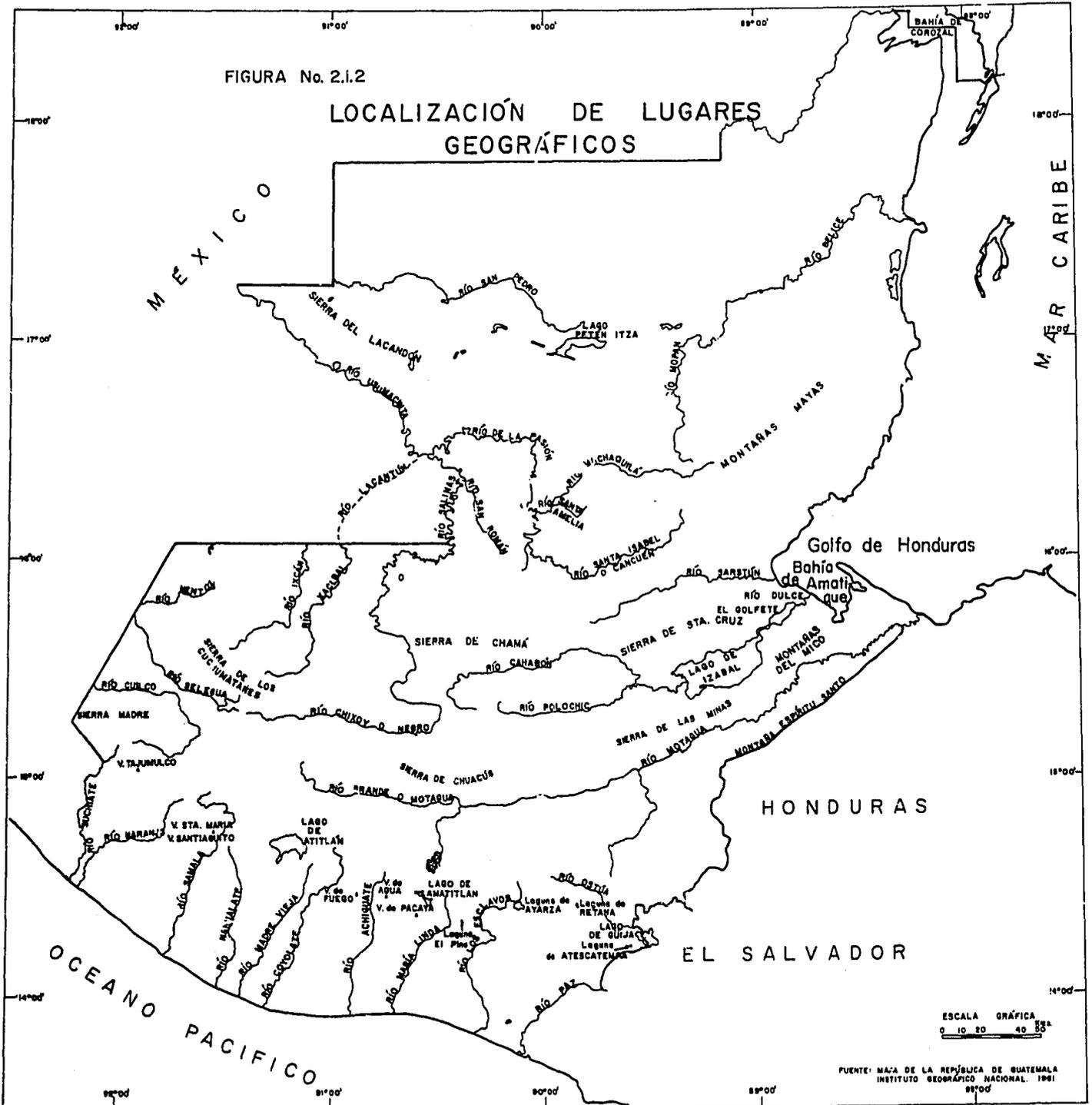
The Pacific coast line is 255 km long and its continental plateau covers approximately 15 000 km². For the Atlantic coast, these figures are 148 km and 2 100 km², respectively. Five species of trees are found on the estuaries of both coasts. Red, brown, white and pink shrimp; small shrimp, lobster, squid, roncador, braize, corvina, catfish, shark, surmullet, bass, guavina, sole, sawfish, and tuna are the principal species found among the marine fauna. The freshwater marine fauna is mainly composed of 16 primary species, 70 secondary spe-

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FIGURA No. 2.1.2

LOCALIZACIÓN DE LUGARES GEOGRÁFICOS



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cies, and 134 peripheral ones. Species of tilapia, carp and guapote are cultivated as well as freshwater shrimp. Experiments have also been conducted with marine turtles.

1.1.3 Human and Cultural Resources

Guatemala is richly endowed with great wealth in Meso-American culture remnants. Practically all over the country, archeological vestiges representative of almost any stage of this civilization can be found. Although vestiges of the pre-Columbian culture dated from 1 500 BC to 1 500 AD exist in the country, the Olmec culture flourished and attained its maximum development in the Pacific coast during the Pre-Classic and formative periods. The Mayan culture thrived in the northern lowlands during the Classic period, while the Quiché culture prospered in the central highlands during the Post-Classic period. The most probable cause of the decline of the Classic period Mayan civilization was compounded by natural, ecological, and social factors.

The year 1524 marks the beginning of the Spanish colonial period which terminated with the Central American independence in 1821. After a short period of annexation to Mexico, Central America (whose capital was Guatemala) severed its ties with that country in 1823, and in 1847 Guatemala declared its independence and became a republic. Since then agricultural export trade has been the primary economic activity, first with anil dyes, followed by kermes or cochineal, and later with coffee.

Although the indigenous groups were distinctive at the time of the conquest, there are sufficient common elements for compounding a cultural profile of the Mayans of Guatemala. Such profile includes superficial manifestations such as dress and language (there are thirty languages with various dialects. Nineteen of these are spoken by more than two million individuals). There are more profound cultural manifestations such as the mystic symbolism of corn and its influence upon agricultural practices with their concomitant ecological effects. Likewise, the propensity of the native indian to trade and some degree of resigned acceptance of the physical and human realities of the world that surrounds him, and the emphasis he places on the function of the individual as a member of the community to which he belongs in contrast to the individualism of the western European.

1.2 PATTERNS AND TRENDS IN RESOURCES USE AND ENVIRONMENTAL PROTECTION

1.2.1 Demographic, Social and Economic Factors

These factors exert a marked and important effect on the environment of the country. First, the population totals approximately 7.7 million inhabitants, and the annual population growth is 2.8 percent. There are some areas of the country where the population density attains 800 inhabitants per square kilometre, although the average is 70; 61% of the total population of the country lives in rural areas; the mortality rate is 11 persons per thousand inhabitants; life expectancy from birth is about 58 years, and the average number of children per family is 5.7. The percentage of illiteracy of the population over 15 years old is 43% and 70% of the population lives in poverty. The annual housing deficit is about 550 000 dwellings. The economic active population is approximately 30% of the total, and 9% of the entire female population falls into this group.

