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DRAFT ENVIRONMENTAL REPORT
ON
HAITI

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DRAFT ENVIRONMENTAL REPORT ON HAITI

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0.0 INTRODUCTION AND SUMMARY

Located in the Caribbean, where it occupies the western third of the island of Hispaniola, Haiti, a colony of France until 1804, is the second oldest republic in the Western Hemisphere. Almost completely forested when Columbus visited it in 1492 and later the source of food, spices, sugar, coffee, and tobacco which made its France's richest overseas colony, Haiti today, with a per capita income estimated at \$80, is the poorest country in the Western Hemisphere, and is suffering from a degree of environmental degradation almost without equal in the entire world.

Haiti's chief environmental problem is erosion, the result of deforestation, poor farming practices, chiefly the result of the farming of marginal lands on slopes, and overgrazing. Farmers desperate for land to grow their market and subsistence crops have pushed even onto some of the steepest slopes, denuding them of their forest cover, and laying the soil open to erosion. Peasants gathering wood for cooking and charcoal burners producing fuel for the market in Port-au-Prince and other urban areas have also contributed heavily to deforestation and consequently to the soil erosion which has followed it. Soil erosion in some parts of Haiti is so severe that little or no topsoil remains and farmers are forced to work the deep but infertile layer of soil that underlies it.

Deforestation has had other consequences. Without forests to perform the necessary function of retaining water from rainfall and releasing it slowly to catchment areas, heavy rainfalls result in torrential river flows which cause flooding or heavy runoff which carries from barren, eroded hillsides loads of silt and eroded soil that fill even the streets of the capital with mud, clog irrigation works, and silt up and consequently reduce the efficiency of hydroelectric operations. The Peligre Dam, the country's only significant source of hydroelectric power has experienced a drastic reduction in its hydroelectric capacity as a result of siltation.

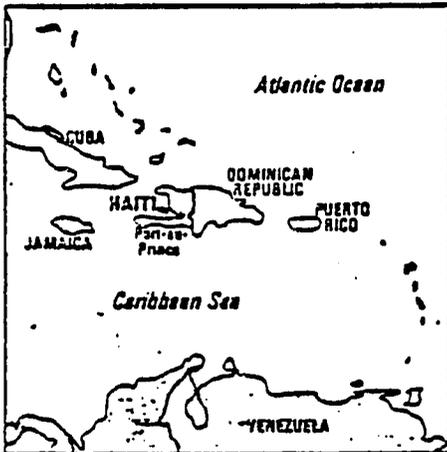
Behind these problems lies the population problem. Haiti is the most densely populated country in the Western Hemisphere simply in terms of population per square kilometer (about 170 by 1978 calculations), but in terms of population per kilometer of arable land this density is even higher: about 490. It is the pressure of population on this limited resource which accounts for the farming of marginal, easily erodible land, the clearing of forests on high slopes, the felling of trees for firewood and charcoal. Furthermore, as land becomes less productive, farmers attempting to meet their food needs, often find themselves forced into farming larger areas, often leading to further clearing of forest land and further erosion.

Faced with this gap between food supply and food demand, many

Haitians are suffering from malnutrition, a condition which afflicts particularly the young, but which also makes both younger and older Haitians more susceptible to a variety of diseases.

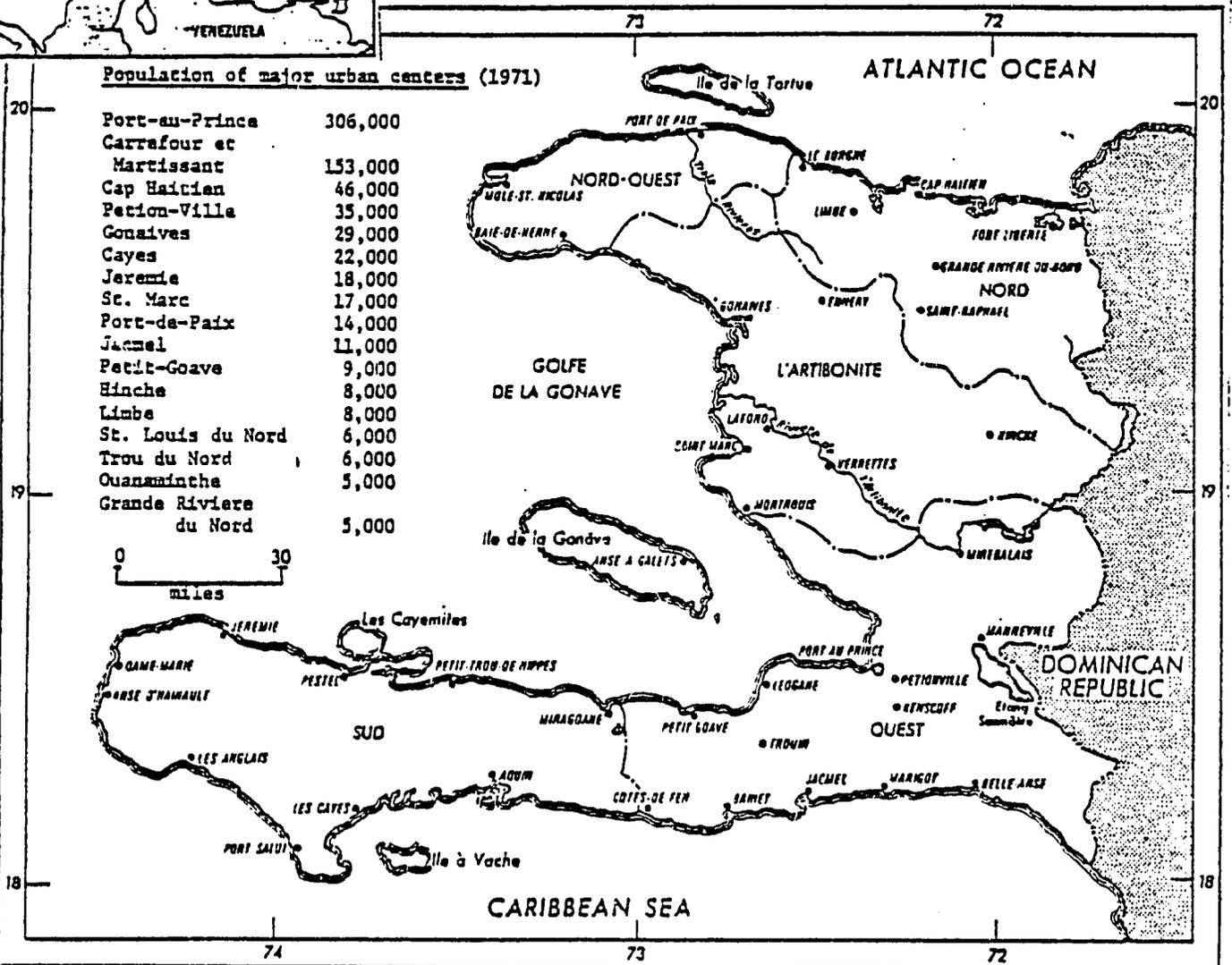
Faced with these many problems, Haiti is attempting, to halt deforestation through the establishment of communal forests, the reforestation of important hydrological basins, and the development of new energy sources to help relieve the pressure on the ever decreasing forest cover; to construct terraces to limit soil erosion on the higher slopes; to extend health services, now centered mostly in the capital city of Port-au-Prince, to the interior of the country. Because of its lack of mineral wealth or petroleum resources that might help to finance such efforts, Haiti is forced to look to outside source, principally the United States, to help to halt the environmental degradation which may soon lead to complete ecological—and human—disaster.

REPUBLIC OF HAITI



Population of major urban centers (1971)

Port-au-Prince	306,000
Carrefour et Martissant	153,000
Cap Haïtien	46,000
Pétion-Ville	35,000
Gonaïves	29,000
Cayes	22,000
Jérémie	18,000
St. Marc	17,000
Port-de-Paix	14,000
Jacmel	11,000
Petit-Goave	9,000
Hinche	8,000
Limbe	8,000
St. Louis du Nord	6,000
Trou du Nord	6,000
Ouanaminthe	5,000
Grande Rivière du Nord	5,000

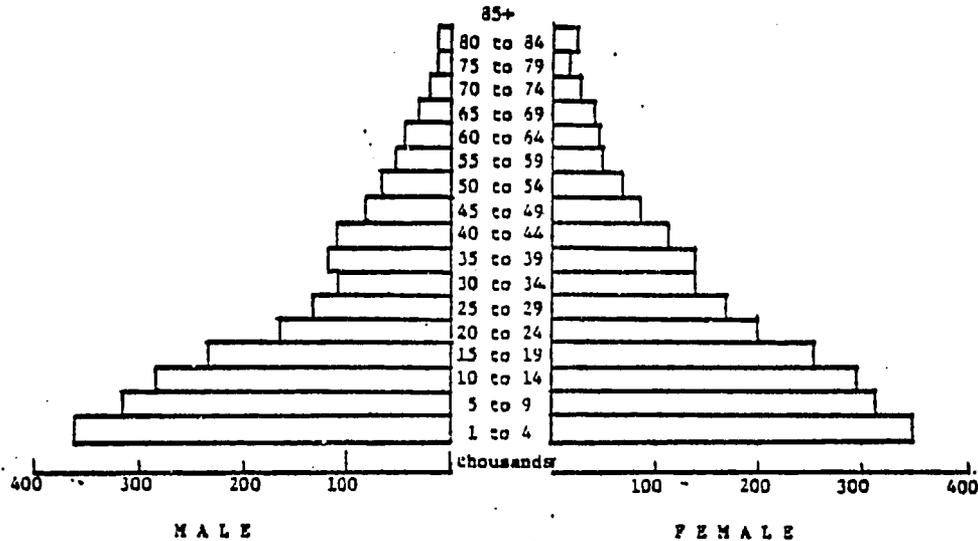


1.0 POPULATION CHARACTERISTICS

- 1.1 Occupying the western third of the Caribbean island of Hispaniola, Haiti, with a territory just slightly larger than the state of Maryland, has a population exceeding Maryland's by nearly two million. It has the highest population density in Latin America.

The pressures of a burgeoning population on a limited amount of arable land is one of the chief factors behind the extensive environmental degradation in evidence in Haiti. The demands of a growing population for food have led to extensive cultivation of marginal land on easily erodible slopes, while clearing of land to satisfy the demands of the population for both food and cooking fuel are the chief causes for the continuing deforestation of Haiti.

POPULATION PYRAMID
1974



Present population: 4.8 million*

Present population
growth rate: 2.2%

Years to double
population: 32

Percentage of population
under 15: 42%

Percentage of pop-
ulation over 64: 4%

Population density (see map, page 3): 160 inhabitants per square kilometer
400 per square mile.

* This figure, from the 1978 World Population Data Sheet of the Population Reference Bureau, differs from other recent estimates; the 1978 World Population Estimates of the Environmental Defense Fund places the population at 5.5 million; the U.S. State Department's 1976 estimate was 5.0 million.

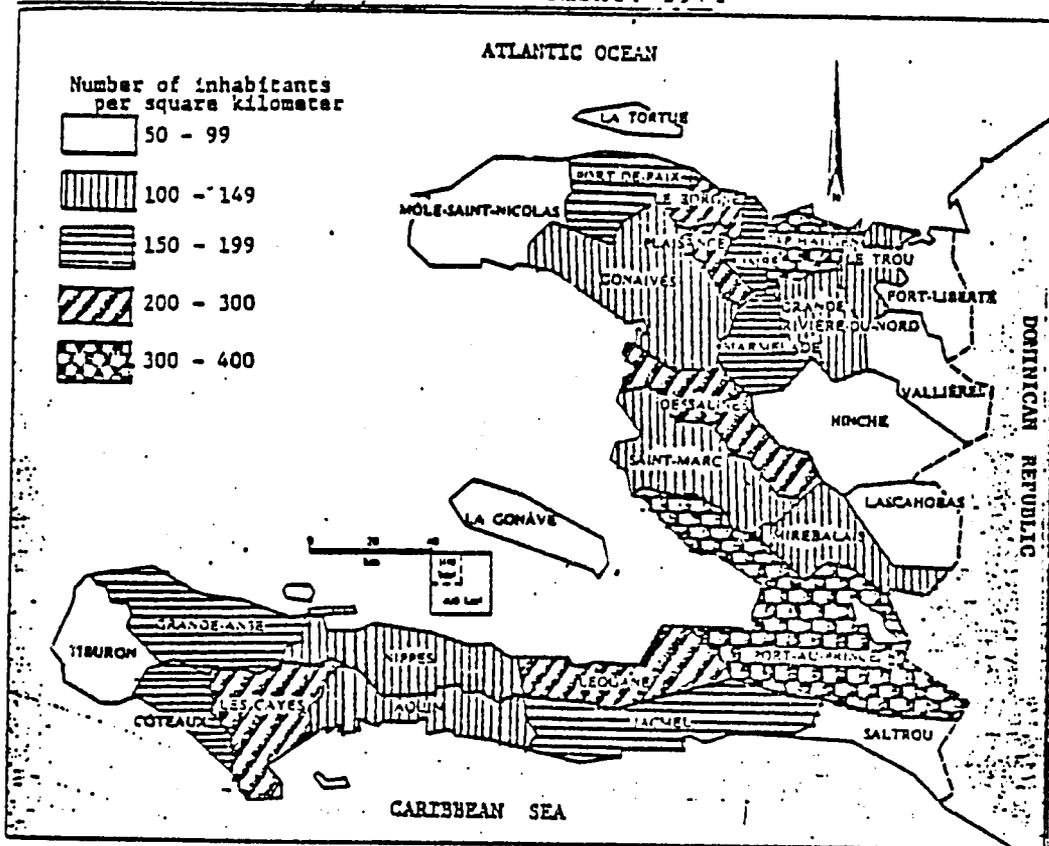
Population density: 160 inhabitants per square kilometer; (USAID estimate)
400 per square mile

Population by arrondissement: 1950 and 1971 (see map for population densities)

<u>Arrondissement</u>	Rural			Urban		
	1950	1971	Growth	1950	1971	Growth
Port-au-Prince	261,859	370,750	41.5	151,918	506,525	233.4
Gonaives	147,854	150,100	1.5	17,862	36,736	105.7
Hinche	95,675	119,320	23.4	7,621	14,221	86.6
Jeremie	159,645	215,740	35.1	15,720	25,117	59.8
Jacmel	233,221	282,610	36.4	12,485	16,449	31.7
Anse-a'Veau	135,846	140,600	3.5	6,002	9,727	62.0
Mole St. Nicolas	49,808	75,690	51.8	2,683	4,391	63.7
Aquin	118,186	155,360	31.4	5,727	5,265	8.1
St. Marc	85,250	127,050	49.0	11,375	20,504	80.2
Belle Anse	54,725	49,200	-10.0	2,187	3,040	39.0
Port-de-Paix	104,980	114,690	9.3	10,808	21,744	101.1
Dessalines	111,157	161,260	45.1	8,936	12,324	49.1
Fort Liberté	52,190	56,010	7.3	12,167	12,869	5.8
Cayes	179,366	245,430	37.0	15,817	27,222	172.1
Vallieres	41,436	44,340	7.0	1,886	3,537	87.0
Mirebalais	109,957	119,400	8.6	4,174	7,080	69.6
Leogane	200,142	257,830	28.8	10,846	16,718	54.1
Lascahobas	38,154	34,750	-8.9	3,401	5,339	56.9
Marmelade	72,307	107,580	48.8	3,104	5,765	87.2
Limbe	35,683	30,030	-15.8	3,190	6,502	66.3
Coteaux	48,546	76,700	58.0	7,694	9,687	25.9
Tiburon	41,515	48,910	17.8	5,538	13,029	135.3
Cap Haitien	88,786	145,120	63.4	29,399	54,691	86.0
Gde Riviere du Nord	97,136	84,330	-13.2	9,137	16,101	72.8
Trou Du Nord	40,362	54,940	36.1	11,919	14,387	20.7
Borgne	54,287	74,530	37.3	3,338	5,735	71.8
Plaisance	54,261	92,750	70.9	2,972	4,014	35.1
<u>Totals</u>	2,713,334	3,434,920	26.2	378,806	879,708	132.2

