

# **Environmental Scarcities And Conflict in Haiti**

**Ecology and Grievances in Haiti's  
Troubled Past and Uncertain Future**

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### **Project Background**

A number of experts have suggested that a better understanding of the physical and economic impacts of environmental degradation could improve the quality of donor policy and interventions. Moreover, several international aid agencies find themselves unable to move their planning focus from crisis and survival needs to long term development goals.

Haiti is important in Canadian foreign policy because of the large community of expatriate Haitians living in Canada, Haiti's association with Canada through the *Francophonie*, and the active community of Canadian non-governmental organizations (NGOs) working to improve the quality of life in Haiti. Moreover, regional security has occasionally been disrupted by desperate Haitian refugees who seek political freedom and economic opportunities in neighboring Caribbean states, the United States, and Canada. Some foreign policy experts are concerned with the rising use of Haiti as a transit point for drugs into North America. Understanding Haiti's internal problems are necessary for understanding how it may pose a threat to regional security, so it is an important and logical choice for a study of how environmental degradation threatens internal stability.

Many studies identify the great social and economic challenges facing Haiti, while others highlight the country's rapidly deteriorating natural environment.<sup>1</sup> Few studies, however, have specifically investigated the critical role of Haiti's natural environment in the generation of civil strife.<sup>2</sup> The government of Haiti itself has long feared rapid migration to the country's urban areas, knowing that "this migration is due principally to the degradation of agriculture and the absence of socio-economic opportunities in rural zones."<sup>3</sup>

Over the years, tens of thousands of Haitians have sought work in the United States, the Dominican Republic and other Caribbean islands. During the military junta at least 15,000 people fled to the US, though only 1,500 were allowed to remain. As one US diplomat pointed out, "Haitians are too ready to deal with their economic problems by getting on a boat."<sup>4</sup>

The broad goal of this research is to explore the connection between scarcities of environmental resources and civil strife in Haiti. It does not, however, evaluate specific donor programs. It seeks to understand how environmental scarcities, in conjunction with other known social and economic sources of public grievance, have contributed to the last few decades of violence in Haiti. Constructed with the best data available from a variety of sources, this research provides both a deeper understanding of the recent history of conflict in Haiti and an awareness of the important environmental, demographic and social trends that will effect Haitians early into the next century.

Overcoming these critical ecological and demographic trends seems a daunting task and a number of observers privately doubt that Haiti will survive as an independent nation or as an integrated society. Although general trends like population growth and soil erosion can be predicted with confidence, political and market trends cannot be predicted and thus remain the most significant source of hope for the future of Haiti. If the country's political and market institutions can be designed to fairly and efficiently meet the needs of its inhabitants, then many of the discouraging ecological and demographic trends will change for the better. Thus, short fictional stories about the lives of individual Haitians are used to remind the reader about the wide range of possible futures that remain for Haiti and to introduce some of the radical new ideas about how to 'do development' using modern communication technologies and ideas that have worked well in other parts of the world. These anecdotes are presented as a counterbalance to some of the more discouraging evidence about the country's social and ecological trends.

The future that evolves will depend on the choices made by aid agencies, Haitian leaders, and most important, by Haitians themselves. While this report occasionally expresses its recommendations in strong terms, the implementation of recommendations must be made in negotiation with the elected leaders of Haitian communities.

### ***Executive Summary***

Environmental degradation reduces agricultural production and family incomes, forcing rural families to move into Haiti's urban areas. Environmental degradation makes the transport of goods, services, and people difficult because roads are often blocked by mudslides or washed out altogether. Environmental degradation damages other kinds of rural and urban infrastructure, causing the loss of life, health, and property in Haitian communities. Environmental degradation has motivated some Haitians to become environmental refugees in their own country, and motivated other Haitians to seek refuge in the Dominican Republic, other Caribbean Islands, the United States and Canada.

Environmentally degradation induced a mass of poor people to migrate to the slums of Port-au-Prince. By the mid-1980s many of these people had organized groups based around small church parishes and achieved a collective awareness of solidarity and common grievances. Protests became riots, riots became increasingly violent, and the political crisis that ensued has yet to be properly resolved.

Many of the ecological and demographic trends behind the social upheaval are continuing to accelerate. Unless these trends are addressed, the international community should be prepared to see widespread famine and civil strife in Haiti, possibly culminating in the collapse of the country's weak social order.

The immediate causes of civil strife in Haiti include poverty, weak civic institutions, and norms of justice, easy access to firearms, and poorly trained and equipped police. However, the impoverishing effects of scarce environmental resources have largely defined, and will continue to define, the broader context of social development in Haiti.

### I. Introduction

Haiti is the most impoverished and environmentally degraded country in the Western Hemisphere. Although most developing countries experience some rapid urbanization, the population of Haiti's capital, Port-au-Prince, has grown at a faster rate than most of the world's larger megacities. This rapid growth has strained local infrastructure and formed the political cauldron in which violent protests, strikes, and riots have simmered for over a decade. The root of this civil strife can be traced to a mass migration in recent decades. The densely populated slums provided the conditions for building solidarity between people with common grievances.

Haiti's tumultuous history is the background for its current predicament in that "Haiti's rulers have siphoned off surpluses for two centuries without contributing even minimally to the education of the people or the growth of new sources of income."<sup>5</sup> The context of endemic poverty is important for understanding recent turmoil, and observers are correct to look into class, corruption, and voodoo culture that are the most apparent facets of Haiti's political culture. However, mob violence in the streets of Port-au-Prince and other major urban centers has disrupted national politics more than protest in rural communities, and it is important to understand how and why these urban slums formed. Even though some analysts have associated rapid population growth and urban poverty with civil strife in Haiti, they often stop short of tracing popular grievances back to an important source – environmental scarcities.

In Haiti, severe scarcities of environmental resources in rural areas forced the migration of many people into even more ecologically fragile lands or city slums. The poverty of many who moved to more fragile areas deepened as forest and soil resources diminished. Those migrants who moved into urban areas eventually suffered from similar environmental scarcities, their poverty deepened by diminishing water quality and rising fuelwood prices. Most families who chose to remain in rural areas saw diminishing returns from their small farms, but had no immediate target for their frustrations. In

contrast, urban dwellers did have more opportunities in the city, and could quickly organize in large numbers to express their collective grievance at ready targets – usually officials from national or international institutions.

The urban population of Haiti has grown phenomenally in the last few decades. Natural growth rates in cities are often lower than in rural areas and the population boom of cities like Port-au-Prince, Cap-Haïtien and Jacmel is largely the result of heavy migration from farming communities in the Highlands. Tens of thousands of Haiti's poor have gone to work in the sugarcane fields of the Dominican Republic and civil strife in Haiti has often resulted in the migration of large numbers to the shores of Florida.<sup>6</sup> Some of this migration was due to general economic malaise and political strife that has long afflicted many highland communities. However, both large industrial development projects and smaller green revolution development projects induced a significant portion of the migration into Haiti's urban centers. The economic opportunities created by these projects were temporary, and they were created at the expense of the very ecological resources used by rural communities for small-scale agriculture.

This study uses both empirical evidence on the general trends in Haitian development and anecdotal evidence about the recent history of development in key regions. First, I review the evolution of the concept of environmental scarcity. Second, I identify the important forms of environmental scarcity that have plagued Haitians and explore how these scarcities interact in the recent history of Haiti's largest watershed, the Artibonite Valley, and its largest city, metropolitan Port-au-Prince. Third, I present Haiti's ecological and demographic challenges through data on critical trends that are slow to change and can be predicted with confidence, such as rates of change in human populations, soil erosion, and deforestation. However, trends in cultural attitudes, entrepreneurial confidence and political leadership are difficult to predict because they can change quickly. So to supplement the data on underlying trends, I have created brief fictional scenarios to hint at how these variables may exaggerate or mitigate the effects of slower trends. In

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conclusion, I explore some of the policy innovations that may cost-effectively address a number of Haiti's desperate problems and build on its important strengths.

# II. The Context of Development Under Haiti's Kleptocratic State

Jean-Claude 'Baby Doc' Duvalier inherited his father's title of "President For Life" in 1971 and led the country through several years of economic prosperity. However, with deteriorating ecological conditions and the new President's corrupt and lackluster leadership, economic growth slowed. Whenever political opposition arose it was violently suppressed.<sup>7</sup> After 15 years of stagnation, protests and riots began to disrupt the country's capital, Port-au-Prince. On February 7 1986, Jean-Claude Duvalier fled for France.

In the following decade Haiti struggled to achieve democracy, with the champion of the poor Jean Bertrand Aristide being elected, deposed by social elites, and reinstated after international sanctions. During this period, protests throughout the country expressed dissatisfaction with government leadership, but it was violence in the capital's slums that proved to be the most pernicious threat to political stability. Although these slums were an important part of Aristide's power base, they remained impoverished, overcrowded, and volatile communities even after his return.

The Haitian state has long been run by a small number of powerful families, and this "educated urban and largely mulatto elite used the state to enrich itself by any means possible. Its members paid little or no taxes or customs duties, or even their utility bills."<sup>8</sup> In contrast, rural families in Haiti were cajoled into paying various taxes by the administrative *chefs de section*, large landowners, and people who organized exports from rural areas, the *spekulate*.

One observer called Jean-Claude Duvalier's regime a 'kleptocratic state' that sought to nationalize the economy so that corruption in the private sector could interact symbiotically with corruption in the public sector.<sup>9</sup> Since large sums were skimmed off public works projects, many were ill fated from the beginning.<sup>10</sup> Most development projects sponsored

by foreign agencies remained under close scrutiny by the donor community and were a relatively minor source of revenue for Haitian elites. However, these projects still had to work around the local elites that manipulated policies, programs, and property rights in their favor.

After decades of management by corrupt elites, Haiti is now known to be one of the least developed countries in the world. Aggregated numbers like Gross National Product - which is now little more than US\$250 per capita - reveal little about the true depth of poverty. Incomes in the city are several hundred dollars higher than those of rural areas, and many families in the arid northwest and isolated southern regions have incomes of less than US\$100 a year.<sup>11</sup> Many Haitians would not actually handle US\$250 worth of currency in a year.

Few Haitians have been able to save money. For most families, about a quarter of their annual income is spent maintaining their shelter, paying housing taxes, and repaying the loans needed for construction supplies and labour. For some urban dwellers, as much as a third of the day's wage is spent on transportation since the costs of operating vehicles on the crumbling roads are high. The rest is spent on food and clothing, and a tiny portion may be reserved for a local lottery.

### **Haiti's Vibrant Informal Economy**

Although economists do attempt to measure the size and dynamics of the national economy, most recognize that at least two-thirds of the goods and services exchanged are traded outside the formal sector. Haiti's informal economy supports a large part of the population by making commercial and domestic goods and services available without burdensome taxes.

In many countries the informal economy is considered a sign of underdevelopment because it consists of marginal subsistence activities that are largely beyond regulation or taxation by the state, activities found only in poor urban areas. As in other countries, participation in Haiti's informal economy is characterized by:

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- little skill, capital, or organization
- shared ownership between family members
- a small scale of operation
- hard work and adaptive technology
- unregulated and competitive markets.<sup>12</sup>

In Port-au-Prince the informal sector is thought to employ 80 percent of the city's inhabitants, and these markets clog the roads with a wide selection of products — from medicines, fuelwood and food to clothes, tools, cars, and bicycles.<sup>13</sup>

Another important feature of the informal economy is that women are usually entrusted to handle most of the market-place transactions, even though they are not counted as being part of the 'economically active' population.<sup>14</sup> Women also act as intermediaries carrying goods between rural and urban areas, selling produce, clothing and small goods in markets, or preparing meals in street side kitchens. The urban population itself is disproportionately female — 123 women for every 100 men — partly because women come from rural communities to buy and sell in the urban markets.<sup>15</sup> These microbusinesses are the engine of the informal economy, and smuggled goods fuel this engine.

### **Haiti's Social Groups**

A handful of Haitian families control a significant portion of the country's resources, but the disparity between social groups is not as pronounced as in other Latin American countries. These families derive their income from international trade and bear a heavy tax burden because import and export duties are a crucial revenue source for the Haitian government. The urban poor and rural farmers have also assumed a significant tax burden due to the arbitrary application of levies. Despite heavy taxes on property and produce, rural populations have received little benefit from the public coffers because state elites preferred to encourage urban industrialization over rural development.

About two-thirds of the Haitian population lives in rural areas of the country, usually close to the sparse network of poorly kept roads that cross both hills and plains. Many families manage small farms under

complex yet flexible tenure arrangements. Based on long standing reciprocity traditions, families will offer their labour or rent their land in exchange for cash, produce, or a commitment of labour from neighbors. As necessary, they will also hire labour and land from neighbors. These arrangements allow families to adjust to crop failures or share in prosperity. Many rural families also produce a variety of goods for a variety of markets. With field gardens producing corn, beans, and sorghum and tree crops producing coffee and fruits, a successful family can simultaneously farm for subsistence and cash income.

Rural Haiti is neither a tribal society with communal control of land nor a peasant society with ancient communal traditions.<sup>16</sup> Unlike rural areas in many Latin American countries, Haitian farmland is freely bought and sold, and rarely managed communally unless so dictated by development projects. The primary economic unit is the family, though occasionally the domestic mode of production is enhanced when neighbors form small *groupe* to make purchases, share labour resources, or save on the transportation costs of shipping goods to market.

## The Challenge of (Re)Building Haiti

### **Social & Technical Ingenuity**

Haiti currently has exogenous sources of technical ingenuity supporting its development: an international donor community that provides 70 percent of the Haitian government's budget, peacekeepers that support civil order, and an expatriate community that sends money back to their families. The Canadian International Development Agency (CIDA), United States Agency for International Development (USAID), and other donor agencies have begun to plan for the medium and long term recovery of a society tormented by serious environmental degradation, rapid population growth, and violent civil strife. Following the establishment of constitutional government in Haiti, donors pledged over US\$1.5 billion dollars in support of the government's efforts to reconstruct Haiti. Considering the diminishing budgets of many donors,

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this new reconstruction phase must have the ultimate goal of building Haiti's capacity to solve its own problems. Even though the government has maintained a substantial amount of legislative control over resource use, the institutional capacity to manage the country's resources has never existed.

### Civil Society

Because neither 'Papa' nor 'Baby' Doc Duvalier tolerated opposition, it was not until the latter fled to France that popular, consumer, and professional organizations began to flourish in Haiti. The wave of populist activism that broke 'Baby' Doc's tyranny and launched Aristide into national politics also formed dozens of new civic associations. As Human Rights Watch observed: "the realm of organized activity broadened rapidly. Politically active trade unions, professional, student and women's organizations, and thousands of block associations and community groups were born. A vibrant press emerged, primarily in the form of the much-listened-to radio, providing information about other organizational activities and a forum to denounce periodic attacks on this independent movement."<sup>17</sup> The coup on the 30th of September 1991, however, forced civic society into retreat. Junta leaders sought to stifle popular movements by violating many basic human rights with intimidation, arrests, beatings, rapes, and murders. In the transition to democracy civic associations have returned, but they are hampered by the dismal economic conditions.

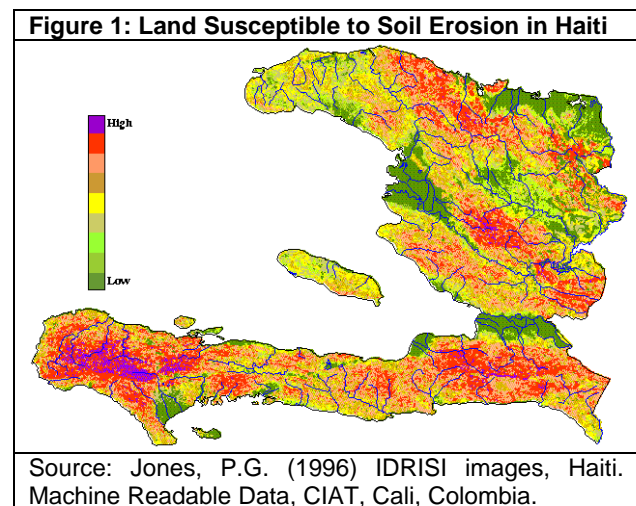
The level of popular participation in national politics is one of the lowest in Latin America. Although the poor turnout in the recent elections can be taken as sign of popular disinterest in national politics, it should not be used as a gauge of civic activity. Most Haitians — both farmers and urban dwellers — do participate in some form of cooperative or grassroots organization for the purpose of increasing their purchasing power. Haitians live in very strong civic associations: the *lakou* brings family and family friends together in living arrangements; the *ti legliz* brings a 'little church' community together; and *gwoupman* bring income earners together in cooperatives. Since the vast majority of Haitians are living in poverty, little of their time and energy can go

to organizations that do not help improve their living conditions.

### A Sensitive Ecology

Haiti is a mountainous Caribbean country of less than 2.8 million hectares. Almost two-thirds of the countryside has a slope of more than 20 percent, and two-fifths of the land is above 400 meters in elevation, making the soil particularly susceptible to erosion by torrential storms that pummel the land from June to October. Not only does this terrain limit agricultural cultivation but it also compartmentalizes the country geographically. The poor roads leave many regions very isolated.

Experts estimate that only one-third of the land is actually cultivable by conventional standards, though over one-half of the land is now put to some form of agricultural production.<sup>18</sup> Although the country is semiarid and protected against moist trade winds by the Dominican Republic, its soils are like those of other tropical islands — fertile but thin. Decades of rapid deforestation and intense farming in several regions expose the soil to the energy of wind and rain, which has carried away the livelihood of many rural families with the soil (See Table 1 and Figure 1).<sup>19</sup>



| Risk Level | Million Hectares | Percent of Total |
|------------|------------------|------------------|
|------------|------------------|------------------|

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|  |      |       |
|--|------|-------|
| None   | 4.8  | 17.6  |
| Low  | 6.5  | 23.9  |
| Low - Moderate   | 10.9 | 40.2  |
| Moderate - High  | 4.1  | 15.1  |
| High - Very High   | 0.9  | 3.2   |
| Total  | 27.2 | 100.0 |
| Source: Antoine Boulos, <i>Haiti: Ressources Physiques Informatisees et Vocation Des Terres</i> (n.p.: 1995) defines risk by slope, soil type, precipitation and vegetative cover. |      |       |

## Theories of Environmental Security

It has been over a decade since scholars began to explore the connection between environmental degradation and security. Most of this early exploration focused more on expanding the definition of 'security' for nation-states than on studying the specific connections between environmental degradation and the grievances of combatants.

The first advance came in acknowledging the impact ecology had on economic productivity: when scholars began to examine global economic interdependence, they made a key observation that ecological catastrophe in one area could have economic consequences for the rest of the world. Furthermore, environmental degradation was shown to slow economic development by presenting itself as general economic loss. For example, fuelwood shortages, dams ruined by silt collection, fouled drinking water or salinized irrigation systems have negative economic outcomes. Population growth then adds to the demand on this deteriorating resource base. These ideas informed foreign policy strategies designed to improve the planning of overseas development assistance.<sup>20</sup> That conflict might spring from environmental degradation seemed self-evident because resource scarcity often caused economic hardship, which often resulted in conflict; since environmental degradation was likely to increase, so too were incidences of violence.

There is no clear and simple correlation between poverty and violence, and the second advance came in acknowledging the complexity of socio-ecological systems. When researchers began looking at specific cases of conflict with a possible ecological component, the complexity of the connection between

environmental degradation and conflict became increasingly evident. For example, most small agricultural producers know the techniques of sustainable agriculture that are most suitable for their habitats. In Haiti, import and export duties encouraged many hillside farmers to give up traditional coffee and banana export crops in favor of tubers and grains demanded by urban food markets. In clearing trees for intense swidden agriculture, farmers exposed their soils to the erosive energy of the wind and rain with devastating effects on the productivity of their land. With such complex interaction between economic incentives, environmental scarcities and population movements, researchers realized that it would be more meaningful to identify sets of causes rather than exclusive causes.

Scholars have found that under certain circumstances, scarcities of renewable resources, such as cropland, forests, and water produce civil conflict and instability. These scarcities act mainly by generating social effects, such as poverty and migrations, that analysts often interpret as conflict's immediate causes.<sup>21</sup> Environmental scarcity is the result of the degradation and depletion of renewable resources, the increased consumption of these resources, and their inequitable distribution. Evidence from several cases suggests that these three sources of scarcity often interact and reinforce one another. Environmental scarcity often encourages powerful groups to capture valuable environmental resources and encourages marginal groups to migrate to ecologically sensitive areas. These two processes in turn reinforce environmental scarcity and raise the potential for social instability.

Researchers at the University of Toronto made a number of important findings in this area. First, most cases are instances of subnational conflict, rather than conflict between nation-states. Second, most of the strife occurs over arable land, freshwater supplies, and forest resources. Focus on these renewable resources is a new area of investigation because most of the previous work on conflict and resource scarcity had looked at cases involving state conflict over oil and mineral wealth. In cases of conflict over renewable resources, social institutions could mitigate, exacerbate, or even concentrate the

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harmful impact of environmental degradation within its communities. Thus, the complex interaction between social institutions and ecological systems required a careful methodology to assess the importance of ecological factors without denying the role of other political and economic factors.