The Gross Internal Product decreased by 3.5% during 1982; the rate of consumer price increases during the same year reached 5%; the total external public debt was 1 297 million US dollars by 1982. Estimates indicate that, at the present time, 40% of the manpower is unemployed or underemployed. On the other hand, in general terms, agriculture provides 50% of jobs, industry 16%, services 14% and the rest is compounded by other economic activities. The overall agricultural segment shows a high stagnancy ranging from a 27% utilization of the economically active population (EAP) in March to 100% in December.

The soil demand is large: in 1982 the average per capita (hectares/man) reached a figure of 1.11, although in some zones, this figure drops as low as 0.22; and if only cropland is considered, the figures would be even lower. The agricultural activity can be subdivided into a "modern" sector which is primarily dedicated to export products and which occupies nearly 77% of available lands, and a "traditional" sector whose main activity is earmarked for food production. The major portion of the peasant groups (around 78%) occupies 10% of the entire land in units which, on the average, comprises one hectare each. These units are mostly spread over the western highlands and the eastern part of the country. Land use patterns are manifested in a wide range of variations and, in

general, form compound associations rather than pure forms of usage. The individual or associated clean crops cover about 11% of the entire land of the country; clean crops associated with grassland, about 14%; natural and cultivated grass lands, shrubs, savannahs, etc. about 12%, and pastures and crops associated with open forest and viceversa, around 22%. In regards to productive capacity, 26% of the lands correspond to croplands, 21% to lands suitable for pastures, and 51 to lands apt for forests.

From the foregoing exposition the conclusion is drawn that food production for internal and external consumption constitutes the most important activity of the country in regards to the space occupied.

The principal agricultural produce are corn, beans, wheat, rice, and potatoes for internal consumption; and coffee, sugar cane, cotton, meat and bananas for external consumption. Food production stems from 70% of the economic croplands, while products not used for human consumption, such as cotton and grassland, use 30% of the land. With respect to fishing, the average marine catch is approximately 26 metric tons per linear kilometre of coast. The catches primarily consist of shrimp, crustaceous, fishes, and molluscs. The catching of squid is undertaken on a minor scale, and large potential species such as tuna fish have not been fully exploited. Artisan fishing accounts for 6% of the total catch, fishing on a medium scale by cooperatives represent about 12%, and large scale fishing for export accounts for 82%. The observed consumption of fish per inhabitant is estimated at 0.5 kg for the 1967-69 period, and for 1990 it is estimated at approximately 0.9 kg. The expansion factor of potential metric tons (live weight) of fishing capture is estimated at 3.4 times the catch observed during the 1967-69 period.

Forest production of conifer logs has been estimated at 7 750 thousand cubic metres per year. Of this total, 40% will be used for sawmills, 20% for pulp and 40% for fuelwood. The annual production of wood logs exceeds 12 000 thousand cubic metres. Ninety percent of these are used for meeting the fuelwood and sawwood demands for domestic consumption.

The latter demand has shown a positive rate of growth, while the demand for industry has manifested a negative rate. Deforestation shows an annual rate of increase ranging from 1 080 to 1 620 km². Over the past ten years the total reforestation has scantily attained 500 km².

Mining in Guatemala continues to be an on-

going activity in some areas of mineral exploitations. Worth mentioning among these is the panning of gold sands during the dry season, the extraction of lead (approximately 60 tons per year), baryta, nickel, copper and marble. Production of this latter item attained 3 247 metric tons in 1980 of which over 95% is exported in blocks and sheets of different sizes. Transportation and communications activities in Guatemala are influenced by prevalent geographic, demographic, and economic conditions.

The road network extends along 15 127 km. Of these 3 425 km are paved. The daily average traffic varies from 4 558 motor vehicles on the highway to the Atlantic coast to 8 668 motor cars on the road toward the Pacific Coast. The largest traffic occurs on the accesses to the capital city and second in the approaches to the town of Escuintla. The most used highways for the external trade of Guatemala are those which link the country with the rest of Central America. On the Atlantic, Guatemala has the port of Santo Tomás de Castilla which in 1983 attended 763 ships and moved 1.7 million shipment tons. On the Pacific, there are smaller facilities and only Puerto Quetzal, commissioned in 1983, has adequate installations for receiving large ships and moving important volumes of cargo. The air service infrastructure possesses 558 airports five of which have paved landing strips and two have international standing (La Aurora and Santa Elena). Only La Aurora airport is being used for such purpose. At the international airport 11 airlines arrive which serve North America, Central America, South America, and Europe. Two local airlines serve the department of Petén.

The Railway system totals 825 km and runs from Guatemala - Puerto Barrios, Guatemala - Puerto Quetzal, Escuintla - Mexican border, Zacapa - El Salvador border and Retalhuleu - Champerico. Internal and external telecommunications are effected by telegraph, telephone, and telex. International automatic dialing is available with several countries. The current telephone density is 1.3 telephones per 100 inhabitants.

Firewood constitutes the principal domestic fuel. The yearly consumption of fuelwood runs to approximately one ton per inhabitant. This accounts for 62% of the total consumption. Sugar cane bagasse and petroleum by products are also used. Oil production in 1982 amounted to 2 292 barrels of which 1 546 were exported. Oil production does not meet the internal demand.

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In 1982, the installed capacity of the electrical grid was divided as follows: 42% hydroelectric, 30% gas turbines, and 28% steam thermal plants. The electric tariff rates at 31 cents of quetzal per kWh are the highest in Central America. The major consumer is the industrial sector (28%), followed by the residential (25%), and the commercial (18%). At present, various hydroelectric and geothermal projects are being studied and constructed. However, important uses of other non conventional energy sources such as solar and wind energies are not contemplated.

Approximately 3% of the annual mean flows of all the rivers is currently tapped. There are about 25 irrigation systems which cover 17 295 hectares; 75% of the residents of Guatemala city have water services at home, and 25% obtain water by other means. Over the entire country, 90% of the urban population has readily accessible supplies of water. In the rural areas, however, this percentage drops to 24%. In urban sectors, the population served by sewers amounts to 40%, while in the rural areas, only 25% have available sanitary facilities for disposal of excreta.