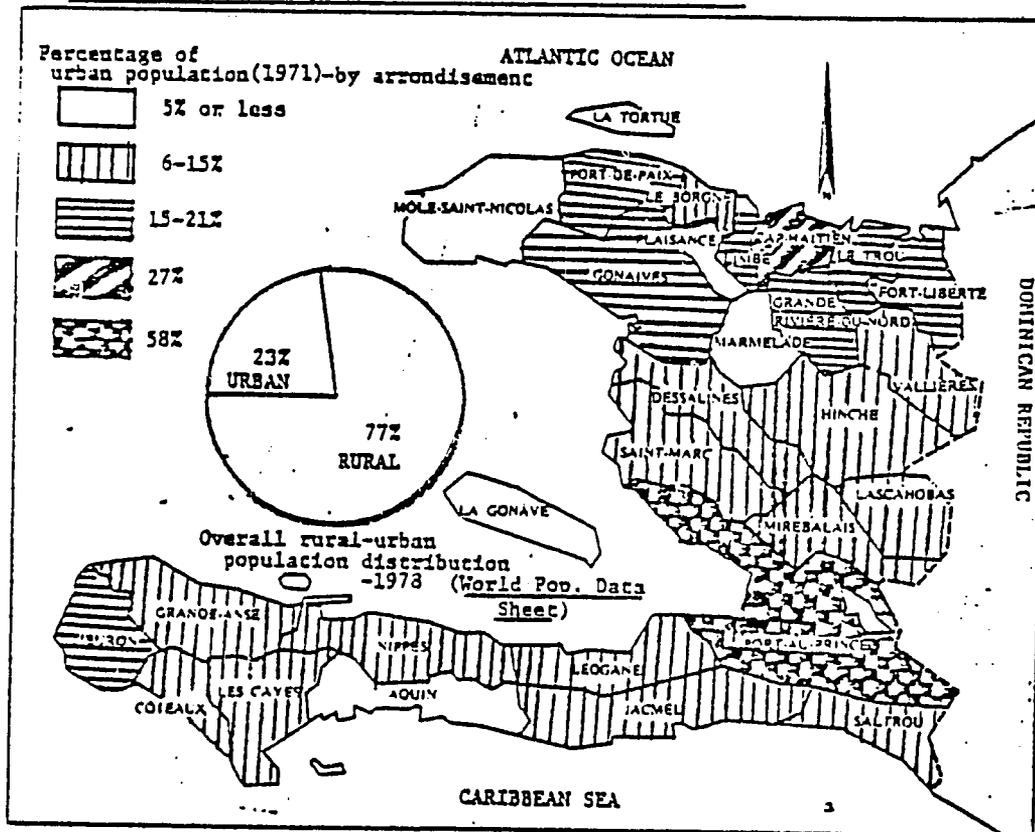
Population migration: internal and external

Internal migration varies little with province but external migration averaged 20,000 annually in the 1960's, with skilled or professional workers prominent among the emigrants; emigration by political refugees to U.S. has increased recently.



With an overall population density of 156 per square kilometer (1971 census) or 172 per square kilometer, based on the 1978 estimate, Haiti has the highest population density in the Western Hemisphere. Measured in terms of arable land, the population density is 490 persons per square kilometer, allowing generally less than a half acre for a family farm.

Rural Urban Population Distribution: 1971



Because the Haitian definition of urban may be so broad as to include hamlets of fewer than 100 inhabitants, some analysts place the the total percentage of rural population at 90% rather than at the level indicated here.

1.2 ETHNIC COMPOSITION OF POPULATION

About 90% of the population consists of blacks, descendants of West African slaves. The bulk of the remaining 10% of the population is formed by mulattoes, the traditional Haitian elite, who in contrast to the predominantly rural, Creole-speaking, voodoo-practicing blacks, are urban, bilingual in French and Creole, and Roman Catholic.

1.3 EDUCATIONAL CHARACTERISTICS OF POPULATION:

Literacy: 20%

School enrollments:

Public schooling is free, but less than half of school age children actually attend school. Although enrollment in primary schools is quite high (255,000 in 1967), secondary school enrollment is low (only about 27,000 in 1967).

Higher education:

University of Haiti -Port-au-Prince
200 teachers, 2,100 students
Library with 7,000 volumes.

Relevant faculties:

- Faculty of Law and Economics
- Faculty of Medicine
- Faculty of Odontology
- Faculty of Science
- Faculty of Agronomy and Veterinary Science

Attached schools: Ecole d'Arpentage (School of Surveying)

Colleges:

Ecole Polytechnique d'Haiti
Port-au-Prince

Institut Supérieur Technique d'Haiti
Port-au-Prince

Learned societies (also to appear under organizations):

Conseil National des Recherches Scientifiques (National Council for Scientific Research):

Under the Department of Public Health and Population, Port-au-Prince; founded in 1963 to coordinate scientific development and research particularly in the field of public health.

Societe d'Histoire, de Geographie et de Geologie
Port-au-Prince, founded in 1923

1.4 HEALTH CHARACTERISTICS OF POPULATION (World population data sheet)

Birth rate: 39 per 1,000 population

Death Rate: 17 per 1,000 population

Infant Mortality Rate: 115 per thousand live births

Life Expectancy: variously stated at 50 or 45 years

Health problems and disease

Because of insufficient documentation (only about 50% of hospitals compile morbidity and mortality statistics and, in any case, many peasants do not receive medical care), reliable data on major health problems is limited, although pneumonia, tetanus, enteric diseases and tuberculosis have been identified as the most frequent causes of death.

Malnutrition, a condition considerably aggravated by intestinal worms, is the major health problem in Haiti today. An estimated 20 to 25% of Haitian children under five years of age suffer from second and third degree malnutrition, and in some areas the prevalence of severe protein malnutrition (kwashiorkor and marasmus) has been estimated to be as high as 10 to 15%. Malnutrition is also a serious problem among other age groups: nutritional deficiencies afflict large numbers of the adult population and tend to increase the mortality figures for enteric diseases and tuberculosis. Malnutrition among pregnant women is also responsible for infant deaths as well as for low birth rates and is, furthermore, a significant contributor, as a primary or secondary cause, to most infant and child deaths.

Apart from malnutrition, major disease problems, often complicated by malnutrition include: tuberculosis (active cases may include as many as 1 to 3% of the population; typhoid, which is endemic in most urban areas; gastroenteritis; and influenza, common in most urban areas. Malaria, while still a widespread problem, is no longer endemic at elevations below 500 feet; the worst remaining areas are Petit-Goave-Mirgaona and Aquin (in the coastal lowlands of the south) and Jean Rabel in the coastal lowlands of the north; about 112,000 people live in such hyperendemic areas, while about 3.7 million live in zones of lower transmission. Mosquitoes, the carriers of malaria, are also responsible for the transmission of dengue fever. Schistosomiasis, a common health problem in other Caribbean countries, is not present in Haiti.

1973 morbidity figures for Les Cayes, an arrondissement in southern Haiti, which in 1971 had a total population of roughly 270,000 are presented in Appendix A. It is not certain to what extent this area is representative of the rest of the country.

Malaria control program:

With assistance from several outside organizations (AID, the Pan American Health Organization), and the United Nations Children's Fund), the Haitian government has conducted a malaria control campaign since 1961. The Service National d'Eradiation de la Malaria (SNEM), an autonomous part of the Ministry of Health, is responsible for the program. Although the program for several years (1964 to 1970) included mass drug administration as one of its aspects, it has consisted principally of spraying of houses with DDT to kill the mosquitoes which are the vectors of malaria. The number of houses sprayed peaked in 1970 through 1972, during which about a million and a half houses were sprayed each year. Shortages of insecticides have forced curtailment of spraying in recent years. Mosquito resistance to DDT has become a significant problem.

1.5 MEDICAL FACILITIES AND HEALTH PERSONNEL:

Medical facilities, consisting of hospitals, dispensary hospitals, health centers, and dispensaries, tend to be concentrated in urban areas. About 44% of the hospital beds are to be found in Port-au-Prince, and 67% of the country's estimated 344 doctors (about 1 per 14,000 population) are located in the Port-au-Prince area.

Private and volunteer organizations account for approximately 40% of all health facilities in Haiti, providing in some rural areas the only available health care facilities.

1.6 WATER SUPPLY

There are only 14 water supply services in Haiti, none of which can be said to supply really safe potable water. Less than twenty cities have a public drinking water system.

Metropolitan area (Port-au-Prince and Petionville):

<u>No. of house connections</u>	<u>% of housing</u>	<u>% of pop.</u>
20,000	38.3%	16%

In its annual development plan for 1977/78 the Conseil National de developpement et de Planification states:

"a large majority of the remaining 84% of the population is provided for by public foundations and the more fortunate buy water by sceaux ? or from tanks (camions), according to their means."

Other sources (Snycrisis), however, place this figure much lower: about 20% of the population with easy access to public fountains.

Interior of the country:

<u>No. of house connections</u>	<u>% of population</u>
3,855	5.1% (less than 200,000)

About 94.9 % of the population living in rural zones receives its water directly from springs, wells, or from the nearest stream, which is usually contaminated; according to a figure cited by the Haitian government in 1977, only about 5.1% of the 4,050,000 people living in towns and rural zones have adequate water supply;

Government plans involving water supply

The World Bank and PAHO have been working with the rural water service (SNEP) to improve its administrative capability so that it can supervise the construction or improvement of water systems in ten provincial towns.

Furthermore, the government development plan for 1977/78 calls for: the construction in the metropolitan area of new reservoirs with a capacity of 188,000 gallons, the repair of reservoirs, the tapping of new water sources, the construction in three provincial towns of water supply systems with a total capacity of 1,300,000 gallons, topographical studies, research and prospecting for new water sources, and improvements in water supply administration.

The program foresees a total investment of 25.082 million gourdes for 1977/78, over 20 million of which is expected to come from outside sources.

Water supply problems have been complicated by the recent drought.

Drinking water quality surveillance:

public health authorities are responsible for water quality control; however, there are no water quality standards, and as of December 31, 1970, none were contemplated. Although no rural water supplies are monitored for bacteria content some urban supplies are monitored regularly and some occasionally.

As of 1970, the most significant constraints on construction of water supply systems were reported as (in order of importance): insufficient internal financing; inappropriate financial framework; lack of trained personnel; and an inappropriate something or the other

Projected expenditures for drinking water in the 1977-1978 development budget are: 33.4 million gourdes (2.0 million in 1971/72, 1.1 million in 1972/73; 1.7 million in 1973/74).

1.7 SANITATION

Sewerage: as of 1970, only about 13% of the total population was said to have adequate sewage disposal;

urban: there was nil or negligible connection with public sewerage systems as of 1970;

70% of the total urban population used pit, privy or septic tank (about 669,000 as of 1970);

rural: about 1% of the rural population was estimated to have adequate disposal as of 1970 (about 43,000 persons).

Apart from a small and inadequate sewer system in Port-au-Prince there is no sewerage in Haiti. Sewage is, therefore, often disposed of by individual means; although better houses have septic tanks and cesspools, the majority of the population of the capital uses latrines. In rural areas, where few sanitary latrines are available, human excreta is frequently simply deposited on the ground, a situation which the Haitian government hopes to remedy through a program of sanitary latrine construction functioning since 1970 with assistance from WHO and PAHO.

Because drains cannot handle stormwater, the main streets of Port-au-Prince are frequently flooded with polluted water during heavy rainstorms.

Constraints on the construction of sewerage systems, as listed by the World Health Organization in 1970, are: lack of a national organization responsible for the program; inappropriate administrative framework; inappropriate financial framework; insufficient internal financing; and lack of trained personnel.

Solid waste is collected in larger towns, but its disposal is inadequate. In poorer urban areas, streets are often littered with garbage. In outlying and rural areas, trash and garbage are simply thrown into ravine or burnt in the same fires which are used for cooking purposes.

Uncollected garbage both attracts and nourishes a large rat population which could serve as a source of typhus infection.

FAMILY PLANNING AND BIRTH CONTROL

The government of Haiti has not yet and does appear to be about to issue an explicit policy statement on population control, and in 1976 the family planning budget of the MCH/FP was only \$21,000 out of a total budget of \$6.85 million.

The Division of Family Hygiene has, however, the goal of increasing acceptors of birth control devices so that by the 1979 the number of fertile females employing birth control in its project areas will have increased by 40-50%. Funding for these programs comes from the United Nations Fund for Population Activities (UNFPA)—the largest donor—, the U.S.A.I.D. (the second largest donor), Family Planning International Assistance (FPIA), Pathfinder, and the Association for Voluntary Sterilization (AVS). Assistance provides funds for technical advisors, salaries, training of local personnel, contraceptives (pills and condoms), and pharmaceuticals. Attempts are being made to make birth control information and devices more accessible by distributing them through community centers rather than through medical dispensaries.

The lack of a government support on the policy level and the lack of coordination and cooperation among agencies involved in health care and family planning continue to act as constraints on successful family planning programs.

2.0 ORGANIZATIONS WITH INTEREST IN ENVIRONMENT AND NATURAL RESOURCES

Haiti, a constitutionally based republic with a president and a unicameral legislature, is under the firm rule of life-president Duvalier, who makes government policy, enjoys the unanimous support of the legislature, nominates his own successor, and appoints his cabinet and most other local officials as well.

For administrative purposes the country is divided geographically into departements, arrondissements, communes (the lowest urban level) and sections rurales (the lowest rural level). Running parallel to this civilian structure are military departements, districts and subdistricts, the last of which consist of several sections, each with its section chief (chef de section), who is head of the section's police force. A dual system of courts also exists on the level of the arrondissement but the lowest judicial level is formed by civilian justices of the peace. Because on the section level, civilian rule has never actually been instituted, the rural section is actually administered by the military chef de section, whose responsibilities include: the exercise of police powers; functions concerning the maintenance of roads, water, forests, and other natural resources; functions relating to agricultural activities; and functions relating to the sale and ownership of domestic animals. The chef de section and his rural police, all of whom are responsible to the military, are of great significance in matters relating to environment and natural resources, because they have the primary responsibility for apprehending offenders under the Rural Code of May 24, 1964, which governs most of the activities in this domain.

2.1 GOVERNMENT AGENCIES

2.1.1 Department of Agriculture, Natural Resources and Rural Development (DARNDR)

DARNDR, with its various subdivisions, is the government agency with the chief responsibility for the development of agriculture and the control of practices detrimental to that development and to the continued productivity of the land.

Institution weaknesses within DANRDR have been identified as a major constraint to agricultural development. The department has suffered from declines in real operational budget, allocations and salaries. Administrative services must be improved, particularly those involving data collection and analysis, planning and programming. The Department and Haitian agriculture in general suffers from a lack of research capabilities.

It was estimated in 1974 that about 8,000 agronomists would be necessary to provide service to the approximately 617,000 farm-

holdings in Haiti; the actual number fell far below this (about 203--158 of which were employed by DARNDR. Of an estimated 2,400 needed agricultural technicians, there were only 158 available, while there were only 19 veterinarians rather than the needed 100. The lack of trained personnel makes it difficult to implement programs for soil and water conservation, and the absence of forestry research impedes developments in that area.

Agricultural expenditures as forseen in the 1977-78 development budget come to 197,482,980 gourdes* (a record 22% of the total budget), 66% of which would have to come from foreign sources.

2.1.1.1 Director General of Natural Resources

Service of Soils Conservation, Forests and Wildlife Conservation (SCS)

Functions: the Service is responsible for matters dealing with soil and the control of soil erosion; the control of forests and the granting of concessions for logging operations in forests; reforestation and the protection of forests; agents of the Service are responsible for participating in hearing regarding infractions against the 1971 Hunting Law and other laws.

