DOMINICAN REPUBLIC
URBAN ENVIRONMENTAL STRATEGY

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URBAN ENVIRONMENTAL STRATEGY

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT
DOMINICAN REPUBLIC

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I. EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

For the past ten years, the Dominican Republic (D.R.) has experienced a series of extended shocks to the economy. Rising petroleum prices, along with a decline in the international price of sugar and stagnation in the country's other traditional exports, have combined with inadequate institutional policies to slow economic growth. Weak economic performance has had its most severe effects on the poorest groups in the society.

Against this background, neither the population at large nor Government has paid much attention to the environment. Households have tried to cut their own costs or generate additional income by resorting to practices which often inflict high costs on the environment. Government has been eager to generate jobs and foreign exchange in the short run, without worrying about environmental consequences. As a result, increasing rates of deforestation, soil erosion, water pollution, inadequate waste disposal, and coastal degradation are combining to rob the country of much of its resource base needed for sustained development.

A. GENERAL FINDINGS

Institutional Constraints

Many of the urban environmental problems in the D.R. can be traced to the inadequate regulatory policies of the national and local levels of government. There are numerous laws and agencies responsible for protecting the country's natural resources, but agency jurisdictions are often overlapping,

regulations are fragmented and enforcement is often nonexistent or inconsistent. The lack of an adequately trained and compensated full time career civil service contributes to poor implementation.

There is a general lack of public awareness of the importance of environmental quality to human health and to the basic economic development potential of the country. Although special national conferences have addressed environmental and natural resources issues, there is little public media debate or interest in environmental matters. There are no local university programs in natural resources management, urban and regional planning, or related disciplines that could create a continuing focus on the environment, and establish capacity for research and for training of local environmental professionals.

National policy authority as well as budget allocations are highly centralized in the Office of the President. This has reinforced the regulatory paralysis within the country, since "independent" authorities can be overridden by personal appeals to the President or his Office. Despite sporadic environmental actions, such as bans on tree cutting, the Office of the President has not made environmental quality a policy priority.

Municipal governments are especially weak. They have found themselves overwhelmed by the responsibility to provide the most basic service functions, like solid waste collection. They are in no position to assume a leadership role in devising or implementing new environmental programs.

The main institutional bright spot is the active movement of nongovernmental and private voluntary organizations (NGOs and PVOs). The D.R. has a history of strong NGO-PVO activity.

This tradition presents an important opportunity for mobilizing resources to enable people to improve the quality of their lives and environment through collective action outside of government.

Economic Development Policy

The past ten years have seen a substantial reduction in the rate of economic development within the D.R. From 1979 to 1986, the real GNP growth rate was less than 1 percent annually. Currently, real growth appears to have turned negative. In recent years, however, the tourism industry and free trade zones (FTZs) have experienced significant expansion; potential exists for continued substantial growth in these sectors.

Structural adjustments being introduced within the macroeconomic policies of the country should eventually improve the D.R.'s economic performance. However, even with renewed economic growth, the trends in environmental degradation are likely to continue unless major sectoral policy changes are made.

Urbanization Trends

Over the past decade the rate of urban population growth in the D.R. is estimated to have been about 4.3 percent, compared to a rural growth rate of substantially less than 1 percent and a country-wide rate of slightly over 3 percent. This is one of the highest urbanization rates in the hemisphere. It is estimated that the urban population, which was 60 percent of the nation's total in 1990, will increase to 77 percent by 2020.

Rapid urban growth has not been planned for, or accommodated efficiently. Some two-thirds of the urban population live in substandard housing in squatter or partially formalized areas. This population will become an increasingly important focus of environmental issues in the D.R.--both because its consumption patterns (e.g., high consumption of charcoal) often precipitate environmental problems and because its location, at the edge of highly polluted rivers, outside of safe drinking water networks, and in areas difficult to access for solid waste collection, make it especially vulnerable to poor ambient environmental quality.

Much of future population growth will be drawn to fragile coastal areas, because of the D.R.'s tourism-led growth strategy. This migration portends intensifying conflict between urban population centers and the natural environment.

Inadequate Environmental Information System

One of the key problems facing the D.R. is a lack of consistent, accessible, and regularly monitored data on pollutant sources and environmental quality. No systems exist for regularly measuring air and water quality; industrial, municipal or residential wastewater discharges; or the enforcement status of various environmental laws and regulations. The lack of objective information makes it difficult to move beyond informed speculation about what future priorities should be.

B. PRIORITY ENVIRONMENTAL ISSUES

Four priority issues emerged from this assessment:

1. urban water pollution and potable water supply

2. deforestation exacerbated by urban energy consumption

3. coastal degradation

4. solid waste collection.

A more precise ranking of the severity of environmental problems is infeasible until further studies have been completed. However, there are important, immediate issues in each of these areas that can be addressed without a comparative prioritization. Other potential environmental issues, such as ambient air quality, toxic metal exposure, and indoor (working place) air quality appear to be of secondary concern at this point, because of the low level of heavy industrial production in the D.R. and favorable air circulation.

Water Pollution and Water Supply

Many of the natural and manmade water resource systems within the D.R. have seriously deteriorated. Health statistics indicate that water-borne diseases are the major cause of death for infants and children, and of disease in the population as a whole. The incidence of water-borne diseases, especially gastroenteritis and typhoid/paratyphoid, increased some 26 percent from 1981 to 1988. More than 70 percent of morbidity is accounted for by water-borne diseases.

Although all urban communities in the D.R. have a public water system, much of the supply is contaminated. This is especially true in the largest cities, Santo Domingo and Santiago, where substantial pumping is required. Frequent and prolonged power outages reduce hydrostatic pressure, thus permitting infiltration and contamination. The Health Ministry estimates that almost two-fifths of all piped water is heavily contaminated.

In Santo Domingo, about 40 percent of the population has access to piped water. However, one-third of the pumped supply is lost in the distribution system. In Santiago, about one-half of the supply is lost. Potable water supply is currently a problem in Santo Domingo, but given population growth rates within a few years it may become critical. Daily water demand in the year 2000 will exceed supply from currently available and planned sources by more than 18 percent, even assuming *no* losses in distribution and the most favorable climatic conditions. Given current loss rates from leakage and drought conditions, water supply will become acutely inadequate.

The aquifers underlying the major urban areas are in serious jeopardy. Unrestrained withdrawals reduce the hydrostatic pressure of water flowing toward the sea and permit the inflow of salt water. The uncontrolled practice of depositing sanitary and industrial wastes in the aquifers is contaminating the very waters being withdrawn for domestic consumption. At present, water intakes for the major cities are far enough upstream to avoid severe contamination to the potable water supply at the source; most contamination enters through the distribution system.

Inadequate treatment and improper disposal of wastewater is also having a negative impact on the water quality of the major rivers. Although the government currently has laws which require each industrial plant to treat its wastes prior to discharge, compliance and enforcement are spotty at best. Forty percent of the urban population is reportedly connected to a sewerage system, but these systems are mainly ineffective. This is due to small pipe diameters, lack of protection from

garbage being dumped into the system, and the uncontrolled discharge of industrial wastes into local collection systems. Most of the capital's sewage is untreated and eventually discharges directly into the ocean or indirectly through the lower portions of the Isabel and Ozama Rivers.

Energy Supply, Urbanization, and Deforestation

Along with slash and burn agriculture and cattle raising, the demand for charcoal and fuelwood is a prime cause for deforestation in the D.R. Of special concern is the demand for charcoal by the growing number of poor urban households. It is estimated that 43 percent of all households, mainly the "urban poor," use charcoal as their prime fuel source; 32 percent, mainly rural groups, use firewood. The remaining 25 percent use propane gas or other combustibles Charcoal usage has grown rapidly, propelled both by growth in the urban poverty population and the high and rising cost of "modern" fuel alternatives, such as petroleum products and electricity. In 1975, charcoal accounted for 26 percent of total D.R. energy consumption; by 1985 it had risen to 38 percent.

Various economic and institutional factors are likely to prevent a significant expansion in the electricity generating capacity of the country within the foreseeable future. Without alternative fuels, charcoal and fuelwood consumption is likely to rise significantly, intensifying pressure on the nation's forests. About 500,000 acres of renewable woodland are needed to satisfy the total wood demand for the D.R. (56 percent for charcoal, 30 percent for domestic fuelwood, and 14 percent for other uses). The government in 1967 designated 188,000 acres as "Areas Carboneras," but these represent less than one-third

the area needed to meet sustained demand for charcoal and domestic fuelwood at current rates of consumption. From 1973 to 1983 the D.R. forest disappeared at a rate of about 78,000 acres annually, contributing strongly to other environmental and agricultural problems in the country.

There is urgent need to analyze the cost effectiveness and social acceptability of alternative urban fuel supply arrangements. Further use of propane may be possible. Otherwise, the development of fuel-wood plantations may be able to halt deforestation as well as supply much of the incremental energy needed by the Dominican people.

Free Trade Zones, Tourism Development, and Coastal Zone Impacts

Santo Domingo and Santiago will continue to be the prime growth areas for the next 20 years. However, the spatial development pattern of the D.R. is also being affected by the growth of tourism areas and the development of free trade zones. In 1989, the 18 FTZs employed about 112,000 workers with an associated population estimated at over one-half million. Twelve additional zones are now actively being developed which could provide 75,000 additional jobs.

FTZs are not presently believed to be major contributors to environmental problems, but increasing concerns have been expressed about the lack of environmental regulations and planning concerning the location and operations of the zones. Industrial wastes, for example, typically are discharged directly into the local public collection system. Uncontrolled squatter settlements are occurring on the perimeter of the zones, resulting in many of the environmental problems associated with squatter areas in the larger cities.

The D.R. tourism industry has about 27,600 hotel rooms and is estimated to directly employ about 546,000. The D.R. has the fastest expanding tourism sector in the Caribbean. With a potential increase in 10 years of 50 percent over the 1990 room supply, tourism employment could increase to more than 80,000 and the associated population to over 400,000. Most of the growth will occur along the fragile coastal zone, an area already experiencing growth-related environmental degradation in the off-shore coral reefs and coastal mangroves, as well as river pollution near the points of discharge into the sea. The Ministry of Tourism is currently doing spatial planning studies for the new tourism growth areas, including some environmental assessments. However, private industry has resisted environmental guidelines, and the pressure for investment and foreign exchange is so strong that Government authorities cannot impose strong restrictions on development. Rationalizing coastal development so as to protect the resource that attracts tourists must be a priority for long-run economic development.

Solid Waste Management

One of the most obvious problems facing the D.R. cities is solid waste collection and disposal. The Dominican Municipal Association has estimated that the installed capacity for garbage collection and disposal in all urban areas can handle only about two-thirds of daily production, even when equipment and sites are managed efficiently. Actual collection rates are much lower.

Although garbage is mainly collected house to house using automated equipment, lack of compaction trucks and poor access

to the barrios makes this method impracticable. To solve the collection problems, municipalities are investigating the use of push carts and drop-off centers. Attempts also have been made to transfer solid waste collection to the private sector, but the record of household fee payment is so poor that neither the public nor private sector has been able to recover a significant fraction of operating costs.

There are essentially no controls on the operations of landfills in the country. There are no leachate controls and no coverings for refuse. Due to inadequately maintained unpaved roadways, truck access to landfills is poor, with the result that dumping often occurs at other locations. Many low-income families are living within the landfill sites as scavengers.

There are several major health impacts associated with the solid waste problem. Ingestion of fecal matter by refuse workers, scavengers and families (especially children) living in or near the landfills or dumps is likely. Secondly, poorly designed and operated landfills cause groundwater and surface water contamination. In 1985, leachate from the Guaricano landfill in Santo Domingo was found to be contaminating the Yaguazu River, located on its periphery. Thirdly, landfills and uncollected refuse are breeding grounds for disease-causing vectors including rats, cockroaches, flies and mosquitoes. This is especially true in countries such as the D.R. where the waste is highly organic and exposed to rapid biodegradation.

With 80 percent of solid waste in the form of organic material, composting is a potentially attractive recycling alternative for Santo Domingo. The high levels of organic

matter and high moisture content also make landfill refuse appropriate for methane recovery. This could provide the power needed for composting operations, and could potentially be an added source for the public power grid.

In the D.R., solid waste collection is traditionally provided by the municipality and is the largest municipal budget item. For example, over the past 10 years, solid waste collection has consumed an average of 58 percent of Santo Domingo's municipal budget. The extremely low ratio of cost recovery, between 1 and 20 percent, means that losses on solid waste collection eat into the municipalities' ability to provide any other type of public service.

C. POLICY RECOMMENDATIONS

Unfortunately, the D.R. now lacks the informational and analytical base needed to establish broad priorities in urban environmental policy. In the short run, therefore, the principal needs are for analytical assessments of specific environmental problems and for pilot projects to demonstrate the feasibility and costs of solutions. Each of the projects listed below should move forward on a relatively modest scale until the payoffs and probability of success are more precisely defined. At that point, the project could be expanded.

Project Possibilities

- Estimate, however crudely, the relative importance of different environmental quality problems to human health. Health consequences are a function of (1) the number of individuals exposed, (2) duration of exposure, (3) level of ambient environmental quality to which the population is

exposed, and (4) known linkages between human disease and threshold levels of exposure. Studies of this type have been conducted by the Environmental Protection Agency for different metropolitan areas in the United States. They have revealed very different rankings of priority problems in different cities. Pilot studies using the same methodology are now underway in Bangkok, Thailand, and Quito, Ecuador. Such an analysis would yield a more specific assessment of the severity of environmental issues for human health in the D.R. and help identify priority areas for intervention.

- Introduce for one tourism growth area or FTZ a pilot project in "multi-media environmental quality management." The framework for such analysis has been developed and applied by Resources for the Future for the Ljubljana region of Yugoslavia. One aspect of importance is analysis of the interrelationship among: the spatial patterns of residential and business activities, waste generation and discharge, resulting ambient environmental quality, and the costs of waste management. A particular high-growth area, like Puerto Plata, would be a logical place to select as a pilot project. Results would feed into the tourism development planning and permitting process of the Ministry of Tourism. The objective would be to plan the development of tourism sites so as to minimize aggregate coastal zone damage and reduce environmental management costs. Alternatively, a pilot project could be developed for a single FTZ. It would estimate the consequences for different types of discharges and ambient environmental quality of different mixes, scales, and locations of industrial activity within an FTZ. It would lay the groundwork for

environmental impact assessments of FTZ expansion, while providing a smaller scale pilot study than a coastal zone.

- Work with NGOs/PVOs and the municipality of Santo Domingo on a pilot basis to introduce low-technology solid waste collection into informal settlements. Push carts or bicycle carts can be used for collection. Collection routes can be organized and operated by an NGO or by private firms under NGO supervision. Refuse would be taken to a central collection point for collection by municipal trucks. A household fee system would be used to pay for all or part of service costs. Similar low-technology systems have been introduced with USAID support in El Alto, Bolivia, and Port-au-Prince, Haiti, in the past two years. A central AID fund exists to help cover the costs of design, technical assistance, and monitoring of private sector initiatives in solid waste collection. It would be logical to start such a pilot study in a single neighborhood, where trash collection historically has been of very poor quality. Preparatory work by the sponsoring NGOs would have to include persuading the population of the importance of fee payments in order to make waste collection feasible.

- Organize a Pollution Prevention Pays (PPP) program for the industries discharging into a certain river like the Ozama for an FTZ. Most industrial production activities are not at the least cost point of their production functions. Small changes in unit processes and unit operations can have significant results in terms of reducing discharges, while actually reducing production costs to the firm, and saving large amounts relative to the costs of installing treatment technology. A

PPP program reduces waste generation in the first place and looks for opportunities for materials and energy recovery. It recognizes that economic incentives to firms to lower net costs create the best long-run potential for discharge reduction. The private Gulf Coast Waste Disposal Authority in Texas operates on this model. An NGO/PVO could organize a pilot project of this type in the D.R.

- Carry out a study of the economic and social feasibility of composting as a means of reducing solid waste accumulation in landfills.
- Carry out a study of the costs and technical feasibility of repairing leaks in the Santo Domingo water system, as an alternative to extremely expensive development of new water supply sources and aqueduct construction.
- With respect to data bases, the principal need is for regular monitoring of pollution discharges and ambient environmental quality. A pilot area should be selected for an inventory of discharges and dischargers. Monitoring would cover point discharges for industrial, residential and commercial use, as well as nonpoint discharges. Data in the inventory would be compiled by geographic area, which would provide basic inputs for estimating the locations with the greatest vulnerability to environmental quality problems. The initial estimates of discharges would be crude, using whatever data are available from the D.R. and from elsewhere. Over time, the data would be improved. An inventory of this type could be implemented at first for the same zone as the PPP program, or for the zone used to introduce the "multi-media environmental quality management" program.

- Carry out a linked study of household demand (both economic and social) for different types of fuels in poor urban neighborhoods and the costs and feasibility of meeting this demand from different sources. Such a study would focus on the potential for reducing urban charcoal demand. Given the high rural-urban migration rates, any measures taken to increase use of alternative fuels in the city have the potential to yield large savings in wood consumption. The study would be carried out in collaboration with one or more NGOs/PVOs, which could then help introduce cost-efficient and socially acceptable fuel alternatives into the neighborhoods.
- Investigate the possibility of designing a Debt-for-Nature swap that would set aside for protection designated forest areas or coastal zones. Although this would not be an "urban" environmental program, it should be a priority objective for the D.R.

Getting Started

In an important sense, it does not matter a great deal which pilot projects or studies are launched first. It is crucial to get started with *some* studies and pilot efforts to begin to accumulate experience and information. The best strategy would seem to be to launch at least three or four separate projects, each on a modest scale at first, to generate a network of environmental activities as well as competition for future AID resources.

All of the projects described here should be implemented primarily by an NGO/PVO, and would be eligible for support under the Mission's PVO cost-sharing program. During our in-country interviewing, we found *Foro Urbano* to be an effective

umbrella organization in focusing urban environmental initiatives.

As much of the technical work described here as possible should be performed by D.R. professionals. However, external technical assistance will be required. This is most effectively provided by one full-time expert who could act as a "flying squad" rotating between AID projects, the NGOs/PVOs implementing them, and the government agencies who potentially can use the information and precedents generated. One goal would be to enlist counterpart D.R. experts who could take over this "flying squad" role in future years.

II. OVERVIEW OF URBAN ENVIRONMENTAL ISSUES

A. WATER POLLUTION, HEALTH IMPACTS AND URBAN INFRASTRUCTURE

The Current Situation

Most of the key elements of the natural and man-made water resource systems within the D.R. are in serious deterioration. This includes the increasing degradation of surface waters and ground waters due to many sources: soil erosion; agricultural run-off containing pesticides and chemicals; industrial discharges by injection wells to underground aquifers; deforestation of watersheds; inadequate treatment and discharge of municipal wastewater; inadequate and contaminated water supplies to urban areas; and the uncontrolled withdrawals from underground aquifers which are themselves becoming polluted.

The causes for the deterioration of the water resource base of the D.R. are numerous and complex, and in many areas are related directly to the basic macroeconomic and institutional capacity problems facing the country. As with other environmental problems in the country, however, a key cause may lie in the lack of public awareness of the importance of protecting water resources, as a system, for the overall functioning of the economy. People know they require water, as do governments, but having "protection" of water resources as a priority, by individuals or government, is a more complicated concept to publicly explain, have accepted or acted upon.

The use and mis-use of water resources, and human intervention in the natural hydrologic cycle, combined with the accelerating pace of unmanaged urbanization, pose a grave threat to the ability of the Government of the D.R. to sustain its programs of economic development based upon industry and tourism, as well as to protect the health and welfare of the population. Interviews with knowledgeable concerned

individuals, both within and without public agencies, and perusal of publications and the daily press, reveal an almost total absence of public awareness of environmental problems and their short and long-term implications. Those public officials who expressed awareness and concern lack the political support, the human resources, and the funds required for effective action.

This section of the report mainly focuses on water pollution, its relation to human health, and on several of the key issues related to institutional constraints, investment planning and policy choices regarding wastewater and water supply. The impacts of water pollution on the coastal zone and potential policies for improving conditions are also addressed.

Water Quality and Human Health

Health statistics indicate that in the Dominican Republic water-borne diseases are the major causes of death for infants and children, and of disease in the population as a whole. These disease problems are associated with urban as well as rural areas. Water supply samples taken from water supply systems in eight health regions showed that 37% of the samples exceeded allowable coliform levels, which is a standard measure of water quality indicating fecal pollution. (Table II-1) The range was from 34% of the samples in National District to 57% of those in Region VII, the northwest corner of the state which includes the Yaque del Norte River.

According to data from the D.R. government, the incidence of water-borne diseases, especially gastroenteritis and typhoid/paratyphoid, has increased significantly during the 1980's. The rate of gastroenteritis increased from 186 cases per 10,000 population in 1981 to 235 cases per 10,000 population in 1988, which yields a 26% increase. For typhoid/paratyphoid, the increase was from 1.8 cases per

Table II-1

BACTERIOLOGICAL QUALITY OF WATER SUPPLY
Dominican Republic, by Region, 1986

Region	Number of Samples	Contaminated Samples*	
		Number	Per Cent
O	555	189	34.1
I	186	73	39.2
II	68	30	44.1
III	115	49	42.6
IV	63	28	44.4
V	122	45	36.9
VI	49	24	49.0
VII	60	34	56.6
Total	1,278	472	36.9

* Values greater than 2.2 coliforms (NMP).

Source: Dr. Defillo National Public Health Laboratory
[As published in Report Number 7600-DO
World Bank, March 1990]

Table II-2

CASES AND RATES OF INFECTIOUS DISEASES
Dominican Republic
(Selected Years, 1981-1989)

Disease	1981	1982	1983	1984	1985	1986	1987	1988	1989
GASTROENTERITIES									
Cases	108,388	125,510	139,336	158,623	107,757	88,423	126,060	165,578	164,612
Rate *	185.7	210.0	227.6	260.0	167.9	134.8	187.9	247.0	234.7
TYPHOID/PARATYPHOID									
Cases	1,053	1,635	1,477	1,606	1,065	1,103	1,867	2,577	3,043
Rate *	1.8	2.7	2.4	2.6	1.7	1.7	2.8	3.8	4.3
DYSENTERY									
Cases	2,583	2,251	2,506	2,771	1,312	1,519	2,825	-	-
Rate *	4.4	3.8	4.1	4.5	2.1	2.3	4.2	-	-
HEPATITIS									
Cases	2,016	2,522	2,807	2,373	1,570	1,552	2,999	2,913	2,188
Rate *	3.5	4.2	4.6	3.9	2.4	2.4	4.5	4.3	3.1
TOTAL REPORTED									
Cases	114,040	131,918	146,126	165,373	111,597	92,597	133,751	171,068	169,853
Rate *	195.4	220.7	338.7	271.0	174.1	141.1	199.4	255.0	242.2

* Cases per 10,000 population
Source: Secretariat of State for Health and Social Affairs (SESPAS)

Table II-3
MORBIDITY RATES FOR SELECTED DISEASES
Dominican Republic, 1970-1987

		1970	1981	1984	1987
Gastroenteritis,	cases	30,000	108,400	158,600	90,300
	rate*	715	1,920	2,530	1,346
Dysentery	cases	6,900	2,600	2,800	2,000
	rate*	164	46	44	29
Infectious Hepatitis	cases	1,600	2,000	2,400	2,300
	rate*	39	36	38	33
Malaria	cases	200	280	240	120**
	rate*	4	49	39	18
Syphilis	cases	700	16,300	17,600	8,000
	rate*	207	289	281	120
Tuberculosis	cases	600	1,800	3,100	2,000
	rate*	15	31	49	30
Typhoid	cases	1,100	1,800	1,100	1,600
	rate*	26	31***	26	23
Measles	cases	2,100	3,400	4,300	5,000
	rate*	51	60	58	74
Gonorrhea	cases	11,600	13,200	19,300	8,300
	rate*	271	234	308	124

* = Rate per 100,000 population
** = 1987 figure from SESPAS/OPS 1988
*** = 1979

Source: Secretary of State for Public Health and Social Affairs (SESPAS), as published in Report Number 7600-DO, World Bank, 1990 (adjusted by author)

10,000 population to 4.3 cases per 10,000, a 139% increase. (Tables II-1,2 and 3) Gastroenteritis, a disease of the digestive organs, can be fatal in children. Although long-term exposure allows some to develop a tolerance, it often can seriously effect the health and work productivity of adults. It can be especially debilitating to tourists and could have longer term implications for the tourism attractiveness of the country.

The health implications of water quality for the D.R. are highlighted by the following statement in the World Bank's 1990 Report: "More than 70% of the high rate of morbidity (incidence of disease at a rate of 179 per 10,000 in 1986) is accounted for by water-borne diseases, which are transmitted mainly by contaminated water."

Water Supply Issues

Although all the 133 urban communities in the D.R. have a public water system (only 15% of the rural communities have a public system), much of the public water supplied is often contaminated. This is especially the case in the larger cities such as Santo Domingo and Santiago where substantial pumping is required. Frequent and prolonged power outages reduce hydrostatic pressures, thus permitting infiltration and contamination. The Health Ministry estimates that almost two-fifths of the piped water is heavily contaminated.

In addition to water quality problems, the maintenance of adequate water supplies for urban, industrial, agricultural and river flow augmentation purposes is a key environmental problem. For example, the assigned flow of the Yaque de Norte River near Santiago is for both urban and agricultural irrigation purposes. During extended drought periods, however, the assigned withdrawal allowance has substantially exceeded the river's flow capacity.

Table II-4

PROJECTION OF POPULATION, WATER DEMAND, AND SUPPLY
City of Santo Domingo
1990-2010

A. PROJECTION OF POPULATION AND WATER DEMAND

Year	Population	Per Capita Daily Water Demand	Total Daily Water Demand
1990	2,248,500 (Estimated)	90 gallons	8.84 cm/s *
2000	3,372,700 (Projected)	100 gallons	14.76 cm/s
2010	4,890,400 (Projected)	100 gallons	21.42 cm/s

* - cubic meters per second of water flow

B. ESTIMATED AVAILABILITY OF WATER

Source	Method	Normal Condition Normal Power	Drought Condition Normal Power
Isa-Mana-Duey	Gravity Flow	1.62 cm/s	1.00 cm/s
Valdesia	Gravity Flow	6.30 cm/s	4.00 cm/s
Mata Mamon-Marenos	Pumped (Aquifer)	1.49 cm/s	1.49 cm/s
Bajo Haina	Pumped (River)	1.49 cm/s	0.70 cm/s
Isabela	Pumped (River)	0.44 cm/s	0.16 cm/s
Villa Mella	Pumped (Aquifer)	0.26 cm/s	0.26 cm/s
Las Caobas	Pumped (Aquifer)	0.10 cm/s	0.10 cm/s
Other	Various (Aquifers?)	0.88 cm/s	0.88 cm/s
Total Daily Supply		12.49 cm/s	8.59 cm/s

Source: Emilio Almonte-Jimenez, PE: Report to Foro Urbano, July 1990
Adjustments by author

In Santo Domingo, about 50% of the population has piped water inside or outside the house, while about 40% has access to nearby communal faucets. However, about one-third of the pumped supply is lost through leakages in the distribution system. In Santiago, about one-half of the supply is lost. In Santo Domingo the World Bank has estimated the current demand of 7.6 M^3/second (cubic meters per second) at twice the actual delivered supply.

Although water supply is currently a problem in Santo Domingo, within a few years it may become critical. Based on estimates of population growth, per capita demand and supply sources by Eng. Emilio Almonte (1990), daily water demand within 10 years (year 2000) will be about 14.76 M^3/second. (Table II-4) Under normal rainfall and electric power conditions, all currently available sources (without losses), can supply only 12.49 m^3/second. Under drought conditions, the supply drops to 8.59 M3/second. His estimates of supply include aquifers, gravity flow systems, and the newly completed Valdecia aqueduct project. (CAASD estimates the Santo Domingo deficit during drought, exclusive of water losses, to be 8.0 M^3/second by the year 2000).

Protection of Santo Domingo's aquifers are especially important. Estimates show a capacity to supply about 2.75 M^3/second (before transmission losses) of the current 7.6 M^2/second demand. However, various sources report that the aquifers are being rapidly degraded by a variety of activities. These include unrestrained withdrawal of water for domestic and industrial use, which reduces the hydrostatic pressure of water flowing toward the sea and permits the inflow of salt water. In addition, the uncontrolled practice of depositing sanitary wastes and industrial wastes in the aquifers is contaminating the very waters that are being pumped out for domestic consumption. Although laws exist that

would regulate such activities, the several agencies responsible for enforcing them lack the technical manpower and equipment needed to effectively monitor such activities.

In summary, the present water supply situation does not address the near-term future growth of the city.

Wastewater Management Issues

According to information from a variety of sources, the lack of adequate treatment and improper disposal of municipal and industrial wastewater is believed to be having a dramatic negative impact on the water quality of the major rivers in the D.R. Although recent specific data was not available, various sources reported that most of the municipal and industrial wastewater produced in the country is not treated before disposal into streams and rivers.

Although 40% of the urban population of the D.R. is reportedly connected to a sewerage system, these systems are believed to be mainly ineffective. For example, according to the World Bank (1990), Santo Domingo's current sewerage system, consisting of 4 treatment plants and 5 pumping stations, serves only two-fifths of the land area of the city. Almost 90% of the collection system is only 8 inches in diameter and only 7 kilometers of the 615 kilometer system is above 24 inches in diameter.

Due to these small pipe diameters, the lack of protection from garbage being dumped into the system, and the uncontrolled discharge of industrial wastes into the system, the ability of the system to process the wastewater from even the small portion of the city served, is significantly reduced. The World Bank concluded: "Most of the capital's sewage is discharged untreated and eventually spills directly into the

ocean or indirectly through the lower reaches of the Isabel and Ozama Rivers."

In seeking to address the wastewater problem, especially for large cities, most conventional solutions address questions such as: extent of coverage for collection systems; various cost/benefit analyses of effluent standards and level of treatment, (i.e., primary, secondary or advanced); and question of user charges, overall finance, and long-term operations and expansion. Especially in developing countries such as the D.R., which are experiencing severe public budgetary difficulties, extensive expansion of sewer systems may be very difficult if not impossible within the next five to ten years. Due to the high capital costs and the extensive resources needed for adequate operations and maintenance of sewer systems, other options need to be carefully evaluated.

To specifically evaluate sanitation technologies for various types of urban conditions in the D.R. is beyond the scope of this study. For overall environmental strategy purposes, however, and when considering many of the budgetary and institutional problems facing the D.R. today, it seems appropriate to indicate some of the potential constraints identified by previous research on sewerage systems in developing countries.

A well maintained conventional sewerage system has obvious advantages to people (i.e., convenience and health) and to the environment (i.e., treated effluent discharges which help protect the quality of the receiving water courses). However, researchers for the World Bank in 1980 published a report citing several of the key constraints to sewerage systems in the Third World. These include: the large volumes of water needed to operate the system; the problems of excavation in poor urban soil conditions and in squatter areas with high

densities; and the difficulties in aligning sewers in these unplanned settlement areas, especially without substantial demolition. Maintenance problems were also found to be a key concern regarding sewer systems in developing countries. The Bank research stated: "Sewage treatment works commonly discharge effluents in a condition little better (and in some cases worse) than the incoming sewage. In any case, current plant designs concentrate on undoing the environmental problems waterborne collection has created rather than on health maintenance through pathogen removal."

There is recognition that sewerage may be the most appropriate technology for wealthier residential areas, and for the industrial and major commercial areas of the larger cities in the D.R. The key point, however, is that low-cost alternatives to sewerage exist for portions of cities and have been found to be effective, cost-wise and health-wise.

The World Bank's (1980) research into waste water systems makes a strong case for nonconventional (i.e., non-sewerage) sanitation technologies as being the most logical and cost-effective approach for excreta disposal in developing countries, especially for rural communities, small towns and metropolitan urban fringe areas. Although low cost sanitation solutions have been found to pollute ground water in the long term in some areas of the Caribbean (Urban Institute 1990), the Bank research states: "When properly constructed and maintained, they provide all the health benefits of sewerage and have fewer adverse environmental effects." These appropriate technologies studied include household systems (e.g., pit latrines, pour-flush toilets, composting toilets, aquaprivies, and septic tanks) and community systems (e.g., bucket latrines and vault toilets).

Essentially, the Bank's recommended strategy is for a "sequenced sanitation" approach. (Recent contacts with World Bank staff did not identify example projects where "sequenced sanitation" was employed. However, the concept is still advocated by the Bank and variations on this demand driven approach to appropriate sanitation technologies is currently being initiated by the Bank in Ghana). This approach seeks to maximize health benefits while minimizing costs, and is based on recognizing the financial and institutional constraints confronting the Third World. In this regard, findings from the recent WASH report (1990) addressing water supply and sanitation resources needed by the D.R. and other Caribbean countries, seems especially important.

While not addressing the quality of existing coverage for water and sanitation, the WASH study sought to identify the investments needed in the D.R. to raise the water and sanitation coverage from 1989 levels to 1995 targets. For sanitation coverage to increase from 60% to 71%, about $129 million (1989 dollar, U.S.) would be needed. The current committed budgets are about $300 thousand, which represents a 99% shortfall. For water supply coverage to increase from 63% to 74%, the funds needed are about $142 million and the funds committed are about $17.4 million, which yields an 88% shortfall. Together, the water and sanitation coverage targets for 1995 have budget shortfalls of about 93% of the $271 million needed.

The WASH report also offered the following observation, which is especially reinforced by the findings of this report:

> "Over the past 10 years, the WASH project has learned that the construction of water and sanitation systems alone is not enough to ensure the desired results of safe, accessible water and hygienic excreta disposal. Efforts to provide potable water and sanitary waste disposal must be integrated with other development activities."

Policy Recommendations

To address the severe water supply and water quality problems facing the country, AID should consider several interrelated policy options. These include: support to strategic water resources planning; data base development; emphasis on maintenance, conservation and public awareness programs; private sector initiatives and research into appropriate technologies. These are discussed below:

Strategic Water Resources Planning

Technical assistance, in the form of strategic planning and budgeting for near-term and long-term water resources management, is urgently needed. While massive funding for infrastructure construction is not likely to be available through the various AID funding sources, this does not preclude the need for AID to take a major role in promoting the critical necessity for urban related water resources management in the D.R.

In this regard AID should consider re-adopting "expanding and improving infrastructure" as a basic objective of its Country Development Strategy. According to the FY1990/1991 Action Plan February 1989 Draft Report, this objective was dropped due to the scarcity of local currency funds and the overall

drop in other funding programs. The thrust of the revised infrastructure objective would not be to directly finance infrastructure construction. It would be to promote the strategic planning needed for determining the appropriate and cost effective ways to meet the critical infrastructural needs within the next 5 to 10 years. Several key items are suggested:

Data Base Development

Development of a comprehensive, yet user-friendly, data base for the Santo Domingo and Santiago regions is urgently needed. Although the data base could take many forms, the main need seems to be for a coordinated system that can incorporate system description, financial, spatial/environmental, and operational elements. This could potentially be done in coordination with other international donors/lenders, a consortium of the larger industries, and with a unit of the office of the Technical Secretary to the President. Another key member of this group would be a PVO such as Foro Urbano.

Currently, a labyrinth of governmental agencies have responsibilities for water and waste water matters. These include: CAASD, and CORAASAN, which operates water and sewers in Santo Domingo and Santiago respectively; INAPA, which has responsibilities for other urban and rural areas; SEOPC, which is providing water supply to part of Santo Domingo and to a tourist resort in Sosua; UAPODAN, which builds water supply and pit latrines in rural communities; and the Oficina Coordinatoray Fiscalizadora de las Obras del Estado, a unit of the President's office which builds water supply and sewerage throughout the country as part of the President's public housing program.

Various sources suggest that many of these agencies and others, perform overlapping functions without any apparent

coordinated investment planning, except for the general budget allocation functions centralized in the Office of the Technical Secretary to the President. Generally, decentralization of planning and budgetary control, is encouraged for developing countries. However, inconsistent pricing policies, lack of coordination regarding sector responsibilities and duplication of certain technical functions can waste scarce human and financial resources. Hopefully, the recommended data base program would provide a vehicle for helping coordinate the technical and budgetary information among these various agencies involved in managing the water resource infrastructure.