The recreational facilities for the inhabitants of the country are limited in practically all regions. In urban zones, for such purpose, the Central Park, the central gardens of the La Aurora zoo, etc., are used. In the interior of the country, Lake Atitlán, Lake Amatitlán, and the beaches of the Atlantic and the Pacific oceans are important resorts. Guatemala has a high potential for international tourism because of its landscape, picturesque vistas, biological diversity, and cultural wealth. The largest number of tourists was reported in 1979, with 503 908 visitors. Thus, the tourist industry occupied the third place according to foreign exchange income (US\$ 211.5 million) This activity was only surpassed by coffee (US\$ 495.21 million) and cotton (US\$ 211.5 million) exports. Even though international tourism has declined consistently since 1980, the potential persists, especially for cultural and scientific tourism which has not been fully exploited. A reason for this resides in the fascinating biological diversity of the country and the conservation of archeological sites such as Tikal, Quiriguá, Ceibal, Yaxhá, Kaminal Juyú, Iximché, Zaculeu, Mixco Viejo, and Santa Lucía Cotzamalguapa.

1.2.2 Technological Capacity

In 1970, Guatemala expended three million

quetzales on research and development activities of which 0.3% was allotted to pure research, 40.9% to applied research, and 1.9% to development. Of these three million, 57% corresponds to regional organizations such as ICAITI and INCAP. This expenditure represented about 0.7% of the GIP and Q.0.57 per inhabitant.

The largest governmental funds for research are currently allotted to the Institute of Agricultural Sciences and Technology (Instituto de Ciencias y Tecnología Agrícola), established in 1972.

The application of technology in the agricultural and livestock sectors has primarily consisted of the use of agricultural chemicals, improved seeds, mecanization and more sophisticated cultivation practices, especially regarding agricultural crops for export. Imports of agrochemicals increased from Q.12.8 million in 1970 to Q.67.7 million in 1981. The major agricultural technological application has been undertaken in cotton growing. Thus, higher yields have been obtained. On the contrary, yields in coffee production are among the lowest in the world. In general, irrigation supply is scant since only 3.4% of the plantations are irrigated. This area only comprises 3.3% of the irrigable surface of the country. Nearly 0.6% of the farms use internal combustion engines, 0.2% use electric motors, 0.6% utilize tractors, and 0.1% use threshing machines. Ninety four per cent of the farms are run with manpower. With respect to resource conservation, the technology used in the country is addressed primarily to exploitation of resources on a non sustained basis. This is mainly reflected in the systems used for exploitation of the forest cover. Utilization of hydraulic resources pays more attention to "extra-source" aspects, that is, to the necessary works, more than to the structure of the basin conditioning the flow regimes.

In the energy sector, efforts have been addressed to developing more efficient fuelwood stoves. However, neither the massive production of stoves nor their acceptance by the population have been contemplated. At the present rate, nearly 500 years would be needed to make all the stoves required for reducing the current high consumption of fuelwood.

1.2.3 Institutional and Managerial Aspects

Guatemala has a large number of institutions which, directly or indirectly, are engaged in

matters relating to natural resources and the environment. Most of them operate independently and are scarcely coordinated.

At the governmental level there are, on one hand, the ministries and, on the other, the executive units depending on them. At the private level, several associations are concerned with these issues. The following ministries can be mentioned: The Ministry of Agriculture, Cattle Raising and Food; the Ministry of Public Health; the Ministry of Communications, Public Works and Transportation; the Ministry of the Interior; the Ministry of Foreign Affairs; the Ministry of Energy and Mines; and the Ministry of National Defence. The Minister of the Interior chairs the Interministerial Commission for Protection of Human Environment and coordinates its Technical Advisory Commission. The energy sector planning is effected through SEGEPLAN and the sectorial units of the ministries involved. Planning work in specific areas is also carried out by USPADA, DIGESA, DIGESEPE, DITEPESCA, INGUAT, INFOM, UNEPAR, EMPAGUA, and INDE.

The principal executive entities are the following; in the agricultural and food areas; ICTA, INTA, INAFOR (the main institution responsible for forest protection), OCREN, DIRYA, and DITEPESCA. In drinking water and sanitation issues function the municipalities, EMPAGUA, INFOM, Development of the Community; UNEPAR, División of Environmental Sanitation; Executive Unit of the project Xajá-Pixcayá, BANVI y DGOP.

The electric energy generation is entrusted to INDE; other institutions such as INSIVUMEH and IGM carry out, as does INDE, work relating to the evaluation of resources. There is also FYDEP which is entrusted with wider responsibilities in Petén. The national Institute of Cooperatives, IDAE, INGUAT, the General Administration of Highways, the National Committee for Reconstruction, CORFINA, the Departamental Governorships, and the Bank of Guatemala also carry out work related to the environment, although some of them perform these functions in a more direct manner than others.

Among the entities dedicated to education and training, it is worth mentioning, at graduate level, the University of San Carlos, the Rafael Landívar University, the El Valle University, the Francisco Marroquín University, the Mariano Galvez University. At the technical training, there are various entities such as SPADA, INTECAP and INAP.

Several private organizations are performing significant work in this field, such as AFMIP, CEMAT, the Association of Friends of the Forest, and the Guatemalan Association for Defense of the Environment. At least 24 international organizations are carrying out work related to the environment of the country and are collaborating with the national organizations. The assessment of the utilizations of human resources in this sector is extremely difficult owing to the diversity and number of functions which are performed. Some estimates are available, however, with respect to SPADA, the water and sanitation entities, and INDE. With respect to financial resources, these are primarily provided by the government through budgets allotted to the entities concerned, and by loans secured from international organizations such as AID, IDB, CIDA, IBRD, CABELI, UNICEF, UNESCO, etc., and grants from AID, CARE, CARITAS.

All these organizations implement a series of actions through some programs which are worthy of mention: the Agrarian Reconstruction Program, the Irrigation and Drainage Program, Marine and Artisan Fishing Program, and the SPADA's Program for Forest Plantations. Other activities worthy of mention are the Preliminary Study of Renewable Natural Resources on the Basin of the International Rivers between Guatemala and Mexico, the Environmental Program of the Municipality of Guatemala city, the activities of Integrated Pest Control, and various programs pertaining to water resources. There exists, however, a notorious dispersion of efforts and undefined solutions. In addition, the activities of the various organization are seldom complementary. A prevalent common factor is, indeed, a virtually overall deficiency of resources and technical cadres.

Finally, it should be mentioned that since 1971, efforts are being addressed toward and institutional restructuring which will include the creation of a central organization responsible for natural resources and the environment. Up to now, none of these efforts, which vary widely as regards focus and scope, have yielded positive results.

1.2.4 Policies and Planning

These plans which comprise sectorial policies do not lead, however, to a sustained management of natural resources. Besides, owing to the lack of this sustained factor, they do not furnish the support needed for establishing national priorities which would provide, indeed,

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an integrated focus on the natural resources and the environment. Moreover, the execution for these plans is not undertaken.

At the sectorial level there exists the concrete formulation of policies and mechanisms for agricultural development based on fostering agricultural crops for export and on expanding the agricultural frontiers by means of colonization. There are, therefore, in this sense, restructuring agrarian policies which include colonization of the Northern Transversal Strip (FTN), the adjudication of land in Petén and the Low North, the national forms and cooperatives, the regrouping of small land holdings, and the revision of irrigation policies.