Personnel: the personnel of the Service consists of 12 district conservationists (one for each agricultural district; 96 forest guards (gardes forestieres); 37 forest agents; 25 wood controllers (controleurs du bois); 3 soil conservation agents; 5 reforestation agents--a total of 178 personnel, nearly a third of whom are located in the metropolitan Port-au-Prince area.

The personnel of the service is said to be in no way qualified for forestal action properly speaking, but it performs functions such as collecting taxes, and selling rights for the cutting and transporting of wood, and is reported to have had some success in educating the public in the necessity for soil conservation. Remarking on the programs of the Service in 1975,

*5 gourdes = 1 dollar

a FAO report noted: "It is evidently impossible to talk about an action forestry program without qualified personnel to carry it out."

The 1976-81 forest plan of the Service recognizes the Service's personnel deficiencies, and calls for considerable strengthening of the Service through the training of present personnel and the hiring of new qualified staff. By 1982, if the forestry plan is followed, the Service will have not only 195 forest guards but also new equipment to facilitate their work.

Hunting and Fishing Service

The Service coordinates fishing activities and is responsible, among other things, for programs involving stocking of streams with fingerlings.

Service meteorologique national (SMN)

-subsections:

-Meteorology Section

-Section on Climatology and Agricultural Meteorology

-Hydrology Section.

2.1.1.2 Director General for Livestock and Farming

Service de Chimie Agricole (SCA)

Service d'Irrigation et Control des Rivieres (SICR)

The service is responsible for about 72 irrigation systems, --all existing systems except those operated by the Co-operative for the Administration, Maintenance and Improvement of the Irrigation Systems in the Artibonite Valley and the private systems owned and operated by the Haitian American Sugar Corporation (HASCO).

2.1.2 National Council on Environment and Erosion Control (CONAELE) (Conseil National de l'Environnement et de Lutte contre l'Erosion)

Established: by Decree of April 9, 1977

Responsible to: directly responsible to the President

Functions: -to formulate a policy for protection national resources against erosion;
-to fomulate, in conjunction with other organizations, a

- national policy designed to discover a cheap energy source in order to curtail deforestation;
- to formulate a national policy for the protection of the environment;
 - to recommend measures appropriate for protecting the environment in the face of government development projects;
 - to recommend measures to be taken to protect the environment in view of private development efforts;
 - to cooperate with other agencies in monitoring the operations of projects affecting the environment or able to be affected by it and to recommend appropriate measures to those agencies;
 - to recommend programs for the training of technicians for carrying out the above programs.

Composition: -a Permanent Committee consisting of the Secretary of State for Agriculture, Natural Resources and Rural Development, the Secretary of State for Public Works, Transport and Communication; the Secretary of State for Mines, the Director General of the National Office for Tourism and Public Relations;

-a Technical Committee, appointed for three year terms, comprised of five members, including a least one engineer, one agronomist, and one economist. This committee studies all questions falling within the competence of CONAELE and to call in technical assistance and form groups to study particular problems.

Budget: In the 1977-78 Development Budget, CONAELE is allotted 875 gourdes (about 175 dollars).

2.1.3 Department of Mines, Resources, and Energy

The Department, which came into being in late 1978, has assumed the natural resources functions formerly under DARNDR and later under INAREM (Institut national des ressources minerales), established by decree in March 1975. These include the basic implementation of mining legislation, including the issuing of permits and concessions for mining operations.

Among the Haitian governments objectives in the mining and energy sector as detailed in the 1977-78 plan were:

- safeguarding the terrestrial and marine environment;
- rehabilitation of zones around quarries and mines
- research into and application of experimental technologies for the utilization of geothermal energy, solar energy, and energy derived from organic wastes;
- mid-range objectives include participation in the elaboration and execution of a water policy, particularly with regard to groundwater;
- long-range objectives include a complete inventory of national mineral and energy resources; and a greater autonomy in energy provision.

Programme de Protection de l'environnement:

Formerly under INAREM and now presumably the responsibility of the Department of Mines, Resources, and Energy, this program, as described in the 1977-78 Development Budget, is intended to prevent the introduction into the environment of chemical elements capable of causing irreversible damage

to the natural and human environments, to make a catalog of the ecological damages caused, and to study the alternatives for protection.

Focusing chiefly on damage cause by mining operations, the program's plan placed particular emphasis on a rehabilitation project on the Rochelois Plateau, the location of Haitian bauxite mining operations. As originally described, the the responsibility for this program was to rest jointly with INAREM's Division of Mines and Quarries and DARNDR and was to operate on on budget of 50,000 gourdes, to be supplied exclusively by INAREM.

Service Geologique

2.1.4 Department of Public Health and Population

Functions: The Department has general responsibility for public health program, including responsibility for a corps of sanitary engineers who in 1968 numbered 56. Although health programs are heavily assisted by outside sources, nearly all work is at least partially government financed or sponsored and thus involves the participation of the Department.

The Statistical Section of the Department has been attempting to collect accurate health data.

The Section for Planning and Evaluation has established a general health policy preliminary to the establishment of a national health plan. This policy calls for:

- reduction of infant mortality and morbidity as well as the general mortality through the control of communicable diseases, improvement in environmental hygiene and campaigns against malnutrition (highest priority);
- regionalization of health services to provide better care for the rural population which comprises 80% of the population but receives only 1/3 of health services ;
- division of Haiti into five large medical regions with its own public health system, comprised of a regional hospitals, district hospitals health centers and dispensaries;

In order to implement this general policy, support will be required in the form of both technical and administrative assistance; plans are underway with PAHO/WHO in conjunction with the Interamerican Development Bank.

2.1.5 CONSEIL NATIONAL DE LA RECHERCHE SCIENTIFIQUE ET TECHNIQUE

Established: Law of September 27, 1968

Composition: the President is the rector of the National University;
 -the other members are the deans of the division of the University and the directors of the colleges (ecoles superisurs);

Functions: -to plan to ensure the devolopment of both public and private scientific research in Haiti;
 -to document both public and private researchj;
 -to specify the goals and methods for scientific de-velopment;

- to organize periodic scientific meetings;
- to conduct studies and investigations and as a result of these studies to recommend concrete measures to improve the life of the population and to favor the evolution of science and technology in Haiti;

Auxiliary units:

-the Interministerial Committee for Scientific and Technical Research, composed of a representative of each Secretary of State;

- the National Institute for Scientific and Technical Research, composed of:

- the division of medical research;
- the division of agronomic and veterinary research;
- the division of research in exact and natural sciences;

The institute is to stimulate and coordinate research in science and technology, and to furnish researchers with, among other things, a documentation center.

2.1.6 NATIONAL COUNCIL OF DEVELOPMENT AND PLANNING (CONADEP)

Under the titular head of the President of the Republic, the Council, as the chief government planning body, is composed of the following members:

Secretary of State for Finance and Economic Affairs
 Secretary of State for Commerce and Industrie
 Secretary of State for Agriculture, Natural Resources,
 and Rural Development

Secretary of State for Public Works, Transport and
 Communications

Secretary of State for Public Health and Population
 President Director General of the National Bank of the
 Republic of Haiti

An executive secretary, nominated by the President of the Republic, serving as his representative and with the status of a secretary of state.

functions: -long run economic planning;
 -preparation of the development budget;
 -assistance to Ministries and semi-autonomous agencies in project preparation.

With the legal requirement to meet once a month, the Council's business is managed by two subunits:

The Central Planning Office:

-with six subdivisions, one of which is the Division of Territorial Management and Environmental Protection;

Regional Planning Bureaus:

-responsible for planning in the various regions of Haiti.

CONADEP had prepared for the period 1971-76 a five year plan which was never implemented; the five year plan covering 1976-81 came into effect beginning October 1, 1976.

2.2 NON-GOVERNMENT ORGANIZATIONS

2.2.1 Operation Koumbite

A grass-roots reforestation operating out of Port-au-Prince since 1972, Operation Koumbite, which is essentially unfunded, relies on the mass assistance of students and other volunteers to carry out its campaign to plant a million trees. It has received support in the form of donations from a cement firm and a construction firm.

2.2.2 HACHO

A private organization operating with assistance from AID, West Germany, and the Haitian government, HACHO is working in the northwest region of Haiti to construct terraces and small irrigation works. HACHO is also encouraging small artisan workshops for producing alternate incomes for peasants.

2.2.3 Foi et Developpement

Operating in the south under the direction of a French priest, Foi et Developpement is attempting, reportedly with much success, to get farmers to work together in communal plots, the income from which is divided in such a way that one third goes to the farmers, one third is saved by the group, and one third is reinvested. The organization, whose technique is said to be spreading, has received a large grant from the Inter-American Foundation.

2.1.7 EDUCATIONAL CAPABILITIES

University of Haiti

Faculte d'Agronomie et de Medecine Veterinaire (FAMV)

Located in Damien, the Faculte d'Agronomie (Agricultural College) occupies four major buildings, which provide space for classrooms, laboratories, a library, dormitories, and administrative offices.

Curriculum: two and four year programs; includes programs in natural resources (water, forests, soils); not all courses taught on a regular basis;

Student body: about fifty students per year, more than the school can adequately handle;

Laboratory facilities: minimal, but veterinary laboratory has more space and equipment;

Library: about 35,000 volumes, only about 10% of which have been judged modern enough to be useful;

Teaching and research personnel: 36 persons, only six of which have a master's degree or equivalent; most staff members also positions in government agencies, etc.

Budget: about \$25,000 per year total (1976 estimate)

College of Engineering

Located in modern facilities in Port-au-Prince

Program: conducts an engineering training program

Student enrollment: total enrollment of 400; 100 to 110 secondary school students admitted to the program each year;

Haitian Institute for Management Training and International Studies (INAEHEI)

No details available.

3. OVERVIEW OF MAJOR LEGISLATION DEALING WITH ENVIRONMENT AND NATURAL RESOURCES AND MAJOR GOVERNMENT AGENCIES RESPONSIBLE FOR ITS IMPLEMENTATION

Coverage: O=ownership; U=utilization; P=protection; C=control;
R=establishment of reserves; Re=restoration; M=marketing

RESOURCE/AREA OF CONCERN	Legislation	Coverage	Implementing Agency Department, Authority	subsection of report	
Renewable Resources WATER resources	Constitution, Article 22	O		3.1.1.1	
	Civil Code, Article 522	O/U		3.1.1.2	
	Rural Code of May 24, 1962, Law no. VII	O/U/P	Department of Agriculture, Natural Resources, and Rural Development (DARNDR)	3.1.1.3	
	Law of June 5, 1974 (on groundwater)	U/C	Department of Agriculture, Natural Resources and Rural Development (DARNDR)	3.1.1.8	
	irrigation	Law of Sept. 20, 1952, establishing the statutes in the system of ir- rigation and drainage...	U/C	Department of Agriculture, Natural Resources and Rural Development (DARNDR)	3.1.1.4
	supply	Decree of May 13, 1964 establishing the Metropolitan Central Water Services (CAMEP)	U/C/P	CAMEP	3.1.1.5
		Law of August 31, 1977 setting the National Drinking Water Service (SNEP)	U/C/P	SNEP	3.1.1.6
	marine waters	Decree of April 6, 1972 (on marine and coastal waters)	O/U/P		3.1.1.8
		Decree of March 13, 1975 approving the agreement on prevention of sea pollution	P		3.1.1.9
	FORESTS	Law of February 3, 1926	R		3.1.2.1
Law of August 20, 1955		U/M		3.1.2.2	
Rural Code of May 24, 1962 Law No. VIII		R/U/P/M	DARNDR, Service of Soil Conservation, Forests and Wildlife Conser- vation (SCS)	3.1.2.3	
Decree of March 13, 1968		R/P/Re		3.1.2.4	
Decree of Nov. 21, 1972		P/Re		3.1.2.6	
Decree of Nov. 20, 1973		P		3.1.2.7	
WILDLIFE		Rural Code of May 24, 1962 Law No. IX Decree of March 31, 1971	P/U P/U	DARNDR, Service of Hunting and Fishing; SCS	3.1.3.2 3.1.3.1
FISHERIES	Rural Code of May 24, 1962 Law No. IX	P/U	DARNDR, Service of Hunting and Fishing	3.1.4.1	
Non-Renewable Resources MINERALS	Constitution, Article 22	O		3.2.1.1	
	Decree of October 10, 1974	O/U	Department of Mines, Re- sources and Energy	3.2.1.2	
	SOIL	Rural Code of May 24, 1962. Law No. V	U/P	DARNDR	3.2.2.2
		Constitution, Article 22	U/P		3.2.2.1
		Decree of June 16, 1977	P/Re	National Council for the Environment and Control of Erosion (CONAELE)	3.2.2.3
Land Use and Agriculture STATE LAND LAND USE	Law of July 26, 1927	O/U		3.3.1.1	
	Constitution, Article 22	U		3.3.2.1	
	Rural Code of May 24, 1962 Laws No. IV and V	O/U	DARNDR	3.3.2.2	
	Law of August 11, 1975	U	DARNDR	3.3.2.3	

3.0 LEGISLATION DEALING WITH ENVIRONMENT AND NATURAL RESOURCES

3.1 RENEWABLE RESOURCES

3.1.1 Water Resources

3.1.1.1 Constitution of 1964, as revised in 1971

Provisions: Article 22 state that the right of ownership is not to extend to spring, rivers or other watercourses, mines and quarries in the subsoil; these are all part of the public domain.

3.1.1.2 Civil Code

Provisions: Article 522 states that anyone whose property borders on a stream of water other than a canal, may make use of it, as its flow passes, for irrigation purposes; if the water traverses a property, the owner may make any use of the water flowing therein, but with the requirement that in leaving his property, it shall be restored to its normal course.

3.1.1.3 Law of 5/24/62 enacting a revised Rural Code

Provisions: Law No. VII deals with water management and irrigation. It covers surface waters, groundwater, irrigation systems, and drainage, laying down the general principles governing these matters. Article 140 prohibits the dumping of industrial or domestic wastes into streams or irrigation canals without a permit from the Department of Agriculture in agreement with the Department of Public Health. Article 147 requires a permit from the Department of Ariculture for the tapping of groundwater for industrial or agricultural purposes. Articles 151 to 171 dealing with irrigation, assigning to the Department of Agriculture the responsibility for irrigation systems, and requires users to pay a fee.

Implementation: DARNDR (Department of Agriculture, Natural Resources and Rural Development).

3.1.1.4 Law of September 20, 1952 establishes the rules for the system of irrigation and drainage as established and controlled by the State; articles 3 and 4 establish rates and an executive order of March 17, 1953 includes a schedule of the charges made.

3.1.1.5 Decree of May 13, 1964, establishing the Central Metropolitan d'Eau Potable

Provisions: establishes the organization for water supply in the metropolitan (Port-au-Prince) area; also provides for reforestation to protect watersheds and water supplies.

Implementation: CAMEP

3.1.1.6 Law of 8/31/77 set up the Service National d'Eau Potable (SNEP)

Provisions: to control, in the national territory the use of surface and underground water, as well as the distribution, planning and supply of underground water; exempted from the provisions of the law are those regions served by CAMEP (see 3.1.1.5) and the use of water targeted for irrigation and the production of electric energy.

Implementation: SNEP

3.1.1.7 Law of June 5, 1974

Provisions: regulates the use of deep groundwater and charges Department of Agriculture, Natural Resources and Rural Development with the control of their exploitation.

Implementation: DARNDR

3.1.1.8 Decree of 4/6/72 [on marine and coastal waters]

Provisions: establishes the limits of Haitian territorial waters at twelve nautical miles, measured from the low water mark. The decree establishes that jurisdiction of the Haitian state extends over an area of three nautical miles continuous to territorial

waters for fisheries purposes; an economic zone of 200 miles is established by the Decree of 4/8/77, which also states that the State shall be competent to regulate fishing in the aforementioned areas, to assure the safety of navigation and to prevent pollution that could endanger the balance of marine environments.

