



# 2010

## State of the Environment Report 2010



# GEOHAITI





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MINISTRY OF THE  
ENVIRONMENT



*GEO Haiti 2010*

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*Jean Marie Claude Germain, Ing.  
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# PREFACE BY THE MINISTRY OF THE ENVIRONMENT OF HAITI

In regard to the environment, Haiti has often been presented as the example of the ecological devastation of the Western Hemisphere. The country is extremely vulnerable. Its natural systems have been visibly weakened, and now seem incapable of withstanding external shocks, each one of these being more catastrophic than the last.

On January 12, 2010, Haiti's extreme vulnerability was again demonstrated when an earthquake registering 7.0 on the Richter scale struck the country, leaving in its wake unprecedented damage and loss to the Haitian society and to its economy, infrastructure, cultural sustainability and environment.

Now, more than three months later, the Ministry of the Environment, with sustained support and close guidance from UNEP, and availing itself fully of university-level knowledge, notably from the University of Quisqueya, is launching the GEO HAITI 2010 Report, the first report on the status and outlook of the Haitian environment. This report, addressed to decision-makers, professionals and the general public in Haiti, is also one of the recommendations of the government's Environmental Action Plan published in 1999.

Some might wonder, following the January 12 earthquake which compromised and weakened the buildings and infrastructure in Haiti, and generating all the new problems that Haitians have had to face since then, why a GEO HAITI? Why now? Is this document not outdated? What will it contribute in terms of solutions to Haiti's various developmental ills?

I will concede that it is not the document in itself that will save Haiti. I also can add that if we have learnt one thing from the event of January 12, 2010, it is that we need to be more serious, coherent and structured in our approach to the implementation of the important provisions contained in the documents on the path and orientation which should be followed in regard to development.

In this regard, I commend the accuracy and foresight of GEO HAITI 2010.

It is true that all eyes are on the new conditions of the post January 12 period. However, well before this, the report had increasingly been bringing to our attention the fact that, at the centre of Haiti's development woes, primarily lies an environmental problem encompassing diverse issues linked to difficulties regarding environmental management. The GEO HAITI report underlines the fact that this environmental problem is also an economic problem (we are paying dearly for our inaction), a problem of poverty and development (the achievement of the Millenium Development Goals is in jeopardy), a problem of trans-generational equity (are we going to pass on to the next generation the burden of resilience and sustained capability of adapting to various external shocks?), and finally a moral and security problem (environmental refugees, new competition for resources, expansion of disease zones).

The January 12, 2010 event has only exacerbated the already dire environmental indicators. Having said that, I commend the addition to the report of the section dealing with the aftereffects of the earthquake, since, let us not delude ourselves, the restructuring of the Haitian government cannot be achieved without addressing the environmental threats that jeopardise the country's recovery and development. The environmental issue is a fundamental one. Things must be done differently, avoiding a recurrence of the vulnerability that existed prior to January 12, 2010.

The GEO Haiti report comes at an opportune time.

Let us give it a warm welcome.



Jean Marie Claude GERMAIN, Ing  
Ministre



*Margarita Astrálagua*  
Director UNEP Regional Office for Latin America and the Caribbean

## PREFACE BY UNEP

After many years in the making, the first GEO Haiti is now a reality, thanks to the continued support of the United Nations Environment Programme, of the Quisqueya University team of professionals, and of Haiti's Ministry of the Environment. Several Haitian government bodies contributed to the execution of this project by providing the necessary key information. The overwhelming participation at the workshops organised by Quisqueya University is testimony to the interest and concern displayed by local and international organisations, as well as by the civil society, to environmental problems.

During the execution of this report, several devastating natural disasters occurred, severely testing Haiti's local and national response capacity. The period between the years 2004–2008 was marked by several hurricanes which left devastation, hundreds of thousands of victims and massive infrastructure loss in their wake. Compared to its neighbours, Haiti has always been more severely affected by such events. In 2010, the country's West and Southeast Departments were badly hit by an earthquake of about 7.0 on the Richter scale, causing varying degrees of destruction in the cities of Port-au-Prince, Leogane, Grand Goave, Petit Goave and Jacmel, and seriously impacting the towns located along the Enriquillo-Plantain Garden fault line (or the Petionville-Tiburón fault line).

The GEO Haiti 2010 Report assesses the state of the country's natural resources and the problems encountered in trying to preserve them from the uncontrolled urban development of the main towns and an excessive use of resources without the necessary protection and security measures. This report aims first to educate the general public, seemingly ill-informed of the natural phenomena which frequently strike the country, including how to adequately prepare for them. Similarly, the weak level of response by the governmental institutions responsible for intervening in such situations increases the country's vulnerability to natural disasters. Experience in regard to natural disasters over the past years has clearly demonstrated the fundamental importance of effective coordination and management of emergency services during critical situations (fire department, hospitals, police), at the national, regional and local levels.

The environmental challenges that Haiti must now overcome are tremendous. The central problem with respect to environmental conservation and quality of life relates to the current sources of energy: the use of firewood and charcoal versus the preservation of the few remaining forests and water resources. Another serious problem is the quality of surface and aquifer water that has been compromised by deforestation and soil contamination due to solid and liquid waste and lack of



adequate sanitary structures. Poor environmental conservation and protection, whether of coastal marine resources, water resources or biodiversity, is an issue which should be quickly dealt with and resolved by the relevant authorities. These issues have undeniable repercussions on the health and quality of life of the population.

Haiti is currently rebuilding vast areas affected by the January 12, 2010 earthquake and its subsequent aftershocks. In light of these efforts, and against the current background, we hope the GEO Haiti 2010 Report can, in addition to offer information, also support the work of environmental policy decision-makers as well as of those who, in one way or another, will have to restructure urban areas. Measures must be immediately implemented as to enable a better monitoring and response to disasters. Although such measures may not prevent natural disasters, they may at least prevent the wide-scale level of the human and material losses caused by the January 12, 2010 earthquake in Haiti.



**Margarita Astrálaga**

Director  
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# Reflections on the January 12, 2010 Disaster and the Future of Haiti

## The most significant facts of the catastrophe

The January 12, 2010 earthquake in Haiti was the result of the displacement of the Caribbean and North American tectonic plates. It occurred at 16:53 local time and shook the country for 35 seconds. The epicentre was located at 18.457° N and 72.533° W, approximately 25 km WSW of Port-au-Prince, at a depth of 10-13 km. Afterwards, from January 12 until March 1<sup>st</sup>, four hundred aftershocks were recorded, many surpassing 5.0 on the Richter scale with the epicentre located near the Petionville-Tiburon fault line. On January 20<sup>th</sup>, a second quake, of a 6.1 magnitude, struck Haiti at 6:03 local time, approximately 59 km west of Port-au-Prince and at a depth of at least 10 km.

The proximity of densely-populated areas and the vulnerable nature of constructions together with the magnitude of the earthquake resulted in an unprecedented level of damage. In comparison to countries such as Chile or Japan for example, better prepared and where the impact would supposedly be less severe, the aftermath of the earthquake in Haiti was unimaginable. The numerous aftershocks further undermined the buildings already rendered fragile by the first quake, most seriously affecting the West and Southwest Departments. Varying degrees of telluric movement were felt throughout the country. The main urban centres impacted by the earthquake were: Port-au-Prince, Cite Soleil, Delmas, Jacmel, Leogane, Gressier, Grand-Goave, Petit-Goave, Carrefour, Petionville, Vallée de Jacmel, Tabarre, Miragoane, Ganthier, Kenscoff and Tomazeau.

Clouds of dust rose up and blanketed the cities, covering everything as buildings crumbled.

Government buildings such as the National Palace, the Ministry of Finance, as well as the Ministries of Public Works, Communication and Culture and the Post Office were destroyed. The Parliament, the Courthouse, the Higher Education Teacher Training College, the Higher Education Civil Service Training College, the National School of Nursing, the University attached to the Francophone University Association (AUF), the main prison and the Tax Centre were extensively damaged. Also, a Petionville hospital, the Maternity Hospital, the General Hospital, the Martisant Hospital and the headquarters of the United Nations Stabilization Mission in Haiti (MINUSTAH) as well as the Montana and Christopher hotels were either destroyed or severely damaged. At the Toussaint Louverture International Airport, the control tower collapsed but the runway was spared, which allowed some relief assistance to be flown in, given that the ports had been damaged during the earthquake. Approximately 105,000 homes were completely destroyed and more than 208,000 others, damaged. Around 1,300 educational institutions and more than 50 hospitals and health centres either collapsed or were rendered inoperable.

Another result of the earthquake was a number of landslides along national highways 2 and 4 leading to Léogâne and Jacmel, and between Grand Goave and Petit Goave, as well as on the hillsides of Port-au-Prince. Small-scale tsunamis were reported on the day of the January 12 earthquake on both the northern and southern coasts of the South peninsula (Jacmel, Grand Goave and Petit Goave). Geomorphological alterations in the coastal area were observed in the Grand Goave

region, including a land and vegetation area which had sunk to 1 metre below sea level. The level of the Azuei and Trou Caiman Lakes, including the turbidity of the water, had increased.

More minor incidents included an oil spill from a damaged tank at the coastal oil terminal, shipping containers falling into the sea, and small fires developing in destroyed warehouses as well as in a gas station.

According to a government estimate, 211 persons were rescued by national and international rescue teams. The Civil Defence Organization reports that 3 million people were affected by the earthquake, of which 1.5 million (or 15% of the country's population) were directly affected. The latest figures from ECLAC indicate that 222,000 people lost their lives, 311,000 were injured and 869 are still reported missing<sup>1</sup>. Almost 1.3 million currently live in emergency camps and temporary shelters in the metropolitan area of Port-au-Prince. It is estimated that more than 500,000 persons have left Port-au-Prince in order to find shelter elsewhere in the country<sup>2</sup>.

The earliest relief assistance was received from nearby countries such as the Dominican Republic and other Latin American countries, followed by the United States, France, Spain, Canada, Switzerland and other European countries as well as from Asia, Australia and Africa. Logistical problems and more specifically the absence of a national disaster response plan hampered the process of dispatching the local and international humanitarian aid to those in need. In light of these constraints, the United Nations, the Haitian government and the various international delegations decided to share the various tasks among 12 cluster partners and developed a coordination system called Flash Appeal. The following clusters meet regularly to coordinate their joint humanitarian aid efforts according to specific needs: Camp Coordination and Camp

Management (IOM), Education (UNICEF/*Save the Children*), Emergency Shelter and Non-Food Items (IOM/IFRC), Food (WFP), Logistics (WFP), Nutrition (UNICEF), Protection (OHCHR with UNICEF for Child Protection and UNFPA for GBV), WASH (UNICEF), Agriculture (FAO), Early Recovery (UNDP), Emergency Telecommunications (WFP) and Health (WHO/PAHO).

Following the earthquake, the main issues requiring attention were: food distribution; waste management (household waste - solid waste and wastewater, medical waste, waste from demolished structures, hazardous waste and pollutants); the issue of security (kidnappings and the need of safe areas to erect shelters); sanitation challenges (burying the dead, disease control, public health and first aid services for survivors, delivery of medical care); living conditions in the camps, energy needs and communication.

The Office of Mining and Energy has issued a warning concerning possible aftershocks during the rest of the year. The population has been asked not to occupy homes, even if these only show a few cracks. The *Institute de Physique du Globe de Paris* (The Paris Institute of Global Physics) and other research institutions concur on the possibility of more aftershocks as well as on the need of preventive measures, given that the affected areas are susceptible to future earthquakes of equal or greater magnitude.

## Damage and Loss Assessment

Profound imbalances already existed between the natural and human environments prior to the earthquake as a result of dire poverty, a largely subsistence-based economy and a geographical, geological, geomorphologic and climatic situation which leaves the country exposed to a wide range of dangerous natural phenomena. Equally important is the chronic incapacity of the governance systems to ensure efficiency and

<sup>1</sup> [http://www.prensa-latina.cu/index.php?option=com\\_content&task=view&id=172601&Itemid=2](http://www.prensa-latina.cu/index.php?option=com_content&task=view&id=172601&Itemid=2)

<sup>2</sup> The figures on the death toll and damage sustained are not precise and may vary from one document to another.

viability in regard to management, first, of resources and territory, followed by risks and disasters, and finally of pollution in the natural, rural or urban environments.

The earthquake has amplified the incidence of pollution and of the problems and hazards which were already plaguing the affected areas, hence increasing the pressure on natural resources and protected areas. These factors have placed the Haitian population in extremely vulnerable conditions which can be clearly seen in the following assessment of the Haitian environment. Moreover, even before the earthquake, the spatial organisation of the urban areas was ineffective in regard to the managing and overcoming of the environmental problems, demographic challenges, shantytown inner city growth, as well as of social and physical inequalities. Construction techniques and the choice of settlement sites did not take into account the various threats such as flooding, landslides or earthquakes.

The Haitian government, with the help of the United Nations Agencies and donor community, has undertaken a Post-Disaster Needs Assessment (PDNA)<sup>3</sup> exercise aimed at producing an evaluation and inventory of the direct and indirect effects of the impact of the disaster. This takes the form of an assessment of the physical impact of the disaster, a determination of the economic value of losses and damages and finally, an evaluation of the impact on human development from the perspective of those affected. This exercise will allow the formulation of a reconstruction strategy, based on the identification of needs and priorities, present and future.

The PDNA also aims the establishing of an action plan enabling the country to address the most urgent environmental needs and in doing so, solve its most serious problems, i.e., those causing the deterioration of living conditions and increasing the vulnerability of the Haitian population. The assessment focused on the following sectors: **environmental governance, pollution and nuisance control, space and resource management and disaster risk management.**

The PDNA, in an effort to comprehensively assess the impact of the disaster on the country's socio-economic development, to develop community strategies for short-term recovery and to assist the government in improving disaster and risk management strategies, has combined two methodologies: the EDP methodology<sup>4</sup> and the HRNA methodology<sup>5</sup>.

The results of the joint analysis led by UNOSAT-JRC-World Bank/Image Cat show that more than 90,000 buildings had been partially or completely destroyed, the damage assessed as being either major or severe. This represents slightly less than one-third of the total number of buildings in the affected areas. Port-au-Prince was the hardest hit, but a large number of buildings were also destroyed in Carrefour, Delmas, Leogane and Petion-Ville. Approximately 105,369 homes were completely levelled and more than 208,164 were damaged. Estimates of damage and loss in the housing sub-sector have been assessed at US\$2,333 billion in damages and US\$739 million in losses. The public sector suffered damages estimated at US\$459 million in regard to housing, while the private sector accounted for US\$2,613 million. This data is captured in the table below.

<sup>3</sup> MINISTRY OF ENVIRONMENT, MINISTRY OF INTERNAL AFFAIRS AND LOCAL GOVERNMENT POST DISASTER NEED ASSESSMENT (PDNA) (2010). *Need assessment after the earthquake disaster of January 12, 2010, Haiti, 55 pages (Environment Group Draft Report/ Risk and Disaster Management March 9, 2010). Final Report. Haiti: PDNA of the Earthquake. Assessment of Damage, Loss, by Sector and General Needs. Prepared by the Government of the Republic of Haiti with the Support of the International Community, 237 pages, March 2010.*

<sup>4</sup> *Loss and Damage Assessment developed by the United Nations Economic Commission for Latin America and the Caribbean (UN-ECLAC). This methodology is based on the use of the national accounts' system of the affected country as a means of assessing the damage and loss caused by the disaster. This assessment provides an estimate of the value of assets destroyed by the natural disaster (damage assessment), the losses in economic flows caused by the temporary absence of these assets and the ensuing changes to economic performance (loss assessment). At the same time, it constitutes a basis for assessing the negative impact on individual and household income as well as on overall social well-being.*

<sup>5</sup> *Human Recovery Needs Assessment - a method developed by the United Nations to assess the need for recovery at community level.*

Over 1,300 educational institutions and more than 50 hospitals and medical centres have collapsed or are inoperable. The Presidential Palace, the Parliament, the Courthouse and the majority of the ministerial and public administration buildings were razed. The total value of damage and loss caused by the earthquake of January 12, 2010 is

estimated at US\$7,863 million<sup>6</sup>, the equivalent of slightly more than 120% of Haiti's gross domestic product for 2009. The private sector accounted for most of the damage and loss with US\$5,491 billion (or 70% of the total) whereas the public sector bill stood at US\$2,374 billion (or 30%). (Table A).

**Table A: Summary of Damage and Loss (US\$ (million))<sup>7</sup>**

Themes/ Sub-Themes	Damages US\$ (million)			Losses US\$ (million)		
	Public	Private	Total	Public	Private	Total
<b>Environment &amp; Disaster Risk Management</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>321,4</b>	<b>175</b>	<b>496,4</b>
<b>Social Sectors</b>	<b>153.8</b>	<b>522.4</b>	<b>676.4</b>	<b>197.8</b>	<b>500.6</b>	<b>698.3</b>
Water and Sanitation	20.9	13.1	34	8.4	193.0	201.4
Health	94.7	101.7	196.4	187.7	86.1	273.7
Education	38.2	395.6	434	1.7	41.5	43.2
Food Security and Nutrition	0	295	295	0	35	35
<b>Infrastructure</b>	<b>621.9</b>	<b>2538.6</b>	<b>3160.5</b>	<b>868.7</b>	<b>520.6</b>	<b>1389.3</b>
Housing	0	2333.2	2333.2	459.4	279.3	738.7
Transportation	188.5	118.6	307.1	91.6	197.5	289.1
Telecommunications	66	28	94	24	22	46
Energy	14.6	0	14.6	131.7	0	131.7
Urban and Administrative Infrastructure	352.8	58.8	411.6	162	21.8	183.8
<b>Production Sectors</b>	<b>3.1</b>	<b>394.0</b>	<b>397.1</b>	<b>0</b>	<b>933.3</b>	<b>933.3</b>
Agriculture	3.1	49.9	53	0	96.0	96
Manufacturing	0	74.6	74.6	0	267.7	267.7
Trade	0	148.7	148.7	0	490.6	490.6
Bank and Finance	0	98.2	98.2	0	0	0
Tourism	0	22.6	22.6	0	79.0	79
<b>Total</b>	<b>781.8</b>	<b>3455.0</b>	<b>4237.0</b>	<b>1387.9</b>	<b>2129.4</b>	<b>3517.3</b>

The value of the destroyed physical assets, including housing units, schools, hospitals, buildings, roads, bridges, seaports and airports, has been estimated at US\$4,302 billion or 55% of the total cost of the aftermath of the disaster. The variation in economic flows (loss of production, reduction in revenues, loss of jobs and salaries, increased production costs etc.) reached US\$3,561 billion or 45% of the total.

The roadway network also suffered significant damage with approximately 70 km of the main roads being seriously affected, including some high-traffic main roads. The port of Port-au-Prince was extensively damaged (north and south quays severely affected) as was the airport (control tower destroyed, runway partially damaged etc.). The telecommunication sector however suffered limited damage.

<sup>6</sup> The sum given as the total value of damage and loss differs from the arithmetic sum of assessments by sector because double-counting was eliminated. A standard conversion factor of 42 Gourds to one United States dollar was used.

<sup>7</sup> Updated: March 8, 2010

The housing sector therefore represents approximately 40% of the losses resulting from the earthquake. The other sectors, in descending order according to damage suffered, are: trade (damage and loss of US\$ 639 million, or 8% of the total), transportation and public buildings (US\$595 million each) and health and education (with an average of 6% of the total). The total value of the need assessment is US\$11.5 billion, broken down as follows: 50% for the social sectors, 17% for infrastructure (including housing), and 15% for environment and disaster and risk management.

### Environmental governance

The Decree of January 20<sup>th</sup>, 2006, defined the national policy in this regard and proposed the development of an institutional framework, i.e. the National Environmental Management System (NEMS). Due to the lack of political and financial support, it has been difficult for the Ministry of the Environment to exercise the necessary leadership in environmental governance and to enforce the Decree. This governance should have expanded horizontally to the other national stakeholders as well as to the civil society. The operations of the MOE were mainly confined to the implementation of projects based on external funding, such as the management of protected areas or focused on local development, and on the production and follow-up of basic environmental information, notably through ONEV. In the meantime, environmental assessment or the understanding of the impact on the environment of sectorial policies, plans and programmes at the heart of the MOE mandate, those outlined in the Decree, have not been addressed by the MOE, due, as mentioned, to a lack of funding.

The earthquake caused considerable damage to the buildings and equipment of the Ministry of the Environment and to those of some of its partners, as well as substantial loss of technical capacity and institutional memory, and in some cases, resulting in the almost total disappearance of the institution. One example is the CNIGS (National GIS Centre), which was unable to react, function and analyze

the circumstances requiring its intervention, as dictated by its central position within the NEMS. The government also suffered human loss and considerable material damage. The destruction of buildings, office equipment and computer data of several key ministries, constitutes a terrible tragedy for the country. The destruction of buildings such as the National Palace, the Prime Minister's Office, the Parliament Building and the main Courthouse also constitute an invaluable symbolic loss for Haiti.

Some main concrete actions taken by the government with the support of the international community have been the provision of drinking water for the urban population, the massive distribution of food aid to those most in need (one million beneficiaries), the option of free regional transportation to those wishing to return to their home towns, a vaccination campaign against tetanus, measles, diphtheria and rubella in the makeshift camps, and the creation, in the metropolitan area, of four camp sites to accommodate the people having lost their homes and who were living on the streets. On the other hand, the international community established a rapid humanitarian response focused on providing for the basic survival needs.

The overwhelming needs of those affected have led to a critical view of the State and to a deep political and social discontent as a result of the lack of trust in government and public officials.

### Control of pollution and harmful effects

It therefore essential to implement emergency measures at the institutional and operational levels in order to reduce the pollution and harmful effects caused directly from the earthquake. The systematic implementation of such measures, either of technical or humanitarian nature, will be needed in order to support the reconstruction process so as to reduce, as far as possible, the ecological consequences of the management of waste and debris. This should ensure the

protection of the environment and the population from potential harm.

**Solid Waste Management:** The structural problems inherent in the management of solid waste (see Chapter 2 of the GEO Haiti) have been exacerbated in direct proportion to the consequences of the earthquake, by a massive additional amount of debris and demolition materials of all kinds. Indeed, piles of garbage cover the streets, impeding vehicular traffic and movement of pedestrians, clogging the sewers and making the affected cities highly vulnerable to flooding. The establishment of camp sites in many open spaces has created uncontrolled sources of pollution and further complicated the task of sanitation. In rural areas, the migration of refugees has also caused an increase in waste generation, and the volume of domestic waste is estimated to have nearly doubled in the affected areas. These piles of debris are sources of pollution and danger, and the resulting environmental degradation requires a revised approach in order to facilitate the development of a new waste management culture.

According to the organization Haiti Earthquake, the earthquake produced about 40 million cubic meters of debris which, when removed, are stored randomly and haphazardly, resulting in street congestion and complicating the distribution of humanitarian aid.

**Management of hazardous waste (infectious and toxic):** The rapid increase in waste-related health issues was the first negative impact during the weeks following the earthquake. The number of infected wounds has increased and has led to the production of large volumes of soiled bandages and other associated waste (syringes, etc.). According to an estimate by the Swedish Civil Contingency Agency in March 2010, 15 to 20% of such waste is considered infectious (drugs, chlorinated hydrocarbons and other chemicals, bacteria), therefore presenting huge risks to the environment and public health.

The lack of waste management systems and the destruction by the earthquake of several hospitals

(including ten in Port-au-Prince, those primarily responsible for the incineration of sanitary waste), has greatly complicated the situation. In some areas, the mobile hospitals set up to provide first aid services to the many victims of the earthquake have produced large amounts of hospital and medical waste not appropriately disposed of. In the camps, the generation of infectious waste is also a major concern.

**Wastewater management:** Even before the earthquake, sewage was not properly treated (see Chapter 2, GEO Haiti) and afterwards, health conditions worsened considerably, especially in the refugee camps where the minimum sanitary facilities, such as pit latrines, are not available. Emergency humanitarian measures have focused on the digging of latrines and on the provision of chemical toilets. These solutions however are not optimal and often, pit latrines are inappropriate due to a lack of space, particularly since the pits and containers require continuous waste disposal. Moreover, the effects of the rainy season, beginning in April, will exacerbate the health and environmental problems, made worse by the blockage of rainwater drains from the accumulation of debris. This constitutes an additional problem for which a quick and effective solution should be provided prior to the start of the rainy season.

## Management of resources and space

The problem of resource and space management should be envisioned from the following perspectives: watersheds, water, soil and forestry management; management of domestic energy sources; biodiversity, and the management of coastal, marine and protected areas.

**Watersheds, water, land and forestry management:** The impact on the situation of the environment and natural resources has been felt in specific areas, however, the earthquake has thrown more than 2 million people into a precarious existence, resulting in significant population displacement

towards the interior of the country and causing an increased demand on energy and firewood resources, including of housing and food in these regions.

The illegal clearing of land in and around the affected cities, as well as in the rural areas affected by the movement of populations, could result in increased pressure on forestry resources and may raise the levels of land degradation as a result of the higher levels of erosion.

Landslides have occurred, especially in the communities of Jacmel, Leogane, Baintet, Petit Goâve, and high-altitude small mountain lakes have been formed, while new water sources have emerged. It should be noted that there is a risk of water pollution from the waste and debris generated by collapsed buildings and houses, and the risk of erosion is greater due to the increased instability of soil particles. The vulnerability of the population has increased because many earthquake victims have tended to take shelter on riverbanks and near coastal ravines.

**Management of domestic energy sources:** The limited forestry area of the country is a direct consequence of the high demand on domestic energy in the form of firewood and charcoal. Around 72% of the domestic energy needs come from biomass, particularly charcoal and firewood, which are used for cooking. The remaining 25% is provided by propane gas, electricity and small quantities of other alternative fuels such as kerosene.

Following the earthquake, and with the rising price of energy, there has been a greater demand on wood, putting additional pressure on this resource. As mentioned, this could result in illegal land clearing in and around the affected towns and rural areas most affected by the displacement of the population, in an effort to create farmland to meet the increased alimentary needs of the population. It is also very likely that the pressure on the forestry resources will also be felt in a demand for construction lumber. There is therefore a real

risk of increased land degradation and a decline in the quality and quantity of the provision of environmental goods and services such as the provision of water. Additionally, there is a risk of reduced soil productivity and biological diversity, as well as lower levels of protection against flooding and erosion.

**Management of protected areas and biodiversity:** Haiti has thirty-five legally-protected areas. However, only four of them are subject to any form of management. These are Macaya National Parks (Massif Hood, South) and La Tour (Massif de la Selle), the Forêt des Pins Reserve (Massif de la Selle) and the Historical Sans-Souci Park / Northern Citadel of Haiti.

**Management of marine and coastal areas:** In the marine and coastal areas, the main types of ecosystems (mangroves, sea grass beds and coral reefs) were already in an advanced state of degradation even before the earthquake. Sedimentation due to erosion in the high watershed zones and to the over-exploitation of marine resources and pollution (solid waste, oil, sewage), as a result of land-based activities and encroachment of human settlements, has placed great pressure on these ecosystems. This has led to a decrease in fish catch and has reduced the potential of aquaculture. The exploitation of mangroves and the destruction of coral reefs now expose coastal areas to storms and hurricanes.

Also a result of the earthquake, breakaways in the marine and coastal areas of Grand and Petit Goâve have caused seawater to encroach onto the land while elsewhere, the reverse phenomenon has been observed. Due to a rise of the seabed level, coral reefs have emerged and now may be observed on the surface of the sea.

## Management of Risks and Disasters (MRD)

At the present time, all ten provinces and almost all of the country's municipalities have an MRD committee with a technical coordinator. However,



these committees do not always have a consistent set of systematic practices including protocols, procedures, tools and other operational and coordination mechanisms able to appropriately respond to a major disaster. In relation to a risk management approach focused on mitigation and prevention of risk, as well as on rehabilitation and early recovery, the existing tools are inadequate. From a legal point of view, the recent national legislation on the protection of investments is still insufficient.

The hydro-meteorological monitoring system consists of 2 fully-equipped stations and a network of volunteers. With respect to seismic hazards, the network is under-equipped and unable to apply scientific-based approaches. This lack of primary data and stored information constitutes a serious obstacle to the MRD committees and has implications on decision-making, strategic land settlement decisions as well as on capacity-building. Finally, the absence of detailed risk maps in regard to locations creates an obstacle to sound decision-making for the authorities.

Haiti is the country with the highest level of vulnerability to hurricanes<sup>8</sup> (see Tables 29, 30 and 32 of the GEO Haiti). Each year, from May to November, the winds, floods, landslides and mudslides which accompany hurricanes cause extensive damage. Due to the fact that the population lives in the center of the Caribbean Basin, 96% of Haitians are constantly exposed to the risk of two or more hazards<sup>9</sup>. Efforts by the SNGRD in recent years have greatly reduced the loss of lives, especially with regard to hydro-meteorological hazards. More recently, Haiti has been identified as one country most vulnerable to climate change.

In addition to the problem of hydro-meteorological threats, Haiti is located within a seismically-active zone. Four fault lines run through its territory and these can produce strong earthquakes. The recurrence period is estimated to be 150-200 years for the two largest cities, Port-au-Prince and Cap-Haïtien, both located directly on these fault lines.

Other towns such as Les Cayes, Jacmel, Légoane, Fort Liberté and Ouanaminthe are equally close to the fault lines.

Another major factor is the weakness that results from land settlement and urbanization, as 39% of the population and 66% of the GDP are concentrated mainly in the Western province. Additionally, deforestation and the presence of communities in sunken watersheds and flood plains are factors that are likely to contribute to the country's increased vulnerability. The high population density in the urban areas, combined with a proliferation of precariously-constructed buildings and overall fragility of infrastructure, have increased Haiti's vulnerability to earthquakes.

In addition to this environmental vulnerability, social factors such as poverty, political instability, rapid urbanization and the fragility of the State have exacerbated the adverse consequences of natural disasters in Haiti, and although there are requirements, as previously-identified, by the National Risk Management and Damage Organization (SNGRD), the earthquake has weakened current capacity and created new needs. These stem from SNGRD's weakened functionality and visibility.

Additionally, the problem of the 250,000 buildings destroyed or damaged, of the nearly 660,000 affected and displaced persons returning to their home towns, and of the one million homeless persons in need of permanent solutions in the Western province, together with the problem of somewhat poorly planned post-disaster efforts (camps placed in flood zones, drainage channels clogged with debris, etc.) and some survival strategies (the use of charcoal), have also contributed to an increased vulnerability to the approaching rain and hurricane seasons.