Societies can adapt to renewable resource scarcity by either using their indigenous environmental resources more efficiently, or by reducing their dependence on these resources. In either case, the capacity to adapt depends on the level of social and technical ingenuity available in the society. If social and economic adaptation is unsuccessful, environmental scarcity contributes to impoverishment and migrations, weakens state capacity, sharpens animosities between ethnic groups, and enhances their opportunities to participate in violent collective action. Ethnic conflicts, insurgencies and coups d'état are often the consequence.<sup>22</sup>

### Common Criticisms

There are several common criticisms of the theories on environmental security. First, some critics argue that humankind has been fighting over land, water, and other resources for centuries, and that there is nothing new about analysis that links resource scarcities to violence. Second, others dispute the independence of ecological factors as causes of conflict, arguing that these factors are only a byproduct of political or market trends, and are at most a distant and indirect cause of conflict. Third, others argue that where scarcities occur, they are almost always redressed by market responses that encourage conservation, substitution, and technological innovation. Fourth, there are those who argue that countries unable to deal with environmental scarcities are usually poor, and therefore are unlikely to cause security threats to their neighbors.<sup>23</sup> It is possible, however, to address many of these concerns with a careful methodology that respects both the direct ecological causes of conflict and those indirect ecological causes of conflict which are actually the result of socio-economic activity.

### Designing A Useful Comparative Framework

A useful methodology for studying the importance of environmental degradation in shaping the character of conflict should outline the possible interactions between social and ecological systems while providing a framework for comparison with other cases. In other words, it should use a framework that brings out the relative importance of environmental degradation in a given economic and political context. Such a framework was recently developed by the Project on Environment, Population, and Security at the University of Toronto. The project studied conflict in places as diverse as Rwanda, South Africa, Pakistan, Gaza and Chiapas, Mexico by assessing 'environmental scarcities' - resources made scarce by a number of different social and ecological processes.<sup>24</sup> With this framework as a guide, but not as an imperative, researchers found that comparisons between cases could be productive and that the causes of conflict in many specific cases could be set into sharp relief.

A *demand-induced scarcity* occurs when the number of people using a resource increases, or when consumption of the resource increases on a per capita basis. Rapid population growth due to high fertility rates in a community, or rapid, unplanned immigration from neighboring regions can raise the demand for local land, forest and water resources. Also, the consumption habits of developing societies often change, raising demand for the specific ecological resources needed to produce goods. To satisfy a growing demand for beef products, for example, a society must devote vast areas to pasture land.

A *supply-induced scarcity* occurs when ecological conditions diminish or deplete the resources used by a population. This can be the result of either human abuse of the local ecology or natural disasters. Land degradation in developing countries usually begins with the rapid removal of forests for commercial profit or subsistence farming, continues with intense farming for little more than 3 or 4 years, then ends when overgrazing by cattle, sheep, and goats removes the last protective roots and grasses from the soil

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A *structural scarcity* occurs when the resource is not equitably distributed within a population. Good land can be quantitatively scarce because some families control large estates, while others have small land holdings or no legal titles at all. It can be qualitatively scarce because some families have secured large tracts of the most ecologically valuable lands, leaving for others land that is less productive agriculturally. Structural scarcities exist for resources whenever powerful groups control the use of land, forest, and water resources and deny access to less powerful groups.

These natural resource scarcities often occur together, and the compounded effects in a social system can be described as the processes of resource capture and ecological marginalization.

*Resource capture* occurs when powerful groups anticipate resource scarcity and manipulate the state's property laws and development plans to secure a supply of good resources for themselves. This process results in large areas of forest, land and water resources being set aside for the use of powerful groups in society. *Ecological marginalization* occurs when large numbers of people react to an unfair distribution of limited resources by social elites. Those who suffer from the unequal distribution of resources migrate to more ecologically fragile areas in search of relief from scarcity. Living at the edge of forests or at the edge of great urban centers, migrant populations can grow quickly in density and damage local environmental resources, which effectively deepens their poverty.

Many of the issues raised by critics can be addressed using this framework. First, sub-state conflict over renewable resources, not illustrated by a simple international political economy, can be clearly identified. Second, the causal independence of ecological factors from social factors can be better appreciated. Third, the interaction of ecological factors with population growth, distributive problems, market malfunctions, government weakness, and elite interests can be mapped out. Fourth, in several cases, states dealing with internal environmental scarcities have violently suppressed civil unrest, become more authoritarian, and tried to deflect internal criticism by intimidating and

threatening neighboring countries. Even though substate conflict is the most frequent outcome of severe environmental scarcities, a hardening of the regime can have implications for international security.

### III. Resource Scarcities and Conflict in Haiti

Within Haiti's political and economic context, environmental scarcities have seriously diminished the quality of life for the vast majority of the population. The three types of environmental scarcity – demand, supply, and structural – have affected primarily the land, fresh water and forest resources of Haiti though these resource scarcities have often interacted in different rural and urban settings.

Though the rate of growth in urban populations is high, about two thirds of the total population still live in rural areas, where environmental resources are particularly important. Experts estimate that it takes half a hectare of good land to feed a person for a year, and about 1,500 cubic meters of clean water to keep that one person healthy. Overall, rapid population growth in Haiti has resulted in one of the highest population densities in the Americas – 2.6 people per hectare – in a country where productive land is scarce. In Haiti there are only 2/5ths of a cultivable hectare for every person

Between 1965 and 1995 the total population of Haiti grew from 4.2 million to 7.2 million despite high rates of infant mortality and low life expectancy. In contrast to the annual growth rate of 1.8 percent for the total population, the urban population grew by about 3.6 percent each year, and today one third of the population lives in burgeoning urban centers. The capital city of Port-au-Prince has grown more than ten-fold since 1950, and is now home to at least 1.7 million people.<sup>25</sup>

#### **The Scarcity of Arable Land**

*Demand-Induced Scarcity.* Haiti has long been one of the most densely populated countries in Latin America. But because Haiti is still a country of rural farmers and the amount of usable land is actually less than half the total area of the country, population density measured per hectare of cultivated land is a better measure of the Haitian land scarcity. Between 1950 and 1970 the rate at which new lands were brought into cultivation roughly paralleled population

growth. Over the following twenty years the area under cultivation decreased in absolute terms while the population continued to grow and between 1970 and 1990 the number of people living off each hectare of cultivated land grew from three to five.

*Supply-Induced Scarcity.* Soil erosion is a significant cause of agricultural decline, deepening poverty and in turn contributing to population displacement within Haiti. The impact of erosion depends on a number of factors, including slope, soil type, vegetative cover and the force of wind or water energy that is transferred to the soil. Erosion reduces soil volume, clogs irrigation systems, and diminishes the water holding capacity and fertility of soil. Erosion has exposed bare rock in large areas, washed tons of good soil into city streets and local rivers, and represents the most pernicious limitation on the supply of good farmland in Haiti.

In the late 1960s, the Organization of American States (OAS) made one of the first national surveys of soil quality. The survey was based on eight gradations of soil quality ranging from good, cultivable soils not requiring conservation measures to soils unsuitable for agriculture because of severe limitations in slope and soil depth. The OAS survey had two important findings. First, the surveyors found that no Haitian soils could be cultivated without the help of some form of soil conservation techniques, extensive drainage systems, or intensive fertilizer use. Second, the surveyors found that over half of Haiti's soils were ill suited for agriculture, except where topography and soil depth permitted coffee or fruit tree crops.<sup>26</sup>

In 1985, the World Bank estimated that between 10,000 and 15,000 hectares were being lost each year, and that cumulatively almost 40 percent of the land area had been stripped of its productive soil.<sup>27</sup> Now it is estimated that around 900,000 cubic meters of earth are lost to erosion each year, laying some 1,500 hectares of farmland bare (See Appendix B).<sup>28</sup>

*Structural Scarcity.* Existing data on land distribution in Haiti is of poor quality.<sup>29</sup> Conventional wisdom suggests that between two thirds and three quarters of all Haitian farmers own much of the land they farm. Most farmers, including

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those with their own properties, also rent land, sharecrop, or sell their labour to other farmers.

Large estates do not dominate agricultural production in Haiti as they do in other Latin American countries, though the size and number of large landholdings is probably underestimated. In many other Latin American countries, land is more clearly concentrated with social elites than in Haiti. However, with population pressures and resource limitations good land is still scarce. Decades of government patronage and malleable property laws have allowed the best lands to be taken over by companies and social elites.

Although the method of data collection varied from census to census, a recent study by the French and Haitian governments has pieced together the history of land distribution in Haiti. While this data is still highly aggregated and may not include some of the largest privately held estates, it does reveal three important changes over the last thirty-year period. First, the amount of land held by the poorest 20 percent of farmers decreased slightly. Second, the amount of land owned by the 'middle class' of landowners decreased. Third, the number of extremely wealthy landowners may have decreased, but the actual holdings of a group of 'upper middle' class increased significantly, accentuating a structural scarcity of land resources.<sup>30</sup>

Even though a majority of Haitians are rural farmers, the state has never spent a significant amount of its revenues on rural development problems. Only a tiny portion of the rural population has had access to credit, and often access was offered in exchange for participation in formal development projects or political allegiance. Moreover, corruption also prevented funds earmarked for rural projects from actually leaving the sight of state elites. By hiring ghost workers, delaying or forgiving the collection of certain loans, and spending research and development money on a select number of properties, the government could add to the wealth of absentee landlords.

### **The Scarcity of Fresh Water**

*Demand-Induced Scarcity.* Haiti is already the most water scarce country in the Western Hemisphere, and

it is currently one of the twenty-five driest countries in the world with about 1,530 cubic meters of fresh water per person per year.<sup>31</sup> If the infrastructure for collecting and distributing water were more efficient, each person could consume the recommended 1,500 cubic meters of water each year. Rising water consumption has been driven both by population growth and the growth of industry in urban areas. As it is the poor water management system cannot meet the rising demand, and the country's irregular rainfall patterns, which vary by season and altitude, magnify distributional problems.

Health experts agree that each person needs at least 1,000 cubic meters of water each year, and Haiti is fast approaching a position of constant water scarcity. Because of the growing population in Haiti demand for fresh water has also risen, but the rapid expansion of Port-au-Prince has placed a particularly high demand on the water supplies in the Cul-du-Sac region around the city. Fresh water resources are not only scarce because of rising demand; falling supplies also limit them.

*Supply-induced Scarcity.* If managed and distributed carefully, Haiti might have enough water to quench the thirst of its growing population. The country does receive 41,200 billion cubic meters of precipitation each year. Most of the water is absorbed by the land, but about 29 billion cubic meters of water evaporates, and 12 billion cubic meters flows out to sea. If this water were managed and collected by the country, each person could receive 1,530 cubic meters of clean water each year, but currently less than 1 billion cubic meters of water is actually managed. For the moment, there are substantial water resources and great potential for capturing water for power and public consumption.<sup>32</sup>

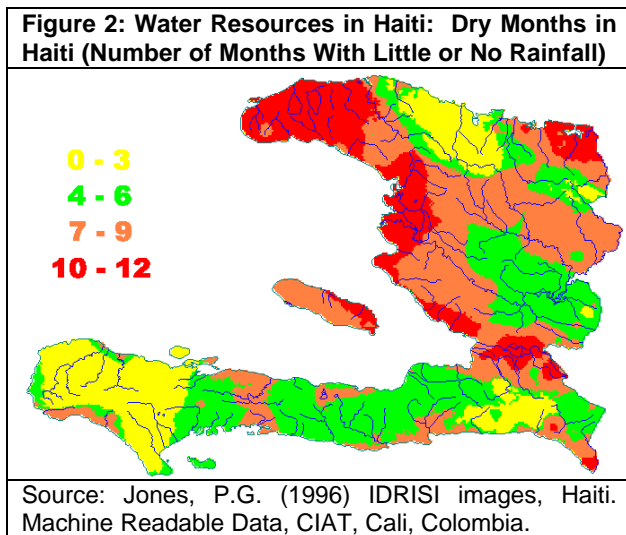
However, some regions do suffer from long droughts (See Figure 2), and in most cities, the water is badly polluted. This irregular supply of freshwater has seriously compromised public health: for every 100 deaths of children under five years old, more than 50 had symptoms linked to typhoid, dysentery bacilli and various parasites that infest the fetid water.<sup>33</sup>

Although difficult to calculate, there has been a growing scarcity in the supply of freshwater as a

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result of both erosion and consumption patterns. Erosion reduces the capacity of the hillside soils above Port-au-Prince to hold water. As a result, local agriculture requires more water to maintain production. By over-pumping freshwater up from aquifers under the city, salt water is actually drawn in from the ocean, ruining a number of wells each year.

*Structural Scarcity.* Water is one of Haiti's most poorly managed resources. In Port-au-Prince, private arrangements with public officials have allowed three-quarters of the water distributed by the city to go to less than a quarter of the population.<sup>34</sup> On a national scale, only one in three Haitians lives within 15 minutes of a clean water supply.<sup>35</sup> Improvement in this ratio over the last two decades is largely the result of work by international aid agencies.



### The Scarcity of Forest Resources

*Demand-Induced Scarcity.* Because forests provide such a variety of products and services, they are a crucial resource for Haitian communities. In the early part of this century about four-fifths of the country was forested, though logging quickly fragmented the forests as the most accessible timber — along roads and waterways — was felled first.<sup>36</sup> It was not until after the 1950s, when the size of rural communities began to increase, that forest resources

became scarce. Today, about 900,000 hectares of forestland remain.

Wood is still used for building homes in rural areas, and mangrove poles are frequently used as supports for brickwork in urban areas. Deforestation also occurs as rural families clear land for gardens, and often the cleared wood is turned into charcoal for the urban markets. With rising population, the demand for fuelwood has grown, and since mangrove wood is also good for making charcoal, mangrove forests along Haiti's coastlines have been disappearing rapidly.

*Supply-Induced Scarcity.* While consumption has reduced the forest resources available in Haiti, natural factors have also constrained the supply of forest resources. Logging removed the precious hardwoods that were easily accessible, and the networks of roads and patchworks of cleared land effectively fragmented large forests, limiting their ability to regenerate.

Deforestation usually results in soil erosion, but Haiti's severe erosion problems have in turn compounded the deforestation of certain areas. As soil washes downhill, it is often caught up behind the exposed roots of the mangrove trees that thrive in the estuaries of Haiti's coastline. Mangrove forests thrive in a high water table, but when several feet of silt have collected in the floodplain, the water table drops below the level of tree roots.

### Scarcities In Interaction - Fuelwood

Several forms of scarcity often affect resources concurrently. For example, fuelwood has been in high demand by growing families for several decades. At the same time, this supply has been limited by the weakened capacity of many forests to regenerate. The best wood was removed for export or reserved for construction in prosperous areas of Port-au-Prince and other cities. These days, almost every scrap of wood harvested in Haiti is for fuel, and both wood and charcoal account for about 85 percent of the country's total energy consumption.<sup>37</sup>

Because of the high demand for fuelwood and construction material, harvesting is both the primary cause of deforestation and an important source of

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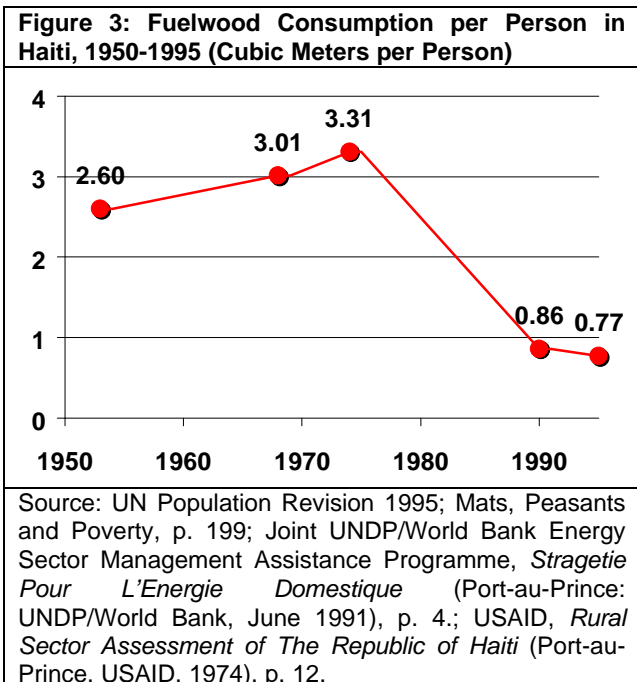
supplemental income for many families. Rural families usually collect deadwood and scrub brush for their own fuel supply, and send solid wood and charcoal to the urban markets. Since burning live wood at high temperatures produces this charcoal, urban demand now accounts for a significant proportion of the country's deforestation. Charcoal is the principal cooking fuel for over 80 percent of the population of metropolitan Port-au-Prince.<sup>38</sup>

Charcoal is distributed by a network of producers, local and regional transporters, wholesalers, and retailers, all of whom add to the cost of the charcoal to the consumer. However, the market price of charcoal is still a good indicator of resource scarcity, and the World Bank has charted the increasing scarcities of fuelwood resources by following charcoal price trends. Up to the late 1960s, fuelwood was relatively abundant and real prices remained steady. Between 1968 and 1986 prices increased by about 5 percent each year, a period of "relative scarcity" according to the Bank. New supplies of propane prevented charcoal from commanding high prices after 1986, and though the supply of wood entered a period of "significant scarcity" fuelwood prices themselves remained steady.<sup>39</sup> Along with the World Bank's data on fuelwood prices, data from other sources reveal that the supply of fuelwood per person began to diminish rapidly after the mid-1970s (See Figure 3 and Table 2).

Currently about 5.5 million cubic meters of fuelwood is consumed each year, though annual forest growth is estimated at only 3.4 million cubic meters. Since demand is about 60 percent higher than the sustainable supply, a simple linear projection of wood consumption suggests that Haiti's wood producing forests will disappear before the turn of the century. However, as prices rise most consumers will substitute fuelwood for petroleum products or other biomass sources. Wood is no longer used as a building material in urban areas since cement is less expensive, and many trees are only allowed to grow large enough to be sold as support poles in construction.

Demand, supply, and structural scarcities interact and reinforce each other. Over the last forty years the population of Haiti grew very rapidly, raising the

demand for natural resources such as fuelwood, land and freshwater. To meet the demand for fuelwood in the burgeoning cities and add to their own income, rural farmers often removed wood for construction material or charcoal. Other farmers cleared forests to expand food production, and only rarely to create pastures. Logging stripped precious hardwoods from large areas for many years, leaving only few tracts of primary forest in the highlands.



**Table 2: Consumption of Fuelwood in Haiti, 1990**

|                          | Wood Equivalent of Charcoal and Wood |         |
|--------------------------|--------------------------------------|---------|
|                          | 1000 Tons                            | Percent |
| <b>Port-au-Prince</b>    |                                      |         |
| Household                | 800*                                 | 21      |
| Informal Economy         | 200*                                 | 5       |
| Bakeries & Dry Cleaners  | 20                                   | 1       |
| Subtotal                 | 1,020**                              | 27      |
| <b>Other Urban Areas</b> |                                      |         |
| Household                | 355**                                | 9       |
| Informal Economy         | 75*                                  | 2       |
| Bakeries & Dry Cleaners  | 20                                   | 1       |
| Subtotal                 | 450**                                | 12      |
| <b>Rural Areas</b>       |                                      |         |
| Household                | 2,100                                | 56      |

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|                         |         |     |
|-------------------------|---------|-----|
| Informal Economy        | 130     | 4   |
| Bakeries & Dry Cleaners | 30      | 1   |
| Subtotal                | 2,260   | 61  |
| Haiti                   |         |     |
| Households              | 3,255** | 87  |
| Other                   | 475**   | 13  |
| Total                   | 3,730** | 100 |

Notes: Since charcoal has about one-fifth the mass of its original wood form (\*) demarks a wood equivalent volume of all charcoal, (\*\*) demarks a wood equivalent volume of 5/6ths charcoal and 1/6 wood. Thus, all of the 800,000 tons of wood consumed by households in Port-au-Prince was consumed as charcoal, and 5/6ths of the wood consumed by the whole city was consumed as charcoal. Joint UNDP/World Bank Energy Sector Management Assistance Programme, *Strategie Pour L'Energie Domestique* (Port-au-Prince: UNDP/World Bank, June 1991), p. 4.

However, this is only one example of how environmental scarcities interact.<sup>40</sup> With a reduction of tree cover, soils became susceptible to erosion by rain and wind energy, creating a shortage in the supply of healthy topsoil in many areas. Because of a structural scarcity of good land, many of the poorest Haitian families work the country's most ecologically fragile lands. Often at the upper reaches of exposed highlands where soils quickly erode, these families carry much of the burden of supply-induced scarcities in Haiti.

Natural ecosystems can only replace the supply of resources at a consistent pace. For example, topsoil erosion is sustainable only if less than 3 or 4 tons per hectare is lost each year, because the organic and matter regenerates at the roughly the same rate. The supply of other resources, such as forests, can be harmed when roads and patchwork logging fragment a forested area into smaller parcels. Each of the smaller parcels of forest will often not regenerate as quickly as the original integrated forest, effecting the supply of resources available to human communities.

Although access to each resource is in some way manipulated by elites, resource distribution is not as unequal as it is in other Latin American countries because the vast majority of people are equally poor. Structural scarcities in Haiti have evolved out of a long history of exploitation by the country's social elites, but these scarcities in resource distribution are reinforced almost daily. For example, social elites

have the power to change local property laws or influence development, sometimes depriving communities of environmental resources overnight and often increasing the value of certain property holdings. These are countrywide trends, and to better understand specific interactions it is necessary to look into the recent history of resource scarcities in particular regions and communities.