Maintenance, Conservation and Public Awareness

The data base should be important in helping address three other important environmental policy issues regarding water. These are system maintenance, conservation, and public awareness issues.

With a 30% water loss in the distribution system in Santo Domingo and a 50% loss in Santo Domingo, the potential gains to the water supply base in the country could be significant if rehabilitation and adequate maintenance can be sustained. AID should, as part of a water resource strategic policy, support technical studies to address the requirements needed to rehabilitate the water supply and existing sewer and other waste water handling practices of the major cities. Health benefits as a result of sustainable rehabilitation could be significant.

Due to the extensive breakdowns in the current public water supply system, conservation of water may already be a major concern. However, public awareness of the importance of storm drains and sewer opening may be limited. AID should support

public awareness programs to highlight the problems associated with illegal dumping and destruction of water infrastructure.

Private Sector Initiatives

In addition to the data base, another important element of the strategic look at water quality and urban infrastructure is the proposal of Roberto Castillo Tio. He is proposing a voluntary association of the main industrial and municipal discharges in central Santo Domingo.

Rather than build individual treatment facilities, which is now required by law for each discharging industry, the association would build a common facility financed with user discharge fees assessed according to each industry's effluent. Depending on the parties involved, this would be private or possibly a joint public-private venture, with also some PVO participation. (To further assess this proposal, the Urban Institute team requested additional specific information from Sr. Castillo Tio during our visit last month. He indicated it would possibly take several months of additional work for him to pull all the information together as a feasibility study).

From discussions with Sr. Castillo Tio, it appears there is much interest regarding this proposal among key industrial and professional groups in Santo Domingo. While the proposal seems promising, there are numerous technical, financial and regulatory questions which need to be addressed to establish preliminary feasibility. Until further information is available, however, further assessment of the proposal must wait. Whether or not AID would eventually help fund infrastructure construction is not implied by agreeing to support the Castillo Tio feasibility study. This study, however, could be an important element of the overall strategic planning for water resources management.

Appropriate Technologies

In addition to the data base and Castillio Tio elements, a third key element is also needed in the strategic overview. This involves addressing the spatial expansion and appropriate sanitation technology issues associated with the growth of the larger cities and key growth areas in the D.R.

The emphasis would be to address the "most appropriate sanitation technologies" to be adopted, especially for the expanding low-income urban fringe housing areas, and the integration of plans for roadways, water, power and trunk sewers in looking at spatial expansion. Unless this is done, it is difficult to see how continued environmental degradation and human health problems from water contamination can be avoided.

If the squatter settlements continue to proliferate without adequate water and sanitation services and continue to locate without regard to the environmental capabilities of specific land areas to support development, any near-term environmental clean-up benefits are likely to be short lived. They will be overwhelmed by the magnitude of the continued degradation from urban population growth and unmanaged urban expansion.

B. ENERGY, URBANIZATION AND DEFORESTATION

The Deforestation Problem

From the early 1900's until the mid 1980's, the forest cover of the D.R. has been reduced from about 85% to less than 10%. From 1973 to 1986, estimates of the annual deforestation rate is over 113,000 acres. Accounting for some natural regeneration, Dr. Eleuterio Martinez (1990) estimates the net D.R. deforestation rate at about 78,000 acres annually. In the mid 1980's the forest cover was about 1.2 million acres. If the net rate of deforestation in the 19,3 to 1986 period continues, in about 16 years all the tree cover in the D.R. would be gone. While many sources indicate the rate of tree loss has been significantly reduced since the 1967 government ban on tree cutting, Dr. Martinez's recent work indicates that massive deforestation is continuing.

It is generally well known that deforestation has significant negative environmental impacts. It destroys animal habitats; it causes massive soil erosion which in turn leads to stream and river sedimentation. This significantly contributes to rapid rates of reservoir silting, which is associated with the loss of hydroelectric capacity and with the general loss in economic value of related water infrastructure.

The main causes of deforestation in the D.R. are believed to result from slash and burn agriculture, cattle raising, and from charcoal and fuelwood production. While specific data on all causes was not found, between 1977 and 1978, Russell's (1988) work indicated that 78% of the forests in the western half of the country were cleared for pastures. Rather than expanding feed programs for beef production, farmers cleared forests as a response to the local and U.S. demand for beef production. Although more recent data was not available to help quantify the relative importance of the various economic

and social forces contributing to deforestation, various sources indicated that the demand for charcoal by the growing number of urban households, especially the poor, was a prime factor (Martinez, 1990; Thomen, 1990).

Charcoal, Wood and Total Energy Issues

The use of charcoal, by industry and the residential sector, accounts for a significant part of the total energy consumption in the D.R. Official government statistics and World Bank (1990) estimates show that in 1975 charcoal was 26% of the total D.R. energy consumed (when converted into tons of oil equivalent). By 1985, the latest statistic available, it was 38% of the total. Fuel and firewood together, accounted for 43% and 55% of total energy in 1975 and 1985 respectively. (Tables II-5 and 6).

During this same 10 year period, however, the percentage of total energy consumed by wood, electricity and gas (LPG) rose only slightly, while the percentage of petroleum related products (minus LPG) actually decreased from 45% of the total consumed, to 32%. In the official COENER statistics, charcoal use by the mining and industrial sectors is shown to be three times the use in the residential and commercial sector. Martinez (1990) indicates that the government statistics in residential charcoal consumption have been significantly under reported and undocumented, suggesting that charcoal as a total percentage of national energy consumption may be higher than the 38% shown by the 1985 data.

Martinez (1990) estimates that in 1987 the total consumption of all wood products from the D.R. was 4.64 million cubic meters and distributed as follows: 56% for charcoal; 30% for domestic fuelwood, 11% for various timber uses; and 4% for industrial fuelwood. Martinez further estimates that currently 43% of the D.R. households, mainly the urban poor

Table II-5

ENERGY CONSUMPTION (100 TOE) 1976-85 PERIOD

	1975	1980	1985
COMMERCIAL AND RESIDENTIAL			
Wood	361	414	489
Charcoal	111	128	254
Gas (LPG)	58	83	114
Electricity	107	130	145
SUBTOTAL	637	755	1002
TRANSPORT			
Gasoline	316	311	337
Diesel and Gasoline	100	186	120
Other	40	67	94
SUBTOTAL	458	584	551
WINES AND INDUSTRIES			
Gasoline	200	124	185
Heavy Fuels	395	400	216
Charcoal	538	505	859
Electricity	65	82	125
SUBTOTAL	1198	1111	1385
AGRICULTURE			
Diesel and Gasoil	7	11	12
Other	1	1	1
SUBTOTAL	8	12	13
TOTAL	2299	2442	2951
GROWTH RATE		1.2	3.9

Source: COENER and Bank staff estimates
TOE (Tons of Oil Equivalent)

Table II-6
ENERGY CONSUMPTION 1975-1985 PERIOD
(100TOE)

All Sectors	1975 (%)		1980 (%)		1985 (%)	
Wood	16	44	17	43	17	55
Charcoal						
· commercial & residential	5	28	5	26	9	38
· mines & industry	23		21		29	
Diesel, Gasoline, Gasoil Heavy Fuels & Others	46		45		32	
Gas (LPG)	3		3		4	
Electricity	7		9		9	
	100%		100%		100%	
TOTAL	2,299		2,442		2,951	
Growth Rate	-		1.2%		3.9%	

Source: Adapted from COENER and World Bank estimates, DR/1989-1991 PSI Program, Report No. 7600-DO, Table 2.3 (1990)
(TOE=Tons of oil equivalent)

but also some middle income groups, use charcoal. 32%, mainly rural groups, use firewood. The remaining 25% mainly use propane gas or other combustibles.

Forestry expert Per Cristiansen of the FAO has estimated that about 600,000 acres (242,000 hectares) of land are needed to satisfy the total wood demand for the country. This represents about 5% of the total land area of the D.R (Martinez, 1990). In January 1987, the government designated 188,000 acres as "Areas Carboneras" in mainly the southwestern and northwestern regions of the country. Under the preceding scenarios, this represents less than one-third the land needed to supply the total 1990 wood demand, and less than 40% of the land needed to satisfy the 1990 demand for domestic fuelwood and charcoal.

The 1973 FAO report indicated a D.R. per capita consumption of fuelwood and charcoal at .45 cubic meters per year. Martinez's recent data, when compared with the WASH (1990) D.R. population estimate, yields a current annual per capita consumption of about .59 cubic meters. With the population of the D.R. expected to increase by almost 20% within the next 10 years, and Santo Domingo estimated to grow by 50%, without alternative fuels, these statistics sketch the outlines of a major long-term crisis facing the D.R. It is not just a charcoal and forest depletion crisis, but a crisis of the total energy system of the country. With or without the recent "Gulf crisis" oil shock being felt within the D.R., the country is facing serious threats even to its "declining gains" in economic development and social betterment due to its energy situation.

As is well known to AID, there are serious problems in the electric power generating capacity of the country. While providing electric power or gas as a substitute fuel for

charcoal is a logical goal, the numerous technical and financial problems facing the D.R. electric power industry make this unlikely within the foreseeable future. For example, three-quarters of the electric power generation is based on imported oil. While coal is projected to increasingly be used, it must also be imported. Within the drop in sugar cane prices and production, the near-term prospects for increased biomass co-generation above the current 6% are uncertain. Also uncertain are the prospects for increasing hydroelectric power above the current 19%.

Within the overall D.R. government, lack of financial, organizational and manpower resources makes it difficult to fully operate the existing electric power capacity in the country. Even with increased private sector production, it is difficult to see how electric power can be a realistic substitute for charcoal and fuelwood within the next five to ten years, or possibly even longer.

AID Policy Interventions

Based on the above considerations, the following AID policy recommendations are offered.

AID should adopt "increasing energy supplies" as a prime objective of its country development strategy. As discussed in the water resources section, lack of power for pumps within the water supply system causes contamination which affects human health. Lack of reliable power also affects the competitiveness and attractiveness of the tourism and free trade zone industries. (A recent article in the Engineering News Record [11/90] indicated Jamaica was having trouble attracting industries with high power demands to its free trade zones due to the unreliability of its public power support).

It is recognized that the AID Mission has already provided important technical assistance to the D.R. in support of opportunities for private sector involvement in off-site electric power production. Also the mission has previously supported the development of "energy farms" and is awaiting further policy directions from the D.R. government on energy farms policy. However, due to magnitude of the overall energy crisis in the country, and its pervasive impacts on most, if not all, aspects of economic and social life in the country, further AID emphasis on energy appears warranted. AID should take a very active role in supporting energy policy planning for the D.R., which addresses supply, demand and environmental impact concerns.

A key element of this energy supply emphasis should be directed to encouraging the D.R. government to significantly increase the currently identified acreage devoted to fuelwood plantations in the southwest and northwest regions of the country. Incentives to the private sector for greater participation are needed. Also, potential for securing "debts for energy farms swaps" should be investigated. Energy farms can be very labor intensive (MITRE, 1980). As an immediate action, AID should consider updating its 1980 energy farms study to better estimate the resource requirements needed for effective operations. Also, the fuelwood plantations strategy should also incorporate PVO support in promoting community woodlots and individual family tree planting as a way to help discourage illegal cutting.

AID technical assistance programs to conserve energy and to promote energy efficiency throughout the economy should be given high priority. These programs could include: pilot studies to determine the effectiveness of improved cooking stoves and other domestic changes as a method for reducing charcoal consumption; promoting the use of low cost passive

solar technologies for water heating; investigations into programs and incentives for organizing smaller groups of charcoal entrepreneurs to make their activities as efficient as possible regarding the charcoal production process itself (based on the presumption of the legalization of selective tree harvesting); and generally supporting incentive programs which encourage private industries to install co-generation plants sized larger than their requirements to encourage power sale to the public grid.

C. SOLID WASTE MANAGEMENT AND HEALTH

The Solid Waste Problem

One of the most obvious problems facing the cities of the D.R. is solid waste collection and disposal. On major boulevards, in public parks, and on side streets and back alleys in almost every neighborhood, one finds uncollected garbage. In many cases, it has been left for weeks. The Dominican Municipal Association has estimated that for urban areas, installed capacity for garbage disposal can handle only about two-thirds the daily production. In 1986, studies reported that less than 40% of urban households had "frequent" garbage collection.

One of the most challenging problems facing the Dominican Republic and other Third World countries is urban population growth. Due to this increase in population, the amount of solid waste has increased beyond the point where municipal governments -- with limited resources and equipment -- can manage the collection and final disposal of solid waste in the major cities. As a result, large numbers of the urban population are at risk. In poor and low middle-income communities, dwellers generally discard waste in the nearest convenient space. As a result, air, soil, groundwater, and rivers become contaminated by the proliferation of neighborhood dumping and the inadequate management of landfills. Many poor communities spring up in the periphery of landfills where informal sector scavengers -- mostly children -- redeem reusable refuse. Furthermore, the improper sanitary management of landfills are known to produce high levels of methane, a powerful greenhouse gas which increases global warming.

Institutional Framework

In the D.R., solid waste systems are traditionally provided by the municipality and viewed as a government responsibility. One of the largest municipal budget items in the D.R. is solid waste management. For the past 10 years, it has consumed an average of about 58% of Santo Domingo's municipal budget. However, with the severe overall national and municipal budget difficulties, the solid waste problem is worsening. While the population of Santo Domingo expanded by about 35% (575,000) from 1985 to 1990, the actual percentage of the municipal budget allocated to solid waste management dropped from 59% to 46%. (The actual per capita expenditure, however, increased by almost 27% during the five year period). While data on actual rates charged for solid waste or other municipal services were not available, generally cost recovery is not achieved. For solid waste, available data shows less than 1% cost recovery by the City of Santo Domingo. In the D.R. the revenue generation power of municipalities is severely limited. Since 1961, if property taxes are to be revised, this must be submitted to the Consejo Nacionale de Desarrollo, yet the Consejo has not met in 10 years.

Generally, the main problems associated with solid waste in the D.R. may be summarized as follows: lack of government priority; inadequate cost recovery; poor maintenance of equipment; low salaries for workers; and poor management of the overall operation.

Solid Waste Collection

The major solid waste problem in the D.R. is the collection function. Although mainly collected house to house, the problems with equipment availability and inadequate access to many neighborhoods due to impassable roadways, make the house to house method untenable, especially in the poor barrios which comprise most of the residential areas of the city.

While the poorest groups (below 300 pesos/month income) generate only about one-half the refuse of the highest income groups (over 1000 pesos/month income), the great size of the poorest groups results in generating about 6 times the solid waste of the upper income groups. (Table II-7) This waste is often uncollected for weeks in the most densely populated areas of the city where collection is needed the most.

Estimates indicate that in Santo Domingo, about 200 compaction trucks are needed for adequate solid waste collection. Currently, less than 50 trucks are operating within the municipal system. Combined with private companies and other agencies, a total of about 110 compaction trucks are available.

To solve many of the collection problems, various municipalities are investigating using push carts and drop-off centers as a solution for the poorer barrios having difficult access. Since 1976 Santo Domingo has had some experience in using the private sector for solid waste collection. The current public-private venture serves only about 8% of the city's population, but has a cost recovery rate of 20% compared to the city's rate of less than 1%.

Solid Waste Disposal and Recycling

Basically, there are no controls on the operations of landfills in the country. There are no leachate controls; no coverings for refuse are provided. Due to inadequately maintained unpaved roadways, truck access is poor; and many poor families are living within the sites as scavengers. There are currently 2 main landfills open in Santo Domingo, although others are used as an emergency when access to these are prohibited due to roadway conditions.

Table II-7

SOLID WASTE GENERATION AND WEIGHT BY INCOME LEVELS FOR SANTO DOMINGO (in Dominican pesos)

Variable	Monthly Income Levels			
	more than 1000	601-1000	301-600	Less than 300
Generation (Kg/Person/Day)	0.916	0.730	0.675	0.463
Volume Weight (Kg/m3)	316	303	156	318
Family Composition	8.8	6.8	6.0	6.2

Recycling Issues

With 80% of the solid waste as organic material, composting appears an attractive recycling alternative for Santo Domingo. A private venture was proposed in 1985 to produce 500 tons per day of recovered compost but the proposal was not implemented due to its high dependence on electrical power. Incineration is a questionable technique for several reasons: the high ash residue (between 20 and 40 percent) raises environmental problems regarding disposal; the energy requirement for operation is substantial; the initial investments are high; and long-term operations and maintenance requirements are substantial.

For the above reasons, sanitary landfills appear to offer the most appropriate solution for the D.R. Due to the high levels of organic matter and its moisture content, the D.R. landfill refuse is appropriate for methane recovery. This could provide the power needed for the composting operations, and could potentially be an important added source for the public power grid.

Health Impacts

There are several major health impacts associated with the solid waste problem in the D.R. Firstly, due to the collection methods and lack of landfill controls, the ingestion of fecally contained matter by refuse workers, scavengers and families (especially children) living in or near the landfills or dumps is highly likely. Secondly, poorly designed and operated landfills can cause serious groundwater and surface water contamination. In 1985, leachate from the Guaricano landfill in Santo Domingo was found to be contaminating the Yaguazu River, located on its periphery. Thirdly, landfills and uncollected refuse disposal areas within communities are breeding grounds for a wide range of disease causing vectors including rats, cockroaches, flies

and mosquitoes. This is especially the case in countries such as the D.R. wherein the waste is highly organic and exposed to rapid biodegradation. For example, the World Bank cites evidence that the rat population has multiplied in Santo Domingo in recent years. According to the National Anti-Rabies Center in Santo Domingo, over 700 cases of rat bites were reported in 1987.

Potential Policy Interventions

There are four areas where policy interventions by AID may be considered for addressing solid waste problems in the D.R.: strengthening municipal management; increasing community awareness; promoting public-private partnerships, and; improving landfill practices. These are briefly discussed below.

Strengthening Municipal Management

To improve the basic service provision of municipal systems - of which solid waste management is perhaps the most visible and serious problem in the country - there is a need to develop institutional capacity to provide adequate services for all income groups. It is also necessary to strengthen municipal capacity to generate financial resources to meet the operation and maintenance of existing systems. To this effect, training and promoting municipal development programs at different levels in order to develop such capacity should be considered.

However, to envision the solid waste delivery system as a solely municipal responsibility is not appropriate. Policies that integrate different sectors of the community in solid waste operation can be more sustainable. Solid waste system often remain in the hands of local governments because there is a lack of political will to create an environment that increases the participation of the community and the private

sector in solid waste operations. Below are several policy and operational suggestions which have been found effective in helping solid waste management practices:

- reducing regulatory barriers to private business by providing incentives to encourage resource recovery;
- stimulating the market for recycled materials perhaps through buying centers;
- establishing maintenance and spare parts facilities and providing training for mechanics and drivers; and
- establishing transfer stations where refuse can be sorted more efficiently before it reaches the landfill.

AID generally should provide technical assistance and support training in municipal management in the D.R. This recommendation is further discussed in the concluding section of this report.

Using PVOS And NGOS To Improve Community Awareness

Large sectors of the population have a limited awareness of neighborhood sanitation, personal sanitation and the health risks involved in the improper handling, storage, and disposal of solid waste. The level of understanding of this risk is related to the level of education of the population. In the D.R., only 69 percent of the population over 24 years of age have attended primary school and over 25 percent of the population is illiterate. Thus, target groups may be difficult to reach.

NGOs can be excellent resources to implement programs oriented to improving community habits, such as solid waste storage and public clean-up campaigns.

There are a wide range of potential PVO/NGO activities related to solid waste operations. Educational programs can modify

public attitudes in terms of increasing awareness of the significance of decreasing the volumes of solid waste at the source. Such programs should be implemented jointly with the provision of garbage cans (or plastic bags), and community containers or dumpsters (served by compaction trucks). A program of this nature could effectively be delivered by community-based organizations.

Promoting Public-Private Partnerships

There is evidence from refuse collection studies that privatization can save governments money and improve services for the users.

A study undertaken by Columbia University found that government-run solid waste collection was 68 percent more costly than private contracting in cities with populations above 50,000. Other studies covering several countries reveal that municipal collection was more than 50 percent more expensive per household than collection by private contractors. Also, private collection crews were found to be 95 percent more productive. What when cities do their own street cleaning, the cost is 43 percent higher than the cost for private contractors (Goodman 1985).

The Municipality of Santo Domingo has already signed a contract with EMLURB, a private company, for solid waste collection in various areas of Santo Domingo. Although EMLURB is presently going through financial difficulties and is receiving considerable subsidies from the municipal government, the overall operation of the company suggests that private-run operations for solid waste might be a viable solution in the D.R.

However, caution must be taken since private collection typically favors middle and upper income groups. Some of the

population below the poverty line might not have the capacity to pay full service fees. AID should support technical assistance studies to help determine the most cost-effective low cost options for the poorest urban areas where health risks are the greatest.

Reducing Human Risk and Environmental Degradation By Improving Landfill Practices

Due to improper practices, landfills constitute a major threat to public health and environmental conditions. The lack of leachate control in sanitary landfills expose large numbers of the population to many serious diseases and can cause irreversible environmental degradation.

In response to health and environmental concerns, there exists an urgency to improve waste disposal in the D.R., especially in the major cities of Santo Domingo, Santiago, and Puerto Plata. Recent studies in response to the present crisis in Santo Domingo have recommended a) the introduction of a sanitary landfill in Guaricano; b) the construction of a sanitary landfill in the eastern portion of Santo Domingo, accompanied by the elimination of Cancino; and c) the creation of a sanitary landfill in the western portion of the city, to be used especially for high risk industrial waste. AID should monitor these landfill improvement programs and provide technical support if possible.

The improvement of landfill practices in the D.R. would require large amounts of capital. At present, the country is experiencing one of the largest economic crises in its history. Thus, the consideration of expensive systems to improve solid waste disposal would seem impractical. Since the social costs in terms of public health can have serious long term implications for the future, some improvements to landfill and dumping operations should be considered now.

Near term improvements may be gained by modifying dumping practices and improving sanitary landfill operations and designs. To accommodate scavengers rather than discourage them, for instance, programs should be established for separating dangerous wastes (industrial, hospital, etc.) from normal wastes, and to providing community cleaning facilities, protective gear, and small equipment at the dump sites. Such measures recognize the scavengers as informal micro-sector entrepreneurs, family providers, and recyclers. PVO's could assist with such a program.

There is evidence to suggest that sanitary landfills with methane recovery is a plausible solution for solid waste disposal in the D.R. Although this has a high initial cost, long term recovery may make the operation self-sufficient. This has been proposed for Guaricano, however, the installations to produce methane and the necessary improvements to Guaricano have not started due to a lack of funds. Investments have been estimated at 3.8 million dollars to provide the necessary infrastructure (World Bank, 1990). AID should further investigate the economic feasibility of this proposal for potential funding support, possibly in concert with other international donors or lenders. The potential for low energy low technology composting for methane recovery should also be explored.

D. TOURISM EXPANSION AND THE COASTAL ZONE

Growth Trends and Impacts

Along with the free zones, tourism is one of the most important economic sectors in the D.R. economy. In 1970, tourism provided only 6.3% of foreign exchange earnings but by 1988 it provided over 33%. Tourism contributed 10% of GNP in 1988, compared with 15% for the industrial sector, 17% for the commercial sector and 12% for agriculture.

In 1971 Law 103 declared two priority zones for development, the Puerto Plata area and the zone between La Caleta and the Rio Higuamo. Also in 1971, Law 153 was established promoting tourism and establishing various investment incentives. In 1980 Law 153 was modified to designate seven priority development areas in the country, six bordering the coastal zone.

These areas included: Luperon-Cabrera (the "Costa Ambar" area); Santo Domingo-La Romara (the "Costa Caribe" strip); Macao-Punta Cana; Samara-las Terreras; Barahona-Enriquillo, and Monte Cristi-Pepillo Salcedo. These designated coastal zones or "strips" extend 5 kilometers landward from the littoral zone and essentially surround their respective cities.

From 1987 to 1990 the number of hotel rooms in the country will have increased from 12,000 to over 27,000 -an increase of almost 130%. Most of the growth since 1980 has occurred in four areas: Puerto Plata/Sosua; Santo Domingo; Costa Caribe/La Romana; and Punta Cana/Macao. (Table II-8).

Although tourism is a key growth industry for the D.R., there are questions regarding the capacity of the country to supply

Table II-8

GROWTH OF ROOM SUPPLY BY REGION, 1980-90

Region	Room Supply			Average Annual Rate of Growth	
	1980	1987	1990a/	1980-1987	1987-1990a/
Puerto Plata/Sosua	612	4,512	10,513	33.0	32.6
Santo Domingo	2,723	2,884	6,697	1.4	32.5
Costa Caribe/					
La Romana	1,117	2,360	6,771	11.3	42.1
Punta Cana/Macao	0	949	2,278	11.6	33.9
	942	1,338	2,696	10.5	26.2
Total	5,394	12,043	27,600	12.2	31.8

a/ Estimate.

Source: Horwath & Horwath, Santo Domingo News and American Express/World Bank (1990)

the basic infrastructure and services needed to continue to attract foreign visitors. There are also questions regarding the degradation of the natural environment caused by the unmanaged development of the industry. While tourism, per se, does not necessarily result in environmental degradation, it can cause problems due to a variety of related activities: the improper disturbing of dunes during facilities construction and resort operations; the clearing of mangroves; the disruption to unique species habitats; the improper treatment and disposal of wastewater and its impacts on coral reefs; and the attraction of unmanaged population growth in the surrounding area, which compounds the tourism facilities impacts.

In Santo Domingo's Colonial Zone, many of the tourism-related environmental problems are those associated with the larger city itself: inadequate water supply; frequent and prolonged power outages; unreliable solid waste collection; poor drainage; nearby squatter settlements; and exposure to the severely polluted Rio Ozama River. While there has been substantial public investment in the redevelopment of target sites in the Colonial Zone, in anticipation of the 500th anniversary of Columbus' arrival to America program, the larger environmental problems of the surrounding city remain.

In the Puerto Plata area, the qualitative impact of tourism seems to be most evident in the infrastructure inadequacies and in social and economic separation of the town from the hotels and tourist facilities. While Puerto Plata was planned 15 years ago to support the tourism industry, the supply of housing and public services was soon overwhelmed by the rapid influx of population seeking tourist-related jobs. While the city has a plan for development, there is no regulatory enforcement and the number of squatter settlements is increasing. While specific data was not available, there is expressed concern regarding the level of the contamination of

the well water used by some of the hotels. Also, concern has been noted regarding potential contamination of ground water in some tourism areas due to poor construction of some hotel septic systems.

There also appears to be poor economic integration between small businesses in local towns and the resorts. While most families are thought to have at least one member employed in tourism, the hotels offer facilities and services designed to keep the tourists and their dollars within the resorts themselves (Urban Institute, 1990).

Current Governmental Planning

An AID 1981 survey identified three key existing or potential problems associated with tourism development and the coastal zones. These included:

- potentials for serious infrastructure and related ecological problems due to the development intensities already approved for the coastal zone;
- lack of a comprehensive coastal resource inventory as a basis for determining potential ecological impacts; and
- lack of an effective planning, permitting and administrative review process to analyze waste disposal needs, physical constraints to development and basic infrastructure requirements.

Recent discussions with IDB consulting staff in the Ministry of Tourism indicated that at least some of the above deficiencies in the planning process were being addressed. Within the coastal zone, 38 areas of critical environmental significance are being studied. For the specific key coastal areas to be developed, spatial plans are reportedly being produced which include locations for permitted development, roadways, infrastructure needs and the identification of

ecologically excluded areas such as mangroves, flood plains and slope limitations. However, discussions with various professionals were inconclusive regarding whether or not there currently is a specific "environmental assessment" process for building in a "defined" coastal zone.

While these planning efforts are encouraging, several important elements seem to be missing. These include: whether or not the development intensities proposed are based upon an "environmentally sound" holding capacity for the area (e.g., relative to effluent treatment; water supply quantities and quality, etc.); and, whether or not the surrounding area growth patterns and demands were considered in the plans being produced.

Estimates of Potential Future Growth

As previously noted, the growth in the room supply in the D.R. from 1980 to 1990 has been estimated to be above 400 percent and has been mainly located in the 4 areas previously mentioned. Based on employment multiplier from 1981 sources and using ONAPLAN-INVI family size figures, for 1990, one estimates that about 56,000 employment and 274,000 population may be directly associated with the tourism industry. (Table II-9).

Data on the projected growth rates for tourism in the country and information on the projected spatial development plans for this growth are being prepared by the IDB planning team for the Ministry of Tourism. Although requested, the information was not provided to our team. However, in order to make preliminary estimates about the magnitude of this growth, and its potential environmental implications, data and criteria from several sources were assembled and assumptions regarding the potential employment and population growth due to tourism were developed.

Table II-9

POTENTIAL TOURISM DEVELOPMENT
(Conceptual Estimates)

Year	Room Supply (Total Country)	Employment* (Direct & Indirect)	Population Related** (Direct & Indirect)
1980	5,400(1)	11,000(3)	54,000
1990	27,600(2)	56,000	274,000
2000 & Beyond			
• Secenario A (1990+25%)	34,500(4)	70,000	343,000
• Scenario B (1990+50%)	41,400(5)	84,000	412,000
(Montellanos Only)	70,100(6)	143,000	701,000
• Scenario C (Montellanos +1990)	97,700(7)	199,000	977,000

Sources & Assumptions

(1),(2) World Bank compiled data, 1990. 90% of 1990 rooms are found in the 4 major tourism growth areas of Puerto Plata/Sosua, Santo Domingo, Costa Caribe/La Romana, & Punta Cana/Macao.

(3) AID D.R. Environmental Survey, 1981

(4),(5) Assumes 25% and 35% growth over 1990 levels, respectively.

(6) Based on World Bank 1990 statement regarding potential for the Montellanos area to develop to 20 times the size of Puerto Plata; assumes 7,013 rooms in Puerto Plata in 1990 x 10 times only.

(7) Adds the Montellanos growth to the 1990 development only.

* All employment estimates are based on ratios of AID 1981 estimates.

** All population estimates are based on occupants per house of 4.9 persons (ONAPLAN-INVIU, 1985)

Based on these various assumptions, within 10 years population growth related to tourism development could increase from about 270,000 now to over 400,000 people. Also, there are potentials for increased growth in market areas such as "ecotourism," which seek to capitalize on the unique biological and natural resources of the country. If certain major project areas such as Montellanos were also fully developed, additional population of over one-half million could be possible. It should be noted that these estimates of future growth do not include populations living there now or that may be associated with growth from other activities such as free zones.

Although the quantities of room supply, employment and associated populations could vary significantly from these estimates, the key point is that substantial additional growth will occur along the fragile coastal zone of the country. This area already is experiencing growth-related degradation.

The main implications from the above scenarios are that tourism development, like the free trade zones, has significant impacts on the spatial distributions of economic activity in the country.

This presents an opportunity as well as a potential problem relative to the environmental quality of the D.R. Because the locations and potential growth magnitudes can be reasonably estimated, this presents an opportunity to forecast (before it occurs) the additional demands likely to be placed on an area environment relative to land absorption, waste treatment requirements relative to discharge levels, water supply, and other factors. Based on various geotechnical conditions, one can determine an "environmental holding capacity" for the area. This would also need to include a consideration for the

infrastructure and service demands generated by other developments likely to occur in the area.

If the area infrastructure demands are known and some measure of area holding capacity is identified, public decisions about permitting specific levels of development in an area, can be better informed relative to potential environmental impacts. The current spatial planning being undertaken by the Ministry of Tourism provides an important environmental opportunity for AID in two ways: to promote coordinated area planning for environmental protection in a critical zone of the country, and; to help promote the economic integration of the surrounding communities with those of the tourism industry.

Potential AID Policy Interventions

As with most of the D.R. governmental agencies, one of the key problems is coordination among the various responsible entities and enforcement of the existing laws and regulations. The spatial planning work by the Ministry of Tourism, therefore, offers AID an important opportunity for assisting with the technical and management training for several key groups: local municipalities impacted by tourism development, the private investors; and local PVO's representing the low income groups who will need housing and basic services.

The emphasis of the AID policy intervention would not be in producing or funding of spatial plans. AID's point of policy intervention relative to tourism and the environment could be similar to those suggested in the discussion of free trade zones. This would involve support to several areas: encourage the development and adoption of an environmental assessment process for all new tourist facilities; technical support in data base development and training for local municipalities; support to PVO's in assisting with local community development for low-income groups in tourism areas;

and investigation of ways to encourage private investors to support investment and development in the surrounding community. The use of AID Housing Guarantee funds to help supply infrastructure jointly to tourism projects and local communities may be one type of incentive to consider.

E. FREE TRADE ZONES AND AREA DEVELOPMENT

Growth Trends and Impacts

While Santo Domingo and Santiago will continue to be the prime growth magnets in the D.R. for the next 20 years, the development of free trade zones (FTZ's) are believed to be having important impacts on the migration and spatial development pattern of the country.

As of 1989, approximately 112,000 were employed in 18 operational zones, which are located primarily in a 20 mile wide north-south corridor stretching from Puetro Plata to Santo Domingo, and in a 20 mile wide southern coastal corridor stretching from La Romana in the east to Barahona in the west. (Figure II-1).

Assuming one FTZ worker per family and an average family size of 4.9 persons, the 18 existing free zones potentially generate a total population of about 550,000 people. Counting indirect support employment to each zone and their families, the multiplier effects could be even higher. With 4 additional zones under construction, and 8 others being actively developed, assuming the same employment rates and family sizes would yield an additional 75,000 jobs and an additional population of about 365,000.