At national level, the earthquake showed the limitations in regard to the capacity to answer to emergencies and non-climate-related threats, especially in urban areas. The territorial committees in these areas require organizational skills and

<sup>8</sup> *Reduction of risks and disasters. UNDP World Report 2004.*

<sup>9</sup> *World Bank: Hotspots and Natural Disasters, A Global Risk Analysis (Washington, DC, 2005)*

equipment to enable them to cope with the complex dynamics of neighborhoods.

In addition to the functions of the State, the earthquake has highlighted the need to develop a culture in regard to risks at national level, including for example, actions on: (i) sectorial development programs (implementation of building codes, creation of maintenance budgets, insurance coverage, etc.), (ii) curriculum development (first aid, emergency skills, etc.) and vocational training (techniques, applications, with flexible teaching materials adapted to the national context, (iii) land-use policies (identification of risk areas, use of appropriate standards, regionalization according to risks and potential, etc.).

### Socio-economic impact

The earthquake has also led to increased unemployment as a result of the destruction of workplaces, equipment, inventory and a more complicated access to markets and sources of energy. Indirectly, employment has been affected by the contraction of markets, the disruption of financing, and the loss of skilled personnel, resulting in lowered levels of competitiveness. An assessment made by the PDNA shows that there has been a total loss of just over 11 million man-days in the four affected regions and a consequent loss of income of US\$53 million, of which 950 million gourds (local currency) reflect a loss of income by women. Of the four areas affected by the disaster, in terms of man-days and lost income, the Western province, where Port-au-Prince is situated, suffered the most, followed by two other provinces, the Southeastern and Nippes. Grande Anse also suffered losses but to a lesser extent. In terms of job losses, 20% refer to positions in the public administration.

Preliminary estimates for the fiscal year 2008 had showed an increase in real income (5.5%), with a dynamism (64%) and moderation (11% against 7% in 2007) significantly higher than that from foreign aid.

An increase estimated previously at 8% for 2010, the impact of the earthquake on the economy has resulted in reduced growth, leveling off at between

2.5% and 3.5% depending on the reconstruction<sup>10</sup> scenarios that were used. The most affected sectors have been those of trade, transport, telecommunications and manufacturing. Inflation in 2009 was of 4.7%, and in 2010 the estimates are that it will reach 11%, due, inter alia, to the reduced supply of goods, higher transport costs and the influx of foreign aid.

Regarding problems linked to registered casualties, there have been 5,250 additional new cases of persons with disabilities, including 400 cases of quadriplegia. There were also 103,000 cases of children who, as a result of the earthquake, were left without parental care and facing increased risks of violence and exploitation. Finally, the number of 250,000 homeless and 600,000 displaced people moved to areas spared by the earthquake (see Figures A, B and C), have placed additional pressure on the host population and its health system.

In the camps, the situation of young people is particularly fragile. Promiscuity has increased the risk of sexual violence, and the vulnerability of female-headed households and other groups with special needs (street children, orphans, the elderly and disabled persons) has increased.

Additionally, there is a deepening health crisis. In the disaster area, 30 hospitals out of a total of 49 were damaged or destroyed, affecting the capacity of the health system and the organization of health services (50% of health personnel live in tents). As a result of the loss of its main building, the Ministry of Health has not been able to play a leading role with respect to the involvement of the many NGOs. It should be noted however that 90% of the smaller health centers are intact or only slightly damaged.

The environmental crisis in Haiti is complicated by poverty. This has had a profoundly negative impact on the environment and lives of the population. The vulnerability to disasters in Haiti will continue to grow unless the issue of basic subsistence is tackled and resolved. Deforestation, coupled with vulnerability to hurricanes, has exacerbated

<sup>10</sup> The first scenario is a "prudent" one in which 1/3 of the rehabilitation and reconstruction budget is spent in 2010 (other page?).

environmental degradation, affecting agricultural productivity, increasing poverty in rural areas and accelerating migration. This partially explains the increase in urban poverty and the deterioration of

the natural environment. The long-term solution lies in an economic development that will benefit the poor while protecting the natural resources or their natural capital.

Figure A

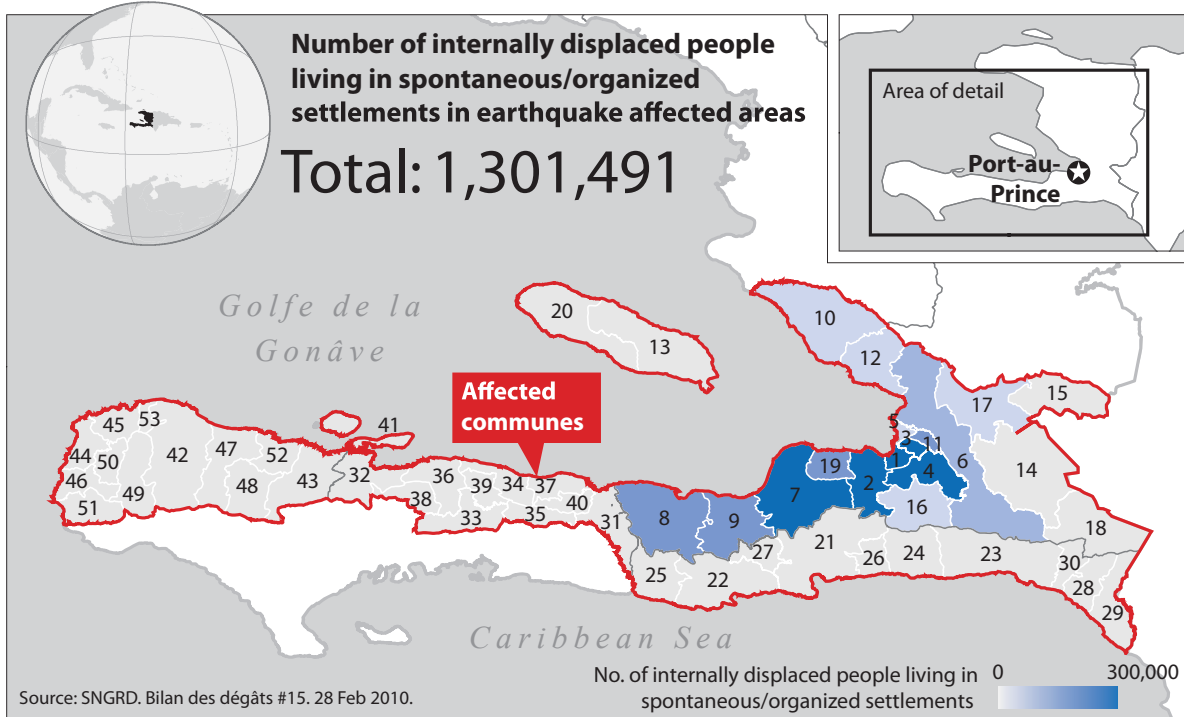


Figure B

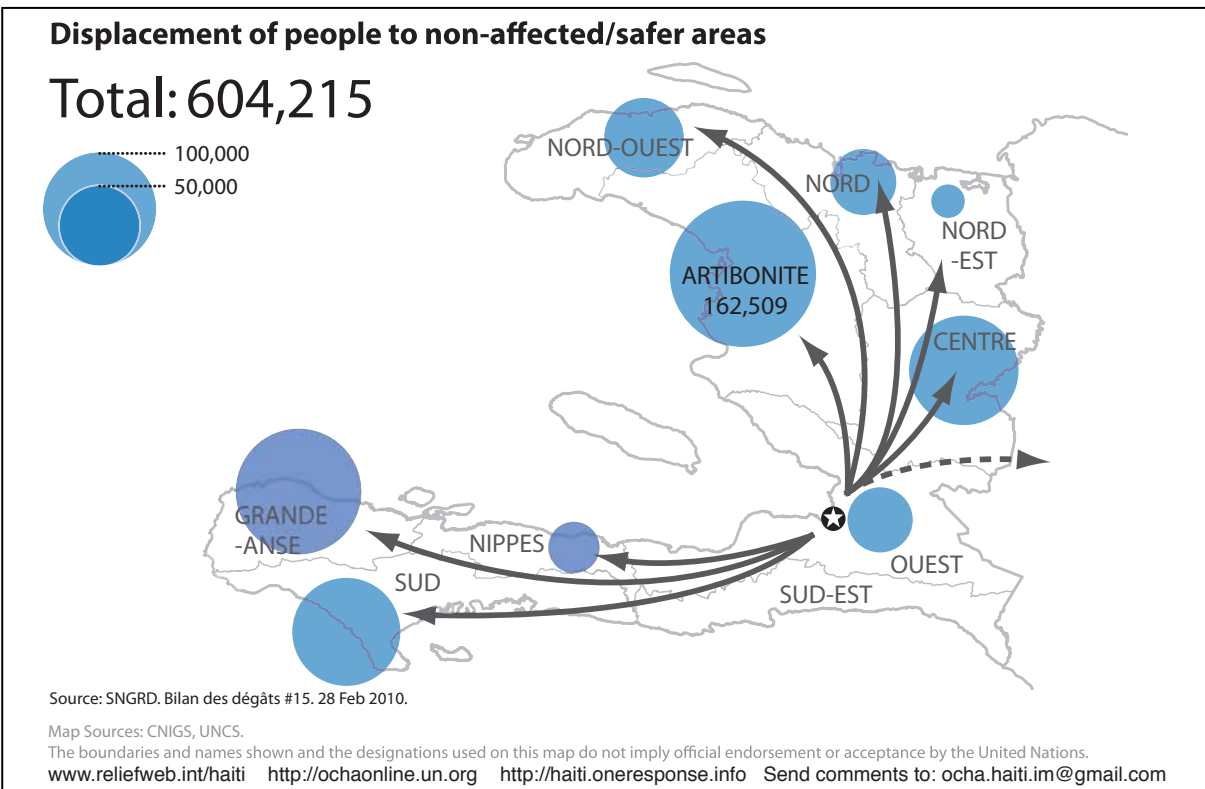
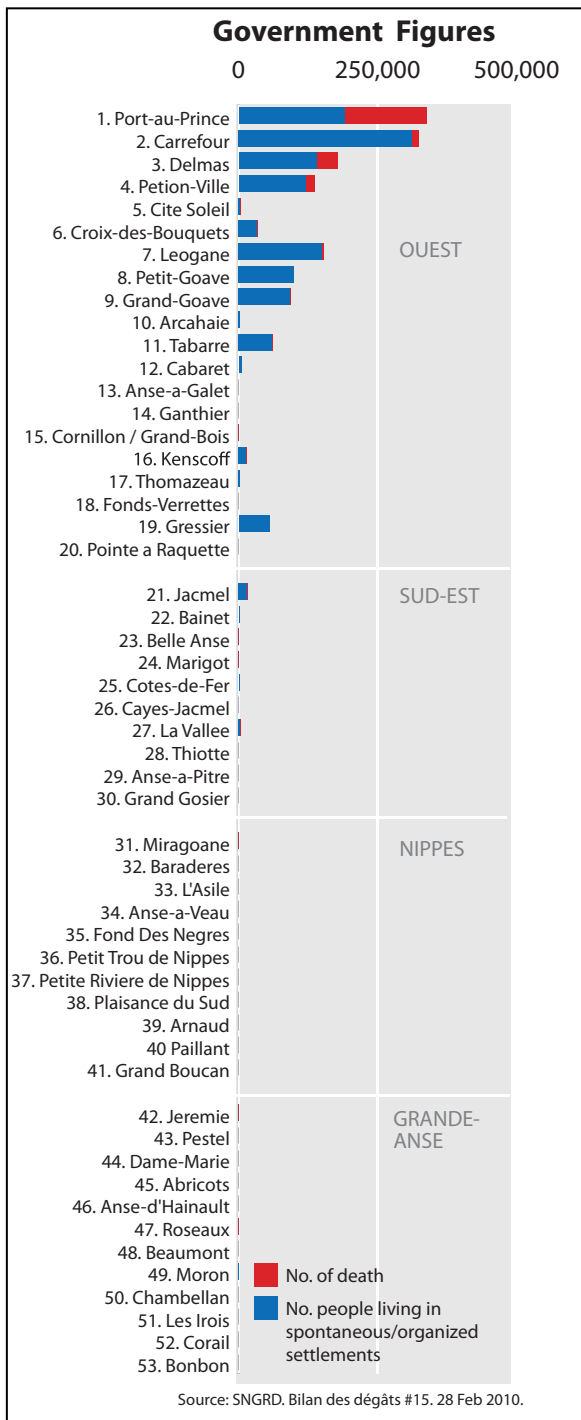


Figure C



### Needs and issues relating to rehabilitation and reconstruction

A national rehabilitation and reconstruction scenario involves the entire country and calls for a review of its development and infrastructure

strategies. In such a context, the identified needs and issues have been used to initially answer to the emergency requirements, as well as to eventually transform the governance system and management of resources, soil, risks and disasters, including the control of pollution.

In the short term, it will be critical to respond to the identified problems posing a threat to the environment or public safety, and to provide the Haitian government with the means to implement them. In the medium and long-term, systemic support will have to be provided, from a technical, humanitarian and financial standpoint, towards reconstruction efforts and developmental strategies. It is estimated that in order to meet the identified short-term needs, US\$385,900 million (18 months) will be required. In the medium-term, US\$1,343,300 million will be needed for reconstruction (3 years) while US\$430,000 million will be needed for a long-term development of the country (10 years).

These requirements are those resulting solely from the earthquake and include: i) the financial resources needed to ensure the restoration of economic activity (at the sectorial, macro-economic and personal or household levels), as well as the improvement of the pre-disaster living conditions and welfare, ii) the financial resources needed for the reconstruction and physical repair of assets in the affected areas which have been completely or partially destroyed, using construction techniques that take into account established standards to withstand disaster, with the aim of rebuilding more efficiently.

The resources needed for rehabilitation and reconstruction have been based on a detailed and quantitative estimate of damage and loss. Those required for rehabilitation are identified as those needed to restore the economy back to normal performance levels, as indicated above, and usually require an amount equivalent to a portion of the production losses estimated for each sector of economic activity. On the other hand, these are identified as the most costly

expenditures in order to meet essential temporary needs, in light of the assets destroyed. Included in these estimates are the high costs of providing the displaced population with temporary shelter, water, sanitation and other basic services. Also included (for a minimum period of four years),

are the costs related to the reconstruction of the housing sector, which will decrease over time<sup>11</sup>.

In total, the resources needed for rehabilitation and reconstruction amount to US\$9 billion for the period 2010-2013, with the following annual allocations:

**Table B:**  
**Total Budget for rehabilitation and reconstruction (based on EDP methodology)**

	Estimated Budget (US\$ million)				
	2010	2011	2012	2013	Total
Rehabilitation	1,606	863	398	75	2,942
Reconstruction	2,912	1,964	712	444	6,032
<b>TOTAL</b>	<b>4,518</b>	<b>2,827</b>	<b>1,110</b>	<b>519</b>	<b>8,973</b>

Until now, efforts have focused on protecting the life of the population (particularly in relation to hydro-meteorological hazards), and with positive results. Similarly, as in the case of risk and disaster management, broadening this task to the protection of physical assets has proven to be a challenge at the institutional, operational and organizational levels. Post-earthquake needs may be grouped into 4 areas of intervention: (i) knowledge of disasters (natural and otherwise), (ii) clarification of the roles and responsibilities of the public and private sectors (legal framework, regulatory instruments, etc.), (iii) organizational and operational capacities for readiness and response of the sectorial ministries and specialized bodies (e.g., firefighters, the territorial committees GRD), (iv) sectorial analysis-capacity of risks, and planning and follow-up on the protection of

physical assets. The ultimate goal is the protection of people, property and investments against the various exogenous shocks.

All these actions are aimed at instilling a national culture of prevention, focused on the transition from a country that lives in danger to one that knows how to manage risk.

In the future, environmental governance should correct the serious imbalances that characterize many aspects of the environment in Haiti and the numerous deficiencies in its territorial management, in order to make better use of its resources and available land, and also to be able to anticipate risks and disasters, to reduce vulnerability and to improve living conditions for everyone in the country.

<sup>11</sup> In other types of disasters, the provision of temporary shelter and essential services for the homeless and displaced population is achieved in a relatively short period of time. However, in the case of Haiti, due to the scope of the relief and reconstruction efforts and the limited local capacities, the cost of these activities is quite high.



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# LIST OF ABBREVIATIONS AND ACRONYMS

AFP	: Agence France Presse
AHSI	: American Society Histocompatibility and Immunogenetics
BID	: Inter-American Development Bank
BME	: Bureau des Mines et de l'Énergie
BRH	: Banque de la République d'Haïti
BRIDES	: Bureau Haïtien de Recherche en Informatique et en Développement Économique et Social
CAMEP	: Centrale Autonome Métropolitaine d'Eau Potable
CATHALAC	: Centro del Agua del Trópico Húmedo para América Latina y el Caribe
CCI	: Cadre de Coopération Intérimaire
CEPIS	: Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente (OPS)
CFC	: Chloro Fluoro Carbones
CHF	: Cooperation Housing Foundation
CHSRH	: Centre d'Habitat Salubre de la République d'Haïti
CIAT	: Comité Interministériel d'Aménagement du Territoire
CIDA	: Canadian International Development Agency
CNIGS	: Centre National de l'Information Géo-spatiale
CNRA	: Centre National de Recherche Agricole
CNSA	: Conseil National de Sécurité Alimentaire
CNUED	: Conférence des Nations Unies sur l'Environnement et le Développement
COHPEDA	: Collectif Haïtien pour la Protection de l'Environnement et le Développement Alternatif
CONATEL	: Conseil national de télécommunication
COVNM	: Composés Organiques Volatils Non Méthaniques
CSI	: Carrefour de Solidarité Internationale
DC	: Developing Countries
DDT	: Dichlorodiphényltrichloroéthane
DPC	: Direction de la Protection Civile
DSNCRP	: Document de stratégie nationale pour la croissance et la réduction de la pauvreté
ECLAC	: United Nations Economic Commission for Latin America and Caribbean
ECMU	: Environmental Country Monitoring Unit
ECOSOC	: Conseil Économique et Social des Nations Unies
EDH	: Electricité d'Haïti
EPA	: Environmental Protection Agency
EPPLS	: Entreprise Publique de Promotion des Logements Sociaux
EROS	: Earth Resources Observation Systems
ESMAP	: Energy Sector Management Assistance Program



EU	: European Union
FAES	: Fond Assistance Economique et Sociale
FAO	: United Nations Food and Agriculture Organization
FMI	: Fond Monétaire International
FOPRROBIM	: Fondation pour la Protection de la Biodiversité Marine
FREH	: Fonds pour la Réhabilitation de l'Environnement Haïtien
FSAE	: Faculté des sciences de l'Agriculture et de l'Environnement-UniQ
GCE	: Groupe de Coordination pour l'Énergie
GDP	: Gross Domestic Product
GEO	: Global Environment Outlook
Gg	: Giga gram
GHG/GES	: Greenhouse Gas Emissions
GRD	: Gestion des Risques de Désastres
GRET	: Groupe de Recherches et d'Échanges Technologiques
Ha	: Hectare
HOPE	: Haiti Hemispheric Opportunity Through Partnership Encouragement Act
HRV	: Haute Résolution dans le Visible
IHSI	: Institut Haïtien de Statistique et d'Informatique
IMF/FMI	: International Monetary Fund
INARA	: Institut National de la Réforme Agraire
IUCN/UICN	: International Union for the Conservation of Nature/ Union Internationale pour la Conservation de la Nature
Km	: kilometre
LPG/GPL	: Liquefied Petroleum Gas
MARNDR	: Ministère de l'Agriculture des Ressources Naturelles et du Développement Rural
MDE	: Ministère De l'Environnement
MEEGE	: Maitrise en Ecotoxicologie, Environnement et la Gestion de l'Eau
MEF	: Ministère de l'Économie et des Finances
MENJS	: Ministère de l'Éducation Nationale de la Jeunesse et des Sports
MICT	: Ministère de l'Intérieur et des Collectivités Territoriales
ml	: millilitre
MPCE	: Ministère de la Planification et de la Coopération Externe
MSPP	: Ministère de la Santé Publique et de la Population
MT	: Metric Ton
MTPTC	: Ministère des Travaux Publics, Transports et Communications
NASA	: National American Space Agency
NGO/ONG	: Non-governmental Organization
OEA	: Organisation des États Américains
OGM	: Organisme Génétiquement Modifié
ONEV	: Observatoire National de l'Environnement et de la Vulnérabilité
OPS/OMS	: Organisation Panaméricaine de la Santé / Organisation Mondiale de la Santé
ORE	: Organisation pour la Réhabilitation de l'Environnement

PAE	: Plan d'Action pour l'Environnement
PAHO/WHO	: Panamerican Health Organization /World Health Organization
PAM	: Programme Alimentaire Mondiale
PAPDA	: Plateforme Haïtienne de Plaidoyer pour un Développement Alternatif
PAS	: Politiques d'Ajustement Structurel
PED	: Pays en développement
PIB	: Produit Intérieur Brut
PMA	: Pays Moins Avancés
PNGRD	: Plan National de Gestion de Risques et des Désastres
PNUD	: Programme des Nations Unies pour le Développement
POCHEP	: Poste Communautaire d'Hygiène et d'Eau Potable
POPs	: Polluants Organiques Persistants
PSSA	: Programme Spécial de Sécurité Alimentaire
PUIDA	: Programme d'Interventions Urgentes dans le Domaine Agricole
RDDH	: Réseau de Développement Durable Haïti
SAH	: Société Audubon Haïti
SEDREN	: Société d'Exploitation et de Développement Économique et Naturel
SGV	: Société Ste. Geneviève
SMSCRS	: Service Métropolitain de Collecte des Résidus Solides
SNEP	: Service National de l'Eau Potable
SNGRD	: Système National de Gestion des Risques et Désastres
SNRE	: Service National des Ressources en Eau
SNU	: Système des Nations Unies
TELECO	: Télécommunications d'Haïti S.A.M
TEP	: Tonnes d'équivalent en pétrole
TM	: Tonne métrique
TPTC	: Ministère de Travaux Publics, Transport et Communication
UE	: Union Européenne
UEH	: Université d'État d'Haïti
ULCC	: Unité de Lutte Contre la Corruption
UNDAF	: United Nations Development Assistance Framework
UNESCO	: United Nations Educational, Scientific and Cultural Organization
UNFPA	: United Nations Population Fund
UniQ	: Université Quisqueya
UNS	: United Nations System
USA	: États-Unis d'Amérique
USAID	: United States Agency for International Development
USSC	: United States Southern Command
UTSIG	: Unité de Télédétection et de Système d'Information Géographique
WFP	: United Nations World Food Programme
WRI	: World Resource Institute

# EXECUTIVE SUMMARY

The Republic of Haiti, a territory of 27,750 km<sup>2</sup>, occupies a third of the surface area of the island of Hispaniola, one of the largest in the Caribbean. The country's capital, Port-au-Prince, includes 12 townships and is home to 25% of the population of Haiti, which accounts for 63% of all urban populations within the country (IHSI, 2003a).

The name « *Ayiti* », which means "Land of high mountains" or "The Mountain in the sea", is derived from the language of the Tainos, the Amerindians of the insular Caribbean. Peaceful people, they were involved in agriculture, fishing and crop-picking, and at the arrival of Christopher Columbus in the New World in 1492, the Spaniards called the island "Hispaniola". Later, a division resulting from the treaty of Ryswick (1677) separated the island in two; the western portion (the future Haiti) was given to France and named Saint Domingue, while Spain retained the eastern portion.

The colony of Saint Domingue experienced unequalled prosperity as one of the region's main sugar and coffee producers, and its external trade was among France's most profitable activities. However the organization of the colony was based on a much criticized social and economic system, which led to a revolution. This revolution represents the first successful rebellion of slaves in the modern world and resulted in the establishment in 1804 of the Republic of Haiti, as the first free black republic in the world.

This country also wished to serve as an example and prove to the rest of the world that no race was inferior and that Blacks could attain a level of civilization equivalent, or even superior, to that of other races. Haiti, under Alexandre Pétion, also supported the emancipation of other American

colonies under the tutelage of the Europeans. Countries such as Venezuela, Mexico, Jamaica, Cuba and the Dominican Republic benefitted from significant assistance (financial, aid in men and ammunition) from Haiti. According to Pétion, the freedom of the people of Haiti would be threatened as long as there remained enslaved populations in the Americas. The history of Haiti is one of heroism and grandeur, although it is marked by a long succession of difficult political, social and economic events.

For the past twenty years, Haiti's economy has been confronting a period of turbulence and the country has faced a serious political and economic crises. The Gross Domestic Product (GDP) fell during the first half of 1990 as a result of the socio-political instability at that time. Calculated at nearly US\$3 billion at the beginning of 1991, the GDP fell to US\$2.5 billion in 1995, slightly rising to US\$2.8 billion in 2001.

However, since 2005, an upward trend has been observed, allowing the GDP to attain a value of US\$3.4 billion in 2007 (UNDP, 2007). That year, this indicator grew by 3.2% (IHSI, 2008) in relation to the previous year because of the re-establishment of a favorable economic climate. It must be noted however, that the per capita GDP, which currently stands at around US\$500, has never regained the historic level of US\$3,151 that it attained in 1980 (UNDP, 2007).

Young people account for a high proportion of the Haitian population with more than half of the population under 21 years of age, and of this number, 36.5% under the age of 15. The population of over 65 years of age represents a mere 5.1% of the total population, and the male/female ratio shows a slight preponderance of women (51%).

The geological substratum is made up mainly of limestone, basaltic and sedimentary rock, giving rise to 5 types of sedimentary rocks.

The country enjoys a tropical climate (19° latitude North), with an average annual temperature of 25 °C. However, its hilly terrain produces a variety of micro-climates, with instances in which the temperature can drop to 15 °C.

With an average annual rainfall of nearly 1,400 mm, the country has such a contrasted spatial variation that some regions enjoy rainfall exceeding 4,000 mm while others receive only 350 mm of rainfall over the same period.

Vegetation in Haiti, which was formerly dense, has suffered over several decades from over-exploitation. It has now been reduced to savannahs, open forests and vestiges of closed forests, which are made up of broad-leaved trees and conifers.

Although faced with a shortage of water and destructive tropical storms, the country's agriculture must nevertheless ensure the alimentary needs of a population in the context of a demographic explosion. This has contributed to an excessive exploitation of the environment in Haiti, leading to over-use and loss of land through acceleration of the process of erosion. Agricultural production is very low because of weak means of production and inefficient marketing channels. Most farms are small-sized, family-owned and primarily geared towards self-sufficiency, planted with cereal crops and food crops such as corn, sorghum, beans, sweet potatoes, manioc, banana and plantain. Export crops such as coffee, mangoes, cocoa, sisal, tobacco, coconut, and cotton are grown on larger plantations.

The industrialization process that began at the beginning of the 1960s has remained to this day in an embryonic stage, with activities focused essentially on the fabrication of electronic spare parts, textile products and beverages. This process slowed down considerably because of the commercial embargo imposed on Haiti by the United Nations Organization between 1992 and

1994 and from which the country has not fully recovered. The industrial sector, which employed 430,000 people in 1991, had only 13,000 employees in 1995 (DESHOMMES, 2005) and no more than 25,000 in 2005 (UNDP, 2005).

Mining is currently reduced to the extraction of construction materials from quarries (limestone) although this extraction is not under the fiscal control of the Haitian government, as it is not usually reported.

The textile sector is considered to be the flagship of the assembly industry in Haiti and has been growing rapidly. The HOPE Law (Haiti Hemispheric Opportunity Through Partnership Encouragement Act), enacted in 2007 by the United States Congress, allows Haiti to assemble and export to the United States textile products manufactured elsewhere. This Law, initially in place for only one year, was extended in 2008 for another 10 years, allowing Haiti to pursue the transformation and exportation of products to the USA.

Over the past decades, the tertiary sector has proven to be very dynamic in Haiti as a result of international investments in the country, and sectors such as commerce, finance, gastronomy, hospitality, transport and communication, have recovered considerably.

Credit was also geared towards activities in the tertiary sector, For example, more than 50% of bank loans in 2006 were granted to the tertiary sector (BRH, 2007). On the other hand, commercial activities, international aid, remittances from the Haitian diaspora and government expenditures, are all factors that have contributed to the vitality of the banking, communication and transportation sectors.

School attendance among children 6 years and older exceeds 68.5% in urban areas and 57.4% in rural areas. About 60% of the children in Haiti, aged 6 to 11 years old, are enrolled in school; however in rural areas, of this age group, only 50% of these attend school. High school attendance nationwide is about 22% (IHSI, 2003).

In view of the recent literacy rate of 54.1% (IHSI, 2003), compared to 44% in 1999 (MENJS, 2004), the efforts made in this area have given positive results, considering also the demographic growth of that period.

The health sector in Haiti is a cause for concern. According to the Health Ministry in Haiti (MSPP, 2003), "the health situation of the Haitian people is essentially precarious". Infectious diseases such as measles, tetanus, cholera, diphtheria and AIDS have been identified as the main causes of morbidity. It is also important to note that malnutrition is among the 10 main causes of death.

The housing problem is above all an urban one. Almost 60% of houses are found in rural areas and, as a result of the rural migration to the cities, the demand there for housing there is superior to what is available. In general, dwellings are over-crowded, with a national average of 2.7 persons per room, and 3.5 persons per room in Port-au-Prince.

Fuel provided by biomass is still the form of energy most used in the country (70%). Wood, charcoal and bagasse respectively represent 55%, 11% and 4% of domestic energy consumption. Traditional industries and hydro-energy account for only 2% of the energy consumption while the rest is supplied by petrol and its derivatives.

This situation engenders the destruction of the environment, placing the natural resources as well as the quality of life of the population under serious pressure. Moreover, the geographical position of the country exposes it to random natural manifestations, contributing to an exacerbation of the environmental crisis.

Haiti enjoys a considerable hydrological potential. From a hydro-geological point of view, the water resources in Haiti amount to 56.2 billion m<sup>3</sup> of water, divided into 48 billion m<sup>3</sup> of continuous aquifers and 8.2 billion m<sup>3</sup> of non-continuous aquifers. Such underground water resources are the result of extensive, permeable geological formations which create natural storage reservoirs.

However, despite an abundance of rainfall, water reserves in Haiti are gradually declining in certain regions, due to deforestation and over-exploitation. As such, water is still inaccessible to 40% of the population, and the mineral and organic pollution of water resources is worsening, thus affecting the health of the population.