## Ecological Marginalization, Urbanization and Civil Strife

### *The Artibonite District*

Between the two coastal towns of Gonaives and Saint-Marc is a large plain of rich fertile soil called the Artibonite District. A system of rivers flow from Lake Péligre in the central highlands of Haiti, nurturing the soils of one of Haiti's most agriculturally productive areas. Several decades ago the Artibonite District also developed the country's most complex irrigation system, a project that temporarily enhanced local agricultural production but eventually displaced large numbers of people.

Until 1949, small producers farmed the Artibonite and the land was of little agricultural value. That year, however, the government began to plan for a new hydroelectric and irrigation facility, about 100 kilometers upland from the mouth of the Artibonite River. With a US\$40 million loan from the American government, the Artibonite Valley Development Organization (AVDO) planned a hydroelectric facility to provide power for Port-au-Prince to the southeast and irrigate the Artibonite valley to the northeast. Social elites were the first to hear about the project, and they bought up tracts of land for about one U.S. dollar per hectare. Knowing that new areas of land were going to become productive, these wealthy elites also arranged for property rights to lands that were either unclaimed or occupied by farmers without clear titles.

The government organized a land registry program two years after making the decision to develop the Artibonite Valley. Using aerial photography engineers determined that 32,000 hectares of the total 45,000 hectares would benefit from the project, and

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that the average farm size was around 1.2 hectares. In actuality the average farm size was probably much lower – little more than 1 hectare per farm. Moreover, the land survey did not track the number of people living off each parcel of land. In Haiti, land is traditionally divided in equal portions between heirs, and by underestimating the population density, planners could not anticipate the demand for irrigation.<sup>41</sup>

Under the direction of the AVDO, the dam was completed and Lake Péligre was flooded in 1956. Wherever irrigation facilities expanded over the next few decades, absentee landowners managed much of the agriculture on the newly productive land through rent and repression.

The AVDO had spent much of its loan on construction and the land registration was left incomplete. While the rapid modernization of agriculture in the valley had significantly increased the area of rice cultivation and the volume of rice produced, it did so without creating the indigenous skills to maintain the irrigation system. Lacking the support of fertilizers and attention of engineers, the infrastructure deteriorated, accelerating the salinization of the soils. The AVDO reopened in 1971, but it was not until five years later that a loan from the InterAmerican Development Bank helped rehabilitate the irrigation system.

Haiti's production of rice increased significantly after the construction of the Péligre Dam, largely because of the expanding irrigation of the Artibonite District. By the late 1970s the Artibonite Valley region produced 80 percent of Haiti's rice across 32,000 hectares, and had 2 large state mills and over 200 smaller mills to collect and clean domestic, American and Taiwanese varieties of rice.

At the time, the government estimated that renters worked 20 percent of the land, sharecroppers worked 20 percent of the land, and owner/occupants worked the remaining 60 percent of the land area.<sup>42</sup> However, these figures belie the complex reciprocal relationships that develop between neighbors in Haitian farming communities. Most families owned some small plots and alternatively hired labour or served as labour when necessary. Because a minority

of property owners owned larger plots of better quality, small producers often had to hire themselves out to supplement the income from their less productive land. Furthermore, these figures belie the complex informal obligations that develop between poor farmers and absentee property owners. The government's category of owner/occupant masks the indebted situation of many Haitian families. The structural scarcity of land resources in rural communities rose rapidly in the early 1970s: 70 percent of the farmers had plots of less than 1.3 hectares; by the end of the decade 85 percent of the farmers had plots of less than 1.3 hectares.<sup>43</sup>

Land registration in the Artibonite did not begin again until 1978, fifteen years after it had stalled. Complete reports started coming back in 1981, revealing astounding population growth since the early surveys. Laborers had been brought in by absentee property owners, families from neighboring regions migrated in search of new opportunities, and high fertility rates in many communities resulted in the constant subdivision of small plots between heirs. One study of 16 communities in 1951 found that property sizes ranged between 0.65 and 1.27 hectares, with the average plot measuring about 0.96 hectares. Thirty years later, property sizes in the same communities ranged between 0.22 and 0.56 hectares, with the average plot measuring only 0.45 hectares.<sup>44</sup> Part of this trend would have been due to the custom of equally distributing land among heirs. However, a more significant reason for the rising number of people in the valleys below the Péligre Dam was the utter decimation of agriculture in the central plateau above the Dam.

The most immediate negative consequence of the Péligre project was the logging that followed. Forests supply fuelwood, food and building supplies to Haitian communities, but tropical forests in these highlands were largely inaccessible to logging interests until a network of good roads were built to service the dam. Subsequently, the river basins above the dam were rapidly deforested, degrading the rivers and watersheds, and exposing a significant amount of topsoil to erosion. In turn, most of the eroded soil collected at the bottom of the Péligre reservoir.

## Environmental Scarcities & Conflict In Haiti

The Dam had a formidable impact on land use patterns in the Artibonite region. Table 3 reveals a radical change in land use along the Samana and Thomondes Rivers that feed into the Péligre reservoir. Both are representative of the effects of the Péligre development on upstream rivers. While the reservoir flooded three thousand hectares of land along the shore of the Artibonite, local farmers also cleared land to feed growing communities in the region.

Given that the population density of the entire region was estimated at one person per hectare in 1956, about 34,300 people were living in these two basins at the time. Assuming that the birth rate in these two basins was similar to that of other rural areas, the population of these two basins would have been between 42,700 and 49,500 in 1978. Using the conservative measure of the region's population, the changing resource base for communities in the Samana and Thomondes basins can be estimated.

In 1956, there were roughly five people for every hectare of forestland and roughly four people for every hectare of cultivated land. The region did not really benefit from agricultural development, since the rising population and severe erosion negated the benefits of cultivating additional land. Twenty years later there were 15 people for every hectare of forest in the region and 4.5 people living off each cultivated hectare. Restricted water flow also created a health hazard for communities by turning their water supplies brackish.

| Land Use                 | Hectares         |                  | People Per Hectare of Resource |      |
|--------------------------|------------------|------------------|--------------------------------|------|
|                          | 1956             | 1978             | 1956                           | 1978 |
| Forest Woodland          | 7,230<br>(21)    | 2,840<br>(8)     | 4.7                            | 15.0 |
| Agriculture              | 8,970<br>(26)    | 9,330<br>(27)    | 3.8                            | 4.5  |
| Denuded, Eroded or Rocky | 18,100<br>(53)   | 22,130<br>(65)   | 1.8                            | 1.9  |
| Total                    | 34,300<br>(100%) | 34,300<br>(100%) | 1.0                            | 1.2  |

Note: Figures for the Samana and Thomondes Basins above the Péligre Dam, where more than half of the land slopes at more than 30%. In 1956, around 34,300 people lived in the watersheds and by 1978 at least 42,700 lived in the watersheds.

Sources: Based on data from M. Frenette et. al., "Cas Historique de Sedimentation du Barrage Péligre, Haiti," *Canadian Journal of Civil Engineering*, Volume 9 (1982), p. 210; World Resources Institute, *World Resources 1994-1995* (Oxford: Oxford University Press, 1994), p. 287; World Bank Indicators of Development CD-ROM.

Acute shortages of land, fuelwood, and fresh water resources began to displace people from the region above the Péligre Dam in the late 1970s. Between 1950 and 1970 the number of people living in the lowlands had increased by 36 percent, while the number of people living in the highlands had increased by 20 percent.<sup>45</sup> The Haitian Institute for Statistical Information calculated that over the 20 year period, one in every five people in the Lascahobas Commune above the Péligre dam left their farms for nearby towns, while one in every eight people left the area entirely.<sup>46</sup>

Some migrants left for Port-au-Prince and other urban centers in search of work, some moved downstream in search of work or land to rent, while others moved across the border into the Dominican Republic either permanently or in search of seasonal labour.<sup>47</sup> The decade of the 1970s saw a significant change in land distribution in the valley below, due in part to growing competition for resources, a competition that heightened with the appearance of migrants from upstream.

Although the state expanded irrigation facilities in the Artibonite and made the region the leading producer of rice, a majority of properties downstream suffered chronic drainage and salinity problems by the mid-1980s. Agriculture was still more productive in the valley than in many places upland, so a large number of displaced people came in search of work or small plots of land to buy, rent or occupy. When possible, the AVDO subsidized fertilizers and repairs to the irrigation system, but dwindling state resources in the late eighties made comprehensive agricultural development difficult.

## **Environmental Scarcities & Conflict In Haiti**

The Péligre Dam has become a textbook example of the importance of environmental impact assessments in sensible development planning. Original designs for the dam were based on sedimentation studies done in 1925, and project engineers estimated that the dam would have an effective life of 180 years at a sedimentation rate of 3.45 million cubic meters each year. After 23 years, the average silting rate was three times that of the design estimates - 9.60 million cubic meters of silt had collected in the reservoir behind the dam each year. Deforestation and rapid population growth had radically altered the vegetative cover of many slopes, and the subsequent erosion altered water courses, expanded river banks, and resulted in gullying, mud slides and increased flocculation in the reservoirs.<sup>48</sup> This rapid sedimentation interfered with the flow of water, reduced the holding capacity of the reservoir, and affected the efficiency of the dam. Today siltation in the reservoir has reduced the holding capacity of the Péligre Dam by about 50 percent, and without dredging, repairs and erosion abatement strategies the full life of the dam will be reduced from the original estimate of 180 years to a mere 80 years. In other words, this huge reservoir may be completely silted up by the year 2030.

Since the construction of the Péligre hydroelectric and irrigation system in the mid-1950s, the percentage of the Haitian population living in urban centers has grown more than fivefold, from 6 percent to 33 percent of the total population. This change was partly the result of the exodus from the Artibonite District. The Péligre Dam increased the productivity and value of downstream land in the years following its construction. Anticipating the rise in value, Haitian elites acquired properties and leased them back to the many local farmers desperate to feed growing families. As communities below the dam grew, heirs were forced to split diminishing land resources, and the appearance of displaced people from the highlands placed a greater burden on local fuel, land, and freshwater resources. This pressure induced another wave of migration, mostly into the squatter settlements at the edge of Port-au-Prince.

The government of Haiti now identifies the Artibonite District as the area most urgently in need of land reform, and a recent field study in the area has

reported that 200 tons of soil is lost to erosion from each hectare of land each year.<sup>49</sup> The Artibonite has the largest number of properties held by absentee landlords in the country, and since the supply of good land has diminished, competition between migrants, renters and small holders has grown violent. With rising competition for land resources, some families have chosen to resolve their disputes with machine guns purchased from the former army officers. While the construction of a hydroelectric and irrigation facility increased the production of some crops in the valleys downstream, the valleys upstream were heavily logged and subsequently eroded. Declining agricultural production upstream forced many people to migrate to the lowlands or urban centers. Other highland areas of Haiti did not see as much investment in agricultural development as the Artibonite. Like the Artibonite watershed, these other regions suffered under government mismanagement, environmental scarcities, and conflict, driving many Haitians into urban centers in search of new economic opportunities.

### ***The Metropolitan Region of Port-au-Prince***

Many countries in Latin American and the Caribbean are dominated by large urban centers, but Haiti is actually one of the least urbanized countries in the region. Only one third of the total population of Haiti lives in urban centers, in contrast with countries like Costa Rica and Jamaica, where half the national populations live in major cities. However, Port-au-Prince has grown faster than many Latin American cities. While migrants sought to escape resource scarcities in rural areas like the Artibonite Valley, the rapid urbanization heightened resource scarcities in the urban environment of Haiti's capital city.

As migrants came to Port-au-Prince in search of work and a higher standard of living, they created the social base for a massive informal economy. Like other growing Latin American cities, most of the new migrants became entrepreneurs because they were excluded from the few formal employment opportunities by urban dwellers who feared competition.<sup>50</sup>

## Environmental Scarcities & Conflict In Haiti

Although some have argued that the informal sector has had an untraceable or negligible impact on the urban environment, recent evidence suggests a direct connection between informal sector activity and degradation in the urban environment of Port-au-Prince.<sup>51</sup> Informal economies do not have 'watchdogs' to monitor pollution or theft, so every public resource becomes a private resource capable of being exploited to the exclusion of others. In metropolitan Port-au-Prince, the best example of this is in the pattern of freshwater consumption.

By the 1970s, the city's meager infrastructure began to collapse. The freshwater supplies of Port-au-Prince were coming from sub-terranean springs and a few small reservoirs above the city. In 1976 Port-au-Prince was given a water management board – the Centrale Autonome Métropolitaine d'Eau Potable (CAMEP) — but international funds earmarked for CAMEP were never actually transferred out of the Haitian government.<sup>52</sup> As with several other development projects, most of the international funding to improve the city's drainage system leaked through government administration into private hands.

In 1976, 73 percent of the population of Port-au-Prince took their water from broken water mains, 27 percent from public standpipes, water vendors, or abandoned supplies.<sup>53</sup> According to a review of residential water distribution centers, 23 percent of consumers had private (legal and illegal) connections, 30 percent of consumers took water from public fountains, leaks or other user's pipelines, and 47 percent of consumers purchased from intermediaries. The city's water system supplied over 11 million cubic meters of water each year.<sup>54</sup>

The health effects of water shortage were compounded by a growing waste disposal problem. In some streets, private companies were contracted to remove garbage, but in most suburbs garbage was put out to sea or thrown into the city's ravines and drainage canals. In combination with the silt washing down from the eroded uplands, the garbage began to plug up the circulatory system that drained water from seasonal rainstorms.

The early 1970s marked the rise of environmental scarcities in many rural areas, driving more people into Port-au-Prince, even though no substantial industry could employ them. Despite this, the incentive for many rural farmers to move to the capital was clear: by the mid-1970s, Port-au-Prince was benefiting from over 80 percent of all public subsidies and public salaries.<sup>55</sup>

A growing amount of land at the periphery of the city was mined for sand. Because of dwindling wood supplies, most builders began to prefer cement as a construction material. Bricks were made with sand mined from nearby hillsides in a very haphazard way. For large construction projects, some cement factories dug into hillsides only a short distance from the expanding slums, and the urban poor had to rely on an army of brick makers who dug into the most convenient source of good material. Altogether, people mining for construction material have laid bare some 3,200 hectares of land in and around Port-au-Prince.<sup>56</sup>

The structure of residential dwellings had evolved drastically by the early 1980s. Migrants built shelter from cement, sheet metal, thatch, cardboard and occasionally wood. They illegally tapped into the city's power grid. The exodus from Haiti's rural areas took many families into squatter settlements at the edge of Port-au-Prince, Cap-Haïtien, and Gonaïves. In every Haitian city shantytowns sprung up: Cap-Haïtien had La Fossette, Sainte-Philomène and Lôt Bò Pont; Port-De Paix had Sous-Canal, Grande Savane and Nan Palan; Les Cayes had La Savane; Gonaïves had Raboteau, Jubilé Blanc and Ka Solay; Jérémie had Sainte-Hélène, Mackanda and Platon; and Port-au-Prince had, to name only the largest, La Saline, Saint-Martin, Lakou Bréa, Tokyo, Cité Soleil, and Cité Carton. Across the country, the average density for these cities and shantytowns was more than 60 people per hectare.<sup>57</sup> By the early 1980s, almost three-quarters of all urban dwellers in Haiti were living in metropolitan Port-au-Prince.<sup>58</sup>

Between 1976 and 1988 Port-au-Prince grew by over 7 percent each year, faster than most of the world's megacities.<sup>59</sup> At the end of this period over 800,000 people - half the city's total population - were living on about one sixth of the land in metropolitan Port-

## Environmental Scarcities & Conflict In Haiti

au-Prince. In contrast with other urban areas around the country, the squatter settlements and degenerated core of Port-au-Prince supported some 1,500 people per hectare.<sup>60</sup> Poor people from rural areas invaded the city, making older areas of the city incredibly dense and creating expansive slums like Cité Soleil and Cité Simone. Few neighborhoods or public spaces were excluded from settlement, and key roads became clogged with markets. Government studies reveal that half the homes surveyed had an average floor space of 2 square meters and were built on a piece of land less than 10 square meters in area.<sup>61</sup> Not surprisingly, the public system of providing electricity, clean water, and drainage was increasingly strained. Electricity was illegally drawn into the shantytowns, water mains were broken to provide access where needed, and the city's drainage ditches filled with refuse and the very poorest squatters.

The 1980s marked the rapid decline of water resources in the city. Some families paid to have water carried to their homes, while others had to walk to public fountains. Over 90 percent of the homes in shantytowns had latrines that flowed straight down into the water table, often contaminating the community standpipes. Four of every five springs in Port-au-Prince had high measures of human and animal fecal matter.<sup>62</sup> By 1988, CAMEP was managing only 75,000 cubic meters each year. Since 1980, the supply of water from CAMEP to residential areas had remained constant at 50,000 cubic meters, and a decade of improvements in water delivery had largely been for the benefit of local industries.<sup>63</sup>

In the late 1980s Haiti was one of the first Caribbean countries to act on the Caribbean Basin Initiative by establishing an export production zone at the edge of Port-au-Prince. In most Caribbean countries these export production zones had positive side effects, generating tourism and light industry in other parts of the countryside and drawing migration away from major cities. However, the Haitian government placed its export production zones within its fastest growing city, adding to the hope of many migrants for a better life in Port-au-Prince. Without political stability and investment, Haiti's small tourism

industry collapsed and light industry did not develop in other parts of the country.

By the early 1990s electricity and clean water were available to only a small portion of the people living in Port-au-Prince. The UNDP now estimates that the inhabitants of Port-au-Prince withdraw some 150 million cubic meters of water each year from the water table below the city, though the supply of freshwater only recharges at a rate of 130 million cubic meters each year. The water deficit under the city draws saltwater in from the ocean, increasing the salinity of the water from standpipes in oceanfront slums like Cité Soleil.<sup>64</sup>

These slums represent an unforgivable blight on the human endeavor. Cité Soleil had 20,000 inhabitants in 1976, about 180,000 in 1988, and more than 250,000 in 1990, with a density of more than 1,500 per hectare.<sup>65</sup> The poorest sections of Port-au-Prince have a density ranging from 820 to 1,700 inhabitants per hectare, and the more wealthy sections of Port-au-Prince have density ranging from 80 to 100 inhabitants per hectare.<sup>66</sup>

The rural exodus has not spared the wealthier areas of the city. Migrants moved into elite areas like Pétionville in search of employment, water, education, and health services. The state electricity company now estimates that more than half of the squatters beside these wealthy neighborhoods have some access to electricity by tapping into power lines.<sup>67</sup>

In recent years, the rainy seasons have brought tons of silt from the highlands into the streets of Port-au-Prince. The open pit sand mines above the city add to the tons of mud that wash towards the sea each rainy season. The city's drainage canals clog with soil and garbage, and many of its roads turn into impassible quagmires. These drainage problems have implications for public health: in these polluted waters parasites replicate quickly and malaria spreads. However, water is not the only polluted public resource that threatens human life.

Haitians consume some 62 million gallons of fuel each year, though like most other less developed countries, their per capita carbon dioxide emissions

## Environmental Scarcities & Conflict In Haiti

are negligible. Air quality in Port-au-Prince, however, is quite poor. The recent EMMUS-II health survey revealed that over the last decade, mortality rates at different ages of infancy are usually higher in rural areas than in urban areas because of better health services in urban areas. However, the reverse is true in metropolitan Port-au-Prince, where 53 of every thousand children less than 12 months old die, in comparison to other urban and rural areas of Haiti where 48 of every thousand children less than 12 months old do not survive. The difference in mortality rates between Port-au-Prince and the rest of the country may be partly explained by the greater air pollution of the city, since the study also found that the largest single cause of death for Haitian children less than a month old is respiratory infection.<sup>68</sup> Industrial pollution in Port-au-Prince is like that of many other cities in the developing world — local industries, tanneries, inefficient automobiles, and dry cleaners all deposit synthetic chemicals in the air, water and soils of the city.

A recent survey of people living in Port-au-Prince found that only a third had actually been born in the city itself.<sup>69</sup> There is now a housing shortage of at least 80,000 units, almost certainly a conservative estimate.<sup>70</sup> Furthermore, public transport in Port-au-Prince is so inefficient that many people spend two hours a day and a third of their daily wages on private transport.<sup>71</sup>

Unaware or undaunted by poor infrastructure and a severe scarcity of water and fuelwood resources, the rural poor remained attracted to Port-au-Prince. Even though 63 percent of the population worked in rural areas, their earnings represented only 33 percent of the national GDP in 1990. By contrast, the industry in Port-au-Prince employed less than 10 percent of the population yet accounted for over 20 percent of GDP that year.<sup>72</sup> Moreover, political instability and international sanctions abruptly ended the success of the original assembly plants in the city's export production zone, and by 1992 only four plants were still operating, employing less than a thousand workers.<sup>73</sup>

Despite the plethora of problems, the average person in Port-au-Prince still makes several hundred dollars more each year than they would living in other parts

of the country. The cost of living is certainly higher, but often the standard of living is also higher. Much of the attraction of life in Port-au-Prince is the chance to earn higher incomes and afford durable goods. People in Port-au-Prince have proportionally more radios, televisions, refrigerators, bicycles, motorcycles, and cars than people living in other parts of the country. Whereas 90 percent of those who live in the capital are within 15 minutes of a water source, only 75 percent of those who live in other urban centers and 40 percent of those who live in rural areas have such easy access.