- 3.1.1.8 Decree of 3/13/75 approves the Agreement on prevention of pollution of the sea immersion of wastes, as signed in Washington on 12/29/72.

[L.M. April 10, 1975] -not clear if this also implements the legislation

3.1.2 FOREST LEGISLATION

Note: water legislation generally contains provisions for reforestation of hydrological basins to protect water supplies

3.1.2.1 Law of February 3, 1926

Provisions: provides that certain portions of the national domain may be declared National Forest Reserves; this requires an executive decree by the president following by usual publicity measures; lands in National Forest Reserves are inalienable; they are administered by the Department of Agriculture and the revenues derived from these forests are collected by the Tax Administration.

Implementation: DARNDR

3.1.2.2 Law of August 20, 1955:

Provisions: various sections regulate: agricultural activities involving forest clearing in area of springs, and hydrographic basins; the felling, transport and commerce in wood; limestone burning; protected zones and reserved zones; penalties; industrial operations using wood or charcoal the development of timber industry.

3.1.2.3 Law No. VIII (Des Forets) of the Rural Code of May 16, 1962

Provisions cover: forest reserves and how they are declared;

- exploitation of forests (permits necessary from DARNDR);
- protection of forests
- prevention of forest fires;
- prohibition of free grazing in forests;
- protection of trees (names specific trees [ebony, oak, etc.] which may not be felled without a permit from the Department of Agriculture;
- Law No. XI (on rural industries) regulates charcoal production: requires a permit to establish such an operation and requires a permit for those supplying wood to such operations as well;

3.1.2.4 Decree of March 18, 1968:

Provisions: calls for reforestation of eroded areas or rehabilitation of tourist and historical sites; certain areas considered to be national parks and natural sites are declared to be of the public domain and, consequently, inalienable and not attachable (Article 2); Under this decree certain areas are declared to be national parks and natural sites (see section on Forestry).

3.1.2.5 Law of July 13, 1966

Provisions: establishes a five year plan of forest replanting

3.1.2.6 Decree of 11/20/72

Provisions: declares reforestation to be of general public interest due to the social and physical balance of the environment.

Article 6 provides that in each commune of the republic forests known as "communal forests" are to be created: all crop raising and grazing of animals are prohibited in such forests.

This law or a decree issued the same day establishes a Commission National d'Amenagement du Territorie (CONAT) for improvement of watersheds and combatting erosion.

3.1.2.7 Decree of 11/20/73

Provisions: provides for the reduction of tax on imported kerosene to preserve forestry by reducing of erosion caused by forest cutting for charcoal production

3.1.2.8 Problems with enforcement of forest legislation:

Despite the large number of laws covering forest protection, there is no tradition of public interference in the process of deforestation; on the contrary, it has been observed that rural police, whose task it is to prevent deforestation, are often involve in lucrative lumber extraction activities.

3.1.3 WILDLIFE AND HUNTING

3.1.3.1 Decree of 3/31/71

Provisions: established hunting rules and rules for the surveillance of hunting activities in order to protect nature and the wildlife of Haiti. Repeals all previous legislation. Lists protected species of birds (see Appendix B).

3.1.3.2 Law of 5/24/62 enacting a revised rural code

Provisions: Law no. IX covers hunting and fishing; permits hunting throughout the country in conformance with existing police regulations; prohibits hunting of birds during the egg-laying season; prohibits the hunting of certain specified birds not considered as game birds.

3.1.4 FISHERIES

3.1.4.1 Law of 5/24/62 enacting a revised rural code

Provisions: Law no. IX declares fishing open in the seas, lakes, ponds, rivers, and watercourses coming within the public domain; prohibits fishing during spawning season; prohibit the construction of dams to catch fish or the use of explosives in fishing.

3.1.4.2 Decree of 12/18/59

Provisions: approves the agreement on fishing and conservation of biological resources in the high seas signed at Geneva on April 29, 1958.

3.1.4.3 Decree of April 6, 1977

Provisions: establishes at 12 miles the boundaries of the territorial sea and at 200 miles the economic zone, as well as the sovereignty of the republic on the continental shelf and the air space above it; the State is made competent to regulate fishing in these areas, to assure the safety of navigation; and to prevent pollution that could endanger the balance of sea life.

3.1.5 AIR AND THE ATMOSPHERE

No legislation was found covering these areas.

3.2 NON-RENEWABLE RESOURCES

3.2.1 MINERAL RESOURCES

3.2.1.1 Constitution of 1964 as revised in 1971

Provisions: Article 22 declares that "the right of ownership is not to extend to...mines and quarries in the subsoil." Such mines and quarries are part of the public domain.

3.2.1.2 Decree of 10/10/74

Provisions: proclaims the ownership by the state of all natural resources found within the territorial limits of the country and provides regulations for their development, exploration and exploitation.

3.2.1.3 Decree of March 25, 1975

Provisions: sets up the Institut National de Ressources Minerales with responsibility for exploitation of mineral resources.

3.2.1.4 Decree of March 3, 1976

Provisions: designed to promote prospecting for mineral resources.

3.2.2 SOIL

3.2.2.1 Constitution of 1964 as revised in 1971

Provisions: Article 22 obligates landowners to cultivate, work, and protect their land, particularly against erosion.

3.2.2.2 Decree of June 16, 1977

Provisions: creates the conseil National de l'Environnement et de Lutte contre l'erosion (CONAELE), to be of a consultative nature to propose a national policy for fighting erosion, recovering and conserving the soil, and protecting the environment.

3.2.3 COASTS AND BEACHES

No legislation was found covering these areas, but see 3.1.1.8 and 3.1.1.9.

3.3 LAND USE AND AGRICULTURE

3.3.1 LAND OWNERSHIP

3.3.1.1 Law of July 26, 1927

Provisions: divides the national domain into the public domain and private domain of the state; provides for the leasing of land, etc.

3.3.2 LAND USE

3.3.2.1 Constitution of 1964 as revised in 1971

Provisions: Article 22 states that landowners have an obligation to the community to cultivate, work, and protect their land, particularly against erosion.

3.3.2.2 Law of 5/24/72

Provisions: enacts a revised rural code; contains provisions on rural property and agriculture.

3.3.2.3 Law of 8/11/75

Provisions: obligates landowners to cultivate every portion of unused or vacant land to promote the agricultural development of the country, within the framework of the government program of agricultural development. Establishes penalties.

4.0 RESOURCES

4.1 WATER RESOURCES

4.1.1 RAINFALL AND CLIMATE

4.1.1.1 General rainfall situation

Because of the mountain systems (see relief map), with elevations of up to 8,773 feet (Massif de la Selle), rainfall through the country tends to be capricious, with areas of unusually high rainfall and low evaporation as well as areas with opposite conditions. Because of Haiti's island location, humidity tends to be high throughout the country.

Rainfall usually occurs in two well-defined rainy seasons (Spring and Fall), while dry seasons occur from December through February and in the summer months, with July generally being the driest month of the year (see rainfall chart).

Hurricanes occur beginning in late July through the middle of September. Coming from the Caribbean, they produce the greatest amount of damage in southern Haiti, and in some years have been responsible for extensive devastation.

GENERAL RAINFALL SITUATION see map:

southern peninsula: well-watered; with 1524 mm (60 inches) of rain or more in all parts except the southern slope of the western end and a small area near Anse-a-Pitres in the southeast;

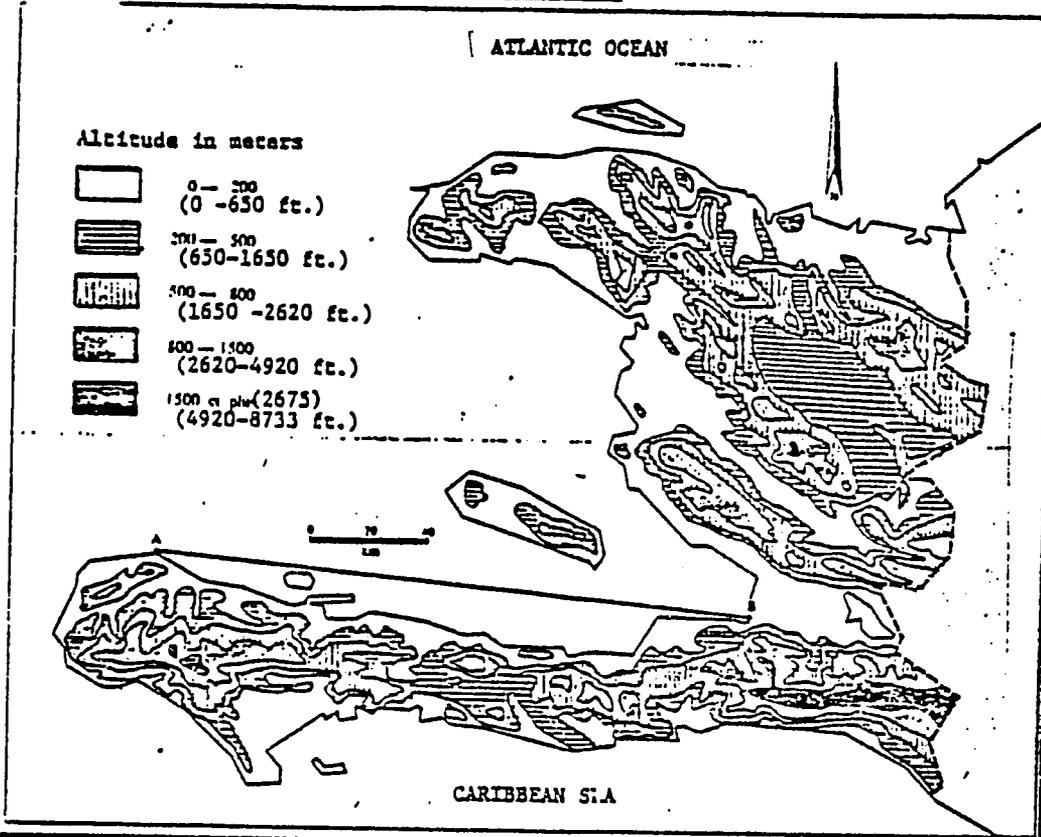
northern plain and mountains: more than 1270 mm (50 inches), with as much as 2540 mm (100 inches) on the higher mountains;

northwest: Port-de-Paix has about 1524 (50 inches) around the mountainous areas, and about 508 mm (20 inches) around Mole-St-Nicolas on the extreme western end of the northern peninsula;

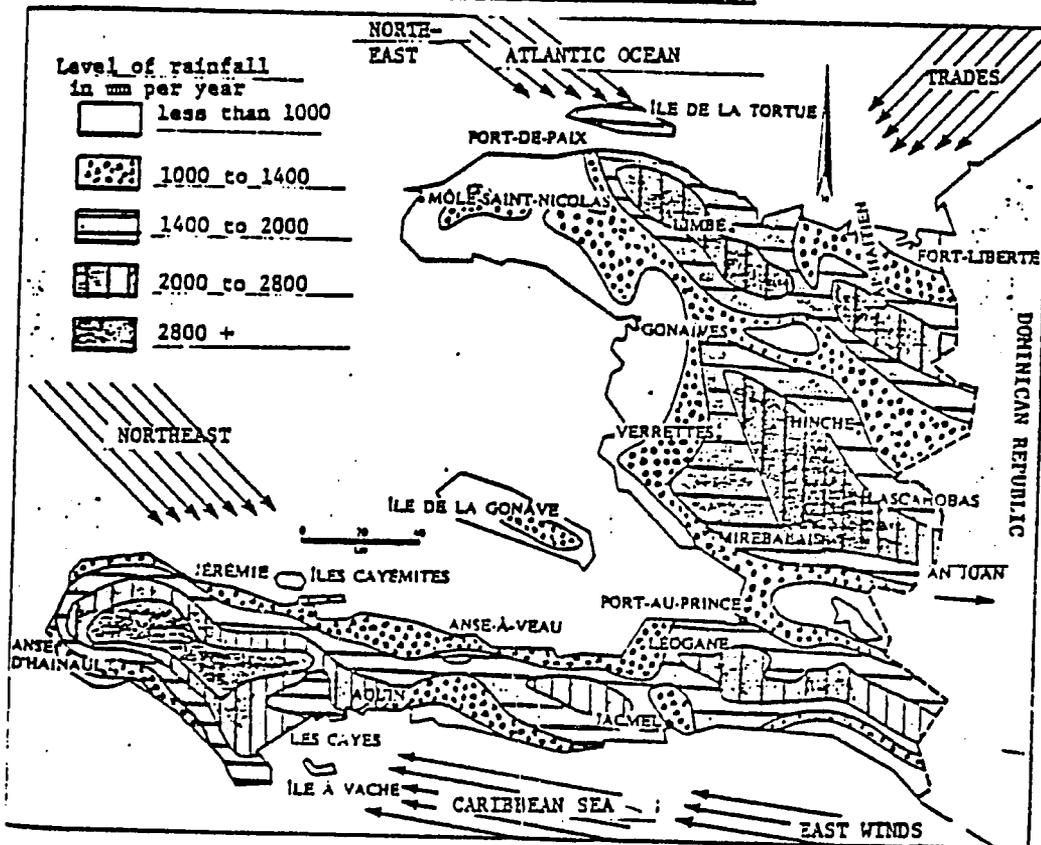
eastern part of the mainland between the two peninsulas: the Central Plateau receives about 1016 mm (40 inches) to 1524 mm (60 inches) of rainfall;

western coast from Mole-St-Nicolas to the Cul-de-Sac Plain at Port-au-Prince: very dry with 20 to 40 inches of rain; a semi-arid area extending

Relief Map of Haiti



Normal Rainfall Levels in Haiti



back from the coast over the plain (covered with xerophytic vegetation such as mesquite, thorny shrubs, and cacti) to the mountains. The island of La Gonave off the coast has similar cover and a rainfall of about 30 to 40 inches (762mm to 508 mm);

Artibonite Valley: lower portion of the valley is a semi-arid area, but rainfall increases rapidly up the valley until it reaches a mean annual level of 122 inches, the heaviest rainfall recorded at any meteorological station in Haiti; however: about 25 miles away, in the Cul-de-Sac plain, at about the same altitude, the driest area, with annual rainfall of about 20 to 30 inches is found;

4.1.1.2 Recent rainfall patterns

In recent years (1967-68, 1972, 1975, 1976-77) Haiti, as well as other Caribbean countries (Jamaica and Trinidad), has suffered from droughts which have led to food shortages, especially in northern areas. Winter and spring of 1975 were, for example, unusually dry. Because of the lack of reliable weather data for Haiti (the Environmental Data Service, for example, says that weather data for this country has not been published in recent years), the Center for Climatic and Environmental Assessment of the Environmental Data Service of the U.S. Department of Commerce has been working with the Office of U.S. Foreign Disaster Assistance (a unit of AID), to carry out satellite monitoring to follow the weather situation in Haiti. In order to facilitate the detection of relatively small-scale droughts, the Center has divided Haiti into six different regions, for which daily reports are produced.

The Center's records indicate that rainfall conditions in Haiti were normal for most of 1978; however, satellite reports for November 1978 indicate that northern Haiti, that area of the country which is the most environmentally degraded, and which has suffered most severely in recent years, had low rainfall for that month; this was a result of the failure of the weather system from the north on which this area is dependent for its normal autumn rains.

The occurrence of droughts in Haiti has been attributed at least partially to deforestation.

4.1.1.3 Rainfall and flooding

Haiti, principally as a result of deforestation, suffers from severe soil erosion. Because of deforestation, the earth in many areas is not able to hold the water dropped by heavy rainfall, which runs off barren hillsides carrying with it soil and debris. Flooding resulting from such runoff is a severe problem even in the capital city of Port-au-Prince, where runoff from the barren hills behind the city often floods the streets during heavy rainstorms, threatening people with drowning and filling the streets with mud, silt, and offal, which must be removed by shovel and handcart. Storm sewers, probably inadequate to begin with, are now totally useless; when, after a severe flood in 1954, estimates were made for replacing the system, the cost was placed at \$6,000,000, but it is believed that unless constructed concomitantly with the reforestation of the hillsides backing Port-au-Prince, such a system would not be capable of handling heavy rainfall.