There are 30 watersheds and hydrographic zones within the country, flowing from the mountains to the coastline. All year long, in Haiti one can find average-flow large rivers and extraordinary waterfalls in Haiti, such as Cascade Pichon at Belle-Anse, Saut-d'eau in the Central Plateau and Saut Mathurine at Camp-Perrin, as well as lakes and ponds such as Azuei Lake or Saumâtre Pond (11,300 hectares), the artificial Péligre Lake (2,750 hectares) and the ponds of Miragoane (1,130 hectares).

Formed by their contact with magma, thermal hot water sources contain dissolved minerals and possess enormous medicinal and curative properties. Thermal water can also be bottled as mineral and carbonated water; however, the lack of available data until now has not allowed the exploitation of this resource in Haiti.

The Artibonite River, the country's largest, originates in the eastern end of the island of Hispaniola and spans across two Haitian provinces: the Central Province and the Artibonite Province. It is of considerable importance to Haiti, as its waters are used for irrigating many farms and serves also as the main source of power to the Péligre hydro-electrical facilities, an artificial lake located in the Central Department. The underground water emanates from the infiltration of rain water into the soil, seeping, as a result of gravity, into the rocks' pores and slightest cracks, humidifying always more deeper layers, until it finds an impermeable layer. There it accumulates, filling even the smallest spaces, saturating the subsoil, and forming a reservoir of underground water called an aquifer.

Water resources in Haiti have been under tremendous pressure over a number of decades and the combined effect of demographic growth

and institutional weakness has opened the sector to private investors which have exploited them without the adequate government control. The water from some water-tables is used indiscriminately and without the proper system to guarantee its sustainability, qualitatively as well as quantitatively. However, solutions are possible since the problems remain localized, as in the case of the Cul-de-Sac Plain.

The city of Port-au-Prince's water resource comes mainly from water-tables located on a plain near the city. The access to potable water has improved over the past few years; in 1990, around 62% of the population had access to potable water in urban areas while by 2006 this percentage had risen to 70%. In rural areas, the access to potable water is far more restricted and progress is slower, i.e. only 48% to 51% of the population, over the same period. However, this does not mean that potable water is available at home: in the case of cities, about one-fifth (21%) of all homes are supplied with running water or are connected to a network, while in rural areas this percentage is only about 4%.

The management of water resources could be planned according to the watersheds that make up the main hydrographic units of the country. At elevated levels, the protection of these resources is essential, chiefly because of their role as water-tower. Their over-exploitation can cause highly-sedimentary torrential flows likely to deteriorate the equipment and services in nearby areas, as well as to the deviation systems to irrigate the plains.

The issue of water contamination remains a problem that has not been sufficiently studied in Haiti, although scientific investigations undertaken in the metropolitan area has determined that the problem could be quite serious. The presence of lead at concentrations of between 40 and 90 µg/litre has been detected in the bottled water distributed by a public company, and the investigation by Brasseur et al in 2002 has shown that *Escherichia coli* and *cryptosporidium oocysts* were found in drinking water.

The coastal marine area is potentially rich, but it is also subject to extreme exploitation. In fact, fishing and the improper use of mangrove forests, which is the vegetation indigenous to the area, remain unregulated practices. This over-exploitation is exacerbated by the contamination of the coastal area and of the sea, due to the dumping there of waste material. This jeopardizes the potential and future of these resources, even if fishing still remains a minor sector of the Haitian economy. The island nation of Haiti has 1,977 km of coastline, a surface area of 5,680 km<sup>2</sup> of continental plateau and 86,398 km<sup>2</sup> of exclusive economic zone (FAO, 2005). The amount of fish imported is one third of the amount exported.

The crisis facing the sea and coastal zones in Haiti is multi-dimensional. The main causes are the inappropriate use of mangrove forests and of fishery resources, the urbanization, soil erosion and emptying of fuel tanks in the Haitian territorial waters. In Haiti, the mangrove forests, an ecosystem unique to the inter-tropical zone, have suffered extreme pressure these past decades. They have been cut down and their wood used in the construction industry and as firewood for domestic and industrial uses. This misuse has unfortunately been carried out without a rational plan and the proper control.

Waste management and squatting along the coastal-marine area pose a real problem for the management of the Haitian urban areas. In fact, the inefficient management of waste implies that after having stayed for some time on the streets, the waste travels via the drains to the sea, giving rise to an increased contamination of the marine area close to urban areas. Inevitably, over the past decades, soil erosion as a result of deforestation has intensified. Consequently, all types of sediment are carried along by rain and reach the coast. A 1995 UNDP study estimated that up to 7.9 million metric tons of sedimentary deposits had ended up in the Port-au-Prince Bay since 1958.

The coastal and marine areas of Haiti, which constitute the receptacle for all the refuse from the

mainland, suffer enormously as a result of human activity, especially from fishermen and poachers. The environment, thus transformed, becomes insalubrious.

The areas occupied by mangrove forests in Haiti have been significantly reduced over the past decades. There are currently only a few pockets of mangroves totaling 20,000 hectares (REPUBLIQUE D'HAÏTI. 2004). Although not recent, the available data on Caracol, a locality to the north of the country, show the progressive disappearance of one of Haiti's largest mangrove forests.

The country also has an enormous potential in terms of marine and under-water recreational activities. However, the polluting of most of its coastal and marine regions is seriously undermining this important potential. Several beaches are practically unusable (MOE-MPEC, 2004), and undertaking activities such as scuba-diving and other water sports, or even a simple swim, would expose persons to serious health risks.

The Arcadins coastline, which is located 70 km from Port-au-Prince, is of an exceptionally-high ecological value and is one of the rare coastal areas still protected from the onslaught of coastal activity.

Under various types of pressures, the coastal and marine ecosystems have tremendously suffered: the mangrove forests, coral reefs and fisheries are almost completely ravaged or are in great danger of being destroyed.

Additionally, land vegetation has seriously diminished. Today, the forest coverage accounts for only between 1.5 and 5% of the country's surface area, whereas 16% of Haiti is alleged to be totally devoid of vegetation. The use of wood for fuel and of land for agriculture, seem to be the major causes to this state of affairs.

In this context, the soil exposed to rainfall has been rapidly eroded; forty-two million m<sup>3</sup> of soil is washed away annually by rain water. Additionally,

the remaining soil has lost 75% of its productive capacity as a result of increased agricultural activity. Consequently, the agricultural sector, year after year, suffers enormous losses, largely due to the rural exodus and degraded ecosystems and infrastructure.

There is no real strategy for land management and this has also led to a deterioration of equipment and services. Most are outdated, defective and very badly distributed throughout the country. This explains why the services offered no longer meet the needs of the population.

According to specialists, land clearing is the second cause of the loss of forests and wooded areas in Haiti. Agricultural activities, those requiring an enormous amount of land space, constitute the most important economic activity in the country. For this reason, an area not used for agriculture and therefore considered useless, is cleared and substituted by cash crops with higher market value.

In the analysis of the causes of forestland destruction, fire does not seem to be an important factor. Nevertheless, large fires have been known to break out during the summer months in the remaining forest reserves of Haiti (Forêt des Pins, La Visite Park or Macaya Park). These were cases of spontaneous forest fires.

These last years, among the secondary causes of widespread deforestation and land clearing in Haiti, is the increasing demand for wood for construction. One of the reasons is the demographic pressure, already mentioned.

The consequences of the situation previously cited are alarming. Mountains are the main features of the Haitian landscape and this topography predisposes to erosion from rainfall. Therefore, the destruction of forest exacerbates the problem.

Sustained deforestation and tree clearing have been occurring in Haiti for several decades, a catastrophic and unprecedented situation in the history of a continent however known for the

disappearance of its forest, with few geographical zones having been spared. As previously mentioned, the topography of Haiti naturally predisposes it to erosion, and given the abundant rainfall in this tropical zone (on average 1400 mm/year), the mountain watersheds have undergone significant soil erosion.

For many years, agriculture has occupied a special place in the Haitian economy. This since Haitian State was established a little over two centuries ago, and when most of the former slaves had made it their main activity. Nevertheless, recent statistics show that there has been a sustained decrease in the percentage of the population involved in this sector over the years. From 1950 to 2000, the percentage of those involved in agriculture fell from 85% to 62%. While the urban population increased from 12.17% to 36% over the same period.

Almost all of Haiti's large cities are located near the coasts, at very low altitudes, and surrounded by imposing chains of mountains which serve as watersheds. It is estimated that 16,000 MT of soil are washed away each year, a large portion of this passing through cities and leaving piles of mud on streets and bridges, thus rendering them impassable (DPC, 2006), including schools, homes and hospitals. This highly sedimentary runoff also causes serious destruction to tourist facilities and to the urban population's drinking water supply systems.

Moreover, the biological diversity, once rich from an ecological, specific and genetic point of view, is declining as a result of over-exploitation and inefficient management. For this reason, twelve (12) species of animals have disappeared from Haiti; 44 species of flora and fauna are highly endangered, 24 are endangered and 49 are in a vulnerable state. It is highly likely that this data does not reveal the full extent of the phenomenon.

According to a recent investigation, there would be at least 230 species of birds in Haiti, a diversity recently confirmed by two scientific expeditions, one to Macaya Park (2004) and another to La Visite

Park (2005); [www.birdlife.org](http://www.birdlife.org)). It revealed that there would be about 12 endangered species.

The wetlands, notably the Saumâtre and Miragoâne Ponds, are the habitat to many species. At Saumâtre Pond for example, there are saurian species such as the American crocodile (*Crocodylus acutus*) as well as aquatic birds, such as the pink flamingo (*Phoenicopterus ruber*).

The impact of biodiversity loss in Haiti has not been extensively studied, although the consequences have exceeded what could be termed as a "simple threat". They rather represent what could be qualified as "a silent catastrophe". Unfortunately, aside from the efforts of a few specialists working in the field of biodiversity in Haiti, very few people show a concern regarding the effects of this erosion.

With respect to atmospheric pollution, despite unimpressive manifestations, this seems to be limited to the urban areas. A wide variety of gases are emitted into the atmosphere mainly through domestic, agricultural and industrial activities as well as through traffic. The main gases are: CO<sub>2</sub>, CO, CH<sub>4</sub>, N<sub>2</sub>O, NO<sub>x</sub>, SO<sub>2</sub>. It is believed that these emissions, although not excessive, are causing severe health problems. Other emissions of atmospheric pollutants, emanate from activities associated with the burning of waste.

As expected, the composition of the air in Haiti varies according to areas, whether rural or urban, and the presence of atmospheric pollutants would be more intense in cities than in the countryside. However, the impact of air pollution in Haiti is not well known, as evidenced by its omission from the most recent National Health Service's reports.

Atmospheric pollution resulting from human activities is not without consequences to the environment. Indeed, the concentration of greenhouse gases would cause serious climatic upheavals in poor countries, usually badly equipped and very vulnerable to such concentrations. Climatic events have increased significantly over a number of years and there is ample evidence of their impact on the country.



The unrestricted exploitation of quarries which provide mineral materials for the construction industry, mainly destined for Port-au-Prince, represents a threat to the city. Indeed, the activity is practiced mainly in the vast massive mountain range surrounding the capital, exposing some sections of the city to the risk of floods and landslides. With respect to mining, the country has a strong potential that is under-used. The recorded mineral deposits show a considerable quantity of both metal and non-metal ore.

As stated above, available data on mining in Haiti shows its under-exploitation. The ore used in the construction industry is the most widely extracted and most of the quarries are located in the Port-au-Prince metropolitan region.

On the issue of mining legislation, the country's national legislation was enacted in 1976 and reviewed in 1990-1991. It regulates exploitation as well as the conditions on the granting of prospecting, research and concession permits.

The quarries provide raw materials to be transformed for further use; this process however, produces waste. Some are convinced that it contributes to a sand build-up and silting of the coastal and marine zones.

Waste that is discarded in this way is carried along through the drainage canals before being dumped into the sea. This type of pollution destroys the spawning area of certain marine species and prevents the migration of others. Researchers have confirmed that the conch is migrating to less polluted areas. There is fear that the fishing industry in Haiti has been severely affected by this marine pollution and that the coral reefs are equally affected. There is not a lot of qualitative data on this issue although it is strongly suspected that sediment is causing the necrosis of the coral reefs in Haitian waters.

Geological instability resulting from the unregulated exploitation of quarries sometimes can cause landslides and other land movements.

However, human activity is only partially responsible for the destruction of the Haitian environment. Natural phenomena such as earth tremors, cyclones and torrential rains are also contributors, often turning into disasters. Cyclones reaching heights of 12.5, with a strength surpassing those of other developing island-nations, render the population extremely vulnerable and have terrible consequences on human settlements. In Haiti, the geo-morphological and hydro-meteorological threats are those of greatest concern. Each region within the country is somewhat more vulnerable to one form of natural disaster, and also to variable degrees. Therefore, the risk of a natural disaster can be greater or lower, depending on the region.

The environmental problems in Haiti are largely the direct consequence of the poverty that plagues a large percentage of the population. These problems are exacerbated by inefficient public management. An environmental policy that serves the entire country should be linked to a sustainable economic development framework.

Finally, Haiti is facing a set of enormous challenges namely, natural resource and environmental degradation, the erosion of its biodiversity, loss of arable land, uncontrolled building practices and absence of territorial management structures.

Uncontrolled population growth also places considerable pressure on resources: the abusive use and parcelling of land lead to a subsistence-oriented agriculture that cannot meet the basic alimentary needs of the population. Also, the uncontrolled construction activities, weakening slopes and obstructing ravines, consequently increase the vulnerability of the country to natural disasters. These facts show that the rapid degradation of the country is the result of the government's inability to enforce the established standards. Hence, the urgent need, in the absence of an immediate solution to the problem of poverty, is to install fundamental environmental provisions based on the Environmental Action Plan, emphasizing the rehabilitation of ecosystems and safeguard of protected areas, including the promotion of national assets.

# INTRODUCTION

The GEO (*Global Environment Outlook*) is a document which offers a diagnosis on the environment. In the case of Haiti, it was made possible through the synergy resulting from an agreement between the three main stakeholders: the United Nations Environment Programme (UNEP), ensuring its financial support, the Ministry of the Environment of Haiti (MOE) as State representative responsible of the process, and finally Quisqueya University (UniQ), in charge of the technical aspect of the document.

Since 1995, the United Nations Environment Programme has been carrying out integral comprehensive assessments of the environment by applying the GEO methodology. This methodology ensures a planned investigation framework, including expert meetings on various international scientific and social research issues. It is a dynamic, inter-disciplinary and participatory process aiming the evaluation of the status of the environment through the contribution of experts, researchers and resource-persons from all sectors of society. This methodology has become the analytical framework par excellence for evaluating the status of the environment at a global, regional, urban and ecosystem level via topics as varied as health, biodiversity and sustainable development.

The general objectives of the GEO reports are:

- To evaluate the current state of the environment;
- To evaluate the impact of human activities and settlements on the natural environment and the ecosystems;
- To provide governments, researchers and the general public a tool facilitating decision-

making tool on the management of the urban areas and the environment.

- To promote the technical capabilities of local agents in their carrying-out of full environmental assessments;
- To facilitate the formulation of urban planning strategies towards an improved urban environment management;
- To promote the creation of institutional networks;
- To improve the execution mode of the integrative-environmental assessments in order to produce improved tools for wise decision-making;
- To facilitate the establishment of prevention strategies and programmes to improve the quality of life of populations of countries throughout the world.

The analytical framework for the GEO methodology is based on the matrix, Driving Forces, Pressures, State, Impacts and Responses. These components are defined in GEO 4 (UNEP 2007) as follows:

*Driving Forces (D): These refer to the fundamental societal processes which act as motors, with a direct impact on the environment. The main driving forces are: demography, modes of consumption and production, scientific and technological innovations, economic demand, markets and commerce, geographical divisions, institutional and sociopolitical frameworks, and the value systems of mankind.*

*Pressures (P): Human interventions may concentrate on achieving a desired ecological transformation such as land use, or they may result, whether desired or not, from other human activities, such as pollution. The unique characteristics and importance of each*

*pressure vary considerably from one region to another, but they are often the association of pressures which lead to environmental change.*

*State (S): The status of the environment and its flexibility with regard to change varies considerably from one region to another because of its climatic and ecological conditions. The environmental situation also includes gradual evolutions which often refer to ecological changes. These changes may be natural, anthropical or both at the same time. The complexity of the physical, chemical and biological systems which constitute the environment makes it difficult to predict ecological changes, especially when this prediction is subject to several pressures.*

*Impacts (I): The environment is affected, directly or indirectly, by the social and economic sectors, and contributes to the changes (positive or negative) which affect human well-being and our ability to manage climate changes. These impacts, whether they influence human well-being, social and economic sectors or environmental services, are largely dependent on the characteristics of the accelerators. For this reason, impacts vary significantly between developing and developed regions.*

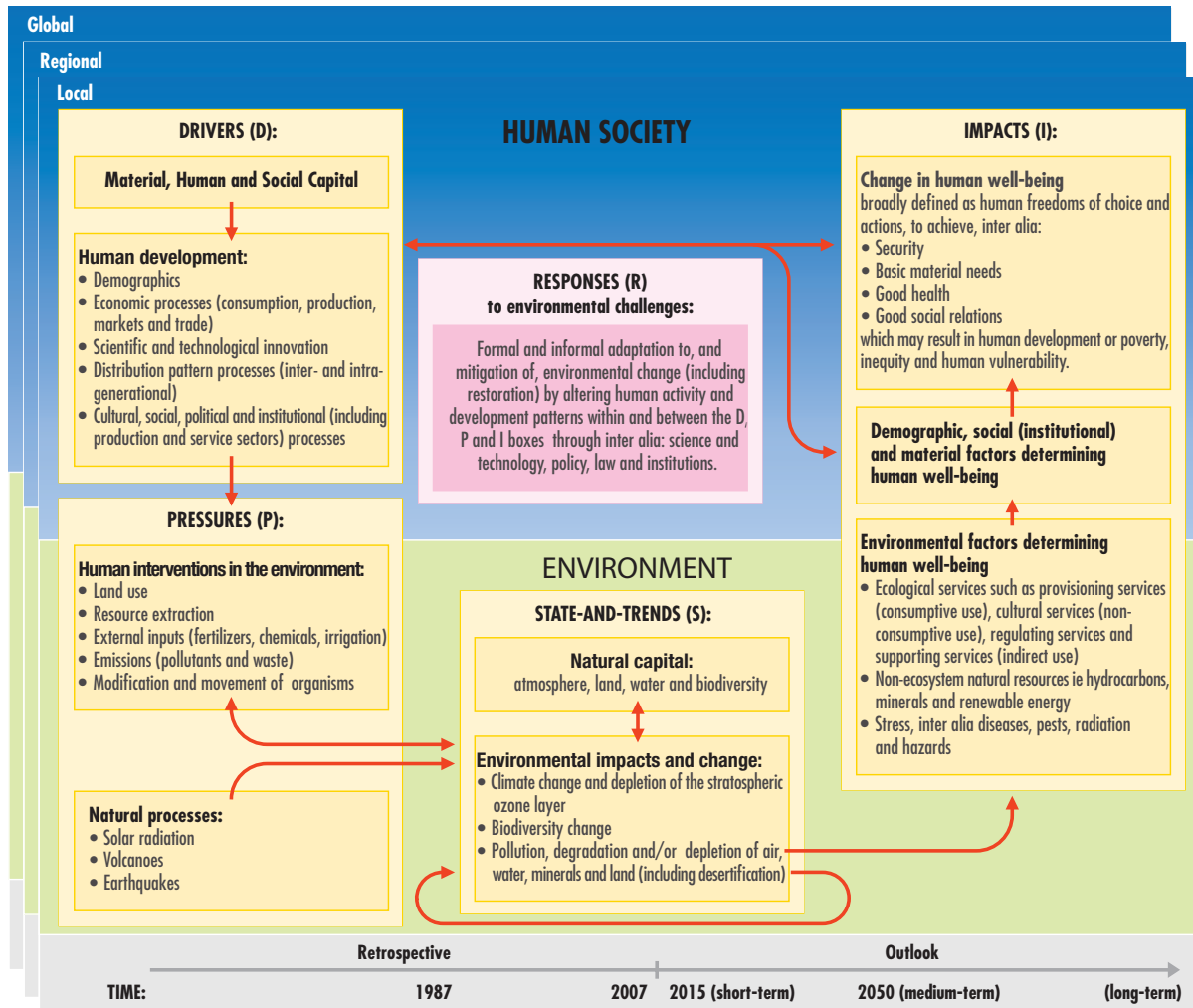
*Responses (R): Responses take place at different levels: for example, environmental laws and institutions at national levels, and multilateral environmental agreements and institutions at regional and global levels. The capacity to mitigate environmental*

*changes and/or adapt to them varies according to and within the regions themselves, and this explains why capacity-development is an essential and major part of the responses. Its function is analysis-integration, in order to better explain the cause-effect relationship and finally offer the best response to the ecological challenges a society is facing.*

*Scenarios: Scenarios are projections in regard to the future, based on the current knowledge of situations and responses given to problems, a coherent and multidimensional overall view that allows decision-makers to anticipate probable situations that are likely to occur in the future and, as such, to avoid negative impacts. The result is a combination of indicators, trends and potential targets with explanatory texts, all of which show the likely progress of events and enable future projections. These scenarios are drawn up under three tendencies: first, the tendency towards inertia; secondly, the optimum or most favorable scenario, and finally the pessimistic scenario, meaning what would happen in the worst case.*

The diagram below shows the relationship between the components of the **DPSIR** (Driving forces, Pressure, State, Impact, Responses) matrix. It should be considered first and foremost as a model for organizing the work and assessment process, and not only as a relationship between the components themselves.

Figure 1: Interaction between the components of the DPSIR matrix (GEO-4 Conceptual Framework)



Source: UNEP, 2007

Throughout the analysis, the GEO reports seek to respond to the following questions:

1. What is the state of the environment and why is it so? (State)
2. Why is this happening? (Driving forces and pressure)
3. What is the impact of this? (Impact)
4. How are we behaving at present on the issue of environment? (Responses)
5. What will happen if no immediate action is taken? (Future outlook)
6. What can we do to reverse the current situation?

The application of the DPSIR matrix, the socio-economic indicators and an assessment of the state of the environment allow us to organize in a logical way the elements that have an impact on the environment, and to better evaluate the behavior of the environment with respect to human activities. They also help foresee the actual trends, those towards improvement or degradation of the quality of the environment and of the life of the population.

The GEO-Haiti report highlights the environmental problems facing the country. It serves as a mirror reflecting the current state of the Haitian environment, the impacts resulting from the problems, the solutions already applied, and the

desired responses that are likely to bring about improved management of the territory and natural resources. This task was carried out with the participation of the institutions involved in environmental management in Haiti.

The report can be broken down into three parts:

1. The first part presents an overview of the historical, geographical and socio-economic situation of the country;
2. The second part focuses on the current state of the Haitian environment. It presents the status of the natural resources in terms of location, exploitation and impact, also outlining the risks of natural disasters and the country's situation in terms of territorial management.
3. The final section deals with policies, scenarios and necessary priority actions for the future.

Finally, the GEO-Haiti document constitutes a reference tool on the environmental situation in

Haiti. It can serve as a guide to decision-makers, notably high-level State officials and Ministers, as well as to local and international organizations that are involved in issues relating to the components of space and the environment in Haiti.

\* Given that the current document was being edited when the earthquake struck on January 12, 2010, it is now clear that GEO Haiti 2010 is a vitally important tool for those involved in the environmental management and sustainable development of the country. At several points throughout the document, Haitian researchers had underscored the risk of an earthquake in the country and most particularly, in Port-au-Prince, while also issuing warnings relating to a possible, very destructive catastrophe. The profound value of the information received from our Haitian colleagues regarding the environmental situation in Haiti and on the risks inherent to certain practices linked to an over-exploitation of the country's resources acquires now its full fundamental dimension.



# OVERVIEW OF THE HISTORICAL, GEOGRAPHICAL AND SOCIO-ECONOMIC SITUATION IN HAITI

## CHAPTER 1







# 1. Geography

## 1.1 Geographical location of the Republic of Haiti

The Republic of Haiti is located in the Northern Hemisphere, more precisely, in the Caribbean Basin between the Caribbean Sea and the Atlantic Ocean. It is situated between 18°0' and 20°6' North latitude and 71°20' and 74°30' West longitude. Known also by the names<sup>12</sup> of Quisqueya and

Bohio, it shares with the Dominican Republic the island of Hispaniola, the second largest island in the Caribbean. Its closest neighbours are the Dominican Republic, Cuba, Jamaica and Puerto Rico (Figure 2).

**Figure 2:** Location of Haiti within the Caribbean



Source: [http://www.maximini.com/fr/haiti/actualite/info-antilles/info\\_antilles.asp?num=15738](http://www.maximini.com/fr/haiti/actualite/info-antilles/info_antilles.asp?num=15738)

## 1.2 Administrative structure

Haiti is divided into ten non-autonomous provinces, i.e., administered by a central power. The capital, Port-au-Prince, is by far the most important city in the country, with about 2 million inhabitants or about a quarter of the population. The other urban centers are Cap-Haïtien to the North, les Cayes in the South, Jacmel in the Southeast and Gonaïves, in the Artibonite province (Figure 3).

The country comprises ten provinces, the most recent of which is Nippes. They are highlighted on the map above, with their main cities as provincial

**Figure 3:** Administrative divisions in the Republic of Haiti



Source: Map from the Office of Geodesy

<sup>12</sup> Magny, 2008

capital. These are the Western Department (main city, Port-au-Prince), the Southeastern Province (main city, Jacmel), the Southern Department (main city, Les Cayes), Nippes (main city, Miragoâne), Grand'Anse (main city, Jérémie), Artibonite Province (main city, Gonaïves), the Central Province (main city, Hinche) and the northern Provinces (North, Northeast and Northwest), with the main cities of Cap-Haïtien, Port de Paix and Fort Liberté, respectively. The country's ten Departments<sup>13</sup> are divided into 42 districts, which are themselves divided into 140 towns that are further divided into 565 communities.

### 1.3 Physiography

#### 1.3.1 Surface area and relief

The territory of Haiti spans 28 704 km<sup>2</sup> which includes a main island (La Grande Terre: 27 750 km<sup>2</sup>) and 5 satellite islands which are La Gonâve (670 km<sup>2</sup>), La Tortue (180 km<sup>2</sup>), L'Île-à-Vache (52 km<sup>2</sup>), Les Cayemites (45 km<sup>2</sup>) and La Navassa (7 km<sup>2</sup>). One of the geographical characteristics of Haiti is its steep topography. Almost 75% of the Haitian landscape is comprised of steep mountain ranges with 50% of its the peaks having slopes above 40% (Figures 3 and 4).

Figure 4: Relief of the Republic of Haiti



Source: (<http://www.quid.fr>, section: monde-Haïti-relief)

The country's main relief is made up of:

- The Northern mountain range with peaks ranging from 1,200 to 1,300 meters;
- The Cahos Hills, the Black Mountains (Montagnes Noires), the Matheux Mountain range, the Trou d'Eau Hills with peaks reaching 1,200 to 1,500 meters located in the central part of the country;
- The La Selle mountain range (Southeast) which extends over 100 km and from which the La Selle peak rises to 2,674 meters, the highest point in the country;
- The La Hotte mountain range, the peaks of which reach 2,347 meters at Morne Macaya (Southwest) (Figure 5).

Moreover, various plains totalizing about 7,000 km<sup>2</sup> occupy nearly a quarter of the country's surface area: the Northern Plain, the Artibonite Plain, the Cul-de-Sac Plain, the Des Cayes Plain, the Léogâne and de l'Arbre Plains. The coastal strip only stretches along 1,500 km.

With a configuration more or less similar to the main island, the satellite islands possess an endogenous potential very important to their development. This is highlighted in the following paragraphs.

#### • La Tortue Island

La Tortue Island is situated in the northern part of Haiti and is close to the city of Port-au-Paix. Separated from the Northern peninsula by a wide channel measuring 16 km, it is 37 km long and 7 km wide, and has a surface area of 180 km<sup>2</sup>. Its population is estimated at 36,000 inhabitants<sup>14</sup>. It has a floral composition characterized by citrus, coconut and avocado trees. The following figure highlights this island.

Embellished by magnificent beaches, such as the one located at the south-western tip of the island, and by historical sites (the La Rochelle Fort built

<sup>13</sup> <http://www.ht.undp.org/public/fichetechniquehaiti.php>

<sup>14</sup> <http://www.campmandingue.com/ile%20de%20la%20tortue.htm>

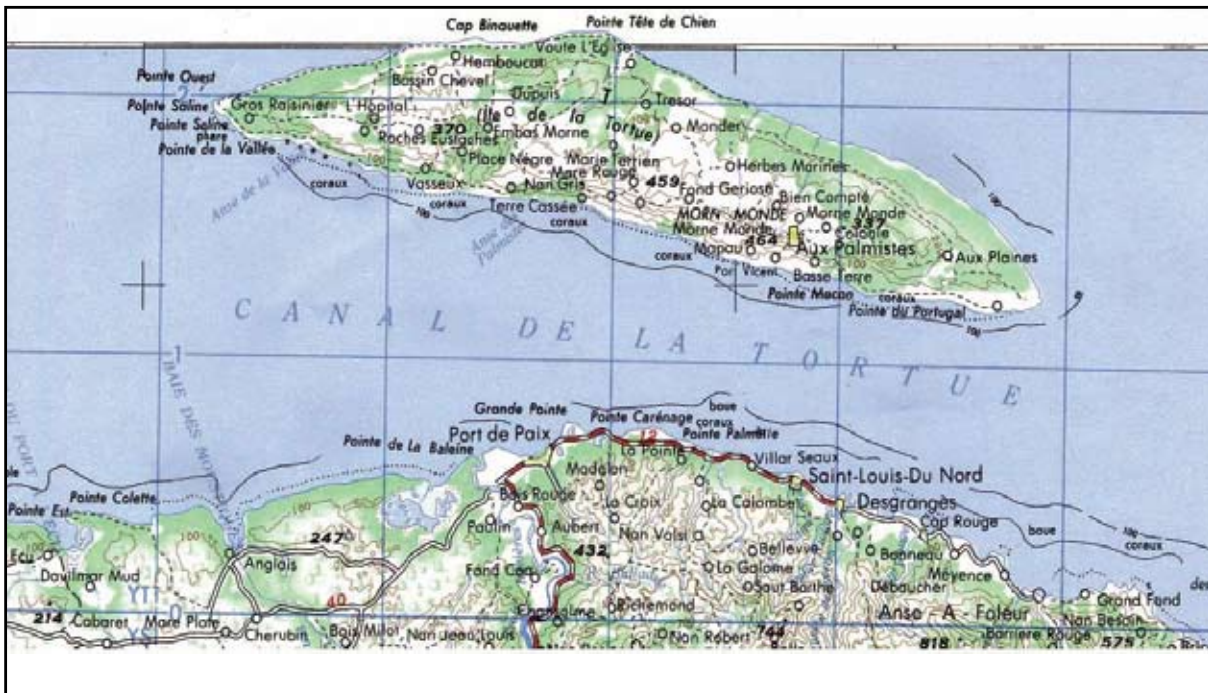
**Figure 5:** Mountainous countryside: La Hotte Mountain Range (Macaya Park, South)



Source: SAH, 2007

in 1639 and the Ogeron Fort in 1666, and also some impressive caves), this small Haitian island possesses considerable attributes that could help it enhance its economic, social and tourism development.