### Scenario 1: Biointensive Gardening

*Striding down John Browne Avenue, Placide glowed with confidence. His loan had just been approved. He had been doing odd jobs for months now, mostly backbreaking work down at the ports. Still, the people at the loan office were pleased with his business plan. With his money he was going to buy seedlings for a network of family and friends across the city. Each person would be responsible for growing the fruit and vegetables, while he would arrange for transport to the market and distribute the profits. The novel part of his plan was to have the produce actually grown in the city, avoiding expensive transport costs.*

*Even though he was relatively new to the capital he had contacts from Leogane and had met some trustworthy people. The people in his network would use every extra piece of land and rooftops to grow plants. The NGO had promised a selection of seedlings that would be good for the soil and advice on dealing with rats.*

*Most of his associates had other occupations and would have their children and grandparents tend the plants. But collectively, Placide thought they could produce enough to bring to market and reward himself, his runners, and his network for their effort. If things went well he could start his own credit pool - a fund made up of regular contributions by people who individually receive grants in rotation. This rotating credit organization could keep his business running over a longer period, and lay the ground for trust within his network of contacts.*

*The first crop would be many months away so in the meantime he would still have to hang around the docks waiting for work. His loan was due back in a year, which made his schedule tight. At least dealing with the Haitian NGO was better than dealing with the international groups or local loan sharks. For now, he had a lot to look forward to, and much to plan out in his mind.*

## Environmental Scarcities & Conflict In Haiti

The growth of Port-au-Prince is astonishing by every important measure: the number of people living in the city; the population density of certain areas, and the physical space occupied by the city. In 1950, about 150,000 people lived in Port-au-Prince. Migrants started pouring into the capital in the late 1960s, and by 1970 around 850,000 people lived in an area of around 2,750 hectares. By 1980, almost 4,300 hectares in the Cul-du-Sac area was occupied by 90 or more homes per hectare. By 1990, metropolitan Port-au-Prince occupied some 6,200 hectares, was home to at least 1.2 million people, and was the second largest city in the Caribbean (See Appendix C).<sup>74</sup>

Life in Port-au-Prince changed dramatically when the flood of migrants began. With hundreds of thousands of poor Haitians living in the city's slums, the demand for freshwater, fuelwood, construction material and food rose significantly. Since the city could not satisfy its needs with local resources, it began to attract traders who could bring in goods from further afield. Those who could not afford these goods sometimes turned to crime, or associated with social movements seeking distributive justice to relieve their grievances.

### Environmental Scarcities, Grievances and Conflict in Recent Years

Environmental scarcities in Haiti have been both an important reason for population displacement, and an important result of population displacement. Scarcities of topsoil and fuelwood resources in the Artibonite forced many people into the lowlands or urban centers like Port-au-Prince. The influx of migrants strained local resources and social institutions. Population displacement itself had a direct impact on the ecosystem, damaging the quantity and quality of soil, forest, and fresh water resources, and polluting urban areas with the solid waste. The indirect impact of environmentally induced population displacement often included the disruption of social networks and traditional beliefs in trust and reciprocity. With severely strained drainage systems, diminishing water quality and

rising fuelwood prices, widespread discontent became civil strife in the form of crime and violent protest.

Although the presence of large numbers of migrants led to fierce competition over natural resources — especially for land resources — violent strife between the resident population and squatters only disrupted in a few rural areas, including the lower Artibonite valley. Strikes, riots and protests have occurred mostly in Port-au-Prince, where people can target their anger at national and international officials.

Violence in Haiti took several forms, but worsened as environmental scarcities spread. In the early years of Duvalier tenure, the infamous network of *tonton macoutes* administered punishment to Haitians who dared to protest the way in which the country's wealth was managed. Informal 'taxes', beating, rape, and murder were the tools of the *macoutes*' trade. Papa Doc was a strong dictator, and repression was his way of controlling the dispersed population of Haiti's rural communities and the volatile slum dwellers. No opportunity for uprising was provided.

People moved to Port-au-Prince in the hope of finding both work and ready access to natural resources like clean water and fuelwood. In the mid-1970s, almost half the urban population had access to piped drinking water while only a tiny fraction of the rural population had the same privileges. Even today, almost 45 percent of urban dwellers in Haiti have legal or illegal access to electricity and only 3 percent of rural dwellers have access to electricity. After the economic embargo, industry in Port-au-Prince employed less than 6 percent of the population yet accounted for 15 percent of the nation's GDP and still garnered most of the state's meager public expenditures.<sup>75</sup> Although government's data on education are of limited quality, a greater portion of urban youth has access to education than rural youth. Similarly, urban dwellers have greater access to medical services and children are less likely to die from diarrhetic sicknesses, malnutrition, respiratory infections, or measles than are rural children.<sup>76</sup> For rural families with diminishing incomes, it made sense to send a family member to Port-au-Prince in search of work, or to migrate to the city altogether.

## Environmental Scarcities & Conflict In Haiti

### 'Cognitive Liberation' and Violence in Port-au-Prince

The success of a popular uprising often depends on the organization and inspiration of a few key leaders. These leaders encourage the membership to consider their condition as unjust, instilling the belief that their condition can and should be changed. Leaders will also focus the attention of a social movement on symbols of injustice, offering a particular definition of the 'social good' and distributive rights. Moreover, leaders shape a group's perception of their chances for success. "Discontent is not a function of the discrepancy between what men want and what they have" writes Gurr, "but between what they want and what they believe they are capable of attaining."<sup>77</sup>

Both Catholic Liberation Theology and the Protestant Missions provided leadership, helping poor Haitians to build the '*ti legliz* movement. The organizing principles of this social movement inverted traditional church hierarchy, empowering the small community parish over church officials. Advocates of the '*ti legliz* movement placed the religious authority of the Bishop in the hands of the people, and this encouraged small assemblies to take on the responsibility of debating the moral, and eventually the political, affairs of the community.

By the late 1970s Port-au-Prince began to swell with migrants, and the city's slums became the meeting place for marginalized people from all over the country. Although the military could be more easily mobilized against urban protest than rural protest, the densely packed slums of Port-au-Prince still facilitated the 'cognitive liberation' of Haiti's poor.<sup>78</sup> In Cité Soliel and Cité Simone, urban dwellers had an evolving awareness of their common grievances, opportunities for protest and conceptions of justice.

Voodoo culture encourages the poor to accept their station and trust in the guidance of individual spirits. In the slums of Port-au-Prince, the Catholic and Protestant missions played an important role in discouraging the resignation of many people. Several missions adopted Liberation Theology in their teachings, and provided a forum for small groups to meet and confer. Perhaps the most encouragement

came with the Pope's visit in 1985, during which the Pontiff frequently declared that 'things must change in Haiti'.<sup>79</sup>

Baby Doc was a weaker leader than his father and scorned by both social and military elites, and tens of thousands of political murders were committed by his regime. However, leaders of Haiti's urban poor soon saw growing opportunities for open rebellion. Their numbers in Port-au-Prince grew everyday, 'Baby Doc' had lost legitimacy in the eyes of the international community and Haitian elites, and state institutions had little or no potential to address public grievances within the near future. The '*ti legliz* and other movements began to see new opportunities for rebellion, and with moral legitimacy provided by the Pope, leaders increasingly believed they were capable of attaining political power.

In the mid-1980s, the *deshoukaj* began: acts of trashing, looting and attacking supporters of the military regime. By 1986 violent protests broke out in the streets of Port-au-Prince and Jean-Claude Duvalier fled to France, taking with him hundreds of millions of U.S. dollars from the national reserves. While a National Council on Government began to plan new democratic institutions, angry civilians and the army massacred the *tonton macoutes* and any vocal supporters of the previous regime.

For the next few years, violent civil unrest destabilized Haitian politics, forcing the suspension of elections in late 1987 and providing an excuse for a sequence of military leaders to assume control. Elections were finally held in 1990 and Jean-Bertrand Aristide, a former Roman Catholic Priest and long-time opponent of the military dictatorships, roused the people of Port-au-Prince in his favor. In the eyes of many Haitians Aristide represented the '*ti legliz* movement, and empowered by two-thirds of the ballots cast, Aristide proposed sweeping reforms to alleviate poverty, increased the minimum wage, and removed several high ranking military officers. However, Aristide was overthrown in 1991 by Haitian military and social elites, and the violence continued.

By the time the head of the military junta Raoul Cedras assumed control of governance, the urban

## Environmental Scarcities & Conflict In Haiti

environment of metropolitan Port-au-Prince had been deteriorating for five years. Water supplies were increasingly salinized or polluted, fuelwood running scarce, and the price of food rising. Protests continued within the city limits but were quickly muted by military and paramilitary groups that committed several thousand political murders. From abroad, Aristide still commanded the underground leadership of the city's slums.

Sanctions by the United Nations began in July 1993, adding to the economic burden of the resource-scarce economy. A year later a peaceful transition to democracy was brokered, and 20,000 US troops were dispatched throughout the country to maintain order. However, with the departure of the military junta the *deshoukaj* returned, and social elites again became the targets for theft and kidnapping. The urban environment had been left largely unattended for a decade, and with continuing desperation in the slums, crime was rampant.

Environmental scarcities disrupted Haitian society by forcing mass migration out of rural areas, but they also had an impact on the country's economic and political institutions. The Haitian state has had one major source of income - port taxes.<sup>80</sup> In recent years, diminished agricultural productivity had meant smaller revenues from the country's export crops, directly affecting the ability of governing elites to disperse favors, finance a strong military, or buy public affection. Widespread smuggling has also prevented the state from collecting taxes on imports.

Not only did environmental scarcities force mass migration into Port-au-Prince where people could express their grievances, but they also helped weaken the state, creating the opportunity for rebellion by diminishing the institutional capacity of the Haitian government. With corruption drawing away the meager tax revenues from dwindling agricultural production, the state could not meet public demand for improved infrastructure. Because state institutions had little autonomy from social elites, they could not meet public demand for land reform and wealth redistribution. In the end, it fell to the international donor community to introduce erosion abatement techniques, build freshwater standpipes,

and provide for the nutrition and basic health of many Haitians.

Environmental scarcities in the highlands forced many Haitians to move to Port-au-Prince, where some became active in the radical social movements that supported Aristide's rise to power. Moreover, these environmental scarcities crippled the economy and diminished the power of the state to set development policy. When Aristide began to redistribute the limited resource wealth of the country, social elites organized against him to protect their land holdings and business interests. Even though democracy is now being restored, Haiti's future depends on how it deals with its environmental scarcities.

**IV. Environmental Scarcities and the Future of Haiti: Key Trends**

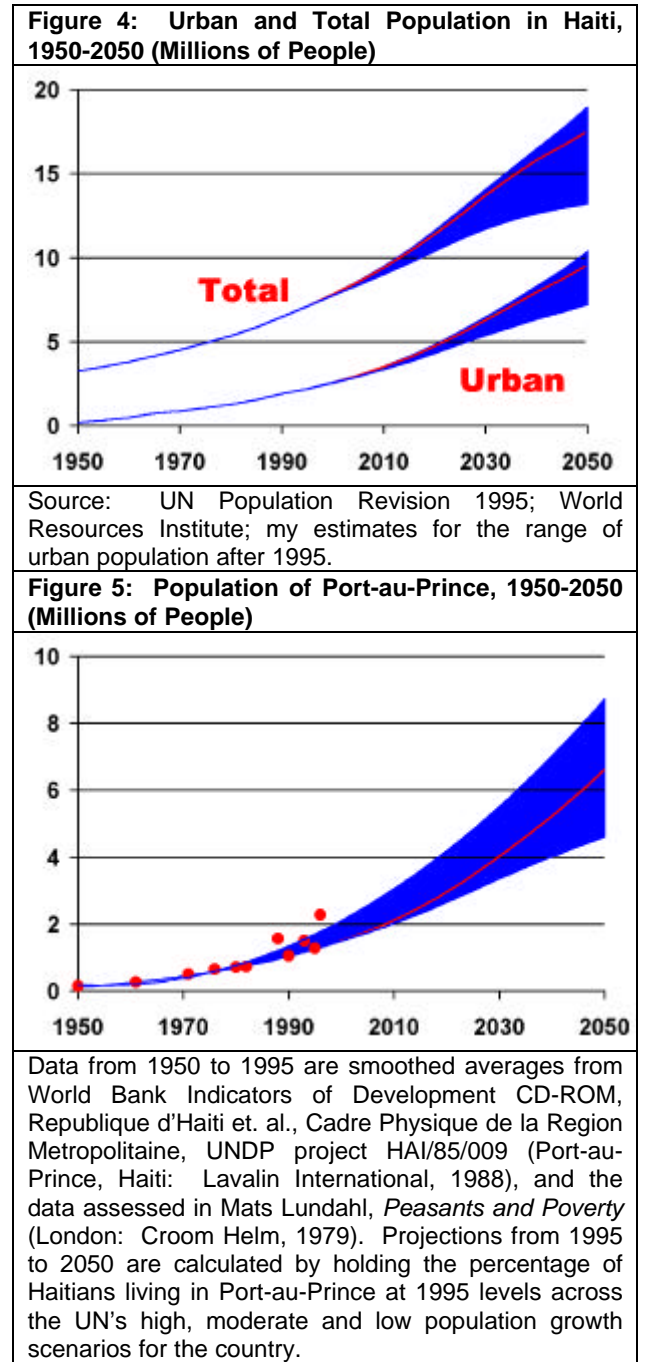
Many important trends will shape the future of Haiti, but not all can be described with confidence. Some kinds of political and cultural developments — such as the transition to more open democracy experienced by several East European societies — occur rapidly and in surprising ways. Other key trends, like environmental scarcities, can be projected with greater confidence. This research has focussed on the consumption of three important resources: cultivable land, fresh water, and forests. The degradation of these resources added to the grievances of many Haitians and in conjunction with other political and economic factors has inspired decades of conflict and violence. If the degradation of these resources continues without substantial changes in the political and economic context of the country, conflict and violence will continue to plague Haiti. If the degradation of these resources can be slowed and reversed, and the country’s political and economic life can be reinvigorated, then Haiti will make a successful transition to a stable society.

Population growth drives the consumption of natural resources, and since projections of population growth contain a high, medium and low estimates resource consumption can also be projected with a high, medium and low estimate. Thus population growth itself is one of the most important trends, and if Haiti can temper its population growth rate, the country as a whole will be better off because more natural resources will be available to each person. In fact, long term sustainable development will not be possible without family planning.

**Population and Urbanization**

The moderate population projection of the UN suggests that Haiti will be home to about 12.5 million people in 2025 and over 17 million people in 2050. The rate of urbanization will also slow, though by 2050 about 10 million people will live in cities. Port-au-Prince will remain the largest city, but its size relative to other urban centers will depend on how

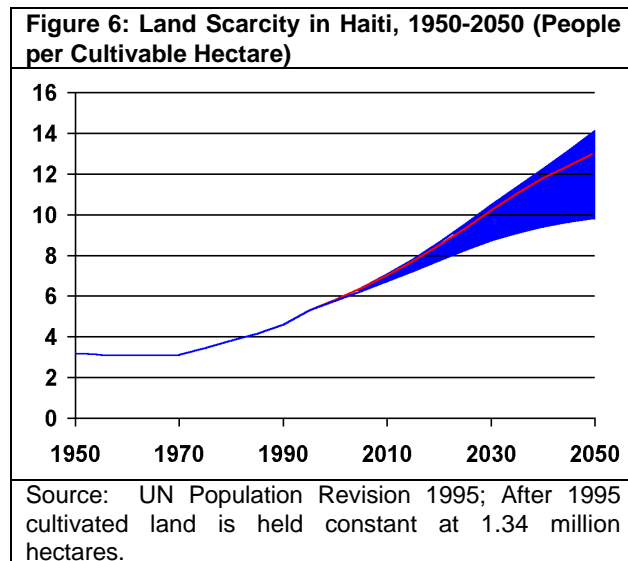
national development is structured in coming years. If some the country’s ‘secondary cities’ – Cap Haïtien, Gonaives, Saint Marc, and Les Cayes – can absorb the families that will be leaving rural areas, then Port-au-Prince will likely grow within the lower limits of this projection (See Figures 4 and 5).



## Environmental Scarcities & Conflict In Haiti

### Land Scarcity

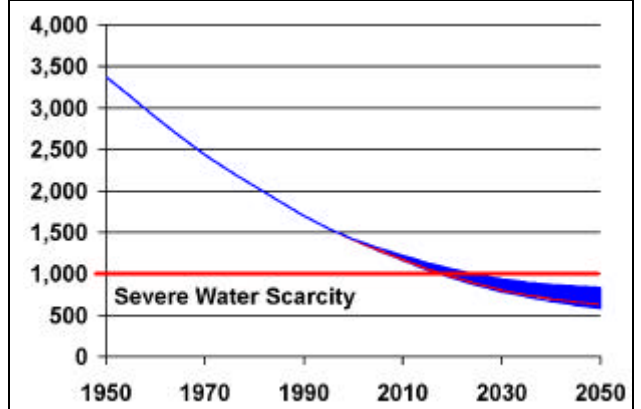
Between 1950 and 1970 the amount of arable land available to Haitian farmers increased with large irrigation projects like those of the Artibonite District. After 1970 population growth began to outpace the addition of new land, and as erosion grew severe throughout the country the amount of cultivable land decreased. Currently, five Haitians depend on each hectare of cultivated land, and even if the amount of land under cultivation stays constant, sometime after 2010 seven people will depend on each hectare of cultivated land, and by 2050 at least ten people will depend on each hectare of cultivated land (See Figure 6)



### Fresh Water Scarcity

Although Haiti receives a significant supply of fresh water, it is poorly managed. Much of the rainfall escapes as runoff, and the water table below several coastal cities is increasingly salinized by sea water that is drawn in when demand on public fountains draws off most of the freshwater supplies immediately below the cities. In Haiti, the annual supply of fresh water will become dangerously low — less than 1,000 cubic meters per person — sometime between 2020 and 2030 (See Figure 7).<sup>81</sup>

**Figure 7: Water Scarcity in Haiti, 1950-2050 (Cubic Meters per Person per Year)**

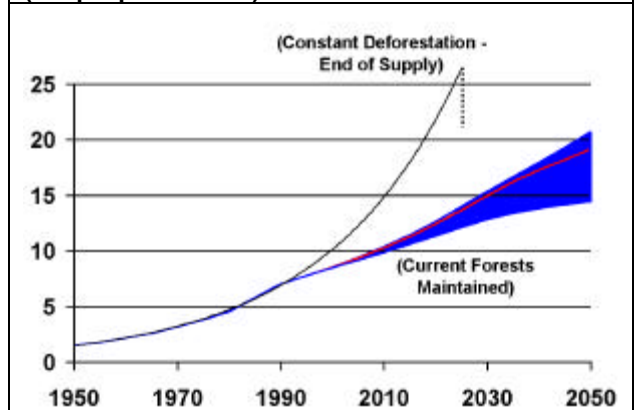


Source: World Resources Institute, *World Resources 1996-97*, p. 303, and UN Population Revision 1995.

### Forest Resources

Currently seven Haitians use resources from each hectare of forest to be found in patches across the countryside. If Haiti can protect its remaining 900,000 hectares of forestland, population growth alone will at least double the current number of people for each hectare of forestland by 2050. If the country cannot use its forests sustainably, the closed canopy forests will become increasingly scarce and may vanish altogether sometime after 2010 (See Figure 8).<sup>82</sup>

**Figure 8: Forestland Scarcity in Haiti, 1990-2050 (People per Hectare)**



Source: UN Population Revision 1995, FAO (Country Department III, Natural Resources Management and Rural Poverty, Latin American and the Caribbean Regional Office, World Bank, *Forest and Parks Protection Technical Assistance Project*, August 19, 1996, p 2.) figures for 1950-1985, UNOPS.



## **V. Advancing Development Assistance Policy**

Evidence suggests that key environmental resources will grow increasingly scarce in coming years - population growth alone will ensure higher demand for clean water, good land and forest resources like fuelwood. Environmental scarcities have already become a significant source of grievance for many Haitians. However, Haiti may be able to prepare for this situation, with the support of the international donor community, by redesigning certain social institutions and adopting specific measures.

Environmental scarcities in rural areas will continue to drive thousands of Haitians off their land in the decades to come. Port-au-Prince is ill equipped to support its current population and every effort must be made to redirect the flow of migrants to Haiti's secondary cities and district towns. Thus, development assistance policy should shift its attention to developing the social and economic infrastructure of Cap Haitien, Gonaives, Saint Marc, and Les Cayes.<sup>83</sup> While poverty alleviation is always the general goal of development work, in Haiti development policy must take the form of market-driven environmental restoration. With this objective in mind, the government of Haiti should promote meritocracy within its ranks, limited privatization of its services, public health, energy substitution, and microcredit loan programs.

### **Improving Institutions**

#### ***Meritocracy & Institutional Capacity***

All of Haiti's public institutions suffered under the corruption of the Duvaliers, the uncertainties of its democratic transition, and the desperation of economic boycott. Today many government Ministries have a very limited supply of expert personnel, and government institutions would significantly benefit by having daily interaction with lead NGOs and development staff.

### **Governing**

The government of Haiti must have a strong policy that governs its own development as an administration. Clear and consistent rules about promotion and pay, especially regarding gender equity, will encourage Haiti's pool of talented agronomists, teachers, and health workers to consider careers in government. Almost every NGO has complaints about the unstable structure and poor administrative habits of government administration, but all aid sectors — environment, industry, population — needs-coordinating committees to help make donor funds more efficient in Haiti. The Haitian Government should not be expected to control such coordinating efforts, but perhaps

#### **Scenario 2: Cap Haitian's New Library**

Rose Marie was a little nervous, but after all, Cap Haitian's new library was her responsibility. A large shipment of books was going to arrive tomorrow and she hadn't finished hiring new staff. And there were so many candidates to choose from! Some of the local officials had pressured her to hire their children, though some were obviously not qualified or even interested in the work. So she made up a small lie, saying that as a private library, her funders insisted that all employees pass a basic test. Many officials and applicants alike complained when they heard this, but some of the applicants went away determined to get the best mark on the test. Rose Marie wanted one of those determined people.