4.1.2 SURFACE WATERS

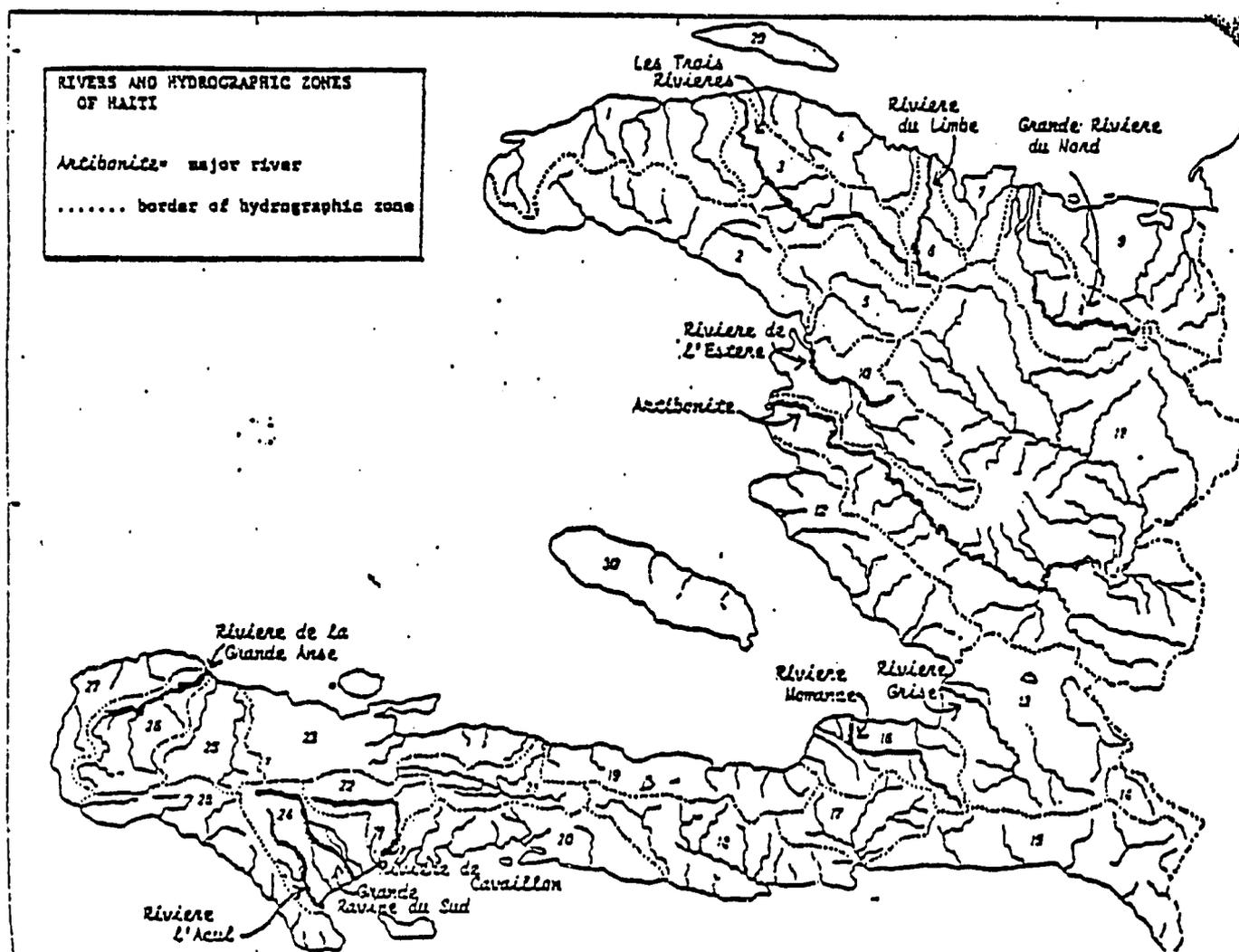
4.1.2.1 Rivers (see map)

There are over a hundred rivers flowing from Haiti's highland areas. Most of the rivers are swift running in the mountains but only intermittent in the plains, some maintaining a flow only during rainy periods. The Artibonite, the country's longest and most important river, is virtually the only one on which navigation is possible.

4.1.2.2 River utilization

4.1.2.2.1 Hydroelectric power

The hydroelectric potential of Haiti remains virtually unexplored. There are only three hydroelectric plants, with a total capacity of just under 40,000 kilowatts; the full potential has, however, been estimated at 140,000 kilowatts. Present hydroelectric plants are located at Belladere (136 kw), Jacmel (Chute de Gaillard 250 kw) and Peligre Dam. The present capacity of Peligre Dam, where hydroelectric operations began in 1971 is 47,100 kw, but because of the irregularity of the flow of water, its production does not exceed 30 megawatts.



Principal catchment areas of Haiti

Main river	Average runoff m ³ /s	Length km	Catchment area km ²
Artibonite	34.0	280	6,862 *
Rivière de la Grande-Anse	27.0	90	556
Rivière de l'Estère	19.0	?	834
Les Trois Rivières	12.0	102	897
Rivière de Cavillon	9.0	43	380
Grande Rivière du Nord	8.0	42	699
Rivière du Limbe	7.0	70	312
Rivière Momance	6.4	53	330
Grande Ravine du Sud	3.9	34	205
Grande Rivière du Cul-de-Sac	3.3	?	290
Rivière l'Acul	?	36	?

*Total catchment area within Haitian territory: about 9,500 km²

4.1.2.2.2 Irrigation

About 90% of the irrigated hectarage on Haiti is supplied by water diverted from rivers. The major irrigation operation using river water is that of the Artibonite plain, where about 24,000 hectares are irrigated, mostly for rice cultivation.

4.1.2.2.3 Domestic Water

In the interior of the country, where public water supplies systems are for the most part non-existent, rivers and streams serve as a source of water for domestic purposes. Acquin in the southern peninsula, with a 1971 population of 2,173, is the only Haitian town whose water supply system depends on river water.

4.1.2.2.4 Fisheries

Inland fishing takes place on rivers as well as on lakes ponds, and flooded rice paddies. Carp, introduced into Haiti by an Israeli technical assistance mission, is the most popular fish with Haitians. A danger to fisheries is the high alkalinity level in many rivers and lakes arising from deposits of alkaline silt brought down from eroded areas.

4.1.2.2.5 Navigation

Most Haitian Rivers are too shallow to serve as important arteries for navigations. Only the Artibonite is navigable and that only for a distance of about 100 kilometers.

4.1.3 Problems with rivers

4.1.3.1 Torrential nature of rivers

Haitian rivers tend to be torrential in nature, a tendency severely aggravated by deforestation in watershed areas, which has led to a situation in which rainfall, rather than being stored in the soil, where it could be released slowly to catchment areas, is immediately lost to rivers, often creating torrential flows. The volume of water in dry season is consequently too low in relation to the volume of water carried in the rainy season. Whereas the low level flow of the Artibonite River, for example, is 17 cubic meters per second, this flow is increased by a factor of 50.

4.1.3.2 Siltation

As a result of deforestation and the consequent soil erosion, rivers carry large loads of silt which are deposited in river beds and irrigation works. The reduction of the size of river beds and the holding capacity of irrigation works and dams is a direct consequence of such siltation. In the case of river beds the reduction of their size contributes to flooding during periods of heavy rainfall; in the case of dams and irrigation works, silt carried by rivers or by runoff from eroded hillsides clogs irrigation ditches and reduces the holding capacity of both irrigation canals and dams.

The Artibonite Dam and the irrigation systems dependent on it have suffered especially severely in this regard. This dam was originally built to collect 560 million cubic meters of water, but because of silt entering the storage reservoir (an estimated 3.5 million cubic meters per year), the dam by 1973 had a capacity of only 533 million cubic meters, a loss of 5% of its total capacity; at this rate, the dam will be completely silted up by 2076.

Siltation in the irrigation canals in the Artibonite system necessitates a gigantic weekly effort, involving about 900 Haitians, to dig out the irrigation canals by hand; this silt comes from the mountains and from the sides of the dug out canals.

4.1.2. Lakes

The largest Haitian lake is the brackish Lake Saumatre, which, located in the Cul-de-Sac close to the frontier, is the habitat of many exotic species of wildlife. There are also several smaller natural lakes, while Lake Peligre, a reservoir formed by the damming of the upper Artibonite is the focus of both irrigation and hydroelectric projects.

4.1.2.3 Springs

Springs are plentiful and almost all are utilized either for drinking water or for irrigation. Of the 14 water supply systems served by the Hydraulic Service of Haiti (the predecessor of SNEP as the body responsible for water supply in all areas but Port-au-Prince), nine received their water exclusively from springs, and one from a combination of spring and wells. The water supply of Port-au-Prince

(the responsibility of CAMEP) is derived from both springs and wells.

4.1.3. GROUNDWATER

4.1.3.1 The Resource

The full extent of groundwater resources in Haiti remains unknown. For most of the 30 hydrographic areas described by the OAS in 1972, little or no reliable information on groundwater was available, and little exploration of these resources has been conducted since that date. Studies of groundwater resources have been limited chiefly to the northwestern section of the country, the Port-au-Prince area, Acquin in the south, and the Ile de Gonave.

In many areas, features of soil and landscape have led to the the assumption that significant groundwater supplies may be present; however, it is feared that in many coastal areas groundwater may be too saline to be of value either for irrigation or for domestic use.

4.1.3.2 Utilization of Groundwater

Groundwater, predominantly for domestic use, is obtained from wells in the plains of the basin of the Grande Riviere du Nord (8),* in the Zone de Limonade-Ouwnaminthe (9), in the Zone de St. Marc-Duvalierville(12), and in the Zone de Leogane Carrefour (16). In the Cul-de-Sac area (13) wells have since 1918 been used to augment the water supply of Port-au-Prince. Water from domestic wells in Acquin (20), which yield water only during the rainy season, tends to be brackish; furthermore, the heavy soil of that area tends to limit the replenishing of the supply.

A considerable amount of the sugar cane land of the Haitian American Sugar Company is irrigated from about 50 wells (3,500 hectares).

*Numbers refer to hydrographic basins as identified by the OAS (1972) study and as shown on map on page 29a.

4.2.0 FORESTS

Although Haiti was apparently completely forested when Columbus visited the island of Hispaniola in 1492, only 7 to 9% of the country is estimated to be forested today. The Service de Conservation du Sol, des Forets et de la Protection de la Fauna in its five-year forestry plan (1976-1981) states, however, that, taking topography and climate into account, forests should occupy 55% of the land, 17 % should be grazing land, and about 28% arable land.

The Service also estimates that of the 243,000 or so hectares of forest land in Haiti, 100,000 hectares or 41.1% are State lands presently in private hands; 700 hectares or .29% are State lands controlled by the state; 200 hectares or .08% are community or municipal forests; and 142,000 hectares or 58.42% are privately controlled. The Service's long-range plans, while not foreseeing the reforestation of Haiti to the 55% level, has set its goal at 500,000 hectares or 18.52% of Haiti.

4.2.1 Types of Forests

NOTE: Because of the ravages of deforestation, forests do not actually exist in the abundance or variety as implied in the descriptions below, which apply more precisely to the natural vegetation of the various areas.

4.2.1.1 mangrove swamps: -along the north east and along the coastline in The Bay of Gonive and generally in all coastal areas where tidal mud flats are formed; about 20,000 hectares of such mangrove forest was estimated to remain as of 1975;

Rhizophora mangle
Laguncularia racemosa
Avicennia nitida
Conocarpus erecta

utilized: - fuelwood;
 - as source of tannin consumed locally for curing leather and for treating fishnets and lines;
 - mangroves have been important breeding grounds for fish and wildlife.

4.4.1.2 Deciduous forests

An estimated 130,000 hectares of deciduous forests are estimated to occupy the semi-arid and dry zones of Haiti; this forest type is most frequently exploited for firewood and charcoal, while

hardwoods of this zone (mahogany, etc.)are used for cabinet making and lumber; moist forests, on the other hand, growing around and among the pines of the Mornes des Commissaires, the Massif de la Selle, and the Pic de Macaya cover about 20,000 hectares.

4.4.1.2.1 semi-arid regions

Forest growth in these areas consists of mesquite (Prosopis juliflora); yucca (Yucca aloifolia) and thorny shrubs and cactus, the last of which stand out as the dominant vegetation; Prosopis juliaflora, the species with the greatest reproduction potential has been used mainly for firewood.

Some trees common both to semi-arid and dry forest regions are: Caiba pentandra, Elaphrium simasruba, Bombax ellipcitum, Metopium brownei, Cercidium praecox, Guaicum officinale (lignum vitae), Phyllostylon brasiliensis, Harrisia divaricatus, Acacia scleroxyla, and Acacia farnesiana, and many other Leguminosae.

The exact nature of the forest growth is dependent on available moisture as conditioned by soil texture and topography.

4.2.1.2.2 dry forest (areas with rainfall between 30 and 70" per year)

Many of the dry-forest species, found mainly in lowland regions, were so heavily exploited because of the commercial importance that they are few species left in any great number.

Species include: Guaicum officinale and G. sanctum (lignum vitae), Acacia scleroxyla, Phyllostylon brasiliensis, Lysiloma latisilqua, Swietenia mahogonia (mahogany), Cordia alliodor, Krugiodendrum ferrea, Colubrina ferruginea, Petitia domingensis, and Haematoyxlon campechianum (logwood).

4.2.1.2.3 moist forest (areas greater than 70" of rainfall per year)

Because rainfall tends to be less in lower elevations, moist forests tend to occur in higher elevations. In 1975, the Haitian government estimated that about 20,000 hectares of deciduous humid forest remained.

Trees at lower elevations: Cecropia peltata, Manilkara mitida, Tetragastris balsamifera, Didymopanax morototoni, Guerea trichniloides, Genipa americana;

Trees at higher elevations: mountain hardwoods: Didymopanax tremulans; Brunellia comocladifolia; Prunus occidentalis;

Dendropanax arborea; Sloaniea illicifolia; Weinmania pennata; Maytenus domingensis; Coccolobis neurophylla; Laplacea alpestris; and several species of Lauracea.

4.2.1.3 pine forest

The forests of Pinus occidentalis are found mainly in the higher mountain ranges of Haiti; ideally its range is from 300 feet above sea level on the northern coastal plain to 8,773 feet in the Massif de la Selle ranges. For the most part, hardwood forests grow around the pine forests and in patches within them as well. It is only in the higher levels of the Massif de la Selle that pine forests and their undergrowth occur in any abundance.

About 73,000 hectares of coniferous forest was estimated to remain in 1975; about 5 to 6,000 hectares of this was being utilized at that time, while about 30,000 was said to be too inaccessible for exploitation.

4.2.2 Utilization of forest resource and deforestation

USE OF WOOD	in 1,000 m ³				
	1965	1970	1971	1972	1973
Wood cut (total)	3,450	3,802	3,899	3,989	3,989
type					
Pines,	345	375	385	390	390
Decid.	3,105	3,427	3,514	3,599	3,599
by use:					
Firewood	3,210	3,570	3,660	3,750	3,750
Pines,	250	275	285	290	290
Decid	2,960	3,295	3,375	3,460	3,460
Economic	240	232	239	239	239
Pines,	95	100	100	100	100
Decid.	145	132	139	139	139

4.2.2.1 Firewood and charcoal

As the above table indicates firewood and charcoal account for about 90% of the wood utilized in Haiti today. Charcoal production remains an important small business venture, providing income for thousands of peasants, many of whom, according to a United Nations report, survive only because of this activity. This industry, and the gathering of wood for domestic fuel, if they continue as the current rate without an increase in the amount of wood available and without the appearance of a viable alternative energy source, will not be able to satisfy the charcoal demand for more than ten more years. Fuel wood is also used commercially to fire lime kilns and bakeries and other small commercial operations. Most boiling houses for cane juice production, as reported by Street (1960) also employ wood as a fuel.