For conceptual purposes, if one assumes the 18 existing free zones generate a total population of about 550,000 using gravity-type allocation ratios, one could suggest that Santo Domingo's current population of about 2.4 million may be 16% smaller than it may have been without the zones. Using similar assumptions, Santiago's current population of 713,000 may be about 23% smaller than it may have been without the zones. (Note that these assumptions ignore the free zones located in Santiago and Santo Domingo). While there are many

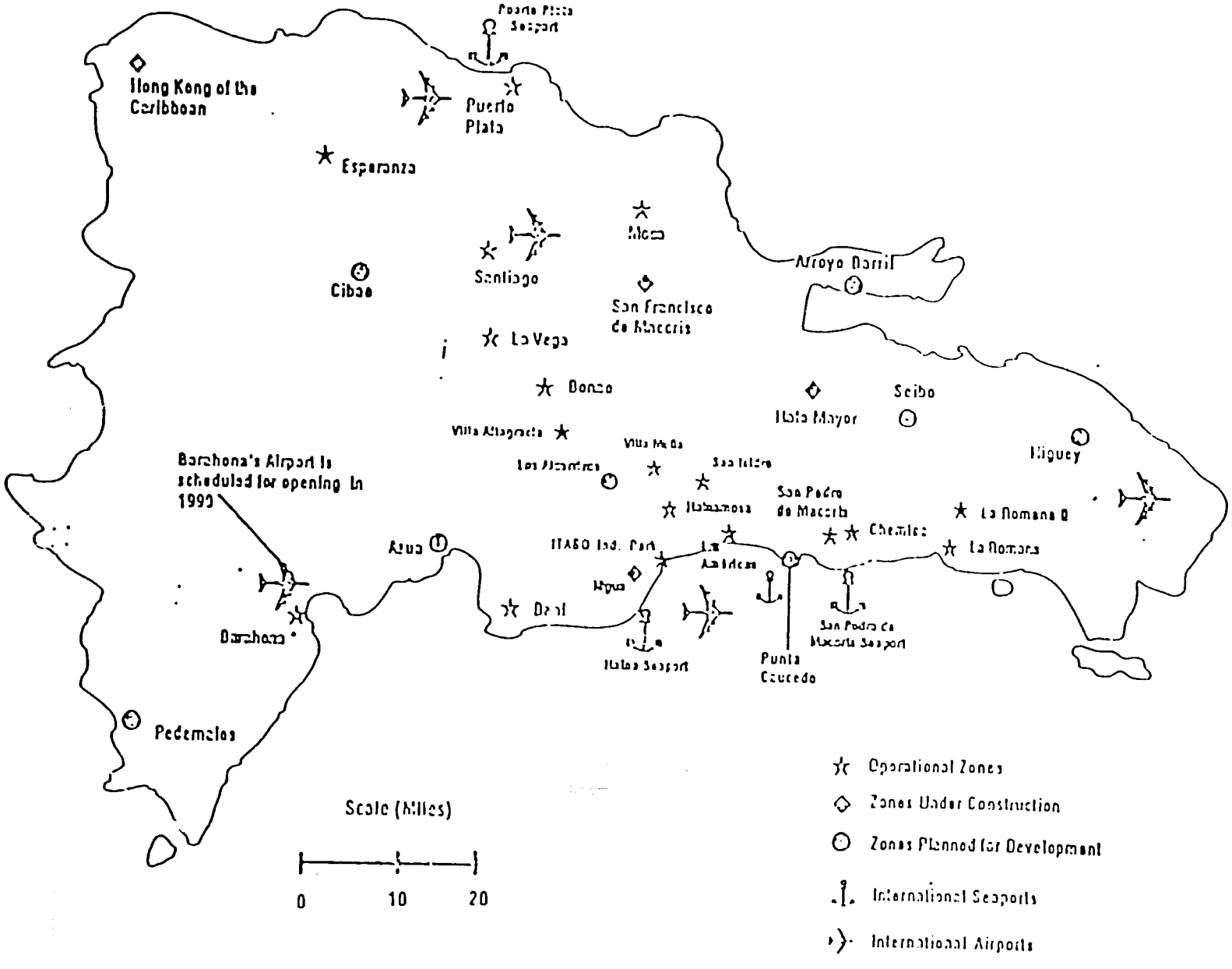
Puerto Plata Seaport
Hong Kong of the Caribbean
Puerto Plata
Esperanza
Mao
Santiago
Cibao
Arroyo Barril
San Francisco de Macoris
La Vega
Bonao
Sabo
Nuevo Mayor
Villa Altagracia
Villa Mella
Los Alcarrizos
San Isidro
Higuey
Barahona's Airport is scheduled for opening in 1990
Nizao
San Pedro de Macoris
La Romana II
Chemical
La Romana
Azua
ITABO Ind. Park
Las Americas
Haina
Baní
Barahona
San Pedro de Macoris Seaport
Haina Seaport
Punta Caucedo
Pedernales
Scale (Miles)
0
10
20
Operational Zones
Zones Under Construction
Zones Planned for Development
International Seaports
International Airports

Figure II-1

variables that may have caused other D.R. cities or other activities (e.g., tourist areas, migration abroad, etc.) to capture growth associated with the free zones, these assumptions do suggest the free zones' development policies may have helped to substantially reduce growth pressures on the two major cities.

Current Governmental Development Policy

While the free zones may have reduced urbanization pressures in the major D.R. cities, data on the zones is sketchy and initial studies are inclusive as to whether or not the development of the free zones themselves may be contributing to environmental problems. Nanita-Kennett's (1990) survey stated that although "free zones are not offering major environmental problems at this point, there are increasing concerns over the lack of environmental regulations and planning concerned with the location and operations of free zones." Physical planning for each zone (e.g., roads, water supply, garbage collection, etc.) is the responsibility of each industrial park. Although licenses for the free zones are granted by the National Free Zone Council, and ratified by Presidential decree, there are no current, nor contemplated, environmental regulations governing the location or operations of the zones. With certain minor exceptions, free zones may be located anywhere in the country.

Initial surveys indicated that while free zones are providing jobs for workers who may otherwise be unemployed, the resulting housing and living conditions around the zones are believed similar to those in most D.R. squatter settlements.

In addition to the basic problems of adequate housing and public services for the free zones, there is some indication that certain zones may be major direct contributors to the severe water pollution problems in the country. For example,

at Santiago's free zone textile industry waste water with high chemical concentrations reportedly drains directly into public streets and into the Jaque del Norte River without treatment (Nanita-Kennett, 1990).

Potential AID Policy Interventions

The economic importance of the free zones to the Dominican Republic is well known. In 1988, free zones represented 68 percent of export earnings for the country and the free zone growth rates of 10 percent make it the most dynamic export sector. AID has supported the D.R.'s export-led growth strategy to promote the development and investment attractiveness of the free zones. A basic recommendation of the study is that AID consider modifying its free zone assistance program to require the addressing of environmental impacts as a basic program requirement. Several approaches may be considered.

An initial recommendation is the promotion of a "pollution prevention pays" (PPP) program at one of the free zones. The purpose is to promote changes in operations which can produce significant reductions in discharges, often at small costs to the manufacturing operations.

AID could offer technical assistance to industries involved in planning the development of new zones or technical assistance to the National Free Zone Council in its review and approval licensing function. Also, various PVO's may be used to organize the squatter settlements around existing trade zones for basic upgrading program assistance. The Free Zone assistance program also may offer an important opportunity for AID to bring together private industry, PVO's and the government in a joint public-private-donor/lender program to promote exported growth that is also environmentally pro-active, as opposed to re-active. To reduce negative impacts, sound land

use planning in and around the zones is needed along with improvements in the plan review, approved and permiting process.

In supporting the continued development of free zones, AID should consider promoting environmental concerns not only for the output of the manufacturing processes but also concerns for the environmental impacts of the induced housing and community growth surrounding the zones. By providing strategic assistance to PVO's, the Free Zone Council and the industries themselves, AID may be able to initiate a meaningful dialogue among groups having a direct interest in improving environmental quality.

It is important to especially note that the World Bank indicates that it is supporting the D.R. government with funding to assist, among other objectives, with formulating a "comprehensive strategy for the development of new free trade zones." AID should consider jointly working with the Bank on this project, relative to overall area planning, which would include addressing spatial expansion, infrastructure provision, and transport needs.

F. URBAN EXPANSION AND ENVIRONMENTAL IMPACTS

National Urban Development Trends

Much of the migration and population growth in the D.R. within the last twenty years has mainly occurred in three growth corridors: La Romana-Santo Domingo-Azua; Santo Domingo-Santiago-Puerto Plata, and Santiago-San Francisco de Macoris. (Figure II-2). According to 1985 sources, about one-half the D.R. population is in the Cibao Valley between Santiago and San Pedro, while one-third live in the Santo Domingo region which includes the coastal plain between La Romana and San Cristobal.

During the 1960 and 1970's, the major cities of Santo Domingo and Santiago grew an average of about 6 to 6.5% annually. During this 20 year period, the smaller towns and cities grew within a range from about 4% to 6%. In the 1980 decade, the rate of urban growth has been estimated at about 4.3%, with a rural growth rate at substantially less than 1% and an overall country-wide population growth rate at slightly over 3%.

According to various D.R. governmental statistics, from 1950 to 1990 the population of the D.R. has grown from about 2.1 million to over 7.1 million. During this 40 year period, the "urban" percentage has increased from 24% to about 60%. (Table II-10). Projections for the period 1990 to 2020 show population increasing in the D.R. from 7 million to about 11 million. The "urban" percentage is projected to increase from the present 60% to over 77%.

As the two principal cities of the country, and the only two "true' urban centers, Santo Domingo and Santiago will continue to have significant importance to the future economic and social development of the overall country. Santo Domingo is the center not only of governmental, financial, and political

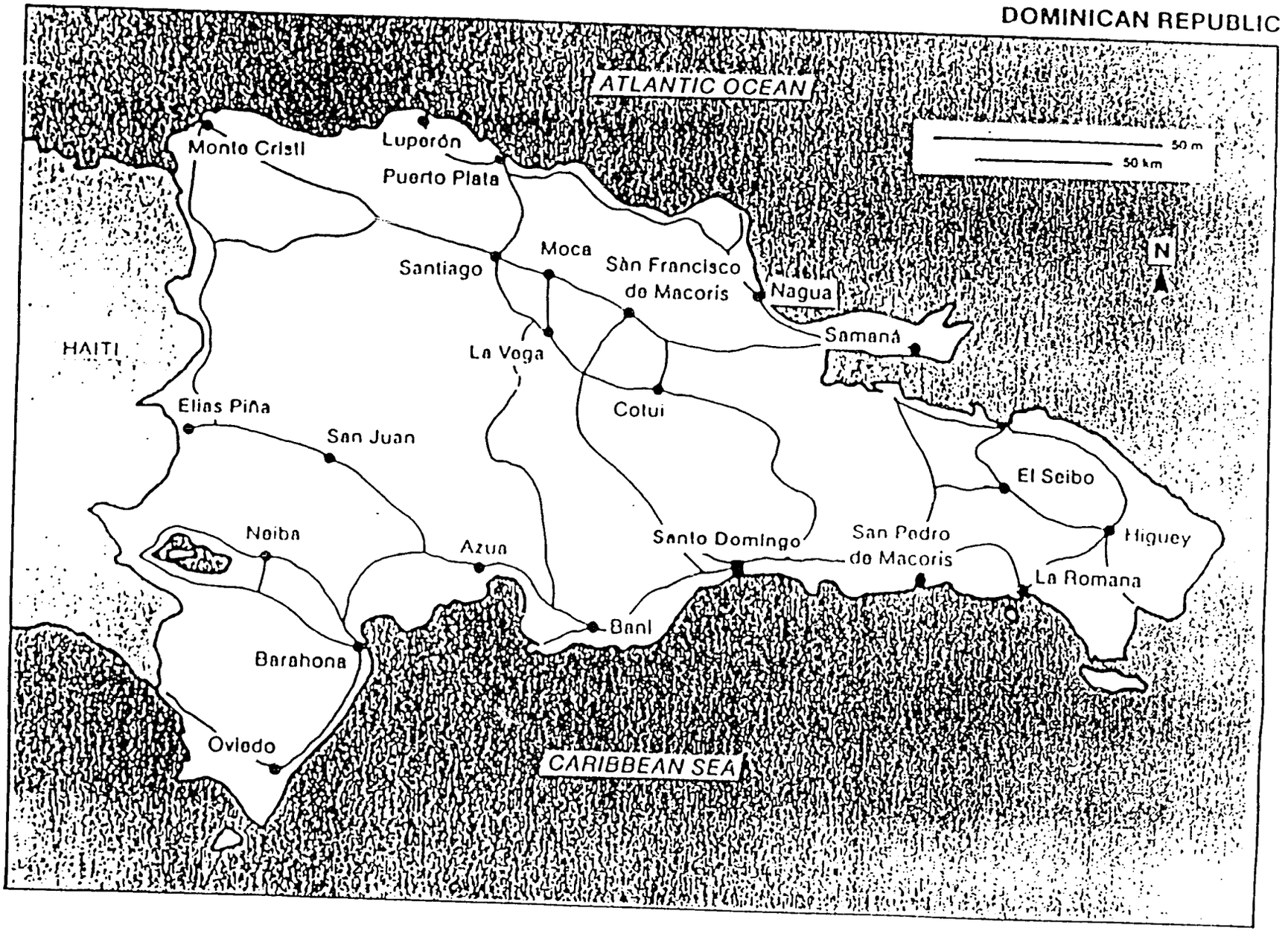
DOMINICAN REPUBLIC
ATLANTIC OCEAN
Monte Cristi
Luperón
Puerto Plata
50 m
50 km
N
Moca
Santiago
San Francisco
de Macoris
Nagua
Samaná
HAITI
La Vega
Elias Piña
Colui
San Juan
El Seibo
Neiba
Azua
Santo Domingo
San Pedro
de Macoris
Higuey
La Romana
Baní
Barahona
Oviedo
CARIBBEAN SEA

Figure II-2

Table II-10

POPULATION PROJECTIONS
DOMINICAN REPUBLIC AND THE NATIONAL DISTRICT
1950-2025

Year	Population	Urban Population Number	Urban Population Per Cent	National District	Source
1950	2,135,872	508,408	24	181,553	Census
1960	3,047,070	929,940	30	464,970 367,058	Census Almonte
1970	4,009,458	1,593,299	40	813,420 671,402	Census Almonte
1980	5,430,879	2,751,923	51	1,458,241 1,228,665	ONE Estimate Almonte
1981	5,697,977	2,935,860	52	1,550,739 1,313,172	Census Almonte
1985	6,416,000	3,478,000	55	-	WASH 303
1989	7,019,000	4,065,000	58	-	WASH 303
1990	7,169,846	-	-	- 2,248,468	ONE/CELADE Almonte
1995	7,915,317 8,045,000	- 5,936,000	- 63	- -	ONE/CELADE WASH 303
2000	8,620,870 -	- -	- -	- 3,372,702	ONE/CELADE Almonte
2005	9,285,037	-	-	-	ONE/CELADE
2010	9,906,760	-	-	-	ONE/CELADE
2015	10,485,394	-	-	-	ONE/CELADE
2020	11,006,524	-	-	-	ONE/CELADE
2025	11,453,818	-	-	-	ONE/CELADE

Sources: 1950,1960, 1970, 1981: Official Census Data, RD en Cifras
1980 ONE Estimate: RD en Cifras, 1980, Table 211.06
Almonte: Report of Emilio Almonte-Jimenez, July 1990
WASH 303: AID Water and Sanitation for Health Report 303, June 1990
ONE/CELADE: Projections of the National Office of Statistics and the Latin American Demographic Center, in RD en Cifras 1987, Tables 211.01 and 211.20

life but is also the center of national culture. Santiago serves as the regional center for the traditional agricultural economy in the north. As the growth of free zones and coastal tourism areas have increased in recent years, the migration rates to the two prime cities has likely been reduced. However, these cities are likely to continue to be the major population growth centers in the country. The ability of these cities to provide people and industry with the services and facilities necessary for efficient functioning may be an important key to the future economic development potential of the D.R.

Expansion Impacts of Low Income Housing in Santo Domingo

Recent estimates show that 70% of the total investment of the country goes to Santo Domingo. With a 1990 estimated population of 2.2 million, the city accounts for over 30% of the total country population of about 7.2 million. Within the next 20 years, Santo Domingo has been projected to reach possibly 4.9 million, which would be almost 50% of the 9.9 million projected for the entire country. Santo Domingo attracts migratory growth not only from rural areas but from other smaller cities as well. Recent estimates indicate that over 60% of the migrants to the city are from the smaller cities in the country.

Currently, Santo Domingo, the urban zone of the national district, has a population of approximately 2.2 million and a land area of 150.44 square kilometers (Km^2). This yields an overall population density for the urban zone of about 13,900 persons per kilometer (per/Km^2), although many of the poorest barrios have over double or triple this density. Of the 93 neighborhoods or communities in the city, one-third are squatter settlements. It is estimated that 90 percent of the migrant population to Santo Domingo are forced to locate to these squatter areas.

While it is beyond the scope of the study to focus on the social and economic issues associated with low-income housing policy in the D.R., a few observations are offered below, relative to overall population growth, its location and implications for overall urban efficiency.

Table II-11 outlines four scenarios addressing the spatial expansion implications for the "urban zone" of Santo Domingo under different population levels and density assumptions within the next twenty years. Assuming a density increase of 20% between 1990 and 2000, the city's urban spatial expansion would be about 27%. With no density increases, however, within 10 years the city would need to expand over 50%.

Within 20 years and a density increase of 30% above that of 1990, the city would need to spatially expand over 70%. With little or no density increases over 1990, in 20 years the city would need to more than double its current urban zone land area. Because of the many unknown factors which are involved in assessing the spatial expansion potential for Santo Domingo, the above scenarios are not intended as forecasts.

Although specific data is not available, much of the low income housing growth in Santo Domingo within the last twenty years appears to have occurred on flood plains, steep hillsides, and on other environmentally sensitive or undesirable land areas. The expansion scenarios illustrate the magnitude of future environmentally inappropriate spatial expansion if current development forces and trends are not altered.

Table II-11

SPATIAL EXPANSION SCENARIOS

SANTO DOMINGO'S URBAN ZONE

Scenarios	Year	Population[1] (millions)	Gross Density (persons/Km²)	Land Area[2] (Km²)	Land Area (Increase Over Base Case) (%)
Base Case	1990	2.20	13,900	158.44	-
A-1 1990 Density	2000	3.37	13,900	242.41	53
A-2 Density Increase (+20% over 1990)	2000	3.37	16,700	201.80	27
B-1 1990 Density	2010	4.89	13,900	351.80	122
B-2 Density Increase (+30% over 1990)	2010	4.89	18.100	270.17	71

Notes:

(1) Population estimates by Eng. Emilio Almonte Jimenez, July 1990.

(2) Poblacion y Desarrollo, Bol.6, Instituto de Estudios de Poblacion y Desarrollo, En-Ab. 1984, p.6; for Base Case Land Area only. The Urban Zone of the National District is defined by the Oficina Nacional de Estadistica to include 97 sectors. The land area cited here (158.44 Km²) is for 93 sectors which have housing included. The large permanent open areas such as The Centro Olimpico, Jardin Batarico and Jardin Zoologico were excluded from the land total.

Institutional Constraints to Managing Growth

The lack of adequate waste treatment, garbage collection, drainage facilities, and overall improper guidance to spatial development in these population growth areas has contributed significantly to deteriorating water quality problems and increases in certain human health problems. There are numerous macroeconomic and political issues underlying the problems associated with supplying adequate housing and minimally safe utilities and community services. However, many of the professionals interviewed stressed that the "lack of publicly supported planning" was one of the key reasons contributing to many of these problems.

For example, the national government has heavily supported public "urban renewal" programs that have constructed over 23,000 low-income housing units in the past four years. There is little to suggest, however, that these programs are part of an integrated strategy to stimulate the sustained development of a land market and a construction industry for longer-term supply of low income housing. Although our information is not complete at this time, most of the professionals interviewed also did not believe that there are current plans for the overall redevelopment or expansion of low-income housing areas for Santo Domingo, Santiago or for the other cities in the D.R. Although the Instituto Nacional de la Vivienda (INVI) has programs oriented toward providing housing upgrades for low-income families, these programs do not appear to be directed at locating future new low-income areas in the metropolitan areas.

The main trust of recent D.R. government policy has been to construct new highly subsidized housing for transfer to low and low-middle class families on concessionary terms. INVI, however, has sought to reorient the public sector with its 1985-88 operating pla to improve existing housing stock.

This "housing solutions" program sought to rehabilitate about 46,000 units by a variety of measures including "regularization" of land titles, creation of materials banks for repairs, improving sanitation and other technical or financial assistance.

Possibly in concert with the World Bank and other lenders, AID should consider providing assistance to INVI relative to data gathering and planning for the spatial expansion of low-income squatter settlements for major urban growth areas in the D.R. This would include Santo Domingo and Santiago and other areas being impacted by the development of free trade zones and tourism.

In addition to planning for the expansion of low-income housing, the planning for transportation is key to avoiding numerous future environmental problems.

Discussions with various sources indicated that the D.R. government was interested in developing a new transportation master plan for Santo Domingo. Also, the World Bank is currently completing a transportation master plan for the entire country. These planning efforts are important because they offer the potential for addressing the spatial expansion issues raised by the growth scenarios outlined above. AID should consider ways for supporting the planning and implementation of these programs.

Growth Policy Dimensions

For achieving higher levels of urban environmental quality in the D.R., policies to help "manage spatial expansion" of the cities must be found. These policies also should promote maximum economic efficiency in the functioning of the city. Adequate expansion of low-income housing areas is one level of

environmental concern. Regional scale economic efficiency, however, is also important to environmental quality.

An efficiently functioning and reliable public transport system is needed for any competitive economy. In many areas of the world, the planning and implementation of an effective multimodal transport system will address the metropolitan efficiency issues. With a spatial expansion potential of between 25 to over 100% within the next 10 to 20 years for Santo Domingo, the location of potential low-income housing areas may be very significant for two reasons. Firstly, unless their locations are planned, low-income housing will likely occur as squatter settlements on any available left-over land areas. Without adequate water, sanitation, site drainage, and other basic services, these areas will likely continue to contribute to water pollution problems with related health consequence for the residents. Secondly, as Santo Domingo expands, the location of small businesses and larger industries needs to be considered relative to housing locations in order to minimize travel times and fuel costs in efforts to promote overall economic efficiency of the city. A key point is that even if resources were made available today to solve many of the current water pollution and public health problems in Santo Domingo, unless the process of urban spatial expansion is altered, many current problems are likely to reappear within a few years.

Potential AID Policy Interventions

AID should explore ways to influence the spatial expansion process of the key cities in the D.R. This is not a recommendation for AID to directly promote traditional "master planning" or public sector "general plan preparation."

Within developing countries throughout the world during the past thirty years, the severe limitations of primarily

physically-oriented metropolitan planning have been documented. However, newer techniques are now available. These include regional growth management planning, performance-based building and zoning standards, and joint public-private development planning programs. These techniques provide more realistic and politically sensitive approaches to development implementation coupled with concerns for environmental quality, economic feasibility and public participation.

AID should consider strong working relationships with groups advocating or sponsoring large scale planning for the D.R., including planning for transportation, energy and water supply/waste water. Even if the D.R. public sector (whether national, regional or local) does not currently have the staffing or resource capability (or interest) for effective planning, AID could work through its network of PVO's, NGO's and private companies to promote grass-roots awareness of the importance of managing the growth of the city. AID could also provide various types of technical support to public agencies to assist with the data collection process needed for spatial planning and effective infrastructure programming and investment. Existing AID programs, such as support to Free Trade Zones, potentially could be modified to assist municipalities and other public agencies in this process. (These concepts are further expanded in the report).

III. CONCLUSIONS: AID URBAN ENVIRONMENTAL STRATEGY

A. RELATIONSHIPS TO MISSION GOALS, OBJECTIVES AND PROGRAMS

The three overall strategic goals of the USAID/D.R. Mission are indicated on Table III-1. Plan objectives are also indicated. These strategic goals and objectives, and the various programs by which they are implemented, provide a policy framework which can incorporate most of the recommendations regarding the urban environmental strategy addressed by this study. Additional strategic goals and objectives which are believed important in addressing many of the D.R.'s key environmental problems are also identified.

Free Trade Zones Program

One of the key findings of this study is that AID's FTZ involvement provides important potentials for helping promote environmental protection for major areas of the D.R. Because of their wide geographic distribution and importance to the economic base and export development policies of the country, AID could use its FTZ influence for two important additional purposes: to influence the spatial growth pattern of the country in order to promote maximum regional transportation and infrastructure investment efficiencies; and to promote environmental protection and public health benefits to local areas and groups (especially the low-income workers and their families) being impacted by the growth of FTZ's. In addition to the FTZ program, the Mission's Debt Conversion, Industrial Linkages and PVO Co-Financing Projects offer possibilities for linking these projects within an FTZ area to promote coordinated investment planning involving the private as well as the public sectors.

Forestry Policy Development

The objectives and strategy of Forestry Policy Development Project, as outlined in Annex 3 of the Dec. 1989 Action Plan, address many of the recommendations identified by this study,

MISSION ACTION PLAN STRATEGIC GOALS: 1991-1992	POLICY REFORM AGENDA AND ACTION PLAN OBJECTIVES
Goal 1 : Explain and Diversify Private Sector Investment and Employment	**Objective 1 :** To Improve the Investment Climate in Order to Promote Exports
Goal 2 : Selected Social Interventions to Address Critical Needs of the Poor	**Objective 2 :** To Strengthen the Private Sector
Goal 3 : Promote Key Sectoral Policy Reforms Which Support Mission Goals of Growth With Equity	**Objective 3 :** To Increase Agricultural Production
	Objective 4 : To Increase Access to Voluntary Family Planning Services
	Objective 5 : To Improve Health & Child Survival
	Objective 6 : To Improve Educational Opportunities
	Other Objectives : (Based on Mission Performance Indicator Data Summary • To Increase Employment • To Manage and Preserve Natural Resources

Table III-1

especially those regarding PVO's, NGO's and private sector emphasis in leadership to the forest preservation effort. However, several additional recommendations are offered:

- A greater AID emphasis is needed on the critical importance of tree farming and charcoal production relative to the overall energy requirements of the country now and in the coming decade. (But preceding this, further energy strategy studies we needed to verify and expand the very preliminary observations on secondary data represented by this study); and

- A greater AID emphasis is needed on understanding and promoting the small scale and larger scale charcoal production and distribution industry, as part of promoting commercial forestry and as part of protecting existing forests.

Energy Conservation and Resources Development Project

This AID project was scheduled for completion in February 1989, with the exception of the mini-hydro component. The prime thrust of the project was to assist the Dominican Electric Company with conservation measures. Technical assistance was also provided to the D.R. government on potential private co-generation in the country. As stated previously, the overall energy picture in the country is alarming, relative to its implications across all sectors. AID should re-evaluate its position on emphasizing energy within its basic objectives framework for the Country Development Strategy.

In addition to the charcoal/deforestation emphasis, a strategy comprising a comprehensive look at various energy conservation measures across all sectors should be initiated. This includes low cost passive solar technologies, co-generation

for solid waste composting and continued emphasis on D.R. institutional reform to promote private investment in all forms of energy production. AID overall support for and emphasis on development of a joint public/private "comprehensive energy strategy" for the country seems immediately warranted.

Data Base Programs

One of the key recommendations of this study is the need to develop a comprehensive urban environmental data base for the D.R. While the specific requirements of the system will need to be developed, it essentially should be a GIS (geographic information) system, in which spatial and geotechnical data are integrated with demographics, socioeconomic and health series data. These systems are now relatively low-cost and microcomputer based. They are also user-friendly and basically menu-driven.

The purpose of the data base program is to serve as a unified information source for AID, other international lenders, governmental agencies and relevant NGO's-PVO's. On a selective basis, it should also be made available to educational institutions and to promote public awareness programs regarding the importance of environmental issues.

Currently, the mission has proposed two new project starts using DA funds which are for data base development. The first is the Agriculture Data Systems (which may be postponed until FY93), which is outlined in the February 1989 Mission Action Plan Report. The second is a data base to be part of the AID Family Planning Expansion, as discussed in an interview with Lee Hougen. While each of the programs has specific needs to be addressed, AID should consider examining the potential expansion or modification of these programs to cover additional critical information needs suggested by this study.

It also may be more cost-effective, as well as more generally useful, to have an integrated system established, that can be expanded over time, as opposed to several independent systems. Evidently ONAPLAN, along with other D.R. agencies and donors, are to be involved in the two currently proposed AID data bases. An AID sponsored working meeting among these groups, plus key PVO's such as IDDI and Profamilia, to outline common data base needs and user requirements, may also be the most cost-effective in the longer term.

AID's Office of Housing and Urban Programs has proposed grant funds for developing an urban environmental data base complementary to a pollution monitoring program being implemented by WHO (the World Health Organization). In the D.R., as well as in most other developing countries, inventorying and monitoring of industrial emissions and other forms of pollution has not been done, especially on a regular basis. The proposed D.R. program should also be interfaced with this proposed program through RHUDO/Jamaica.

PVO Co-Financing Project

The PVO Co-Financing Project provides an important vehicle for helping resolve many of the environmental degradation issues addressed by this study. Throughout the report, numerous sections have recommended the use of PVO's to provide local and community input for project implementation.

The PVO Co-Financing Project's purpose is to increase the capacity of the PVO's and NGO's to deliver selected services and other resources at the grass-roots level to the geographically and economically isolated lower income groups. According to the AID Mission Project Paper on Co-Financing (9-22-88), the possible types of subgrantactivities under the project would include but not be limited to:

- Health Delivery
- Water and Sanitation
- Upland Irrigation
- Small Scale Commercial Forestry Plantations
- Commercial Agroforestry, and
- Community Development and Self-Help.

Recent discussions with AID staff regarding the PVO program indicated a slightly different categorization of subsector activities to:

- Natural Resources
- Hillside Agriculture
- Employment Generation
- Health Delivery
- Water and Sanitation, and
- Community Development

Within both categorizations of subgrant activities are opportunities for helping implement many of the recommendations of this study.

While basically supporting the Mission's PVO Co-Financing strategy as currently understood, there are two areas of modification to the strategy which AID should consider. These include: area-investment and environmental coordination; and the direct linking of the PVO Co-Financing Project to other AID programs.

Area Investment and Environmental Coordination

An element of the PVO strategy should include sub-program activities which are directly and explicitly funded to address investment and environmental planning and coordination among various other PVO categorical subproject areas. While

coordination with appropriate groups is required and intrinsic within each specific subproject, the emphasis recommended here is on investment planning and coordination among AID's subproject categories such as Water and Sanitation and Community Development. This strategy also recommends that the local PVO work with counterpart organizations in the U.S., such as the Nature Conservancy, to establish a model for organized action of the public and private sectors.

Linkages to Other AID Mission Programs

Free Trade Zones

In initially formulating the PVO Co-Financing Project, the Mission choose not to add social components to programs such as the Free Trade Zones (FTZ's) in order not to divert or dilute the central purposes (i.e., economic development, income generation, etc.) of these programs.

In relation to the preliminary findings and observations regarding the unmanaged environmental impacts of some of these zones on the surrounding areas, this study recommends a reconsideration of this mission strategy. Essentially, it is recommended that AID support be contingent on coordinated area planning for all parties involved (e.g., industry, PVO's, local and national government agencies) to insure adequate area environmental protection, infrastructure and social services.

Due to the magnitude of the future FTZ development anticipated for the country, one would anticipate that substantial environmental improvements could be attained without massive infrastructure investments which would detract from the economic competitiveness of the zones. The PVO Co-Financing Project could be the vehicle to help this happen.

Improving Educational Opportunity/ Institutional Building

The Mission has provided support to several types of educational programs in the D.R. aimed at supplying the needed technical and managerial personnel required for private sector led development.

The Mission's Graduate Management Training Project has established both MBA and MPA programs with a local university to provide managers for public and private sector roles. Due to the importance of tourism in the economy, a hotel management and tourism element has been addressed in this program. A key recommendation of this study is to explore with local universities the expansion of the Graduate Management Training Project to address the following areas: pollution control and environmental engineering; infra-structure, transportation and urban development planning; and municipal administration and management.

Several approaches are suggested. With an appropriate D.R. university, AID could support establishment of a research center focusing on Urban and Environmental Management, possibly along the lines of the Agribusiness Training Project's Rural Development Management Center (ISA/CADER). In addition to graduate and professional training, the center could also be a focus for local private companies to sponsor vocational training related to areas such as environmental monitoring, testing and clean-up or other areas needed to promote environmental management as a part of economic development.

B. RELATIONSHIPS TO THE DOMINICAN REPUBLIC GOVERNMENT

The lack of an effective civil service at all levels of the D.R. government is a major obstacle in addressing many of the environmental quality and growth management issues covered by this study.

Because of the importance of environmental issues to the health of the D.R. economy as well as to the health of most of its people, AID could assume a much larger role as an environmental advocate in the country. This does not mean supplanting economic development, public health, social equity and promotion of a market economy with an environmental platform as AID's primary goal and priority. However, it does imply bringing environmental goals and issues up-front and equal to the Mission's other concerns and agenda as it dialogues with the various elements of the D.R. government.

Also, with over one-half the D.R. population now living in cities (over 30% in Santo Domingo alone) and with the trend to continue, an elevation of the Mission's concerns for the country's urban development process itself seems warranted in dealing with the D.R. government.

The Mission's current overall strategy of focusing on PVO's/NGO's, public/private partnerships and continued dialogues with various levels of the D.R. government to promote policy reform, seems the appropriate strategy for addressing economic development issues. However, a different emphasis may be needed for environmental issues. As an overall strategy in relating to the current D.R. government, there are several areas where AID could support institutional strengthening regarding urban environmental issues. These include: TSP; ONAPLAN; ONAPRES; DRC; FONDUPREI; Oficina Fiscalizadora de las Obras del Estado; The Central Bank; the

League of Municipalities; and the National Environmental Commission. The following are brief suggestions regarding each of these organizations.

TSP

As a longer term option, AID should consider having dialogue directly with the Office of the Technical Secretary (TSP), for ways to raise the environmental planning and evaluation function within the overall national budget allocation process. Possibly, AID could suggest creation of a special environmental unit within the TSP, somewhat similar to the AID sponsored Local Currency Development Resources Coordinating Unit (DRC). A variation on this would be for AID to elevate the importance of environmental planning and evaluation in the functioning of this unit relative to operations of the PVO Co-Financing Project.

ONAPLAN

ONAPLAN, the National Planning Office, makes a three year rolling public investment program for the country. However, according to the World Bank (1990), in the past it has performed only limited evaluation and prioritization functions.

In the near term, the Mission should consider providing technical assistance to ONAPLAN in developing environmental criteria for project selection and evaluation for its own use and for issuing to the sector line ministries. This would also involve strengthening the environmental as well as overall project monitoring functions within ONAPLAN.

ONAPRES

ONAPRES, the National Budget Office, is also within the TSP. It prepares budgets mainly based on program requests from the line ministries. Again, according to the Work Bank and other

sources, during budget preparation, little indication of priorities or preferences is available. Also, overall there appears to be little coordination among the line ministries, ONAPLAN and ONAPRES, regarding project planning, investment programming and budgeting.

AID support to strengthening of the monitoring, programming, evaluation and budgeting function between ONAPLAN and ONAPRES, and within the TSP overall, could be an important step in the ability to have environmental concerns inserted into the national resource allocation process. AID's support to data base development, as previously discussed, contemplates ONAPLAN involvement. This is an important initial step in efforts to upgrade the information base needed for effective project selection and resource allocation.

FONDOPREI

FONDOPREI is the National Preinvestment Fund. In recent years, funds for performing preinvestment studies have been drastically reduced and FONDOPREI now concentrates on monitoring projects in the D.R. financed with external funds. The D.R. government is requesting donor support for technical assistance in preparing preinvestment studies. AID should consider supporting FONDOPREI as this presents an opportunity to incorporate urban environmental objectives and criteria, as well as other Mission objectives, into the national project identification and selection process.

Oficina Fiscalizadora de la Obras del Estado

The Oficina Fiscalizadora de las Obras del Estado is the office which manages the 1401 Fund (known as the President's Fund). Through this fund this office allocates almost one-half of the ordinary revenues of the national government. One of the functions of this office is to allocate funds relative to capital and operations/ maintenance expenditures in the

country. Because of the importance to human health, improvements to the existing water supply, sanitary landfills and other urban infrastructure systems should be receiving great levels of investment. AID should initiate policy dialogue with this office to promote a great attention to urban environmental concerns in the allocation of funds from this office.

Central Bank Debt/Equity Swap Unit

Another AID supported project is the Debt/Equity Swap Unit to be located in the Central Bank. Building on this program, AID should explore innovative ways to use the "debt-for-nature" swap concept. In recent years, countries such as Ecuador, Bolivia, the Philippines, and Costa Rica have exchanged debt for local currencies and the promise to preserve parts of the national resource base, usually unique forest areas.

In a similar fashion, the D.R. recently initiated the largest debt-for-nature project ever undertaken by a country. A PVO coalition of conservation and development organizations called PRONATURA worked with the Dominican Central Bank which has allocated 80 million dollars (US) of the country's foreign commercial debt to benefit conservation efforts. The Nature Conservancy, with Puerto Rico's Conservation Trust, has purchased over one half million dollars (US) of the Dominican debt for 20 cents to the dollar. The proceeds will be used to benefits certain national parks. (Nature Conservancy, 1990).

Especially in a country with tourism resources, a variation on the "debt-for-nature" swap theme is a "debt-for-managed development" concept. The basic idea is to structure deals in which larger scale growth areas, such as those surrounding tourism zones, are environmentally protected as well as developed in part with local currency generated by debt swaps. This should have the double advantage of helping retire D.R.

foreign debt while also helping directly promote a key growth sector which is ultimately dependent on environmental quality.

A similar concept of "debt-for-sustainable development" (e.g., energy farms) should also be explored. The key point is to link First World conservation donor interests (public and private), with private developer interests, with D.R. government interests. Such a program could also be linked to President Bush's June 27, 1990 announcement of his Enterprise for the Americas Initiative, in which debt reduction, along with trade liberalization and investment policy reform, could work together to promote economic growth in the hemisphere.

League of Municipalities

Municipalities in the D.R. are severely restricted in their ability to adequately provide the infrastructure and municipal services needed by most of their populations.