She wrote some final questions.

En quoi consiste l'indexation d'un document?  
Repondez par vrai ou faux: a) à identifier les concepts;  
b) à traiter les documents; c) à extraire les mots-clés d'un document; d) à classer les ouvrages sur les rayons.

A qui servent les tables auxiliaires dans la classification Décimale de Dewey?

Donnez les indices complets correspondants aux sujets suivants: Philosophie et Théorie de la religion; Etude de la religion Chrétienne au 20<sup>ème</sup> siècle; histoire de la France de 1939 à 1945.

That should do it. Along with a couple of questions on Haitian geography, current affairs and literature, the test should help her pick the best people for the new library. She wasn't very popular with some of the local officials right now, but she knew that would change when Cap had the best library in the North!

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funding simple 'secretariat' services in key Ministries would allow the Haitian public service to monitor and learn about the important work done by NGOs. Further, this would force government organizations to interact in a more transparent manner with other organizations and client groups.

Along with promoting an internal meritocracy, the government's institutional capacity to adapt will be enhanced if Haiti's university is home to more independent research institutions and a good library system. Research now conducted by the cadre of independent consultants should be associated with the development of the country's higher education system. As the caretaker of the country's development, government institutions must build up its analytical abilities by observing the evaluation of externally funded project evaluations and learning from local expertise.

Haiti's libraries are always full of eager students and entrepreneurs. The addition of better shelving units and more trained staff would improve the ability of the library system to meet the nation's high demand for reading material. A system of open resource centers could provide the public with information about funding opportunities from the international donor community, business and accounting practices, and development experiences in other parts of the country. Moreover, it could help fledgling NGOs by providing informational resources, training sessions, and advice on writing grant proposals.

In applying for grants, foreign NGOs should provide evidence their work will enhance the technical and institutional capacity of the Haitian government. Subprojects developed by Haitian groups could then be created by a participatory process as part of a coherent community development plan, and could be designed to build the capacity of small producer groups to manage their resources. NGOs should require their staff to carry out surveys during their fieldwork. Standardized forms would collect basic information, even if unrelated to the project's immediate goals, so that long term social change can be measured. The information would be turned over to the Haitian Statistical Information Institute for analysis.

Most developed countries spend between two and four percent of their annual agricultural GDP on research. Even though developing countries find it difficult to set aside funds for agricultural research, those that have are now benefiting from their investments. Bangladesh, Indonesia, and several countries in sub-Saharan Africa have seen great returns on applied research into their crops. The results have been very encouraging. With liberalized fertilizer markets and integrated pest management, many farmers in these countries have reduced their dependence on fertilizers and pesticides, governments have been able to eliminate certain agricultural subsidies, and more food is made available for domestic consumption. Modest, long term and stable funding for public research institutions is one of the best investments a developing society can make.

### **Limited Privatization**

Privatization of certain government services can also be an important investment in a developing country's future. In areas where government administration has a poor record, it should retreat from 'micro-management' and allow stakeholders or private organizations to step in. However, state resources that are managed well should not be sold off because they represent sources of revenue and are excellent training grounds for the kinds of government officials that should populate other public institutions.

For example, the efficiency and effectiveness of Haiti's private schools greatly exceeds that of its public schools. The Ministry of Education operates around 1,100 public schools but many are without crucial supplies, and teachers are paid irregularly and poorly. In contrast, there are around 9,000 private schools operating under the guidance of a number of religious and secular organizations, and these private groups employ 70 percent of the teachers and teach two thirds of all Haitian students enrolled in primary schools.

The government has grudgingly recognized its inability to meet the educational needs of the population, and has contributed funds to educational organizations like the *Fonds de Parrainage National*. This fund is a private sector initiative that has proven its ability to efficiently manage disbursements, in consultation with major

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stakeholders, across Haiti's many regions and independent schools. About 20 percent of its funds go to project administration, while 80 percent of the funds go directly to the schools. This ratio of administrative costs to school funding is almost the opposite of the Ministry of Education's ratio, where about 80 percent of its funds go to management and 20 percent of its funds go directly to public schools.<sup>84</sup>

For a school to be admitted to the support program it must first pass a standardized assessment test, forcing schools to compete for inclusion in the program. The fund organizers have strong analytical skills and have earned the respect of both schools and Haitian-based donors. Unfortunately, the funds it can pass on to schools vary with irregular commitment from the government. Many schools are forced to drop students during the years that funding is limited, though some will keep students knowing that they are more likely to be reimbursed by the Fonds than by the Haitian government for their effort.

A lean Ministry of Education could be responsible for broad education goals, dispersing funds to regional implementing agencies and monitoring their performance under Ministry guidelines. The Ministry should publicly tender the regional schooling contracts, yet set the educational standards and content for the country's schools, and perform frequent audits. Similar 'macro-management' roles should be defined for other government Ministries.

The Ministry of Environment cannot be solely responsible for ameliorating the environmental scarcities of Haiti. It and other government ministries have poor management records. However, when NGOs operate completely outside the government, the civil service does not build its capacity to manage money, staff, or the country's problems. There is a significant amount of experience in Canada and the United States in the area of organizational management, and some of this experience should be applied to the challenge of grafting the best features of NGOs and our own civil service onto the Haitian bureaucracy. For example, the World Bank's new Forest and Parks Protection Technical Assistance Project will place NGOs under the technical supervision of government authorities,

### Scenario 3: From an Imaginary Speech by the President of Teleco in 2020 to the Haitian Parliament:

At the end of the last century, who would have thought that Teleco had a future as a public enterprise? Were it not for the vision of several key Haitians, Teleco would have been privatized, and our country's communications infrastructure sold into foreign hands.

Instead, we became 'semi-private', reducing our staff but vastly expanding our use of private contractors. With a loan from the international community, we entered a partnership arrangement with Motorola to provide cellular telephone communications across the country. Although Haitian subcontractors did not turn substantive profits until after 2000, by 2010 cellular communications were used by all major Haitian corporations, the government, and international agencies. Cellular communications proved more reliable than existing telephone lines and more secure than walkie-talkies. Overall, they were less costly to maintain than ground-based telephone lines, they could be efficiently administered, and by 2015 the cost to the consumer had dropped well below the projected costs of conventional telephone systems. In fact, Teleco managers once believed that even with privatization by 2005 the conventional telephone system would have completely collapsed under the burden of consumer fraud and impossibly high maintenance costs.

At the turn of the century, we had an important advantage over many countries in the developed world. Because our communications infrastructure was so poor, we did not have to go through the expensive process of incrementally overhauling and upgrading our telephone exchange with every new technological advance. Instead, we jumped straight into the 21<sup>st</sup> century with a fraction of the overall investment required by developed countries. Of course, we did not abandon the conventional phone system, and some of the profits from our cellular service went into improving the old telephone exchange for those who could not yet afford cellular services.

Members of Parliament, I firmly believe our country's transition over the last twenty years should be credited to our wireless communications infrastructure. At the end of the 1980s Haiti had some 47,000 usable phone lines, 41,000 of which were in Metropolitan Port-au-Prince. Today we celebrate 1 million active personal and business accounts across the country. Now the mango producers of Les Cayes can confirm market prices in Port-au-Prince instantly, without depending on a series of greedy resellers for information. The famous Coffee Cooperative of Belle-Anse accepts international orders directly from some of the finest restaurants in New York, Paris and Shanghai. Government agronomists out in the field consult with head office at the end of each day. The new 'back-office' facility in Port-de-Paix is fitted with direct satellite links to offices in Miami and Atlanta, and will employ at least 1,200 people.

The communications revolution made us more efficient, and brought us closer together as a people. Some were skeptical that Haiti could turn itself around, but I am glad Teleco helped prove them wrong.

exposing government staff to the principles of institutional transparency and meritocracy.

Complete withdrawal of state activity in economies with large amounts of surplus labour is not

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recommended. In Haiti, this would encourage employers to abuse workers, pay only minimal wages, and provide no incentive for worker training or investment in technological research. In effect, the large factories would adopt the habits and conditions of informal workshops. This would expose small informal businesses to competition from larger companies that are no longer constrained by taxes and labour controls. Unless very large investments of capital and technology turned these small businesses into competitive and flexible micro-enterprises, most would lose their competitive advantages and fail.<sup>85</sup>

## Improving Market Institutions

### *Microcredit*

For the majority of rural families, capital is available only through local loan sharks at exorbitant rates. This has proven to limit investment in both the family farm and in other cash generating schemes that so many rural families have come to depend on.

Communities around the world have benefited from decentralized rural development banks, and several microcredit programs now offer loans to a variety of constituencies in Haiti. The most successful of these give target groups responsibilities in program design and grant evaluation, giving the program local credibility and in turn building the management skills of community leaders. A long term sustained supply of investment capital would also help the formal economy absorb the informal economy.<sup>86</sup> To this end, the government and donors should pursue four goals in a coordinated manner.

First, the government should maintain the legal requirements for minimum wages and benefits, but diminish the legal protections of employees against dismissal. This ensures some income standards, but allows businesses to be flexible and reward trained workers.

Second, both donors and the Haitian government should target low-income households for healthcare and education services. Not only will this improve the overall health and education of Haiti's labour

supply, but in the short term, it will also allow these households the option of keeping children in school.

Third, the Haitian economy will build momentum only when the costs of economic transactions begin to fall, and since most economic transactions in Haiti depend on the quality of roads, new road works and maintenance projects should be highly encouraged. Many families must travel long distances to buy, sell, and trade their products. This journey is made perilous and time consuming by Haiti's pitted and often unpaved roads. Road maintenance reduces vehicle wear, which ultimately cuts down on both travel time and gas consumption.

Fourth, and most important, donors and the government should not try to discourage the informal sector, but instead realize that it is currently the engine of development in Haiti. Every modern society evolved from a large informal economy that slowly formalized with the influx of capital, improvements in technology, and increasing government competence. Haiti cannot build a community of viable entrepreneurs unless it encourages its small informal businesses to expand.

Cumulatively, the largest microcredit programs in Haiti manage about US\$650,000, of which only a small fraction is devoted to their operational costs.<sup>87</sup> Donor support for development projects can sometimes be irregular, and since the funds can only ever reach a tiny percentage of the potential borrowers, a growing number of analysts believe that microcredit institutions should seek to recover costs and build, if only moderately, their portfolio. Donor supported microcredit institutions should not set out to profit, but their operational costs should be reflected in the interest rates charged. Since farmers need longer repayment periods than vendors and artisans, loan periods should be short but considerate of the client group. Funds should circulate as much as possible without burdening the institution itself with unreasonable management costs. In addition, donor funds to microcredit institutions should be for loans that are recoverable, not grants that are freely dispersed. Currently, USAID is trying to coordinate loan programs, and it is very important for repayment periods and interest rates to remain consistent across the country. Inconsistencies only allow the better

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clients to capture more subsidies by snapping up the loans with lower interest and repayment rates.

### ***Moving the Market***

Neither over-regulated nor uncontrolled markets will bring Haiti's economy into gear. Unfettered markets in developing countries often exaggerate income disparities and limit economic opportunities for large numbers of people, both on the basis of gender and class. However, since the market is also an important source of ingenuity, policy makers should give careful consideration to using the market, with strategic interventions, to rebuild Haiti.

Introducing alternative cooking fuels and technologies to Haiti could be achieved using such strategic interventions. One recent study suggests that providing incentives to consume alternative energy, while enforcing penalties for illegal deforestation, could make solar cookers a viable option for people throughout the countryside.<sup>88</sup> Such interventions would require subsidizing cheap technologies, taxing fuelwood, and patrolling parks. In this example, both policy and market interventions could help steer Haitians away from deforestation and towards a more cost effective cooking method. Policy makers may be right to fear government intervention in more structured and efficient markets, but Haiti's informal markets need guidance. In essence, Haiti's informal sector needs to be 'formalized' by the slow introduction of governance by democratic institutions. Similarly, donor agencies should encourage the government of Haiti to privatize public infrastructure, like the country's seaports, telecommunications, electricity, or airport infrastructure, so as to create market competition, not private monopolies.

Ultimately, Haitian ingenuity and hard work will be the source of social reform. But Haitian entrepreneurs lack both credit and information. Microcredit institutions can help redress the want of small loans for entrepreneurs, but donors could help fill the information gap by creating a network of small business and agriculture centers. These offices, based in Haiti's secondary cities, would advertise jobs, provide subsidized communication for small

businesses, and offer resource libraries with everything from applications for donor grants to agriculture and market news. Micro-business promotion centers in Haiti's secondary cities could provide local entrepreneurs with information on mid-size loans for light industry, reducing the pressure on Port-au-Prince to provide for the nation's growth.

### **Slowing The Rural Exodus**

#### *Land Reform and Rural Development*

Haiti will be a country of rural families farming small plots of land for decades to come. Currently, farmers are working two thirds of the land in Haiti, though experts agree that only one third of the land in Haiti is usefully cultivable. The vast majority of farmers work some land that is ecologically marginal — plots perched at the edge of eroded ravines, roads, and dry riverbeds. Large, organized farming communities could easily be provided with technical assistance, but the fragmented and disorganized character of Haiti's agriculture requires that farmers be motivated by the one system of social organization to which they all belong: the market.

Haiti's few remaining forest resources must be guarded - a fairly simple, inexpensive yet crucial task. After the military coup of 1991, guard services and sustainable development projects around several major parks were suspended, exposing forests in the Pic Macaya Park and Pine Forest Reserve to large-scale logging and in-migration. Fortunately, a private individual provided salaries to several guards — about US\$50 each month — and protected the La Visite Park for the duration of the military regime. A long term, authoritative presence is crucial and need not be costly. For several thousand dollars a year, guard services could be offered to host communities that wish to manage the countries remaining forest resources.<sup>89</sup>

The government land reform initiative is getting underway, and its immediate goals include a national survey of land distribution and property titles. In other rural societies, experts have found farmers with less tenure security to be less interested in adopting

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sustainable farming practices. Experience in Haiti, on the other hand, suggests that short-term yielding, low-input technologies and investment in social organization can overcome the disincentive of land insecurity.<sup>90</sup>

In the battle to conserve topsoil, policy makers have found that mechanical measures — bench terraces, rock walls and canals — require so much capital and labour to construct and maintain that most communities are unable to maintain them. Vegetative techniques such as hedgerows and gully plugs have been widely adopted, often without external incentives, because they retain soil, nutrients and water, supply forage to farm animals and scrub for fuel.<sup>91</sup>

As White has observed, the agricultural techniques that become widely adopted without external incentives are ones which:

1. combine methods that are already familiar to farmers and are compatible with other agricultural and social activities;
2. are simple and require little labour or capital investment;
3. provide short-term economic returns;
4. are adaptable to each individual farmers' lands and production goals;
5. can be adopted at a variable pace according to the farmer's learning curve.<sup>92</sup>

Although environmental scarcities will likely prevent Haiti from again being a largely agrarian economy, rural development projects should provide a supply of seedlings and expertise to farmers who seek advice and are willing to borrow responsibly.

### *Ecotourism*

At the end of the 1980s Haiti was being visited by nearly 300,000 tourists a year, translating to almost US\$70 million each year in revenue, though not all of these tourists were ecotourists — people who visit a

site specifically interested in ecological marvels. Today, several Latin American countries are encouraging ecotourism as a means of simultaneously earning tourist dollars and protecting natural resource endowments. Costa Rica, for example, received 1.7 million visitors in 1996 and these visitors brought almost US\$600 million into the country, making tourism a larger industry than its coffee export industry. It is calculated that ecotourists spend between US\$275 and US\$300 each day.<sup>93</sup> Marine parks in other parts of the Caribbean contribute significantly to regional development. The Virgin Islands National Park, with 750,000 visitors a year, generates income 11 times the cost of park maintenance. Each year, protected areas in the Cayman Islands attract 168,000 divers and generate over US\$50 million year.<sup>94</sup>

Haiti's remaining coral reefs, Mangrove forests and sea grass beds are ideal sites for eco-tourism, and preserving these sites will have other ecological and economic benefits. Coral reefs also shelter lagoons, beaches, and mangroves by serving as breakwaters. The reefs also generate white sands to replenish beaches and support reef-fisheries. Mangrove forests stabilize the coastline by catching sediments and nutrients washing out to sea, provide nursing grounds for many marine species, and serve as habitats for resident and migratory birds and wildlife. Such forests also provide communities with fish, crabs, prawns, oysters, fuelwood, timber, and tannin. Sea grass beds reduce the energy of waves hitting the coastlines. Like mangrove forests, sea grass beds stabilize the shoreline, filter sediments and nutrients, and serve as nurseries and feeding grounds for fish stocks. The government of Haiti, in cooperation with the international donor community, should establish some test parks that both protect areas of forest and coastline while closely regulating the impact of visitors.

### *Erosion Control Through Agriculture Policy*

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### Scenario 4: Ecotourism

*Claude Dorléans looked across the water, squinting at the distant white plume that signaled the arrival of another boat full of tourists. This one was supposed to hold 20 biology students from a place called Vancouver in Canada. Claude had lived on Tortue Island all his life and knew all the trails. For many years he had worked for an old scientist interested in birds, so he also knew where to take people when they came to explore the nature on their island.*

*La Tortue was not a major tourist destination, but several years ago a group of from Port-au-Prince came to visit Palmiste to ask if people would like to help set up a small hostel for visitors. They promised to do nothing without permission of the city counsel, and had many good suggestions. They helped build a dock and small lecture hall, a kitchen and some bedrooms for guests.*

*The committee of citizens in charge of this new business hired Claude as a guide and gave him two tasks. First, he was to plan the sightseeing hikes each day, taking care not to overuse particular trails or allow the visitors to disturb the environment. Second, since the island had suffered under recent droughts, he was to help rebuild the ecology by bringing birds over from the mainland and guarding a few select mangrove forests and subtropical glades from abuse by local people.*

*Their business was young, but Claude was always amazed at the side effects of their modest success. The new docks could also be used by merchants who now took produce into Port-de-Paix each week. Locals were free to use the water and latrine system built for guests. Madeleine and her daughter worked as cooks, old Matheux and his wife cleaned. Last year an elderly woman from Belgium enjoyed her trip so much she donated the funds for a library and repairs to the school. And Claude knew of three other communities with similar successes. Most important, people all over the island took more care of its natural beauty. He was proud of his island, proud of his community, proud of the new colony of rare Zagoutis that were settling in quite well. As the boat drew close, he set down the scuba gear and stood to greet his guests.*

Erosion controls, whether in the cities or on rural farms, can be an expensive and labour intensive process. During the rainy seasons, bulldozers must clear the streets of Port-au-Prince of silt and the highland roads of mudslides. In rural areas farmers use a variety of techniques, building terraces and gully-plugs to catch the topsoil as it washes downhill. Within a few seasons, however, so much soil collects

behind the branches and thatch that another set of gully-plugs is required downhill. There have been few erosion projects with long lasting success primarily because these projects do not alter the market incentives or opportunities of Haitian farmers. However, two agricultural policy changes could provide new opportunities and incentives, simultaneously reducing erosion rates on steep slopes.

Haitian agriculture should return to tree crops like coffee, cocoa, and fruit trees that protect slopes from erosion. Haitian farmers produced these crops for centuries until the early 1970s, when rising export tariffs discouraged production and high import duties created an urban-based demand for locally produced goods, effectively discouraging small producers from growing tree crops for export.

Along with tree crops, Vetiver grass has economic value and practical uses in that it guards against erosion, protects the soil around tree crops, and produces valuable oil. Haiti is the world's second largest supplier of Vetiver oil, a valuable product used in the manufacture of perfumes. Although the plant is common to many parts of Haiti, it is not used as it is in other parts of the world - to control soil erosion.

Some Haitian farmers do know of vetiver's usefulness. Vetiver propagates easily, is highly resistant to drought, and requires little maintenance. Unlike leucaena, a plant recommended by many agronomists, animals will rarely forage on Vetiver and Vetiver bushes recover quickly when people walk through them. The opinion that Vetiver impoverishes soils has been proven untrue: many farmers associate it with bare hillsides because little else will grow on severely eroded slopes. For example, the road between Port-au-Prince and Cap Haïtien climbs steep, eroded hillsides, and Vetiver plants have stabilized many of the embankments overlooking the road.<sup>95</sup>

Vetiver is certainly not the exclusive solution to all of Haiti's erosion problems, but worldwide experience suggests that the plant has many ideal properties.<sup>96</sup> Vetiver must be planted and will not spread like some weeds; it requires little fertilizer and water as it takes

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root. The large coarse leaves and strong dense stems create an almost impenetrable barrier that can block the movement of soil even under torrential rainfall.

Thin hedges of Vetiver effectively reduce erosion, and the plant is able to survive drought, flood, windstorm, fire, grazing animals, and sudden drops in temperature. It has a deep penetrating root system yet does not seem to compete with nearby crops for soil moisture or nutrients. Most important for Haiti's farmers, Vetiver requires little labour or equipment, is naturally occurring, and can survive on soils of varying quality and depth in a wide range of climates. Since Vetiver roots grip the soil so well, regular Vetiver harvesting should be discouraged because farmers who uproot the plants will tear up their fields. Coupled with its value in international markets as a perfume base, Vetiver grass is ideal for use as a safeguard against erosion.