**Figure 6:** La Tortue Island



Source: [www.campmandingue.com](http://www.campmandingue.com)

• **The Cayemites Islands**

Located in the Coral bay, the Cayemites comprise two islands situated at the south of the Gulf of Gonâve, about 35 km to the east of the city of Jérémie, in the Department of Grand’Anse. They cover a total surface area of 45 km<sup>2</sup> and have a population of 18,000 inhabitants. Their magnificent boulder-rock coastline, clear and calm waters and brightly-colored cays create superb landscapes. Many seaside activities are carried out there, such as regattas, which attract many tourists, local as well as from the Haitian diaspora.

• **The Vache Island**

This paradisiacal island (l’île à Vache) is located in the Southern Department, across the city of Les Cayes. It is 16 km long and 8 km wide, and has an average annual temperature of 27 °C (80 °F) and a rainy season similar to the other regions of the country. Its population is estimated at 15,000 inhabitants spread over a 52 km<sup>2</sup>. River navigation is the main mean of transportation, facilitating the commercial and touristic connection between the island and neighbouring regions.

**Figure 7:** Fascinating landscape at Ile-à-Vache

With impeccable seaside infrastructure, as in the case of Port Morgan, Ile-à-Vache possesses a luxuriant vegetation of magnificent mango trees, oleanders and coconut trees, giving it its name that alludes to a cow sleeping in the middle of an untouched landscape. The figure below is a clear example of such a fascinating natural environment.

- **The Gonâve Island**

This island is situated in the Western Department and faces the city of Port-au-Prince. It has a surface area of 670 km<sup>2</sup> and is the largest of the satellite islands with a length of 60 km and a width of 15 km. It has a rainfall pattern ranging from 800 to 1,600 mm and a geological substratum dominated by limestone. Its population is estimated at 100,000 inhabitants. Many investors, such as the *Gonâve Economic Development Group*, are interested in making tourism the development vector there, as well as developing other essential sectors such as agriculture, large-scale fishing and the necessary infrastructure to high-speed transportation.

- **The Navase Island**

Navassa Island is located in the Caribbean Sea, some 60 km to the west of Cape Des Irois, at the western tip of Hispaniola and 40 km south-west of Jérémie. With a surface area of only 7 km<sup>2</sup>, it

is regularly under threat of being annexed by the United States because of the richness of its biodiversity and the quality of the manure generated from the bird droppings (guano).

### 1.3.2 Geology and Soils

The soil in Haiti is very diverse as a result of the geomorphology of the vast differences in the quantity of rainfall. The geological substratum comprises mainly limestone, basaltic and sedimentary rocks, giving rise to five categories of sedimentary rocks. These are ultrabasic soils containing heavy metals, magmatic extrusive and intrusive soils, soils on limestone rocks as well as sedimentary and alluvium soils (HILAIRE, 2008).

Produced by sedimentary rocks, limestone soil is predominant throughout the country and occupies more than 80% of its territory (INESA, 2008 in Woodring et al.1924). It is constituted mostly of hard limestone likely to yield litho soils that do not retain water well. The softer limestone rock with gentler slopes are usually made up of rendzina and «tè tif», which are grey or white tufas made up of relatively thin soil (10-40 cm deep) that is often pebbly and dry.

On the average-size or gentle slopes, there is generally brown soil over limestone and calcic, melanized soils over basalt. These soils are rich in organic matter and without any serious deficiencies.

With respect to basalt, this is found on the gentle and average-size slopes and produce calcic, melanized soils or brown, clayey soils. The basaltic soils are very vulnerable to erosion but their depth and fertility are quite considerable.

### 1.3.3 Climate

Situated at 19° North latitude, the country enjoys a tropical climate with an average annual temperature of 25° Celsius. However, its hilly terrain produces microclimates with instances where the temperature at high altitudes can drop to 15° Celsius.

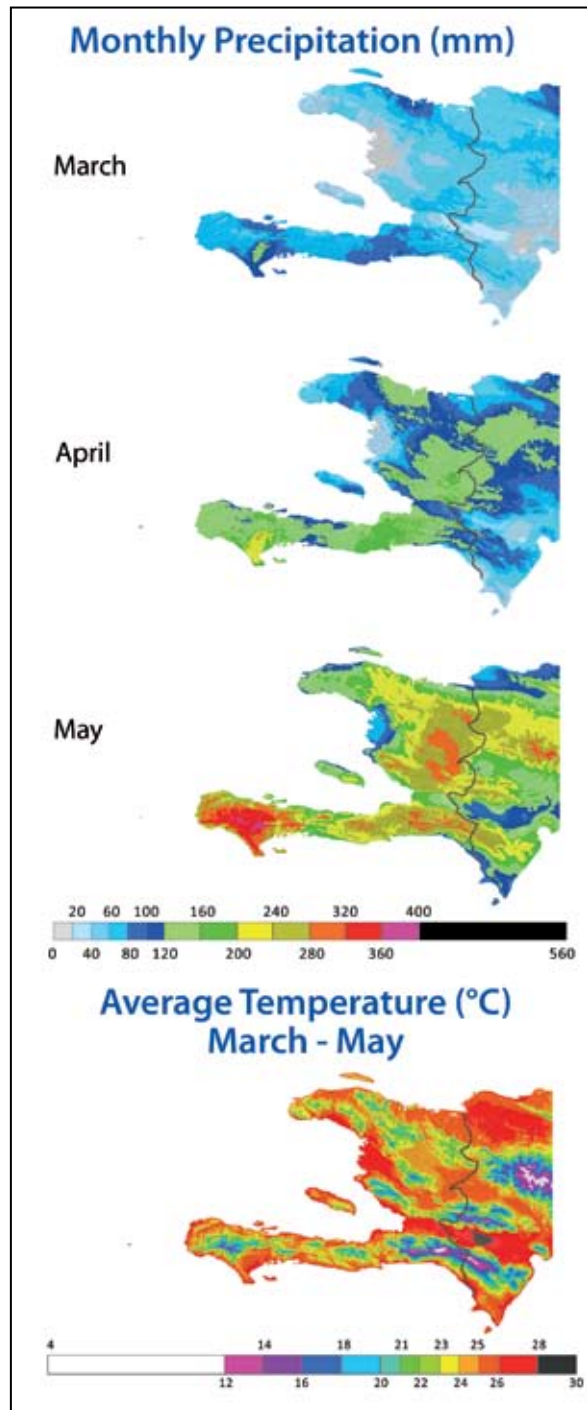
The country receives annually a volume of 40 billion m<sup>3</sup> of water, of which 60% of it returns into the water cycle through evaporation (GEORGES, 2008). In spite of an average annual rainfall of nearly 1,400 mm, the pluviometry however presents high variations to the extent that some regions receive amounts exceeding 4,000 mm while others only 350 mm over the same period.

Rainfall also shows a defined temporal variation as a result of trade winds, northern, eastern and local winds which are often blowing in opposite directions. The resulting rainfall pattern, very unequal from the seasonal point of view, has divided the year into two rainy seasons and two dry seasons. The first ones run from March to May and from August to October, while the others run from November to February and from June to July.

The following figures 8-11 provide interesting information on rainfall and monthly temperature at national scale. Figure 8 shows that at the beginning of the rainy season (April-May), the heaviest rainfall affects the entire country (60 mm and 400 mm), especially in the south, followed by the central region receiving between 200 mm and 400 mm of water in the month of May. The Artibonite region receives the least amount of rainfall, more precisely, the plains of Gonaïves (between 0 to 20 mm of water). However, the average monthly temperatures between March and May vary according to region and altitude, between 12 °C and 28 °C. Average temperatures between 25 °C and 28 °C are recorded in the coastal regions, the Gonaïves plain and in the west. The lowest average temperatures, between 12 °C and 20 °C, are recorded in the mountainous regions, the Massif de la Hotte, the Massif de Selle, the Matheux Mountain range and Morne Bonhomme.

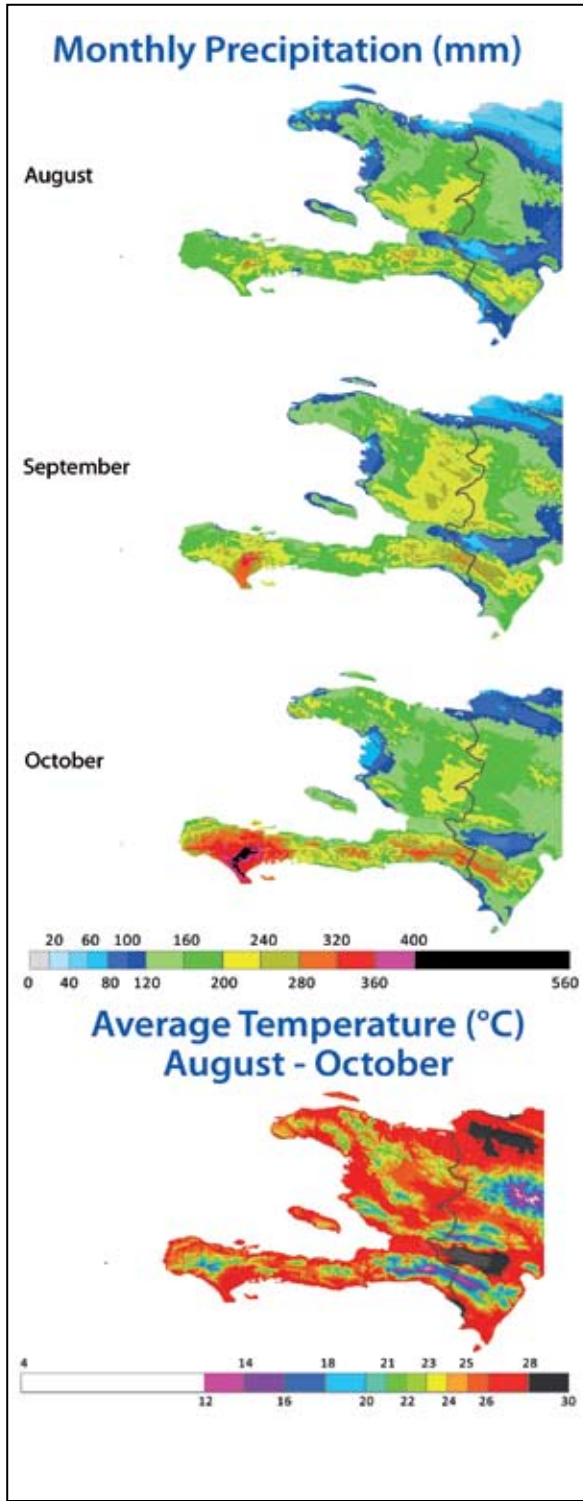
During the rainy season which runs from August to October, rainfall is more abundant than in the March to May period. In fact, there is between 120 mm and 400 mm of rainfall in October. In the

Figure 8: Average monthly rainfall and temperature from March to May



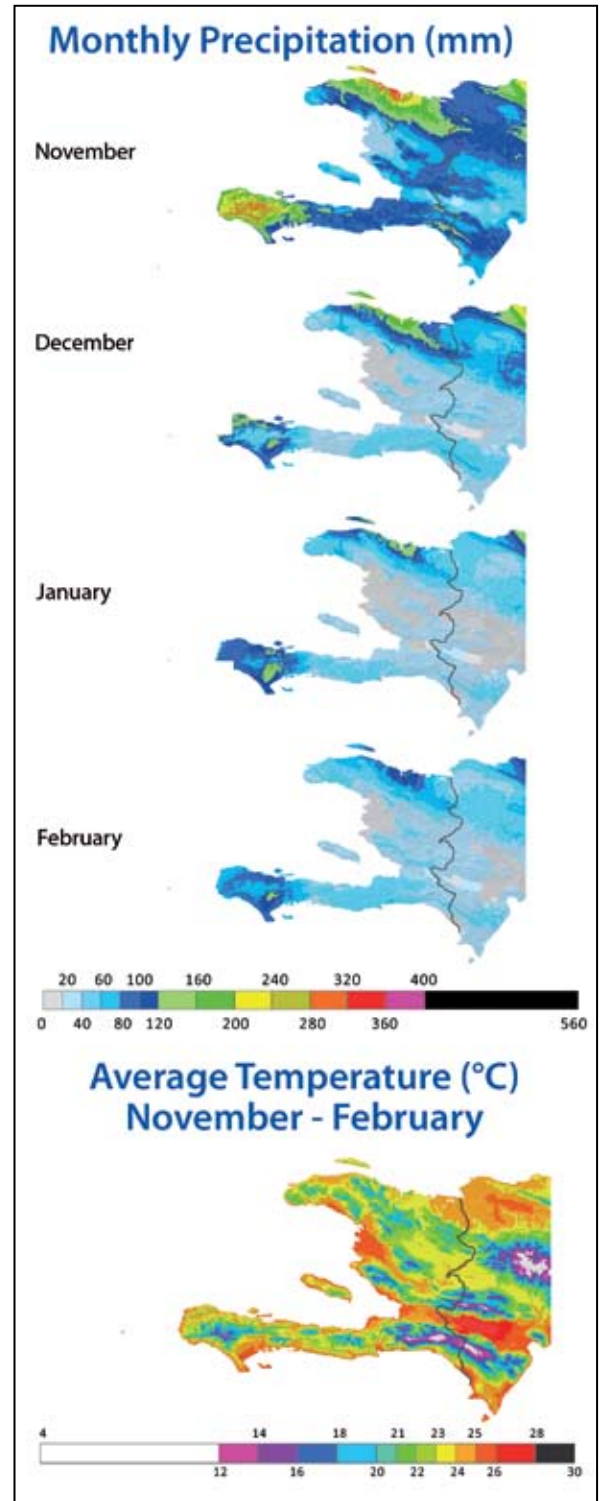
Source: Wordclim, 1961-1990)

**Figure 9:** Average monthly rainfall and temperature from August to October



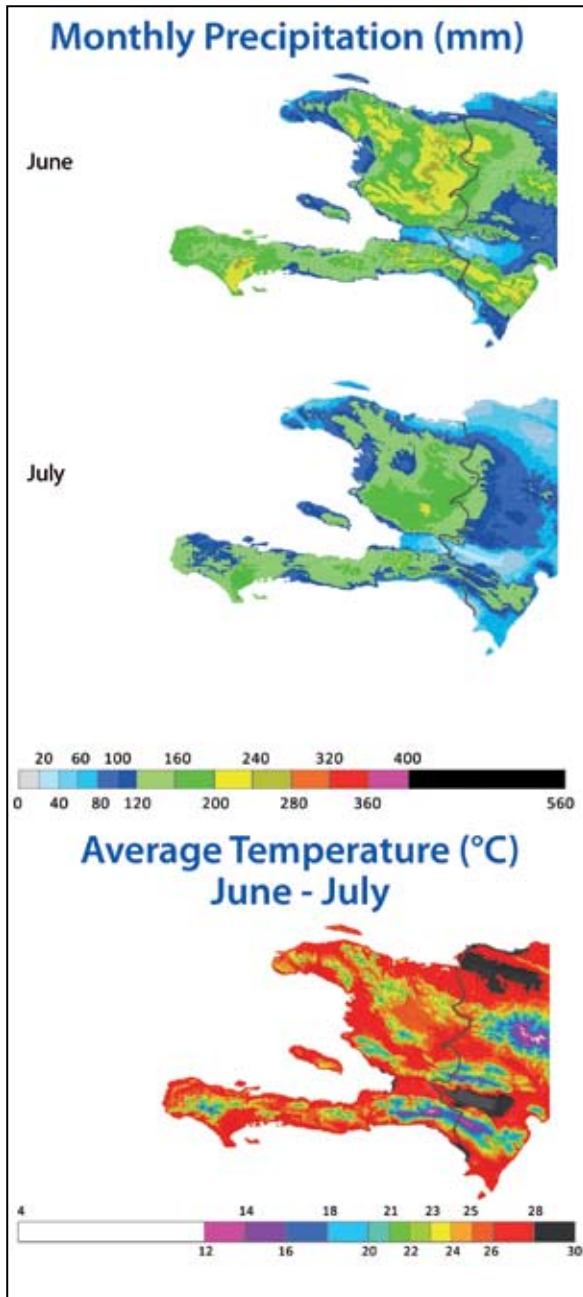
Source: Prepared by CATHALAC with data from Wordclim (1961-1990).

**Figure 10:** Average monthly rainfall and temperature from November to February



Source: Prepared by CATHALAC with data from Wordclim (1961-1990).

**Figure 11:** Average monthly rainfall and temperature from June to July



Source: Prepared by CATHALAC with data from Wordclim (1961-1990).

South and Southeast departments, rainfall can exceed 400 mm of water (Figure 9). The average monthly temperatures recorded for the period remain high throughout the country (between 25 °C and 28 °C) and milder temperatures (between 12 °C and 22 °C) are found only in the higher regions, as in the case of the Massif de la Hotte, Massif de la Selle, Matheux Mountain Range and the Massif du Nord.

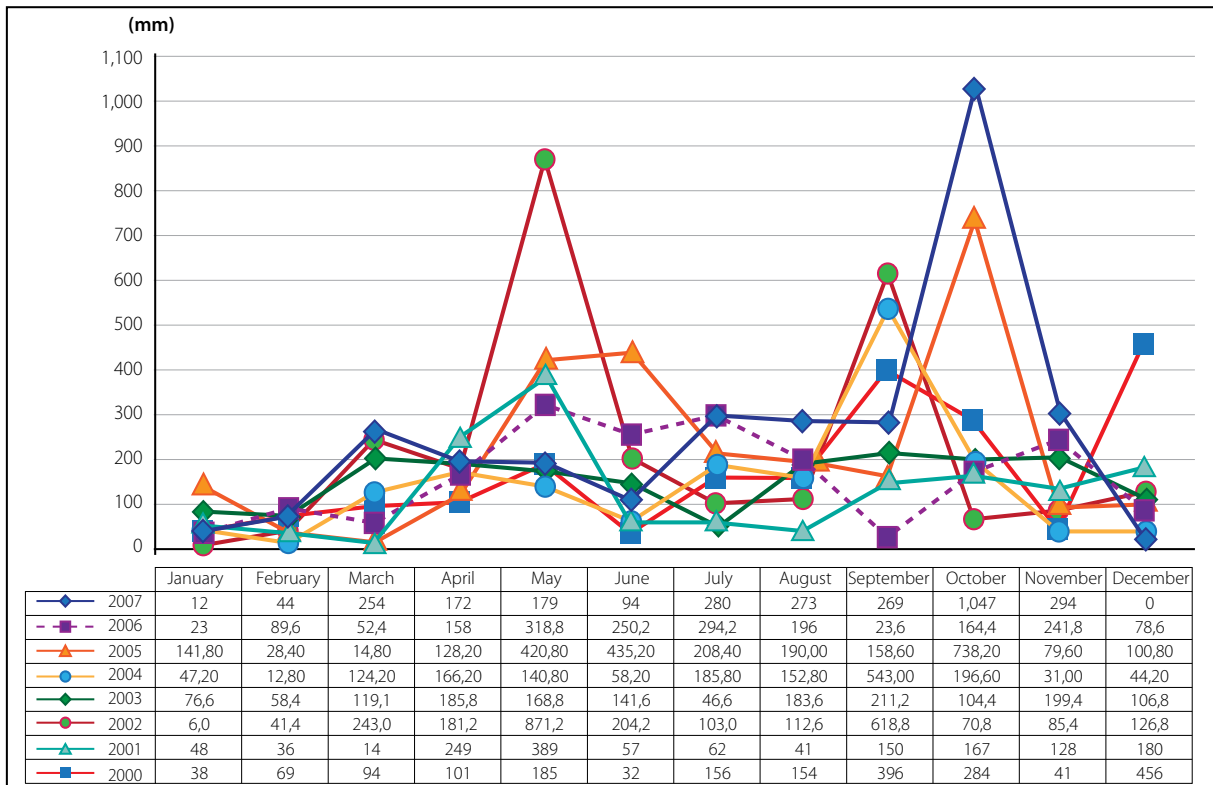
December, January and February are the driest months (Figure 10). In spite of this, rainfall still occurs mainly in the Southern, Northwestern and Northern departments including that of Grand’Anse. During this period, the entire country experiences the lowest average annual temperatures (22 °C and 26 °C). In November, rainfall remains at between 120 mm and 280 mm of water in the North, at Grande Anse and in the South. In February, the driest month of the year, rainfall in rainy regions is between 0 and 160 mm of water.

Temperatures for the period August to October are similar to those of June to July (Figure 11). However, variations have been observed in the rainfall pattern: rainfall is between 20 mm and 120 mm in the coastal regions (Northwest, North and Grand’Anse) while in the rest of the country it varies between 120 and 240 mm.

The dry and rainy seasons are significantly distinct, as in the case of Camp Perrin in the southern part of the country (Figure 12). During the same rainy and dry seasons, the other regions of Haiti experience a situation similar<sup>15</sup> to that of the Cap-Perrin zone, particularly in the Cul-de-Sac plain, which is located to the north of Port-au-Prince.

<sup>15</sup> Georges. 2008. Contribution à l'évaluation de l'érosion dans le BV de la rivière Grise, Plaine Cul-de-Sac

Figure 12: Annual rainfall variation at Camp Perrin from 2000-2007



Source: Organization for the Rehabilitation of the Environment (ORE<sup>16</sup>), 2007

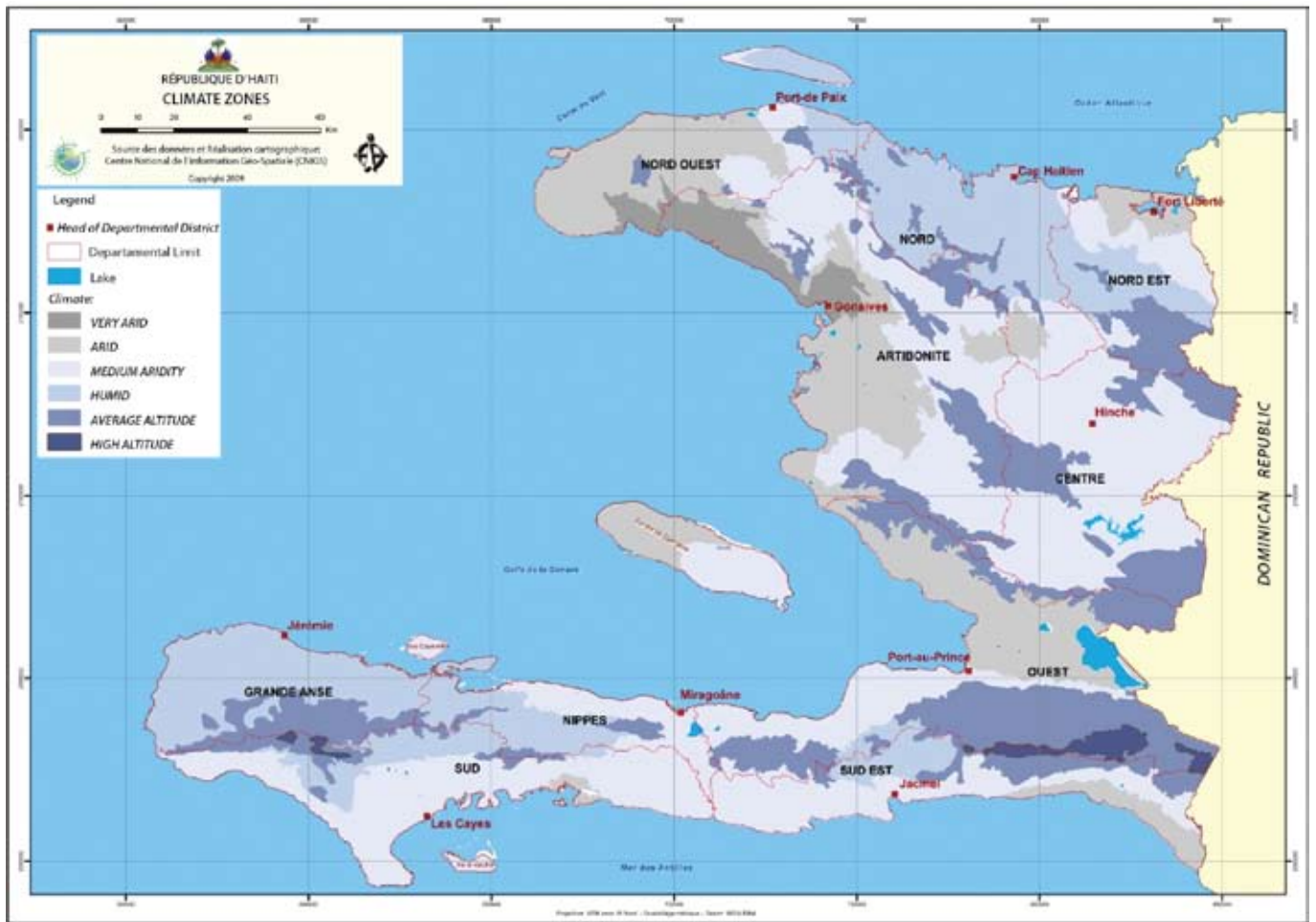
Figure 13 highlights the different climate zones within the country. The wet zones are located in the South, North and Southeast of Haiti, while the other regions possess arid and semi-arid climates, as in the case of Artibonite. Nevertheless,

the altitudinal gradient is very favorable to the presence of a humid climate throughout the year. This is the case of the Massif de La Hotte in the southern region and the Massif La Selle (Southeast and West).

<sup>16</sup> [http://www.oreworld.org/images/r\\_1993-2007/1993-2007%20mm.pdf](http://www.oreworld.org/images/r_1993-2007/1993-2007%20mm.pdf)



Figure 13: Different climate zones



Source: CNIGS, 2009

### 1.3.4 Hydrography

Given the limited size of its territory, Haiti does not possess vast river systems. The country’s main river, the Artibonite, originates in the Dominican Republic and the three-quarters of its course meanders through the department of the same name in Haiti. The Artibonite River is very irregular and seasonal, and is the largest water course in the Caribbean Basin.

The water courses in the country are subjected to significant seasonal variations. Among those which have a large drainage area are the Artibonite (6 800 km<sup>2</sup> and a maximal daily flow of 2500 m<sup>3</sup>/s), Trois Rivières (900 km<sup>2</sup> with a maximal

daily flow of 1500 m<sup>3</sup>/s), Estère (156 km<sup>2</sup> with a maximal daily flow of 95 m<sup>3</sup>/s), Grande Rivière du Nord (528 km<sup>2</sup> with a maximal daily flow of 390 m<sup>3</sup>/s), Grand’Anse (435 km<sup>2</sup> with a maximal daily flow of 850 m<sup>3</sup>/s), de Cavaillon (386 km<sup>2</sup> with a maximum estimated daily flow of 1035 m<sup>3</sup>/s), de Limbé (303 km<sup>2</sup> maximal daily flow of 485 m<sup>3</sup>/s), the Acul du Sud (183 km<sup>2</sup>), Ravine du Sud (86 km<sup>2</sup>, maximal daily flow of 350 m<sup>3</sup>/s) and Momance (330 km<sup>2</sup> and a maximal daily flow of 420 m<sup>3</sup>/s) (US SOUTHERN COMMAND, 1999). Figure 14 below highlights the hydrographical network of the country.

Figure 14: Map of the hydrographic network of Haiti

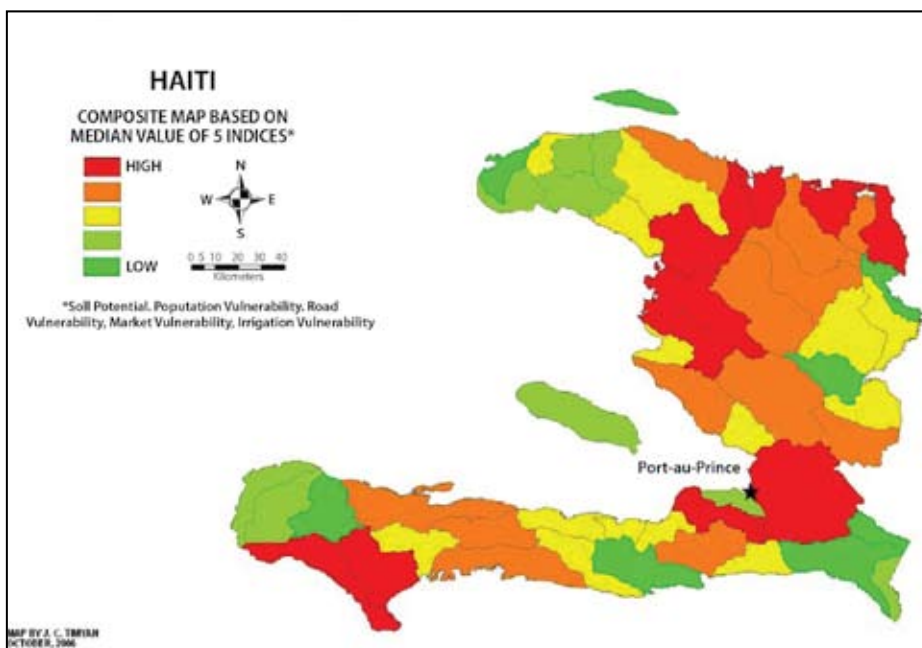


Source: CNIGS, 2009

Most rivers are facing enormous problems of soil degradation, especially upstream, including the degradation of their river banks and excessive sedimentation. Communities living alongside their banks are much more vulnerable to the risk of floods. The situation is similar with respect to the watersheds from which the rivers flow. According

to a study carried out in 2006 by USAID, around 54 watersheds have been categorized as priority watersheds mainly because of their relative fragility. They are moreover considered a priority as they mitigate the risk of natural disasters and contribute to the promotion of economic growth.