4.2.2.2 Other uses of wood

Wood is also used for construction, for poles, and for the construction of furniture. The manufacture of handicrafts for sale to tourists also utilizes wood. Turpentine is produced from Haitian pine.

4.2.2.3 Lumber industry

The forest industry, once important in Haiti, has declined because of excessive cutting of lumber. Once an exporter of mahogany, Haiti in 1944 prohibited all exports of mahogany lumber, while continuing to permit exports of handicrafts and other items made from this wood. Some lignum vitae (*Guaiacum*) logs are exported, but most are used domestically. Apart from pine, present-day commercial woods, taken only in small amounts, are lignum vitae, mahogany, tavernon, bois de chene (*Catalpa longissima*), and gommier (*Bursera Simaruba*).

4.2.2.4 Other causes of deforestation

Apart from the felling of trees for use as fuel or lumber, deforestation is also caused by the clearing of land for slash and burn farming, a common practice in Haiti. Furthermore, domestic animals, especially goats, which eat branches off trees and tear away at the roots of seedling trees, account for a certain amount of deforestation by discouraging the growth of new forest cover.

4.2.2.5 Deforestation in the colonial era

Heavy demands were placed on Haiti's forests during the period of French rule which ended in 1804. Wood, especially mahogany lignum vitae, and logwood were exported from Haiti throughout the colonial era, most of the exports coming from the valley of the Artibonite. On the southern peninsula great quantities of wood were used in sugar boiling houses and in the manufacture of rum, bricks, tiles, pottery, and lime. So heavy were the demands of the various sugar-related operations on the forests on the plains that plantation owners brought in wood from upland areas of their lands. By the late 18th century the plains areas of the southern peninsula had been so stripped of their forests that wood for construction purposes was brought in from other parts of the colony or imported from the United States.

The revolution which brought an end to French rule in the early 19th century also resulted in devastation of forest lands, when slaves burnt large tracts of woodland.

4.2.2.6 Results of deforestation

Deforestation, which may be said to have as its root cause the growing population of Haiti with its increasing claim on a limited resource, is one of the most basic environmental problems in Haiti and is intimately linked with Haiti's overwhelming problem: soil erosion.

Deforestation exacerbates the soil erosion problem; it accounts for problems with the hydrological cycle and may be behind some of Haiti's localized drought, not by preventing rainfall but rather by allowing rivers to run dry because insufficient water is stored in the soil to supply water to increase the flow of rivers during the dry season. Siltation of streams and irrigation systems is also ultimately traceable to deforestation.

4.2.2.7 Road construction and deforestation

Road construction, an important item in a country whose internal communication system is so poor that many areas are virtually inaccessible during rainy season because of flooded roads, is presently the top priority in Haitian development plans, accounting for about 30% of the development outlined for 1977-78. Concern has, however, been expressed that the penetration roads currently being cut into

*at the rate of five hectares per year for ten years;

watershed areas, for example in Acul in the northwestern part of the country, will result in an increase of lumbering off state lands unless steps are taken to the contrary. Furthermore, road building along the coast has resulted in the destruction of mangroves with detrimental consequences for the fishing industry. It is feared that road now being built into the last forests of Haiti will simply bring with them loggers and results in further deforestation.

4.2.3 Moves against deforestation

The Haitian government has in recent years shown an awareness of the extent and implications of deforestation in Haiti. Laws prohibiting the export of timber, requiring peasants to plant new trees to replace cut ones, and directing local governments to plant communal forests in eroded mountain areas (1972) have been passed. The importance of the important role of forests in the hydrological cycle in Haiti is recognized in the introductory paragraphs of Haitian laws dealing with water supply, and forest reserves have been established around several important watershed areas.

The export of mahogany has been prohibited since 1944, and the same law also requires that for every mahogany tree cut, ten seedlings must be planted; government nurseries distribute mahogany seedlings for this purpose.

Forest reserves were created as early as 1937, when a National Forest Reserve in the pine forests of the Massif de la Selle was declared; this area was subsequently logged by a joint Haitian-American corporation until 1953, when management of the forest was turned over to the Department of Agriculture.

Other suggestions for reforestation include the creation of plantations to provide firewood. It has been recommended, for example, that fast-growing species such as *Leucaena*, which has proved quite successful in the Philippines, could be used to provide firewood as well as to provide erosion control, soil enrichment and a limited amount of food. Limiting of grazing would also aid in the natural regeneration of forests, as would better enforcement of existing legislation. Also suggested are the development of energy alternatives to wood and charcoal, and perhaps, in this connection the lowering of the taxes which make the presently most viable alternative—kerosene—prohibitively expensive for most Haitians. Reforestation must, above all, emphasize the high slopes if soil erosion is to be limited.

4.2.4 Obstacles to reforestation

Because almost all acreage on Haiti is cultivated, reforestation programs entail convincing subsistence farmers to remove land --their source of food--from cultivation while trees are planted or terraces constructed. Reforestation, which has few short term benefits for farmers, would mean reduction in land available both food production and grazing. Furthermore, reforestation efforts on high slopes may be of more immediate benefit not to the farmers whose land is being taken out of production but rather to farmers on the plains who will benefit from a reduction in soil loss from flooding which tree planting and terrace construction could help to prevent. It has also been observed that Haitian farmers tend to view the erosion which reforestation could help to control as an inevitability, as an act of God.

There is, furthermore, little hope that local police will interfere with deforestation activities of peasants; such police, themselves cultivators who serve relatively short terms as officers of the law, can only share both the incentive of fellow cultivators to clear the land for cropping and their aversion to planting trees or building complicated walls and terraces for erosion control.

Land ownership patterns are also frequently cited as a deterrent to successful reforestation-soil erosion programs. The reported inability of farmers to prove their ownership of the land they work and problems involving complicated tenancy relationships reportedly discourages them from involvement in long range efforts to improve land which may then only be taken away from them. There are also difficulties in getting farmers to perform the cooperative type of efforts necessitated for terrace construction for soil erosion control, although the experiences of the Foi et Developpement Project (see 2.2.3) seem to indicate that such cooperation is indeed possible. It has been suggested that both terrace construction and the maintenance of irrigation works could be facilitated by using cash incentives for workers.

4.2.5 Government plan for forestry

The Second Development Plan, covering October 1976 to September 1971, states several major goals for forests within the period covered by the plan:

1. To search for alternative energy sources capable of replacing the growing demand for fuel which at present accounts for 95% of the total consumption of wood;

2. To create a forest estate in Haiti, not only to supply wood and other natural riches, but also for the beneficial effects that forests have on the soil, water and climate, on which agriculture depends;
3. To develop in the public an awareness of the importance of forests, by all means possible. To inform both executives and politicians, as well as to teach the public and train the technicians of the ways and means of diminishing the pressure of the population on the forest as a source of energy.

In December 1977, the Service of Soil, Forests and Wildlife issued its plan for the reforestation of 200 hectares in the interior of the Peligre Basin; the project, scheduled to begin in 1978 and to be completed in December 1979, the plan calls for the reforestation of 150 hectares of state land and 50 hectares of private land as a total cost of 964,117 gourdes (about

4.2.2.11 Forest Reserves

Various forest reserves have been set aside by laws such as the Decree of March 18, 1968, which establishes the following reserves:

- a minimum area of 10 hectares surrounding the Source Puantes (Hot Sulphur Springs) at Port-au-Prince;
- a minimum area of 20 hectares surrounding the Hot Springs at Anse Rouge;
- A minimum area of 5 hectares surrounding Fort Mccredi at Port-au-Prince;
- a minimum area of 25 hectares surrounding the citadel at Milot;
- a land area surrounding Peligre Lake at Mirebalais, reaching back 200 meters from the shore.

4.3 SOIL RESOURCES

For the most part Haiti is underlain by limestone, imparting to Haitian soils in general a calcareous, alkaline character.

- 4.3.1 Major soil types (see soil map, adapted from Anglade as adapted from Haspil and Butterlin. 1955. Les principaux types des sols de la republique d'Haiti et leur repartition geographic)

Red soils of the hills: Very frequent in Haiti, these soils are suitable for cultivation of coffee and legumes
 - principal problems:
 -erosion, as a consequence of the deforestation of the hillsides
 -these soils have become practically unsuitable for agriculture because of erosion and their agricultural possibilities are limited to the development of orchards and of forest;

Black hill soils: These soils cover a large extent of the high mountains (massifs) of Haiti.
 -Less suitable for coffee than red soils, their agricultural possibilities have been reduced as much as those of the red soils.

Saline littoral soils:

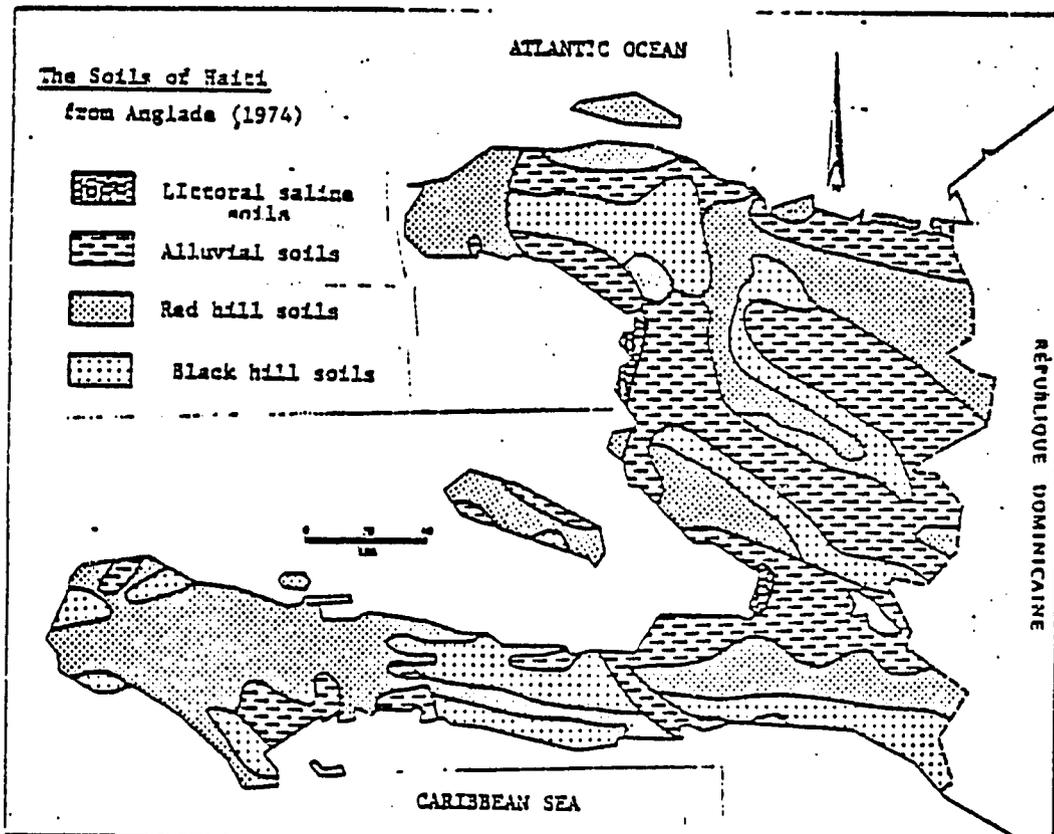
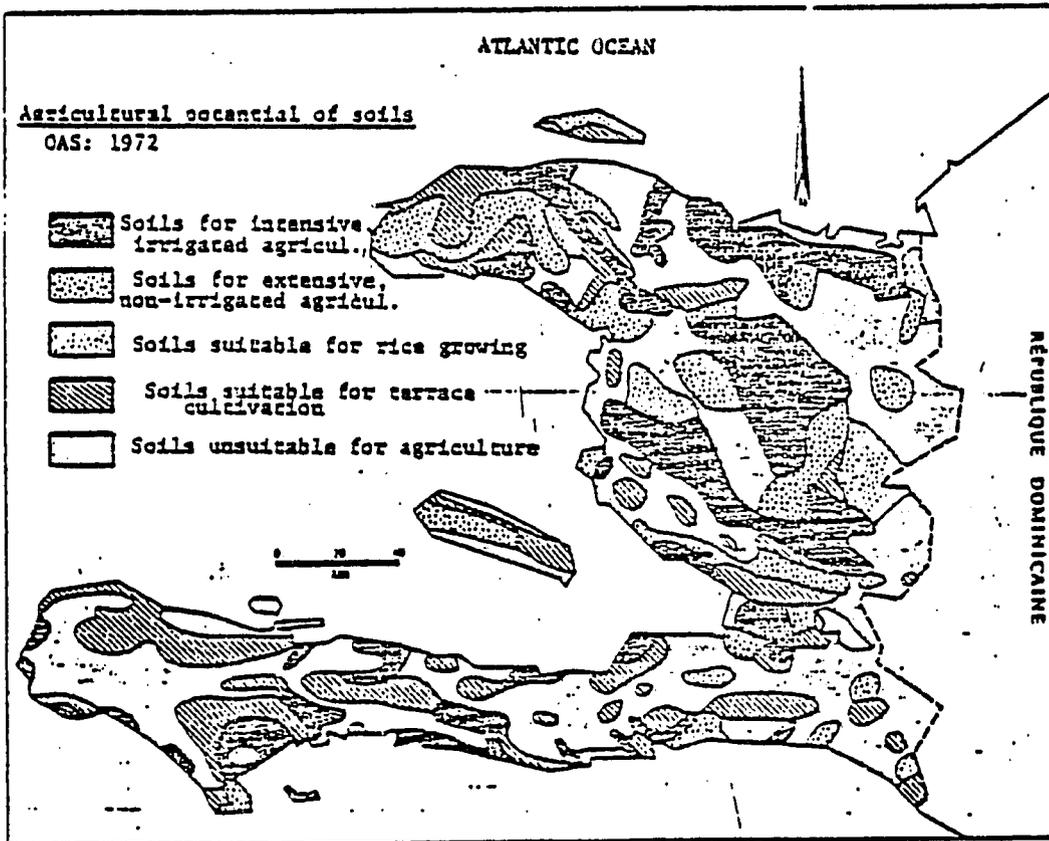
Saline soils are black or white depending on the humidity of the soil and the abundance of rains.

- (1) white saline soils: in dry poorly drained areas, such as the dry triangle;

The plant most suited to these soils is cotton; the region of Gonaives is the most important cotton producing area, as it has been since colonial times;

- (2) black saline soils: : occur in more humid zones than the black soils; their extent is limited in Haiti

Alluvial soils: Formed by deposits of pebbles, gravel, sand and mud carried by rivers and rainwater cutting through the slopes, the exact composition of these soils depends on the nature of the soils which they have washed away;



-occur in all the Haitian plains and in all the valleys of the central plateau; they are poor but their fertility depends of rainfall and on irrigation; once they are irrigated their agricultural possibilities become very great: they are used for growing bananas, sugar cane and legumes;

-alluvial zones closest to the shorelines are poorly drained and often inundated by the rivers in flood, as required for rice cultivation; the lowlands of the Artibonite and the valley of Estere are the largest rice-producing areas.

4.3.2 Potential of soils

Soils map no. 2 shows the potential of Haitian soils as reported by the Organization of American States study in 1972.

There are five basic breakdowns:

- soils suitable for intensive cultivations and irrigation
- soils suitable for extensive agriculture but non-irrigable
- soils appropriate for rice cultivation
- soils appropriate for terraced cultivation
- non-agricultural soils: suitable for forests and national parks.