Likewise, there is a forest policy whereby forestation and reforestation of the country is declared of national urgency and of social interest. It also includes conservation programs for national parks, recreational areas and wildlife, as well as the management of forests.

Regarding the hydraulic resources, however, no defined policy exists. Only 11 policy objectives have been formulated and they have yet to be approved. In the Drinking Water and Sanitation Sector, a National plan for 1990 has been drawn for DIAAPS as part of a national effort. This plan places emphasis on a more widespread coverage of services. A similar situation prevails in the field of conservation of wild reserves and wildlife. This is the objective of one of INA-FOR programs.

A coherent national policy on energy does not exist. Different aspects are fixed separately by the Ministry of Energy and Mines and IN-DE. In general, planning in this sector has been focused, up to now, on the side of the supply, but no guidance has been shed on the side of demand.

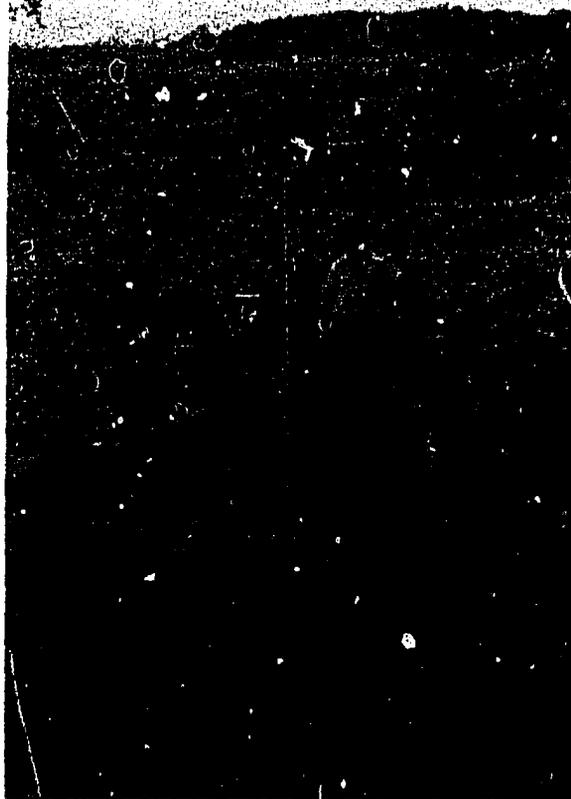
Regarding the Science and Technology sector, there exists, indeed, the formulation of objectives and policies which are addressed to increasing supply of knowledge, providing sufficient experimental development, establishing a national scientific and technological system congruent with the indigenous resources of the country, promoting the application of macroeconomic criteria to imports of technology, reducing limitations to the access of more productive technologies, fostering a change in cultural attitudes as a function to better living conditions, and contributing to the managerial capacity for technological administration. These are, however, assertions of general scope which are not integrally applicable to nature resources and the environment.

1.2.5 Legal Framework

Legal rules relating to the environment stem from the general Principles of Constitutional Law and the Fundamental Statutes of the Government and extend to the administrative regulations of the different authorities.

This legislation is embodied in more than 12 legal instruments among which the following should be mentioned: The Fundamental Statute of the Government (1982), the Civil Code, the Municipal Code, the Forest Law, the Hydrocarbons Law, the Hunting Law, and the Legislation Decree 1,004 of 1953 which prohibits the contamination of water bodies. However, neither a Water Law nor an Environmental Law exist as such, even though some projects have been prepared.

DEFORESTATION - Section 1.3.1



Courtesy of Dr. Thor Jansen
Defenders of Nature

Most likely the main problem in this sense is the dispersion of rules and regulations and the

lack of means of enforcement of different provisions.

1.3 Principal environmental problems

The main problems relating to the environment in Guatemala can be summarized, according to sectors, as follows:

1.3.1 Deforestation

From the forestal standpoint, the principal problem which varies in some localities is that the felling of trees exceeds natural and artificial restoration. The fundamental reason for this stems from the high consumption of logs for fuelwood and, in a lesser degree, to forest fires and pests. Colonization follows fuelwood consumption and burning practices for clearing land also contribute to the depredation of woodlands.

Estimates indicate, for instance, that from 1969 to 1982, the woodlands in the Department of Petén have decreased approximately from 36,000 to 32,000 km². This deforestation implies an annual loss of five million cubic metres of wood. This is attributed only to colonization.

In the following table an estimate of the decrease in the volume of standing wood in the woodlands of the country during the period from 1982 to 2,000 is given in thousand cubic metres.

DESTINATION	1982	1985	1990	1995	2000
Industrial Use	234	1121	1145	1178	1261
Fuelwood	13064	14232	14630	15037	15455
Fires and Pests	1350	1350	1080	540	486
Colonization	7800	5200	3467	2427	—
TOTAL	22448	21903	20322	19182	17202

It can be readily appreciated that the situation is alarming. Not only a natural resource of high economic worth is being depleted, but also a resource of considerable ecological value, since its essential function is the protection of the soil against erosion and floods, the protection of croplands, the regulation of the hydrological cycle, the conservation of wildlife, and, in general, the protection of the national environment.

1.3.2 Accelerated Soil Erosion

The erosion of the soil, aggravated by defores-

tation and lack of adequate techniques for soil conservation, is particularly severe in densely populated and intensively cultivated areas in the country, for instance, in the highlands.

It has been estimated, albeit approximately, that in certain zones of the country the annual losses of soil amount to 1,416.74 tons per square kilometre, equivalent to 778 pyramids such as Tikal's Temple IV. The main causes of the foregoing situation are: removal of the forest cover, unsuitable practices in land use, use of inappropriate technology or misuse of technology in agriculture, the sensitivity to erosion inherent to some soils, and the combination of all these factors. It should be recalled that 65% of the national land is classified as having a susceptibility to erosion ranging from great to high and very great to very high. According to some authors, the removal of the fertile layer of soil from the beginning of the century to the present is equivalent to 40% of the productive capacity of the land. In general, deforestation with its associated erosion, represents a degradation and withering process in an estimated percentage of the surface of the country of approximately 40%.

The most critical areas of soil erosion are located in the physiographic provinces called Crystalline Highlands and Sedimentary Highlands. Erosion is also observed in the Recent Volcanic Slope and the Northern Karstic Lands. In the

latter, erosion is caused by the dissolution of limestones.

1.3.3 Contamination by the Use of Agrochemicals

The use of insecticides, herbicides, fungicides, etc. has resulted in an increase of agricultural yields. However, the excessive and indiscriminate use of these pesticides constitute one of the principal environmental problems in the country. In addition to abating the harmful species which is their objective, these pesti-

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des have destroyed beneficial and productive insects such as bees on the southern coast, and have spurred proliferation of resistant individuals in harmful species.