The administrative problems of cities seem to closely parallel those of the national government, including: lack of coordinated investment planning and project execution; inadequate attention to operations and maintenance requirements; inadequately trained staffs and low salaries; and overall inadequate cost recovery for varied services provided.

Because of the pervasive administrative and financial problems facing all municipalities in the D.R., AID dialogue with the key directors of the League of Municipalities itself regarding services pricing/cost recovery policies and private sector promotion seems the most important policy areas to address. From discussions with numerous D.R. professionals, however, there appears to be little planning for the future spatial expansion of the cities. Where there has been planning, there has been little monitoring or enforcement of regulatory controls in development.

This study is recommending that AID dialogue with the League of Municipalities, and selected city governments regarding the incorporation of environmental criteria as a basis of future spatial expansion. This may include the need for AID technical assistance to the League and to selected cities. For the cities, this could be provided as part of the coordinated program involving the private sector and PVO's in tourism or free trade zone areas, as discussed in earlier sections of this report.

National Environment Commission

The National Environmental Commission (Comision Nacional Para El Medio Ambiente) is an advisory group to the D.R. President on matters relating to national environmental policy. Although the commission has no professional full-time staff, it does have political influence and its executive staff appears knowledgeable and committed to environmental improvements for the country.

The Mission should consider some form of support to the Commission. For example, AID could support inclusion of the Commission in an advisory role on selected AID projects, such as the comprehensive data base program recommended by this study. This project would include other national agencies such as ONAPLAN. Eventually, the National Commission may be an appropriate office for giving technical support in establishing a working access to the data base.

As an alternative to the above recommendation, the Mission may wish to explore the concept of promoting an expanded role for an "environmental executive" at the national level of the D.R. government. While in reality this person may not have decision-making or budgetary authority over projects, international donor/lenders could require that their programs be reviewed and approved at a "one-stop" office relative to

environmental matters. This may have the effect of helping consolidate the many fragmented and overlapping agencies and laws that address environmental concerns.

Such an environmental executive could be part of the Office of the Technical Secretary to the President, where most decision-making regarding the country already appears to occur. An initial program emphasis at this office could be on helping create the environmental data base previously mentioned, which would be accessible to all responsible parties in the country.

C. RECOMMENDED NEXT STEPS

The urban environmental overview presented by this study represents an initial effort at gathering and analyzing a broad spectrum of data related to environmental quality and development in the D.R. Due to the limitation of time, manpower and the "energy crisis" conditions prevalent during the data gathering and interview period in the D.R., however, substantial additional data was sought but not available. For this reason, the suggested next steps for AID in addressing many of the issues and recommendations contained in this study are broken into three phases: additional data needs; near-term actions; longer-term strategy and a special considerations option.

Additional Data Needs

Additional data is needed in the following categories: industrial pollution; water and coastal degradation; air pollution; organization of the charcoal market; land market operations; evaluation of the Castillo Tio collective waste treatment proposal; start-up capital needs for cogeneration operations; further area surveys of tourism and free zones sites; additional health statistics; and information on infrastructure and transportation expansion plans for the major D.R. cities.

Near Term Actions

In addition to the data needs, the most important near term priority actions recommended to AID in addressing urban environmental problems are the following:

Data Ba

Development of a comprehensive relational urban environmental data base for the D.R., addressing point

and non-point pollution sources, air and water quality indicators and infrastructure systems status.

- Energy and Charcoal
  Promotion and technical assistance in development of a comprehensive sustainable energy strategy for the D.R.

- Free Zones
  Modification of AID's existing support strategy and program regarding free trade zones to address more specifically on-site as well as off-site and area environmental quality impacts.

- Tourism
  Modification of AID's support strategy regarding tourism to promote environmental protection for the coastal zone.

- Debt-For-Nature Swaps
  Investigate further the "debt-for-nature" swap strategy, especially as related not only to conservation but to promotion of sustainable economic development.

- Water Supply-Wastewater
  Technical support to feasibility studies regarding alternatives for increasing water supplies and improving wastewater disposal and solid waste management in Santo Domingo.

- Environmental Objectives Promotion
  Generally, incorporate and promote urban environmental quality improvements and infrastructure enhancements as major objectives within the Mission's Country Development Strategy.

To accomplish the above recommended near term actions, AID should provide full-time technical assistance to the D.R. government.

Long Term Actions

Eventually, the longer term action items will be influenced by AID's resource constraints and by the Mission's policy decisions regarding the recommended near term actions and their results. Based on the information available to date, however, those items which may require the longest time frame relative to implementation are the following:

- National Government Strengthening
  Support to the strengthening of the institutional capacity of the national government, and the required regulatory reform, needed to incorporate urban environment quality and general resources conservation as workable and meaningful evaluation elements in the overall sector planning and budget allocation process;

- Municipal Government Strengthening
  Support to strengthening municipal governments, through required regulatory reform, relative to increasing their management and technical capabilities in program planning, budgeting and operations.

- Environment and Business
  Actively promote environmental quality and environmental protection as a friend and direct benefactor to business and the financial community.

- Land Markets
  Generally promote the opening up of urbar land markets; this includes encouraging the government to adopt realistic incremental approaches to providing low cost

housing; continued support is also needed to help promote credit mobilization of the poorer groups for upgrading and expanding homes and businesses in the poorest communities;

- Support to Infrastructure/Transportation Planning
  Provide support to governmental agencies and international lenders promoting transport and infrastructure planning for the major cities in the D.R.

- Public Education
  Support public education and awareness campaigns at all levels of society regarding the importance of environmental quality in the lives of each Dominican.

Special Considerations Option

Due to the likely rapid expansion of the Santo Domingo, Santiago and Puerto Plata areas within the next few years, AID should consider directly sponsoring a 5 year technical assistance program to help "manage the expansion" of these high growth areas.

The focus should initially be on technical support such as environmental mapping, and other data base tasks. Where possible, this effort should be coordinated with other D.R. governmental or donor-lender programs for transportation, infrastructure and tourism planning.

The next steps would involve using the information in dialogue with various governmental agencies, other lenders, private developers and PVO's in finding least cost ways to provide minimally needed roadways and utilities and eventually serviced sites. In essence, the basic idea is to initiate a dialogue among the various groups on how to manage the urban growth that is coming.

10/

Final Observations

Environmental problems in the D.R. are significantly influenced by a variety of dynamic international macroeconomic forces, such as world oil, sugar and tourism industry markets. Environmental problems in the country, however, are also significantly effected by and closely interrelated to the localized activities and economic decisions of urban and rural families, businesses and governmental agencies at all levels in the country. Problems such as deforestation, pollution of the rivers, damage to the coral reefs off-shore and a general deterioration in the livability quality of the cities and towns in the country did not occur rapidly, but over several decades. Their ultimate solution, therefore, will not occur quickly. When solutions do occur, it will result from the efforts of many groups, both public and private, at all levels of the society. While the international economic forces cannot be controlled by the people of the D.R., many of the local action affecting environmental quality can be controlled.

Due to the various "crises" facing the country now, however, which includes gasoline shortages, rapid inflation, prolonged power-outages, and many other problems, one gets the impression from talking to many people that the quality of life in the country is rapidly deteriorating. AID alone cannot do much directly about this growing pessimism in the country. However, by helping many groups to understand the causes or reasons for these problems, and by helping identify solutions (even if long term), AID has the potential to provide valuable assistance to the country.

ANNEX 1.

STUDY GOALS, SCOPE OF WORK, TEAM AND APPROACH

A. GOALS AND OBJECTIVES

The prime purpose of this study is to assist AID in developing an urban environmental strategy for the Dominican Republic (D.R.) to be used as input in formulating the Mission's overall Country Development Strategy. Relative to the overall goal, there are several interrelated supporting objectives, including:

1. To identify the major environmental trends and issues that are associated with urban growth and development in the D.R.; this includes identifying those areas where policy intervention opportunities may exist for promoting environmental quality, associated with human health, social equity, and the promotion of economic growth and efficiency;

2. To examine the policy connections among various sectors in the economy (i.e., free trade zones, tourism, agriculture, energy, etc.) as these relate to or impact upon urban development and the indicators of environmental quality;

3. To specifically address issues associated with deforestation and charcoal demand, water quality, solid waste, coastal zone development and other key issues effecting overall urban expansion and environmental quality; and

4. To review the Mission's current goals, objectives and programs for the D.R. and to suggest ways in which these programs could be augmented or expanded as a basis for implementing strategic urban environmental policy interventions in the country.

The study concludes with an identification of additional data or studies needed and an identification for the next steps required in implementing the or recommendations.

B. SCOPE OF WORK, STUDY LIMITATIONS AND APPROACH

The prime data collection period for this study occurred during the two week period of 23 October to 2 November 1990 in Santo Domingo. The work was performed by a three person team, incuding: J. Michael Cobb (team leader); Boris Oxman and Milagros Nanita-Kennet. The basic scope of work involved collection of available secondary data and reports, selected site visits and interviews with Dominican governmental officials, private industry representatives, local professionals, AID staff and various private voluntary organizations (PVO's).

Dr. J. Michael Cobb is the prime author of the report, with contributions from team members Boris Oxman (water quality) and Milagros Narita-Kennet (solid waste). While substantial information was acquired during this period, it is important to note the limitations on data availability. This especially included limitations on access to governmental officials and other professional groups during the in-country work period due to the D.R. "energy crisis". While the analyses and preliminary recommendations presented in this draft report are thorough relative to the resources available for the work, additional data collected is needed, as indicated in the concluding section of the report.

ANNEX 2.

WATER POLLUTION, HEALTH IMPACTS AND URBAN INFRASTRUCTURE

A. WATER POLLUTION AND ECONOMIC DEVELOPMENT

The use and mis-use of water resources, and human intervention in the natural hydrologic cycle, combined with the accelerating pace of urbanization, pose a grave threat to the ability of the Government of the Dominican Republic to sustain its programs of economic development based upon industry and tourism, as well as to protect the health and welfare of the population. Interviews with knowledgeable concerned individuals, both within and without public agencies, and perusal of publications and the daily press, reveal an almost total absence of public awareness of environmental problems and their short and long term implications. Those public officials who expressed awareness and concern lack the political support, the human resources, and the funds required for effective action. The problem of water pollution is pervasive, affecting the underground water in the aquifers, the surface waters in the streams, rivers, and lakes, and the nearshore coastal waters.

The aquifers, especially those in the vicinity of Santo Domingo, are being degraded at a rapid rate by a combination of human activities. These include unrestrained withdrawal of water for domestic and industrial use, which reduces the hydrostatic pressure of water flowing toward the sea and permits the inflow of salt water. In addition, the uncontrolled practice of depositing sanitary wastes and industrial wastes in the aquifers is contaminating the very waters that are being pumped out for domestic consumption. Although laws exist that would regulate such activities, the several agencies responsible for enforcing them lack the technical manpower and equipment needed to effectively monitor such activities.

Agricultural practices, including the clear-cutting of hillside forests for cultivation, grazing, and coffee plantations, as well as the cutting of trees for fuelwood and timber, expose the soils to the action of wind and rain. This generates erosion, which is translated into high levels of sediments in the streams and rivers. When the flow of sediment-laden waters is slowed or stopped, as in reservoirs for hydroelectric generation, irrigation, or water supply, the sediments settle to the bottom. The volume of space occupied by the sediments reduces the storage capacity for water, and thereby shortens the useful economic life of the facilities.

Minerals and other substances in the soils add taste to the water, which sometimes makes it unpalatable for domestic use or requires that it be treated to make it useful for various industrial purposes. The absence of forest cover accelerates run-off, which increases the rate of erosion, generates downstream flooding, and reduces the opportunities for water to percolate into the soil to replenish the underground water table.

Surface waters may be contaminated by inadequate site drainage systems, by the deposit of human sanitary wastes and by discharge of industrial wastes. The water in streams and rivers also is affected by the use of agricultural chemicals (fertilizers, fungicides, herbicides, and pesticides) as well as by petroleum derivatives that are washed off paved surfaces in urban areas. The non-point sources of pollution are supplemented by the impact of concentrations of animals, such as dairy farms and other forms of animal husbandry.

Coastal waters are affected by the flow of polluted streams and rivers, by the direct discharge of human and industrial wastes, and by the development of industry and tourism along the shore. The increased recreational use of coastal waters

adds to the stresses generated by artesanal and commercial fishing. The great dependence on imported fuels exposes coastal waters to the threat of damage from spills of petroleum and other substances that may be toxic to aquatic species and that may affect important beaches. High levels of sediments in streams that flow into the coastal waters adversely affect fringing mangroves, nearshore coral reefs, and other marine life that are important for the fishing industry.

All of the above have been observed and commented on by concerned scientists and others in the Dominican Republic, but little has been published in the way of scientific evidence or facts that connect them directly to the health and welfare of the population. Some of the available evidence is cited in the next section.

Water Pollution and the Urban Environment

For the purpose of this study, the term "urban environment" must include any activity or combination of activities that generates concentrations of human beings, whether for residential, recreational, tourism, institutional or economic purposes, such as commercial and industrial complexes.

The impacts of water pollution are many and varied. They range from the direct effects on human health to indirect effects, such as the very low rate of return visitors to tourist areas in the D.R. Evidence of such conditions is found in official statistics and reports, as well as in articles by engineers, social scientists, environmentalists, and planners. The statistics, however, are scattered among various agencies and documents, and a considerable time will be required to identify all that are pertinent. Only a general overview can be presented on the basis of the materials available. The statistical series are often

incomplete or conflicting with one another, as may be observed from the tables included in this report.

B. ANALYSIS OF WATER QUALITY

The Statistical Yearbook of the Dominican Republic includes several sets of data related to water. One table contains data on the physical characteristics of water, obtained from samples collected at locations on various rivers. Table 2-1 extracts the information on eight physical characteristics, including sedimentation, for the ten rivers that demonstrated the highest sedimentation levels, plus the Haina and Ozama Rivers in the National District. Outstanding in that table is the build-up of sediment levels in the Yaque del Norte River, for which samples are taken at four locations. In comparison, the Haina and Ozama Rivers have low sedimentation levels.

The data show measures for a variety of elements, but they do not include toxic substances and heavy metals. To be significant, the water quality samples should be tested for metals such as mercury, as well as for the components of agricultural chemicals, such as fungicides, herbicides, and pesticides. There is no explanation in the table concerning the numbers of samples taken at any location, nor if they are taken at a specific time of the year. Further, it is not feasible to determine if water characteristics have changed over time unless a comparative table is constructed for several years.

Table 2-1

LEVELS OF SEDIMENTATION AND OTHER COMPONENTS OF WATER IN SELECTED RIVERS
Dominican Republic, 1986

River	Station	Suspended Sediments (Gr/L)	Calcium	Alkalinity (pH)	Magnesium	Sodium	Bicarbonate (HCO3)	Sulfate (SO4)	Chloride
Licey	Naranjal	0.860	2.21	8.3	3.46	4.83	5.4	2.04	2.39
Blanco	Blanco	0.583	0.93	7.5	0.51	0.25	1.3	0.05	0.25
Yaque del Norte	Las Charcas	0.013	0.69	8.1	0.40	0.27	1.0	-	0.25
	Manabao	0.040	0.70	7.8	0.30	0.18	1.0	0.01	0.19
	Puente San Rafael	0.110	2.73	8.5	2.31	1.92	2.3	0.03	1.06
	Palo Verde	0.358	2.31	8.3	2.00	2.09	2.3	2.58	1.19
Yaque del Sur	El Puente	0.030	1.59	8.2	1.06	0.65	2.3	0.02	0.75
	Conuquito I & II	0.223	2.76	8.2	1.59	1.75	2.5	1.46	1.33
Bajabonico 0.63		Imbert	0.223	1.58	8.1	2.10	0.62	2.9	0.60
Mao	Bulla	0.183	0.63	7.6	0.42	0.25	1.1	0.02	0.19
Nizao	Palo de Caja	0.180	1.05	8.2	0.84	0.39	1.6	0.15	0.33
	Bocaina	-	1.27	8.0	0.59	0.34	1.7	0.12	0.38
	La Lechuza	0.040	1.68	8.4	0.63	0.29	1.7	0.15	0.31
Amina	Inoa	0.140	0.84	8.0	0.32	0.24	1.2	0.02	0.23
San Juan	Sabana Alta	0.098	2.10	8.0	1.79	1.06	3.8	0.09	0.83
Yuna	El Limon	0.090	1.67	8.1	1.22	0.28	2.4	0.07	0.53
	Piedras las Veganos	0.013	1.20	8.1	0.40	0.35	1.4	0.20	0.19
Ozama	San Juan	0.033	0.69	7.8	0.58	0.38	1.5	-	0.29

The data presented in the yearbook do not show bacteriological contamination. Water provides a medium for the transmittal of many different kinds of infections and diseases. A usual standard for determining water quality is the number of colonies of coliform bacteria; standards relate to total count of coliform colonies or to counts of fecal coliforms or fecal streptococcal bacteria. Table 2-2, adapted from a report issued by the World Bank, notes that of 1,278 samples taken from water supply systems in the eight health regions of the D.R., 472, or almost 37 per cent, exceeded the allowable coliform count, and were considered contaminated. An analysis reveals that the proportion of contaminated water samples ranged from 34 per cent in Region 0 (National District) to 57 per cent in Region VII (the northwest corner of the nation that includes the Yaque del Norte River). The southeastern corner of the Republic (Region V), which includes the tourist areas at La Romana and San Pedro de Macoris, had the second lowest proportion of contaminated samples.

In a report on the Yaque del Norte River, prepared by two engineers early in 1990, there is a brief discussion on the levels of coliform bacteria discovered in samples taken at three points in the vicinity of the city of Santiago. The samples taken from the river above the intake of the city's water supply system showed a level of 2,300 coliforms per 100 milliliters (100 ML), which was an acceptable level for water for domestic use prior to filtration. Samples taken further downstream, below the confluence of the Nibaje River with the Yaque del Norte, showed 400,000 to 600,000 coli/100 ML. The Nibaje carries wastes from a tannery and other manufacturing plants. Other samples taken from the Yaque del Norte above the outfall from the municipal sewage treatment plant showed a level of 11 million coli/100 ML, which was described as "totally contaminated". The effluent from the sewage

Table 2-2

BACTERIOLOGICAL QUALITY OF WATER SUPPLY
Dominican Republic, by Region, 1986

Region	Number of Samples	Contaminated Samples*	
		Number	Per Cent
O	555	189	34.1
I	186	73	39.2
II	68	30	44.1
III	115	49	42.6
IV	63	28	44.4
V	122	45	36.9
VI	49	24	49.0
VII	60	34	56.6
Total	1,278	472	36.9

* Values greater than 2.2 coliforms (NMP).

Source: Dr. Defillo National Public Health Laboratory
[As published in Report Number 7600-DO
World Bank, March 1990]

treatment plant showed a level of 21,000 coli/100 ML, which, to the engineers, demonstrated that the plant was working effectively, considering that no chlorine had been applied at that point.

A more thorough analysis would permit the plotting of the locations where samples were taken, as well as the various land uses in the area, to determine the impact of human settlements on the quality of water in the rivers, especially the presence of bacteria, and a review of the morbidity records for each area to determine the relationships between pollution and diseases.

Analysis of Morbidity and Mortality Data

Information on morbidity (incidence of diseases) and mortality (causes of death) can be related to water pollution. The data for the Republic reveal that two water-borne diseases (gastroenteritis and diarrhea) are high on the list in terms of morbidity, and are especially important in terms of the causes of death among infants and young children. The data are presented in Tables 2-3, 4, and 5, which come from different sources.

It must be noted that health statistics can be misleading, because there are many public health service units that fail to submit timely reports of the causes of death and of morbidity. Hence, the statistical series may be skewed, and may be misleading to a casual researcher.

The seriousness of the situation in the D.R. is highlighted in the following excerpts from a report of the World Bank, issued in March 1990:

Table 2-3
MORBIDITY RATES FOR SELECTED DISEASES
Dominican Republic, 1970-1987

		1970	1981	1984	1987
Gastroenteritis,	cases	30,000	108,400	158,600	90,300
	rate*	715	1,920	2,530	1,346
Dysentery	cases	6,900	2,600	2,800	2,000
	rate*	164	46	44	29
Infectious Hepatitis	cases	1,600	2,000	2,400	2,300
	rate*	39	36	38	33
Malaria	cases	200	280	240	120**
	rate*	4	49	39	18
Syphilis	cases	700	16,300	17,600	8,000
	rate*	207	289	281	120
Tuberculosis	cases	600	1,800	3,100	2,000
	rate*	15	31	49	30
Typhoid	cases	1,100	1,800	1,100	1,600
	rate*	26	31***	26	23
Measles	cases	2,100	3,400	4,300	5,000
	rate*	51	60	58	74
Gonorrhea	cases	11,600	13,200	19,300	8,300
	rate*	271	234	308	124

* = Rate per 100,000 population
** = 1987 figure from SESPAS/OPS 1988
*** = 1979

Source: Secretary of State for Public Health and Social Affairs (SESPAS), as published in Report Number 7600-DO, World Bank, 1990 (adjusted by author)

Table 2-4

CASES AND RATES OF INFECTIOUS DISEASES
Dominican Republic
(Selected Years, 1981-1989)

Disease	1981	1982	1983	1984	1985	1986	1987	1988	1989
GASTROENTERITIES									
Cases	108,388	125,510	139,336	158,623	107,757	88,423	126,060	165,578	164,612
Rate *	185.7	210.0	227.6	260.0	167.9	134.8	187.9	247.0	234.7
TYPHOID/PARATYPHOID									
Cases	1,053	1,635	1,477	1,606	1,065	1,103	1,867	2,577	3,043
Rate *	1.8	2.7	2.4	2.6	1.7	1.7	2.8	3.8	4.3
DYSENTERY									
Cases	2,583	2,251	2,506	2,771	1,312	1,519	2,825	-	-
Rate *	4.4	3.8	4.1	4.5	2.1	2.3	4.2	-	-
HEPATITIS									
Cases	2,016	2,522	2,807	2,373	1,570	1,552	2,999	2,913	2,188
Rate *	3.5	4.2	4.6	3.9	2.4	2.4	4.5	4.3	3.1
TOTAL REPORTED									
Cases	114,040	131,918	146,126	165,373	111,597	92,597	133,751	171,068	169,853
Rate *	195.4	220.7	338.7	271.0	174.1	141.1	199.4	255.0	242.2

* Cases per 10,000 population
Source: Secretariat of State for Health and Social Affairs (SESPAS)

Table 2-5

PRINCIPAL CAUSES OF DEATH IN INFANTS AND CHILDREN*
Dominican Republic, 1982 and 1986

Rank	Cause	1982 Under 1 Year Number	1982 Under 1 Year Per Cent	1986 Under 7 Years Number	1986 Under 7 Years Per Cent
1.	Other causes originating in the perinatal period and mal-defined	1,294	20.0	2,735	42.7
2.	Other intestinal and mal-defined infections	892	14.2	1,091	17.0
3.	Hypoxia, asphyxia and other affections of the fetus and newborn	828	13.2	584	9.1
4.	Retarded fetal growth, fetal immaturity and malnutrition	406	6.8	**	**
5.	Other protein-caloric malnutrition	262	4.2	166	2.6
6.	Pneumonia	252	4.0	121	1.9
7.	Other illnesses of the endocrine glands, metabolism, and immune system	224	3.5	n.a.	-
8.	Septicemia	199	3.2	248	3.9
9.	Meningitis	153	2.4	n.a.	-
10.	Other congenital anomalies	135	2.2	354	5.5
11.	Mal-deformed signs, symptoms, and morbid states	540	8.6	380	5.9
12.	Other causes	1,091	17.4	732	11.4
	TOTAL, ALL CAUSES	6,276	100.0	6,411	100.0

* These figures reflect only those infant deaths actually registered. The actual number of infant deaths in 1982 is estimated to be double that (i.e., 12,500) given the estimated populations of 5.8 millions, crude birth rate of 33/thousand, and infant mortality rate of about 65 per 100 live births.

** Included in Category 1

Source: Division of Statistics, Secretariat of State for Public Health and Social Affairs (SESPAS), as published in Report Number 7600-DO of the World Bank, March 1990. (Adjustments by author)

"During the 1980s, average health standards have deteriorated considerably. The incidence of water-borne diseases, especially gastroenteritis, typhoid and paratyphoid, as well as other maladies like tuberculosis, syphilis and gonorrhea, have climbed. For example, the number of reported cases of gastroenteritis alone, which mainly affects children, tripled between the mid-1970s and the mid-1980s, reaching epidemic-like proportions (i.e., 159,000 cases)."

"While official statistics indicate that the incidence of these and other communicable diseases peaked in the mid-1980s, and in some cases declined thereafter, the rate of morbidity from the ten main communicable diseases was substantially higher in 1986 than in 1981."

"More than 70% of the high rate of morbidity (179 per 10,000 inhabitants in 1986) is accounted for by water-borne diseases, which are transmitted mainly by contaminated water."

Gastroenteritis is a debilitating disease. Although it can be fatal in children, it is a serious matter for adults, too, and can be tied to high rates of absence from work and a loss of productivity. Although some people are able to develop a tolerance of the bacteria, through life-long exposure, the disease is especially hard on tourists, whose systems are not usually prepared to resist the effects. Not only do such illnesses spoil vacations, but they can generate long-lasting negative impressions, which are transmitted to other potential visitors to the county.

C. POLLUTION IN PUBLIC WATER SYSTEMS

Although all 133 urban communities in the D.R. possess a public water system, a significant proportion of the urban population does not have direct or indirect access to piped water. In the rural communities, only about 15 per cent have some form of public water system. However, under present circumstances, even those who have piped water in their houses are not secure against water-borne bacteria. Tables 2-6 and 2-7 present data on the proportions of households served by various water delivery systems and by different forms of sanitary facilities, broken down by various categories of urban and rural development. It is worthy of note that the smaller urban centers have a higher proportion of households with water piped into the house, while the largest city (Santo Domingo) has a smaller proportion. One explanation for this phenomenon may be the rapid growth of Santo Domingo, with a majority of the new population settling in informal residential areas which do not provide water or sewer service.

There are several reasons why public water systems are not secure against contamination. The primary reason appears to be the frequent, prolonged loss of electric power. When the power is off, and the pumps are not functioning, there is no pressure in the water mains, and ground water may infiltrate the pipes and contaminate the water lying stagnant in the pipes. The ground water in the urban areas may be contaminated because of the lack of adequate sanitary collection and treatment facilities, resulting in the frequent use of latrines and septic tanks that are not adequately maintained. Also, inadequate site drainage in residential, commercial and industrial areas increases human exposure to pollutants and may contribute to groundwater contamination. The loss of electric power also affects the filter plants, so

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Table 2-6

SOURCE OF WATER, BY REGION
Dominican Republic, 1988
(Per Cent)

	Total Population	Santo Domingo	Other Urban Areas	Frontier Rural	Sugar Cane and Livestock	Other Total Areas
Totals	100.0	100.0	100.0	100.0	100.0	100.0
Faucet inside house	23.2	26.7	44.6	0.5	12.1	9.6
Faucet outside house	26.1	23.3	31.5	16.5	21.6	27.2
Faucet in the street	9.1	27.3	3.7	1.9	8.2	0.8
Faucet in another house	12.0	12.7	16.0	11.3	7.4	10.7
River	10.0	0.0	0.0	39.2	19.0	18.8
Well	8.0	0.0	0.3	19.3	11.7	18.4
Spring	2.9	0.0	0.0	1.4	6.9	5.4
Cistern	2.4	0.0	0.0	0.0	0.0	0.0
Tank or barrel	1.6	9.9	0.3	7.1	2.6	3.1
Other	4.7	0.0	3.5	2.8	10.4	6.1

Source: Tufts University School of Nutrition, "Determinants of Food Consumption in the Dominican Republic," Medford, MA, April 1988 As published in Report Number 7600-DO, World Bank, March 1990

SANITARY FACILITIES, BY REGION
Dominican Republic, 1988
(Per Cent)

	Total Population	Santo Domingo	Other Urban Areas	Frontier Rural	Sugar Cane and Livestock	Other Total Areas
Totals	100.0	100.0	100.0	100.0	100.0	100.0
Private toilet	23.3	38.9	42.2	2.4	2.3	9.2
Shared toilet	5.0	13.0	5.4	6.1	0.9	0.8
Private Latrine	42.0	19.0	29.6	18.4	56.3	64.9
Shared Latrine	19.2	29.1	15.6	40.6	16.5	14.5
No facilities	10.5	0.0	7.3	32.5	24.2	10.7

Source: Tufts University School of Nutrition, "Determinants of Food Consumption in the Dominican Republic," Medford, MA, April 1988 As published in Report Number 7600-DO, World Bank, March 1990

Table 2-7

PROJECTION OF POPULATION, WATER DEMAND, AND SUPPLY
City of Santo Domingo
1990-2010

A. PROJECTION OF POPULATION AND WATER DEMAND

Year	Population	Per Capita Daily Water Demand	Total Daily Water Demand
1990	2,248,500 (Estimated)	90 gallons	8.84 cm/s *
2000	3,372,700 (Projected)	100 gallons	14.76 cm/s
2010	4,890,400 (Projected)	100 gallons	21.42 cm/s

* - cubic meters per second of water flow

B. ESTIMATED AVAILABILITY OF WATER

Source	Method	Normal Condition Normal Power	Drought Condition Normal Power
Isa-Mana-Duey	Gravity Flow	1.62 cm/s	1.00 cm/s
Valdesia	Gravity Flow	6.30 cm/s	4.00 cm/s
Mata Mamon-Marenos	Pumped (Aquifer)	1.49 cm/s	1.49 cm/s
Bajo Haina	Pumped (River)	1.49 cm/s	0.70 cm/s
Isabela	Pumped (River)	0.44 cm/s	0.16 cm/s
Villa Mella	Pumped (Aquifer)	0.26 cm/s	0.26 cm/s
Las Caobas	Pumped (Aquifer)	0.10 cm/s	0.10 cm/s
Other	Various (Aquifers?)	0.88 cm/s	0.88 cm/s
Total Daily Supply		12.49 cm/s	8.59 cm/s

Source: Emilio Almonte-Jimenez, PE: Report to Foro Urbano, July 1990
Adjustments by author

that the water entering the system is not completely treated to eliminate bacteria and viruses.

In some areas, as noted above, where water is being pumped from aquifers, other persons are discharging industrial and sanitary wastes into the same waters, fouling the aquifer for all users. Although there are laws to regulate the taking of water from wells, the resources are lacking to enforce them and to monitor the use of the aquifers.

The contamination of water supply systems takes on special importance in the vicinity of the new "Free Zones" and tourism development centers. The development of such areas attracts people from the hinterlands who are seeking jobs. Generally, they migrate from one area to another without resources, and are unable to acquire standard housing. They congregate in substandard housing along the margins of the industrial areas and on the edges of urban areas, where there is no water or sewer service. Although the law requires the Free Zones to have sewage disposal facilities, some factories discharge their wastes into the nearest street or watercourse. The substances in those discharges frequently contain irritants and toxic elements, which directly and indirectly affect the health of the nearby residents. They run off into receiving waters eventually, contaminating them and making them unfit for domestic or industrial use.

D. COASTAL ZONE IMPACTS

Pollution of the nation's streams and rivers, combined with the discharge of industrial and sanitary wastes into coastal waters, adversely impact several kinds of coastal resources, and indirectly affect important sectors of the local economy. Sediments settle out on reefs and thalassia beds and smother

them, thus destroying important areas that nurture marine life. Sediments cause turbidity in coastal waters, reducing their desirability for recreation and tourism.

The discharge of wastes into near-shore waters affects recreational beaches with odors and unsightly materials, and can cause skin infections, as well as some water-borne diseases. The substances may also affect marine life, especially fish and shell-fish, either killing fish or, by being ingested into the organisms, may cause illness in humans who consume them. Data on the impacts of municipal and industrial effluents on the D.R. fishing industry was unavailable.

The series of reports by Dr. Plinio Cabrera for the Secretary of State for Tourism pinpoints the problem areas in each proposed tourism zone, and recommends corrective and preventive measures. The general objectives of the management proposals are: to promote the reasonable use of natural resources; to preserve natural habitants to the greatest extent possible in the context of development; to restore environmental quality in coastal areas, including coastal waters and beaches; to stimulate sustainable commercial fishing activity; to halt the deterioration of aquifers, especially due to the uncontrolled withdrawal of such water from the ground; and the establishment of buffer zones between incompatible existing or proposed uses. There are many other objectives and recommendations that do not bear directly on the topic of water, but that relate indirectly to problems of developing sustainable tourism in areas where other uses have long existed, such as beaches within sight of industrial operations.

E. WATER SUPPLY PROBLEMS

In addition to water quality, the maintenance of adequate water supplies for urban, industrial, agricultural and flow-augmental purposes is a key environmental problem facing the country. The two largest metropolitan regions, Santiago and Santo Domingo which are discussed below are of key concern. While additional data is needed to form specific conclusions, available data summarized below suggests the potential dimensions of the water supply problems.

River Flow Augmentation Deficiencies

It is common practice to count on rivers to dilute the effluents discharged from industrial plants and sewage treatment plants. To attain that objective, however, it is essential to maintain at least a minimum flow of water throughout the year. Water use plans must take into account the maximum demand for water during periods of lowest flows, such as during extended drought. This becomes especially critical when the total unassigned flow is assigned to irrigation, as has occurred in the upper reaches of the Yaque del Norte River near Santiago. The river's waters must satisfy public needs for domestic use, as the first priority. The remaining water is assigned to irrigation.

The river's normal flow in the vicinity of Santiago is 25 to 30 cubic meters per second (cms). The priority flow for the municipal water supply is 1.5 to 1.7 cms, leaving between 23.5 and 28.3 cms for irrigation. However, the river's flow is known to have dropped to 18 cms during period of extended drought. Below the city of Santiago, the river receives the wastes of several industrial plants, the outfall from the sewage treatment plant, and the waters of other tributary rivers and streams. In addition, there is a return flow from the irrigation system, which picks up agricultural chemicals.

The smaller tributaries carry heavy loads of sediments, the result of rainfall on open slopes and fields. Thus, except for intermittent flood flows, the river is practically an open sewer in certain stretches.

In his recently published book on the Dominican forests, Dr. Eleuterio Martinez states that twenty-four rivers in the Republic no longer have constant flows of water, and that another twelve streams are carrying sharply diminished flows. This situation is ascribed to the deforestation of large areas in the interior of the country. Dr. Martinez states that a process of decertification has begun. Such a natural process is extremely difficult to reverse. If it is permitted to proceed, it will have serious adverse consequences.

Urban Supply Problems

In addition to river flow augmentation problems, adequate water supplies for meeting the needs of growing urban needs, expecially Santo Domingo, is a major concern.

In Santo Domingo, about 50% of the population have piped water inside or outside the house, while about 40% have access to nearby commercial faucets. However, about two-thirds of the pumped supply is lost through leakages in the distribution system. In Santiago, about 50% of the supply is lost. In Santo Domingo, the World Bank has estimated current demand of 7.6 m^3/second (cubic meters per second) at twice the actual supply.

Although water supply is currently a problem in Santo Domingo, within a few years it may become critical. Based on estimates of population growth, per capita demand, and supply sources by Eng. Emilio Almante, daily water demand within 10 years (year 2000) will be about 14.76 m^2/second. (See Table 2-7) Under normal rainfall and electric power conditions, all currently

available sources, without loses, can supply only 12.49 m^3/second. Under drought conditions, the supply drops to 8.59 m^3/second. His estimates of supply include aquifers, gravity flow systems, and the newly completed Valdesia agreement project. (CAASD estimates the Santo Domingo deficit, exclusive of water losses, to be 8.0 m^3/second by the year 2000).

Protection of Santo Domingo aquifers are especially important. Estimates show a capacity to supply about 2.73 m^3/second (before transmission losses) of the current 7.6 m^2/second demand. However, various sources report that the aquifers are being rapidly degraded on a variety of activities. These include unrestrained withdrawal of water for domestic and industrial use, which reduces the hydrostatic pressure of water flowing toward the sea and permits the inflow of salt water. In addition, the uncontrolled practice of depositing sanitary wastes and industrial wastes in the aquifers is contaminating the very waters that are being pumped out for domestic consumption. Although laws exist that would regulate such activities, the several agencies responsible for enforcing them lack the technical manpower and equipment needed to effectively monitor such activities.