Figure 15: Priority watersheds for the mitigation of vulnerability



Source: (USAID, 2006)

The Port-au-Prince region with its large Grise River watershed has been given high priority, followed by the watersheds of the cities of Les Cayes, Gonaïves-La Quinte, Trou du Nord, Jassa and Cap-Haïtien. These would be followed by the regions of Grand'Anse and by the large rivers at Jacmel and Fonds Verrettes with their high-mountain watersheds and significant biological diversity. The figure above shows the watersheds given priority.

### 1.3.5 Vegetation

The plant cover in Haiti is made of savannahs, open forests<sup>17</sup> and vestiges of closed forests<sup>18</sup>, these latter made of conifers and broad-leaved trees. The plant cover was formerly dense but has suffered over time from the indiscriminate use of its resources, starting as early as the beginning of the XIX century in order to allow Haiti to pay the fee imposed by France in recognition of its independence. The country had to sell huge quantities of wood, especially mahogany, to pay this debt. The cutting-down of trees has continued and today, nearly 80% of the population uses wood as a source of energy<sup>19</sup>.

Forest vegetation includes mahogany (*Swietenia mahagoni*), guaiac (*Guaiacum sp*), cedar (*Cedrela odorata*), yellow wood (*Chlorophora tinctoria*), logwood (*Haematoxylon campechianum*), tavernon (*Lysiloma sabicu*), oak (*Catalpa longissima*) and ash (*Simaruba glauca*) (FAO, 1980). The undergrowth contains mainly cacti and grass, which is the type of vegetation most widespread in Haiti (TIMYAN, 1996). Mangroves are important in coastal zones and mainly divided into four species (See Section 3, Chapter 2).

Conifers, found mainly at high altitudes, are primarily made of pines, *Pinus occidentalis*, an endemic type to the island. These pine forests represent the country's main open forests which are located at high altitude in the South, Central

and Northeastern provinces (See Section 3; Chapter 2).

## 2. Demography: rapid growth

Demographic explosion is the major phenomenon impacting the general economic and normative structure of the country. According to Louis-Naud Pierre (2008), "a demographic explosion, coupled with the Haitian open economy, produces the dismantling of a rural system previously centered around land and agricultural activities and enterprises, and leads eventually to poverty".

### 2.1. Demographic growth

A demographic explosion has occurred in Haiti over the past decades. In 1804, the year of its independence, its population was estimated at 5,000 inhabitants. One hundred and fifty years later, it had grown to 3,221,000. However, between 1950 and 2005, less than 50 years later, the population has almost tripled. The accelerated demographic growth over this period is mainly due to the improved living conditions in Haiti. The following table illustrates the situation (IHSI, 2008).

**Table 1: Demographic growth in Haiti between 1804 and 2005**

Year	Population
1804	5,000
1950	3,221,000
2005	9,293,000

Source: IHSI, 2008.

Nevertheless, between 2000 and 2008 and according to a report published in the January 2008 issue of CIA World Factbook, the Haitian population was still growing at a considerable rate. See table below.

<sup>17</sup> Open forest: formation in which trees are present in a discontinuous manner, with a minimum cover of 10% and 40% maximum [Source: U.S. Geological Survey, Earth Resources Observation Systems (EROS) Data Center, 2002.]

<sup>18</sup> Closed forest: formation in which trees of varying heights and undergrowth cover more than 40% of the terrain, with no continuous herbaceous stratum [Source: U.S. Geological Survey, Earth Resources Observation Systems (EROS) Data Center, 2002.]

<sup>19</sup> www.in-terre-actif.com

**Table 2: Population growth rate between 2000 and 2008**

Year	(% Growth rate)	Population
2000	1.39	6,867,995
2001	1.40	6,964,549
2002	1.42	7,063,722
2003	1.67	7,527,817
2004	1.71	7,656,166
2005	2.26	8,121,622
2006	2.30	8,308,504
2007	2.45	8,706,497
2008	2.49	8,924,553

Source: CIA World Factbook, 2008

It should be noted that the growth rate of the Haitian population, very high in the large urban centers, has had a significant impact on its density, which also continues to increase. This density, estimated at 307 inhabitants/km<sup>2</sup> in 2003, rose to 321.6 inhabitants/km<sup>2</sup> in 2006. The table below shows the population growth, estimated at 1.39% (6,867,995 inhabitants) in 2000 and at 2.5% in 2008 (8,924,553 inhabitants).

## 2.2. Cities with the Largest Populations

Haiti is the most populated country of the Caribbean region. Among highly-populated cities, we find, in the Western province: Port-au-Prince, Carrefour, Delmas and Petionville; in the Northern Province, Cap-Haïtien; in the Artibonite, the cities

of Gonaïves and Saint-Marc, and finally in the Southern province, the city of Des Cayes.

**Table 3: Cities in Haiti with largest populations**

Cities	Population	Year
P-A-P	900,000	2003
Carrefour	290,000	2003
Delmas	240,000	2003
Cap Haïtien	105,000	2003
Metropolitan Region	+ 2,000,000	2009

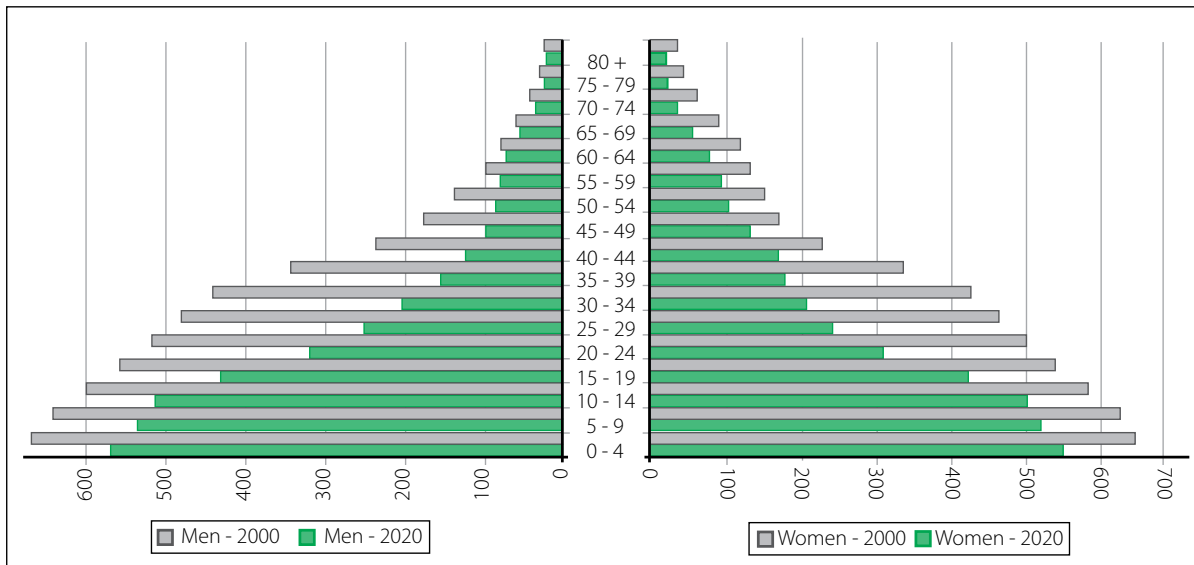
Source: World Fact Book 2002 (Octobre 2002)

## 2.3 Structure of the Haitian population

### 2.3.1. Age Distribution

The Haitian population includes a high proportion of young people. More than half of the population is under 20 years of age (USAID, 2007), 36.5% of the population is under 15 years of age and 58.3% of the population is between 15 and 64. People aged 65 and older represent only 5.1% of the population. There are slightly more women than men, women representing (51%) of the population (IHSI, 2003). Previous studies (USAID, 2007 in ORC Macro, 2000) show that Haitians are usually sexually active during adolescence, which sets the stage for a more rapid increase of the population. In fact, 31.3% of women aged 20 to 24 years have procreated before the age of 20. An analysis of the following figure shows that the increase of male population is slightly different from that of women.

**Figure 16:** Population and projection by age and sex in 2020 (in thousands)



Source: USAID, 2007

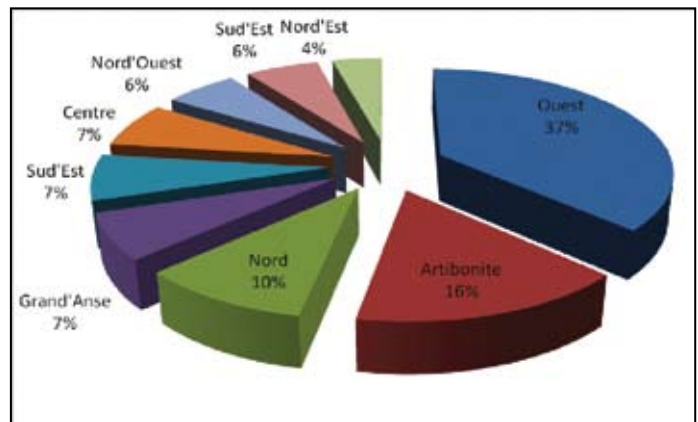
The population, which is mostly comprised of young people, could be a positive factor for the future of the country. However, uncontrolled growth population is a matter of concern as only half of the 54.4% active population is gainfully employed (IHSI, 2005).

### 2.3.2. Space Distribution

Approximately 2/3 of the population (63%) live in three (3) of the ten geographical regions of the country, distributed as follows: 37% in the Western region (the capital and its suburbs (home to more than 2 million inhabitants), 16% in the Artibonite, and 10% in the North. It should be noted that more than half of the population lives in the first two regions (Figure 17).

According to official figures from the last National General Population and Housing Census carried out by the institution responsible of Censuses in Haiti in 2003, the country had 8,375,750 inhabitants (IHSI, 2005). Projections made by the same institution in 2008 estimated that the population of Haiti would reach 11 million in 2015 and 16.1 million in 2050 (IHSI, 2008).

**Figure 17:** Distribution of the Haitian population by province



Source: IHSI, 2003

The 2.5% annual population growth-rate is alarming and is estimated to continue over the coming years. This increase can be explained by a lack of public education on birth-control as well as of access to contraception and family planning for the population of reproductive age. The Ministry of Public Health and Population estimates that around 40% of the population of reproductive age has access to contraception while only 22.8% of married women use modern family planning

methods (MSPP, 2000), leading to an average fertility-rate of 4.9 children per woman (USAID, 2007).

This alarming population increase is more evident in the larger urban centers which also receive in-coming migrants from rural areas and those migrating from one urban area to another. In the second case, the metropolitan area of Port-au-Prince is the undisputed Western region's attraction point, with 95% of the country's inter-city migration. With respect to the city of Cap Haitian,

it not only represents the second largest urban center in the country, but is also the main focal point of the wider northern region of Haiti. The situation is quite similar in regard to the city of Les Cayes, the third largest city and home to nearly 70% of the Southern region internal migrants. The cities of Gonaives (4<sup>th</sup> largest) and St. Mark (in the South) are the two main centers of economic growth in the Artibonite, largely receiving most of its regional migrants. The following table lists the major urban centers in Haiti.

**Table 4: Large urban centers in Haiti and capital cities**

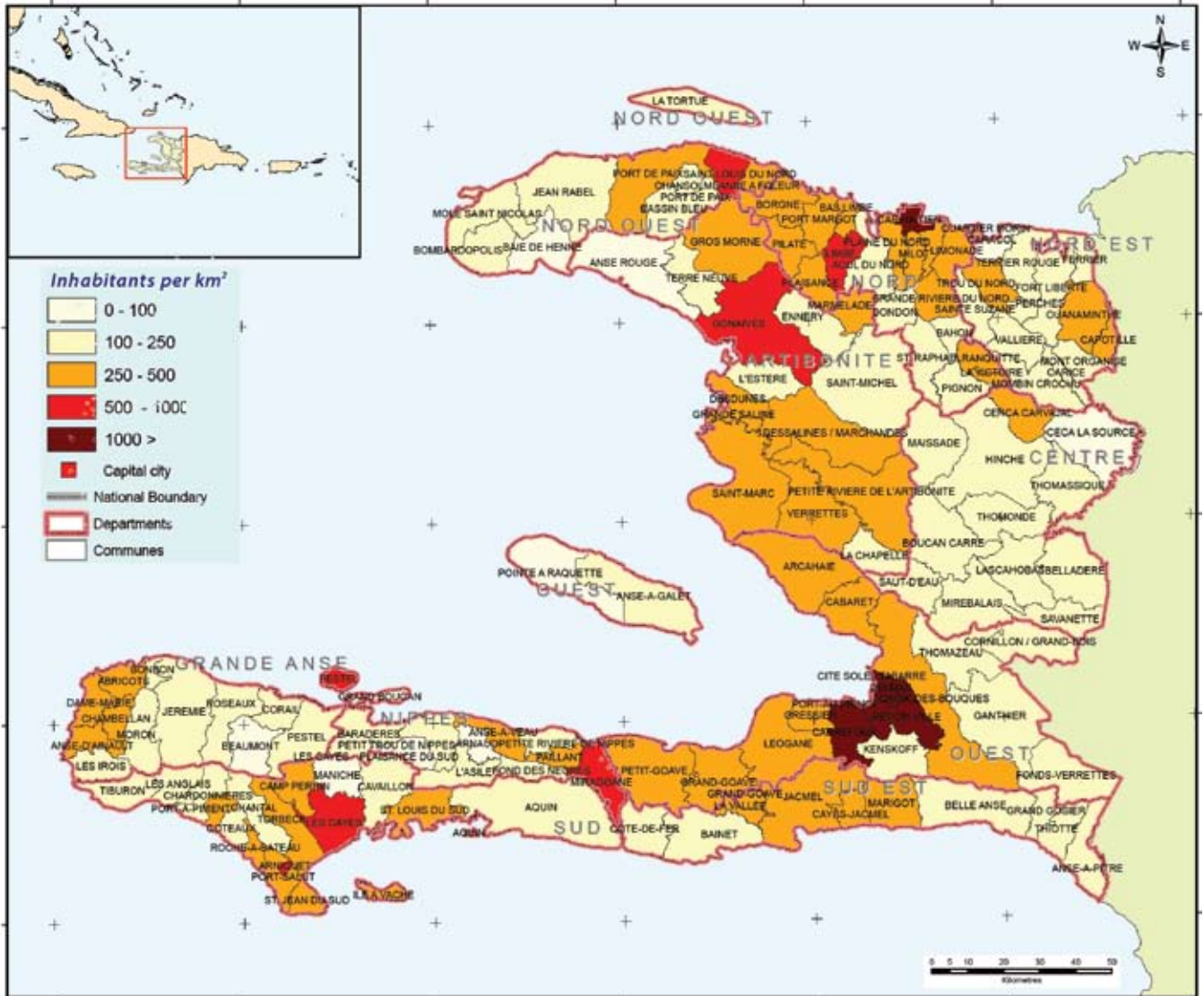
Large Urban Centres	Department	Number of immigrants moving to the capital cities of the Departments
Port-au-Prince Metropolitan Area	Capital of the Western Department	Petit Goâve (24,114), Léogâne (22,771), Arcahaie (14,186), Anse-à-Galet (12,431), Cabaret (8,575), Ganthier (6,637), Grand-Goâve (6,213), Gressier (2,999), Fonds-Verrettes (2,251), Pointe à Raquette (1,049), Cornillon (437).
Cap-Haïtien	Capital of the Northern Department	Port-Margot (1,880), Plaine du Nord (1,650), Limbé (1,512), Borgne (1,375), Dondon (1,316), Limonade (1,311), Grande Rivière du Nord (1,170), Milot (1,167), Acul du Nord (1,109), St Raphael (808), Pilate (756), Plaisance (608), Quartier Morin (496), Pignon (308), Bas Limbé (295), Ranquitte (227), La Victoire (62).
Cayes	Capital of the Southern Department	Torbeck (647), Charbonnières(310), Chantal (235), Tiburon (217), Saint Jean du Sud (215), Coteaux(188), les Anglais (172), Camp Perrin (173), Arniquet (122), Port Salut (118), Port-a-Piment (106), Saint Louis du Sud (99), Roche-à-Bateau (98), Cavaillon(73), Aquin(52)
Gonaïves	Capital of Artibonite	Gros morne (942), Terre Neuve (898), Anse Rouge (749), Desdunes (516), Dessalines (321), Estere (286), St Michel de l'Attalaye (277), Ennery (248), Grande Saline (118), St Marc (167), Marmelade(142), Petite Rivière de l'Artibonite (59), Verrettes (50)

Source: UNFPA, 2006

With an average population density of 302 inhab./km<sup>2</sup>, Haiti has one of the highest densities in the region. This leads to a large number of people living in congested slums, including those of La Saline in Port-au-Prince, of Raboteau in Gonaives and of La Faucette in Cap-Haitien. This

promotes a high demographic urban population rate, estimated at 3.63% compared to the very low rate of the rural population growth (0.92%). The figure below shows the population density per square kilometer and by municipality.

Figure 18: Population density by municipality

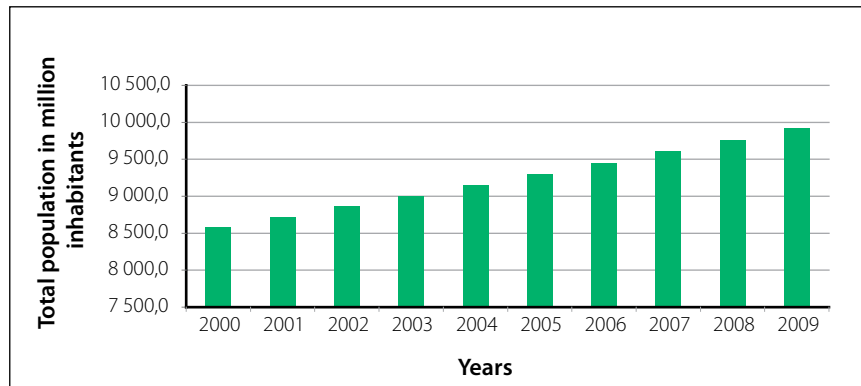


Source: Map Action et DPC, 2008

The country's capital, Port-au-Prince, which includes seven municipalities, is home to more than 25% of the population of Haiti, representing 62% of all urban populations (USAID, 2007). This increase in urban population has been

accompanied, these last twenty years, by an accelerated anarchic urbanization process and a reduced availability and access to basic services, such as water, education, sanitation, etc. (See Sections 1 and 8, Chapter 2).

**Figure 19:** Total population growth

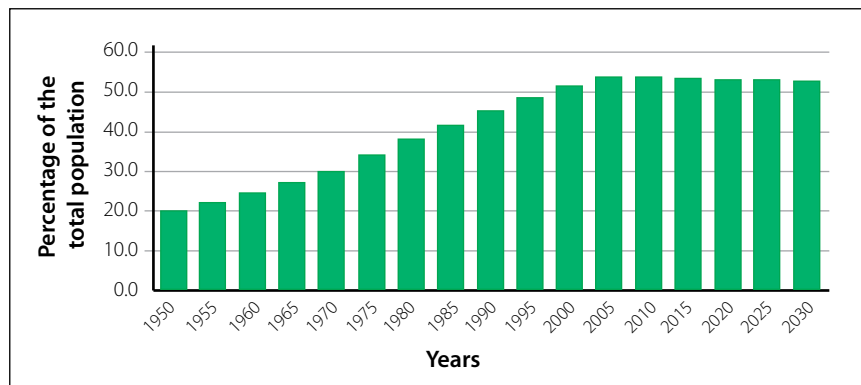


Source: [http://websie.eclac.cl/anoario\\_estadistico/anoario\\_2008/esp/index.asp](http://websie.eclac.cl/anoario_estadistico/anoario_2008/esp/index.asp)

There was little change in the total population between 2000 and 2006 (Figure 19), however a significant increase could be possible between 2014 and 2050 (Figure 91). The urban population

has steadily continued to grow since 1950. More than half of the total population will be concentrated in cities between 2005 and 2030 (Figure 20).

**Figure 20:** Percentage of the urban population of Haiti



Source: [http://websie.eclac.cl/anoario\\_estadistico/anoario\\_2008/esp/index.asp](http://websie.eclac.cl/anoario_estadistico/anoario_2008/esp/index.asp)

### 3. Historical Highlights of the Haitian Nation

The name “Ayiti” comes from the language of the Amerindian-Caribbean Tainos, and means “the land of high mountains” or “the mountain in the sea”. Peaceful people, the Tainos dedicated themselves to agriculture, fishing and hunting at the time of the arrival of Christopher Columbus in the New World in 1492. The Spaniards called the island Hispaniola.

Attracted by the abundant gold in the riverbeds, the Europeans subjugated the natives, forcing them to work and extract this mineral. The

newcomers also were introduced to products unknown to them, such as sweet potatoes, cocoa, maize and tobacco (MERCIER, 1949). Gradually, the Europeans colonized the island, intensifying agriculture, particularly of sugarcane. The number of autochthones, estimated at one million at the arrival of the Spaniards in 1492, had fallen to 60,000 fifteen years later, in 1508, and then to 15,000 in 1514. The regime of extenuating hard labour and of abuse, and also the diseases brought back from Europe by the Europeans were the main causes of the situation, not to mention the acts of collective suicide, often the only way for the natives to escape their misery.



Later on, French and English pirates who attacked and looted the cargo ships en route to Spain, subsequently settled in the island of La Tortue (to the north), but the depletion of gold deposits on the island and the discovery of larger deposits in Mexico, and also the continuing conflicts with France, led Spain to cede the western third part of the island to France in 1697 by way of the Treaty of Rijswijk. This was the beginning of the colony of Santo Domingo.

As a result of the shortage of labor on the plantations, the French settlers brought back Africans from the West African coast. Captured, chained in slave ships (ships engaged in the slave trade) they were transported by force to America and used as slaves on coffee, cotton, cocoa, sisal, indigo and sugarcane plantations. The slave trade continued until the end of the 17<sup>th</sup> century.

Once harvested, the largest share of the production was then transported by ship and sold in France, after which the ships continued on to the coast of Africa to embark more slaves bound for Santo Domingo. This system was known as the “triangular trade”. Many slaves did not survive long under these conditions, forcing the settlers to continually replace them. The slave market was, unfortunately, extremely prosperous.

Saint-Domingue was the most prosperous of all American colonies, even worldwide. One third of the French foreign-trade revenue came from Saint-Domingue (WARGNY, 2004) and many French, even among the nobility, depended directly or indirectly on the colony. The luxurious wealth of Paris and the elegant French palaces, all which made France one of the finest countries, and Paris the capital of the world, were largely paid for by the industries of Saint-Domingue (MERCIER, 1949). For its part, the town of Cap-Français (now Cap-Haïtien) was the center of French culture and knowledge in the Americas.

A generalized slave rebellion began in 1791. The French commissioners then, given the fact that the colony was in turmoil, were left with no other choice in order to stabilize the situation, but to proclaim the general freedom of the slaves. The decision was ratified in the first instance by the National Convention in 1793 and revised shortly thereafter.

This revolutionary movement began under the leadership of Toussaint Louverture, then a general in the French army. Faced with more and more persistent rumors concerning the restoration of slavery, he assembled a Constituent Assembly and had the Constitution ratified in 1801. This act was considered an impertinence by Bonaparte, who sent an expedition commanded by General Leclerc who had Toussaint Louverture arrested and deported to France in 1802. Louverture finally died in prison. Then Jean-Jacques Dessalines, supported by other local generals, took command of the rebellion and led it to victory. Nearly 100,000 slaves lost their lives, but the Haitians nevertheless defeated the 30,000 most aggressive troops of Napoleon Bonaparte’s army, the best army at that time. This heroic and unique historical uprising led to the creation of the first black Republic on January 1<sup>st</sup>, 1804<sup>20</sup>.

The context within which Haiti won its independence brought the country enormous difficulties. The victory over Napoleon’s army, an army victorious in Europe and Africa, was an affront to the hegemony of France, a dangerous precedent in the New World, in addition to being a threat to the interests of France and to those of the other colonialist countries. It was necessary to squelch this young nation in the strongest possible way, and the strict trade embargo coupled with quarantine and isolation on the international arena was extremely harmful (D’ANS, 1987). Haiti’s agricultural production, its main source of foreign exchange, was hard-hit.

<sup>20</sup> Combined sources

The Haitians created a state based on the structure and functions of the French monarchy. After the assassination of Dessalines, the Father of the Nation, the country split into two states, each with its own vision of the role Haiti should play on the international stage. On the one hand, Henri Christophe imposed a harsh and severe regime in the north, establishing order and discipline in the areas of justice, security and education. Named “the builder”, Christophe set up fortresses to defend the country in the event of reprisals from France. This State wanted, as an example, to prove to the world that there were no inferior races, and that Blacks could attain a level of civilization comparable to that of others, and even higher.

For his part, Alexandre Petion strived towards the emancipation of other American colonies under European control. Countries like Venezuela, Mexico, Jamaica, Cuba and the Dominican Republic received tremendous support from Haiti, in the form of men, weapons and ammunition, and also financial. According to Petion, the freedom of the Haitian people was threatened by the very existence of populations still subjected to slavery in the Americas.

However, organizational problems during the first decades were harmful to the young nation. Corruption among the elites and the exclusion of the majority of the population hampered its progress (Barthelemy, 1996). The reins of the country and the means of producing wealth had passed into the hands of men of color (the former free) and generals of the War of Independence, but the vast majority of former slaves, around 500,000, had not come into their share of wealth. They finally settled in the hinterland, and on their own, tried to survive by practicing extensive subsistence farming. Their situation will deteriorate gradually as a result of decreased soil fertility and erosion caused by deforestation, together with precarious land-rights and a traditional inheritance pattern of land subdivision. Still now, the attempts of various

governments have not produced a genuine agrarian reform (INARA, 2007).

The subsequent governments attempted to renew international trade relations with France, even agreeing to pay the French government a staggering 150 million gold francs in return for the diplomatic recognition by France of their independence. Haiti therefore had to borrow from French banks and carry out an intensive exploitation of its natural and forest resources, as well as the production and sale of commodities (especially coffee), to answer to its commitment. This was to have serious long-lasting consequences on the economy and trigger chronic deforestation.

The country enjoyed a period of relative stability under the government of Jean-Pierre Boyer, who began the unification of the island in 1822, leading to a military occupation of the Dominican Republic for 22 years. In the mid-nineteenth century, power struggles inflamed the country, culminating in civil wars, with their attendant atrocities and destruction. In 1915, on the heels of this civil war, the United States army invaded the country and initiated an occupation which would last 19 years.

The year 1986 marked a profound shift in the political and social development of the country, ending nearly 30 years of the authoritarian rule (1957 to 1986) of Francois Duvalier. It seemed that finally democracy had triumphed, but not without difficulties.

Since then, three democratic elections were held, legitimate governments installed, and efforts at good governance and democratic progress made. However, in 2004, after months of popular uprising, the elected president, Jean Bertrand Aristide resigned and went into exile. The United Nations then passed a resolution, in February 2004, to send military troops to stabilize the country, which led to the holding of democratic elections and the arrival of Rene Preval into power for a period of five years. Haitians again hoped for a better future.

The people of Haiti, as any other nation, possess their own unique culture, a product of their past and of their history. Their way of perceiving the world around them is the synthesis of what their ancestors combined- of the lifestyles and relationships, agreeable to some and less to others- of their Taino, Spanish and French legacy. To this legacy must be added their West African roots. The French influence is particularly noticeable by way of deeply-ingrained practices. The Haitian nation represents a crossroad where each of these cultures, at various levels and in different ways, has contributed to their enrichment, endowing their culture with uniqueness and authenticity.

Also, through heroic acts and their unique qualities, Haitians have been able to demonstrate what Haiti represents as a country. More than ever, they must now rely on these qualities and that heroism, drawing on them to overcome the immense challenges they are now facing. They have managed to overcome them in the past, will be able to do so again, and continue to occupy their rightful place within the international community.

## 4. Socio-economic Conditions

### 4.1 Haitian Economy

For the past twenty years, the Haitian economy has known a period of turbulence. The main cause of the fall in Gross Domestic Product (GDP), since the first half of 1990s, was the socio-political instability of this period. From almost \$3 billion at the start of 1990, it declined to 2.6 billion in 1995 and to 2.8 billion in 2001.

However, since 2005, an upward trend allowed, in 2007, to reach a figure of 3.4 billion dollars (UNDP,

2007), an increase of 3.2% (IHSI, 2008) compared to the previous year, due to the restoration of a positive climate conducive to the resumption of economic activities. It should however be noted that the GDP per capita, which currently stands at around \$500, has never resumed the historic level of \$3,151 dollars attained in 1980 (UNDP, 2007).

Some tighter fiscal policies by the Bank of the Republic of Haiti, such as a refusal to finance the budget deficit, had led to progress. Inflation had been controlled with a net reduction which stabilized below 7.9% at the end of the fiscal 2006-2007 exercise period, down from the 12.4% recorded the previous year. An analysis of the 2008 increase in GDP, a 3.1% growth in overall investment and 1.7% of final consumption may have helped to improve these figures, although exports at stable prices had decreased by 2.9% (IHSI, 2008).

Over the years, the contribution of the different economic sectors to the GDP has changed. The contribution of the primary industry, from 35.5% in the early 1980s, fell to 26% in 2008, and that of the secondary and tertiary sectors increased to 42% and 58% respectively, compared to the values of 23% and 16% over the same period (IHSI, 2008). The tertiary sector of the Haitian economy has tended to confirm itself however efforts in the other two sectors are expected to show a reversal of this trend. A summary analysis of the economy's key sectors allows a better understanding of the situation, although we cannot ignore the effect of the hurricanes in 2008 on the country's GDP. As can be observed in the comparative table below, the GDP has undergone a tremendous setback not only in the productive sectors, but also in the social sectors and infrastructure. This gives us a better idea of the impact of disasters on the GDP of Haiti in particular.