The indiscriminate use of pesticides affects, in addition to the biological deterioration, the quality of many foods as will be seen farther on.

According to a study by ICAIT¹ on the Environmental and Economic Consequences of Pesticide Use in Central American Cotton Production, the following mean values of contamination by DDT were found in Guatemala (period 1974-1976):

Sustratum	ppm
Ground water	0.0002
River water	0.033
Consumers	
Meat	4.93
Shrimp	4.06
Other shellfish	3.07
Fish	8.26
Milk	4.54
Plants and Plants Products:	
Corn	0.0119
Cottonseed	32.15
Animal feed	0.18
Edible greens	0.185
Pasture	0.72
Fruit	0.23

Other studies conducted over the period 1976/1982 on the DDT content in the meat of slaughtered cattle, indicated values in the order of 193 ppm in 1979, in Escuintla, and 99 ppm in 1976, in Retalhuleu. However, since 1981 a decrease has been observed.

1.3.4 Air, Water, Soil, and Food Contamination

The problems relating to environmental pollution in Guatemala are varied and widespread. The fast population growth exerts a strong pressure on several of the nature resources of the country which suffer the impact of population increase. In a certain sense, however, the country is in a fortunate position, since its state of industrial development has not yet produced the pollution by toxic substances which exists in other countries. This is a situation Guatemala can and must avert. The current pollution problems, however, must be tackled now, not only because they endanger public health, but also because they constitute a poten-

tial loss of revenue from resources use and tourism.

Water pollution is latent. The main causes are the disposal of all kinds of wastes, without previous treatment, into the water bodies. Of special significance are human wastes. The pollution problems seem to be in the rivers of the Pacific coastal plains, in the basins of the Maria Linda and Motagua rivers (where Guatemala city lies), and in the basins of the Salamá and Paz rivers (the latter is affected by pollution

ACCELERATED SOIL EROSION Section 1.3.2



Courtesy of Ing. Carlos Lemmerhofer

problems by boron and arsenic). Lake Izabal, Lake Amatitlán, Amatique Bay, and Lake Petén Itzá are also contaminated.

There is a latent danger that eschistosomiasis, a disease not yet occurring in Guatemala, will spread over the country for the transmitting vector exists and lately a strong immigration from El Salvador has been observed. This disease exists in El Salvador.

On the other hand, soil erosion does not only entail the loss of this resource, but because of the absorption of the particles, it is an excellent carrier of pesticides into the water bodies, and then to the species thriving there and, finally, to humans.

The soil contamination by pesticides, therefore, has a twofold harmful effect on public health, since it averts the degradation of the chemical compounds and maintains their toxicity. However, this contamination appears to be decreasing, not only as a result of reducing agricultural production, but also because the cost of protecting crops by pesticides is reaching a point whereby it is no longer economical. In spite of this, pesticide use is still a signifi-

cant contamination source.

Other potential sources of pollution of soil and water are the sanitary landfills and open garbage dumps. Both liquid and solid wastes can include a great variety of chemical substances which often percolate through the soil into the groundwater bodies.

The main sources of air pollution in urban centers are the motor car exhausts. The black smoke from diesel engine exhausts and exhaust gases from gasoline engines are harmful and contain cancer producing agents. Particularly harmful in Guatemala are emissions from tetraethyl lead used to increase the octane rating in gasoline. Studies carried out in other countries show that this chemical compound induce derangements in behaviour and learning patterns of children, especially in those whose diet is lacking in calcium as occurs in the major part or the urban population of Guatemala.

Foods, especially meat and milk, are contaminated with chlorinated pesticides. There is quality control services for exports but not for domestic consumption. Thus, the lots discarded for export are sold for internal consumption. Even though DDT use is prohibited in Guatemala, DDT residues continue to appear in the analyses of meat, although in lower concentrations.

At present, the highest residues of 27 ppm are found in lots from the Department of Izabal. There is yet no control for organophosphorous insecticides, although by 1989 it will be applied only to export meat. Pesticide control in milk does not exist, but there is evidence of contamination. Other contamination source of milk is the water used for dilution which often contains faecal contamination. Carboxymethylcellulose thyl-cellulose (CBMC) is added to cream for dilution, although it is prohibited.

For many Guatemalans noise constitutes a serious problem. However, foreign visitors only perceive the sound effects from jet aircraft, since the approaching air corridor from the north to the La Aurora International airport runs over Guatemala city.

1.3.5 Problems Relating to Hydraulic Resources Development and River Basin Management

Six fundamental problems constrain development in this sector, namely: institutional aspects, basic information, standardization aspects, human resources, financing, and nature aspects.

As part of the foregoing, noteworthy are the

variability of river flows, the karstic geology of the northern part of the country, the rough topography of the central part, and the high yield of sediments from some river basins. In this latter respect, values as high as 1,170 m³/year km² have been reported in the basin of the Villalobos river which discharges 372,000 tons of material into Lake Amatitlán per year. An important contribution to increasing the sedimentable material on the Pacific watershed are the eruptions of the Fuego and Santiaguito volcanoes. These problems could be aggravated in the future because of lack of an integrated management of the river basins. Likewise, for the same reason, the problem could arise in other parts of the country.

1.3.6 Problems Related to Wild Areas and Biological Variety

The wild areas of Guatemala are continuously disappearing at an extraordinary pace. Some causes of this extinction are expansion of forest activities without duly paying attention to refurbishing or reforestation, the increase of urban and industrial use of the soil, the contamination of soil, water, flora, and fauna by organic and inorganic chemicals, and the change of the natural hydrological cycle. These and other manifestations of modern economic development are destroying the biological variety of the wild nature resources.

Another contributing factor is the lack of awareness of the role which wild areas play in sus-

TOUCAN - Section 1.3.6



Courtesy of Dr. Thor Janson
Defenders of the Nature

taining regional and national development, and a weak legal base for setting up protected areas.

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However, at present, attempts are being made to ensure the survival of the principal species in danger of extinction. These efforts must be supported, promoted, and at the same time complemented with other measures, such as an integrated plan for protecting ecosystems as complete functional units. Thus this will guarantee the long-term conservation not only of the species already identified, but also of those that are yet to be identified, so as to preserve the biological variety of the country.

Some natural ecosystems are being conserved like the Tikal National Park. However, very little is being accomplished in the conservation of genetic resources (except species like the manatee, the quetzal, and the diving duck), the creation of educational and research regions, the conservation of the hydrological production, the sedimentation and erosion control, the production of wild fauna for feeding and sport purposes, the development of recreational sites for tourism, the production of fibers and pastures on a sustained basis and the conservation of scenic vistas and panoramic views.

1.3.7 Problems Related to Marine, Coastal and Fish Resources

The protected zones in Guatemala do not include marine or coastal resources.

At present, there are four significant ecological changes which affect these resources: inappropriate fishing methods, lake basins pollution, ignorant and empirical importation of exotic species, and the excessive pesticide use in agriculture.