### **Improving Secondary Cities**

Although human fertility rates in metropolitan Port-au-Prince are well below those of other rural and urban areas, net migration will continue to add to the city's population.<sup>97</sup> Port-au-Prince will be a city of 2.5 million sometime after 2005, and if there is to be peace throughout Haiti, there must be a strong urban management team in the nation's capital. The team will have to plan the distribution of water supplies, schools, drug stores, hospitals, and manage electrical, drainage and garbage collection systems across the urban environment.

The recent health survey provides some hints about the demographic future of urban areas like Port-au-Prince. In Haiti, over 40 percent of the total population are under 15 years old, and 25 percent of the population is now between 15 and 30 years old. However, the population of Port-au-Prince and other urban centers is unusually young: in urban areas over 30 percent of the population is between 15 and 29 years old, whereas in rural areas only 20 of the population is between 15 and 29 years old.<sup>98</sup> The size of this urban-based youth bulge has grown in recent years, and in the next decade political stability will depend on how satisfied this volatile group is with its living environment and economic prospects.

### **Scenario 5: Dengue Fever Epidemic**

*Port-au-Prince was the first Latin American city to fall to Dengue Fever. The aedes aegypti mosquito found ample breeding opportunities in the stagnant water of the city. By 2006 the garbage filled every ditch and clogged every drain. Some of the detritus decomposed into the mud. However, the piles of plastic containers, wax cartons and rubber tires collected putrid water, providing the ideal habitat for aegypti. Mosquitoes usually killed roughly 1 in every 17 people around the world, but never had the insect caused the collapse of such a populous city.*

*Each year over the past decade countries of Latin America had seen small outbreaks of dengue fever, but the mosquito population of Port-au-Prince had tripled in the year before social collapse. Since aegypti could live for several weeks and preferred to live and lay its eggs in sheltered ditches or indoors, whole families of Haitians were infected quickly.*

*When dengue hit Rio de Janeiro in 1986-87 over a million people were affected. When dengue came to Port-au-Prince in 2006-7 almost two million were affected -- two-thirds of the city's population. Since the health infrastructure was so poor, several thousand slum-dwellers died in the first few months, while as many as 700,000 suffered from the excruciating pain of dengue hemorrhagic fever. Haiti did not have the institutional capacity to manage the crisis, and with administrators themselves falling sick, the city was without leadership.*

*Once the population realized that the sickness spread each time rain fell on the city's garbage, a mass exodus to Haiti's rural areas followed. Aid workers and wealthy elites retreated to the United States, government officials scattered in all directions, and city residents had the choice of fleeing to the countryside or contending with gangs of looting thugs. Some rural Haitians thought Port-au-Prince had been cursed, so they responded violently to the appearance of city dwellers in their communities.*

*In September 2006 the last radio station went dead, and for a week the only communications with Haiti came by the cellular phones of a few desperate Medecins Sans Frontiers workers. While spraying the country with a DDT variant, UN helicopters often heard gunshots but reported little visible human activity. When UN troops were finally given the mandate to come ashore at Port-au-Prince they found a horror unknown since the Black Plague had taken London centuries ago.*

Several important planning decisions, if made now, will make it easier for Port-au-Prince to meet the expectations of its growing population. If the city

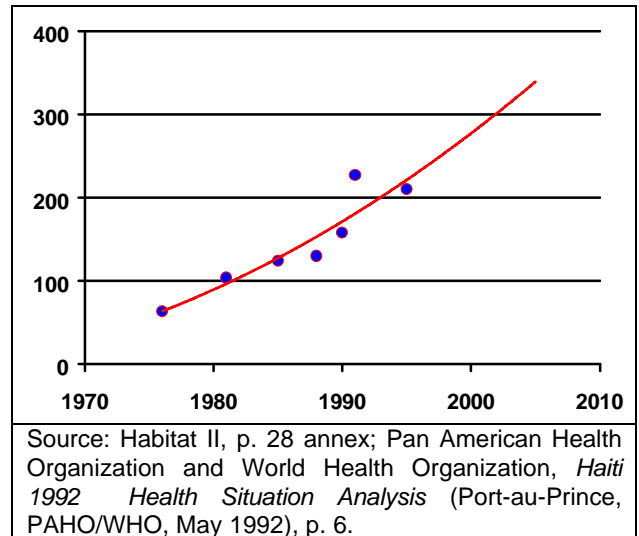
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can clearly delimit spaces for industrial development away from core living areas, it will be able to closely monitor pollution and administer tax collection more effectively. If the city can improve the quality of its major thoroughfares, it will reduce the maintenance costs for the army of private 'tap taps' that cross the city every day weighed down with passengers. The lower maintenance costs would translate to lower transportation costs, and given the degree of competition between drivers, fares might also drop.

Since 1980, the production of solid wastes in metropolitan Port-au-Prince has tripled, and now the city produces over 1,500 tons of garbage every day. Port-au-Prince produces less than a tenth of the garbage produced by most Canadian and American cities each day, but with no waste removal system, the wastes just collect in roadside gullies and empty lots. Unfortunately, the services created in 1985 to collect solid wastes have never functioned effectively, and some of the wealthier neighborhoods in the city have hired private collectors. If the trend continues, Port-au-Prince will end up producing 300 kilograms per person each year after the turn of the century (See Figure 9).<sup>99</sup>

Although the volume of garbage is overwhelming, much of it is organic, consisting of human and animal fecal matter, rotting fruits and vegetables from city markets, and cloth, paper, and wood scraps. The thousands of cubic meters of organic waste that now decompose on the streets of Port-au-Prince, if collected, have great potential for generating methane gas for fuel or serving as compost for bio-intensive urban gardens. Once the city government is prepared to collect the wastes properly, it should tender the collecting services to private businesses, or create a municipal composting site that offer food or cash for the delivery of garbage, glass, metals and plastics. Cleaning up the living environment of the city will go a long way to improving the health of its inhabitants.

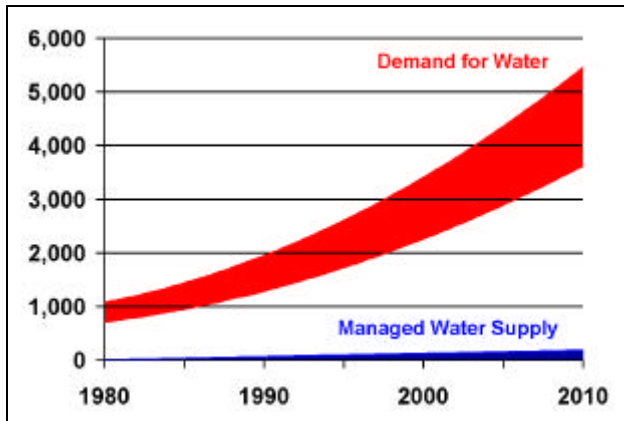
**Figure 9: Solid Waste in Port-au-Prince, 1970-2010 (Annual Kilograms per Person)**



Without major improvements in water management, Port-au-Prince will have critical water shortages early in the next century. Most of the water projections conducted in recent years have proven inaccurate, either because they overestimated the population growth rates for the city or because they underestimated the water needs of the population. The city water utility estimates that unless major repairs are begun soon, more water will be lost from broken pipes than will be brought to homes and industries. At their peak, CAMEP services can provide a quarter million cubic meters each day, though the city consumes at least fifteen times that amount of water each day (See Figure 10).<sup>100</sup>

**Figure 10: Annual Demand and Managed Supply of Water in Port-au-Prince, 1980 to 2010 (Million Cubic Meters)**

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For each person in Port-au-Prince a moderate rate of water consumption is 1,500 cubic meters of water each year, and the minimum rate of water consumption per person is 1,000 cubic meters each year. Multiplying these two figures by the population of Port-au-Prince gives the water consumption range to 2010.

Source: World Resources Institute, *World Resources 1996-97*, p. 303, UN Population Revision 1995, Decennie Internationale de l'Eau Potable et de l'Assainissement, as found in Pierre Adam, *Environnement Urbain et Industriel*, draft report to Ministry of Environment, Port-au-Prince, July 1996, p. 35

## Sectoral and Cross-Cutting Initiatives

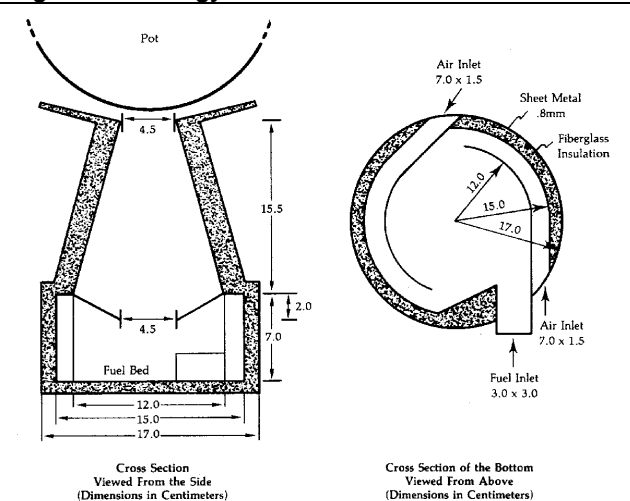
### Health & Population Policy

Haiti is not feeding its current population. A significant amount of aid that comes to the country is food aid, and a large portion of the population remains undernourished. Infant mortality rates (deaths of children less than 1 year old) are declining steadily, a good sign because management of sick children is one of the most cost-effective health interventions in both low and middle-income countries.<sup>101</sup> However, child mortality rates (deaths of children between 1 and 5 years old) have risen over the last few years because of the impact of poverty and the economic embargo on the diet of many Haitians. By providing clean water and separating drinking from wastewater, many common sicknesses will not spread as quickly. Since population growth will drive resource demand in the next few years, long term sustainable development will not be possible without extensive family planning.

### Energy Policy

Haiti's supply of fuelwood is almost gone. Wood and charcoal satisfy about 70 percent of the country's current energy needs and if consumption remains constant, the entire countryside will be reduced to little more than scrub brush sometime after 2010.<sup>102</sup> Many strategies for altering human consumption of fuelwood have been proposed, and none will work in isolation. Perhaps the most effective strategies are those that propose small but substantive changes in the way Haitians live. While carbon taxes and other aggressive policies would have an impact, they would be most effective if paired with cost-effective energy conservation technologies, and the diminished use of carbon-intensive fuels altogether. The demand for carbon based fuels should be reduced, and evidence suggests that carbon taxes would go some way towards achieving that reduction. More important is the substitution of carbon-based fuels, products, and processes for less carbon intensive fuels, products and process (See Figure 11).<sup>103</sup>

Figure 11: Energy Efficient Stoves



Source: H.S. Mukunda et. al., *Single Pan Wood Stoves of High Efficiency, Parts I and II* (Bangalore, India: Centre for the Application of Science and Technology to Rural Areas, Indian Institute of Science, 1985).

One of the immediate goals of the government should be to create the economic conditions for competition between charcoal and gas fuels such as propane, kerosene, and butane. It would be logistically difficult to tax charcoal production at the source, and with thousands of points of sale in Port-au-Prince

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alone it would also be difficult to tax charcoal at its point of sale. Instead, the government could regulate the transport of charcoal into Port-au-Prince and other major cities, taxing trucks as they pass into the city on route to the markets, and taxing boats as they land with charcoal from remote parts of the country. The current tax is about only 2.5 percent of the total cost of a charcoal sack but it is irregularly collected. Even enforcing the existing tax strategy would have an impact on consumption.

At the same time, the price of Kerosene in Haiti should be subsidized so that it can compete with charcoal as a source of cooking fuel. Inexpensive yet more efficient charcoal stoves would allow many families to get more energy from the charcoal they do consume. Addressing the issue of charcoal and energy consumption in Haiti will simultaneously address problems of biodiversity loss, erosion, human health, and economic inefficiency.

However, industrial energy consumption is also rising, and for over a decade several Haitian scientists have argued that solar energy is the definitive solution to the national energy crisis.<sup>104</sup> On average only 2 percent of the country is under cloud cover for more than 3 hours a day, and satellite images identify some 10,000 hectares of land that are ideal for capturing solar energy: maximum exposure to the sun, a slope of less than 30 percent, and less than 600 millimeters of rain each year.<sup>105</sup> A good cost-benefit analysis of the possibility of using solar power should be done before any more large hydroelectric projects are considered. For example, small-scale solar power projects may effectively supply power to communities not on the main power grid, or may supplement the energy needs of particular industrial areas.

Haiti consumes about 72 kilowatts per person each hour, the lowest consumption rate in the Caribbean.<sup>106</sup> According to the most comprehensive assessment of energy consumption in Haiti, about 35 percent of the country's electricity is lost each year: 12 percent to technical inefficiency and 23 percent to theft from squatters.<sup>107</sup> However, at this stage in the country's development, the state should be more concerned about providing the power to develop

rather than collecting from people who cannot pay anyway.

### *Haiti's Strengths*

Despite the country's severe environmental constraints, Haiti has a number of diverse strengths that should be nurtured in coming years. Haiti has a good supply of labour eager to work, a rapidly growing commercial radio industry, a strong informal economy, and significant biodiversity.

Haitians are hardworking and innovative. A decade ago the country's manufacturing sectors were expanding, eager to take advantage of the inexpensive labour supply. By the late 1980s, the Caribbean Basin Initiative had inspired some 130 assembly plants to employ more than 50,000 Haitians in the production of clothing, sporting goods, toys, electronic components, and pharmaceutical products. Most of this production occurred in Port-au-Prince, where it generated more than US\$200 million in revenues each year.<sup>108</sup>

In a country where only a tiny fraction of the population can read, radio has become the most effective means of mass communication in Haiti. New stations open up every few months, bringing advertising, news, and music to a rapidly growing body of listeners. A number of health and family planning projects already claim that radio dramas and interactive radio programs have helped to communicate important messages to wide audiences.<sup>109</sup> If the government were to require one hour of broadcast time each day from every station that applied for a public frequency, educational dramas could introduce a wide population to new family planning ideas, bio-intensive gardening techniques, and legal rights.

In contrast to the formal economy, Haiti's informal sector is extremely dynamic, offering a diverse range of goods and services across the country with great efficiency and better prices. The two economies are intimately connected in that each interacts with the other on a daily basis, and successes or failures in each can invigorate or depress the other. However, the informal sector offers distinct advantages to both producers and consumers. Unregulated markets

## **Environmental Scarcities & Conflict In Haiti**

allow vendors to easily enter with their wares, encouraging intense market competition. Most participants operate small businesses that adapt technologies and use local resources. These businesses are labour-intensive and easily passed on to younger family members. A large number of private micro-credit institutions would help this economy flourish by encouraging innovation and competitive markets. Eventually it will be possible to formalize the economy by introducing taxes.<sup>110</sup>

With a wide range of topography and climate, the island of Hispanola has been blessed with a diverse group of animal and plant species from both North and South America. About one third of the animal species in Haiti are endemic to the island, though the Dominican Republic has a larger number of these endemic species because of its more stable environmental conditions. Biodiversity in Haiti has clearly suffered in recent years, but it may remain one of that country's best hopes for medium-term economic development. The diverse topography has given the small country an incredible range of wildlife habitats: mangrove forests along the shorelines, pine forests in the humid highlands of the south, arid high altitude plains, and offshore reefs.

### ***CIDA's Comparative Advantage***

CIDA has a proven ability for program and policy innovation in Haiti. Program opportunities that might appear too radical in other institutions do not often face such conservative or traditional development paradigms that are strongly held by larger donor institutions.

In most quarters of Haitian society, Canada has a good reputation for honesty and conviction of purpose. Although some Haitians are beginning to associate Canadian personnel with the unpopular 'American Occupation', several key Canadian NGOs — MEDA, CECI, CARE-Canada, and SOCODEVI — are openly appreciated. CIDA can be credited for mounting, with NGO partners, several promising 'integrated' development programs in the southwest. CIDA should build on these strengths by expanding its microcredit programs and designing them to become self-sufficient within a decade.

CIDA has played a crucial role within the international community by leading the restoration of democracy and peacekeeping forces in Haiti. The language and cultural skills of CIDA and Canadian NGO staff have frequently been called to service in Haiti. Furthermore, Canada's technical expertise in power generation, telecommunications, election organization, and justice administration will represent key contributions to a positive future for Haiti.

Given the history of relations between the government of Haiti and the international donor community, CIDA's programming should avoid new initiatives that require the active participation of the Haitian government. CIDA should consider sponsoring more management training for Haitian bureaucrats, but should concentrate on regional and local market-based initiatives contracted through local NGOs and organized in full cooperation with civic leaders. Where active association with the government of Haiti is necessary, CIDA must inform Haitian staff of CIDA's corruption standards, and must remove funding when these standards are breached. CIDA should continue to tender contracts to Haitian NGOs with clear expectations of how funds should be managed and disbursed.

If Haiti is to become a healthy, stable country the energy of its people must be properly harnessed. Better access to information and communication, more microcredit institutions, and clear and transparent governance are the broad requirements. This report has attempted to fill out these concepts. In many respects, the development goals suggested by studying the impact of environmental scarcities are similar to development goals based on more orthodox economic analyses. This is reassuring because when donor resources dwindle, it is especially important that funds be put into programs that represent the convergence of differing policy perspectives: sustainable microcredit institutions, ecotourism, and alternative fuel technology programs would represent this convergence.

### Epilogue: Advancing Environment & Conflict Theory

Understanding how environmental scarcities have impeded development and contributed to civil strife in Haiti allows us to advance the theory on the links between environment and conflict in three areas.

#### Climate Change and Conflict

Most experts on environment & security issues agree that global climate change has little relevance for state security. Not only are the dynamics of climate change difficult to understand, but no clear example of how climate change can induce conflict exists. However, the international scientific community is developing a consensus about some of the likely short-term effects of climate change, and Haiti may become one of the first examples of climate change-induced conflict.

The success of tropical and subtropical agriculture depends on fairly uniform temperatures and the timing of precipitation. More than a quarter of Haiti has an annual precipitation of less than 1,200 millimeters, and since unusual fluctuations in climate disrupt highland agriculture, many of these areas can become dependent on agricultural areas that suffer less, such as in irrigated lowlands.

In recent years drought has disrupted the annual the annual rhythms of precipitation and temperature in parts of Haiti. Both farmers and climatologists have noted increasing delays in the arrival of spring rains. When these rains do not arrive until late April, rice and coffee production is seriously hampered.

Similarly, experts have observed long term ecological disruptions caused by violent hurricanes: fruit and coffee trees have been leveled over wide areas, and land has been taken permanently out of production as the storms carry away all but large rocks and barren soil. Hurricanes and cyclones form in the Caribbean Ocean and Gulf of Mexico, bringing winds of between 100 and 300 kilometers per hour across Haitian slopes. While it is certainly too early to attribute these disruptions to global climate change,

the expected results of climate change will have a definite impact on Haiti. This impact will likely be much stronger than the disruptions experienced in recent years.

The most recent report of the Intergovernmental Panel on Climate Change (IPCC) suggests that average temperatures around the world will rise by about two degrees over the next century. This will likely result in the thermal expansion of the oceans and is expected to lead to an increase in the number of extremely hot days and a decrease in the number of extremely cold days. Warmer temperatures will also invigorate global hydrological cycles, affecting the severity of droughts and floods in different regions. Although the IPCC does not confidently predict changes in the intensity of severe tropical storms, it does suggest the possibility of more extreme rainfall events.<sup>111</sup>

The expected effects of climate change on Haiti are not clear. Given the historical connection between environmental scarcities and conflict in Haiti, it is possible that climate change would further disrupt the county's fragile ecosystems, and consequently, its social institutions. More irregular weather patterns would speed erosion, bring more droughts, and damage property and agricultural productivity, indirectly posing a threat to Haitian social stability. Haiti will remain an important country to watch in coming years because it may be the first to suffer a range of extreme weather events.

#### Environmental Scarcities in an Informal Economy

Haiti's environmental scarcities reveal some of the strengths and weaknesses of informal economic institutions. In the short term, the informal economy can be very responsive to localized environmental scarcities. When individual farmers are faced with deteriorating ecological conditions, they can quickly draw upon the labour, tools, seeds, and produce of neighbors who respect reciprocity traditions. Thus, a family can offset the negative impact of a drought-burned coffee crop by offering labour in exchange for seeds and food. Moreover, the informal economy allows farmers to produce a number of different

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crops at once, so that changes in soil quality, precipitation, and prices do not radically disrupt the family's yearly income. Most communities have their own established dispute settling procedures that have evolved through the experience of many generations.

In the long term, however, the informal economy cannot respond well to widespread environmental scarcities. Families with few economic options are forced to consume, rather than manage, scarce resources, and since the informal economy is unregulated by the state, it is very difficult to restrict resource consumption for the better good. When environmental scarcities affect watersheds and larger regions, a cash-poor state can do little to coordinate action, and large areas of forest are left unprotected.

For example, charcoal production in rural areas seeks to meet the demand for cooking fuel in urban areas, even though deforestation seriously damages rural agriculture. Since the state does not have the resources to develop the trade sustainably, it can only avoid ecological disaster (or promote recovery) by introducing effective incentive structures. The state's options are further limited because it can effectively

tax neither at the source of production nor at the point of sale. Larger social goals are difficult to meet unless the state can occasionally influence the national economy in a meaningful manner.