**Table 5: GDP and losses caused by disasters (million U.S. \$)**

Sectors	GNP (current prices)		Losses (in % GNP)	
	2007	2008	2007	2008
<b>Social Sectors</b>	<b>46,059</b>	<b>53,727</b>	<b>2.3%</b>	<b>2.0%</b>
Non-marketable services	26,575	30,999	NA	NA
BTP (Buildings, Public Works) & Extractive Industries	19,484	22,728	4.3%	3.7%
<b>Productive Sectors</b>	<b>166,869</b>	<b>194,649</b>	<b>7.0%</b>	<b>6.0%</b>
Agriculture, breeding, silviculture and fishing activities	62,744	73,190	7.8%	6.7%
Manufactured products and Industries	18,969	22,127	15.1%	12.9%
Commerce, Restaurants and Hotels Other marketable services	85,157	99,333	4.7%	3.3%
<b>Infrastructure</b>	<b>17,238</b>	<b>20,107</b>	<b>14.5%</b>	<b>12.4%</b>
Electricity and Water	1,050	1,224	20.6%	15.3%
Transport and Communications	16,188	18,883	14.1%	12.0%
<b>Total GNP at current prices</b>	<b>230,166</b>	<b>268,483</b>	<b>NA</b>	<b>NA</b>
<b>Total GNP at constant prices</b>	<b>13,498</b>	<b>13,835</b>	<b>NA</b>	<b>NA</b>
<i>Production Cost Deflator</i>	<i>17.1</i>	<i>19.4</i>	<i>NA</i>	<i>NA</i>

Source: Government of the Republic of Haiti, 2008

### 4.1.1 Agriculture

Although faced with water shortages and devastating tropical storms, the country must ensure the food supply of its population within the context of a demographic explosion, leading to an outrageous and widespread exploitation of the environment and to the depletion and loss of soil through accelerated erosion processes.

With limited means of production and inefficient marketing channels, the agricultural production is very low. Most farms are family-own and concerned first with self-sufficiency. They therefore grow grain and food crops such as corn, rice, sorghum, beans, sweet potato, cassava, plantain etc.

**Table 6: Presentation (years 2000-2005) of the country's production of most important commodities**

Year / Commodities	Annual Production in tons					
	2000	2001	2002	2003	2004	2005
<b>Sugar cane</b>	800,000	1,008,000	595,000	600,000	1,050,000	1,050,000
<b>Banana</b>	322,500	290,000	308,000	310,000	300,000	300,000
<b>Mango</b>	250,000	250,000	595,000	600,000	1,050,000	1,050,000

Source: MARNDR, 2006

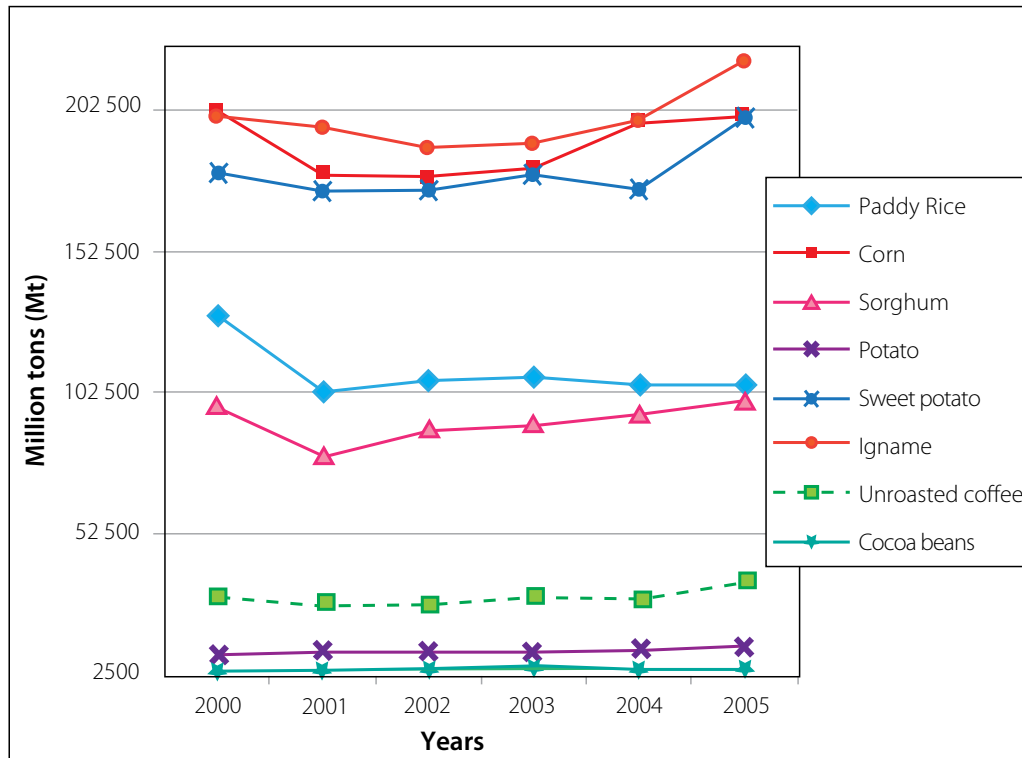
Export crops such as coffee, mango, cocoa, sisal, tobacco, coconuts, cotton, etc., are grown on

somewhat larger farms. However, their production has in recent decades suffered a decline, resulting

from various factors such as a fall in prices on the international markets (Table in Annex 1) as well as a decline in productivity (Figure 21). Other constraints to be taken into account include depleted plant cover and its various diseases, as well as the loss of soil fertility resulting from the degradation of the ecosystem (HILAIRE, 1995).

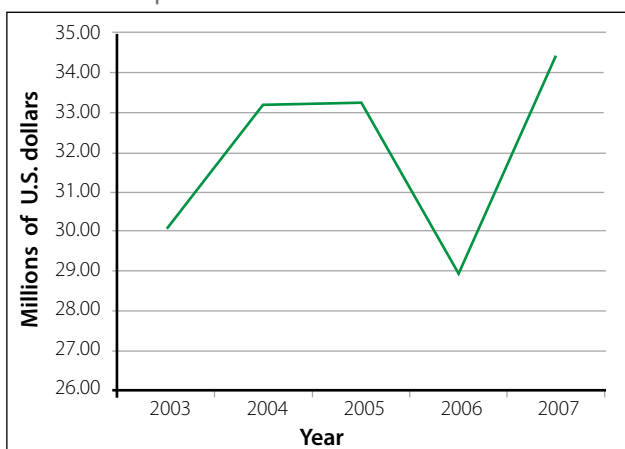
However, due to certain positive results over the years (Table 6), one can hope for a gradual however slow, resolution of the problems affecting the agricultural sector. In 2007, the efforts made in this sector resulted in an increase of 2.9% and a growth of 1.7% in comparison with the previous fiscal year.

**Figure 21:** Trends in the production of major agricultural commodities in the country



Source: MARNDR, 2006

**Figure 22:** Recent developments in agricultural exports in Haiti



Source: BRH, 2006

A series of initiatives had been undertaken to promote the recovery of agricultural production. These are, according to IHSI (2008):

- Increased financial and technical support from the Ministry of Agriculture and Rural Development (MARNDR) to the banana, export mango, coffee and bean sectors;
- Intensification of the agricultural cooperation programme with Cuba;
- Implementation of a *Programme of urgent intervention in agriculture* (PUID);

- Implementation of the Special Food Security (*Programme SPFS for*) in the MARNDR;
- Implementation of a joint program MARNDR / Embassy of the United States, against crop pests.

The sector benefited in 2007 from favorable weather conditions, as for example, an increase of 38.2% of rainfall over the previous year, which led to a positive increase. However, this suffered a setback due to the hurricanes that struck the country during the summer of 2008.

### 4.1.2 Fishing

Fishing is a sector of minor importance to the Haitian economy, despite its potential. As an island state, Haiti has a surface area of 5,860 km<sup>2</sup> of continental shelf and 86,398 km<sup>2</sup> of exclusive economic zone (FAO, 2005). The quantity of imported fish however is much higher than exports, this sector still very low

**Table 7: Annual Production and Supply of Fish**

Data	Production (in tons of live weight)	Imports (in tons of live weight)	Exports (in tons of live weight)	Total Supply (in tons of live weight)	Supply per inhabitant/year (kg)
Fish destined for consumption	5,000	16,679	337	21,342	2.6

Source: FAO, 2005

- Even if the fishing industry does not occupy a place of primary importance in the Haitian economy, it plays a role in creating jobs, especially in coastal areas, employing over 50,000 people. Aquaculture, for its part, is undeveloped, with a production of 300 tons and contributing only 800 jobs to the economy (FAO, 2005).
- The sector also faces certain difficulties such as:
  - Decreased fish catches,
  - Increased fishing activity on the continental shelf,
  - Degraded coastal ecosystems as a result of a weak environmental monitoring,
  - Weak legal supervision in relation to the preservation of marine productivity,
  - The use of too finely-meshed fishnets,
  - Compressor or seine fishing causing a destructive use of the environment.

### 4.1.3 Industry

The industrialization process initiated in the early 1960s is still underdeveloped.

At the beginning of the industrialization process, activities centered mainly on the manufacturing of electronic parts, of textiles and beverages. This significantly slowed down as a result of the United Nations' trade embargo against Haiti between 1992 and 1994, the consequences of which the country is still suffering. This sector employed 430,000 people in 1991, but numbered only 13,000 in 1995 (Deshommes, 2005) and not more than 25,000 people in 2005 (UNDP, 2005).

The country's mining industry has also remained at an embryonic stage. Mining has been concentrated on bauxite (from 1956 to 1982 by the Reynolds Mining Corporation), with 14,000,000 tons extracted, and copper (from 1960 to 1971 by the Society for Economic and Natural Mining and Development (SEDREN) in the central part of the country, with 1,500,000 tons (PREPETIT, 1997). The mining operations carried out by these foreign companies provided little to the country in terms of benefits to the State or to the community, whether from the point of view of fees paid by these companies to the State, or wages paid to employees and workers (PIERRE-CHARLES, 1994).

Mining has essentially been reduced to the extraction of construction materials in the quarrying of limestone, without being subject to any form of fiscal control by the Haitian government<sup>21</sup>.

An upward trend in the economic activities of the industrial sector was recorded in 2007. The manufacturing sector showed an increase of 1.3%, with textiles accounting for 98% of the assembly segment, which rose by 2.3%. This segment is considered to be the leading element of the Haitian assembly industry and has demonstrated rapid growth. The HOPE Act (Haiti Hemispheric Opportunity Through Partnership Encouragement Act), passed in 2007 by the Congress of the United States of America, has allowed Haiti to assemble and export to the U.S. textile products manufactured elsewhere. This Law, initially for one year, was renewed in 2008 for a period of 10 years. This will enable Haiti to process and export to the United States, duty-free, the equivalent of 70 million square of woven fabrics for all types of clothing, and 70 million square meters of fabrics from third countries. In addition, items of clothing (women's underwear, pajamas, luggage,

handbags and backpacks, caps and hats in fabric) can be produced in unlimited quantities in Haiti and exported to the United States duty-free<sup>22</sup>. It is therefore possible to believe in a significant development of the textile sector, which at the moment is the mainstay of the Haitian industrial sector.

#### 4.1.4 Energy

In Haiti, the energy sector is made up of local energy which satisfies 80% of national demand. Energy from biomass (wood energy) remains the country's most-used form of energy (71%). Thus, wood, charcoal and bagasse, respectively contribute 55%, 11% and 4% to energy consumption by households and traditional industries (ESMAP, 2007). Hydro-energy, however, (see Chapter II) provides only 5%. The rest comes from oil and its derivatives and from imported traditional energy resources such as liquid petroleum products, gas and sometimes coal. The table below highlights the evolution of the production and importation of primary energy in Haiti.

**Table 8: Evolution of production and importation of primary sources of energy in Haiti**

National Year	1973 (ktoe) %	1979 (ktoe) %	1985 (ktoe) %	1990 (ktoe) %
		<b>857,087.0</b>	<b>1,133,083.0</b>	<b>1,304,082.5</b>
- Hydroelectricity	28.0	48.0	54.2	47.6
- Fire wood	731.0	98.0	980.0	105.0
- Bagasse	1164.0	86.0	1305.0	55.0
<b>IMPORTED</b>	<b>127,013.0</b>	<b>231,017.0</b>	<b>275,067.5</b>	<b>343,819.7</b>
- (Mogas, Kerosene, Jet fuel)	31.0	54.0	90.35	106.4
- Diesel	60.0	112.0	97.00	133.2
- Liquid Petroleum Gas (LPG)		2.0	3.89	8.4
- Fuel oil	1.0	62.0	47.40	95.8
- Charcoal	35.0		36.51	
- Non energy				
<b>TOTAL</b>	<b>984,100.0</b>	<b>1,364,100.0</b>	<b>1,579,150.0</b>	<b>1,751,500.0</b>

Source: BME, 2009 Note \* ktoe = Thousand Ton Oil Equivalent

Utilized in a significant manner nationally, the amount of wood used annually amounts to energy levels ranging from 3.4 to 4.1 million metric tons, equivalent to about 12 to 30 million trees. Expressed in tons of petrol (TOP), this amount

corresponds to more than four times the amount of petrol consumed annually in Haiti. The current demand for wood energy is under two forms, both in urban and rural areas, and is summarized in the table below.

<sup>21</sup> [www.bme.gouv.ht/carriere](http://www.bme.gouv.ht/carriere)

<sup>22</sup> [www.adih.ht](http://www.adih.ht)

**Table 9: Estimated firewood consumption, 1993**

Consumption Sectors	Quantity (in millions)		%	Source
	Tons	m <sup>3</sup>		
Firewood	<b>2655.0</b>	<b>3865.0</b>	<b>65.5</b>	
Households	2250.0	3275.0		
Rural	68.0	100.0		
Urban	103.0	150.0		Dead trees and shrubs
Bakeries, dry cleaners, limekilns	233.0	340.0		Green wood, felled trees
Rural industry (mills, distilleries, essential oils)				Pruning, large unwanted trees, trees found along urban ravines
				Lumber and fruit trees
Charcoal	<b>1400.0</b>	<b>2038.0</b>	<b>34.5</b>	Green wood from cleaning activities, fallowed and fragile ecosystems (mainly mangroves)
• urban households	1150.0	1674.0		
• informal sector and others	250.0	364.0		
<b>TOTAL</b>	<b>4055.0</b>	<b>5903.0</b>	<b>100.0</b>	

Source: BME, 2009

Existing lignite deposits, because of their weak heating and quality capacity, lower than that of wood (10 to 12 against 15 to 16 MJ / kg) are not, in the current context, a resource that can be effectively enhanced (ESMAP, 2007).

Renewable energies, in percentage, represent a very small proportion of the national energy needs. Solar energy is used primarily for crop-drying and in the domestic sector, for clothes-drying. Some studies have been done on this type of energy, such as the use of 20 kilowatts of photovoltaic cells and modules imported from the United States in

1993. Certain rural areas have benefitted from this form of energy through the help of international organizations, mostly in the area of health services for disadvantaged populations. Photovoltaic energy remains a luxury product used only by the wealthy.

The country has significant hydro-electric power capacity. The artificial lake Peligre leads the way with an output of 47.1 MW, followed by Drouet in the Artibonite region and Saut Mathurine in the South, respectively capable of power outputs of 2.8 MW and 2.4 MW (Table 10).

**Table 10: Hydroelectric potential**

Rivers or sources	Developed site	Height of the waterfall	Power generated (in MW)	Turbine type and date
Artibonite	Péligre	12.0	47.10	Francis (1971)
Artibonite	Drouet	9.0	2.80	
Cavaillon	Saut Mathurine	110.0	2.40	Ossberger (1978)
Cayes-Jacmel	Gaillard	210.0	0.50	Pelton (1983)
Onde Verte	Belladère	16.5	0.30	Pelton (1985)
Caracol	Caracol	160.0	0.85	Ossberger (1983)
Délugé	Délugé-Lanzac	298.0	0.80	Pelton (1985)
Petite-Rivière	Milot	111.0	0.13	Pelton (1991)
<b>TOTAL</b>			<b>55.00</b>	

Source: BME, 2009



Eolian energy has always been used in navigation, and some eolian pumps were set up, without success, in the main plains of the country, including in 1991, a 150 KW eolian park in the region of Port de Paix (Northwest), within the framework of the Federal German Republic Cooperation and EDH framework. However, it didn't last due a lack of maintenance (BME, 2009).

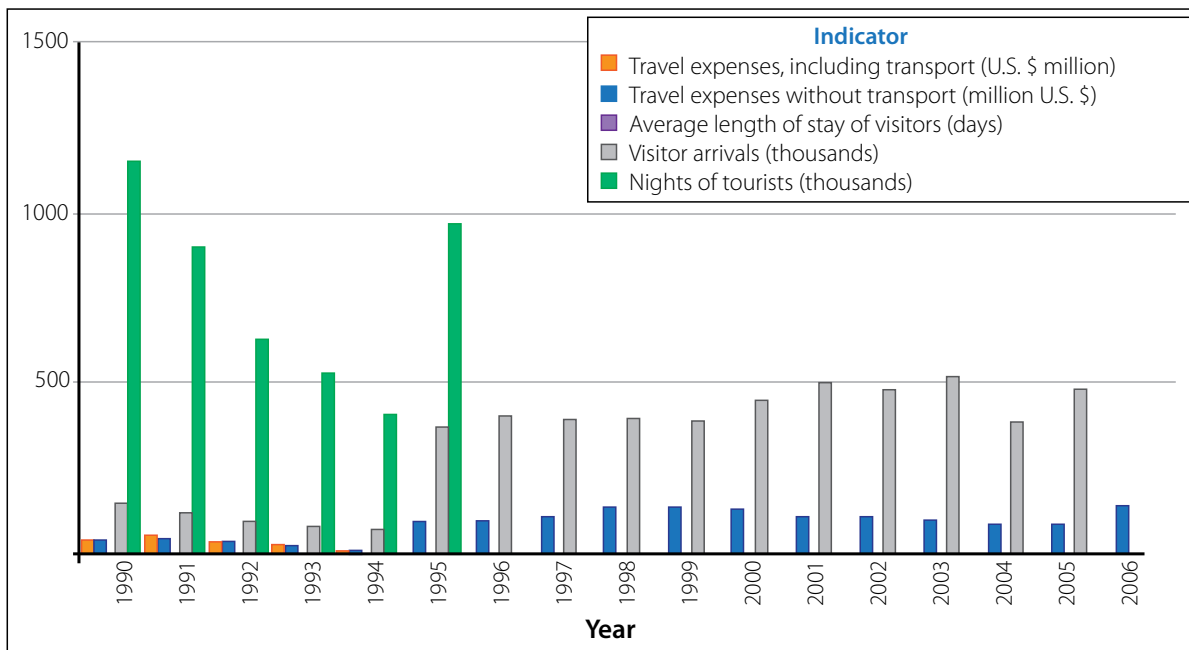
An investigation was carried out by Winergy (2006) on three sites (Cap Haïtien, Port de Paix and Fort Liberté) which led to recommendations, among which, a study on eolian potential in regard to the investors' expectations.

### 4.1.5 Tourism

Tourism is one of the Haitian government's priority areas, explicitly emphasized in its national strategy for economic growth and poverty reduction. Tourists include two broad categories: those who stay more than 24 hours in the country, and vacationers or cruise-ship passengers who spend less than 24 hours in the country. From 2002 to 2007, the number of vacationers staying for longer periods had increased from 108,000 to over 386,000, and that of cruise ship passengers, from 342,000 to over 482,000<sup>23</sup>.

The following graph (Figure 23) outlines the flow of tourists between 1990 and 2006. It indicates an increased number of visitors since 1995, reaching its highest level in 2003.

**Figure 23:** Recent evolution of tourism in Haiti



(Source: Dupond, 2009)

Significant investments are now being made in the area of tourism, with more than \$319 million by the private sector. With respect to State investment, it concentrates on four targeted areas as indicated in the Tourism Action Plan: the West, the North, the South and the Southeast regions, respectively receiving 13, 12, 3 and 4 billion gourds, according to the number of projects carried out in each region.

The main attractions first include the country's natural patrimony: beaches, mountains, caves, waterfalls and other sites of particular natural features, ranging from landscapes to specific flora and fauna, followed by Haiti's cultural heritage: fortresses, castles, plazas, colonial buildings, cathedrals and finally, by its artistic and folklore manifestations, cuisine, etc.

<sup>23</sup> <http://www.lenouvelliste.com/article.php?PubID=1&ArticleID=68238>

## Natural Heritage:

- **Beaches**

The beaches have been enhanced by a variety of facilities, among which are communication systems, beachside hotels, campgrounds, gift shops, equipped beaches, marinas. The following picture is an example of a resort found on the Arcadins Coast (Figure 24).

**Figure 24:** A resort on the Arcadins coast.



The Arcadins coast, 70 km from Port-au-Prince, boasts exceptional ecological assets and is, among other things, a coastal area that has not been deeply affected by coastline mutations (PIERRE et al 2008). The photo below highlights one of these locations.

**Figure 25:** Bananier Beach (Little Goève), a fascinating seaside landscape <sup>24</sup>



All along the coast, many beaches enjoy a high natural potential, such as at Labadée, Ti- Mouyaj, Port-Salut, and Ile à Vache and Cayemites islands, just to name a few.

- **Waterfalls and caves**

Other less well-known sites, where water however remains the center of interest, are the Mathurine Falls at the Cayes, those of St. Louis du Nord, and the Blue Pond (Bassin Bleu) at Jacmel and the Zim Pond at Hinche.

In the Southern region, we find the Marie-Jeanne Caves at Port Piment, the Doudou and La Voute caves at Minguet, and Grotte-au-Bassin and Grotte-Galerie (caves) on La Tortue Island <sup>25</sup>.

- **Mountains**

Most of the mountainous regions boast seaside resorts and other tourist destinations of interest. These are areas rich in biodiversity, and some mountainous areas welcome both local and foreign tourists throughout the year. We could list in this category, the eco-tourist site at Valle (West), situated between 650 to 990 meters above sea level, and the National La Visite Park (Southeast), whose peak is at 2,347 m, and located in the Massif de la Hotte (South) between the Morne d'Enfer (1,900 m), Morne Kaderneau (2,155 m) as well as the Morne of Macaya.

**Figure 26:** Macaya



<sup>24</sup> roroli.com

<sup>25</sup> (<http://www.arqueotur.org/yacimientos/isla-de-la-tortuga-grotte-au-bassin-grotte-de-la-galerie-y-fuertes-de-la-rocher-y-dogeron.html>)

## Cultural Heritage

### • Historical Monuments

As a result of its past and of its history, Haiti has many historical monuments throughout the country. The cities of Cap-Haïtien and Port-au-Prince, having been the most important commercial, political and social centers, and where the scenario of the small French colony of Saint Domingue unfolded, remain the main historical vestiges. Thus, the glorious history of its past is perceptible through its small streets, houses and century-old buildings, those having survived fires and earthquakes, and even destruction resulting from internal strife.

Pre-Columbian archaeological sites are to be found on Turtle Island (Ile de la Tortue) at Grotte-au-Bassin and Grotte-la-Galerie (Caves Au Bassin and La Galerie).

In the Northeastern province are the fortifications of Fort-Liberté, founded by the Spaniards in 1578. Initially called "Bayah" and later renamed Fort Dauphin by the French, the fort was finally called Fort Royal by Christopher Henri. The De la Bouque forts, located at the mouth and on the western shore of the bay of Fort-Liberté, constitute a set of four forts built to defend Fort-Liberté: Fort-Saint-Frédéric (1740), Fort-Saint-Charles (1740), the Battery's Cove (1756) and Fort-Dauphin or Fort-St. Joseph.

Part of the cultural heritage of Turtle Island, are the foundations of Fort-Rocher, built in 1640 by Jean La Vasseur, and Fort Oregon, which dates back to 1666. Several other lesser-known forts are found along the coasts of the country, among others, the Plantons-Fortress in Les Cayes.

In the Northern region, within the National Historical Park, is the La Ferrière Citadel, and the Sans-Souci Palace in the town of Milot, both built by Christopher Henry (Henry I) between 1805 and 1820, after the slave-uprising. The Citadel was to defend the young Republic from French attacks.

In downtown Port-au-Prince, among the many examples of French and European-influenced architecture, one can find: Dessalines Square, Place d'Italie (Italy Square), the Champs-de-Mars, the National Palace, the Legislative Palace, the Esplanade of the Heroes of Independence and the Pantheon Museum.

Another installation of cultural interest is the Barbancourt<sup>26</sup> rum distillery which dates back to 1736.

**Figure 27:** La Ferrière Citadel



Source: Antonio Pereira, 2009

**Figure 28:** The ruins of the Sans-Souci palace



Source: Antonio Pereira, 2009

<sup>26</sup> (<http://fr.tixik.com/foto-citadela-lafferriere-2363096.htm>)

In 1995, a joint UNDP-UNESCO programme was initiated, aimed at protecting Haitian historical and cultural sites. Moreover, the La Ferrière Citadel (Figure 27) and ruins of the Sans-Souci Palace (Figure 28) are on the UNESCO World Heritage list and receive technical and financial assistance through a restoration project<sup>27</sup>.

### • Haitian art

Haiti holds a place of prominence within the Caribbean basin as far as art is concerned. Its art is very diverse thanks to the extraordinary levels of creativity of the Haitians, and the reputation of Haitian art is well established and attracts the curiosity and interest of many.

Artistic expression is extremely present in the daily life of Haitians, but pictorial art is the most prevalent, followed by music. This uniqueness is largely due to the mixture of the heritage of their African ancestors. In the early nineteenth century, Haitian painting experienced its first expansion with the arrival of several European artists, such as the Englishman Richard Evans, and the French Barincourt, and others like Dewitt Peters, Truffaut, Robert Tige and Maud, to name a few. They founded Art Schools in both the north and southern part of the country in view of promoting the artistic expression of everyday life in Haiti. Haitian art shows the beautiful landscapes of the country and depicts also some traditions, such as voodoo, which are recreated on canvas, colored and transformed by the ingenious Haitian artists.

Haitian handicrafts display unlimited creativity and a variety of ways to make objects from wood (sculpture, furniture), wrought iron, papier maché or stone. There are also products such as basketry, jewelry, beadwork, and several other crafted objects very appreciated by tourists, who come from nearby islands or from even further, such as Europe or North and South America.

The music of Haiti follows two trends: the Compas, created in the sixties by Jean Baptiste de Nemours,

and the Musique-Racine, the fusion of voodoo rhythms and American jazz, which has known a revival in the 1980s. These local rhythms, sung in Creole, are slower than the Caribbean salsa and meringue rhythms. In regard to literature, it has enormously evolved after the revolution and one could say it is largely a “committed” literature, and influenced by external literary trends. The authors Rene Depestre, François Duvalier, Alexandre Dumas and Pascale Blanchard-Glass, among others, are well-known.

### • Cuisine

Haitian cuisine is a blend of flavors and culinary traditions from the Taino and Arawak cultures, of those who inhabited the island of Hispaniola before colonization, followed by the European gastronomy, mainly Spanish and French, and finally, by African traditions, especially those from the western coast of Africa. Many dishes are based on rice and seafood (fish and crustaceans) and wild meat. Vegetables (Congo peas, kidney beans, pumpkin, and cocoyam) and tubers (sweet potatoes, yams) are very prevalent, and accompany many dishes often flavored with fruits and spices. Among the wide variety of available local fruits, we find the coconut, banana, plantain, guava, citrus fruits (lemons, oranges, grapefruit, shaddock, passion fruit, breadfruit, avocado, pineapple, star apple (caimite), and soursop fruit (*Annona muricata*), pomegranate, mango, watermelon, carambole fruit and papaya.

Among the specialties of Haitian cuisine we find a red-bean rice dish, cod fish cakes, creole fish broth, Haitian roast chicken, rabbit with prunes and rum, stewed pig-tails, creole coconut chicken, mango mousse, coconut ice cream and sweet potato bread, to name a few. Haitian food is quite spicy but is still less than in the rest of the Caribbean.

### • Religion

Haiti’s religious practices revolve mainly around the Catholic and some Protestant religions. However,

<sup>27</sup> <http://www.unesco.org/csi/pub/papers/papf210.htm>

voodoo, a set of beliefs and rituals which were practiced by the Black slaves who came from Africa, is still very important in Haiti. The word “voodoo” comes from the Fon language of Dahomey, and in Haiti these practices incorporate elements of African religions with the worship of saints of the Catholic religion, a common feature everywhere in America, where there is a juxtaposition of local beliefs with those of the Catholic religion.

Historically, voodoo played a key role in organizing the revolt against the French colonists, and the Bois-Caiman ceremony, which took place on the night of August 21, 1791, marked the beginning of the slave insurrection in Santo Domingo<sup>28</sup>. Many tourist destinations are linked to voodoo activities, among which are the activities at Saut-d’Eau Falls and Plaine-du-Nord Pond or at the Zaberth Source. These touristic sites are strongly associated to voodoo, while others are also visited for their Catholic religious festivities.

- **Touristic events in Haiti**

In Haiti, the major annual festivals are occasions that bring together many tourists from different parts of the country and also from elsewhere in the region. The Haitian diaspora plays a significant role in the volume of regular tourists to Haiti. The major tourist season is during the Haitian Carnival, at Easter, and during the period of countryside festivals. Most of the current projects<sup>29</sup>, projected or already underway, aim the redevelopment or restructuring of some sites, such as at the city of Jacmel, the restoration of the natural and touristic patrimony of Cap-Haïtien, and development of the Arcadins coast.

#### 4.1.6 Services

The tertiary sector in Haiti has been very dynamic in recent decades. Trade, finance, catering, hotels, transport and communications have experienced a resurgence of activity because investments have been largely channeled towards this sector.

Credit has been geared primarily towards the tertiary sector. For example, in 2006, over 50% of bank loans were granted to this sector (BRH, 2007). On the other hand, commercial activities, international aid, remittances from Haitians from the diaspora and government spending are all factors that have contributed to the vitality of the banking, communication and transportation sectors.

In 2007, the volume of market services increased by 2.3%, while caterer and hotel services rose by 1%. The transport and communication sectors, considered to be very dynamic these past ten years because of the vitality of the mobile telephone sub-sector, grew by 4.4%. Other non-marketable services have experienced little growth, such as financial services with a mere 1% (IHSI, 2008).

The trend towards economic recovery, accompanied by the introduction of more rigorous financial and economic policies and a climate of political stability, was severely hampered following the series of hurricanes that ravaged the country during the summer of 2008.

- **Computers and Internet**

According to a study by NOEL in 2002, the rate of the access to computers by the urban population reached 57%, with 61.95% of users in the metropolitan area. Barely 14% of Internet users, representing 8.5% of the total population, had a computer. In 2006, 19.2% of households were equipped with at least one computer, an increase of 126% compared to 2002. In terms of penetration, there is a better positioning of other cities over the metropolitan area, the city of Les Cayes first on the list with 29.8% of households, followed by Delmas (29%) and Pétion Ville (23.7%).

Internet-cafes are very busy and first main access to computers and Internet in Haiti, followed by homes (in second place), and even surpassing other areas of access, such as schools and workplaces. Nowadays, almost all provinces are connected to this technology.