1.3.8 Industrial Impacts

Industrialization in Guatemala has not attained the stage where significant contaminations impacts can be distinguished. There are some isolated cases which are worthy of mention due to their potential impact, such as the cellulose plant CELGUSA which will discharge considerable contamination into the Motagua river and will produce adverse effects such as deforestation and erosion increase, if preventive measures are not taken in time.

1.3.9 Problems Pertaining to the Use of Different Components in the Energy Sector

The main environmental issues germane to the energy sector are: use of all types of forest resources for fuelwood, because of lack of alter-

native sources; loss of fertile plains of some rivers which have been flooded by impounded water reservoirs, (although this effect is still small), burning the sulphurous gases from oil, danger of oil spills during transportation, harmful emissions from badly tuned up internal combustion engines, erosion increase by highways construction, and waste disposal from geothermal plants (boron, silica, arsenic).

1.3.10 Problems Related to Land Use

The superimposing of cultural parameters over parameters of quantity, quality, and land tenancy patterns releases strong forces which affect land use and the environment.

In regions where groups of native indian peasants and small farmers predominate, a deterioration of the forest cover occurs to give way to the cultivation of food products like corn. The system of felling, burning, and clearing the woodlands are an objective manifestation of a given socio-cultural order in which the native farmers are compelled to make pressing demands upon the natural resources for survival. An environmental damage also occurs in regions where crops for export are cultivated. However, the reason for this damage is different from the preceding causes. Among these, the introduction of cotton growing on large extensions in the southern coastal plains predominates. Thus, a pattern for land use has been established which has steadily changed the ecosystem along with the indiscriminate extermination of flora and fauna, in exchange for a larger input of foreign exchange for the country.

Another effect having a strong impact on the environment is the pushing of the agricultural frontiers imposed by prevailing population and economic factors. This can affect the environment solely by the enlargement of the agroeconomic space, as it obtains in Petén, for instance, or else by changes in resource use brought about in the agroeconomic space, as it occurs in the highlands.

PROBLEMS RELATED TO LAND USE



Courtesy of Dr. Thor Jansen
Defenders of Nature

1.4 Irreversible or Irrecoverable Losses of Resources and of Development Opportunities

The issues discussed in the preceding sections have caused and will continue to cause adverse consequences for the socio-economic development and the quality of life in the country. Some of these consequences can be foreseen to be irreversible or irretrievable, and others could lead to a loss of opportunities for development. In what follows, these consequences are pinpointed in order to emphasize the aspects mentioned.

1.4.1 Resource Losses

Although the available information is neither complete nor always updated, the experience of many professionals working in the field of natural resources and the environment indicates the following:

a) Loss of Ecosystems

Guatemala has suffered the complete degradation of the ecosystem belonging to the life zone of the very wet, hot region of the Pacific watershed and its cloud-forests. The mangrove agglomerations are also in the process of disappearing. The assertion can be made that, in general, the remaining ecosystems are rapidly waning, and there is no program for real and integrated conservation.

b) Loss of Germplasm

The destruction of the ecosystems and the loss of species are accompanied by the loss of va-

uable genetic information accumulated by natural selection over thousands of years. Likewise, species like the manatee and the diver duck are nearly extinct, and many trees and plant species in the woodlands are in process of deterioration.

c) Loss of Forestal Resources

Many woodlands are losing their own means of protection as well as their productive capacity. At the same time, many natural wildlife reserves are receding. The transformation of large primary forest masses to subsequent secondary to recent states, or to their extinction has occurred. Likewise, the main energy source for domestic consumption is being lost (fuelwood and charcoa).

d) Soil Losses

The irreversible losses are produced not only by the physical loss of the soil surface, but also by the loss of the productive capacity of the soil in regions where, even though the soil is not yet eroded, is subjected to practices or use of non appropriate technology.

e) Decrease of Water Sources

The policy pertaining to the supply of drinking water to the population has been to use springs (because of water quality) and to conduct the water by gravity (low cost). The changes effected on the hydrological regime by improper management (or lack of management) of the river basins are reducing these sources.

f) Loss of Urban Environments for Social Development

Even though the major part of Guatemala is rural country, the importance of maintaining the quality of life in important urban concentrations like Guatemala city cannot be overemphasized. However, this urban environment is becoming hostile on account of the human agglomeration, on the one hand, and air pollution, on the other, with the concomitant threat to public health.

1.4.2 Loss of Development Opportunities

The loss, decrease, or deterioration of any resource implies the potential reduction of alternatives for development. Moreover, if these losses are irreparable or irreversible such op-

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tions will be forever lost due to the lack of foresight of the present generations. The following losses are likely to occur:

a) Development of Intensive Agriculture in Regions with the Most Fertile Soils.

The soil losses and the salitation of them, as well as the use of inappropriate technology, entail a potential loss of agriculture production.

b) Losses by Floods

Soil erosion and sedimentation deposits on the river basins augments the frequency and magnitude of floods, causing losses by decreasing agricultural production and reburshing the disrupted infrastructure.

c) Losses of Base Flows and Water Quality

The decrease of basic flows by alteration of the hydrological cycle augments the cost of drinking and industrial water supplies for it is necessary to resort to pumping and water impounding. Likewise, the alteration of water quality demands costly pretreatment for industrial and domestic use.

d) Electrical Energy Generation

The loss of vegetation cover and, in general, the improper management (or lack of management) of the tributary basins for hydroelectric developments like Pueblo Viejo-Quizal, increase erosion and, consequently, silt deposition on reservoirs which will in time decrease their usefulness as well as their generation capacity. This demands the construction of expensive additional works for maintaining or reclaiming the capacity.

e) Recreational and Tourist Development

The tourist potential of Guatemala is based on its variety and outstanding cultural traits and natural resources. The deterioration of such traits and resources also influences, in an extraordinary form, the waning of the tourist industry which occupied third place in 1979 by importance with respect to foreign exchange income.

f) Development of New Medicines, Drugs, Chemicals and Food Products

The development of cultigens has been reduced

to a few species which Guatemala exports as raw material (Spanish dagger, dioscorea, orquids, solanaceous, mushrooms, etc.). Some of these now have populations so scant that in the future they will have to be introduced anew.

g) Utilization of Comparative Advantages of the Country with Respect to its Natural Resources

With the abatement of the forest cover the country ceases to take the advantage offered by nature in its different vegetable formations and life zones. In addition, there is a loss of forest productivity and of the variety of the flora inherent to such areas on account of its geographic position. This would not only entail underrating the current economic potential of woodlands, but also undervaluating the other 1,500 tropical species existing in the country which in the future could have great demand.

h) Main Social Costs

It has been mentioned that tetraethyl lead emissions from gasoline engines affect children's health. The future of the country is at stake if this situation is not forestalled.