4.3.3 Soil problems

4.3.3.1 Soil erosion

Soil erosion resulting from clearing of land from agriculture, deforestation of hill areas, and slash and burn agriculture is Haiti's major environmental problem. Since many of Haiti's farmer's work land on slopes (slopes sometimes so steep that it has been said that a farmer might fall from his corn field to his death), soil is especially susceptible to erosion. Where the soil cover is particularly shallow, the nutrient level is quickly washed away, often leaving a deep layer of less productive soil, which continues to be washed away by heavy rains. In many areas only remnants of the natural topsoil remain.

The consequences of soil erosion are many:

-siltation of dams and irrigation works:

-The Peligre Dam is severly silted and great loads of

silts are added to it each year as rainfall on the eroded, treeless hillsides washes away the soil; such siltation reduces the hydroelectric potential of the dam; irrigation systems also become clogged with silt, and many have been rendered virtually inoperable;

-damage to fisheries:

-the high alkalinity of the sediment transported from the calcareous soils of the limestone hillsides of has resulted in alkaline waters in lakes, ponds, and rivers, often creating intolerably high levels of alkalinity for fish life.

4.3.3.2 Practices harmful to soil

In Haiti, gardens are cleared at the end of the dry season (in March), brushwood is spread out on the land; during the first half of April the fields are burnt so that the ashes may enrich the soils. Such slash and burn agriculture, practiced on Haiti for two centuries, is ultimately harmful to soil fertility, especially when lack of land leads farmers to shorten fallow periods.

4.3.3.3 Other problems with soil

waterlogging and salinity: Researchers with the Food and Agricultural Organization of the United Nations have also identified waterlogging and salinity as a serious problem, especially in northwestern Haiti, a region suffering from drought and famine in the mid-1970's. As salt accumulates on the fields there, the cultivation of important food crops like peanuts and beans is impaired and then abandoned. More salt-resistant crops like cotton are substituted and their yields, too, begin falling; eventually the land is given over to cactus and thorny brush. Leaching and drainage could reverse this catastrophic trend, report the FAO analysts; a program was said to be underway as of mid-1975.

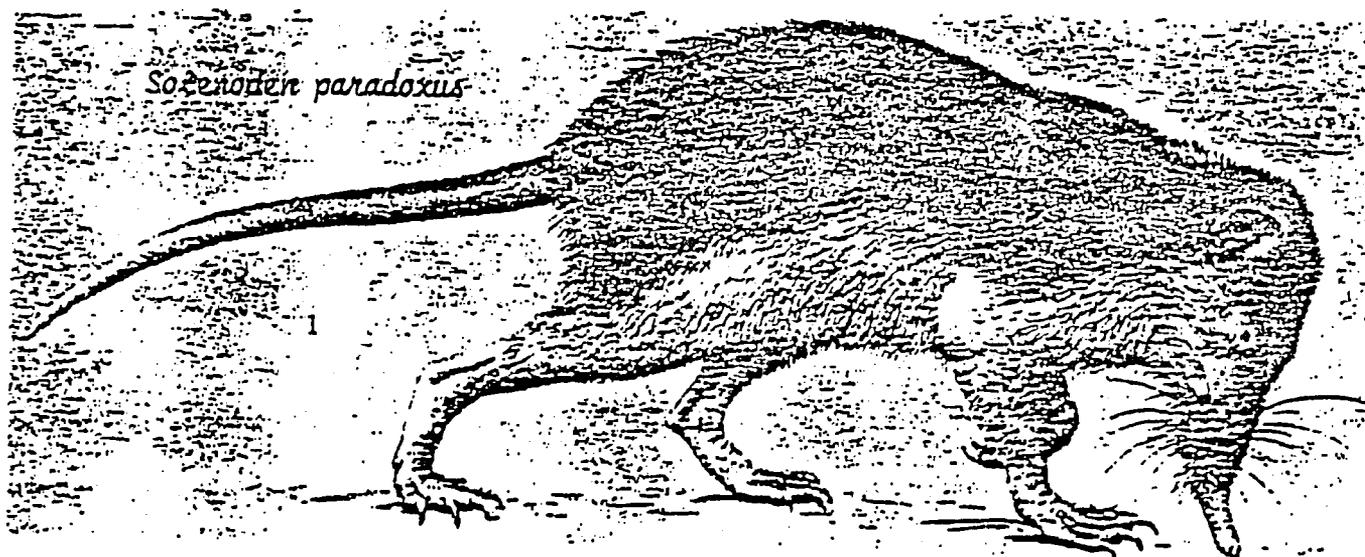
4.4 WILDLIFE

Apart from two species of insectivorous animals (see below) Haiti has no indigenous mammals. However, there are several species of reptiles, including three varieties of crocodile, the rhino-horned iguana, many small lizards, and several species of non-poisonous snakes. The more interesting insects include poisonous spiders, scorpions, and centipedes. Bird life includes parrots, four kinds of wild pigeon, guinea hens, ducks, weaverbirds; egrets, and flamingoes (in the brackish lakes of the Cul-de-Sac region around Port-au-Prince); the most unique and interesting birds are found in the few remaining high forests in the western section of the southern peninsula. Wildlife continues to be threatened by loss of habitat through the rampant deforestation of the country.

4.4.1 Endangered Species

Two insectivorous mammals native to Haiti are in danger of becoming extinct.

Solenodon paradoxus: This indigenous mammal is in imminent danger of extinction because of loss of habitat through the removal of forest cover resulting from human activities as well as from the devastating hurricanes of the 1950's and 1960's. It has recently been estimated that less than 100 individuals presently survive in the most remote mountain areas between Morne Mansinte and Catiche in the western portion of the Southern Peninsula.



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Plagiodontia aedium: Locally called zagouti, this mammal, which resembles the Solenodon without the funnel-like snout, is in danger of extinction in most areas of Haiti. Some individuals survive in rocky ravines at elevations above 600 meters in the mountains between Miragoane and Baraderes (southern peninsula). The zagouti is more common west of Pic Macaya in the southern peninsula, where breeding populations still survive on isolated mountainsides and in ravines. It has been estimated that without protection and assistance the zagouti will not survive for more than a decade.

4.4.2 National parks and reserves

There are presently no national parks or reserves in Haiti. Recently recommendations for possible locations of such reserves have been made. A particularly favorable location would be in the southern peninsula in La Hotte region, the most biogeographically isolated part of Haiti, where Plagiodontia still survives and many exotic species of birds and plants are to be found.

4.4.3 Legal protection of wildlife

The Hunting Law of 1971 lists several protected species of birds. These species are listed in Appendix B.

4.5. MINERALS

4.5.1 The Resource

Haiti's mineral resources, nationalized by law in 1974, are said to be quite abundant, and include gold, silver, copper, platinum, nickel, manganese, iron, lignite, and bauxite. With the exception of copper and bauxite, however, the capital necessary for their exploitation has not been forthcoming; lack of the energy necessary for mineral exploitation has also hindered the development of mineral resources. Efforts to find oil have not been successful.

Copper-mining operations, carried out in the early 1960's, have stopped, but new finds, the exact extent of which has not yet been determined, have been made in the northern part of the country and may soon be exploited.

Bauxite-mining has been carried out on the Rochelois Plain on the southern peninsula since the late 1950's; the deposits, with an aluminum content of from 48 to 52%, are estimated at 12 million tons; 624,000 long tons of bauxite were extracted in 1975/76.

Sand for use in local construction is extracted from quarries, rocks and gravel.

Salt is extracted from seawater at many locations along the Haitian coast.

4.5.2 Environmental effects of mining operations

Details on pollution caused by mining operations could not be found; however, a program for the restoration of the Rochelois Plateau, the scene of bauxite operations (see 2.1.3), would indicate that strip-mining operations have caused some destruction to the environment in that area.

5.0 THE ECONOMY OF HAITI

5.1 GENERAL ECONOMIC PICTURE

GNP: \$960 million [1976]

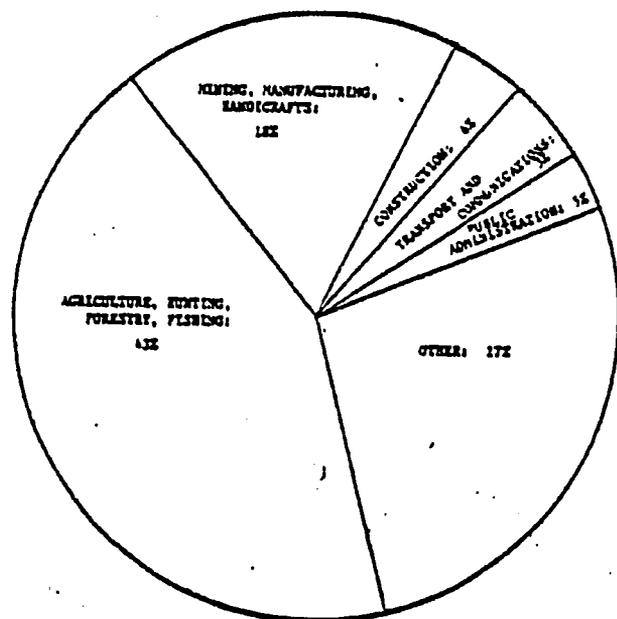
Per capita share of GNP: \$200*

Per capita income: about \$80 per year; industrial wages reported to be about \$1.30 per day

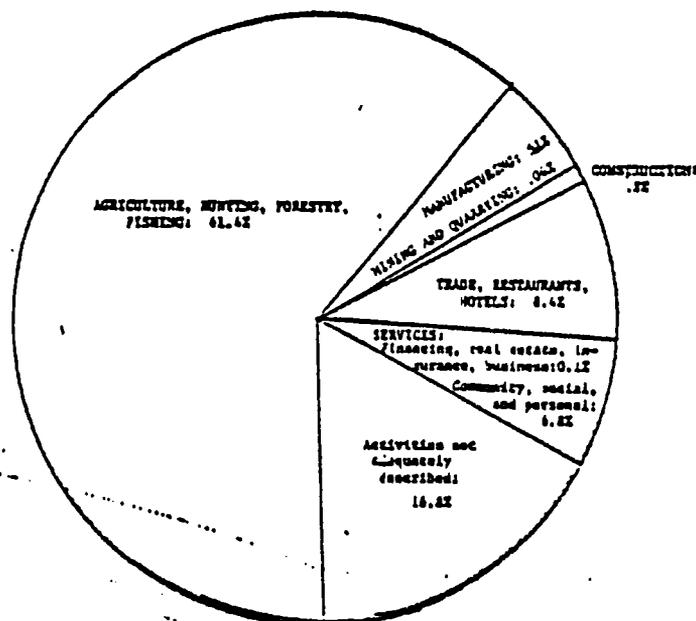
Real Growth Rate[1976]: 4.7%

Monetary Conversion Rate: 5 gourdes = US\$1

GROSS NATIONAL PRODUCT BY SECTOR (1974)

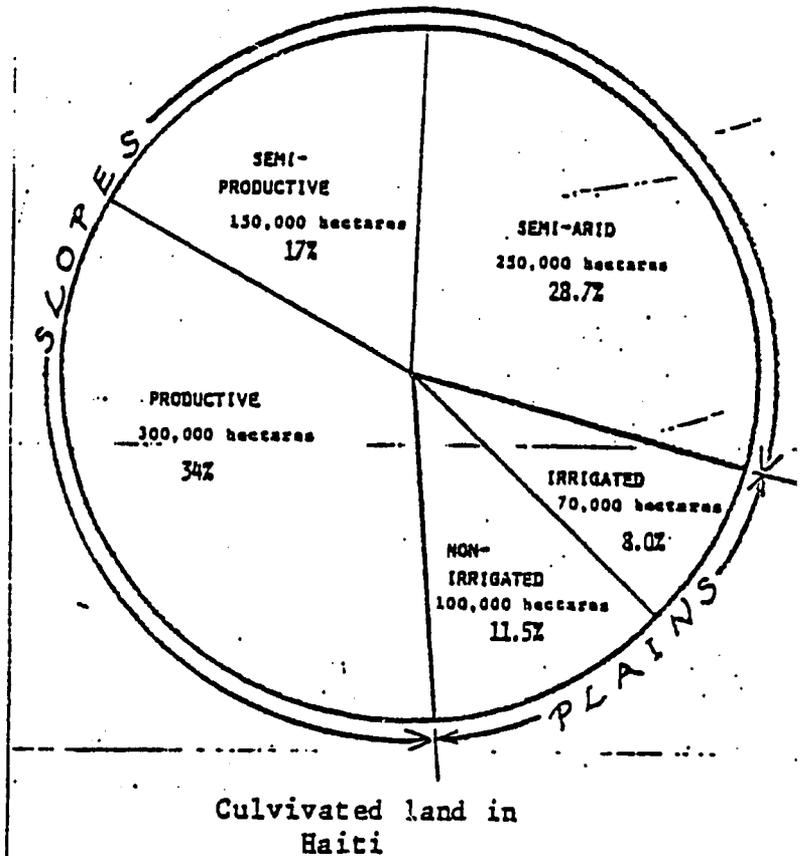
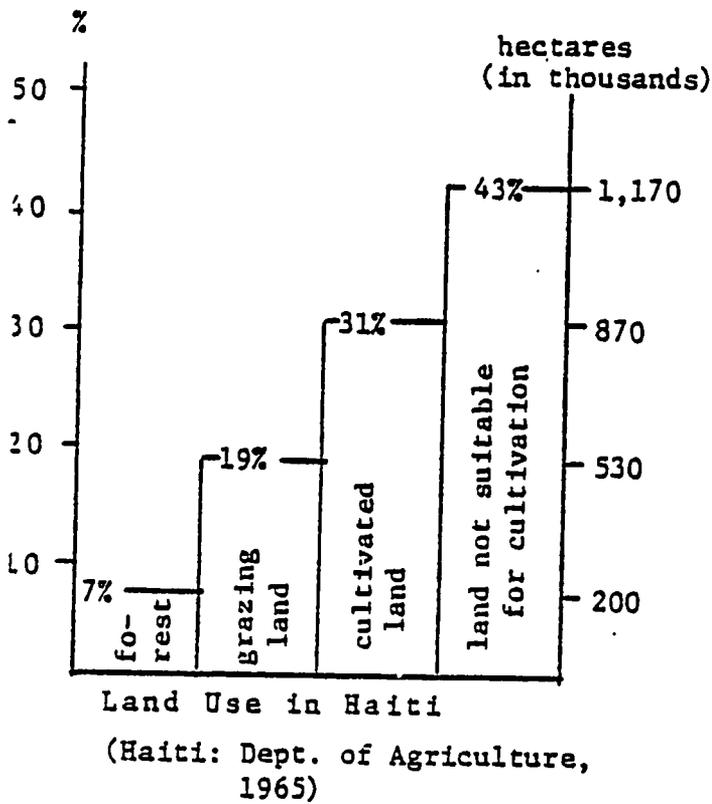


EMPLOYMENT IN HAITI (1971)**



*1976, based on population figure of 4.8 million

**based on the 1971 census, which reported a total work force of 2,326,201 persons, 47.2% of which was female; the previous (1950) census differs considerably in reporting an agricultural work force of amounting to 85.7% of the total number of workers.



5.2 Agriculture

About 32% of the total area of Haiti is cropland, 60% of which is on steep slopes. An estimated 44% of the land is idle or unproductive because of the mountainous nature of the country. Population pressures have pushed peasants on to land on steep slopes, where soils is poor and the deforestation accompanying the clearing of the land has resulted in serious soil erosion.

At the time of independence, the large specialized colonial holding dedicated to export agriculture were transformed into a multitude of small parcels for subsistence farming; these holdings were further split up by inheritance practices. Today 2/3 of the peasants (Or 71% of the holdings) work plots no larger than one carreau (1.29 hectares) 1.3 hectares. Cultivated land is divided into over 560,000 farms, about 70% of which are worked by the owners.

Because heavy taxes have tended to discourage the production of export crops, there has been a shift to to staples such as corn, beans, and manioc, grown not, however, for

on farm consumption but rather as cash crops for sale in urban areas such as Port-au-Prince.