<sup>28</sup> *idem*

<sup>29</sup> *idem*

In 2006, computer-users of 40 years-old and more, represented less than 5% of users, while 80% of users were between 20 and 39 years of age. Conversely, the cybercafé users are younger – while 60% of costumers were under 35 in 2002, nearly 65% of users in 2006 were under 30, the majority of these between 20 and 30 years old.

### • Telephony

According to a study by AHSI, carried out by the Haitian Bureau of Computer Science and Economic and Social Development (BRIDES), and published by the Sustainable Development Network of Haiti (RDDH) in 2006, the mobile phone has gained a strong entry into the communication sector. The presence of household mobile phones is about two and a half times more important than that of fixed telephones. The RDHH states (2006): “Of the thirteen cities surveyed, the overall coverage is 34.8% for fixed lines against 82.4% for cell phones”. Despite the fact that the use of this technology is quite recent in Haiti, households are already very familiar with it.

Phone usage is strongly approved by nearly 94.1% of the population, with 80% of surveyed households satisfied, despite occasional malfunctioning. Telephony is now considered the main source of information and communication in Haiti, equally with the Internet. It seems that a further study on this subject is necessary as the habits of the population indicate that the situation has evolved significantly.

### • Transportation

Three modes of transportation – by road, sea and air – have been contemplated as answering to the population’s needs. However, each suffers of serious deficiencies.

According to the MWPTC (Ministry of Public Works, Transport and Communication; [mtptc.gov](http://mtptc.gov).

ht), the country has lost 30% of its road network during the past fifteen years. Roads, whether main or secondary, are in poor condition and even the capital, Port-au-Prince, has many dirt and unpaved streets or in very poor condition. Sometimes, there are no adequate roads connecting adjacent areas, and few provincial cities have a fairly accessible public transportation system.

The situation in shipping is no different. Maritime activities are concentrated around a few ports where the infrastructure and facilities have largely degraded. Maritime operations are poorly managed and the service offered is totally inadequate by international standards.

Air transportation is mainly centralized at the airport in Port au Prince, which has not yet attained international standards. This airport, alike the country’s other airport infrastructure, is aging and poorly adapted, and unable to meet local, regional and international air traffic needs.

## 4.2 Social Conditions

### 4.2.1 Education

School attendance among the population aged 6 years and over is 68.5% in urban areas and around 57.4% in rural areas. Around 60% of children aged 6 to 11 years attend school. Once again, the rural areas are disadvantaged, with only about 50% of children in the same category attending school. The rate of secondary-school attendance is around 22% (IHSI, 2003).

Private schools receive an overwhelming majority of children at the pre-school and primary levels (kindergarten, grades 1-3 and 4-6) as well as at the secondary level. For these three categories, private schools register, respectively, 95%, 81% and 74% of the school population, compared to enrolment in the public schools, for these same categories, of 5%, 8% and 9% (Table 11).

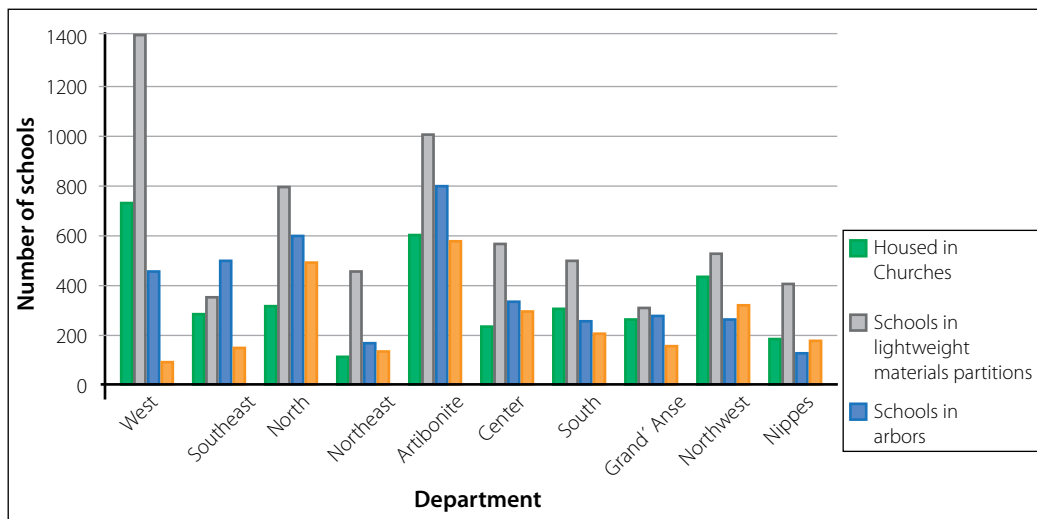
**Table 11: Share of public and non-public sector in the school system, in %**

	Public sector		Private sector	
	Schools	Pupils	Schools	Pupils
Pre-school	5.5	4.67	94.5	95.33
Elementary, grades 1-4	8.0	18.54	92.0	81.46
Elementary, grades 4-6 and Secondary	9.0	25.36	91.0	74.64

Source: MEYS, 2007

Nationwide, schools are managed by different Congregations and groups, which explain the existence of heterogeneous infrastructures. There are schools run by Churches (Baptist, Protestant, Adventist and Pentecostal) and presbytery schools. There are summarily-built schools, others under trees, with thatched roofs, or even some with no roof. The largest number of schools functioning within churches, are in the Western province (753), as well as schools with summary partitions (1397). The Artibonite region ranks first in schools held under trees (823) and straw-built schools (594).

**Figure 29: Distribution of schools by department according to type of building (1<sup>st</sup> and 2<sup>nd</sup> level elementary)**



Source: MEYS, 2007

On average, across the various departments in rural areas, 94% of public schools are located in churches, while in urban areas this applies to only 16% of private schools. The trend is similar with regard to schools with summarily-built walls in the rural areas, where 55% are public schools and 64% are privately-run. In urban areas, on average, 22% of schools held under trees are public institutions and 59% are private (id).

As mentioned, the literacy efforts made over the last ten years have yielded positive results, given the population growth recorded during this period. The table below shows the success rate at

national examinations from 2002 to 2005 (Rhetor + Philo). We note that the success rates recorded in 2002 and 2005 were the highest.

**Table 12: Rate of academic success at national examinations (Rhetor + Philo)**

Academic Year	2001-2002	2002-2003	2003-2004	2004-2005
Success rate	48.49	39.68	43.18	48.34

Source: MEYS, 2007. (Baccalauréat 2004-2005. Session (Regular and Extraordinary).

On the other hand, an evaluation of the educational system in general has identified several factors which could be the cause of some rather disappointing results, such as the lack of teaching materials, of motivation and incompetence of teachers (MEYS, 2004). The State's weak regulatory capacity would also be a factor since most schools, particularly at the elementary level (75%), are not accredited and operate without a license, which brings into question their educational quality. Also, a number of private Higher Education Institutions (Technical Institutes and Universities), seem to escape the control of the State (MEYS, 2007).

Despite this situation, which we could describe as alarming, there is reason to believe that there has been some improvement. Efforts have been undertaken by public authorities, particularly in regard to the provision of additional quotas with the construction of public schools, the granting of school supplies and uniforms, increased school lunch-programs and the implementation of the National Education and Training Plan (MEYS, 1997).

### 4.2.2 Health

The condition of the health sector in Haiti is cause for concern. According to the Health Ministry

(MSPP 2003), "The health situation of the Haitian people can be defined essentially as precarious".

Indicators show that the gross mortality rate in 2000 was around 10.72 deaths per 1,000 inhabitants, while infant mortality was 81 deaths per 1000 live births or 8.1% (MPHP, 2003). Infectious diseases like measles, tetanus, cholera, diphtheria and AIDS are classified as major causes of morbidity. It is also important to note that malnutrition ranks among the top 10 causes of death in the country.

According to the Health Ministry (MPHP, 2003), the political and economic situation, poor infrastructure (49 hospitals serving the entire population of Haiti) and lack of human resources (2.5 physicians, 1 nurse and 2.5 nurses-aides per 10,000 inhabitants), make the situation even more fragile and vulnerable.

The distribution of hospitals and medical centers is concentrated in the metropolitan area of Port-au-Prince; however, the majority of these health facilities are private. An analysis of Table 13 gives an idea of the distribution throughout the different provinces. With the exception of the Western department, the other departments are poorly served and lacking with regard to health infrastructure.

**Table 13: Distribution of medical centers and hospitals throughout the country**

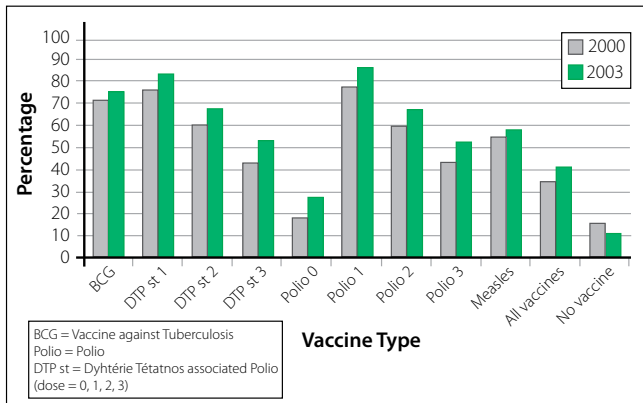
WEST AND METROPOLITAN AREA OF PORT-AU-PRINCE
<b>PORT-AU-PRINCE:</b> Hôpital de l' Université d'État d'Haïti; Centre Obstétrique Gynécologique Isaïe Jeanty-Léon Audain Chancelles; Hôpital du Canapé-Vert; Hôpital Français (Asile Français); Hôpital Saint François de Sales; Hôpital-Maternité Sapiens; Hôpital OFATMA Cité Militaire; Clinique de la Santé; Maternité de Christ Roi ;Centre Hospitalier Rue Berne; Maternité Mathieu.
<b>PÉTION VILLE:</b> Citymed - Pétiön-Ville; Hôpital de la Communauté Haïtienne; Hôpital de Fermathe (Route de Kenscoff); Maternité de Pétiön-Villeque
<b>DELMAS:</b> Grace Children's Hospital; Citymed - Delmas ; Hospital Espoir; Centre Hospitalier Delmas-Musseau
<b>CARREFOUR:</b> Hôpital Adventiste de Diquini; Hôpital Saint Charles (Mariani)
<b>WEST:</b> (except Port-au-Prince metro): Hôpital Sainte Croix de Léogane ; Hôpital Wesleyen de La Gonâve (La Gonâve Wesleyan Hôpital), Notre Dame de Petit Goâve
<b>NORTH:</b> Hôpital de Bienfaisance de Pignon ; Hôpital Justinien - Cap Haïtien; Hôpital de Milot
<b>SOUTH:</b> Hôpital Immaculée Conception (Les Cayes); Hôpital Bonnefin ; Hôpital Sainte Anne
<b>SOUTH:</b> Hôpital Immaculée Conception (Les Cayes); Hôpital Bonnefin ; Hôpital Sainte Anne
<b>ARTIBONITE:</b> Hôpital La Providence (Gonaïves); Hôpital Albert Schweitzer ( Deschapelles )
<b>GRAND'ANSE:</b> Hôpital Saint Antoine (JEREMIE);
<b>CENTER:</b> Hôpital Sainte Thérèse de Hinche; Clinique Bon Sauveur de Cange ; Hôpital de la Nativité de Belladere
<b>NORTHWEST:</b> Hôpital de Port-de-Paix.
<b>SOUTHEAST:</b> Hôpital Saint Michel de Jacmel.

Source: <http://haitimedical.com/union/reference/hospitals.asp#pap>



Progress has however been made in the health sector, especially with respect to vaccination (MPHP-PAHO/WHO, 1998). In fact, the number of children vaccinated is rising steadily (Figure 30).

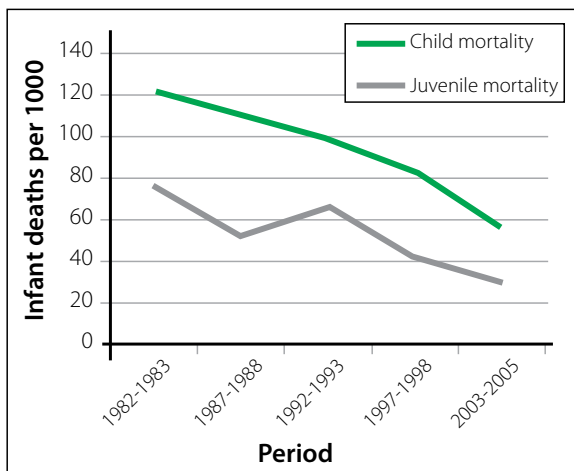
**Figure 30:** Vaccination coverage by vaccination type



Source: MPHP, 2006

This effort has resulted in a persistent reduction in the rates of infantile and juvenile mortality per 1000 inhabitants, as demonstrated by the figure below:

**Figure 31:** Prevailing trends in infant mortality (0-1 an)



Source: MPHP, 2006

The most recent statistics show that efforts made will help, hopefully, maintain the trend on the reduction of the rate of infant and child mortality.

### 4.2.3 Housing and Infrastructure

The problem of housing is primarily an urban one, since most (60%) homes are located in rural

areas. Owing to the rural exodus, the number of dwellings in the cities is inferior to what is needed, and flats and houses are usually overcrowded, with an average of 2.7 persons per room, nationally, and of 3.5 people in Port-au-Prince (IHSI, 2003).

Constructions in Haiti are generally built with local materials (sand, rock, gravel). In some areas, particularly rural, there are houses made of mud, straw huts covered with thatch roofs (rural and semi-urban areas), or made of concrete with tin or concrete roofs; homes of 3, 4 and 5 levels are also found, especially in the residential areas of large urban centers, as well as older homes generally built of wood (UniQ et al. 2000).

Additionally, according to the Haitian Statistic and Computer Institute (IHSI, 2003), nationally, the access to electricity is low. Only 31.6% of households are connected, with a peak of 92.2% in Port-au-Prince and 23.2% in provincial towns. In rural areas, only 10.5% of residents are connected. In relation to the water supply system, one in five homes disposes of running water, and in the other cases, water is obtained from public fountains (IHSI, 2003).

Representing the oldest telecommunication infrastructure in the country, TELECO covers almost all cities in regard to fixed telephones. It currently faces major problems of competitiveness as the mobile phone sector is in full expansion, and which could also soon be combined to an extensive nationwide internet service. Telephone companies now cover almost the entire country, compared to the major internet providers which serve only the metropolitan area and some provincial towns, although the available data on users is not exhaustive (see Table 14). The city of Les Cayes seems the best served in terms of electricity services, with almost all internet providers and mobile phone suppliers operating there. Not all cities have the same mobile internet provider (for example, les Cayes and Port-au-Prince). Some provincial cities and towns, such as the town of Miragoane, have very weak telecommunication infrastructures owing to a serious lack of electricity. However, a power plant was recently built in Tapion (CONATEL, 2009).

**Table 14: Telecommunication infrastructure in the main provincial towns of Haiti**

Provinces and main cities	Access to telephones and the internet			Internet-cafes	Electricity
	Mobiles	Fixed lines	Internet		
<b>Cap-Nord</b>	70%	Téléco (NS)	Hainet (NS) Accès Haïti	63	15 h/d
<b>Sud-Cayes</b>	Digicel 98% Voila 95% Haitel 30%	120.000 clients	Hugues Net, (NS) Accès Haïti, Star band, Téléco net	46 and 36 call centers	24/24
<b>Fort Liberté-Nord-est</b>	Digicel(NS) Voila (NS) Haitel (NS)	No longer exists	No longer exists plus	12 for the province	6 h/d
<b>Gonaïves-Artibonite</b>	Digicel(NS) Voila (NS) Haitel (NS)	No longer exists	Accès Haïti.	125 and 60 call centers	10 h/d
<b>Centre-Hinche</b>	Digicel 75% Voila 75%	No longer exists	1 seul fournisseur	14 Internet-cafes, 2 call centers, 1 multimedia center	3 communities are served
<b>Sud-est-Jacmel</b>	Digicel (NS) Voila (NS) Haitel (NS)	Téléco (NS)	Several suppliers Accès Haïti	30 Internet-cafes 6 centers	NS
<b>Grand'Anse Jeremie</b>	Digicel (NS) Voila (NS) Haitel (NS)	Téléco (only the town center of Jérémie)	La Televens	11 Internet-cafes et 14 call centers	NS
<b>Les Nippes – Miragoane</b>	Digicel Voila Haitel	Exists only in the Miragoane town center	No supplier	NS	18-24h/d Ville Miragoane & Payant
<b>Ouest-Port-au-Prince</b>	Digicel (NS) Voila (NS) Haitel (NS)	Téléco (16 communities served)	Hainet, Accès Haïti, Multilink, ACN	NS	6 h/d
<b>Port-de-Paix Nord-est</b>	Coverage in the department Digicel 90% Voila 60% Haitel 30%	Téléco (NS)	Direcway and Accès Haïti (ville Port de Paix)	40 Internet-cafes	6 h/d

NS = Non specified

Source: <http://www.conatel.gouv.ht/departement/>

According to CONATEL (2009), the national Haitian regulator of this sector, a significant amount of infrastructures has been created in the country in recent years, and more than 4,000 Internet-cafes have benefited from the provision of these services. Through CONATEL, some parts of the country possess TeleCentres<sup>30</sup> to provide training on information technology and on the application, by the population, of such technologies. In this context, broadband internet coverage would have

been considered by the main suppliers of Internet services for the country's ten provinces, under terms set by CONATEL.

With respect to roads, these are mostly in poor condition. Most secondary roads are made of dirt and lack maintenance. This network serves all those transiting constantly from one region to another, seriously deteriorating even more during the rain and hurricane seasons.

<sup>30</sup> [http://www.conatel.gouv.ht/hebdo/no\\_011.pdf](http://www.conatel.gouv.ht/hebdo/no_011.pdf)

# THE STATE OF THE ENVIRONMENT IN HAITI





## 1. Water Resources

### 1.1 Overview of Water Resources

Water nourishes and sustains all living things yet at least 400 million people in the world live in regions affected by a shortage of water.

According to Caircross (1987), water consumption in developing countries decreases from 40 liters a day per person in areas where running water is available, to 15 a day, if the water supply is at a distance of 200 meters. If the water supply is more than 1000 meters away, consumption drops to less than 7 liters a day per person.

Haiti has a considerable hydrological potential. From a hydro geological perspective, Haiti's water resources amount to a total of 56.2 billion cubic meters of water, including 48 billion cubic meters of continuous aquifers and 8.2 billion cubic meters of discontinuous aquifers. Underground water resources are thus distributed, thanks to the allocation of permeable geological formations which form natural reservoirs (CEPIS, 2000)<sup>31</sup>.

**Figure 32:** Seguin Waterfall in the la Selle Mountain Range (Massif de la Selle)



#### 1.1.1 Ground Water

Haiti has abundant water resources. More than 100 streams flow from its mountains into the

Gulf of Gonâve, the Atlantic Ocean and the Caribbean Sea. In the mountains, the current is rapid and torrential, but in the plains, the same streams become slow and winding. As a result of evaporation and permeation, many of these never reach the sea. Ground water also flows directly into the many irrigation systems, but the quantity of water available for irrigation is decreasing significantly as a result of deforestation.

The country has 30 basins and hydrographic areas that flow from the mountains to the coastal waters, and Haiti has important rivers with moderate flows year round. The country also boasts extraordinary waterfalls: for example, Cascade Pichon at Belle-Anse, Saut-d'Eau in the Central Plateau and Saut Mathurine at Camp-Perrin, including lakes and ponds such as: Lake Azuei or Saumâtre Pond (11,300 hectares), the artificial Péligré lake (2,750 hectares) and the Miragoâne ponds (1,130 hectares). There are also more than 31 waterways representing roughly 6,820 ha, as well as 71 smaller streams totalizing approximately 2,770 hectares (DIMANCHE, 1998). Additionally, there are 90 hectares of reservoirs in the hills of Artibonite, Central Plateau and in the Northeast.

The following mineral watersprings (the hot springs of Los Posos, Sud-Est, Sources Puantes and Balan in the Cul-de-Sac Plain, and six hot springs with limited mineral deposits, located between Terre-Neuve and Gonaives) should also be mentioned. Owing to their contact with magma and dissolved minerals, these hot springs contain medicinal and healing properties against some sicknesses. The value of thermal water can also be enhanced through the production of bottled mineral and carbonated water. The lack of available data on the exploitation of this resource does not permit yet an assessment of its potential. Concerning the rules on its exploitation, they appear to be the same as those regulating mining and are monitored by the Office of Mines and Energy.

The following table shows the country's main rivers and their characteristics.

<sup>31</sup> <http://cepis.ops-oms.org/eswww/eva2000/Haiti/informe/inf-02.htm>

**Table 15: Main Rivers and their Characteristics**

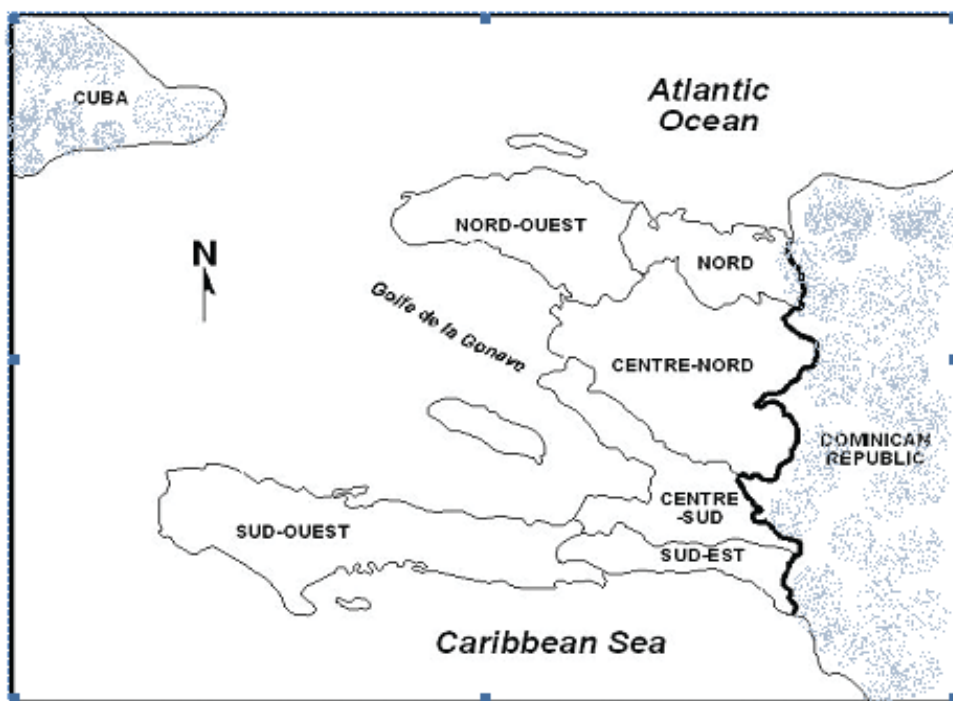
Name of River	Drainage in Haiti (km <sup>2</sup> )	Maximum Daily Flow (m <sup>3</sup> /s)	Minimum Daily Flow (m <sup>3</sup> /s)	Annual Runoff (Average Daily Flow) (m <sup>3</sup> /s)
Les Trois Rivières	897	1,500	0.3	13.13
Rivière du Limbé	312	485	0.3	4.29
Grande Rivière du Nord	663	390	0.02	7.65
Rivière de l'Estère	834	95.3	1.85	18.76
Rivière de l'Artibonite	6,862	2,500	8.4	101.4
Rivière Grise (Grande Rivière du Cul-de-Sac)	290	475	0.31	3.97
Rivière Momance	330	420	0.6	5.88
Grande Rivière de Jacmel	560	800	0.12	4.67
Rivière de Cavaillon	380	1,035	0.7	9.42
Ravine du Sud	330	350	0.28	4.85
Grand'Anse Rivière	541	850	0.7	26.85

Sources: M. Ehrlich et al. June 1985. Organization of American States, 1972. OPS/OMS, 1996. United Nations Development Programme, Department of Technical Cooperation for Development, 1991.

These watercourses flow countrywide, but have been classified according to regional subdivisions given their distinct and quite pronounced

variation. The table below illustrates this situation and highlights the regional divisions.

**Figure 33: Hydrographic regions**



Source: CI USA, 1999

**Table 16: Annual Average Surface Water Distribution by Hydrographic Region**

	N-O	N	C-N	C-S	S-E	S-O	Total
Area (km <sup>2</sup> )	4,580	2,450	7,200	3,240	1,810	8,470	27,750
Surface Water (10 <sup>6</sup> m <sup>3</sup> /year)	1,200	750	3,300	858	315	4,430	10,853

Source: FAO-AQUASTAT ([www.fao.org/nr/water/aquastat/countries/haiti/index.stm](http://www.fao.org/nr/water/aquastat/countries/haiti/index.stm))

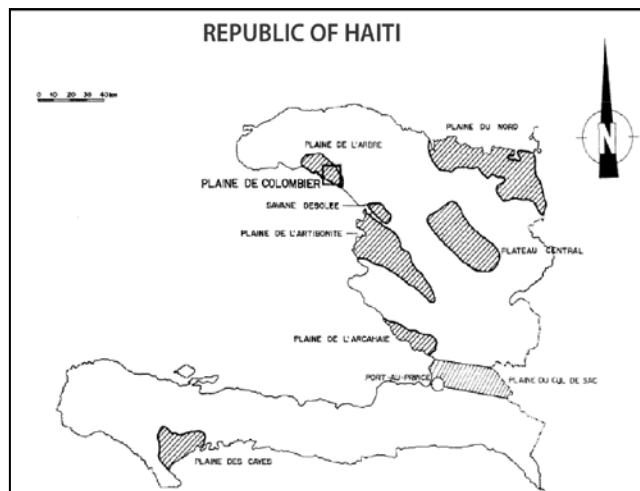
The most important river is the Artibonite River. It has its source in the western part of Hispaniola and stretches across two Haitian provinces: Centre and Artibonite. It is very important to Haiti since it irrigates numerous farms as well as provides electrical energy, for example, to the Péligre hydro-electrical plant, an artificial reservoir located in the Central province. These installations supplied, up until the 1980s, Port-au-Prince with most of its electricity, and in recent decades, they have become less efficient mainly due to silt deposits caused by the erosion of the Artibonite River watershed.

### 1.1.2 Underground Water

- Underground water comes from the infiltration of rain which seeps into the soil. It seeps through the pores, micro-fissures and fissures of rocks, moistening the deepest layers until they reach an impermeable layer. Then, it accumulates, filling and saturating the subsoil, thereby forming an underground water reservoir called an aquifer.
- In Haiti, during a period of 25 years prior to 1988, geophysical studies on underground water were carried out in most of the alluvial plains. Since then, the Geophysical Unit of the National Water Resource Service (SNRE) of Haiti has pursued this investigation, with the support of the United Nations Project (PNUD/DTCD/HAI/86/003: "Development and Management of Water Resources" (Radstake, 1990a). Within the framework of the project, the SNRE has carried out an inventory of Haiti's hydrological and hydro-geological data and as well as drilling surveys as well as geophysical exploration studies for underground water in seven alluvial plains of Haiti.

- Underground water is generally found in abundance across the plains and valleys of the country, but the availability of fresh water in the mountainous areas varies considerably; it may be plentiful or scarce (PAHO/WHO, May 1996, pp. 21 and 22). The alluvial plains and valleys make up approximately 17% of the country's territory and account for 84% of its available underground water reserves (R. B. Knowles et al, 1999). The mountainous areas have many types of aquifers, such as aquifers that are karstic, fractured, with low permeability, and also igneous aquifers. Therefore, there are:
  - The karstic areas and extremely fractured aquifers: 15% of the country and 2% of available underground water reserves.
  - The less-fractured and discontinuous aquifer areas: 25% of the country and 12% of the available underground water reserves.
  - The low-permeability areas and igneous aquifers: 42% of the country and less than 1% of the available underground water reserves.

**Figure 34: Map of Locations of SNRE geophysical studies.**



Source: F. Radstake et al. 1992

Underground water is also abundant. In fact, these reserves account for more than 2 km<sup>3</sup> annually. Its decrease is an important topic as, due to deforestation, groundwater is not sufficiently refilled and in some regions, water is

excessively withdrawn. This is the case of the Cul-de-Sac Plain, located on the outskirts of Port-au-Prince, and which supplies a large area of the city from its underground water.

**Table 17: Underground Water Distribution by Year and Hydrographic Region**

	N-O	N	C-N	C-S	S-E	S-O	Total
Surface (km <sup>2</sup> )	4,580	2,450	7,200	3,240	1,810	8,470	27,750
Underground water (10 <sup>6</sup> m <sup>3</sup> /year)	100	250	500	242	495	570	2,157

Source: FAO-AQUASTAT ([www.fao.org/nr/water/aquastat/countries/haiti/index.stm](http://www.fao.org/nr/water/aquastat/countries/haiti/index.stm))

The following figure shows underground water distribution on a national scale with special

attention given to general and local abundance of water.

**Figure 35: Underground Water Resources**



Source: United States Southern Command, 1999

**Key:**

**1** Water volume of the alluvial aquifers and limestone quaternary in the North plain, the Artibonite river valley, the Gonaïves Plain, the Cul-de-Sac Plain and in the coastal plains and fluvial valleys. The water-table is generally less than 50 m deep.

**2** Insufficient water volume on the Bonbardopolis Plateau and the Gonave and Turtle islands, and the karstic or extremely fissured limestone throughout the country. The depth of the water-table generally varies between 5-25 m, but can reach 200 m in the mountainous areas.



**3** Insufficient volumes of water in limestone, sandstone, conglomerate and schist. These units are slightly deformed and unequally fissured. The depth of the water-table generally varies between 5-50 m, but may be as much as 200 m in the mountainous areas.

**4** Insufficient volume of fresh water in the almost impermeable clay; and in the consolidated conglomerate, shale, limestone, and other rocks. The depth of the water-table generally varies between 5-50 m, may be as much as 200 m in the mountainous areas.

**6** Insufficient volumes of fresh water in the igneous and metamorphic rocks. The depth of the water-table can exceed 100 m.

**8** The volume of water in the alluvial aquifers in the North Plains close to Fort Liberté, in the Artibonite delta, in a large part of the Cul-de-Sac Plain around Saumatre Pond, and in other alluvial outlets close to the coast is hardly sufficient. The depth of the water-table generally varies from 10-75 m.

## 1.2 State of Water Resources

The quantity and quality of water resources are adversely affected by excessive exploitation, inefficient management, deforestation and land-clearing.