1.5 Critical Assessment

1.5.1 The Present Environmental Situation

The analysis of data, information, and opinions presented in the preceding sections conform a frame work which encloses the present environmental situation in Guatemala. In the sections that follow, as a sort of conclusion, a summarized version of this framework is presented.

The most significant factors are the following:

—Lack of the Guatemalans understanding and appreciation, in every social strata, of their environment.

—Accelerated deforestation.

—Lack of planning for an effective and integral land use.

—Population's demand for resources.

—Lack of adequate managerial capacity, sufficient technical capacity, and financial resources necessary for proper management of natural resources and environment.

—Lack of a coordinated policy for development based on a sustained and long-term use of resources.

1.5.2 Responsibilities of the Country for Environmental Conservation and Protection.

The responsibilities of the country in this sense are distributed on various levels, namely:

—Government: rules, organizes, legislates, executes, and finances.

—Non governmental organizations: form, guide, multiply, and channel individual concerns.

—Private firms: cooperate and support projects in which they are closely involved.

—Universities and research centers: offer the basic studies which justify and explain the need for environmental conservation.

The groups and organizations described have the opportunity of exerting multiple, organizable, directive action, but the responsibility for achieving a healthy environment to complement the economic and social development of the country rests in the last instance on the entire Guatemalan Society.

1.5.3 Conceptual Base

Already in 1975, on the occasion of the "Workshop on Environmental Problems in Guatemala" organized by the Ministerial Commission Entrusted with the Conservation and Improvement of the Human Environment, the following main problems relating to the environment were singled out: Institutional, legal, academic, of basic information and lines of reference, financial, of environmental awareness, of technological and demographic attitudes.

Ten years later, it seems interesting to ask an answer to what is the present priority on environmental aspects in different national sectors; the priority with which such issues should be confronted; if the situation has changed or not with respect to that formulated in 1975; which are the central factors which have made the solution of these problems difficult and which are the new variables which have influenced the present situation and that were absent in 1975. The answer to the preceding questions leads to the following conclusions:

a) In general, the priority assigned by Guatemalans to the environmental issues is low. Security, employment, and food aspects predominate.

b) Given the present situation in the country, the priorities for confronting the present environmental problems have been assigned by groups.

First, the problem related to the integral socio-economic development of Guatemala.

Second, the short and long-term problems which affect the health of the Guatemalan population and which are potential causes of progressive degradation of the human resource and, therefore, of the entire Guatemalan nation.

Third, the problems related to the loss of soil and forest resources, and to the degradation of water.

Fourth, other problems and specific issues already singled out by different experts.

c) The environmental situation at present compared with that prevailing in 1975 shows a larger degree of deterioration.

d) The main causes for the preceding situation are the result of an incorrect strategy in the formulation of solutions made in 1975, and in focusing the solution of national problems without considering, in an explicit, realistic, and tangible manner, the long term environmental problems and their importance within the development context.

d) The same variables present in 1975 prevail now, but some of them have taken on different traits and more critical manifestations owing to the emergence of the degrading and disrupting factors in the Guatemalan social texture which were hitherto largely latent.

1.6 Recommendations

1.6.1 Scope and Limitations of Environmental Policies

The diagnosis of the preceding Section serves as a basis for the recommendations herein presented. For practical reasons, these refer to the short (immediate), intermediate (next five years), and long term (next fifteen years), acknowledging that such are relative and contingent.

1.6.2 Strategy

The first recommendations deal with the formulation and definition of an integral environmental policy which should optimize the positive effects of the sustained management of the environment in the long, intermediate and short terms. The benefits accrued in such sense are manifold; for instance, the multiplying effect of natural regions when they are oriented conveniently towards the recreational and tourist sector, the supply of good quality water, the reduction of disease incidence in urban centers, the recycling and reuse of materials, etc. In the long term, water supplies will be en-

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sured permanently, costs incurred by the drop in public health problems will be reduced, the tourist development will be ensured by preserving the landscape and the attractive tourist sites, the potential of agricultural soils will be preserved and enriched, the possibility of developing new medical, food, or industrial products will be ensured, a more effective use of human resources will guarantee the capacity of rendering maximum productivity, and the integrated and sustained socio-economic development of the country will be spurred.

In order that this environmental policy be effective, it must be developed on the basis of the following general principles:

- a) Technical awareness: it is necessary to be aware of what is happening and why.
- b) Improvement by increments: a general policy for improvement of the situation by small increments is preferable to one that attempts to remedy the problem immediately. A reasonable time span must be given so that the agents responsible for the problem will adapt to the positive changes.
- c) Realistic goals: a clear concept of the need to work towards realistic possibilities instead of towards unattainable or utopic ideals.
- d) Balance: the policy should be balanced between the real benefits stemming from the protection and the management of the environment in order to preserve the quality of life.
- e) Public awareness: the public must be aware of the issues and the measures taken for their solution.
- f) Simple laws: simple laws must be passed, easy to understand and to apply; these should not be punitive at the beginning.
- g) Perspective: there should be no insistence on the paramount importance of environmental problems over the three central concerns at present, namely: food, employment, and security, until such situations are improved.
- h) Representativity: formulations of an environmental policy must maintain a close relationship with all social groups and sectors of the country.

1.6.3 Objectives, Programs and Projects of the Long-Term Strategy

Among these the following recommendations are most relevant:

- a) That the forests be developed
- b) That the energy resources be rationally used by fostering the use of new and renewable sources of energy and by establishing energy forests.

c) That the energy required by the population be obtained at the least possible economic-environmental costs.

d) That treatment plants for sewage water be established.

d) That priority criteria of effluents for ranking industrial wastes be established.

f) That a national quality control service for foods and domestic consumption be established

g) That a sound program for integrated pest control be instituted.

h) That strict controls to avert cattle grazing in fields with pesticides residues be implemented.

i) That a national research program on ground water be established for location and proper management of sanitary landfills.

j) That the system of wildlife reserves be completed and the management of the new selected sites be initiated.

k) That the necessary legal adjustments be determined and implemented.

l) That a policy for the rational management of mangle resources be gradually implemented.

m) That a soil conservation program be implemented throughout the country.

n) That a national program to govern wildlife be established.

o) That regulations for deposition of wastes from geothermal plants be established.

1.6.4 Objectives, Programs and Projects of the Short-Term Strategy.

In the light of the recommendations suggested in the preceding sections, albeit under constraints to follow an ambitious environmental policy, there is evidence that deterioration of the environment requires urgent measures. Within this frame of reference, the following short and intermediate terms objectives and measures could be included:

a) To study, define, and establish the institutional, legal, informational, and academic bases which will permit attaining the long term objectives; and

b) To carry out simultaneously demonstration programs in priority defined areas, with a view to improve or guide and environmental policy and the awareness and attitudes with respect to environmental issues.