Another important problem is that of 'bargaining position'. Much of the agricultural production of rural areas is designed to meet demand in Port-au-Prince and other urban areas. Because of the poor road and communications infrastructure in an informal economy, the price of goods at the farm gate is often much less than that sought by retailers in the urban markets. Many farmers simply do not know that their goods can command higher prices: charcoal resellers in Port-au-Prince often charge three times as much as the price they paid at collection points in distant regions. In this unregulated informal market, wood resources are scarce, but the high price they fetch at market does not benefit the farming families that sacrifice their trees. Formal economic institutions will eventually allow more of the economic benefit of charcoal production to accrue to the risk-taking farmer, and allow Haiti to regulate fuelwood use in a sustainable manner.

## Appendices

### A) Statistical Annex

|  | Year                      | Latin America<br>& Caribbean | Haiti   |      |
|--|---------------------------|------------------------------|---------|------|
| <b>POPULATION</b>  |                           |                              |         |      |
| Total Population (millions)                                    | 1970                      | 279.5                        | 4.5     |      |
|  | 1995                      | 463.9                        | 7.1     |      |
|  | 2025                      |                              | 12.5    |      |
| Population Growth Rate (% of total)                            | 1980-85                   | 2.1                          | 1.8     |      |
|  | 1990-95                   | 1.7                          | 2.0     |      |
|  | 2000-2005                 | 1.4                          | 2.1     |      |
| Total Fertility Rate (births per woman)                        | 1970-75                   | 4.6                          | 5.8     |      |
|  | 1990-95                   | 3.0                          | 4.8     |      |
| Population Density (population per square kilometer)           | 1970                      | 14.0                         | 163.0   |      |
|  | 1995                      | 23.0                         | 257.0   |      |
|  | 2025                      | 34.0                         | 451.0   |      |
| Urban Population (% of population)                             | 1960                      | 50.0                         | 16.0    |      |
|  | 1994                      | 74.0                         | 31.0    |      |
|  | 2000                      | 77.0                         | 35.0    |      |
| Urban Population Growth Rate (annual %)                        | 1960-1994                 | 3.6                          | 3.9     |      |
|  | 1994-2000                 | 2.5                          | 4.1     |      |
| Increase in Population of Coastal Cities (%)                   | since 1980                | 74.0                         | 134.0   |      |
| Rural Population Growth Rate (annual %)                        | 1995                      | -0.1                         | 1.2     |      |
|  | 1995                      |                              | 257.0   |      |
| Population By Age Group (% of total)                           | Under 15                  | 1975                         | 39.5    | 41.1 |
|  | Under 15                  | 1995                         | 32.7    | 40.2 |
|  | Between 15 and 65         | 1975                         | 56.3    | 54.3 |
|  | Between 15 and 65         | 1995                         | 61.8    | 55.9 |
|  | Over 65                   | 1975                         | 4.3     | 4.6  |
|  | Over 65                   | 1995                         | 5.5     | 3.9  |
|  | Population Below 30 Years | 1995                         |         | 68.5 |
| <b>RESOURCES</b>   |                           |                              |         |      |
| <b>WATER</b>   |                           |                              |         |      |
| Access to Safe Water (% of population)                         | Rural                     | 1975                         | 3.0     |      |
|  |                           | 1995                         | 31.0    |      |
|  | Urban                     | 1975                         | 46.0    |      |
|  |                           | 1995                         | 37.0    |      |
|  | Total                     | 1975                         | 12.0    |      |
|  |                           | 1995                         | 36.4    |      |
| Internal Renewable Freshwater Supply (cubic meters per capita) | 1970                      |                              | 2,500.0 |      |

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|   |           |               |         |
|---|-----------|---------------|---------|
|   | 1995      | 28,200.0      | 1,530.0 |
|   | 2050      |               | 500-675 |
| Water Consumption by Sector (% of total)                                |           |               |         |
| Domestic  | 1987      | 18.0          | 24.0    |
| Industry  | 1987      | 23.0          | 8.0     |
| Agriculture   | 1987      | 59.0          | 68.0    |
| <b>LAND</b>   |           |               |         |
| Total Area (millions of hectares)                                       |           | 2,042.0       | 2.8     |
| Agricultural Land (% of land area)                                      | 1970      |               | 52.4    |
|   | 1995      | 34.0          | 50.8    |
| (% change)  | 1970      |               | 1.0     |
|   | 1995      |               | -0.1    |
| Agricultural land under irrigation (% of total)                         | 1995      |               | 13.0    |
| Cropland Area (1000s of hectares)                                       | 1991/93   | 104,567       | 908.0   |
| (% change)  | 1981/83 – |               |         |
|   | 1991/93   | 1.6           | 1.3     |
| Pasture (1000s of hectares)   | 1991/93   | 495,884       | 495.0   |
| (% change)  | 1981/83 – |               |         |
|   | 1991/93   | 3.9           | -2.3    |
| Forest & Woodland (1000s of hectares)                                   | 1991/93   | 846,721       | 140.0   |
| (% change)  | 1981/83 – |               |         |
|   | 1991/93   | -4.1          | 0.0     |
| Other Land Area (1000s of hectares)                                     | 1991/93   | 305,753       | 1,212.0 |
| (% change)  | 1981/83 – |               |         |
|   | 1991/93   | -5.2          | 0.0     |
| Cropland Availability (hectares per person)                             | 1983      | 0.4           | 0.2     |
|   | 1993      | 0.3           | 0.1     |
| Fertilizer Consumption (kilograms per hectare)                          | 1983      | 31.0          | 4.0     |
|   | 1993      | 59.0          | 5.0     |
| <b>FORESTS</b>  |           |               |         |
| (Caribbean)   |           |               |         |
| Total Forest Area (1000s of hectares)                                   | 1990      | 47,447.0      | 31.0    |
| (annual % change)   | 1981-90   | -0.2          | -1.9    |
| Natural Forest Area (1000s of hectares)                                 | 1990      | 47,138.0      | 23.0    |
| (annual % change)   | 1981-90   | -0.3          | -4.0    |
| Plantation Forest Area (1000s of hectares)                              | 1990      | 309.0         | 8.0     |
| (annual % change)   | 1981-90   | 11.3          | 256.7   |
| Other Wooded Area (1000s of hectares)                                   | 1990      | 3,543.0       | 108.0   |
| Closed Broadleaf Forests Logged Annually (% of total broadleaf)         | 1981-90   | 0.1           | 7.7     |
| Closed Broadleaf Primary Forests Logged Annually (% of total broadleaf) | 1981-91   | 73.0          | 11.0    |
| <b>ECONOMY</b>  |           |               |         |
| <b>NATIONAL INCOME ACCOUNTS</b>   |           |               |         |
| GDP (billions of US\$)  | 1994      | 1,549 (total) | 1.6     |
| Contribution of Economic Sectors to Economy (% of GDP)                  |           |               |         |
| Agriculture   | 1994      | 10.0          | 44.0    |
| Industry  | 1994      | 33.0          | 12.0    |
| Services  | 1994      | 57.0          | 44.0    |

## Environmental Scarcities & Conflict In Haiti

|  |            |         |       |
|--|------------|---------|-------|
| Private Consumption (% of GDP)   | 1994       | 69.0    | 101.0 |
| Government Expenditure (% of GDP)  | 1994       | 13.0    | 6.0   |
| Gross Domestic Investment (% of GDP)   | 1994       | 21.0    | 2.0   |
| Gross Public and Private Domestic Savings (% of GDP)                           | 1994       | 20.0    | -7.0  |
| GNP per Capita in 1987 US Dollars  | 1970       | 1,435.0 | 333.0 |
|  | 1994       | 1,931.0 | 226.0 |
| Average Annual Change in GDP per Person (% change)                             | 1960-94    |         | -1.6  |
| Real GDP per Person (PPP\$)  | 1994       | 5,873.0 | 896.0 |
| Share of Total Income Earned by Women  | 1994       | 26.9    | 42.0  |
| Total labor force (millions)   | 1970       |         | 2.3   |
|  | 1995       |         | 3.1   |
| Labor force in agriculture (% of total)  | 1970       |         | 74.0  |
|  | 1995       |         | 65.0  |
| Total Net Official Development Assistance (net disbursement, millions of US\$) | 1995       | 6,058.0 | 733.0 |
| (percent of GNP)   | 1994       | 0.5     | 45.5  |
| (US\$ per person)  | 1994       | 12.9    | 104.0 |
| <b>ENERGY CONSUMPTION</b>  |            |         |       |
| <b>NATIONAL</b>  |            |         |       |
| Traditional Fuel Consumption (% of total fuel consumption)                     | 1973       | 30.0    | 88.0  |
|  | 1993       | 21.0    | 86.0  |
| Electricity Consumption (kilowatt-hours per person)                            | 1970       | 547.0   | 28.0  |
|  | 1994       | 1,556.0 | 51.0  |
| <b>COMMERCIAL</b>  |            |         |       |
| Commercial Energy Consumption (gigajoules per person)                          | 1993       | 33.0    | 1.0   |
| (% change)   | since 1973 | 30.0    | -13.0 |
| GDP Output per Kilogram of Commercial Energy Consumed (oil equivalent)         | 1994       | 4.4     | 5.0   |
| <b>DOMESTIC</b>  |            |         |       |
| Household Energy From Fuelwood (% of households)                               | 1973       |         | 88.0  |
|  | 1990       |         | 72.0  |
| Population With Access to Electricity (% of total)                             |            |         |       |
| Port-au-Prince   | 1994       |         | 92.3  |
| Other Urban Areas  | 1994       |         | 50.7  |
| All Urban Areas  | 1994       |         | 76.0  |
| Rural Areas  | 1994       |         | 4.0   |
| All Areas  | 1994       |         | 31.0  |
| <b>FOOD &amp; AGRICULTURE</b>  |            |         |       |
| Index of Agricultural Production (1979-81 = 100)                               | 1982-84    | 106.0   | 103.0 |
|  | 1992-94    | 135.0   | 86.0  |

## Environmental Scarcities & Conflict In Haiti

|  |                      |          |          |
|--|----------------------|----------|----------|
| Index of Agricultural Production per Person<br>(1979-81 = 100)             | 1982-84              | 99.0     | 98.0     |
|  | 1992-94              | 105.0    | 67.0     |
| Index of Food Production (1979-81 = 100)                                   | 1982-84              | 107.0    | 104.0    |
|  | 1992-94              | 140.0    | 87.0     |
| Index of Food Production per Person (1979-81<br>= 100)                     | 1982-84              | 100.0    | 99.0     |
|  | 1992-94              | 108.0    | 68.0     |
| Food Production (per capita change since<br>1979-1981)                     | 1995                 | 4.0      | -33.0    |
| Cattle Population (1000s average annual<br>population)<br>(% change)       | 1992-94              | 279,363  | 800.0    |
|  | 1982-84 -<br>1992-94 | 13.0     | -36.0    |
| Sheep & Goat Population (1000s average<br>annual population)<br>(% change) | 1992-94              | 118,854  | 995.0    |
|  | 1982-84 -<br>1992-94 | 0.0      | -5.0     |
| Pig Population (1000s average annual<br>population)<br>(% change)          | 1992-94              | 50,885.0 | 200.0    |
|  | 1982-84 -<br>1992-94 | -1.0     | -65.0    |
| Chicken Population (1000s average annual<br>population)<br>(% change)      | 1992-94              | 1,138.0  | 5.0      |
|  | 1982-84 -<br>1992-94 | 51.0     | -25.0    |
| Grain Consumption Actually Fed to Livestock<br>(% of total)                | 1974                 | 39.0     | 0.0      |
|  | 1994                 | 52.0     | 2.0      |
| Marine Catch (% change)  | 1981-83 -<br>1991-93 |          | -16.0    |
| Dependence on Marine Catch Food (% change)                                 |                      | -4.0     | 12.0     |
| Cereal Production (% change)   | 1982-84 -<br>1992-94 | 11.0     | -5.0     |
| Cereal Yield (kilograms per hectare)<br><br>(% change)                     | 1982-84 -<br>1992-95 | 2,475.0  | 936.0    |
|  | 1982-84 -<br>1992-96 | 26.0     | -10.0    |
| Roots & Tubers Yield (kilograms per hectare)<br><br>(% change)             | 1982-84 -<br>1992-95 | 11,891.0 | 3,829.0  |
|  | 1982-84 -<br>1992-96 | 10.0     | -5.0     |
| Daily Caloric Supply per Person  | 1995                 | 2,756.0  | 1,707.0  |
| Food Aid in Cereals (metric tons)  | 1970                 |          | 9,100.0  |
|  | 1995                 |          | 179,089  |
| Cereal Imports (metric tons)   | 1970                 |          | 51,056.0 |
|  | 1995                 |          | 309,552  |
| <b>HEALTH</b>  |                      |          |          |
| Infant Mortality Rate (per 1000 live births)                               |                      |          |          |
| Total  | 1970                 |          | 141.0    |
|  | 1993                 | 38.0     | 93.0     |
| Port-au-Prince   | last 10 years        |          | 85.1     |

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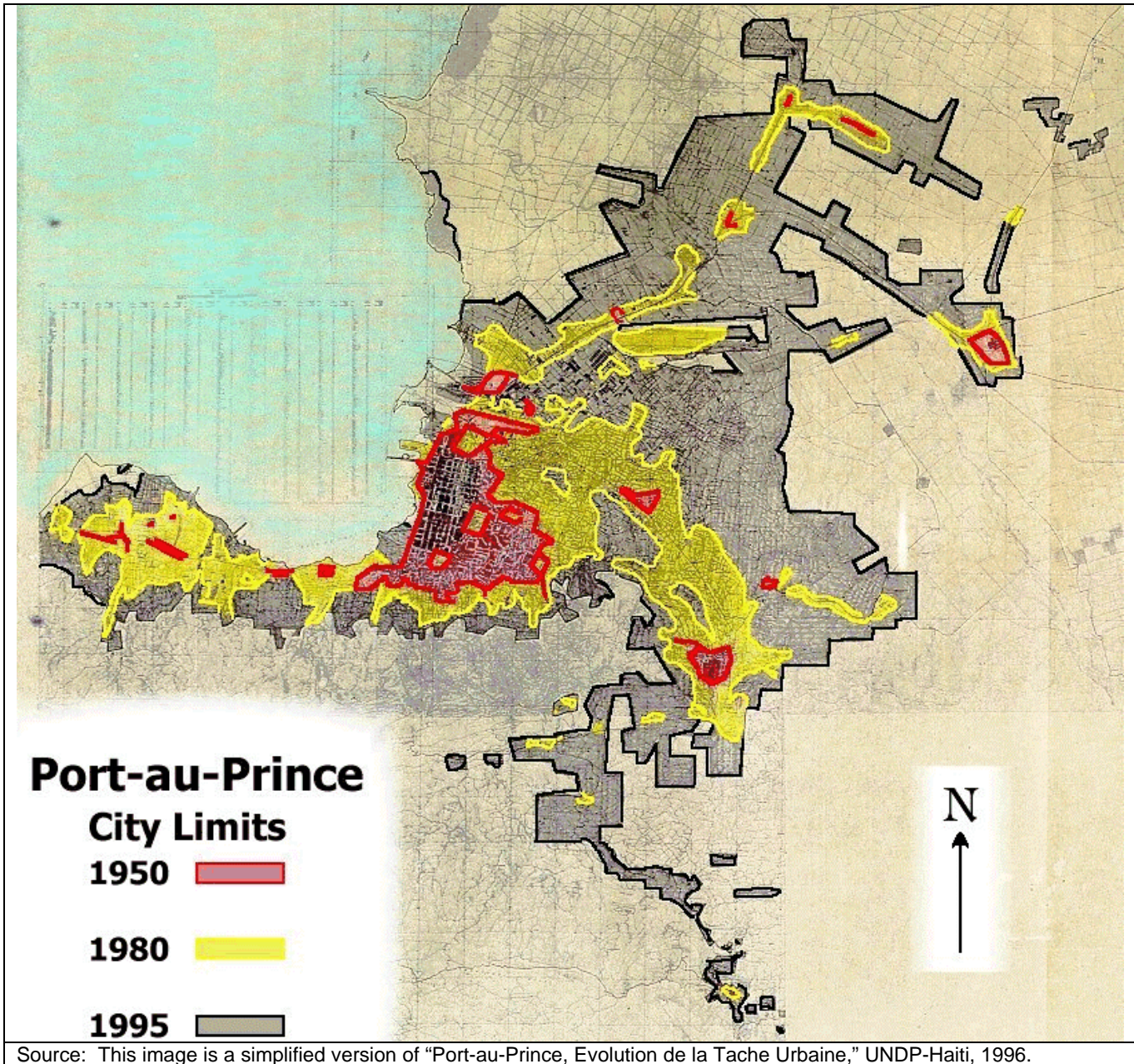
|  |               |         |          |
|--|---------------|---------|----------|
| Other Urban Areas  | last 10 years |         | 80.4     |
| Rural Areas  | last 10 years |         | 88.9     |
| Under Five Mortality Rate (per 1000)                               | 1975          |         | 176.0    |
|  | 1995          | 46.0    | 131.0    |
| Maternal Mortality Rate (per 100,000 live births)                  | 1995          | 190.0   | 600.0    |
| Children Dead Before Age 1   | 1995          |         | 43,000.0 |
| Percentage of Population in 1990 not Expected to Survive to Age 40 | 1995          | 10.8    | 27.1     |
| Life Expectancy at Birth (years)                                   | 1975          | 61.0    | 49.0     |
|  | 1995          | 69.0    | 57.0     |
| Population per Hospital Bed  | 1970          |         | 1,275.0  |
|  | 1995          |         | 1,323.0  |
| Population per Doctor  | 1975          |         | 12,520.0 |
|  | 1988-1991     | 1,042.0 | 7,143.0  |
| Percentage of Population With Access to Some Health Care           | 1990-1995     |         | 60.0     |
| Population With Access to Sanitation (% of total)                  | 1995          | 39.0    | 55.0     |
| (% of urban)   | 1995          |         | 41.8     |
| (% of rural)   | 1995          |         | 16.2     |
| Cigarette Consumption (% change)                                   | since 1970-72 | -6.0    | 241.0    |
| Contraceptive Prevalence Rate (% using any method)                 | 1987-1994     | 60.2    | 18.0     |
| <b>SOCIAL PROFILE</b>  |               |         |          |
| <b>EDUCATION</b>   |               |         |          |
| Illiteracy Rate, total (% of pop age 15+)                          | 1970          |         | 87.0     |
|  | 1995          |         | 55.0     |
| Newspaper Circulation (per thousand population)                    | 1970          |         | 17.0     |
|  | 1995          | 73.0    | 7.0      |
| Percentage of Male Adult Population Literate                       | 1970          |         | 28.0     |
|  | 1990          |         | 44.0     |
| Percentage of Female Adult Population Literate                     | 1970          |         | 20.0     |
|  | 1990          |         | 38.0     |
| Pupil-Teacher Ratio, Primary                                       | 1970          |         | 46.8     |
|  | 1995          |         | 21.2     |
| Pupil-Teacher Ratio, Secondary                                     | 1995          |         | 19.5     |
| Percentage of Children Who Did Not Reach Grade 5                   | 1990-1995     | 27.0    | 53.0     |
| <b>GENDER</b>  |               |         |          |
| Female Administrators and Managers, % of total                     | 1995          | 20.0    | 33.0     |
| Female Administrators and Managers, % of male                      | 1995          | 26.0    | 48.0     |
| Female Professional and Technical Workers, % of total              | 1995          | 50.0    | 39.0     |
| Female Professional and Technical Workers, % of Male               | 1995          | 102.0   | 65.0     |
| <b>COMMUNICATIONS</b>  |               |         |          |

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|   |      |       |         |
|---|------|-------|---------|
| Radios (per 1,000 people)   | 1994 | 349.0 | 50.0    |
| Televisions (per 1,000 people)  | 1994 | 210.0 | 1.0     |
| Paper Consumption (metric tons per 1,000 people)  | 1994 | 10.7  | 0.4     |
| Main Phone Lines (per 1,000 people)   | 1994 | 81.0  | 7.0     |
| International Calls (minutes per person)  | 1994 | 4.7   | 2.8     |
| Road Length, Total (km)   | 1970 |       | 3,150.0 |
|   | 1995 |       | 3,700.0 |
| Sources: World Bank CD-ROM Dataset; World Resources 1996; EMMUS-II 1995; United Nations 1995 Population Revision. |      |       |         |



**C) The Expansion of Port-au-Prince in the Cul-du-Sac Region, 1950 to Present**



### ENDNOTES

<sup>1</sup> See George Foy and Herman Daly, *Allocation, Distribution and Scale as Determinants of Environmental Degradation: Case Studies of Haiti, El Salvador and Costa Rica* (World Bank, Environment Department Working Paper No. 19, September 1989); Elizabeth Abbott, "Where Waters Run Brown" in *Equinox*, p. 37-47; Chetan Kumar and Elizabeth Cousens, "Policy Briefing: Peacebuilding in Haiti" (International Peace Academy, March 1996) recognises the environmental threats to long-term peacebuilding in Haiti. "If left unchecked in Haiti," write the authors, "current rates of environmental degradation stand to render Haiti's countryside incapable of supporting its population, triggering . . . situations of internal migration and potential for violence." See also Ernest Preeg, *The Haitian Dilemma: A Case Study in Demographics, Development, and U.S. Foreign Policy*, Center for Strategic and International Studies, Significant Issues Series, 1996.