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F. EXISTING INSTITUTIONAL RESPONSIBILITIES

The government structure of the D.R. includes several agencies that have responsibilities for water resources in one form or another. They include the following:

- Institute Nacional de Recursos Hidraulicos (INDRHI)
  (National Institute for Hydraulic Resources)
  Responsible for multi-purpose use of water, including irrigation and hydroelectric power

- Instituto Nacional de Aguas Potables y Alcantarrillados (INAPA)
  National Institute for Potable Water and Sewers)
  Responsible for water supply systems and for sanitary sewer system for the entire nation, except for the National District (Santo Domingo) and Santiago

- Corporacion de Acueducto y Alcantarrillado da Santo Domingo (CAASD)
  (Aqueduct and Sewer Corporation of Santo Domingo)
  Responsible for water supply system and for sanitary sewer system for the metropolitan area of the capital city

- Corporacion de Acueducto y Alcantarrillado de Santiago (CORAASAN)
  Responsible for water supply systems and sanitary sewer system for the metropolitan area of the city of Santiago

All four agencies are creatures of the state, and are independent of one another. In theory, CAASD, CORAASAN and INAPA are self-sustaining through the collection of fees for water service. Actually, the fees collected are seldom adequate to meet operating costs and to finance expansion of the systems. INDRHI builds dams and reservoirs with installed hydroelectric generating capacity, but turns the generating facilities over to the Corporacion Dominicana de Electricidad (CDE) without reimbursement of its investment in the facilities or for operation and maintenance of the dams.

Other agencies of the government have responsibilities for other kinds of natural resources. Their names are indicative

of their jurisdictions, but frequently their responsibilities overlap, in some cases causing friction. The primary resource agencies are listed below:

- Secretaria de Estado de Agricultura (SEA)
  (Secretary of State for Agriculture)
- Subsecretaria de Estade de Recursos Naturales (SURENA)
  (Undersecretary of State of Natural Resources)
- Departamento de Recursos Pesqueros, (SEA)
  (Department of Fishery Resources
- Departamento de Tierras y Aguas, (SEA)
  (Department of Land and Water)
- Departamento de Vida Silvestre, (SEA)
  (Department of Wildlife)
- Secretaria de Estado de Salud Publica y Asistencia Social (SESPAS)
  (Secretary of State for Public Health and Social Assistance)
- Direccion General Forestal (DGF or FORESTA)
  (Forestry Directorate-General)
- Direccion Nacional de Parques (DNP)
  (National Parks Directorate)
- Secretaria de Estado de Turismo (SECTUR)
  (Secretary of State for Tourism)
- Comision Nacional para el Medio Ambiente, Oficina de la Presidencia
  (National Commission on the Environment, Office of the Presidency)

The activities of all government agencies are coordinated through the National Budget Office (ONAPRES), and major projects are cleared through the National Planning Office (ONAPLAN); all agencies submit periodic statistical reports to the National Office of Statistics (ONE). All of these units are in the office of the Technical Secretariat of the Presidency. Although a major concern for environmental matters is demonstrated by many public officials, the

decisions made at the top level often are made without consideration for such concerns. The National Commission on the Environment, for instance, has prepared reports and recommendations for dealing with the Haina and Ozama Rivers in the National District. However, the activities recommended must be carried out by the government agencies already in place, and it is difficult to assure the coordination needed to provide the resources and to provide the appropriate monitoring of their execution.

In response to the apparent lack of environmental concern at the top level of government, and for the lack of coordination related to major long term investment programs and their environmental impacts, a number of private groups have been formed to raise public awareness of the need for such concern. One such group is Foro Urbano (Urban Forum) which has held several small conferences to bring together public officials and concerned individuals for open discussion of basic problems. Recent seminars touched on water and waste disposal and on housing and urban development patterns, especially for the low income migrants from rural areas.

G. POLICY OPTIONS AND RECOMMENDATIONS

Options

Given the range of problems and the inter-relationship among them, the following is a list of potential policy options:

1. Undertake a massive reforestation program to protect the nation's drainage basins against further erosion and decertification.

2. Promote a soil conservation program to protect arable lands against further erosion and degradation.

3. Implement existing regulations for regulating the drilling of wells and the taking of water from aquifers, and for assuring effective monitoring of the quality of the water in the aquifers.

4. Enforce the requirements for industrial waste treatment plants.

5. Develop and implement a comprehensive program for multi-purpose use of the nation's water resources.

6. Prepare designs and arrange financing for long term development of water supply systems to assure an adequate supply of potable water.

7. Develop an integrated approach to investment in and management of land, water, and other resources.

8. Investigate appropriate methods of collecting and treating sanitary wastes, so as to protect underground waters against contamination.

9. Promote public awareness of the environment and the need for effective conservation and preservation measures.

Recommendations

Certainly it is unrealistic to expect hugh investments in facilities under present conditions. Vastly increased investments in water supply and sanitary sewer systems will be required in any event, simply to support the on-going economic development programs for industry and tourism. Some of those investments will be made by the private sector. The extreme need may promote the effective coordination of projects by public and private agencies. Among the possibilities for making the most efficient use of available resources are the following:

1. A prime recommendation is to encourage private sector involvement in responding to needs for urban infrastructure related to water and sewage systems. For example, there are opportunities for the privitization of metering and billing services for water use.

2. Support private voluntary organizations that promote awareness programs, to bring pressure for government action related to urban development needs and for environmental matters.

3. Encourage conservation programs for energy and water.

4. Promote the forestry program. Investigate the possibility of a Civilian Conservation Corps-type program to make use of young, able-bodied people in the reforestation effort. Train them to be the teachers of a conservation ethic among their peers.

5. Organize programs to induce cooperation by the manufacturing sector in environmental programs, building on the current policies and practices of the corporate headquarters in other countries.

6. Support programs to raise awareness of sanitation measures to reduce the incidence of debilitating diseases and absenteeism from employment.

7. Support the training of specialists in local institutions of higher education or abroad in areas related to environmental protection, conservation, and management.

8. Support the development of proposals for voluntary design, construction, and operation of urban service facilities, such as that proposed by Roberto Castillo-Tio for the northern area of Santo-Domingo (which requires further detailed development). The adoption of a "pollution prevention pays" program, similar to the program proposed for the free zones, would be an initial element of this undertaking. One model for this collective treatment entity is the private Gulf Coast Waste Disposal Authority in Texas.

ANNEX 3.

ENERGY SUPPLY, URBANIZATION AND DEFORESTATION

A. DEFORESTATION PROBLEM

The overall deforestation of the Dominican Republic since the early 1900's has been dramatic. In reviewing the various technical data source, the Dominican agro-forestry engineer Eleuterio Martinez (1990) has estimated that from the turn of the century until 1986, the D.R. forest cover has been reduced from about 85% (4 million hectares) to 10% (.50 million hectares). From 1973 to 1986 the deforestation rate from all causes has been 459 Km^2, or about 113,400 acres annually. Considering some natural regeneration in abandoned areas, the net rate of deforestation within the last ten years is assumed to be around 78,000 acres annually.

Assuming this to be accurate and assuming that the rate of depletion for the last ten years continues, within less than sixteen years most of the forest cover within the D.R. could be destroyed. While certain knowledgeable people indicate that the rate of forest depletion has slowed in recent years (due to the 1967 governmental ban on tree cutting) data to confirm this position was not available. Also, Martinez's (1990) work seems to indicate that massive deforestation is continuing.

Most environmental scientists agree that deforestation has significant environmental impacts. It contributes to soil erosion, which in turn leads to increased stream sedimentation rates and ultimately to the rapid rates of reservoir silting associated with reduced capacities for hydroelectric projects. Deforestation also dramatically effects precipitation patterns in river basins.

The deforestation of the D.R., like many third world countries, involves a complex series of economical, political, social, and environmental forces. Measures such as the 1967

law banning tree cutting and permit restrictions on the transport of charcoal may be effective responses for curtailing indiscriminate cutting of trees in certain areas. However, a longer-term policy response will be needed to address the underlying web of social and economic forces contributing to the deforestation problem. This section of the report seeks to highlight some of the key issues involved with deforestation and how it relates to potential AID urban environmental policies and strategies.

In his recent book entitled "Los Dosques Dominicanos" (The Dominican Forests), Martinez (1990) identifies five key "enemies" that he says are threatening to totally destroy the Dominican forest: forest fires; the small mountain farmer; the expansion of the cattle production industry; the demands for fuelwoods and charcoal production; and the clandestine cutting of special species, such as ebony and cedar, for a variety of purposes.

While the scope of this study did not permit a comprehensive inquiry into each of these areas, the results of our efforts did indicate that the increasing urban demands for charcoal to be one of the most significant causes of deforestation in the country.

In the D.R. and other developing countries, the issues surrounding deforestation, fuelwood, and charcoal, all are closely related to overall macro-economic conditions and to specific energy policies within the country. Data on overall energy consumption in the D.R. highlight these relationships.

B. DEMAND FOR WOOD, CHARCOAL AND OVERALL ENERGY

According to the World Bank (1990) total energy consumption in the D.R. has increased at 4% per year from 1980 to 1986, compared to a population growth rate of 2.4% and a growth in real gross domestic product (GDP) of 1.3% per year. As shown by Table IV-1, energy consumption in the D.R. is about 83% of the average in Latin America generally. Petroleum imports were equivalent to 9% of gross domestic product (GDP) in 1987 and petroleum consumption relative to GDP was higher than any other oil importing country in Latin America. As another point of comparison, 1984 data indicated the D.R. per capita energy consumption to be only 30% of Jamaica's, 15% of Puerto Rico's, but over 700% of Haiti's.

Table 3-1
PER CAPITA ENERGY CONSUMPTION IN SELECTED LATIN AMERICAN COUNTRIES, 1986 (KOE)

Countries	Consumption
Brazil	781
Colombia	755
Uruguay	745
Chile	726
Ecuador	720
Panama	634
Peru	543
Costa Rica	543
Dominican Republic	372
Paraguay	281
Bolivia	263
Nicaragua	259
Honduras	201
Guatemala	176
Salvador	145
Haiti	55
Average	450

Source: ONAPLAN/WORLD BANK
KOE (Kilograms of Oil Equivalent)

As shown by Tables 3-2 and 3-3, and according to official government estimates charcoal and fuelwood accounted for about 44% of total annual energy consumption in the D.R. from 1975 to 1980. By 1985, however, charcoal and fuelwood consumption had increased to approximately 55% of the total energy consumption. Note also that the percentage of total energy accounted for by wood, electricity and gas (LPG) rose only slightly from 1975 to 1985, while the percentage use of petroleum related products (minus LPG) actually decreased by about 13%. Note also that in offical government statistics, charcoal consumption in the mining and industrial section is over three times greater than in the commercial and residential sector.

Presently in the D.R., petroleum refining capacity meets only about two-thirds of the total demand. For the 40% of the population served by the electric power system, disruptions have been significantly increasing in recent years. Three-quarters of the electricity generated is mainly dependent on imported oil. Only 19% is from hyrdro- power and less than 6% is from biomass (bagasse). Some imported coal is used for power generation and will expand in the coming decade. The prospects for increased domestic use of biomass, especially co-generation plants associated with sugar cane production, however, has been radically reduced, This because of the 50% reduction in the sugar industry due to decline in international prices (World Bank, 1990).

While projections for future energy demand by sector and by fuel type are unavailable and uncertain at this time, recent trends for the D.R. suggests that fuelwood and charcoal are

Table 3-2
ENERGY CONSUMPTION (100 TOE) 1976-85 PERIOD

	1975	1980		1985
COMMERCIAL AND RESIDENTIAL				
Wood	361	414		489
Charcoal	111	128		254
Gas (LPG)	58	83	114	
Electricity	107	130		145
SUBTOTAL	637	755		1002
TRANSPORT				
Gasoline	316	311		337
Diesel and Gasoline	100	186		120
Other	40	67		94
SUBTOTAL	458	584		551
WINES AND INDUSTRIES				
Gasoline	200	124		185
Heavy Fuels	395	400		216
Charcoal	538	505		859
Electricity	65	82		125
SUBTOTAL	1198	1111		1385
AGRICULTURE				
Diesel and Gasoil	7	11		12
Other	1	1		1
SUBTOTAL	8	12		13
TOTAL	2299	2442		2951
GROWTH RATE		1.2		3.9

Source: COENER and Bank staff estimates
TOE (Tons of Oil Equivalent)

Table 3-3

ENERGY CONSUMPTION 1975-1985 PERIOD
(100TOE)

All Sectors	1975 (%)		1980 (%)		1985 (%)	
Wood	16	44	17	43	17	55
Charcoal						
• commercial & residential	5	28	5	26	9	38
• mines & industry	23		21		29	
Diesel, Gasoline, Gasoil Heavy Fuels & Others	46		45		32	
Gas (LPG)	3		3		4	
Electricity	7		9		9	
	100%		100%		100%	
TOTAL	2,299		2,442		2,951	
Growth Rate	-		1.2%		3.9%	

Source: Adapted from COENER and World Bank estimates, DR/1989-1991 PSI Program, Report No. 7600-DO, Table 2.3 (1990)
(TOE=Tons of oil equivalent)

likely to remain primarily fuels for most of the rural as well as urban households for the coming decade and possibly beyond.

Sources indicate that although charcoal is the primary cooking fuel used by the urban poor, it is also used by many middle income urban families. The rural poor, however, mainly rely on firewood as a prime fuel. Traditional economics suggests that charcoal demand may be subject to the relative prices of alternative fuels such as electricity and liquid gas. However, the current high rate of inflation in the D.R. and the related variety of macro-economic policies associated with the current energy crisis complicate the analysis at this time.

For example, the World Bank indicates that electricity in recent years has been heavily subsidized by the national government. In 1988 the price was only about 40% of the costs of production. Also, due to low taxation, retail petroleum prices were among the lowest in the world. However, in recent months there have been dramatic governmental price increases for gasoline (over 300% from July to October) and severe power rationing policies by CDE (no electric stove use after 7 P.M.) for addressing the energy crisis. Also, the price of charcoal has reportedly increased several hundred percent in recent months.

Until the overall macro-economic policies of the D.R. are further clarified, especially regarding energy regulatory controls and taxation, meaningful cost comparisons among competing fuels appears problematic and could not be done for this study.

According to Martinez, (1990) from 1964 to 1980 the D.R. production of charcoal is estimated to have been 1.2 million

sacks annually. From 1981 to 1986, government statistics show 1.3 million sacks produced annually. From 1987 to 1989 the government's production figures report a dramatic production decrease to 650,000 sacks annually, which are less than one half the annual levels of the 1964 to 1986 period. This dramatic decrease is due to the severe government restrictions imposed on charcoal production following the "Operativo Selva Negra" of August 30, 1986. Martinez (1970) indicates that in 1986 these restrictions annually increased the price of a 35 kilogram sack of charcoal from RD$15 to about RD$60 in Santo Domingo.

Informed sources indicated that within the past few months a 35 kilo sack of charcoal, when available, in Santo Domingo has risen from about RD$40 to about RD$200, a 500% increase. In addition to the restricted supply of charcoal, other factors such as gasoline shortages and prolonged electricity disruptions may be contributing to the severe inflationary pressures on charcoal prices. AID has estimated an overall inflation rate for the D.R. economy to be approximately 70% for 1990. The charcoal price rise has been substantially above this. Since charcoal is primarily used by the poorer urban groups, these increases are likely to impose increasingly severe financial hardships on these lower income groups in the major cities.

Various sources indicate that charcoal is the prime cooking fuel of the urban poor, in both the larger cities and smaller towns. Many middle income families also use charcoal. The rural poor, however, mainly use firewood. Martinez (1990) estimates that currently 43% of the D.R. households use charcoal and 32% use firewood, for a total of 75% of the households. The remaining 25% use propane gas and other combustibles.

Given the projected growth rates of population for the D.R., and the likely financial and institutional limitations to alternative fuel sources for most Dominicans within the next decade, strategies for addressing wood and charcoal policies, overall energy supply and forest depletion will need to be formulated concurrently.

Martinez (1990) estimates of charcoal productions and consumption in the D.R. are substantially higher than the official production estimates cited above. He estimates that in 1987, the D.R. consumed about 7.5 million sacks, which is equivalent to 2.6 million cubic meters (m^3) of firewood. This is in addition to the 1.3 million (m^3) of estimated firewood consumption used by bakeries, poultry farmers, laundries and other commercial establishments. Martinez's overall D.R. estimated consumption of all wood products is as follows:

• timber for various uses	500,000 m^3
• industrial fuelwood	175,000 m^3
• domestic fuelwood	1,350,000 m^3
• charcoal	2,610,000 m^3
Total	4,635,000 m^3

This indicates that about 29% of total consumption was for domestic fuelwood and over 56% was for charcoal. Together domestic fuelwood and charcoal comprise over 85% of the total demand for wood in the D.R.. The remainder is for timber and industrial fuelwood needs. Forestry expert Per Cristian of the FAO estimates that about 600,000 acres (242,210 hectares) of land area is needed to satisfy the total wood demand for the country. This represents about 5% of the total land area of the D.R.

In January 1987 the national government (by decree number 25) designated approximately 760 Km^2 (about 188,000 acres) as

"Areas Carboneras," or charcoal areas, in primarily the southwestern and northwestern regions of the country. This designation represents less than one-third the total land needed to supply the wood demand for the country in 1990, and less than 40% of the land needed to supply the 1990 demand for domestic fuelwood and charcoal.

Due to the current "energy crisis" in the D.R., the general inflationary trends in the overall economy and the specific drastic increases in recent charcoal prices, projections of overall charcoal demand for the next ten to twenty years are not presented at this time. A few trend observations on the preceding data are offered for discussion, however.

Martinez's (1990) data indicated that in 1989, the D.R. consumed 4.635 million m^3 of wood for all purposes. About 4.135 million (89%) was for fuelwood and charcoal. For a population of 7,019,000 (WASH, 1990) this results in a consumption of fuelwood and charcoal of about .59 m^3 per person. The 1971 FAO report indicates a 1970 consumption for fuelwood and charcoal at .45m^3 per person. While there may be many data collection, definitional or conversion factor difficulties which would account for much of the differences in these ratings, the trend is clear. As confirmed by the World Bank data (Tables IV-1&2), the rate of consumption within the past 20 years has dramatically increased This results in a very negative implication for future deforestation since the prospects for alternative fuels is extremely poor under existing trends and government policies.

B. POTENTIAL POLICY OPTIONS

Based on the increasing demands for fuelwood and charcoal in the D.R., several potential areas for policy intervention may be considered. These include:

a) restrictive or punitive measures
b) demand reduction techniques
c) supply strategies
d) substitution programs, or
e) combination of the above

Restrictive Measures

The restrictive measures include those instituted by the D.R. government in recent years including the prohibitions on the transport of charcoal and the general ban on tree cutting. Efforts by FORESTA and DNP to protect the prime forests of the Bermudez and del Carmen Ramirez National Park, and the two Cordillera Central National Parks, seem to have been effective in slowing the advance of slash and burn agriculture and charcoal making in these areas. Although, current statistics were not available, informed sources indicated that the 1967 law closing sawmills and prohibiting tree cutting has not been effectively enforced by FORESTA in the non-pine forests areas of the country. This is especially the case for the dry forests of the Southwest.

Current data on the monitoring and control of dry forest cutting for charcoal was not available. However, the 1980 AID Country Environmental Profile indicated that FORESTA's monitoring of charcoal transport accounted for only about 20% of the 4.8 million sacks produced in 1979. AID, through dialogue with the government, could encourage these policies to be considered in concert with others discussed here. While the official data available on charcoal production suggests that restrictive policies since 1987 have been effective, other estimates by Martinez (1990) on overall deforestation and charcoal consumption suggests that these policies have not been effective.

Demand Reduction

Demand reduction techniques can take several forms such as technical measures to improve stove designs to increase efficiencies or increased sales taxes on charcoal to discourage consumption.

Improved stove designs offer potential for substantial energy saving for rural and especially, for urban households. The amount of savings depends on the type of cooking methods and stove devices being used by rural and urban households. For example, studies in Zimbabwe indicate that the "high grate" device is about 10% efficient, while the "three-stone hearth" is about 15% or greater. A "lower grate" method, however, was 22% efficient. While the National Academy of Science (1980) study indicated that improved stove designs can probably yield efficiencies of 20 to 30%, they indicate that such savings have yet to be substantiated outside laboratory tests, due to the large number of variables involved in actual cooking practices.

Hosier (1986) in his energy planning research for Zimbabwe indicated that the adoption of energy efficient stoves for rural and urban households could generally be assumed to offer, at most, a 25% reduction in consumption. He cautions, however, that "Numerous stove programs throughout the world have provided no tangible benefits to the populations they were designed to serve." Nonetheless, most energy experts suggest that improved efficiencies are possible and offer important policy options. AID should consider incorporating a cooking stove efficiency pilot project within its PVO Co-financing program.

Increased sales taxes on charcoal is not considered a realistic or recommended policy option due to several factors. It would be a very regressive tax on those least able to afford it, since the higher income group use less charcoal

than the urban poor which use it almost exclusively for cooking. Secondly, such taxation should only be reviewed relative to an overall D.R. governmented energy pricing and revenue revision program, which is beyond the scope of this study.

Supply Strategies

The single most important policy intervention option for reducing D.R. deforestation may involve increasing the supply sources of fuelwood and charcoal. This would mainly be done through increasing the acreage devoted to fuelwood plantations in the southwestern and northwestern regions of the country. As previously mentioned, in 1987 the national government designated about 188,000 acres as "charcoal production areas, which may represent only about 56% of the land needed to supply the 1990 charcoal demand. (If the domestic fuelwood demand is also included, the designations would supply only about 37% of the total land needed). With an estimated population increase of over 40% during the next twenty years, even with significant demand reductions due to efficiencies or fuel substitutions, substantial increases in land areas devoted to fuel plantations will be needed. This appears to be a policy intervention option with a high potential benefit to the national environment as well as to poorer income groups within the D.R..

Current public and private operations of energy farms in the D.R. is believed to be minimal relative to need. While specific data on governmental and private programs was not available, discussions with several knowledgeable sources indicated two or three large corporations are operating energy farms of several thousand hectares. Also, numerous smaller trucking companies are reported to be involved in transporting charcoal from the western region for sale to local distributors in the larger cities. Martinez (1990) estimates

that the fuelwood and charcoal industry contributed between R.D.$262 to R.D.$300 million pesos to the 1987 economy. While this represented less than 2% of the country's 1987 GDP, its significance may be more political than economic.

Since 1982 there have been over twenty-three laws or government decrees enacted to protect and regulate the D.R. forest. As with other government environmental policies, however, there is little enforcement and limited public compliance. Martinez attributes this to the powerful economic and political forces which tend to make the small rural farmers, who harvest wood and produce charcoal, into a powerful voting block.

There are likely powerful urban connections as well. For example, a small news article in a recent (October 1990) Dominican newspaper indicated that the Mayor of Santo Domingo was investigating allegations that municipal garbage trucks were being used to clandestinely transport sacks of charcoal. Whether or not the recent D.R. permit restrictions on transporting charcoal are effective could not be determined at this time. The recent dramatic price increases suggest that supply is being restricted. The effectiveness of this as a long term policy solution, however, seems questionable when alternative fuels do not appear a realistic alternative.

Studies by Hosier (1986) and others in Africa and elsewhere in the developing world suggest that three types of fuelwood supply projects may be needed for an effective strategy:

- individual farm approaches
- communal or community scale wood lot approaches and
- larger commercial plantations

In selected provinces, individual farm families would be encouraged to set aside approximately 1/3 hectare for tree planting, which could serve as an individual tree farm, windbreak or orchard for the family. Various grant incentives could encourage this individual action. In the large community wood lots could be established by cooperatives or the local government, on already established community or public lands. The larger fuelwood plantation option could be operated on private land by private corporations. Currently, in the D.R. there are several of these plantations of over 1,000 hectares each. Data on the precise number and size of these larger fuelwood plantations was not available, however.

The above three level fuelwood supply option seems appropriate to consider for the D.R. at this time. With an AID emphasis on grass root organizations, PVO involvement and the encouragement of the private sector, overall programs to enhance rural incomes and agricultural productivity could be modified to address this fuelwood supply strategy. While it is beyond the scope of this study to address potential AID rural development policies, the fuelwood supply approach appears to offer environmental and economic enhancements for rural areas and population while providing a much needed fuel supply for urban groups as well.

As previously discussed, charcoal demand has significantly increased within the last fifteen years and is likely to continue into the foreseeable future. Relative to overall energy efficiency, this could be discouraging since more than 50% of wood's energy is lost during the charcoal production process. However, charcoal is easier and less costly to transport than wood, and its smokeless concentrated heat is more convenient than wood for urban households. Charcoal demand in the D.R. therefore, is likely to increase substantially within the next two decades.

One area for potential energy efficiency increases is in the charcoal production process itself. While it is beyond the scope of this study to investigate the production technologies themselves, research has shown improved kilns and retorts to substantially increase efficiencies in production, and to offer potentials for liquids recovery which may be useful as petroleum substitutes. AID program to promote energy production should consider investigations into the most efficient plantation methods for charcoal production.

Since 1986 AID has promoted the development of "energy farming" in the D.R. through ESF funding. A total of 5,825 hectares are planned. Currently, 3,274 hectares have been approved for financing. The "local current component of the fund to help establish pilot energy farms has made no disbursements, although 42 applications for financing were approved". A basic recommendation of this study is to consider substantial increases to this program, including adding the components related to efficient charcoal production methods, and the incorporation of the three level fuelwood supply strategy (i.e., individual farms; community wood lots; and the larger scale commercial plantations).

Substitution Programs

The substitution of alternative fuels in the D.R. to replace charcoal and fuelwood does not appear a realistic policy option within the current reference framework for this study. This is due to two main considerations. Firstly, the current supply of electricity within the D.R. falls significantly below current demand levels. The World Bank cites severe price distortions, major operational deficiencies and malfunctioning institutional mechanisms as among the major problems contributing to the present "energy crisis" in the D.R., especially regarding the electric power production sector. While 43% of the proposed D.R. public sector

investment program for 1989-1991 is targeted to the energy sector, a severe lack of financial resources is likely to continue to prevent significant improvements to the electricity production and distribution capability for the D.R. within the foreseeable future.

With the current 75% reliance on imported fuels (mainly petroleum) and the lack of substantial expansion of cost-effective hydroelectric power, there appears little chance for substantial expansion of reliable electric power to the urban poor within the next five to ten years. While imported coal seems to offer possibilities for expansion of the power system, it is also an imported fuel and subject to international financial and political uncertainties. In the energy section summary of their analysis of the 1989-1991 D.R. Public Sector Investment Program, the World Bank stated:

> "Prompt policy initiatives...are required to arrest the adverse impact of energy operations on the environment, particularly of deforestation and the degradation of the resource base arising from the demand for fuelwood and charcoal. Such initiatives would include forest management, direct subsidies for reforestation, and setting the prices of wood-based fuels to cover economic costs."

A final observation on the potential importance of energy plantations and the D.R. energy future is found in a 1980 AID commissioned report. Recognizing that the D.R. does not have any substantial domestic energy resources, and also recognizing the need to decrease the country's dependence on imported oil, in 1980 the US AID Mission in Santo Domingo commissioned an energy study for the country. Entitled "Potential For Energy Farming in the Dominican Republic," the study addressed the potential for generating electricity from dry forest energy farms.

One key finding of the study was that 1.3 million acres of arid and semi-arid land in the D.R. was suitable and available for biomass farming (Figure IV-1). These were land areas not deemed suitable for agriculture or timber production. Based on various technical assumptions, this acreage could support at least eight 50 MW power plants. Overall, the 1.3 million acres "translates into a total potential of 300 MW to 1800 MW of installed electrical capacity, based on the biomass yield estimate used for the irrigated dry forests." (An interesting comparison is that in 1987, the total installed capacity of the power system in the D.R. was 1,594MW, one-third of which has been installed by the private sector). The 1980 study also indicated that the 20MW to 50MW biomass plants total costs (capital, O+M) were only about one-half that for oil fired facilities.

Due to the limitation of the varies studies cited above, specific conclusions cannot be derived at the present time. However, this previous work does suggest that energy farms have the potential not only to provide sources for fuelwood and charcoal for direct domestic consumption but also the potential to supply a substantial amount of the electric power needed by the country.

Combination of Policies

Within the next five to ten years various international donors, lenders, private investors and NGO's will be operating within the D.R. seeking to address issues related to deforestation, energy and other country-wide problems. A likely scenario suggests that a combination of policy options (i.e., restrictions, demand reductions, supply, substitutions, etc.) will likely be attempted. An important role for AID may be in helping to further the dialogue among the private

sector, PVO's, local governments and the national government regarding how energy policy is related to deforestation and environmental problems in the country.

D. SUMMARY AND POLICY RECOMMENDATIONS

Summary

The importance of wood as a fuel for Third World countries has been recognized by AID and most international lending agencies for several decades. A major report by the National Academy of Sciences in 1980 stated:

"Trees, if better managed and utilized, could rapidly increase the energy available to developing countries. And this could be done fairly inexpensively, without masses of foreign exchange or technology, and in many cases by using unskilled workers who are already available and underemployed in countries with severe energy shortages. The additional benefits in improved environment are hard to quantify but are likely to be substantial".

While some projections to the year 2000 have shown that worldwide demands for fuelwoods will likely be 10 times greater the acreage planted to meet the demands (even with optimistic assumptions about improved stove efficiencies, solar cookers and biogas reactors), there have been some successful case studies reported in several regions. Examples include the Acua Plains region of Ghana and the Palipsan area of the Philippines. In these areas, sustained productive energy forests have been planted and provide the fuelwood demands for the cities, towns and rural groups for the entire region.

Fuelwood management, as a recommended policy, has several scale of application. For rural areas, efforts are needed to

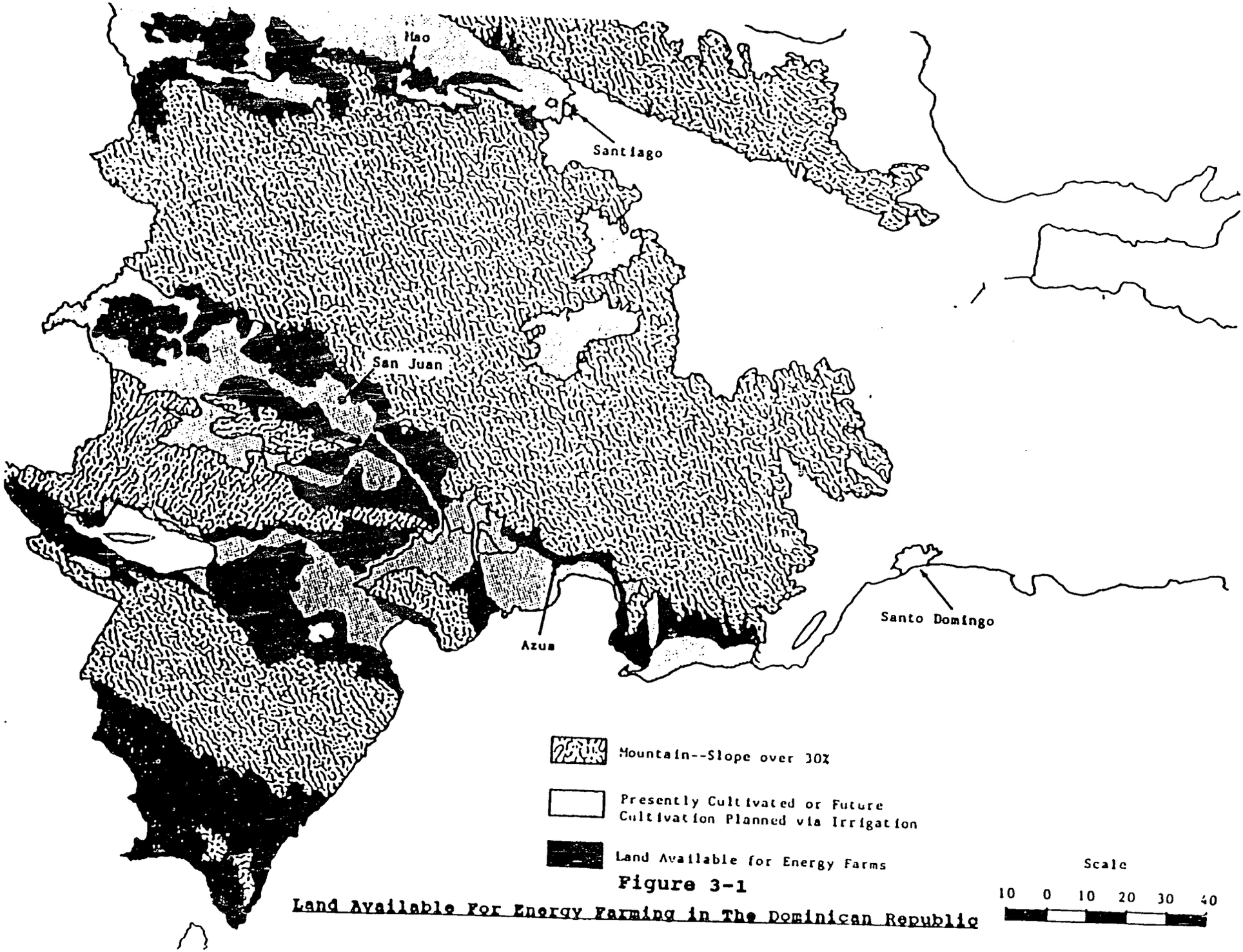

Figure 3-1

Land Available For Energy Farming in The Dominican Republic

identify the varieties of woody plants which can provide rural farmers with options for using trees for fuel, or a forage material or for other uses. Trees for firewood can be planted around houses, on unused land, along roadsides in shelter belts, or in specially designated community "woodlots." With intensive locally based planting in areas accessible to local villagers, pressures to illegally cut other forest areas could be reduced.

For urban populations, with little direct access to fuelwood, firewood and charcoal plantations are required. With proper protection and management, these plantations can be self-renewing in 5 to 10 years, depending upon soil quality, species selected, intensity of cultivation and other factors.

The preceding sections addressed the following: the overall deforestation problem in the D.R., the demands for charcoal in the country and its relationship to overall energy issues; and lastly, potential areas of AID policy intervention in addressing the deforestation problem. While the scope of this study does not warrant definitive policy recommendations to AID at this time, certain preliminary recommendations are identified below for further analysis and discussion.

Recommendations

1. Encourage the national government to strengthen its monitoring role to prevent tree felling for fuel woods outside those specifically designated fuel wood production areas (Areas Carbonares).

2. Further investigate the demand supply relationship regarding fuelwoods to determine the total land areas needed for meeting 5 to 10 year demands and for sustainable harvesting of those areas. In assessing the viability of energy plantation in the

D.R., issues such as long term soil fertility and the generation of undesirable gases should also be explored.

3. Strengthen current AID programs that promote the development of these energy plantations through encouragement of taxation and investment credit policy incentives, to help maximize private sector participation in the fuel wood energy supply system.

4. Initiate studies and pilot programs (through AID) to determine the production, distribution and furnace system configuration needed for effectively using agricultural waste products (from rice, coconuts, sugar cane, coffee and other products) in producing charcoal briquets.

5. Initiate studies to determine ways to promote the most efficient use of fuel woods and charcoal in the country, including: increasing the efficiency of existing stoves and cooking practices; modification to charcoal production practices; and the incorporation of Lorenza stoves, or others, found to be relatively fuel efficient.

6. Initiate studies to determine the most effective methods and applications for passive and active solar technologies to be used within all sectors of the society.

7. Establish dialogues with the public and private sector to encourage any industry that installs cogeneration units to size it large enough to have excess capacity for sale to the public electric power grid.

8. Initiate an overall updated energy strategy study for the DR, especially considering the use of solar, cogeneration biomass and other domestic sources on a basis for integrating the above recommendations relative to deforestation. The output should be a phased implementation program geared to the overall country development strategy.