The foregoing would entail measures such as the periodic collection of data; publications in popular editions; averting new contamination; taking measures for the conservation of uncultivated and wildlife reserves, the aquatic mari-

ne and freshwater resources, the hydrological basins, and the energy sources. Likewise, the existing legislation should be improved.

Regarding the foregoing recommendations, noteworthy are the practical benefits to be achieved by reducing by 10% the consumption of gasoline containing lead over the next 5 years, 20% over the intermediate term, and 100% by the year 2,000. Likewise, to reduce the sulphur content in diesel to 50% of the current content, and increase the use of collective transportation from 80% to 85%, of travel by 1990, and 90% by the year 2,000. Likewise, reduce the fuelwood consumption at least by 15% of the families for the year 1990, by using the Lorena stoves and thus increasing the fuelwood forest.

which contradict the general principles for an environmental policy such as the one stated in the preceding sections, it is necessary to point out certain actions by means of which the short and intermediate term objectives and measures can be achieved. All previous statements would lack a supporting base if some priority programs and projects are not clearly defined. In selecting these projects, attention was paid to the ranking priorities of the problems previously presented, as well as to existence or lack of previous conditions or prerequisites on which the previously mentioned recommendations would eventually rest on firm foundations.

The recommended projects are described in Table 1.1.

1.6.5 Recommended Projects

In order not to fall into an unrealistic situation,

Tabla 1.1
Summary of Recommended Projects

No.	Project Title	Objectives	Description	Location	Beneficiaries
1	Strategy for environmental awareness	<p>Identification and characterization of groups or sectors with some capacity to take the initiative in relation to environmental issues. <i>These environmental Initiative Groups</i> will initiate actions, programs, projects, etc., addressed to different population sectors.</p> <p>Identification and characterization of the population groups or sectors towards which the preceding actions and programs will be addressed.</p>	<p>Study among key groups for determining the most feasible method for arousing the Guatemalan collective awareness to the importance of their environment.</p> <ul style="list-style-type: none"> • Survey and establishing bases • Demonstration Program (see No. 10) • Use and special occupational plans (see No. 9). • Environmental Education program 	<p>Nation-wide</p> <p>Nation-wide</p> <p>Municipalities</p> <p>Guatemala city and University Study Centers</p>	<p>Entire population</p> <p>Entire population</p> <p>Elementary and Secondary school levels</p> <p>Municipal population</p> <p>Institutional level</p>
			<p>— Pilot program for environmental promotion</p> <p>— School program for environmental education</p> <p>— Formation and orientation of environmental groups</p> <p>— Academic program of environmental sciences.</p>		

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Project No.	Title	Objectives	Description	Location	Beneficiaries
2	Energy program	<p>Study the public response to a campaign promoting collective transportation.</p> <p>Study the reasons why the public prefers individual transportation to collective transportation</p>	<p>Studies and projects related to collective transportation in Guatemala city, to the use of alcohol for raising gasoline octane rating, to decrease black smoke emissions, and to the use of fuelwood.</p> <ul style="list-style-type: none"> • Promote the use of collective transportation to a 10% increase. • 10% fuel alcohol mixed with low-octane gasoline to reduce the use of leaded high-octane gasoline • Decrease black smoke pollution by lowering oil content in diesel • Decrease deforestation by promoting the use of more efficient stoves and developing fast-growing-plants energy forests. 	<p>Guatemala city Nation-wide Nation-wide Nation-wide</p>	<p>Urban population Urban population Urban population Entire population</p>
3	Integrated Pest Control	<p>Control of pests affecting agricultural production, reducing them to lower levels of those causing economic damage by maximum use of natural control factors, and thus reducing the use of pesticides.</p>	<p>Control of pests affecting agricultural production, reducing them to lower levels of those causing economic damage by maximum utilization of natural control factors; therefore reducing the use of pesticides.</p>	<p>Escuintla, Santa Rosa, Retalhuleu, and Nation-wide.</p>	<p>Entire population</p>
4	Basic Studies for Development and Conservation of Forest Resources	<p>Inventory of priority areas for national reforestation. Conduct research on investigation techniques. Conduct studies on conservation and integrad management of hydrogeophysical basins for economic development.</p>	<p>Inventories, investigations, studies, surveys, etc.</p>	<p>Nation-wide</p>	<p>Entire population</p>
5	Culture of water species	<p>Study the feasibility of implementing a quinquennial project based on the preliminary inventory of the renewable natural resources of Guatemala.</p>	<p>Feasibility studies for implementing the project</p>	<p>Uspantán, Aguacatán, Chiantla, Nebaj, San Antonio, Santa Cruz del Quiché, Huehuetenango.</p>	<p>Rural population</p>
6	Northern fish culture Center	<p>Carry out feasibility studies for construction of a fish-culture center.</p>	<p>Feasibility studies for establishing a fish-culture Center.</p>	<p>Cobán, Cukulco or Rabinal, Sacapulas or Nebaj</p>	<p>Rural population</p>
7	Environmental Information Program (also see no. 1).	<p>Provide qualitative and quantitative information on environmental variables and land use at regional and urban levels.</p>	<p>By using digital and automation remote sensing surveying techniques, establish a record, filing and processing system of graphic, quantitative and descriptive data on the environment.</p>	<p>Nation-wide</p>	<p>Public and Private sectors.</p>

8	Elaboration of plans for occupation of regional and urban space (No. 1).	Identification of priority areas for environmental development and preparation of plans for occupation of regional and urban space.	Based on information from project No. 7, establish feedback comprehensive studies for occupation of regional and urban spaces.	To be determined upon results of Project No. 7.	Nation-wide public and private sectors
9	Treatment of dry wastes in the urban zones.	Conserve and improve the environment. Solve the problem of sanitary handling of litter	Recycling of solid waste containing litter to obtain cellulose pulp, plastics, and other industrial raw materials, as well as organic fertilizers for agricultural use, animal feed, and biogas production for energetics.	Municipalities	Entire population
10	Demonstrative studies (pilot also see No. 1), and consolidation and enlargement of the present <i>biotope</i> system	Demonstrate, through projects for developing communities of less than 3,000 inhabitants located in representative sectors of the country, the economic benefits of environmental management with the cooperation and participation of all the sectors and institutions involved.	Protect at least one sample of the most threatened ecosystems.	To be decided upon results of the study	All the inhabitants of the country.
	Project No.	Title	Description	Location	Beneficiaries
11	Air Pollution Control	Reduce discomfort and harmful effects on the health of the inhabitants of the republic: example, lung diseases.	Establish minimum emission standards pertaining to the environmental concentrations of air pollutants.	Guatemala city	Urban Population
12	Codification of Guatemalan Environmental Legislation	Complete the dispersed standards on environmental subjects existing in the country in several legal bodies whose principal function is not environmental.	Creation of a systematic consulting body on matters germane to environmental standards in the country	Guatemala city	Entire population, tourists, and institutions.