<sup>2</sup> See Ernest Preeg, *The Haitian Dilemma*.

<sup>3</sup> My translation from the Ministère de L'Economie et des Finances et Institute Haitien de Statistique et d'Informatique, *L'Urbanisation en Haiti* (Port-au-Prince: Division D'Analyse et de Recherche Demographiques, 1987), p. 20.

<sup>4</sup> *The Guardian*, June 4, 1994.

<sup>5</sup> Sidney Mintz, "Can Haiti Change?" *Foreign Affairs* 74 (1), p. 86.

<sup>6</sup> See Frank Marino Hernandez, *La Inmigración Haitiana*, (Santo Domingo: Ediciones Sargazo, 1973).

<sup>7</sup> See Abbott, 1988.

<sup>8</sup> Anthony Maingot "The Political Rot Within," *Current History*, February 1995, p. 60.

<sup>9</sup> *Ibid.*, p. 61.

<sup>10</sup> For a recounting of the more infamous abuses of foreign aid in Haiti, see Maingot "The Political Rot Within."

<sup>11</sup> A recent study has estimated that average annual per capita income in Southern Haiti is around US\$120, while a fifth of the population earns less than US\$20. Country Department III, Natural Resources Management and Rural Poverty, Latin American and the Caribbean Regional Office, World Bank, *Forest and Parks Protection Technical Assistance Project*, August 19, 1996, p 5. These low numbers do not reflect the purchasing power parity (PPP) of many Haitians. This PPP rate measures the cost of a fixed quantity of goods in Haiti relative to the cost of the same goods in the United States, and in these terms the average income for

Haitians is probably higher than gross product figures suggest. In 1990 the GDP (PPP) in Haiti was around \$1,000US per person, yet the GDP was around \$400US per person.

<sup>12</sup> Lisa Peattie, "Anthropological Perspectives on the Concepts of Dualism, the Informal Sector, and Marginality in Developing Urban Economies," *International Regional Science* 5, pp. 1-31.

<sup>13</sup> Republique d'Haiti et. al., *Cadre Physique de la Region Metropolitaine*, UNDP Project HAI/85/009 (Port-au-Prince, Haiti: Lavalin International, 1988), Volume V, p. 97.

<sup>14</sup> See Sidney Mintz, "The Employment of Capital by Market Women in Haiti" in Raymond Firth and Basil Yamey (eds.), *Capital, Saving and Credit in Peasant Societies* (Chicago: Aldine, 1964).

<sup>15</sup> Michel Cayemittes et al., *Enquete Mortalité, Morbidité et Utilisation des Services (EMMUS-II) Haiti 1994/95* (Calverton, Maryland: Macro International Inc., 1995), my calculation from data on page 10.

<sup>16</sup> Gerald F. Murray, "The Tree Gardens of Haiti: From Extraction to Domestication" in *Social Forestry: Communal and Private Management Strategies Compared* (Conference Paper, School of Advanced International Studies, Johns Hopkins University, February 14, 1991), p. 40.

<sup>17</sup> Human Rights Watch, *Silencing a People: The Destruction of Civil Society in Haiti* (New York: Human Rights Watch, 1993), p. 3.

<sup>18</sup> T. Anderson White and Jon L. Jickling, "Peasants, Experts and Land Use in Haiti" Lessons From Indigenous and Project Technology," *Journal of Soil and Water Conservation*, January-February 1995, p. 8

<sup>19</sup> Categories made by combining data on land slope with average annual rainfall to create a relative scale of risk ranging from no slope and/or minimal rainfall up to more than 50 degrees slope and/or more than 3,000 millimeters of rainfall.

<sup>20</sup> See Janet Welsh Brown, *In the US Interest*, (London: World Resources Institute, 1990).

<sup>21</sup> See Philip Howard and Thomas Homer-Dixon, "Environmental Scarcity and Violent Conflict: The Case of Chiapas, Mexico," Occasional Paper for the Project on Environment, Population and Security, University of Toronto, April, 1996.

<sup>22</sup> See Thomas Homer-Dixon and Val Percival, "Environmental Scarcity and Violent Conflict: Briefing Book," University of Toronto: Occasional Paper for the Project on Environment, Population and Security, May, 1996. This project gathered, evaluated and disseminated existing data among population growth, renewable resource scarcities, migration and violent conflict. It

produced several thematic papers and case studies on Chiapas, Mexico, Gaza, Pakistan, Rwanda and South Africa and was supported by the Global Stewardship Initiative of the Pew Charitable Trusts.

<sup>23</sup> See “Environmental Scarcity and Violent Conflict: A Debate,” *Environmental Change and Security Project Report 2* (Spring 1996).

<sup>24</sup> Howard, “The Case of Chiapas,” 7-15. See also Thomas Homer-Dixon, “Environmental Scarcities and Violent Conflict: Evidence from Cases,” *International Security* 19(1), 8-9.

<sup>25</sup> Estimates for the current population of Port-au-Prince range between 1.7 – 2.5 million, though the largest squatter settlement, Cité Soleil, has never been the subject of a comprehensive census. See Lundahl, *Peasants and Poverty*, pp. 189-194 for a critique of census data up to the 1971 *Institut Haïtien de Statistique* census. In these data the definition of ‘urban’ is often unclear. In the 1950 census a generous definition of urban zone included groups of homes built from materials typically used in major towns. Demographers from the United Nations estimated that the census figures for 1950 fell short by 8 percent, while others have estimated a shortfall of as high as 30 percent. Thomas Weil, *Area Handbook for Haiti* (Washington, DC: US Government Printing Office, 1973), p. 17.

<sup>26</sup> Mats Lundahl, *Peasants and Poverty* (London: Croom Helm, 1979), p. 58.

<sup>27</sup> Anthony Catanese, “Haiti’s Refugees: Political, Economic, Environmental” in *Field Staff Reports*, No 17, 1990-91, p. 4.

<sup>28</sup> Louis Arnault Guerrier, *Desastres Et Environnement*, Consultant’s Report to the Minister of Environment, Port-au-Prince, Haiti, September 1996, p. 18.

<sup>29</sup> Existing census data does not support solid conclusions about long term changes in tenure patterns — how many owners actually have clear legal titles, the degree of farmer participation in mixed tenure patterns combining the renting, sharecropping, and ownership of worked lands, or the number of fragmented parcels being farmed.

<sup>30</sup> Republique de Haiti, Ministère de l’Economie et des Finances, *Gestion Des Ressources Naturelle en Vue D’un Developpment Durable en Haiti* (Paris, France: BDPA-SCETAGRI, 1990).

<sup>31</sup> World Resources Database Diskette, 1996-97

<sup>32</sup> UNDP, “Evaluation des Ressources en Eau” as found in Pierre Adam, *Environnement Urbain et Industriel*, draft report to Ministry of Environment, Port-au-Prince, July 1996, p. 34.

<sup>33</sup> Cayemittes, EMMUS-II, p. 162.

<sup>34</sup> Republique d’Haiti et. al., *Cadre Physique de la Region Metropolitaine*, Volume III, p. 4.

<sup>35</sup> Cayemittes, EMMUS-II, inside front cover.

<sup>36</sup> Walter Reid et. Al., *Bankrolling Successes: A Portfolio of Sustainable Development Projects* (Washington, D.C.: Environmental Policy Institute, 1988), p. 36.

<sup>37</sup> Jon L. Jickling and Thomas A. White, *An Economic and Institutional Analysis of Agroforestry Projects in Haiti* (World Bank, Environment Department, Working Draft, 1993), p. 468.

<sup>38</sup> Joint UNDP/World Bank Energy Sector Management Assistance Programme, *Strategie Pour L’Energie Domestique* (Port-au-Prince: UNDP/World Bank, June 1991), p. 6.

<sup>39</sup> Jickling and White, *An Economic and Institutional Analysis of Agroforestry Projects in Haiti*, p. 468.

<sup>40</sup> While water scarcity has specific health implications, the World Health Organization has also noted a clear connection between more general environmental degradation in Haiti and the country’s attendant health problems. In many communities, severe soil erosion weakens agricultural productivity, leading to malnutrition when economic downturn does not provide other opportunities. When silt collects and makes water supplies brackish, water-borne diseases spread. Since the streets and ditches are also the dumping grounds for organic and inorganic wastes, a home is provided for populations of rats, mosquitoes, and other pests.

<sup>41</sup> In 1955, engineers reported that in the area to benefit from irrigation “the average dimension of worked land is 1.2 hectares”. However, their report identifies 33,861 parcels of land in 32,000 irrigable hectares, and the average dimension of worked land should probably have been calculated at 1.06 hectares. Guillaume Zamor, Guillaume, “Importance du Cadastre dans la Vallée de l’Artibonite,” *Bulletin Agricole*, Port-au-Prince, Haiti: n.p. 1983, p. 30.

<sup>42</sup> Federico Cuevas Perez and Jean René Bona, “Situation de la Riziculture en Haiti,” *Bulletin Agricole*, Port-au-Prince, Haiti: n.p. 1983, pp. 9-10.

<sup>43</sup> Wilson Durand, “Enquête sur la Production et la Commercialisation du riz dans la Vallée de l’Artibonite,” *Bulletin Agricole*, Port-au-Prince, Haiti: n.p. 1983, p. 19.

<sup>44</sup> Zamor, “Importance du Cadastre dans la Vallée de l’Artibonite.”

<sup>45</sup> On average, urban centers in the Artibonite lowlands grew 78.4 percent between 1950 and 1971, and rural populations grew by 32.3 percent. In contrast, urban centers in the Artibonite Highlands grew 74.7 percent between 1950 and 1971, and rural populations grew by only 17.9 percent over the same period. Figures calculated from data in Clarence Zuvekas, *Agricultural Development in Haiti* (Port-au-Prince: USAID, 1978),

Table 1.7, p. 15. In my calculations, the Artibonite highlands are taken to include the arrondissements of Marmelade, Hinche, Mirebalais, and Lascahobas, and the Artibonite lowlands are taken to include the arrondissements of Gonaives, St.-Marc, and Dessalines.

<sup>46</sup> République d'Haïti, Ministère Du Plan, *Développement Agricole Dans la Périphérie du Lac de Péligre* (Port-au-Prince: Organization of American States, 1984), p. 33.

<sup>47</sup> Catherine Orensen, "Illegal Transnational Labor: Mexicans in California and Haitians in the Dominican Republic," *Journal of International Affairs* 48, (Winter 1995) pp. 601-24.

<sup>48</sup> M. Frenette, et. al., "Cas Historique de Sedimentation du Barrage Péligre, Haiti," *Canadian Journal of Civil Engineering* 9, 1982, pp. 206-223.

<sup>49</sup> Thomas A. White and Jon L. Jickling, *An Economic and Institutional Analysis of Soil and Water Conservation in Haiti* (World Bank, Environment Department, Divisional Working Paper No. 1992-33, February 1992), p. 42.

<sup>50</sup> Hernando De Soto, *The Other Path* (New York: Harper and Row, 1989), p. 11.

<sup>51</sup> See République d'Haïti et. al., *Cadre Physique de la Région Métropolitaine*, Volume VI.

<sup>52</sup> République d'Haïti et. al., *Cadre Physique de la Région Métropolitaine*, Volume III, p. 1.

<sup>53</sup> *Ibid.*, p. 1.

<sup>54</sup> Barbara C. Turner, *Land Tenure Problems in the low Income Sector: Haiti's Case*, USAID report, spring 1984.

<sup>55</sup> World Bank, 1978 as found in Simon Fass and Carole Roy, *The Housing Process in Port-au-Prince, Haiti* (Washington, DC: The Urban Institute, 1989), p. 6.

<sup>56</sup> UNOPS, *Présentation de la Carte d'Occupation du Sol d'Haïti* (New York: United Nations Office for Project Services, No Date), p. 1.

<sup>57</sup> According to satellite data, 18,100 hectares of land in Haiti were occupied by human settlements of 90 family units or more in 1978. About 1.1 million Haitians lived in urban areas at the time, giving the ratio of 60 people per hectare. Antoine Boulos, *Haiti: Ressources Phisiques Informatisees et Vocation des Terres*, (No Publication Data), p. 140.

<sup>58</sup> Ministère de L'Economie et des Finances, Institute Haitien de Statistique et d'Informatique, *L'Urbanisation en Haiti* (Port-au-Prince: Division D'analyse et de Recherche Demographiques, 1987), p. 15.

<sup>59</sup> The period from the mid 1970s to mid 1980s marked the most rapid increase in the population of Port-au-Prince, and these particular numbers are taken from

Republique d'Haïti et. al., *Cadre Physique de la Région Métropolitaine*, Volume VI, pp. 33 & 37.

<sup>60</sup> My calculations from *Ibid.*, pp. 31-35.

<sup>61</sup> UNDP, *Habitat II*, p. 23 & 25.

<sup>62</sup> *Ibid.*, pp. 23 & 25.

<sup>63</sup> République d'Haïti et. al., *Cadre Physique de la Région Métropolitaine*, Volume III, p. 17.

<sup>64</sup> UNDP, *Habitat II*, p. 14

<sup>65</sup> *Ibid.*, p. 24. Density figure from Guerrier, *Desastres Et Environnement*, p. 10.

<sup>66</sup> Interamerican Development Bank, *Haiti: Rapport Economique et Social*, p. 24.

<sup>67</sup> UNDP, *Habitat II*, p. 23.

<sup>68</sup> Cayemittes, EMMUS-II, pp. 153, 162.

<sup>69</sup> The surveyors interviewed 300 people. Sabine Manigat, "La Vida en la Ciudad: Los Sectores Populares y la Crisis en Puerto Príncipe" in Alejandro Portes & Carlos Dore Cabral, Editors, *Ciudades del Caribe en el Umbral del Nuevo Siglo* (Santo Domingo: FLACSO-República Dominicana, 1995), p. 98.

<sup>70</sup> UNDP, *Habitat II*, p. 22.

<sup>71</sup> Maingot, "The Political Rot Within," p. 62.

<sup>72</sup> World Bank, *Social Indicators of Development CD-ROM*, 1995.

<sup>73</sup> Anthony Bryan, "Haiti: Kick Starting the Economy," *Current History*, February 1995, p. 67.

<sup>74</sup> My calculation of 1980 area from satellite data in Antoine Boulos, *Haiti: Ressources Phisiques Informatisees et Vocation des Terres*, p. 140; 1990 area from satellite data in UNOPS, *Présentation de la Carte D'Occupation du Sol d'Haïti* (New York: United Nations Office for Project Services, n.d.), p. 1.

<sup>75</sup> Bryan, "Haiti: Kick Starting the Economy," p. 68.

<sup>76</sup> Cayemittes, EMMUS-II, p. 171.

<sup>77</sup> Ted Gurr, *Why Men Rebel* (Princeton, N.J.: Princeton University Press, 1970), p. 359.

<sup>78</sup> Douglas McAdam, *Political Process and the Development of Black Insurgency 1930-1970* (Chicago: University of Chicago Press, 1982).

<sup>79</sup> Elizabeth Abbott recalls the Pope's radio address: "There must be a better distribution of goods, a fairer organisation of society, with more popular participation, a more disinterested conception of service on the part of those who direct society. I appeal to all those who dispose of power, or riches, or culture, to understand their urgent responsibility towards all their brothers and sisters. Things have got to change here!" Abbott, *Personal Communication*, October 4, 1997.

<sup>80</sup> Even though Haiti has only nine Departments, the main source of income for the country as a whole is said to come from the 'tenth' Department – remittances from expatriate Haitians.

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<sup>81</sup> World Resources Institute, *World Resources 1996-97* (Washington, DC: WRI, 1996), p. 303.

<sup>82</sup> Forestland is held constant at 914,669.2 hectares (of pine and medium to high-density forest) from 1990 on because if the model assumed constant rates of deforestation there would be no significant forest resources in Haiti beyond 2010.

<sup>83</sup> However, careful thought should be given to the selection of secondary cities. For example, the population of Gonaives has been growing rapidly in recent years, even though the city is often suffers from low water supplies.

<sup>84</sup> Personal Communication, Antoine Levelt, Director, Le Fonds de Parrainage National, Port-au-Prince, Haiti, April 1997. Great fluctuations in support from the Haitian government in the last few years has made it difficult for the fund to develop long term plans, though the organisation supports the tuition of about 1,500 students for every 1,000,000 Gourdes it manages. Of Haiti's 9,000 schools, almost a third apply for some form of support each year,

<sup>85</sup> Alejandro Portes and Richard Schauffler, "The Informal Economy in Latin America: Definition, Measurement, and Policies," Program in Comparative International Development, Department of Sociology, Johns Hopkins University, *Working Paper #5*, December 1992.

<sup>86</sup> Portes and Schauffler, "The Informal Economy in Latin America: Definition, Measurement, and Policies."

<sup>87</sup> Personal Communication, Juana Rodriguez, USAID - Programme Pour La Relance De L'Economie En Transition, Port-au-Prince, Haiti, April 1997. Rodriguez estimates that six groups manage 9.4 Million Gourdes with combined annual operational costs of only 100,000 Gourdes.

<sup>88</sup> Paul Namphy, *An Analysis of the Potential Penetration of Solar Cooker Technology into Haiti*, Institute for International Studies, Stanford University, 1997.

<sup>89</sup> Country Department III, *Forest and Parks Protection Technical Assistance Project*, p 9.

<sup>90</sup> Thomas A. White and Jon L. Jickling, *An Economic and Institutional Analysis of Soil and Water Conservation in Haiti* (World Bank, Environment Department, Divisional Working Paper No. 1992-33, February 1992), p. 39.

<sup>91</sup> *Ibid.*, p. 41.

<sup>92</sup> *Ibid.*, p. 41.

<sup>93</sup> Jocelyn David, *Profil Environnemental de la Region Metropolitaine de Port-au-Prince, Haiti*, Draft report to UNDP, Project HAI/94/003, p. 32.

<sup>94</sup> Caribbean Conservation Association, *Expansion of Coastal and Marine Protected Areas Network with the Caribbean Region*, Draft Report, May 1996, p. 2.

<sup>95</sup> National Research Council, *Vetiver Grass: A Thin Green Line Against Erosion* (Washington, D.C.: National Academy Press, 1993), p. 25.

<sup>96</sup> Elizabeth Abbott, Personal Communication, June 1996; see National Research Council, *Vetiver Grass: A Thin Green Line Against Erosion* (Washington, D.C.: National Academy Press, 1993), pp. 49-58.

<sup>97</sup> Cayemittes, EMMUS-II, p. 33.

<sup>98</sup> Cayemittes, EMMUS-II, p. 10.

<sup>99</sup> Pan American Health Organization and World Health Organization, *Haiti 1992: Health Situation Analysis* (Port-au-Prince, PAHO/WHO, May 1992), p. 6.

<sup>100</sup> Decennie Internationale de l'Eau Potable et de l'Assainissement, as found in Pierre Adam, *Environnement Urbain et Industriel*, draft report to Ministry of Environment, Port-au-Prince, July 1996, p. 35, estimates that soon after the year 2000 at most 300,000 cubic meters could be supplied each day. The report also projected that by the year 2000, with 2.4 million inhabitants, Port-au-Prince could only supply 432,000 cubic meters of water each day and 157 million cubic meters each year. Republique d'Haiti et. al., *Cadre Physique de la Region Metropolitaine*, Volume III, p. 5. However, if Port-au-Prince reaches 2.4 million inhabitants in 2000 and each person needs at least 1,000 cubic meters of water each year, the city as a whole will need over 2,400 million cubic meters each year. To provide the inhabitants of Port-au-Prince with a moderate supply of water at 1,500 cubic meters per person, the city will need over 3,600 million cubic meters each day.

<sup>101</sup> The WHO/UNICEF approach to Integrated Management of the Sick Child, Update February 1995 in Luca Barrile, et. al., "Summary of the BASICS/Haiti Program and Recommendations for Future Action in Child Survival," November 1994-December 1995, USAID.

<sup>102</sup> Guerrier, *Desastres Et Environnement*, p. 5.

<sup>103</sup> See Terry Barker et al (eds.), *Global Warming and Energy Demand* (London: Routledge, 1995).

<sup>104</sup> Michelet Destin, *Solution Definitive du Probleme Energetique National* (Academie de Science et de Technologie, Port-au-Prince, 1989), p. 3.

<sup>105</sup> Boulos, *Haiti: Ressources Phisiques Informatisees et Vocation des Terres*, p. 140.

<sup>106</sup> UNDP, *Habitat II*, p. vi.

<sup>107</sup> Republique d'Haiti et. al., *Cadre Physique de la Region Metropolitaine*, Volume IV, p. 110.

<sup>108</sup> Bryan, "Haiti: Kick Starting the Economy," p. 67.

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<sup>109</sup> Barrile, “Summary of the BASICS/Haiti Program and Recommendations for Future Action in Child Survival.”

<sup>110</sup> Miami’s Haitian community provides evidence of how little investment capital and Haitian ingenuity can build a strong informal economy. Because neither the American government nor other ethnic communities have welcomed Haitian immigrants, a large, self-contained informal sector has developed in Miami. Women often use a small amount of capital - between 15 and 20 USD - to become small merchants selling Haitian food products, hand-made clothes, or goods purchased from Cuban retailers. Men have a smaller role in the informal sector, operating gypsy cabs or working as mechanics. A little capital would help Haitian ingenuity flourish in Haiti.

<sup>111</sup> See Chapter 5, “Climate is expected to continue to change in the future,” in IPCC, *Summary for Policymakers: The Science of Climate Change - IPCC Working Group I*.