ANNEX 4.

SOLID WASTE MANAGEMENT AND HEALTH

A. MAJOR PROBLEMS IN SOLID WASTE SYSTEMS

One of the most distinctive elements of Third World urbanization is population growth. Due to this increase in population, the amount of solid waste has increased beyond the point where municipal governments -- with limited resources and equipment -- can manage the collection and final disposal of solid waste in the main cities of the developing world. As a result, large numbers of the urban population are at risk. In poor and low middle income communities, dwellers generally discard waste in the nearest convenient space. Solid waste remains uncollected by municipal authorities for a considerable period of time -- many times over weeks; air, soil, groundwater, and rivers become contaminated by the proliferation of neighborhood dumping and the inadequate management of landfills; and many communities spring up in the periphery of landfills where informal sector scavengers -- mostly children -- redeem reusable refuse. Furthermore, the improper sanitary management of landfills are known to produce high levels of methane, a powerful greenhouse gas which increases global warming.

Institutional Framework

In the Dominican Republic, solid waste systems are traditionally provided by the municipality and viewed as a government responsibility. There are several laws that form the legal framework of the political administration of municipalities. In December of 1952 a law was created to define the role of government for the city of Santo Domingo. In September of 1961 another law was promulgated providing autonomy to municipal governments. In April of 1966 it was determined that property tax rates must be submitted to the Consejo Nacional de Desarrollo if increases were needed. However this Consejo has not met in 10 years. Presently

changes in tariffs for solid waste service delivery are approved through La Sala Capitular of the Municipality.

Other institutions in addition to the municipal government are involved in solid waste collection: the private sector (Empresa de Limpieza Urbana, EMLURB), Senator Jacinto Peynado's Office (SJPO), Presidency Civic Plan, and independent contractors and recycling companies. With the exception of EMLURB and the recycling companies, these institutions are government agencies which have emerged as a result of the present crisis in the solid waste delivery system.

Municipal governments in the Dominican Republic are not currently delivering services which were traditionally undertaken by these institutions. For example, municipalities are not involved in the provision of potable water since management of this service was transferred in the early 1960s to other government institutions (Corporación Dominicana de Acueductos y Alcantarillados and Instituto Nacional de Aguas Potables). By transferring these services municipal revenues decreased depending almost solely on solid waste collection tariffs.

Although an average of 57.5 percent of the municipal budget in Santo Domingo has been used for solid waste management over the last decade, the service remains ineffective and inefficient. (Table 4-1). Increasingly municipal governments are finding it more difficult to provide solid waste delivery to a growing urban population while municipal budgets undergo serious budget reductions along with an inflated bureaucracy and severe mismanagement problems. The cost of solid waste services per capita (amount of pesos in terms of urban population) is currently $RD 17.94. The percent of budget used for solid waste management has decreased from a high of

66 percent in 1988 to the present 46 percent in spite of the fact that urban population is expanding at an annual rate of 5.7 percent.

Table 4-1

INCOME GENERATION OF
THE MUNICIPALITY OF SANTO DOMINGO

Year	Urban Population	Municipal Budget	% Used in Solid Waste
1981	1,297,892	$RD 16,369,041	
1982	1,397,200	17,989,251	
1985	1,668,800	40,092,383	59
1986	1,770,600	40,490,000	59
1987	1,878,600		-
1988	1,993,200	66,395,527	66
1989	2,114,700	76,027,486	-
1990	2,243,700	87,502,966	46

The major characteristics of solid waste service delivery in the Dominican Republic can be summarized as follows:

- Even though solid waste delivery consumes a significant portion of the municipal budget it is rarely perceived as a high priority by the government.

- Although municipalities use large percentages of their budgets for solid waste systems, the operation is ineffective.

- Tariffs for service delivery are low and cost recovery inadequate.

- Solid waste operations are capital intensive systems in spite of the surplus of workers available in the country.

- Appropriate technology and abundant labor are not considered as an alternative to these capital intensive operations.

- Vehicles are scarce, maintenance poor, repair and washing of equipment is highly inefficient.

- Supervision and management of solid waste operation is inadequate.

- The existing conditions of workers in this field are extremely inadequate: salaries are extremely low and no health care is provided to the workers.

As a result of these deficiencies in the solid waste services of the municipalities solid waste is collected infrequently and street sweeping is highly inefficient in most of the cities. A large percentage of refuse remains on the street for several days. Streets are used as dumping grounds; gardening waste, construction and demolition debris accumulate in open drains causing severe floods; commercial, eating, and cooking activities contribute to high levels of solid waste in large sectors of the city. Municipal governments are hard pressed to sustain a solid waste delivery system requiring larger and larger increases of capital for these operations.

B. COLLECTION AND DISPOSAL OPTIONS

Solid waste system management involve storage at the source, collection and final disposal of the solid waste. These three phases are extremely important for service delivery systems, and major constraints in the service are related to the lack of ability to properly administer these phases. Handling of solid waste at the source involves improving cultural and social practices, and increasing community participation in

order to reduce excess refuse in households and neighborhood and to improve environmental quality. Collection is concerned with increasing the ability of municipal governments to provide an efficient service. Final disposal is related to the effective management of landfill operations and recovery of by-products from solid wastes. The failure to perform these phases successfully results in the deterioration of an already inadequate solid waste system, thus increasing the risk to public health and environmental degradation.

Solid Waste Storage

The proper storage and handling of refuse at the community level is crucial in solid waste system management. This early activity of the solid waste system is related to the education and social and economic stratification of the community and the economic resources available for the collection of solid waste.

It is difficult to estimate the amount of solid waste that remains uncollected in Santo Domingo since various independent organizations are involved in solid waste collection for which specific data is difficult to collect since these services are not provided regularly but respond to political needs and crisis. However, data suggests that between the municipality and EMLURB alone, 60 percent of 1,500 tons/day is being collected (44 trucks collecting 870 tons/day; see table on Equipment Available). Uncollected refuse accumulates in drains, empty lots, hillsides, and river banks. Since solid waste generated in the Dominican Republic is highly organic and exposed to rapid biodegradation due to high temperatures it is an excellent environment for the reproduction of disease vectors.

Residential refuse contributes about 65% of the total volume of solid waste in Santo Domingo. Industries contribute about

4%, commercial areas 6% and markets about 10% of the volume. (Table 4-2). While data was not available on the specific collection and disposal operations by these non-residential activities, one assumes that the larger industries and commercial establishments contract to dispose of their solid waste. Smaller entities are assumed to rely on municipal services.

Table 4-2

DISTRIBUTION OF SOLID WASTE GENERATION FOR SANTO DOMINGO

Generated by	Distribution %
Residential	65
Street	4
Commercial	6
Parks and gardens	6
Markets	10
Hospitals	0.7
Hotels	1
Industries	4
Others	3.3

Source: Yokohama Kano in Relleno Sanitario Guaricano

The Urban Poor: A Target Group

The amount of solid waste generated by the urban poor is less than the levels generated by other social groups. (Table 4-3). However, the presence of uncollected refuse in low income neighborhoods is many times that in other communities. Excess garbage, uncovered dumping, unsanitary conditions, and bad smells are frequent characteristics of poor neighborhoods and slum areas.

Table 4-3

SOLID WASTE GENERATION AND WEIGHT BY INCOME LEVELS FOR SANTO DOMINGO (in Dominican pesos)

Variable	Monthly Income Levels			
	more than 1000	601-1000	301-600	Less than 300
Generation (Kg/Person/Day)	0.916	0.730	0.675	0.463
Volume Weight (Kg/m3)	316	303	156	318
Family Composition	8.8	6.8	6.0	6.2

Because of the conditions of these poor neighborhoods, the population most at risk is the urban poor. This does not imply that excessive refuse is exclusively found in low income communities. On the contrary, excessive garbage is noticeable in most of the streets of the city and it is an issue of national concern affecting all income strata. However the poor-income neighborhoods are most affected in terms of:

- Population densities;
- Limited education in waste disposal practices;
- Large numbers of uncovered dumping sites close to dwellings;
- Poor health practices;
- Present levels of unsanitary conditions; and
- Limited political power for improvement or changes.

The lack of space and backyards in substandard housing have an impact on the accumulation of refuse. In Santo Domingo, 88.30 percent of the population occupies only 39.7 percent of the urban space; squatter densities have been estimated at 14,000 people per square kilometer. Overcrowded conditions do not allow dwellers to keep large containers inside their houses and in backyards. Since refuse collection can be infrequent, communities are compelled to discard solid waste in the nearest open sites, such as empty lots, sidewalks of community buildings and schools, hillsides, and riverbanks. To collect street refuse the municipality has to undertake special programs that can take more than a day to clean up a particular neighborhood; the next day dumping will restart at the same location.

The types of commercial activity located in poor neighborhoods contribute to the levels of garbage in these communities. Markets, street cooking, and informal vendors are part of the urban fabric and are activities that generate large amount of refuse. Coupled with these factors are the lack of walkways, clean drains, and basic infrastructure.

Uncoordinated sizes and shapes of refuse containers reduce the efficiency of garbage collection and thus decrease coverage. Low income communities can not afford to buy plastics bags or standard containers for garbage disposal. The present economic crisis experienced in the Dominican Republic continually decreases the purchasing power of the poor. A recent study (Encuesta Nacional de Ingresos y Gastos) showed that by 1984 the number of people living below the poverty line had increased to 27 percent from 23 percent in 1976. Present inflation is estimated at 70 percent. This crisis does not only have an effect on the efficiency of solid waste service delivery but also affects the handling of refuse at the source. Although the quantity of garbage production tends

to decrease during economic recession, the environmental conditions of these communities tend to worsen.

The urban poor as a social group exerts little pressure on local authorities for all services. Solid waste collection in poor neighborhoods is probably worst where the need is probably the greatest. This is related to the fact that these groups have less political power than other social strata and a number of pressing problems that require immediate solutions, thus causing solid waste collection to become a secondary priority in their lives.

Solid Waste Collection

In the Dominican Republic, the major solid waste problem is the collection function. Solid waste is collected house-to-house from central locations. This method has become unsustainable since it is a very expensive process for a resource-scarce society. Furthermore, fixed routes can not be maintained due to the low availability of equipment. Access to many communities is difficult or almost impossible because of the lack of adequate roadways. Equipment needed for solid waste collection is limited and far below demand.

PAHO has estimated for 1972-1986 that between 0.6 and 0.65 Kg/person/day of solid waste is produced for the City of Santo Domingo. The distribution of 0.65 Kg/person/day is as follows:

Table 4-4

SOLID WASTE PRODUCTION IN TERMS OF INCOME DISTRIBUTION
(in Dominican pesos)

Monthly Income	Number of Households		Tons/day	
	1986	1990	1986	1990
Over 1,000	28,117	-	96.0	120.0
601 to 1,000	41,004	-	168.0	210.0
301 to 600	87,866	-	360.0	450.0
Less than 300	140,585	-	576.0	720.0

Source: Based on Informe del Banco Central in Estudio de Poblacion e Ingreso

For many years the main urban centers in the Dominican Republic have presented serious problems of solid waste collection and disposal. The problems became critical after 1970 when the urban population increased at a pace of a million people every five years. Presently the population of the Dominican Republic is estimated at 7.16 million of which 4.24 million live in the cities.

Population growth in the main urban centers is directly related to the excessive pull of the cities. Cities, such as Santo Domingo, Santiago and Puerto Plata, have become attractive sites for the rural population who desire to improve their quality of life and have access to employment, health, education, and basic services.

Solid waste collection problems are more intractable in Santo Domingo than in the rest of country. Santo Domingo has more than four times the population of Santiago, the next largest city. As a primary city, Santo Domingo also has more

concentrated administrative and economic activities, thus generating more solid waste than elsewhere. In fact, as reflected on the following table, while the city's population has been growing slightly faster than solid waste production since 1980, solid waste production will be growing at a faster rate than population in the years to come.

Table 4-5

TRENDS OF URBAN POPULATION AND SOLID WASTE PRODUCTION IN SANTO DOMINGO

Year	Population	Ton/day
1980	1,241,100	870
1985	1,668,800	1,123
1990	2,242,700	1,392
1995	3,016,800	1,809
2000	3,549,722	2,461
2005	4,619,639	3,341
2010	5,999,031	4,587

Planades 33 and Plan Maestro de los Residues Solidos

Transportation Component: A Major Problem in Solid Waste Collection

Solid waste management includes an important transportation component. In spite of the abundance of cheap labor, most solid waste collection is done through motorized equipment, making solid waste operation very expensive. For many years, the number of trucks available for solid waste collection has been completely inadequate. It has been estimated that the Municipality of Santo Domingo requires 150 additional compaction trucks to solve the present deficit in vehicles for

solid waste collection. At present there are 44 compaction trucks operating within the municipal system. (Table 4-6).

Large-scale investments would be required to correct the present deficit if other alternatives are not taken. A study prepared by the World Bank indicated that equipment designed to reduce volume by compaction is generally not justifiable for developing countries (Johnson 1982). Developing countries usually fail to identify appropriate technologies which take into account a) characteristics and composition of local solid waste; b) resources available (e.g. labor, skills, materials, cash flow); c) costs in terms of operation and maintenance; and d) systems compatible with culture and tradition.

In addition to the solid waste vehicles of the municipality, there are other institutions providing services to the community working independently and outside of municipal coordination. With the exception of private collection and recycling companies these institutions respond to political pressures and do not provide services to the service of the municipality in a coordinated way.

Table 4-6

EQUIPMENT AVAILABLE IN SANTO DOMINGO
FOR SOLID WASTE COLLECTION AND DISPOSAL

Institution	Compaction Trucks	Dump Trucks	Bulldozers	Roll-on
Municipality	24-30	8	3	1
EMLURB	17	2	-	2
SJPO	51	3	-	-
Office of Pres.	16	-	1	-
Recycling Co.	-	40	-	-
Total	108	53	4	3

Besides the deficit of vehicles for solid waste there are other factors affecting the efficiency of the service. Vehicle productivity has been estimated at between 1.8 and 2.0 km/hr as a result of current recycling practices undertaken by municipal workers while collecting waste. Due to the low salaries of municipal workers and almost no health safety (no gloves, no uniforms, no boots, no health insurance) authorities overlook the fact that workers recover paper, boxes, and cans to be sold for personal profit. This practice dramatically reduces the efficiency and coverage of the collection service, although it also considerably reduces the volume of solid waste undergoing final disposal.

The type of garbage collected is many times incompatible with the equipment. For example solid waste can have a high content of hard material (limbs and rocks) or various chemicals which can cause serious damage to trucks. Despite the fact that the practice and operation standards recommend that cleaning should be performed daily, equipment is extremely dirty. Also, due to the high contents of organic matter of the solid waste, trucks tend to corrode in a relatively short time. Municipalities lack facilities to wash the equipment at terminals on any regular basis.

One of the reasons for an excess shortage of solid waste vehicles is the lack of maintenance given to this equipment. As a result of the low numbers of vehicles it is impossible to remove any truck from service to provide periodic maintenance. The different makes of solid waste vehicles make maintenance very difficult including maintaining the proper supply of parts. Moreover, municipalities lack tools and repairing facilities for these vehicles. When one truck breaks down parts are removed from another vehicle under repair which may need only a minor repair at the moment.

Some municipalities are searching for new methods to solve the crisis of excess garbage in urban areas and to decrease the numbers of routes and large refuse vehicles in circulation. For example the municipality of Santiago is designing a system where small engine powered or push carts would collect garbage house-to-house in communities with difficult access. Vehicles would empty refuse at drop-off centers serviced regularly by compaction trucks.

In selected communities of Santo Domingo the Municipality is planning to introduce a system to reduce the circulation of solid waste trucks in areas of difficult access by creating drop-off centers. Communities would dispose of refuse at a particular day and time when trucks are scheduled to visit. The municipality is planning to also have regularly-serviced dumpsters available where dumping currently takes place.

Other Alternatives to Solid Waste Collection

In 1976 the Sala Capitular formulated a public-private partnership to allow the private sector to undertake solid waste collection for various areas of Santo Domingo. The objective of the project was to ensure that sustainable technical, financial, and administrative assistance would be provided to the community in terms of solid waste collection.

After public bidding, EMLURB signed a contract that entitled the firm to collect a maximum of 500 metric tons/day on the basis of $RD 137.86 per ton of collected solid waste. For their part, EMLURB assumed the responsibility of investing over 3.0 million dollars for the purchase of 47 trucks, 32 compaction trucks, and 12 other auxiliary units.

At present, this company provides services to 176,000 people, while recovering 20 percent of the total operational costs ($RD 300,000) each month. The Municipality provides service

to 2.1 million people and only recovers approximately $RD 250,000. These figures suggest the cost-effectiveness of a well organized solid waste operation in the private sector.

EMLURB is presently going through some financial difficulties. As a result of the current gasoline crisis EMLURB can not dispatch its fleet on a regular basis. The poor conditions of unpaved access to the landfill prevent trucks from refuse disposal, causing serious delays in the system. However, financial difficulties can be improved if cost recovery increases. This can be accomplished with the support of the Municipality by using joint billing systems with other government agencies whose services can be terminated for non-payment. A few months before the election EMLURB billings were $RD 500,000, while after the election they decreased to the present levels since the community perceived that the new municipal government did not support privatization. At present, authorities have clearly indicated their support for EMLURB and are oriented to undertake private sector initiatives to solve the present solid waste crisis. A public campaign to increase the awareness of solid waste collection may increase the cost recovery.

EMLURB revenues must increase in order to make the operation sustainable. A number of actions can be taken to increase recovery: a) payment of pending accounts; b) increase monthly billings; c) low cost loans to improve productivity; d) adoption of appropriate and less costly technologies; and d) increase the number of users of the system in order to provide a better economy of scale. The later should not be considered until EMLURB has proven their efficiency in solid waste collection.

Solid Waste Disposal

Landfills are a major problem in the solid waste management system in the Dominican Republic. There are no standard refuse recovery practiced; refuse material is discarded in open landfills without long term planning; there are no leachate control measures; sites are not fenced and the presence of scavengers -- especially children -- and animals are abundant; and access routes are unpaved and poorly designed limiting the dumping of solid waste material during rainy periods.

Traditionally landfills have caused problems for municipal governments. Locations are selected within existing communities to respond to the pressing crisis of solid waste. As a result projects have been strongly opposed and rejected by the communities and landfills have typically had short durations.

Before 1933 solid waste in Santo Domingo was incinerated or discarded in empty lots. Between 1933 and 1975 the city disposed of most of its solid waste in the sea, creating high levels of contamination. The first landfill was located at Ciudad Nueva and the most recent in the waterfronts of La Feria Ganadera.

The progression of landfills in Santo Domingo is:

1946-	An incireration plant operated at 27 de Febrero Avenue.
1959-	An uncovered landfill was located in Olympic Center.
1968-	Isabelita, close to Isabela river.
1969-1970	Area under President Peynado's bridge (1969-1970). This landfill was located in the area of influence of the Isabela river. Reopened in 1982 during a crisis of the solid waste system.
1972-	Hainamosa. Opened after the incinerator plant was closed.

1973-	Cancino (1973). 30 hectares, uncovered landfill. Several problems of access and drainage.
1978-1979	Prolongacion 27 Febrero avenue. Closed due to strong community complaints.
1980-1981	San Miguel (27 Febrero avenue). Closed due to community complaints.
1980-1981	Hato Nuevo, Manoguayabo. This landfill was operated very poorly. Closed in a few months due to violent community mobilizations.
1981-1981	Lecheria, Hato Nuevo. Located very far away from the city and was closed soon due to community complaints.
1981-1981	Km 21, Duarte Highway. Located very far away from the city. Bad access and drainage problems. Closed soon after initiating operations.
1981-1981	Km 12, Haina (Asphalt Plant). Used only for emergencies when Cancino and Guaricano are not in operation.
1981-	Guaricano is the main landfill of the city of Santo Domingo. Occupies lands to the south of the road leading to Guaricano.
1989-	San Isidro. Recently opened.

The large number of landfills that have been opened and closed in Santo Domingo suggest that the present solutions are not sustainable. Guaricano and San Isidro (Km 22 of Duarte highway) are currently the active landfills in Santo Domingo. Other landfills are used during emergencies when Guaricano and San Isidro can not be operated due to the poor conditions of access roadways. Information on the useful life of existing landfills was not available.

There is a great need for planned and coordinated sanitary landfills. Guaricano was opened as an emergency landfill, designed to operate only for a short period of time; today it is the main landfill to serve the city. Since landfills are not planned with any criteria and cause a decrease in land and property values, there were violent complaints when Guaricano first opened. However, today, large numbers of poor families have moved inside Guaricano, although ordinances do not permit human settlements to be located less than 200 mt. from the border of the landfill. Large numbers of families make a

living from collecting refuse, such as paper, cans, bottles, and plastics. Due to poor management, however, Guaricano has only one more year of operation and presently operates with a complete lack of sanitary health conditions increasing the risk of innumerable diseases.

Solid Waste Recovery

In the Dominican Republic various techniques for refuse recovery have been considered. The most common technique for solid waste is recycling. Refuse in Dominican Republic as in all developing countries is low in paper, glass, plastic and metals. Recycling practices take place from the moment communities discard refuse in open spaces. Scavengers and municipal workers recover reusable refuse. Thus, final recycling is extremely low for reusable materials.

Due to the composition of solid waste in the Dominican Republic -- 80 percent organic waste -- and 60 to 70 percent humidity, urban refuse is an attractive alternative for compost recovery. (Table 4-7). In 1985 the municipality of Santo Domingo signed an agreement with RESUR, a local enterprise, to process 160 tons/day initially, increasing to 500 tons/day of compost recovery.

Table 4-7

VARIANCE IN REFUSE COMPOSITION

Physical Component	Weight (%) Kg
Organic matter	79.7
Paper	12.0
Soil	3.2
Metals	1.9
Plastics	1.3
Glass	0.7

In spite of the existing demand in the country for compost to be used as an organic fertilizer, the RESUR project was not implemented since it was designed using a technology highly dependent on electrical power. Other initiatives to recover compostable refuse have also taken place. In 1981, FAO prepared a project for compost recovery using appropriate technology for low income countries. The cost of the project was $US 23.95/ton which was too expensive for the Dominican Republic. This technique should be studied further and its application considered for solid waste recovery in the Dominican Republic.

The incineration of refuse has been a matter of strong controversy. In the Dominican Republic combustibles as a fraction of refuse ranges from 50 to 80 percent of the total mix of materials. In spite of this acceptable range (60 to 70 percent is acceptable in developed countries) the moisture content is very high for incineration purposes. The portion of miscellaneous inert materials from incineration would generate ash residues between 20 and 40 percent while in industrialized countries this range is from 10 to 15 percent. Thus incineration is believed not to be favorable in the Dominican Republic due to pollution effects. In addition this system is highly energy dependent, and initial investments are very high.

Sanitary landfill is a system which experts consider most adequate for the Dominican Republic due to its low operational cost and the potential of methane recovery. The refuse composition in the Dominican Republic is highly adequate for the process due to the high levels of organic matter and moisture amenable to anaerobic digestion. To remove methane from landfills, pumps must be connected to perforated pipes or gravel packed trenches placed within layers of anaerobically decomposing refuse which will require a fairly large initial

capital investment.

Methane recovery from urban refuse has been considered in the Dominican Republic. In 1988 the municipality of Santo Domingo signed an agreement with a US company, Empresa Sistema de Reciclaje del Caribe (SRC) to obtain methane from urban refuse. Although specific data could not be confirmed, the project apparently is on hold due to the World Bank's objections to the power generating costs associated with the project. In 1989 the National Electrical Company expressed interest in buying electrical energy produced from methane. This alternative should be further studied since it would appear to be most applicable, less controversial and less costly than other recovery systems considered in the Dominican Republic.

C. HEALTH AND ENVIRONMENTAL IMPACTS OF URBAN SOLID WASTE

To substantiate the impact that solid waste has on public health is difficult since the few studies that have addressed the problem are limited. However, it is known that the urban poor, people living on hillsides and on the fringes of urban areas are most at risk; and within this population children are the most vulnerable to disease vectors resulting from solid waste.

In 1985, there were 58,000 homeless children in urban centers in the Dominican Republic. The mortality rate for children under five years of age was estimated to be 88 per thousand. For mothers without education child mortality reached 101.7; for mothers who have attended primary school the rate was 76.0; 56.5 for those mothers who had attended secondary school; and only 34.4 for those who had attended universities. In 1987, 51 percent of the children under the age of 5 years were undernourished, and 16% were born underweight.

There are five major health and environmental impacts associated with solid waste management.

First, most municipal refuse contains human faecal matter attributable to inadequacies of the sanitation infrastructure and management. Human excreta is a critical vehicle for transmission and spread of a wide range of communicable diseases. The most obvious route is direct, whereby refuse collection workers, informal scavengers and playing children are in contact with faecally contaminated refuse and then place their contaminated hands in their mouths or on their food.

Second, most municipal refuse is likely to contain some industrial waste. While the level of industrial activity is

much lower in developing countries than it is in developed countries, the degree of hazard associated with the wastes generated are likely to be similar.

Third, the decomposition by-products of materials within urban solid waste can release chemical constituents into soils, drainage, and seepage. In 1985 it was discovered that Guaricano (Proyecto Relleno Sanitario Guaricano) was producing leachate contamination as a result of water percolating from waste to porous soils. Yaguaza River is located in the periphery of Guaricano. Large amounts of waste and the low presence of oxygen were found in the water of this river. The contaminated groundwater was also found discharging into the Isabela River. Although leachate contamination may only have a small impact on the Isabela River -- at the point of intake the water for human consumption is presently at an acceptable quality -- it is necessary to minimize the degradation effects of the water quality of this river since it is the main source of potable water for Santo Domingo.

Another result of inadequate solid waste management is that residents tend to discharge their wastes in the most convenient open area or drain. In the neighborhoods housing the highest percentages of the urban poor, municipal refuse clogs drains and causes stagnant waters. Where these open drains contain human sullage and faeces, there is potential for mosquitoes to breed in the stagnant waters, a vector of various diseases.

Fourth, smoke from continuous burning at dumps creates extensive pollution. Refuse in dumps has a high organic content and where exposed and sun-dried at the surface, spontaneous combustion occurs readily.

Fifth, and probably most importantly these refuse areas become breeding grounds for a range of vectors causing disease. Uncovered refuse and garbage in neighborhoods, and improper landfill disposal practices provide excellent sources of nutrients for rats, flies and cockroaches, turning into large pockets of disease potential for the urban population and the workers of the solid waste system. This situation can reach critical levels when the solid waste, as in the Dominican Republic, is highly organic and exposed to rapid biodegradation.

As a result of poor practices in the handling, collection and disposal of waste, insect vectors and rats can proliferate in urban centers at such a high level that it becomes an unmanageable problem.

Rats can infect humans in various ways: by direct biting, by contaminating food, and through flies. The most common diseases associated with rats are murinus typhus (transmitted by contaminated fleas from rats causing similar effects as epidemic typhus); cholera (a deadly disease, also transmitted by contaminated fleas); and salmonellosis (transmitted through contaminated food, causing diarrhea and dysentery).

Rats can be eliminated through the reduction of uncovered refuse. Home refuse containers can be waterproof, tightly closed, easily cleaned, and manufactured of a durable material. To eliminate the proliferation of rats recommended practice is to collect solid waste twice a week in residential areas and daily in commercial sectors.

Flies can cause typhus fiber, dysentery, and diarrhea; and are the cause of millions of deaths throughout the world. An important practice in reducing the numbers of flies is to collect residential solid waste at least once a week. Flies

proliferate with heat and their evolutionary cycle increases with the higher temperatures. The Dominican Republic's average temperature is 25 to 30 degrees centigrade. At this temperature, flies may reproduce every 12 to 14 days. If refuse is not collected at least once a week it will cause large increases in the number of flies.

It is important to emphasize that until the problem of open refuse and landfills in the Dominican Republic is solved, there will be a large number of disease carrying vectors. In 1990 over 85,000 cases of gastroenteritis were reported in the Dominican Republic.

D. POLICIES IN SOLID WASTE SYSTEMS

This section discusses a number of policies that would improve the storage, collection, and disposal of solid waste in the Dominican Republic. Some require the introduction of new local and national approaches, others require improved management techniques, and others would increase the participation of the community in solid waste disposal. All clearly reflect USAID interests in environmental management, health, PVOs and NGOs, private enterprise, and democratic institutions.

Strengthening Municipal Capacity

Because of the explosive growth of primary urban centers and the accompanying problems, municipal systems are experiencing more and more demand on their resources for services while there is a reduced supply of tax revenues and other resources to pay for these services. Municipalities now have the primary responsibility for solid waste management but they are weak, have limited budgets, and are affected by intrinsic administrative problems.

In order to improve the basic service provision of municipal systems -- of which solid waste management is perhaps the most visible and serious problem in the country -- there is a need to develop the institutional capacity to provide access to good services for all income groups. It is also necessary to strengthen municipal capacity to generate financial resources to meet the operation and maintenance of existing systems. To this effect, training and promoting municipal development programs at different levels in order to develop such capacity must be considered.

However, to envision the solid waste delivery system as a solely municipal responsibility is not appropriate. Policies that integrate different sectors of the community in solid waste operation can be more sustainable. Solid waste systems typically remain in the hands of local governments because there is a lack of political will to create an environment that increases the participation of the community and the private sector in solid waste operations. When that will exists, governments should consider:

- reducing regulatory barriers to business;
- creating new tax incentives for the private sector to deliver a public service;
- providing incentives and price signals to encourage resource recovery;
- stimulating the market for recycled materials perhaps through buying centers;
- establishing maintenance and spare parts facilities;
- providing training for mechanics and drivers; and
- establishing transfer stations where refuse can be sorted more efficiently
  before it reaches the landfill.

Using PVO's and NGO's to improve Community Awareness

Large sectors of the population have a limited awareness of neighborhood sanitation, personal sanitation and the health risks involved in the improper handling, storage, and disposal of solid waste. The level of understanding of this risk is related to the level of education of the population. In the Dominican Republic, only 69 percent of the population over 24 years of age have attended primary school and over 25 percent of the population is illiterate. Thus, target groups may be difficult to reach.

Private Voluntary Organizations (PVOs) and Non-Governmental Organizations (NGOs) can be excellent resources to implement programs oriented to improving community habits, such as solid waste storage and public clean-up campaigns.

There are a wide range of potential PVO/NGO activities related to solid waste operations. Educational programs can modify public attitudes in terms of increasing awareness of the significance of decreasing the volumes of solid waste at the source. Such programs should be implemented jointly with the provision of garbage cans (or plastic bags), and community containers or dumpsters (served by compaction trucks). A program of this nature could effectively be delivered by community-based organizations.

Standardized containers when provided free or subsidized are critical for solid waste collection, but can be misused since they are valuable items for the poor to store water and food. NGOs can become excellent channels to promote the proper use and standardization of containers at the community level.

Separation of recyclable products at the source allows for the efficient recovery of materials such as paper, glass, plastic and metals. Although informal recycling of solid waste

generates several millions of pesos every day, and reduces the volume of solid waste collection, small recognition is given to this activity. An organized activity with the participation of the NGOs could maximize recovery, generate income, and reduce the health risks to informal sector scavengers.

The Dominican Republic has a strong PVO movement. There are a large number of community based organizations that can work in partnership with municipal governments. These may include community clubs, neighborhood groups, citizens, and environmental associations. The Centro Dominicano de Organizaciones de Interes Social (CEDOIS) is an association of NGOs which includes a large number of organizations concerned with environmental protection and public health problems. These groups could be included in potential community programs directed toward upgrading solid waste service delivery.

Given USAID's selected interventions in addressing the critical needs of the poor, of which health is one of the most important, and given the experience and resources of PVOs, the USAID PVO Co-Financing Project may offer the opportunity for support to PVOs providing services in sanitation, community development, income generation, and non-formal education.

Promoting Public-Private Partnerships

There is evidence from refuse collection studies that privatization can save governments money and improve services for the users. The fundamental reason is that private operations center around competition and business incentives to accomplish the tasks in an efficient and effective way. On the other hand, the operations and decision-making process of municipalities are centered around political issues and are not oriented toward profit or the efficiency of the operation. Most basic services provided by municipal governments result

in losses while services remain ineffective and inefficient. This suggests that local and national governments should focus on adopting policies that provide incentives and signals to encourage resource recovery.

A study undertaken by Columbia University found that government-run solid waste collection was 68 percent more costly than private contracting in cities with populations above 50,000.

Other studies covering several countries reveal that municipal collection was more than 50 percent more expensive per household than collection by private contractors; that private collection crews were 95 percent more productive; and that when cities do their own street cleaning, the cost is 43 percent higher than the cost for private contractors (Goodman 1985).

The Municipality of Santo Domingo has already signed a contract with EMLURB -- a private company -- for solid waste collection. EMLURB is responsible for solid waste collection in various sectors of Santo Domingo. Although EMLURB is presently going through financial difficulties and is receiving considerable subsidies from the municipal government, the overall operation of the company suggests that private-run operations for solid waste might be a viable solution in the Dominican Republic.

However, caution must be taken since private collection typically favors middle and upper income groups. Some of the population below the poverty line might not have the capacity to pay full service fees. The municipal governments must assure that all income levels receive efficient service. To accomplish this, collection strategies for low-income areas should be designed for community-assisted lowest cost

operations. Also, private companies need to be monitored, and provided with financial incentives and penalties, to ensure that low income areas are being adequately serviced.

Municipal solid waste management versus private sector operation should be considered carefully.

Municipal Government Advantages

- The basic reason for operating the system is a municipal responsibility for providing sanitary conditions
- Municipal governments are held responsible by the community for solid waste services
- With good programs municipal governments can achieve cost-effective operations
- Municipal governments have more flexibility in dealing with emergency situations

Municipal Government Disadvantages

- Lack of trained government workers can increase inefficiencies
- Lack of resources to undertake large-scale investments
- Excess bureaucracy

Private Sector Advantages

- Access to trained personnel
- Efficient operation can become cost-effective
- Reduced bureaucracy
- Capital investments are provided by contractors and not by the public

Private Sector Disadvantages

- Profit motive is the major concern
- Responsibilities are with the municipality and not with the community

- Company's overhead is paid by the consumer
- Municipality may lack trained personnel to supervise private sector operation
- Less flexibility to respond to the community during emergencies
- Lack of local experience
- Resistance of municipal authorities
- Private collection typically favors middle and upper income levels (low income families usually can not afford to pay for services)

Improving Landfill Practices

Due to improper practices, landfills constitute a major threat to public health and environmental conditions. The lack of leachate control and sanitary landfills expose large numbers of the population to many diseases that can be fatal and causes irreversible environmental degradation.

In response to health and environmental concerns, there exists an urgency to improve waste disposal in the Dominican Republic, especially in the major cities of Santo Domingo, Santiago, and Puerto Plata. Recent studies in response to the present crisis in Santo Domingo have recommended a) the introduction of a sanitary landfill in Guaricano; b) the construction of a sanitary landfill in the eastern portion of Santo Domingo, accompanied by the elimination of Cancino; and c) the creation of a sanitary landfill in the western portion of the city, to be used especially for high risk industrial waste.

Landfill standards are intended to control the transmission of illness, decrease the reproduction of vector and rats, reduce environmental contamination; reduce accidents of solid waste trucks, fires, etc; and avoid the presence of scavengers.

The improvement of landfill practices in the Dominican Republic would require large amounts of capital. At present, the country is experiencing one of the largest economic crises in its history. Thus, the consideration of expensive systems to improve solid waste disposal would seem impractical. Since the social costs in terms of public health can have irreversible implications for the future, some improvements to landfill and dumping operations must be considered now.

Intermediate solutions can be implemented by modifying dumping practices and improving sanitary landfill designs. To accommodate scavengers rather than discourage them, for instance, consideration should be given to clearly separating dangerous wastes (industrial, hospital, etc.) from normal wastes, and to providing community cleaning facilities, protective gear, and small equipment at the dump sites. Such measures recognize the scavengers as informal sector entrepreneurs, family providers, and recyclers.