Agriculture generally suffers from antiquated farming methods in which crop rotation is rare; fertilizer is only rarely used because it is too expensive; the fertility of already poor soils is strained by erosion and overcropping; agricultural implements are limited to machetes and hoes; and irrigation systems, often dating back to the colonial period, are frequently inoperable because they are silted up or in disrepair.

Uncertainty of tenure system is often cited as a reason for difficulties in getting farmers to improve their land.

5.2.1 Export crops:

Coffee, essential oils, sisal, sugar and molasses, which in 1973-74 accounted for 53.3 % of the total value of exports.

Coffee: cultivated between 900 and 5,000 feet on mountain slopes, predominantly in the southern peninsula. Coffee is often grown on small holdings in combination with food crops. An estimated 100,000 to 140,000 hectares are under coffee production; these are worked by approximately 160,000 small coffee growers; even those coffee holdings considered most important (about 10% of the total) are no larger than 6 hectares each.

Although Haitian soil is suitable for coffee production, and climatic conditions are suitable, coffee growing suffers, as do other Haitian crops, from soils impoverished by erosion and lack of fertilizer and from the absence of land planning; coffee production also suffers from the cultivation of old unproductive varieties (Arabica typica), overly close plantings, and poor agricultural methods. Bad weather is another important factor: in 1963-63, cyclones destroyed 75 million plants;

production: 33,000 tons in 1974; down from 37,000 tons in 1961-65; no greater than 230 kg per hectare; many of the growers do not produce more than 4 60 kilogram sacks per year; only about 9 % of the 1973/74 production was cleaned coffee.

Sugar cane: grown on four plantations and by hundreds of small growers, mostly on the plains. Sugar cane production has declined since the colonial era, when it was Haiti's most important product.

production: 3,580,000 tons in 1974; 477 quintals per hectare;

processing: sugar cane is processed in local plants.

Sisal: grown on poor soil in arid areas; production, which had decreased because of a drop in world market demand, may increase because of extensive use of sisal in export-oriented handicrafts;

production: 19,000 tons in 1974; up from 14,000 in 1972 but down from 26,000 in 1961-65;

Cocoa: plants grow amid other plants or bushes; because of poor bean processing, is little respected on the world market; cocoa sales were down to 46 tons in 1971-1972;

production: 3,500 tons in 1974;

Cotton: a promising crops, has been ravaged by the mexican weevil;

production: 1,000 tons of ginned cotton in 1974; production has remained constant since the 1960's.

Oil plants (vetiver, lemon grass, neroli, etc.): grown on small farms in the vicinity of processing plants;

production: 3.3 million dollars of essential oils were exported in 1971-72.

5.2.2. Subsistence agriculture

Food crops:

corn: occupying the largest acreage, corn is grown wherever rainfall is sufficient;
250,000 tons produced in 1974; down 10,000 tons from 1973; 7.8 quintals per hectare;

sorghum: grown where conditions are too dry for corn;
219,000 tons grown in 1974, up 3 tons from 1973 and 34,000 tons from 1961-1965;
7.8 quintals per hectare;

rice: grown in Artibonite and small irrigated areas in the south; although it is the preferred cereal in urban areas; 200,000 tons produced in 1974 (up 20,000 tons from 1973), and up 136,000 tons from 1961-65;
35.1 quintals per hectare;

legumes: red kidney beans are produced in irrigated areas on plains; production tends to be localized in the vicinity of towns, the most important locations are the Artibonite plain and Kenscoff Hill; pigeon peas are grown on drier and steeper slopes; 43,000 tons of dried beans were produced in 1974, the same as in 1972-73; dans l'Artibonite une use fabrique de la 360,000 lbs in 1974;

root crops: grown throughout the country:
potatoes (7,000 tons in 1974); sweet potatoes (91,000 tons in 1974); yams (24,000 tons in 1974); and manioc (137,000 tons in 1974);

fruit: oranges, bananas, chadeques (a hybrid of a grapefruit and an orange), pineapples, and mangoes. Fruit preserving plants had existed but have closed. Until 1945, when they were struck by the "mal de panama," bananas were a Haitian export.

5.2.3 Irrigated agriculture

Although irrigated agriculture has been common in Haiti since colonial times, only a small percent of present-day Haitian agriculture is practiced under irrigation (about 8%). Many of the existing irrigation systems are either in disrepair or are so badly silted up as to be useless. Rice, the major irrigated crop is grown on the Artibonite Plain; beans and other legumes are also grown under irrigation in plains areas.

5.2.4 Use of fertilizers and pesticides in agriculture

Because most Haitian peasants are too poor to employ them (or perhaps unaware of their existence), Haitian agriculture does not employ extensively either fertilizers or pesticides, although imports of both products have been increasing.

	<u>Imports of pesticides and fertilizers (in tons)</u>		
	1972	1973	1974
fertilizers	1,324	2,756	3,398
pesticides	117	170	180

5.2.5 Detrimental agricultural practices

Agricultural practices detrimental to soil include: slash and burn agriculture, the farming of steep slopes, and the clearing of forest land for farming. A recent report (Woods and Rosen, 1977) indicates that there are few mountains on which peasant gardens had not spread to the highest elevations. Indications were that without some effort to preserve certain areas, even the last remaining forest on the heights would fall to farmers and charcoal burners. The harvesting of vetivier, which necessitates pulling the plant out by its roots, carrying soil along with it, is conducive to soil erosion.

5.3 Animal husbandry

Livestock production is not highly developed in Haiti; the most suitable area of Haiti for livestock grazing is the central plateau in the region around Hinche; development would, however, require substantial investments, roads to make this part of the country more accessible, and the organization of markets. Presently animal products are consumed by growers or processed and exported by the Haitian American Meat and Produce Company, principally to Puerto Rico. Meat exports in 1974 were valued at 1.1 million dollars.

Livestock (1976) and food and skins production (1976) (FAO Estimates)

	Livestock (in thousands)	Livestock products (in metric tons)				
		<u>meat</u>	<u>milk</u>	<u>cheese</u>	<u>eggs</u>	<u>hides</u>
Horses	387	4				
Mules	84					
Asses	235					
Goats	1,384	4	25			
Cattle	747	19	41	1.5		
Pigs	1,771	24				2.3
Sheep	81					
Chickens	3,410				8.0	
Ducks	114	3				
Turkeys	46					

Although not reflected in these figures, goat skins are used for handicraft production.

5.2.3.2 Utilization of domestic animals

Apart from their value as food sources, animals are also used for work (supplying the power for sugar mills, for example) and as means of transport.

5.2.3.3 Environmental degradation from domestic animals:

The grazing practices of goats, which frequently involve tearing out plants, including young trees, by their roots, are often cited as a major cause of deforestation and soil loss in Haiti.

5.3 Industrial production

The Haitian industrial sector is still in the developmental stages, accounting, along with mining for only about 18% of the GNP and employing just slightly more than 5% of Haitian workers in 1971. There are only a few industrial plants, among which handicraft and small manufacturing operation predominate. Industry is based above all on the processing of Haitian agricultural products, especially sugar and coffee. A recent upsurge in Haitian industrial production has resulted from the operations involving labor-intensive assembly of items such as baseballs and electronic goods, the parts for which are brought in from other countries, particularly the United States.

There are a limited number of larger industrial plants: two textile plants, three sugar factories, one cement plant, one fertilizer plant, one plastics plant, one foundry, one chemical plant producing both pharmaceuticals and dyes, as well as large tanneries and sisal processing operations. The Port Dauphin Plant at Cap Haitien is one of the largest sisal processing operations in the Caribbean.

About 700 industries prepare products for the local market. A recent list included firms engaged in the following activities: 226 in food processing; 218 in beverages; 47 in clothing; 12 in leather; 28 in chemicals; 12 in leather; 11 in mechanical products; 7 in printing; 1 in tobacco; 5 in wood products; and 25 in furniture production.

Most large-scale business and industry are located in the capital city of Port-au-Prince. Industry in rural areas is engaged chiefly in meeting the needs of the local population through operations such as clothing manufacture, pottery production, baking, and, in those sugar growing areas such as the plains of the southern peninsula, the distillation of rum.

5.3.1 Industrial pollution

Little information is available on industrial pollution in Haiti; in its 1972 report prepared for the United Nations Conference on the Human Environment, the government reported that because Haiti is not an industrialized nation pollution is not a problem and certainly not a primary concern of the government. It noted however, that the competent government agency (not identified) is constantly attempting to control air pollution from dust in Port-au-Prince, the city with the most polluted air. Communiques dealing with automobile exhausts were said to have been issued. With regard to water, the report says that Haitian lakes and seas are not truly polluted in the fashion of the of industrialized countries, the exception being the waters near Port-au-Prince, which are subjected to industrial effluents from "certain plants." Mentioned, however, is water pollution from waste oil discharged from ships in the Atlantic and the Caribbean.

Street (1960) refers to the foul aroma proceeding from the many small distilleries operation on the plains in the southern peninsula, and the OAS (1972) reports water pollution from rum production as a factor hindering the reactivation of an irrigation system in the Leogane region.

5.4 Energy use

5.4.1 Electricity

Electricity (an estimated capacity of minimally 70 megawatts), presently produced by two small and one large hydroelectric plant (47 megawatts) and a number of diesel-powered plants scattered throughout the country, is available to only a small percentage of Haitians. While residents of major towns such as Port-au-Prince, Jacmel, Les Cayes, Cap Haitien, Gonaives, and St. Marc have access to electricity, less than 1% of the rural population is linked with electricity systems. Furthermore, siltation in the Peligre Dam, the chief source of hydroelectric power, is steadily decreasing its output capacity.

5.4.2 Firewood and charcoal

The most common form of fuel for domestic purposes, principally cooking, is wood; it has been estimated that over 97% of Haitians cook their food using wood or charcoal. In urban

areas an estimated 40% of families use charcoal. About 50% of the charcoal produced is consumed in the Port-au-Prince area, where the consumption of charcoal increased an estimated 19% per year from 1970 to 1975. The production of charcoal to meet this growing demand is leading to a situation where in the Jean Rabel area of the northwest the rate of deforestation will soon be about 25 times greater than the rate of reforestation as foreseen by a joint AID/DARNDR program.

The costs of charcoal have also been rapidly increasing, a development especially burdensome for the urban poor, who must spend an increasingly larger portion of their small incomes simply for cooking fuel.

The discovery of a fuel source to substitute for much of the charcoal in use in Haiti today would seem to be necessary if the disastrous rate of deforestation is to be slowed down. A recent survey of the situation suggests, however, that rather than employing other forms of energy, the establishment of renewable energy plantations using fast-growing species such as Leucaena leucocephala might offer the most promising solution to Haiti's growing energy crisis (Benge 1978).

5.4.3 Kerosene

Kerosene, the most likely candidate as a substitute for charcoal and firewood as a cooking fuel, must be imported into Haiti, which has no petroleum resources. Kerosene is, however, subjected to a tariff which makes it prohibitively expensive for most Haitians.

5.4.4 Other energy possibilities

Certain energy alternatives such as nuclear energy and solar energy are overly expensive answers to Haiti's problem, while wind energy, a possibility for northeast Haiti, is not feasible in Port-au-Prince, the area in which most of the charcoal is presently consumed. The Inter-American Bank is investigating the possibility of energy produced from agricultural wastes and sewage. Haiti has both geothermal potential, which would probably be too difficult to exploit economically, and deposits of lignite (the most extensive in the West Indies), which offer some hope if they could be converted through coal gasification into a more efficient form of energy.

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Appendix B

Birds protected under the Haitian Hunting Law of 1971

Hunting, barring any contrary specifications posted at the time that the hunting season is opened, does not apply to the following species:

- a) Anatidae: ducks, teals, including the West Indian tree-duck [Dendrocygna arborea], the Bahama pintail [Dafila bahamensis bahamensis], the Green-winged teal [Nettion carolinense], and the Blue-winged teal [Querquedula discors];
- b) Perdidae: the bob-white [Colinus virginianus virginianus]
- c) Numididae: the guinea hen [Numida galeata]
- d) Rallidae: rails, including the Hispaniolan clapper rail [Rallus longirostris vafer], the yellow-bellied rail [Porzana flaviventer hendersoni] and birds locally known as poules d'eau, a term which covers the Antillean gallinule [Gallinula chloropus portoricensis], the American coot [Fulica americana americana] and the Caribbean coot [Fulica caribaea]
- e) Columbidae: pigeons, including the white-crowned pigeon [Columba leucocephala], the scaled pigeon [Columba squamosa], and the plain pigeon [Columba inornata inornata]; turtle doves, including the Zenaida dove [Zenaida zenaida zenaida], the West Indian mourning dove [Zenaidura macroura macroura], and the white-winged dove [Melopelia asiatica asiatica]; the ortolan or cuban ground dove [Chaemepelia passerina insularis]; quail doves, including the ruddy quail dove [Oreopeleia montana] and the Key West quail-dove [Oreopeleia chrysia];

It is prohibited to slaughter, hunt or capture the following birds:

- a) Ardeidae: including the West Indian great blue heron [Ardea herodias adoxa]; the egret [Casmerodius albus egretta]; the snowy heron [Egretta thula thula]; the reddish egret [Dichromanassa rufescens rufescens]; the Louisiana heron [Hydranassa tricolor ruficollis], the little blue heron [Florida caerulea caerulescens], the West Indian green heron [Butorides virescens maculatus]; the black-crowned night heron [Nyctanassa violacea violacea]; and the least bittern [Ixobrychus exilis exilis];
- b) Threskiornithidae: including the glossy ibis [Plegadis falcinellus]

falcinellus], the white ibis [Guara alba], and the roseate spoonbill [Ajaia ajaja];

- c) Phoenicopteridae: flamingo [Phoenicopterus ruber];
- d) Accipitridae: the local name malfini, used in the law, applies to the following birds of this family: Hispaniolan sharp-shinned hawk [Accipiter striatus striatus]; the West Indian red-tailed hawk [Buteo jamaicensis jamaicensis], and Ridgeway's hawk [Rupornis ridgwayi];
- e) Falconidae: Hispaniolan sparrow hawk [Falco sparverius dominicensis], and the turkey vulture [Cathartes aura], listed in the law as a Falconidae but generally classified as a Cathartidae;
- f) Cuculidae: mangrove cuckoo [Coccyzus minor teres]; yellow-billed cuckoo [Coccyzus americanus americanus];
- g) Tytonidae: Hispaniolan barn-own [Tyto glaucops];
- h) Strigidae: Hispaniolan burrowing owl [Speotyto cunicularia];
- i) Trogonidae: Hispaniolan trogon [Temnotrogon roseigaster].

NOTE: Passeriformes, with some stated exceptions are also covered. No mammals or other classes of animals appear to be covered by the law. Not mentioned as protected, although they appear on the U.S. Fish and Wildlife Service's list of species endangered in Haiti or the Caribbean in general, are:

the Haitian Solenodon [Solenodon paradoxus]
-very rare insectivorous mammal of Haiti and Cuba;

the Brown pelican [Pelecanus occidentalis].

Normal Rainfall Levels in Haiti

MONTHLY RAINFALL IN REPRESENTATIVE LOCATIONS IN HAITI

Zone		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tot.
North	Cap Haitien	123	115	88	106	139	88	32	62	97	206	278	195	1529
Northwest	Mole-St-Nic	21	40	27	52	63	57	26	38	51	71	100	43	589
Central plain	Gonaives	3	12	14	33	87	89	75	63	84	63	23	8	554
Central plateau	Mirebalais	17	26	50	136	280	215	187	244	256	223	74	23	1731
Gulf	Port-au-P.	33	35	69	155	215	91	83	137	155	176	87	41	1277
	Jeremie	68	73	80	94	159	111	92	95	109	139	165	108	1293
Western Carib.	Les Cayes	76	72	90	139	254	161	180	205	235	310	117	69	1908
Eastern Carib.	Jacmel	35	42	82	168	220	98	92	147	152	170	66	40	1312