There seems to be evidence to suggest that the construction of sanitary landfills with methane recovery is a plausible solution for solid waste disposal in the Dominican Republic; although this has a high initial investment, long term recovery can make the operation self-sufficient. The potential for low energy low technology composting for methane recovery should also be explored.

The necessary installations to produce methane and the necessary improvements of Guaricano have not started due to a lack of funds. Investments have been estimated at 3.8 million dollars to provide the necessary infrastructure.

ANNEX 5.

TOURISM EXPANSION AND THE COASTAL ZONE

A. GROWTH TRENDS AND IMPACTS

Along with the free zones, tourism is one of the most important economic sectors in the D.R. economy. In 1970, tourism provided only 6.3% of foreign exchange earnings but by 1988 it provided over 33%. Tourism contributed 10% of GNP in 1988, compared with 15% for the industrial sector, 17% for the commercial sector and 12% for agriculture.

Relative to other Caribbean countries, the D.R. has had one of the strongest real growth records since 1980, including a higher rate than Jamaica, a key competitor. From 1985 to 1990 the annual growth rate in tourist arrivals has ranged from about 14.3 to 20%. (Urban Institute, 1990)

Since 1968, tourism development has been a high priority sector for the government. In 1971 Law 103 declared two priority zones for development, the Puerto Plata area and the zone between La Caleta and the Rio Higuamo. Also, in 1971, Law 153 was established promoting tourism and establishing various investment incentives. Essentially, the D.R. government paid for all infrastructure and investors were exempt from all taxes for ten years after construction. Most investments have been financed in pesos while income has been derived in dollars, thus providing additional substantial windfall gains to investors. In 1980 Law 153 was modified to designate seven priority development areas in the country, six bordering the coastal zone.

These areas included: Luperon-Cabrera (the "Costa Ambar" area); Santo Domingo-La Romana (the "Costa Caribe" strip); Macao-Punta Cana; Samara-las Terreras; Barahona-Enriquillo, and Monte Cristi-Pepillo Salcedo. These designated coastal zones or "strips" extend 5 kilometers landward from the

littoral zone and essentially surround their respective cities.

Within the past four years, about 50% of all hotel rooms built in the Caribbean were in the D.R. As shown by Table 5-1, from 1987 to 1990 the number of hotel rooms in the country will have increased from 12,000 to over 27,000 - an increase of almost 130%. Although there are 12 major areas for tourist development planned for the country, most of the growth since 1980 has occurred in four areas: Puerto Plata/Sosua; Santo Domingo; Costa Caribe/La Romana; and Punta Cana/Macao.

Although tourism is a key growth industry for the D.R., there are questions regarding the capacity of the country to supply the basic infrastructure and services needed to continue to attract foreign visitors. There are also questions regarding the degradation of the natural environment caused by the development of the industry itself. Manita-Kennet's (1990) survey of tourism development in the D.R. highlighted many of the problems associated with tourism development in Santo Domingo's Colonial Zone and in Puerto Plata.

Table 5-1

GROWTH OF ROOM SUPPLY BY REGION, 1980-90

Region	Room Supply			Average Annual Rate of Growth	
	1980	1987	1990a/	1980-1987	1987-1990a/
Puerto Plata/Sosua	612	4,512	10,513	33.0	32.6
Santo Domingo	2,723	2,884	6,697	1.4	32.5
Costa Caribe/ La Romana	1,117	2,360	6,771	11.3	42.1
Punta Cana/Macao	0	949	2,278	11.6	33.9
	942	1,338	2,696	10.5	26.2
Total	5,394	12,043	27,600	12.2	31.8

a/ Estimate.

Source: Horwath & Horwath, Santo Domingo News and American Express/World Bank (1990)

In Santo Domingo's Colonial Zone, many of the problems are those associated with the larger city itself: inadequate water supply; frequent and prolonged power outages; unreliable solid waste collection; poor drainage; nearby squatter settlements; and exposure to the severely polluted Rio Ozama River. While there has been substantial public investment in the redevelopment of target sites in the Colonial Zone, in anticipation of the 500th anniversary of Columbus' arrival to America program, the larger environmental problems of the surrounding city remain. The World Bank (1990) summarized policy recommendations for the D.R. tourism sector with the following statements: "Environmental problems also may harm tourism... Management of Santo Domingo's solid waste problem and curtailment of the high incidence of communicable diseases will also be necessary to protect and enhance the country's tourism potential."

In the Puerto Plata area, the qualitative impact of tourism seems to be most evident in the infrastructure inadequacies and in social and economic separation of the town from the hotels and tourist facilities. While Puerto Plata was planned 15 years ago to support the tourism industry, the supply of housing and public services was soon overwhelmed by the rapid influx of population seeking tourist-related jobs. While the city has a plan for development, there is no regulatory enforcement and the number of squatter settlements is increasing.

Although most of the hotels have back-up power generation, the city experiences power outages up to seven hours daily. The potable water quality problems for the overall town are not specifically known. Most hotels have private wells. This water, however, is not generally considered suitable for human consumption, although half the hotels reportedly do not treat

the water while the other half buy water from trucks or bottle sources. Since many of the hotels also have septic tanks, there are concerns that their poor construction techniques may be contaminating the groundwater supply sources for the area.

There also appears to be poor economic integration between small businesses in Puerto Plata and the hotels. While most families are thought to have at least one member employed in tourism, the hotels offer facilities and services designed to keep the tourists and their dollars within the resorts themselves and out of Puerto Plata. Nanita-Kennet (1990) summarized her observations as follows:

> "Although large numbers of the local population are employed by the hotels, these are usually menial jobs; support goods and services are not purchased from the town; tourists are hampered from visiting the town and buying goods; and the profits that are realized from the hotels return to investors in other parts of the country. The situation appears to hinder the capacity of tourism as an economic model to provide solutions to the problems of underdevelopment."

B. CURRENT GOVERNMENTAL PLANNING

An AID 1981 survey identified three key existing or potential problems associated with tourism development and the coastal zones. These included:

- potentials for serious infrastructure and related ecological problems due to the development intensities already approved for the coastal zone;
- lack of a comprehensive coastal resource inventory as a basis for determining potential ecological impacts; and

- lack of an effective planning, permitting and administrative review process to analyze waste disposal needs, physical constraints to development and basic infrastructure requirements.

Recent discussions with IDB consulting staff in the Ministry of Tourism indicated that at least some of the above deficiencies in the planning process were being addressed. Within the coastal zone 38 acres of critical environmental significance are being studied. For the key coastal areas to be developed, spatial plans are being developed which include locations for permitted development, roadways, infrastructure needs and the identification of ecologically excluded areas such as mangroves, flood plains and slope limitations.

While these planning efforts are encouraging, several important elements seem to be missing. These include: whether or not the development intensities proposed are based upon an "environmentally sound" holding capacity for the area (e.g., relative to effluent treatment; water supply quantities and quality, etc.); and, whether or not the surrounding area growth patterns and demands were considered in the plans being produced.

Part III of Law 153, which establishes the tourism development process states the following: (Tourism) projects must be preliminarily approved by the organization in charge of town and municipal planning, which are competent in their jurisdictions." Law 153 further states that enforcement of the tourism law is the prime responsibility of the Tourist Development Board, plus seven other agencies, one of which includes the Office of the Technical Secretary to the President.

Data on the projected growth rates for tourism in the country and information on the projected spatial development plans for this growth are being prepared by the IDB planning team for the Ministry of Tourism. Although requested, the information was not provided to our team. However, in order to make preliminary estimates about the magnitude of this growth, and its potential environmental implications, data and criteria from several sources were assembled and assumptions regarding the potential employment and population growth due to tourism were developed.

C. ESTIMATES OF POTENTIAL FUTURE GROWTH

As shown by Table 5-1, the growth in the room supply in the D.R. from 1980 to 1990 (estimated) has been above 400 percent and has been mainly located in the 4 areas previously mentioned. Based on employment multiplier from 1981 sources and using ONAPLAN-INVI family size figures, in 1990 about 56,000 employment and 274,000 population may be assumed associated with the tourism industry. (The ratio of about 2.0 jobs per room could be conservative. Nanita-Kennet's 1990 report cited a 1983 direct employment of 41,220, which may have been associated with 12,043 rooms. This yields a multiplier of 3.4 jobs per room. Also, however, family size, due to family planning, may be dropping from the 4.9 persons per household cited here).

Table 5-2 also outlines several scenarios beyond 1990 for the D.R.'s tourism development potential relative to room supply, direct and indirect associated employment and related population. Due to the lack of more specified data and other limitations, these figures are not intended as projections or forecasts. They are only offered as preliminary conceptual

Table 5-2

POTENTIAL TOURISM DEVELOPMENT
(Conceptual Estimates)

Year	Room Supply (Total Country)	Employment* (Direct & Indirect)	Population Related** (Direct & Indirect)
1980	5,400(1)	11,000(3)	54,000
1990	27,600(2)	56,000	274,000
2000 & Beyond			
• Secenario A (1990+25%)	34,500(4)	70,000	343,000
• Scenario B (1990+50%)	41,400(5)	84,000	412,000
(Montellanos Only)	70,100(6)	143,000	701,000
• Scenario C (Montellanos +1990)	97,700(7)	199,000	977,000

Sources & Assumptions

(1),(2) World Bank compiled data, 1990. 90% of 1990 rooms are found in the 4 major tourism growth areas of Puerto Plata/Sosua, Santo Domingo, Costa Caribe/La Romana, & Punta Cana/Macao.

(3) AID D.R. Environmental Survey, 1981

(4),(5) Assumes 25% and 35% growth over 1990 levels, respectively.

(6) Based on World Bank 1990 statement regarding potential for the Montellanos area to develop to 20 times the size of Puerto Plata; assumes 7,013 rooms in Puerto Plata in 1990 x 10 times only.

(7) Adds the Montellanos growth to the 1990 development only.

* All employment estimates are based on ratios of AID 1981 estimates.

** All population estimates are based on occupants per house of 4.9 persons (ONAPLAN-INVIU, 1985)

estimates to illustrate the potential growth and related environmental impacts which may be associated with tourism development.

Scenario A assumes a moderate growth in tourism room supply of 25% from 1990 to 2000. Scenario B assumes a 50% increase in rooms over 1990 levels. Scenario C is based on the assumption that Montellanos, a large area on the north coast owned by the Central Bank, may eventually be developed for tourism. Its massive size is based on the World Bank's (1990) assessment that "such a project would involve the creation of tourist facilities twenty times the size of those in operation in Puerto Plata." (The estimate shown in Scenario C assumed Montellanos' growth to be only ten times the room supply in Puerto Plata in 1990, not 20 times as mentioned in the World Bank 1990 report.)

Although the quantities of room supply, employment and associated populations could vary significantly from those estimates shown in Table 5-2, the key point is that substantial additional growth will occur along the fragile coastal zone of the country. This area already is experiencing growth-related degradation to its off-shore reefs, mangroves and beach areas due to inadequate waste discharges and an overall lack of environmental concerns in planning and development. Scenario C implies that potentially up to a million or more people within the next 10 to 20 years could be living in the coastal zone as a result of tourism development alone. This does not include population living there now or the additional growth possibly related to free zones or other economic activities which could mean additional demands on the coastal ecosystem.

The main implications for the above scenarios are that tourism development, like the free trade zones, has significant

impacts on the spatial distributions of economic activity in the country.

This growth presents an opportunity as well as a potential problem relative to the environmental quality of the D.R. Because the locations and potential growth magnitudes can be reasonably estimated, this presents an opportunity to forecast (before it occurs) the additional demands likely to be placed on an area environment relative to waste treatment, discharge levels, water supply, and other factors. Based on various geotechnical conditions, one can determine an "environmental holding capacity" for the area. This would also need to include a consideration for the infrastructure and service demands generated by other developments likely to occur in the area.

If the area infrastructure demands are known and some measure of area holding capacity is identified, public decision about permitting specific levels of development in an area can be better informed relative to potential environmental impacts.

The current spatial planning being undertaking by the Ministry of Tourism provides an opportunity for AID to promote coordinated area planning for several mutually supporting purposes: 1) to promote environmental protection in a critical zone of the country, a zone critical to longer term economic development as well as to environmental quality; and 2) to promote the most efficient use of scarce public sector resources for infrastructure investment, especially by coordinating the demands and promoting supply strategies for all sectors in an area in addition to those of tourism; 3) to further the economic integration of the surrounding communities with those of the tourist industry; 4) to promote strategies for providing adequate sites, credit material, and other resources

needed by low-income groups in acquiring basic housing and community services; and finally; 5) to help support the technical framing and capabilities of local municipalities impacted by tourism in planning, budgeting, environmental assessment and basic growth management.

D. POLICY OPTIONS AND RECOMMENDATIONS

As with most of the D.R. governmental agencies, one of the key problems is coordination among the various responsible entities and enforcement of the existing laws and regulations. Due to low comparative salaries and other factors, most D.R. governmental agencies, national and local, are poorly staffed to perform the technical work necessary to evaluate plans or to perform their own analysis, forecasting of growth, spatial planning, budgeting or other management tasks.

The spatial planning work by the Ministry of Tourism, therefore, offers AID an important opportunity for assisting with the technical and management training for several key groups: local municipalities impacted by tourism development; the private investors; and local PVO's representing the low income groups who will need housing and basic services. The emphasis of the AID policy intervention would not be in producing or funding of spatial plans.

AID's point of policy intervention relative to tourism and the environment could be similar to those suggested in the discussion of free trade zones. This would involve support to several areas: technical support in data base development and training for local municipalities; support to PVO's in assisting with local community development for low-income groups in tourism areas; and investigation of ways to encourage private investors to support investment and development in

the surrounding community. The use of AID Housing Guarantee funds to help supply infrastructure jointly to tourism projects and local communities may be one type of incentive to consider. The use of other potential AID programs are discussed later in this report.

ANNEX 6.

FREE TRADE ZONES AND AREA DEVELOPMENT

A. GROWTH TRENDS AND IMPACTS

While Santo Domingo and Santiago will continue to be the prime growth magnets in the D.R. for the next 20 years, the development of free trade zones are believed to be having important impacts on the migration and spatial development pattern of the country. Although no studies on migrating impacts have been done to date, Ninita-Kennett's (1990) recent study on the impact of free zones on the D.R. environment indicated that many groups of D.R. professionals consider the 20 years of free zone development to be having a significant impact on urban to rural migration.

As of 1989, approximately 112,000 were employed in 18 operational zones, which are located primarily in a 20 mile wide north-south corridor stretching from Puetro Plata to Santo Domingo, and in a 20 mile wide southern coastal corridor stretching from La Romana in the east to Barahona in the west. (See Figure II-1)

Based on an average family size of 4.9 persons, the 18 existing free zones potentially generate a total population of about 550,000 people. Counting indirect support employment to each zone and their families, the multiplier effects could be even higher. With 4 additional zones under construction, and 8 others being actively developed, assuming the same employment rates and family sizes would yield an additional 75,000 jobs and an additional population of about 365,000. As with the existing zones, these new zones are likely to have multiplier effects causing the total employment and area populations to be even larger.

While specific forecasts for future employment and population of the free zones are beyond the scope of this study, the simple ratio assumptions used above are useful in discussing

potential impacts on migration patterns and on demands for community services.

If one assumes the 18 existing free zones generate a total population of about 550,000, one can assume that this represents the migration that could have been attracted to Santo Domingo or Santiago without the trade zones. Using simple gravity-type ratios (e.g., Santo Domingo is 3.4 times the size of Santiago and would get a similar percentage of the 550,000 population attracted), one could suggest that Santo Domingo's current population of about 2.4 million may be about 385,000 persons (or 16%) smaller than it may have been without the zones.

Similarly, Santiago's current population of 713,000 may be about 165,000 (or 23%) smaller than it may have been. (Note that these assumptions ignore the free zones located in Santiago and Santo Domingo). While there are many variables that may have caused other D.R. cities or other activities (e.g., tourist areas, migration abroad, etc.) to capture growth associated with the free zones, these assumptions do suggest the free zones' development policies may have substantialy reduced growth pressures on the two major cities. When one considers the employment and population assumptions for the 8 additional zones under development (75,000 additional jobs and 365,000 population respectively), the potential migration impacts may be even greater.

B. GOVERNMENTAL DEVELOPMENT POLICIES

While the free zones may have reduced urbanization pressures in the major D.R. cities, initial studies are inclusive as to whether or not the development of the free zones themselves may be contributing to environmental problems. Nanita-

Kennett's (1990) survey stated that although "free zones are not offering major environmental problems at this point, there are increasing concerns over the lack of environmental regulations and planning concerned with the location and operations of free zones." Physical planning for each zone (e.g., roads, water supply, garbage collection, etc.) is the responsibility of each industrial park. Although licenses for the free zones are granted by the National Free Zone Council, and ratified by Presidential decree, there are no current, nor contemplated, environmental regulations governing the location or operations of the zones. With certain minor exceptions, free zones may be located anywhere in the country.

Initial surveys indicated that while free zones are providing jobs for workers who may otherwise be unemployed, the resulting housing and living conditions around the zones are similar to those in most D.R. squatter settlements. On the periphery of the zones there are growing squatter settlements which lack paved roads, electricity, piped water, public transport, garbage collection, sewers and fire protection services. While there are government housing projects reportedly planned for the free zone workers at Santiago, coordinated governmental planning programs for providing housing and basic services at other zones is evidently not in existence at this time. (Nanita-Kennett, 1990)

In addition to the basic problems of adequate housing and public services for the free zones, there is some indication that certain zones may be major direct contributors to the severe water pollution problems in the country. For example, at Santiago's free zone textile industry, waste water with high chemical concentrations reportedly drains directly into public streets and/or into the Jaque del Norte River without treatment. While denied by the free zone and textile authorities, the allegations are supported by private sector

professionals and officials of the water and sewage management agency in Santiago.

C. POLICY OPTIONS AND RECOMMENDATIONS

The importance of the free zones to the Dominican Republic is well known. In 1988, free zones represented about 67 percent of export earnings for the country and the free zone growth rates of 10 percent make it the most dynamic export sector. The structural adjustments needed by the D.R. economy have included increased exports, expanded employment and other efforts to counter the impacts of the declining sugar cane market and the declining peso against the U.S. dollar. These structural adjustment needs make a strong case for a vigorous free zone expansion policy.

AID has supported the D.R.'s export-led growth strategy to promote the development and investment attractiveness of the free zones. A basic recommendation of the study is that AID consider modifying its free zone assistance program to require the addressing of environmental impacts as a basic program requirement. Several approaches may be considered. AID could offer technical assistance to industries involved in planning the development of new zones or technical assistance to the National Free Zone Council in its review and approval licensing function. Also, various PVO's may be used to organize the squatter settlements around existing trade zones for basic upgrading program assistance.

The Free Zone assistance program also may offer an important opportunity for AID to bring together private industry, PVO's and the government in a joint public-private-donor/lender program to promote export-led growth that is also environmentally pro-active, as opposed to re-active. While the attractiveness of much foreign investment is based on

least cost production, it is also based on a reliable workforce, adequate reliable infrastructure and political stability. In supporting the continued development of free zones, AID should consider promoting environmental concerns not only for the output of the manufacturing processes but also concerns for the environmental impacts of the induced housing and community growth surrounding the zones.

While it is easy to make recommendations for AID policy, one recognizes the difficulties inherent in implementation in the D.R. today. In the example of free zones, in addition to the Free Zone Council, at least four key agencies are involved in the problems cited above. The regulation of industries is the responsibility of the Secretary of Industry and Commerce. The Secretary of Agriculture and the National Institute of Water Resources (INDRHI) have responsibilities for water resources and the national housing institution (INVI) is responsible for improving the conditions of squatter settlements.

As with other elements of the D.R. government, there is little evidence of meaningful interagency coordination among these agencies to address the environmental problems associated with the development of free zones in the country. By providing strategic assistance to PVO's, the Free Zone Council and the industries themselves, AID may be able to initiate a meaningful dialogue among groups having a direct interest in improving environmental quality.

It is important to especially note that the World Bank (1990) indicates that it is supporting the D.R. government with funding to assist, among other objectives, with formulating a "comprehensive strategy for the development of new free trade zone... (It) will finance technical assistance to strengthen institutions involved in financing, promoting and regulating free trade zones. "This will also include credit assistance

to private developers and studies to increase the economic linkages of the zones to the rest of the economy. The Bank project is expected to add 2.2 million square feet of factory floor space and create 30,000 direct jobs." AID should consider jointly working with the Bank on this project, relative to overall area planning, which would include addressing spatial expansion, infrastructure provision, and transport needs.

ANNEX 7.

URBAN EXPANSION AND ENVIRONMENTAL IMPACTS

A. NATIONAL URBAN DEVELOPMENT TRENDS

The recent 1990 RHUDO report entitled "Urbanization in the Caribbean: Prospects and Management Priorities" presented an overview of recent urban development trends in the Dominican Republic. One of the key observations was that much of the migration and population growth in the last twenty years has mainly occurred in three growth corridors: La Romana-Santo Domingo-Azua; Santo Domingo-Santiago-Puerto Plata, and Santiago-San Francisco de Macoris. According to 1985 sources, about one-half the D.R. population is in the Cibao Valley between Santiago and San Pedro, while one-third live in the Santo Domingo region which includes the coastal plain between La Romana and Bani. (Figure II-2)

According to 1970 D.R. census data, there were 12 D.R. cities and towns with a population of 20,000 up to 100,000. By 1986, the number of cities and towns in this range had increased to 18. During the 1960 and 1970's, the major cities of Santo Domingo and Santiago grew an average of about 6 to 6.5% annually. During this 20 year period, the smaller towns and cities grew within a range from about 4% to 6%. In the 1980 decade, the rate of urban growth has been estimated at about 4.3%, with a rural growth rate at substantially less than 1% and an overall country-wide population growth rate at slightly over 3% (Third World, 1987).

According to various statistics, from 1950 to 1990, the population of the D.R. has grown from about 2.1 million to over 7.1 million (Table II-11). During this 40 year period, the "urban" percentage has increased from 24% to about 60%. Projections for the period 1990 to 2020 show population increasing in the D.R. from 7 million to about 11 million. The "urban" percentage is projected to increase from the present 60% to over 77%.

As the two principal cities of the country, and the only two "true" urban centers, Santo Domingo and Santiago will continue to have a significant impact on the future economic and social development of the overall country. Santo Domingo is the center not only of governmental, financial, and political life but is also the center of national culture. Santiago serves as the regional center for the traditional agricultural economy in the north. As will be discussed later, due to the growth of free zones and coastal tourism areas in recent years, the migration rates to the two prime cities has likely been reduced. However, these cities are likely to continue to be the major population growth centers in the country. The ability of these cities to provide people and industry with the services and facilities necessary for efficient functioning may be an important key to the future economic development potential of the country.

B. EXPANSION IMPACTS OF LOW-INCOME HOUSING IN SANTO DOMINGO

Recent estimates show that 70% of the total investment of the country goes to Santo Domingo (Urban Institute, 1990). With a 1990 estimated population of 2.2 million, the city accounts for over 30% of the total country population of about 7.2 million. This level of investment in Santo Domingo is assumed to be roughly comparable to the city's contribution to GNP. Although D.R. data to confirm this assumption was not available, data from other sources suggest this relationship. Recent work by AID (1988) indicated that Third World cities produce about 60% of GNP even though their share of national population is much lower. For example, Bangkok reportedly accounts for over 85% of BNP in banking, real estate and insurance and 74% in manufacturing, even though the city has only 10% of Thailand's population. Within the next 20 years, Santo Domingo has been projected to reach possibly 4.9

million, which would be almost 50% of the 9.9 million projected for the entire country. Santo Domingo attracts migratory growth not only from rural areas but from other smaller cities as well. Recent estimates indicate that over 60% of the migrants to the city are from the smaller cities in the country.

Currently, Santo Domingo, the urban zone of the national district, has a population of approximately 2.2 million and a land area of 158.44 square kilometers (Km^2). This yields an overall population density for the urban zone of about 13,900 persons per kilometer (per/Km^2), although many of the poorest barrios have over double or triple this density. (According to 1981 ONE data, 65% of Santo Domingo's population [about 850,000 people] lived on less than 19% of the city's residential land area. The average density in these barrios was about 29,000 per/Km^2.) Of the 93 neighborhoods or communities in the city, one-third are squatter settlements.

Although each squatter neighborhood has its own distinctions, there are common characteristics. They are most often constructed on marginal or leftover land, which includes the flood plains of the rivers, the steep banks of drainage areas, or on vacant lots near industrial facilities. Although piped water may be in the area, few individual houses are served and sanitary facilities include common latrines shared by many families. Electricity, when available, is usually illegally and unsafely installed. There are few, if any, paved roads, and no garbage collection or fire protection. Various sources estimate that 90 percent of the migrant population to Santo Domingo are forced to locate to these squatter areas.

While it is beyond the scope of the study to focus on the social and economic issues associated with low-income housing policy in the D.R., a few observations are offered below,

relative to overall population growth, its location and implications for overall urban efficiency.

Table II-11 outlines four scenarios addressing the spatial expansion implications for the "urban zone" of Santo Domingo under different population levels and density assumptions within the next twenty years. (The overall National District encompasses an area of 1,477 Km_2. The Urban Zone, as defined by the National Office of Statistics, includes mainly the built-up urbanized area of Santo Domingo and is divided into 9.7 sectors. Excluding the major permanent open spaces, 93 sectors have been identified as having housing within the urban zone. This area encompasses about 158.44 Km^2, which represents about 11% of the total National District land area.)

Scenario A-1: Assuming a density increase of 20% between 1990 and 2000, the city's urban spatial expansion would be about 27%.

Scenario A-2: With no density increases, however, within 10 years the city would need to expand over 50%.

Scenario B-1: Within 20 years and a density increase of 30% above that of 1990, the city would need to spatially expand over 70%.

Scenario B-2: With little or no density increases over 1990, in 20 years the city would need to more than double its current "urban zone" land area.

Because of the many unknown factors which are involved in assessing the spatial expansion potential for Santo Domingo, the above scenarios are not intended as forecasts. Also, due to limited information available to this study, these expansion potentials for Santo Domingo should not be viewed as trends until further analysis is performed on a variety of land use, employment, transportation, geotechnical,

demographic and land absorption time series data. The expansion scenarios are offered, however, in seeking to suggest the potential magnitude of environmental problems which are likely to worsen if unmanaged spatial expansion continues.

C. INSTITUTIONAL CONSTRAINTS TO MANAGING GROWTH

As discussed in other sections of this report, the lack of adequate waste treatment, garbage collection, drainage facilities, and an overall lack of siting standards for guiding spatial development in low-income areas have contributed significantly to deteriorating water quality and increases in certain human health problems. There are numerous macroeconomic and political issues underlying the problems associated with supplying adequate housing and minimally safe utilities and community services in the D.R. Many of the professionals interviewed, however, also stressed that the "lack of publicly supported planning" was one of the key reasons contributing to many of these problems.

For example, the national government has heavily supported public "urban renewal" programs that have constructed over 23,000 low-income housing units in the past four years. There is little to suggest, however, that these programs are part of an integrated strategy to stimulate the sustained development of a construction industry for longer-term supply of low income housing. Although our information is not complete at this time, most of the professionals interviewed did not believe that there are current plans for the overall redevelopment or expansion of low-income housing areas for Santo Domingo, Santiago or for the other cities in the D.R. Although INVI has programs oriented toward providing housing upgrades for low-income families, these programs do not appear to be concerned with environmental impacts associated with

locating future new low-income areas in the metropolitan areas.

According to 1981 data, over 75% of the 1.1 million housing units in the D.R. were defined as "inadequate" to meet the basic needs of families. By 1987, there were over 1.36 million units in the country, with almost 420,000 defined as "inadequate" by the Instituto Nacional de la Vivienda (INVI). Assuming the formal sector will be able to produce about 18,600 houses per year, the annual deficit for adequate housing is projected to be 65,000 units per year for the next 10 years. While the informal sector has produced 25,000 units annually between 1970 and 1980, and is projected to potentially produce 37,000 units annually, most of this housing is also defined as inadequate (World Bank, 1990).

Dominican Government Housing Policies

The main trust of recent D.R. government policy has been to construct new highly subsidized housing for transfer to low and low-middle class families on concessionary terms. INVI, however, has sought to reorient the public sector with its 1985-88 operating plan to improve existing housing stock. This "housing solutions" program sought to rehabilitate about 46,000 units by a variety of measures including "regularization" of land titles, creation of materials banks for repairs, improving sanitation and other technical or financial assistance.

Another program worth noting is the World Bank's "site and services" program to provide 8,000 "housing solutions" in 1980. After 4 years, this program only achieved about 20% of its targets although almost all its funding was expended. The main reasons cited for its failure were the lack of D.R. government contingent funds, the large devaluation of the peso and other INVI administrative problems.

In addition to INVI, two other government organizations are responsible for building and financing low income housing. The Instituto de Auxilios y Viviendaes (INAVI) assist low income public employees. The Oficina Coordinadora y Fiscalizadora de las Obras del Estado is a new part of the President's office. The World Bank (1990), recommending that these three organizations be consolidated within INVI, states: "INVI's present policies and regulations are well conceived, it has a professional staff and, if provided with an adequate budget and some external technical assistance, could improve considerably the Government's direct contribution to housing needs."

Transportation Programs

In addition to planning for the expansion of low-income housing, the planning for transportation is key to avoiding numerous future environmental problems related to air pollution and overall urban efficiency. (Thompson/World Bank, 1983; Renaud, 1981; Cobb, 1988).

Discussions with various sources indicated that the D.R. government was interested in developing a new transportation master plan for Santo Domingo. Also, the World Bank is currently completing a transportation master plan for the entire country. These planning efforts are important because they offer the potential for addressing the spatial expansion issues raised by the growth scenarios outlined above. If Santo Domingo is to expand spatially between 25 to over 100% within the next 10 to 20 years, this expansion should specifically address the location of low-income housing areas (as well as other land uses) as a guide to minimize negative environmental impacts as well as to maximize transport economic efficiencies.

D. GROWTH POLICY DISCUSSIONS

One of the prime concerns regarding Third World urbanization is on finding ways to "manage spatial expansion" in order to minimize adverse environmental impacts, while also seeking to maximize economic efficiency in the functioning of the city. This environmental/efficiency concern embrace a range of issues from housing policies, to energy consumption, to regional land use allocations. A few examples are outlined below.

Within the past 20 years throughout the world, numerous studies by the World Bank and other international lenders and donors have shown the advantages of a variety of strategic policy-oriented approaches to supplying low-income housing and upgraded community services. These include: "sites and services" programs; credit mobilization schemes; cost recovery approaches; and various privitization techniques for stimulating the private sector to supply goods and services needed by the poor as well as other income groups. For the future growth and expansion of Santo Domingo and other D.R. cities, many of these strategic policy-oriented programs will be needed (World Bank, 1988; AID, 1989).

At the larger metropolitan scale, environment/efficiency concerns include the following: the relative energy consumption of various growth patterns; the air quality implications of various land use patterns; the relative capital and operating costs for utility services to alternative spatial growth patterns; or the relative impacts on surface water or ground water quality from alternative metropolitan expansion patterns. For example, research has shown that about one-half the water quality problems in the U.S. are due to non-point source pollution as opposed to point-source (Cobb, 1988). In other words, the pollutants in

the storm run-off from roadways, parking lots, lawns, and various agricultural uses are causing as much water quality degradation as the pollutants from various municipal, industrial and other effluent sources. Other "cost of sprawl" type research has shown the energy and utility capital cost efficiencies when comparing various spatial patterns, such as linear, radial or dispersed (Thompson/World Bank, 1983).

Other research on developing countries' expanding metropolitan areas has shown the importance of basic land use planning to the economic efficiency of cities and their key industries. A prime example is the industrial city of Cuidad Guayana in Venezuela. Here, the government and industry failed to properly locate future low-income squatter housing near the major employment areas. In addition to causing massive traffic congestion on the major arteries during rush hours, these spatial anomalies contributed to higher rates of work absenteeism and employee turn-over. Because of the excessive distances and travel times between residential and work areas, industries were forced to pay employees wages based on their beginning commute time rather than their start of work time. This resulted in key industries in Cuidad Guayana having substantial cost of production disadvantages (Cobb, 1980). The key point of this example is that the spatial distribution of basic economic activities in a region has a direct impact of the production efficiencies of those activities.

An efficiently functioning and reliable public transport system is needed for any competitive economy. In many areas of the world, the planning and implementation of an effective multimodal transport system will address the metropolitan efficiency issues. With a spatial expansion potential of between 25 to over 100% within the next 10 to 20 years for Santo Domingo, the location of potential low-income housing areas may be very significant in two areas: health and urban

efficiency. Firstly, health: Unless their locations are planned, low-income housing will likely occur as squatter settlements on available left-over marginal land areas. Without adequate water, sanitation, site drainage, and other basic services, these areas will likely continue to contribute to water pollution problems with related health consequence for the residents. A key point is that even if resources were made available today to solve many of the current water pollution and public health problems associated with Santo Domingo, unless the process of urban spatial expansion is altered, many current problems are likely to reappear within a few years. Secondly, urban efficiency: As Santo Domingo expands, the location of small businesses and larger industries needs to be considered relative to housing locations in order to minimize travel times and fuel costs in efforts to promote overall economic efficiency of the city.

E. POTENTIAL AID POLICY INTERVENTIONS

Housing

Possibly in concert with the World Bank and other lenders, AID should consider providing assistance to INVI relative to data gathering and planning for the spatial expansion of low-income squatter settlements for major urban growth areas in the D.R. This would include Santo Domingo and Santiago and other areas being impacted by the development of free trade zones and tourism.

Growth Management

As a basic area for potential urban environmental policy intervention, AID should explore ways to influence the spatial expansion process of the key cities in the D.R. This is not a recommendation for AID to directly promote traditional "master planning" or public sector "general plan preparation" for Santo Domingo or other key D.R. cities.

Within developing countries throughout the world during the past thirty years, the severe limitation of primarily physically-oriented metropolitan planning have been documented. However, newer techniques are now available. These include regional growth management planning, performance-based building and zoning standards, and joint public-private development planning programs. These techniques provide more realistic and politically sensitive approaches to development implementation coupled with concerns for environmental quality, economic feasibility and public participation (Lea/World Bank, 1985; Cobb, 1988).

Transportation and Infrastructure

AID should consider strong working relationships with groups advocating or sponsoring large scale planning for the D.R., including planning for transportation, energy and water supply/waste water. Even if the D.R. public sectors (whether national, regional or local) do not currently have the staffing or resource capability (or interest) for effective planning, AID should work through its network of PVO's, NGO's and private companies to promote grass-roots awareness of the importance of managing the growth of the city. AID could provide various types of technical support to public agencies to assist with the data collection process needed for spatial investment planning. Several existing or proposed AID programs targeted to other purposes could be potentially modified to provide for this additional technical support. These AID programs will are discussed later in the report.

ANNEX 8.

CONCLUSIONS: AID URBAN ENVIRONMENTAL STRATEGY

A. RELATIONSHIPS TO MISSION GOALS, OBJECTIVES AND PROGRAMS

The three overall strategic goals of the USAID/D.R. Mission are indicated on Table III-1. Plan objectives are also indicated. These strategic goals and objectives, and the various programs by which they are implemented, provide a policy framework which can incorporate most of the recommendations regarding the urban environmental strategy addressed by this study. These goals, objectives and selected AID programs will be briefly addressed to highlight potential relationships to the issues and recommendations of this study. Following this, additional strategic goals and objectives which are believed important in addressing many of the D.R.'s key environmental problems will be summarized.

Free Trade Zones Program

The mission's basic goal and objectives of promoting private sector investment and employment are reflected in its support to several programs, among them the Free Trade Zones (FTZ) and micro and small business enterprises. One of the FTZ's emphasis is on integrating local businesses to increase local value added to exports. One of the key findings of this study is that AID's FTZ involvement provides important potentials for helping promote environmental protection for major areas of the D.R.

Within the past few years, AID's support to free trade zones in the D.R. has been substantial. As of 1989, program disbursements have totalled about $6.4 million for assistance in constructing 189 buildings in 10 zones, employing about 85,000 people (65% women). Currently, there are 32 areas designated as free FTZ's. AID uses local currency loans channeled through commercial banks to provide credit to free zone developers.

Because of their wide geographic distribution and importance to the economic base and export development policies of the country, AID could use its FTZ influence for two important additional purposes: to influence the spatial growth pattern of the country in order to promote maximum regional transportation and infrastructure investment efficiencies; and to promote environmental protection and public health benefits to local areas and groups (especially the low-income workers and their families) being impacted by the growth of FTZ's.

Along with the FTZ program, several additional recent AID projects potentially could be used to support one of the key recommendations of this study, namely, the integrated planning and development of FTZ's within the surrounding local areas or communities.

The 1988 Debt Conversion Project will assist the Central Bank in establishing mechanisms to convert the country's foreign debt into investor equity or possibly domestic D.R. debt. Over the 4 year period, the project will support or encourage US$100 million of debt conversions into new investments in priority areas and could be used for projects such as infrastructure upgrading or expansion. Another key AID supporting effort is the Industrial Linkages Project. It gives technical assistance and local currency lines of credit for local industries to establish relationships with the FTZ manufacturers. This project also will assist the Free Trade Zone Associations in establishing these local linkages.

AID should consider integrating or augmenting these FTZ related programs with the PVO Co-Financing Project, in which Community Development is an emphasis. This could provide the opportunity to integrate and partially fund the key actors in the overall area of the Free Trade Zone as well as the Zone itself. This results in the following scenario: the Free

Zone Program addresses employment; the Debt Conversion Program addresses area (out-of-zone) basic "appropriate" infrastructure; the Industrial Linkage Program addresses the local business community; and the PVO Co-Financing Project addresses assistance to area low-income housing needs and grass roots community organization.

This amount of activity in an area should also stimulate local municipal government interest, and as part of the process, would provide on-the-job training in local-development. The overall process should also help promote localized grass-roots democracy. AID could try such an "integrated" effort on a pilot program basis in two or three areas, with variations on the approach as needed by local circumstances.

A variation on this approach would also be to promote the regional coordination of transportation and infrastructure investments among, for example, several tourism projects and/or free trade zones within the coastal zone. There could be substantial savings in capital investment for the parties involved, plus the added benefits of more environmentally sensitive land development for the projects and the induced surrounding local development.

Forestry Policy Development

The AID/DR Action Plan for FY 1990-1992 (Dec. 1989) identified four new important program initiatives, each of which builds on existing or previous AID D.R. programs. The Forestry Policy Development project proposal is especially relevant to the purposes of this study. The Action Plan states:

> "The protection and preservation of forests, given their crucial function in terms of the ecosystems in general and soil erosion in particular, is the major environmental concern in the Dominican Republic. One proposed Forestry Policy Development local currency project...will complement work done to date in

agroforestry and watershed management under the Natural Resources Management Project, fuelwoods development under the Energy Conservation Project and the Commercial Farming System Project promotion of systems for non-traditional agriculture."

The Natural Resources Management Project ended in mid 1988. The fuelwood component of the Energy Conservation and Resource Development Project ended in February 1989. This was a research program on fast growing tree varieties, with the intention of extending this research to promote private investment in "energy farms."

The objectives and strategy of Forestry Policy Development Project, as outlined in Annex 3 of the Dec. 1989 Action Plan, address many of the recommendations identified by this study, especially those regarding PVO's, NGO's and private sector emphasis in leadership to the forest preservation effort. However, several additional recommendations are offered:

- A greater AID emphasis is needed on the critical importance of tree farming and charcoal production relative to the overall energy requirements of the country now and in the coming decade. (But preceding this, further energy strategy studies we needed to verify and expand the very preliminary observations on secondary data represented by this study); and

- A greater AID emphasis is needed on understanding and promoting the small scale and larger scale charcoal production and distribution industry, as part of promoting commercial forestry and as part of protecting existing forests.

Energy Conservation and Resources Development Project

This AID project was scheduled for completion in February 1989, with the exception of the mini-hydro component. The prime thrust of the project was to assist the Dominican Electric Company with conservation measures. Technical assistance was also provided to the D.R. government on potential private co-generation in the country. As stated previously, the overall energy picture in the country is alarming, relative to its implications across all sectors. AID should re-evaluate its position on emphasizing energy within its basic objectives framework for the Country Development Strategy.

In addition to the charcoal/deforestation emphasis, a strategy comprising a comprehensive look at various energy conservation measures across all sectors should be initiated. This includes low cost passive solar technologies, co-generation for solid waste composting and continued emphasis on D.R. institutional reform to promote private investment in all forms of energy production. AID overall support for and emphasis on development of a joint public/private "comprehensive energy strategy" for the country seems immediately warranted.

Data Base Programs

One of the key recommendations of this study is the need to develop a comprehensive urban environmental data base for the D.R. While the specific requirements of the system will need to be developed, it essentially should be a GIS (geographic information) system, in which spatial and geotechnical data are integrated with demographics, socioeconomic and health series data. These systems are now relatively low-cost and microcomputer based. They are also user-friendly and basically menu-driven.

A key element of the data base would involve inventorying dischargers and discharge types relative to liquid, gaseous and solid waste pollutants. It would include not only industrial but also residential, commercial and institutional users. It would also address three classes of pollutant sources: point, urban nonpoint and non-urban non-point. A potential model for such an inventory is the National Residuals Discharge Inventory developed originally at the National Ocean and Atmospheric Administration (NOAA). Initial estimates would be based on available data and would likely be very incomplete. Over time these estimates would be refined and could serve as proxies for ambient environmental quality until these measures are later defined.

Currently, the mission has proposed two new project starts using DA funds which are for data base development. The first is the Agriculture Data Systems (which may be postponed until FY93), which is outlined in the February 1989 Mission Action Plan Report. The second is a data base to be part of the AID Family Planning Expansion, as discussed in an interview with Lee Hougen. While each of the programs has specific needs to be addressed, AID should consider examining the potential expansion or modification of these programs to cover additional critical information needs suggested by this study.

It also may be more cost-effective, as well as more generally useful, to have an integrated system established, that can be expanded over time, as opposed to several independent systems. Evidently ONAPLAN, along with other D.R. agencies and donors, are to be involved in the two currently proposed AID data bases. An AID sponsored working meeting among these groups, plus key PVO's such as IDDI and Profamilia, to outline common data base needs and user requirements, may also be the most cost-effective in the longer term.

PVO Co-Financing Project

The PVO Co-Financing Project provides an important vehicle for helping resolve many of the environmental degradation issues addressed by this study. Throughout the report, numerous sections have recommended the use of PVO's to provide local and community input for project implementation.

For the past 25 years, the D.R. has had an active PVO movement directed at the social and economic development of the country. AID in recent years has tracked the activities of 10 of the 27 NGO/PVO organizations that have programs dealing with environmental and national resource issues. Generally, these organizations have been found to be very effective in promoting public awareness of the importance of environmental quality and the impacts of continued environmental degradation on the quality of life.

The PVO Co-Financing Project in the D.R. builds on an already established working relationship between AID and a number of PVO's (ie., IDDI, Profamilia, Adopem). The main thrust of the Co-financing program is to address the critical needs of the poor. It recognizes that the country's worsening economic situation is having the severest impacts on the poorest groups. It recognizes the limitations of the current D.R. governmental response capacity and that the large scale macro employment generation policies may not reach these poorest groups.

The PVO Co-Financing Project's purpose is to increase the capacity of the PVD's and NGO's to deliver selected services and other resources at the grass-roots level to the geographically and economically isolated lower income groups. According to the AID Mission Project Paper on Co-Financing (9-22-88), the possible types of subgrant activities under the project would include but not be limited to:

- Health Delivery
- Water and Sanitation
- Upland Irrigation
- Small Scale Commercial Forestry Plantations
- Commercial Agroforestry, and
- Community Development and Self-Help.

Recent discussions with AID staff regarding the PVO program indicated a slightly different categorization of subsector activities to:

- Natural Resources
- Hillside Agriculture
- Employment Generation
- Health Delivery
- Water and Sanitation, and
- Community Development

Within both categorizations of subgrant activities are opportunities for helping implement many of the recommendations of this study. For example, smaller Natural Resources project areas have already been identified by the Mission to include energy plantations and coastal zone management. The Water and Sanitation area would allow for support to rural as well as marginal urban areas. The Community Development component could support water, sanitation and housing improvement activities.

While basically supporting the Mission's PVO Co-Financing strategy as currently understood, there are two areas of modification to the strategy which AID should consider. These include: area-investment and environmental coordination; and the direct linking of the PVO Co-Financing Project to other AID programs.

Area Investment and Environmental Coordination

An element of the PVO strategy should include sub-program activities which are directly and explicitly funded to address investment and environmental planning and coordination among various other PVO categorical subproject areas. While coordination with appropriate groups is required and intrinsic within each specific subproject, the emphasis recommended here is on investment planning and coordination among AID's subproject categories such as Water and Sanitation and Community Development. This element of the AID strategy would involve funding a PVO or NGO (with proven analytical capability) to be an environmental coordinator and economic promotor for a specific geographic area. The PVO's function would be to monitor and promote economic and environmental planning and coordination within an area. The PVO or NGO would deal with governmental agencies, the other subproject PVO's, private businesses, and other organizations.

For example, a focus could be on several north central urban fringe barrios of Santo Domingo for water, sanitation and community development. Another focus, for example, could the southwest in a town such as Neiba and its surrounding area, where energy farms and community development subprojects would be considered.

AID in coordination with PVO's, NGO's and appropriate D.R. governmental agencies, would select candidate geographic areas. The main purpose would be to promote economic and environmental synergism among subproject activities in an area. The basic focus of each individual PVO subproject would be retained as outlined in the Mission's strategy. The modification to the strategy proposed here only suggests funding an area investment and environmental coordinating function which may precede or run in parallel with the individual subprojects, depending on the specific conditions.

While AID's PVO Support Unit and the Office of the Technical Secretary of the Presidency (TSP) may provide some area coordination in subproject selection and monitoring, the thrust of the recommendation here is to allocate some PVO Co-Financing Project funds (say 10%) to qualified PVO's or NGO's for this investment and environmental planning and coordination function for key "change areas" within the country.

If the municipalities and other governmental agencies were functioning adequately, this recommendation would not be needed. Hopefully, by focusing on economic development and environmental quality for a sizeable key "change area," the PVO coordinator can help promote grass roots democracy in which people come together to help themselves. This strategy also recommends that the local PVO work with counterpart organizations in the U.S., such as the Environmental Defense Fund or certain universities, to establish a model for organized action of the public and private sectors.

Linkages to Other AID Mission Programs

Free Trade Zones

In initially formulating the PVO Co-Financing Project, the Mission choose not to add social components to programs such as the Free Trade Zones (FTZ's) in order not to divert or dilute the central purposes (i.e., economic development, income generation, etc.) of these programs.

In relation to the preliminary findings and observations regarding the unmanaged environmental impacts of some of these zones on the surrounding areas, this study recommends a reconsideration of this mission strategy. However, information available to this study regarding the environmental impacts of all the FTZ's in the DR is extremely sketchy, including those supported by AID funding. If the

subjective observations for the few zones cited by this study are confirmed for most of the FTZ's, however, the Mission should consider modifying its support program. The earlier section of this report outlined a scenario in which this modification could occur. Essentially, it is recommended that AID support be contingent on coordinated area planning for all parties involved (e.g., industry, PVO's, local and national government agencies) to insure adequate area environmental protection, infrastructure and social services.

Due to the magnitude of the future FTZ development anticipated for the country, one would anticipate that substantial environmental improvements could be attained without massive infrastructure investments which would detract from the economic competitiveness of the zones. The PVO Co-Financing Project could be the vehicle to help this happen.

Improving Educational Opportunity/ Institutional Building

The Mission has provided support to several types of educational programs in the D.R. aimed at supplying the needed technical and managerial personnel required for private sector lead development. UCMM, a major private sector University, has initiated a program to encourage development of a career civil service. This seems an important ingredient in addressing urban efficiency and environmental management in the country. This study encourages the Mission's support to UCMM and the Mission's continued policy dialogue with the D.R. government.

The Mission's Graduate Management Training Project has established both MBA and MPA programs with a local university to provide managers for public and private sector roles. Due to the importance of tourism in the economy, a hotel management and tourism element has been addressed in this

program. A key recommendation of this study is to explore with local universities the expansion of the Graduate Management Training Project to address the following areas: pollution control and environmental engineering; infrastructure, transportation and urban development planning; and municipal administration and management.

Several approaches are suggested. With an appropriate D.R. university, AID could support establishment of a research center focusing on Urban and Environmental Management, possibly along the lines of the Agribusiness Training Project's Rural Development Management Center (ISA/CADER). Several U.S. universities and NGO's could be approached for their interests in affiliation to provide technical assistance, teaching, research, or other forms of support.

In addition to graduate and professional training, the center could also be a focus for local private companies to sponsor vocational training related to areas such as environmental monitoring, testing and clean-up or other areas needed to promote environmental management as a part of economic development.

B. RELATIONSHIPS TO THE DOMINICAN REPUBLIC GOVERNMENT

The lack of an effective civil service at all levels of the D.R. government is a major obstacle in addressing many of the environmental quality and growth management issues covered by this study. These issues cut across the various jurisdictional, social, spatial, economic and political interests of many groups. Without effective public institutions addressing these cross-boundary public interest issues (with regulations, incentives, and prohibitions, where necessary), even with the "unseen hand" of an efficient marketplace it will be difficult

to solve problems like water pollution and coastal degradation.

Because of the importance of environmental issues to the health of the D.R. economy as well as to the health of most of its people, AID could assume a much larger role as an environmental advocate in the country. This does not mean supplanting economic development, public health, social equity and promotion of a market economy with an environmental platform as AID's primary goal and priority. However, it does imply bringing environmental goals and issues up-front and equal to the Mission's other concerns and agenda as it dialogues with the various elements of the D.R. government. Also, with over one-half the D.R. population now living in cities (over 30% in Santo Domingo alone) and with the trend to continue, an elevation of the Mission's concerns for the country's urban development process itself seems warranted in dealing with the D.R. government. (Whether or not AID maintains a rural focus or moves more toward adopting an urban focus seems a dead issue. The important point seems to be in understanding the critical linkages and the policy intervention opportunities for accomplishing the basic goals of the Mission and the U.S. AID program generally.)

The Mission's current overall strategy of focusing on PVO's/NGO's, public/private partnerships and continued dialogues with various levels of the D.R. government to promote policy reform, seems the appropriate strategy also for addressing the urban environmental quality issues. Throughout the study, suggestions have been offered for addressing certain governmental organizations for specific issues. The following is a general observation on environmental issues and AID's relationships to key elements of the D.R. government. As an overall strategy in relating to the current D.R. government, there are several areas where AID could support

institutional strengthening regarding urban environmental issues. These include: TSP; ONAPLAN; ONAPRES; DRC; FONDUPREI; Oficina Fiscalizadora de las Obras del Estado; The Central Bank; the League of Municipalities; and the National Environmental Commission. The following are brief suggestions regarding each of these organizations.

TSP

According to World Bank (1990) estimates, the President's office makes decisions on about 50% of the investment decisions within the country, and possibly has influence on almost all major projects. [However, some public entities such as CORDE (state enterprises) and CEA (the sugar council) also make investment decisions.] Although an all-inclusive budgetary process does not currently exist for the country, the Office of the Technical Secretary of the Presidency (TSP) appears to have most of the responsibility for final budget recommendations. (The TSP also includes ONAPLAN, ONAPRES and the DRC.)

As a longer term option, AID should consider having dialogue directly with the Office of the Technical Secretary (TSP), for ways to raise the environmental planning and evaluation function within the overall national budget allocation process. Possibly, AID could suggest creation of a special environmental unit within the TSP, somewhat similar to the AID sponsored Local Currency Development Resources Coordinating Unit (DRC). A variation on this would be for AID to elevate the importance of environmental planning and evaluation in the functioning of this unit relative to operations of the PVO Co-Financing Project.

ONAPLAN

ONAPLAN, the National Planning Office, makes a three year rolling public investment program for the country. However, according to the World Bank (1990), in the past it has performed only limited evaluation and prioritization functions. Interviews with the Director and some key staff indicated that the office makes project recommendations to the TSP. However, its technical capabilities to perform thorough evaluations are limited due to the shortages of qualified staff and other resources. There are seven operating units within ONAPLAN. The Ambiente Division covers regional and environmental issues, although the ability of this division to perform technical environmental evaluations of programs or project proposals from the line ministries, is probably poor at best.

In the near term, the Mission should consider providing technical assistance to ONAPLAN in developing environmental criteria for project selection and evaluation for its own use and for issuing to the sector line ministries. This would also involve strengthening the environmental as well as overall project monitoring functions within ONAPLAN.

ONAPRES

ONAPRES, the National Budget Office, is also within the TSP. It prepares budgets mainly based on program requests form the line ministries. Again, according to the Work Bank and other sources, during budget preparation, little indication of priorities or preferences is available. Also, overall there appears to be little coordination among the line ministries, ONAPLAN and ONAPRES, regarding project planning, investment programming and budgeting.

AID support to strengthening of the monitoring, programming, evaluation and budgeting function between ONAPLAN and ONAPRES,

and within the TSP overall, could be an important step in the ability to have environmental concerns inserted into the national resource allocation process. AID's support to data base development, as previously discussed, contemplates ONAPLAN involvement. This is an important initial step in efforts to upgrade the information base needed for effective project selection and resource allocation.

FONDOPREI

FONDOPREI is the National Preinvestment Fund. In recent years, funds for performing preinvestment studies have been drastically reduced and FONDOPREI now concentrates on monitoring projects in the D.R. financed with external funds. The D.R. government is requesting donor support for technical assistance in preparing preinvestment studies. AID should consider supporting FONDOPREI as this presents an opportunity to incorporate urban environmental objectives and criteria, as well as other Mission objectives, into the national project identifi-cation and selection process.

Oficina Fiscalizadora de la Obras del Estado

The Oficina Fiscalizadora de las Obras del Estado is the office which manages the 1401 Fund (known as the President's Fund). Through this fund this office allocates almost one-half of the ordinary revenues of the national government. One of the functions of this office is to allocate funds relative to capital and operations/ maintenance expenditures in the country. Because of the importance to human health, improvements to the existing water supply, sanitary landfills and other urban infrastructure systems should be receiving great levels of investment. AID should seek policy dialogues with this office to promote a great attention to urban environmental concerns in the allocation funds of this office.

Central Bank Debt/Equity Swap Unit

Another AID supported project is the proposed Debt/Equity Swap Unit to be located in the Central Bank. In a similar fashion, AID should explore innovative ways to use the "debt-for-nature" swap concept. Typically, countries such as Ecuador, Bolivia, the Philippines, and Costa Rica have exchanged debt for local currencies and the promise to preserve parts of the national resource base, usually unique forest areas.

In addition to the recent D.R. debt-for-nature project established between PRONATURA and the Central Bank, there are other examples worth noting. For example, the Nature Conservancy recently purchased debt from a major Costa Rican creditor for about 14 cents on the dollar. The Conservancy then traded the paper back to the Costa Rican government for about twice the amount in local currency bonds, with the interest to be paid to local groups to manage the conservation projects (Passell, 1990). In another example, Conservation International, which organized the first debt-for-nature swap, purchased steeply discounted Bolivian debt and donated it to the Bolivian government. The government then used the proceeds to develop a public-private partnership that combines national resources conservation with development planning on a regional scale (Welsh, 1990).

Especially in a country with tourism resources, a variation on the "debt-for-nature" swap theme is a "debt-for-managed development" concept. The basic idea is to structure deals in which larger scale growth areas, such as those surrounding tourism zones, are environmentally protected as well as developed in part with local currency generated by debt swaps. This should have the double advantage of helping retire D.R. foreign debt while also helping directly promote a key growth sector which is ultimately dependent on environmental quality.

A similar concept of "debt-for-sustainable development" (e.g., energy farms) should also be explored. The key point is to link First World conservation donor interests (public and private), with private developer interests, with D.R. government interests. Such a program could also be linked to President Bush's June 27, 1990 announcement of his Enterprise for the Americas Initiative, in which debt reduction, along with trade liberalization and investment policy reform, could work together to promote economic growth in the hemisphere.

League of Municipalities

Municipalities in the D.R. are severely restricted in their ability to adequately provide the infrastructure and municipal services needed by most of their populations. As discussed in previous sections, their expanding populations have drastically outpaced their abilities to expand or even maintain the existing stock of municipal capital investments in roads, solid waste collection and disposal, community facilities, and related services.

The administrative problems of cities seem to closely parallel those of the national government, including: lack of coordinated investment planning and project execution; inadequate attention to operations and maintenance requirements; inadequately trained staffs and low salaries; and overall inadequate cost recovery for varied services provided. Because municipal water and sanitation services are handled by other agencies, as was discussed previously, solid waste collection and disposal are among the major service delivery problems facing governments.

For solid waste and other services provided by municipalities, their budgets are approved by the League of Municipalities, which then pass them on to ONAPRES for approval. Because of the pervasive administrative and financial problems facing all

municipalities in the D.R., AID dialogue with the key directors of the League of Municipalities itself regarding services pricing/cost recovery policies and private sector promotion seems the most important policy areas to address. Due to time and manpower limitations, this study could not fully address the many institutional issues facing the D.R. municipalities relative to environmental quality. From discussions with numerous D.R. professionals, however, there appears to be little planning for the future spatial expansion of the cities. Where there has been planning, there has also been little monitoring or enforcement of regulatory controls in development.

This study is not recommending restrictive building, infrastructure standards of zoning controls which inhibit the land markets from supplying the needed low income housing and related commercial services areas. This study is recommending, however, that AID dialogue with the League of Municipalities, and selected city governments regarding the incorporation of environmental criteria as a basis of future spatial expansion. This may include the need for AID technical assistance to the League and to selected cities. For the cities, this could be provided as part of the coordinated program involving the private sector and PVO's in tourism or free trade zone areas, as discussed in earlier sections of this report.

National Environment Commission

The National Environmental Commission (Comision Nacional Para El Medio Ambiente) is an advisory group to the D.R. President on matters relating to national environmental policy. Although the commission has no professional full-time staff, it does have political influence and its executive staff appears knowledgeable and committed to environmental improvements for the country.

The Mission should consider some form of support to the Commission. For example, AID could support inclusion of the Commission in an advisory role on selected AID projects, such as the comprehensive data base program recommended by this study. This project would include other national agencies such as ONAPLAN. Eventually, the National Commission may be an appropriate office for giving technical support in establishing a working access to the data base.

It seems premature to suggest that AID supports elevating any one agency or person to the role of "environmental czar" in the country. However, because of the massive overlap of laws, regulations and agencies responsible for environ-mental matters, AID support to a well respected group in the D.R. which does not have an entrenched bureaucracy may provide strategic advantages in promoting positive change.

As an alternative to the above recommendation, the Mission may wish to explore the concept of promoting an expanded role for an "environmental executive" at the national level of the D.R. government. While in reality this person may not have decision-making or budgetary authority over projects, international donor/lenders could require that their programs be reviewed and approved at a "one-stop" office relative to environmental matters. This may have the effect of helping consolidate the many fragmented and overlapping agencies and laws that address environmental concerns.

Such an environmental executive could be part of the Office of the Technical Secretary to the President, where most decision-making regarding the country already appears to occur. An initial program emphasis at this office could be on helping create the environmental data base previously mentioned, which would be accessible to all responsible parties in the country.

C. RECOMMENDED NEXT STEPS

The urban environmental overview presented by this study represents an initial effort at gathering and analyzing a broad spectrum of data related to environmental quality and development in the D.R. Due to the limitation of time, manpower and the "energy crisis" conditions prevalent during the data gathering and interview period in the D.R., however, substantial additional data was sought but not available. For this reason, the suggested next steps for AID in addressing many of the issues and recommendations contained in this study are broken into three phases: additional data needs; near-term actions; longer-term strategy and a special considerations option.

Additional Data Needs

The following information is needed to augment and further clarify or verify many of the issues addressed by this study. It is recognized that some of this information may be readily available while others may require substantial search and compilation from many sources. Data not readily available should be added to the near-term action tasks. (Some of the information was previously requested in a memo from M. Cobb to T. Cornell, dated 2 November 1990.)

Industrial Pollution

Data on industrial pollution was not available. However, AID's 1981 survey indicated that meat packing, food processing, detergent and related industries, use minimal, if any, waste removal before discharge to sanitary sewers or storm drains. Although there have been recent allegations from professional and local citizens that some industries in the free trade zones are discharging untreated wastewater with high chemical context directly into receiving water, the industries deny the practice.

Within the D.R. there are a wide variety of industries which may be contributing to water and atmospheric pollution. (See Table 8-1, adapted from the 1981 AID D.R. Country Environmental Profile). Some of the more obvious ones cited include particulate or smoke emission from the FDC cement plant and Metaldom in Santo Domingo, and sulfur oxide emissions from the electric power generation plant. While the scope of this study did not permit a detailed inquiry into industrial pollution or its impact, it could be an important consideration in formulating an overall strategy for environmental quality in the D.R., especially as related to water quality treatment.

Water and Coastal Degradation

Information is needed on the current extent and status of wetlands in the D.R. Also, the degree of beach erosion and the extent of sand extraction being permitted for tourism and other economic development activities needs to be determined. The degree of coastal dredging and landfilling occurring in the coastal zone is also an important consideration in understanding potential protection strategies needed. Also, concerns were expressed regarding the degree of existing marine and shipping industry pollution in the harbor and dangers posed to major resort areas by potential oil tanker collisions in the Canal de la Mona.

Air Pollution

Data on the extent of D.R. air pollution and its impacts was not available. Also, due to the severity of water related environmental problems in the country, several professionals interviewed did not rank air pollution as a priority problem. However, while outdoor air pollution is not believed to be a priority problem, data on the coverages and pollutants being generated by automobiles and the large industries in the major cities needs to be assessed. Also, studies have shown indoor

Table 8-1

CHARACTERIZATION OF THE MAJOR INDUSTRIES IN THE DOMINICAN REPUBLIC
Rough Estimates 1980

Name/Location	Product/ Capacity	Employees	Water Use	Impacts
CEA Discharge	Sugar Management	50,000	Minor	Soil
Gulf Western Central Romana	Sugar/ Furfural	18,000	Closed recycle	
Vicini	Sugar	5,000	Closed recycle	
Falconbridge Banao	Ferronickel	2,000	22,700.00 l/d	Water
ALCOA Pedermales	Bauxite	1,000	Dry	Dust
Rosario Dominicana Cotui	Gold-Silver	740	Closed Recycle	Water Hazard
Metaldom S D	Steel	1,000	2000.000 l/d	Smoke
Refineria Dominicana de Petroleo, Haina	Petroleum Products	120	100.000 l/d	Stack sulfer emissions
Fabrica Dominicana de Cemento, S.D. (smoke)	Cement	1,300	100,000 l/d	Stack particulates
Industrias de Asbestos Cementos S.D.	Asbestos-Cement	120	200.000 l/d	Untreated waste-water Breathing in mixing room
Carnes Dominicanas S.D.	Meat Packing	150	200.000 l/d	Direct discharge of blood
Acromax Dominicana S.D	Pharma-ceuticals	150	200.000 l/d	
Proteinas Nacionales	Animal Feeds	160	50.000 l/d	Dust explosion hazard
Cerveceria Nacional Dominicana, S.D.	Beer	850	3.000.000 l/d	
Industria Nacional del Papel Bonao	Reclaimed Paper	250	.500.000 l/d	Untreated waste-water

Source: Adapted from the AID Dominican Republic Country Environmental Profile: Table X-2, 1981

air pollution to be of concern in Third World countries (Elsom, 1987). Various fuels used in cooking make women especially at risk relative to cancer, pulmonary disease and fetal deaths. Due to the high use of charcoal in the D.R., more efficient cooking stoves could have added health as well as energy conservation benefits. AID public health improvement programs are encouraged to consider addressing these concerns in their data base programs.

Proposal for Collective Waste Treatment Facility

Ing. Robert Castillo Tio has presented a proposal and pre-feasibility study for a collective wastewater treatment facility to be developed by a voluntary association of the main dischargers into the Ozama and Isabela Rivers in Santo Domingo. AID should support the further refinement of this proposal as a key potential element in significantly improving the city's river water quality and related benefits. (See the memo on this dated 10-26-90 from M. Cobb to G. Peterson, copied to T. Cornell).

Survey of Free Trade Zones and Tourism Sites

Additional data is needed on the character and extent of development in the areas surrounding the free trade zones and tourism sites in the country. This includes basic demographic, land use and health statistics as well as information on PVO, donor or governmental or private developments proposed for the areas. According to the Ministry of Tourism, data is available on the growth projections and infrastructural demands for the tourism areas being planned for the country. This data was requested but not provided.

Organization of the Charcoal/Fuel Wood Market

Information (or estimates) on the number and size of companies operating legally and illegally is needed. This includes land

areas. Also, any information on government plans for increasing the supply of energy farms, including incentives for the private sector. This information was requested from Ms. Margarita Gil of JACC, but was not available.

Land Market Operations & Geotechnical Criteria

A better understanding of the operation of land markets, especially in the major cities, free trade zone areas and tourism areas is needed. The data needed involves land use, ownership patterns, (public or private) site development costs, finance factors and absorption patterns and rates. Also, a better understanding of national land tenure policy, especially as related to rural-urban origination, is needed.

The geotechnical information needed mainly includes topographical, soils and flood plains data. (Initially, only broad-brush information is needed for a better understanding of workings of the existing urban land development process).

Other Demand, Supply and Health Statistics

Further data is needed on water demand and the water supply wastewater systems currently operating in the major cities and tourism area. Also, the water quality from urban area aquifers and the sedimentation rates of rivers needs clarification to the extent possible. Additional data is also needed on disease vectors associated with the solid waste problem, especially morbidity of populations near uncontrolled landfills/dumps.

Information of Urban Infrastructure and Transportation Expansion Plans

Further data is needed on the existing and proposed governmental and donor-supported master plans for Santo Domingo, Santiago and the other larger cities within the D.R.

This includes information on land use, absorption rates, capital improvement projections and methods proposed for financing and general implementation of water supply, waste water, power distribution and intermodal transportation.

Near Term Actions

In addition to the data needs, the most important near term priority actions recommended to AID in addressing urban environmental problems are the following:

- Data Base

  Development of a comprehensive sector relational data base for the D.R.; would be a geographic information system (GIS) addressing urban environmental quality, natural resources conservation, urban-rural economic linkages and health indicators within the D.R.; would include monitoring elements and modeling components such as the AID's RAPID model for projecting alternative regional and urban growth options and impacts; should be low-cost, menu driven and user-friendly to the maximum extent feasible.

- Energy and Charcoal

  Promotion and technical assistance in development of a comprehensive sustainable energy strategy for the D.R; would emphasize energy plantations, charcoal production optimization, biogas and solar applications and comprehensive conservation measures; would continue AID'S emphasis on maximization of co-generation opportunities in industrial applications, maximum private sector participation and the importance of minimum reliance on imported fuels; an analysis of start-up capital needed for various cogeneration operations is especially needed.

- Free Zones

  Modification of AID's existing support strategy and program regarding free trade zones to address more specifically on-site as well as off-site and area environmental quality impacts; would include promotion and support to coordinated area planning for adequate infrastructure and services to minimize environmental degradation and to encourage maximum economic integration of zones and the surrounding area; would include technical support to PVO's, private industry and local municipalities in formulating and implementing joint infrastructure investment programs.

- Tourism

  Modification of AID's support strategy regarding tourism to promote environmental protection for the coastal zone; similar to the free trade zone recommendations, would include technical support to PVO's and municipalities in selected tourism zones to encourage and permit meaningful dialogue with private sector tourism proposals and national tourism plans being prepared.

- Debt-For-Nature Swaps

  Investigate further the "debt-for-nature" swap strategy, especially as related not only to conservation but to promotion of sustainable economic development; this includes potential "debt-for-nature" swap elements as part of the recommended actions regarding energy farms and tourism/coastal zone protection.

- Water Supply-Wastewater

  Technical support to feasibility studies regarding alternatives for increasing water supplies and improving wastewater disposal and solid waste management in Santo

Domingo; would include the Castillo Tio proposal on collective waste treatment, the Guaricano landfill cogeneration scheme, and potentially a new study on critical water supply augmentation requirements for the near term, and

- Environmental Objectives Promotion
  Generally, incorporate and promote urban environmental quality improvements and infrastructure enhancements as major objectives within the Mission's Country Development Strategy; these objectives directly support AID's overall goals of growth with equity and selected interventions to address the critical needs of the poor, especially regarding the health of the lowest income groups.

Long Term Actions

Eventually, the longer term action items will be influenced by AID's resource constraints and by the Mission's policy decisions regarding the recommended near term actions and their results. Based on the information available to date, however, those items which may require the longest time frame relative to implementation are the following:

- National Government Strengthening
  Support to the strengthening of the institutional capacity of the national government relative to incorporating urban environment quality and general resources conservation as workable and meaningful evaluation elements in the overall sector planning and budget allocation process;

- Municipal Government Strengthening
  Support to strengthening municipal governments relative to increasing their management and technical capabilities in program planning, budgeting and operations; this

includes emphasis on improving land registration and titling, cost-recovery techniques for municipal services and for more effective incorporation of privitization opportunities; strengthening the capacity of the municipalities to more effectively coordinate with PVO/NGO activities is also needed.

- Environment and Business

  Actively promote environmental quality and environmental protection as a friend and direct benefactor to business and the financial community; focus on the costs of not investing in environmental improvements when the direct costs for improvements are discussed; environmental clean-up itself is a major private sector growth industry in the world and should be promoted as a micro as well as a macro business in the D.R.

- Land Markets

  Generally promote the opening up of urban land markets; this includes encouraging the government to adopt realistic incremental approaches to providing low cost housing; it also includes continued efforts to change the attitudes regarding the sale of under-utilized "once public-always public" land holdings which could help promote orderly urban growth patterns; continued support is also needed to help promote credit mobilization of the poorer groups for upgrading and expanding homes and businesses in the poorest communities;

- Support to Infrastructure/Transportation Planning

  Provide support to governmental agencies and international lenders promoting transport and infrastructure planning for the major cities in the D.R.; be an advocate for promoting the realistic inclusion of low-income "sites-and-services" housing expansion areas

for low-income groups and for promoting energy conservation and overall environmental quality as key planning objectives, and

Public Education

Support public education and awareness campaigns at all levels of society regarding the importance of environmental quality in the lives of each Dominican; in all existing AID programs where possible, consider giving greater emphasis to environmental quality planning up-front in the program planning phase, which is an effort beyond the negative declaration exercise relative to impact assessment.

Special Considerations Option

(The following is only intended as a discussion item [as a possible next step] for AID in addressing urban environmental quality. Additional information would be needed before it would be added or dropped as a recommendation.)

Due to the likely rapid expansion of the Santo Domingo, Santiago and Puerto Plata areas within the next few years, AID should consider directly sponsoring a 5 year technical assistance program to help "manage the expansion" of these high growth areas.

Without such a program, many efforts to remedy "existing" environmental problems, such as water quality, are likely to be overwhelmed by expansion of many of the key "causes" of the environmental problems. These causes include the expansion of squatter settlements and supporting small business enterprises on inappropriate or environmentally sensitive lands, where inadequate provision for drainage, sanitation and water supply result in numerous environmental and health problems.

This is not a recommendation for AID to launch an urban planning program for these cities. The focus should initially be on technical support such as environmental mapping, and other data base tasks. Where possible, this effort should be coordinated with other D.R. governmental or donor-lender programs for transportation, infrastructure and tourism planning. Although land ownership determinations and numerous other problems will be encountered, it should be possible to develop an "environmental profile" of generally where development should and should not occur, based on environmental as well as "least" infrastructure costs parameters.

The next steps would involve using the information in dialogue with various governmental agencies, other lenders, private developers and PVO's in finding least cost ways to provide minimally needed roadways and utilities and eventually serviced sites. In essence, the basic idea is to initiate a dialogue among the various groups on how to manage the urban growth that is coming.

ANNEX 9.

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ANNEX 10.

INDIVIDUALS CONTACTED DURING VISIT TO SANTO DOMINGO

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