Much groundwater is contaminated or salty. It is still however used by the population for domestic purposes although it is mostly untreated. Water is supplied to approximately 40% of the population by water supply systems or wells built by the government and non-governmental organizations (R. B. Knowles et al, 1999).

Of the yearly one billion cubic metres of rainfall (MPCE, 2004), only 10% of this quantity filters into the ground as a result of the geology and morphology of some watersheds, as well as environmental problems.

In the industrial sector, more than 4 million cubic metres of water are used yearly, among other things, for beverages (juice, beer). Underground water extracted from almost 800 wells is the main

source of water for this sector (PAHO/WHO, May 1996).

In regard to its use for agricultural purposes, groundwater flows directly into a large number of irrigation systems. The most important agricultural areas in the country are the irrigated plains which include the North Plain, the Fort-Liberté area, the Cul-de-Sac Plain, the Cayes Plain and the smaller valleys of the Artibonite and Estere Rivers (R. B. Knowles et al, 1999).

However, ground water is also used in part for energy production. The Electricité d'Haiti Service (Ed'H), responsible for the electric energy system, is located in Port-au-Prince and limits itself to providing a rotational service by sector during the driest months. There are seven Hydraulic power projects underway in Haiti, accounting for a total 55 MW of power (see Table 10, chapter 1).

### 1.2.1 Exploitation of Water Resources

Over the last decades, Haiti's water resources have been under severe pressure. In fact, the population increase together with the problem of management faced by the public institutions, have allowed private investors to exploit these resources, without the proper methods or necessary operational regulations. As a result, water from some layers is used without the essential measures to guarantee sustained quality and quantity. However, this problem is still localized. The case of the Cul-de-Sac Plain is very representative: the city of Port-au-Prince is largely supplied with water from the watersheds of this Plain, situated on the outskirts of the city, however the distribution is ensured by private enterprises and trucks, and there are hardly any provisions to ensure water-table replenishment and a constant quality of water. The similar situation exists in the Gonaive Plain, in the Artibonite Province. The possible deterioration of the water resources is inevitable and could result in the difficulty of supplying water to a significant segment of the population.

**Figure 36:** Water Pumping at the Cul-de-Sac Plain

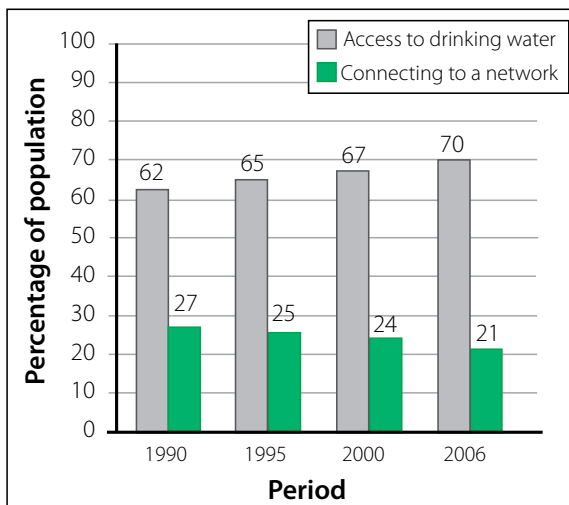


Source: Courtesy of P. Basquiat

### 1.2.2 Drinking Water Supply

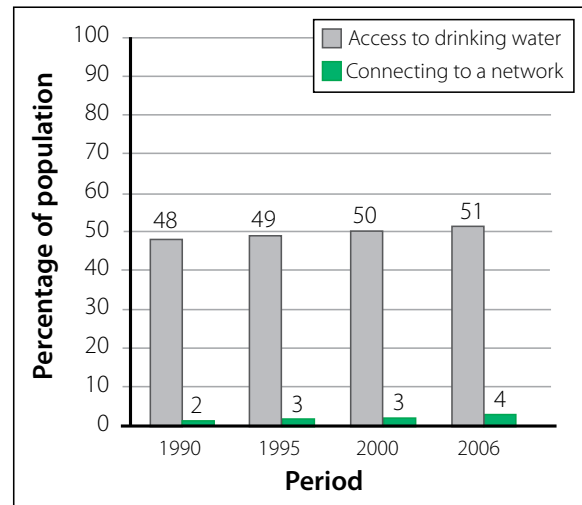
Access to potable water has improved over the past 15 years. The percentage of the urban population with access to water has increased from 62% in 1990 to 70% in 2006. In the rural areas, there is less access and progress has been more modest, from 48% to 51% over the same period. However, this doesn't mean that potable water is directly connected to homes. In urban areas, 21% of dwellings are connected to a network, while in rural areas, the percentage is only 4%. The graphs below show the evolution to drinking water in Haiti.

**Figure 37:** The Access of Urban Population to Drinking Water



Source: WHO / UNICEF (2008). Joint Monitoring Programme for Water Supply and Sanitation. Coverage Estimates Improved Drinking Water

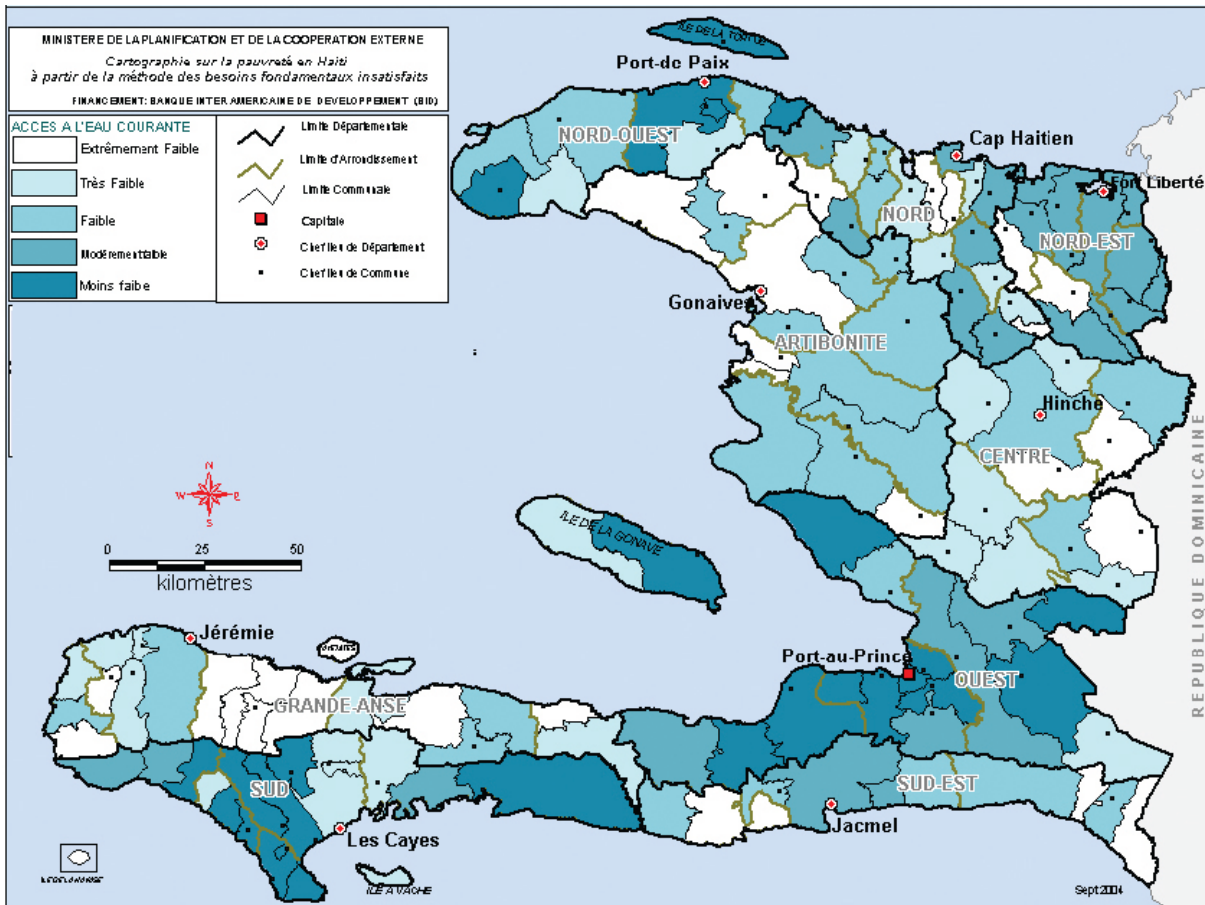
**Figure 38:** Access of rural population to drinking water



Source: WHO / UNICEF (2008). Joint Monitoring Programme for Water Supply and Sanitation. Coverage Estimates Improved Drinking Water

Although the country has registered an increase in access to potable water, particularly in urban areas, this still remains insufficient in relation to the demographic growth. The spatial distribution of access to fresh water is shown in Figure 38.

Figure 39: Map on the Access to Potable water

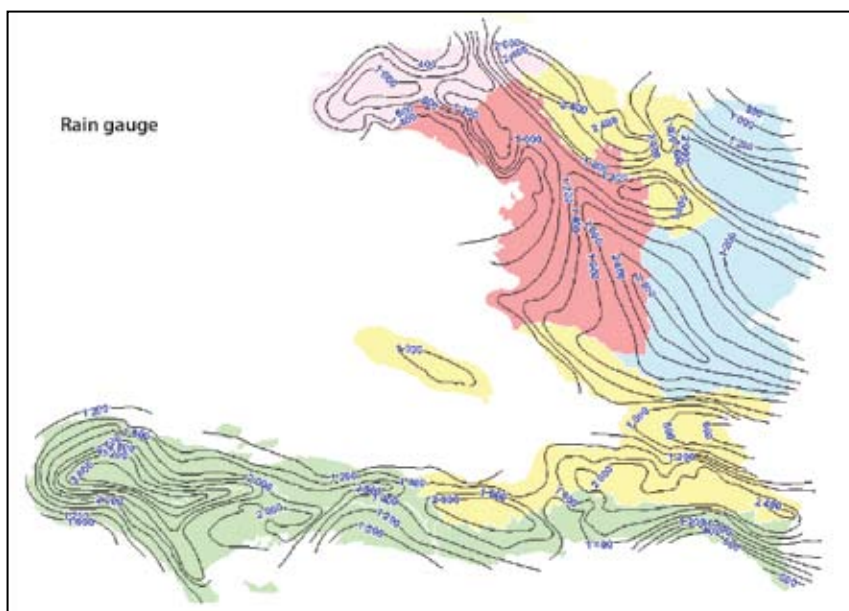


Source: UTSIG, 2004

The disparity in the spatial national distribution of the needs in regard to water is no small matter. Communities in the Artibonite, Central and Grande Anse Provinces, with rare exceptions, have higher overall water necessities than in the North, Northwest and Northeast provinces as well as those in the South, Southeast and the West (Figure 39). The UNICEF/WHO study on water policy in Haiti points out to an increase in demand from now to 2050, a valid estimate if based on the projections that the Haitian population would increase to 16,149,000 by 2050 (IHSI, 2008). This spatial deficiency seems in correlation with the national variations in rainfall (see figure below).

Hydro resource management could be viewed from the perspective of the watersheds which constitute the Haitian main hydrographic units. Upstream, the protection of these watersheds results vital, in particular because of their role as catchment areas. Their bareness only results in a strongly sedimentary torrential rainfall likely to affect the equipment and services of the adjoining areas including deviation services for the irrigation of plains, as these, during periods of drought, become so low that the rivers disappear downstream, with tremendous consequences for the residents of these areas.

Figure 40: Geographical Distribution of Rainfall



Source: UTSIG, 2003

The abundance of rainfall and its annual distribution constitute determining factors on the microclimates of the country. According to D'ANS (1978), 30% of the country's territory receives more than 500 m of rain, while 15% receives more than 800 m, allowing every possible transition, especially at high altitudes, thus increasing its biological diversity

The improved access to potable water is the result of the intervention of the public and private sectors together with the support from Non-Governmental-Organizations. The public organizations are CAMEP and SNEP: CAMEP, responsible for the management of fresh water in the Port-au-Prince metropolitan area, and SNEP, of the secondary towns and rural areas. The main institutions responsible of facilitating the access to water are listed in the following table:

Table 18: Main Organizations Working in Water Sanitation in Haiti.

Organizations	Geographic area of intervention
<b>1. Public sector</b> CAMEP SNEP POCHEP	Port-au-Prince Metropolitan Area Secondary cities and rural environment
<b>2. Non-governmental/international</b> OXFAM GB GRET ACF French Red Cross APPEL	Supplying Cap-Haïtien Supplying communities of d'Aquin and Southern Saint Louis in the Southern Province
<b>3. Private Sector</b> Cooperation and action for sustainable development Action for Sustainable Development	Les Palmes, Delatte, Petit-Goâve, Grand-Goâve  Marigot (Southeast)

Source: unknown

Vegetation cover has deteriorated to the point of bareness, leading to a considerable increase in rainwater run-off. Deforestation has reduced the quantity of water which refills the aquifers, resulting in low underground-water levels. In many areas, this decline resulted in the drying-up of wells and a level of water too low to restore it to a level of less than 300 feet. Although underground water is generally safer than the supply of untreated surface water, many shallow aquifers become biologically contaminated because of poor waste management.

With regard to groundwater, currently lakes and ponds are ecosystems generating enormous environmental problems in Haiti. The main challenges, together with the variation of levels of these ecosystems called "Eaux dormantes" or stagnant waters (Saumatre pond 11,300 hectares and the Miragoane ponds, 1,130 hectares), would be the enormous impacts in terms of damage to agricultural and human settlements in the nearby areas. According to experts, this is due either to the presence of alluvium, the effects of the rain system or human-based activities or even the hydro-dynamism in the aquifers that are in use or no longer in use.

Therefore, taking into account the projected population<sup>32</sup> growth according to recent data, Haiti would be one of nine countries facing a serious shortage of water by 2025. However, the question of shortage is to be seen less in terms of potential and availability but rather in terms of geographic distribution and methods of exploitation, resulting in an inadequate number of water supply systems and of irrigated perimeters and in insufficient sanitation, particularly in the large towns (Gadelle in Emmanuel, 2007).

According to Emmanuel et al (2002), the water problem in Haiti today occurs within a very particular demographic context, characterized by a densely-populated country with people suffering at the same time from poverty, malnourishment and deficiencies in education.

### 1.2.3 Reduction and Unavailability of Water

There has been a marked reduction in water resources in Haiti. Indeed, as a result of the imbalance in the hydrological cycles, caused mainly by deforestation, there has been an increase in rainwater run-off. Consequently, the water-table is now showing a deficit, a situation still not well documented. Watercourses are drying up more easily and undergoing physical modifications as a result of sediments coming from watersheds.

Experts have therefore observed a 50% decrease in water levels (PAHO/WHO, 2003). In addition, some bodies of water have seen their storage possibility reduced. For example, the Péligre Lake, the country's only major reservoir, has lost at least a third of its storage capacity (USSC, op.cit.).

Water is unavailable for a considerable part of the population. During the last decade of the 20th century and two years beyond that, less than 60% of the population had access to drinking water (PAHO/WHO, 2003).

It should be noted that the major problem is not yet the scarcity of water, but its inaccessibility, and when drought further reduces the population's water supply, there is evidence of a certain level of inertia on the part of the institutions concerned.

### 1.2.4 Deterioration of the Quality of Water Resources

The deterioration of the quality of water has reached significant proportions in Haiti over the last few decades. This is manifested in its saltiness, the presence of harmful substances such as faecal coliforms, *Cryptosporidium oocysts*, and heavy metals in the water.

Some underground waters have become salty as a result of over-pumping. The Cul-de-Sac Plain close to Port-au-Prince is one such example. Also, according to some sources, the extraction of

<sup>32</sup> GADELLE, F. *Le monde manquera-t-il bientôt d'eau? Sécheresse. 1995: vol. 6, 1:11-15*

water from the aquifers which supply 50% of the water of Port-au-Prince, contributes to a reduction in the water-table level, and to its salinity, because of the proximity of the sea (200 m). It has been confirmed that the annual rate of increased salinity of the aquifers of the Cul-de-Sac Plain is about 3%. The situation is so severe that some fear that the quality of the water will completely deteriorate and eventually dry up (Emmanuel et al, 2003).

Moreover, other water-tables in the country, such as those in Gonaïves, a town situated in the central region of the country, face a similar situation.

The situation concerning water contamination is still not well documented in Haiti. However, some scientific investigations carried out in the metropolitan area have shed a harsh light on this problem.

It was therefore possible to determine the presence of concentrations of lead, ranging between 40 and 90 µg/liters, in the water distributed by a public company (Emmanuel op.cit.). Also, Basseur et al, 2002 confirmed that coliforms and *Cryptosporidium oocysts* could also be found in some of the water distributed throughout Port-au-Prince. The situation is more or less similar in the case of Les Cayes, as recent studies conducted there revealed the presence of *Cryptosporidium sp oocysts* and *Giardia sp cysts* (Emmanuel 2008). It should be noted that cryptosporidiosis represents 17% of the acute cases of diarrhoea seen in children under 2 years old and 30% of chronic diarrhoea in HIV-positive patients (Pape et al in Emmanuel 2008).

The colour of water also serves as quality indicator, and according to information from the Government of Haiti (2008)<sup>33</sup>, 33% of the population consumes unclean water during the rainy season, more than 23% of people drink cloudy water, and only 42% of the population considers that it always drinks clean water.

Despite insufficient national available data, especially on the poor coverage of waste and excreta elimination, there is a strong possibility that water in Haiti is contaminated, notably by bacteria of faecal origin, especially coliforms (DIMANCHE, 1999).

The supply of drinking water to secondary cities is provided by the national drinking water service (SNEP), but the last bacteriological analyses date back to 1991 (Emmanuel et al, 2002). From samples of 100 ml of water taken from the 19 drinking-water systems, results showed that 5 systems had a number of faecal coliforms ranging between 1 and 5; 4 systems with a number ranging between 6 and 10; 1 system with 11; 5 systems, ranging between 21 and 25; one system with 81 (Mirgoâne), and one system with 110 (Les Cayes).

## 1.3 Impacts Observed

### 1.3.1 Increased Health Risks

Serious health risks are linked to the quality of water in Haiti. Thus, "diarrhoea-related illnesses [due in part to the consumption of water contaminated by bacteria of faecal origin], still represent one of the two primary causes of death in children under 5 years of age (MSPP-PAHO/WHO, MSPP, 2004)". Other infectious illnesses due to "faecal risk" such as cholera, typhoid, intestinal helminthiasis, intestinal protozoosis and intestinal bilharziasis still claim victims in Haiti.

Studies conducted by BRAS (2005) showed the health risks for immune-depressed persons exposed to *Cryptosporidium oocysts* present in the water distributed in Port-au-Prince and its surroundings. Moreover, according to some sources, the chloral treatment of the drinking water distributed by the public water-distribution company is likely to cause the formation of trihalomethanes, a carcinogenic substance, due to the presence of faecal coliforms (Emmanuel et al, 2000).

<sup>33</sup> <http://www.ht.undp.org>

## 2. Sea and Coastal Areas

### 2.1 Geography

According to UNESCO (1998), the country has a very narrow continental shelf, measuring 5,000 km<sup>2</sup>. The underwater topography presents a significant incline. The 200 m isobath which forms the limit of the continental shelf is often located less than 300 m from the shoreline. The length of Haiti's coastline is estimated to be 1,500 km (REPUBLIQUE D'HAITI, 2004).

### 2.2 Potential

Haiti's coastal marine heritage possesses exceptional wealth. It comprises three large ecosystems: hard bedrock occupied by reefs or coral communities, sand beds of seagrass beds, and finally the low-lying wetland coasts, and estuarial zones (Bouchon et al, 2000). Given that the country is located in a tropical zone, mangrove forests were formed in these areas.

**Figure 41:** The coast of d'Aquin in the South



Moreover, Haiti's specific wealth in fish and coral reefs is very high. With territorial waters of more than 30,000 km<sup>2</sup> (REPUBLIQUE D'HAITI, 2004), which exceeds the land mass of Haiti, the country

has a strong fishing potential. In 1990, FAO estimated it to be 14,000 metric tons (Bouchon et al, 2000).

The high-level productivity in the coastal and marine ecosystems of Haiti is recognized. Ottenwalder<sup>34</sup> confirms that "[the] estuaries [located in the central part of the country] are among the largest and most productive in the Caribbean.

### 2.3 Overview

The crisis that exists in the sea and coastal areas of Haiti are many and varied. The overexploitation of mangrove forests and of fishery resources, urbanization, solid waste, soil erosion and the emptying of fuel tanks into the territorial waters of Haiti are mainly the determinants of this situation.

Due to various types of pressure, the marine and coastal ecosystems have been severely impacted. Therefore, the mangrove forests, coral reefs and fisheries are almost completely ravaged or are in serious danger of destruction.

#### 2.3.1 Mangroves

Over the last few decades, the mangrove forests, an exclusive ecosystem of the inter-tropical zone in Haiti, have undergone excessive pressure. According to FAO (2007), they constituted only approximately 20,000 hectares in 1980, and were made up of four mangrove species (*Avicennia germinans*, *Conocarpus erectus*, *Launcularia racemosa* and *Rhizophora mangle*). Nationally, they are all suffering from an irrational exploitation. This is only slightly controlled, as there is no coastal protection in Haiti (see table below).

As early as the end of the 18<sup>th</sup> century, historical documents already referred to mangroves on the coastal strip of Haiti, as being very significant in size, both in terms of length and width (Hatzenberger, 2001). Almost all the coastal areas of the country were covered by mangroves, especially along the coast of the Haut-Cap River up to Quartier

<sup>34</sup> <http://unesdoc.unesco.org>

Morin and at Grande-Rivière, where mangroves expanded over a length of 500 to 600 m.

Mangroves were also visible at Limonade-Cove, Caracol-Bay, Acul Bay (to the west of Cap-Haïtien), along the coast of La Tortue Island facing Port de Paix, along the Saint-Nicolas bank, and at Gonaïves Bay at St. Marc. These extended over a distance of 20 km long and 6 km wide, serving as filters against the deposits coming from the Artibonite, Esther and Salée rivers.

Mangroves forests were also mentioned at Saint Marc l'Arcahaie, extending 15 km to the Bretelles river, as well as from the mouth of the Boucon Brou river mouth, after l'Arcahaie, up to the Croix-des-Bouquets region. Mangroves forests were also found at Port-au-Prince and at the Trou-Bordet River going towards Leogane, and up north towards Source Puante. The small island of Grand-Goave, at the mouth of the Tapion River, registered a low quantity, while the coast of St. Louis-du-Sud, the Cavaillon region, the extreme-South region of Baradere and the area of d'Aquin also had mangrove forests.

The mangroves trees however have been cut down and used as lumber in construction and as firewood for domestic and industrial purposes (REPUBLIQUE D'HAÏTI, 1997). This exploitation began at the end of the 18<sup>th</sup> century when mangroves were used as a source of fuel, for example, on the Arcadins coast (to the north of Port-au-Prince). Some species were used for the fabrication of curves for dinghies and row-boats, as well as in the construction of houses. In other regions, such as Leogane, they were cut down to make the area healthier or more attractive (Hatzenberger, 2001).

The area occupied by mangrove forests in Haiti has been drastically reduced over the last decades, and data from FAO (2007) reveal this. The considerable decline in the country's mangroves is explained in part by the difficult socioeconomic situation of the last decades, and also by the poverty and demographic increase. The table below shows the evolution of the area occupied by mangroves, reduced from 17,800 hectares to 13,000 hectares between 1980 and 2005.

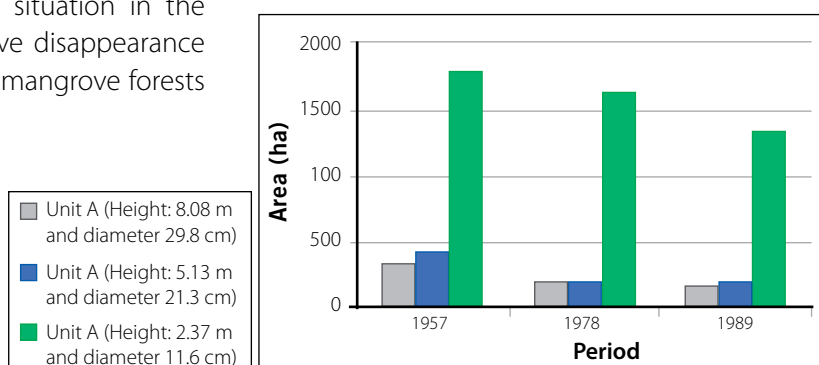
**Table 19: Status and Trend in Mangroves in Haiti from 1980 to 2005**

Most reliable estimate		1980	1990	1980-1990 Evolution		2000	1990-2000 Evolution		2005	2000-2005 Evolution	
ha	Year of Reference	ha	ha	ha	%	ha	Ha	%	Ha	ha	%
15 000	1988	17,800	15,000	-280	-1.7	14,300	-70	-0.5	13,700	-120	-0.8

Source: FAO, 2007 : <http://www.fao.org/docrep/010/a1427e/a1427e00.htm> (Février 2009)

Although not recent, the available data on Caracol, a town in the northern part of the country, follow the same trend as the overall situation in the country, showing the progressive disappearance of one of the largest remaining mangrove forests in Haiti (Figure 42).

**Figure 42: Evolution in the Surface Area of the Different Types of Mangrove at Caracol Bay**



Source: UEH, 1994



A study conducted by the University of Moncton (2001) at Caracol and four other neighbouring sites (Bord-de-Mer de Limonde, Petite-Anse, Riviere Haut-du-Cap and River Salée) showed a reduction of approximately 43% of their mangrove areas, between 1978 and 1998. This situation is the result of an intensive use of mangroves in order to fulfil the energy needs of the population (coal and firewood), of intensive fishing activities and the conversion of the majority of these areas into residential areas.

### 2.3.2 Fishery Resources

In the “Interim Cooperation Framework” (REPUBLIQUE D’HAITI, 2004), the under-development of the fishing industry in Haiti is mentioned. Actually, despite the significant number of people (30,000) who dedicate themselves to fishing, methods have not been modernized, and are still carried out with traditional materials.

Therefore, despite the existence of a territorial sea considered vast, the area within which the fishermen operate is limited to the coastal waters, and does not extend to the high seas. This has

resulted, consequently, in under-fishing. According to the FAO list (1999), among the less-exploited species, are the white shrimp, bottom crab, octopus, groupers, tuna, the istiophorus albicans, and coryphenes, some found at great depths and others that are pelagic ocean resources. Nevertheless, the continental shelf, where most of the fishing takes place, has been depleted due to technical deficiencies and over-exploitation<sup>35</sup>.

Moreover, other practices also encourage overfishing, for example, the use of chemical products, such as insecticides and other herbicides, which are believed to facilitate the catch of fish.

However, according to FOPROBIM et al (2002), the law stipulates the conditions under which fishing activities in Haiti must be carried out. Nevertheless, “the lack of means to enforce it” contributes to a large extent to the situation. The following table, on the results of a study carried out by USAID in 2006, shows the absence of protected areas on the Haitian coastline, compared to other countries of the region, highlighting the situation of the continental shelf with respect to over-fishing (see the table below).

**Table 20: Marine Protected Areas (MPA) in the Caribbean Region**

Country	MPA	Other	Total
Cuba	15	15	30
Dominican Republic	7	4	11
Jamaica	4	0	4
<b>Haiti</b>	<b>0</b>	<b>0</b>	<b>0</b>
Saint Lucia	2	1	3
Trinidad & Tobago	1	7	8
Barbados	1	1	2
Belize	2	0	2
Dominica	1	0	1
Bahamas	9	0	9
St Vincent and the Grenadines	1	0	1
Guadeloupe	1	0	1

Source: USAID 2006

<sup>35</sup> www.fao.org

Fishery resources are therefore in a significant state of degradation and are not being replenished. Similarly, species such as the manatee, sea turtle, flamingos, sharks and dolphins, which are protected internationally, are threatened

(REPUBLIQUE D'HAITI, 2004). Wargny (op. cit.) states that species protected elsewhere, such as some shellfish, are openly captured in Haiti, even if “they are regarded as the least well-known in the Caribbean (BOUCHON, op. cit.)”.

**Figure 43:** Coral Reefs: Estimated Level of Threat in Haiti



Source: WRI, 2005

Finally, the behaviours in relation to the sea and coastal areas of Haiti lead to a scarcity of fishery resources and to the impossibility of using certain beaches.

Over the last few years, the catches from commercial fishing activities have declined in spite of a gradual increase in the number of persons involved. The most acceptable hypothesis for explaining the reduction of catches is the scarcity of resources given the lack of respect for regulations, and of catches exceeding the ecosystem replenishing capacity. Actually and according to FAO (2002), the national fishery production is estimated to be approximately 8,000 metric tons/year, distributed as follows:

**Table 21: Catch Profile**

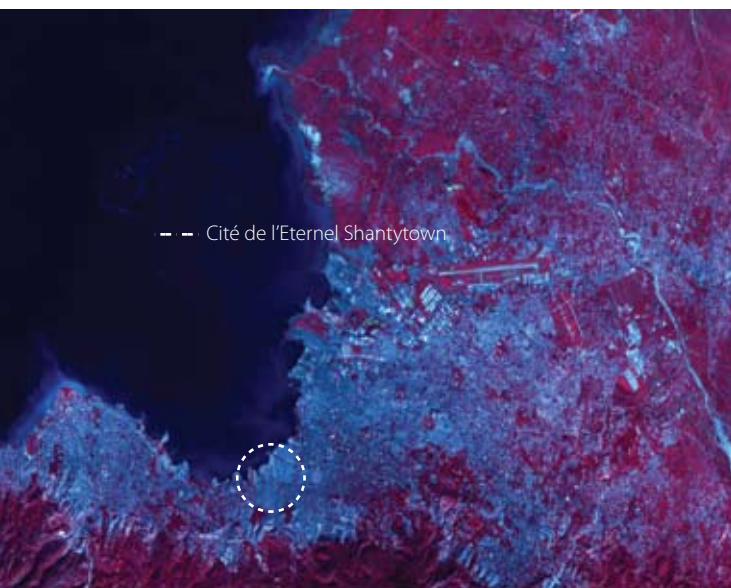
Species Caught	Production in tons
Dermersal and shore fish	3,000
Coastal pelagic	1,200
Ocean pelagic	1,500
Crustaceans (shrimp, lobster, crab)	2,000
Conch	300
<b>Total</b>	<b>8,000</b>

Source: (FAO, 2005)

### 2.3.3 Coastal Occupation

The urban fabric of Haiti has expanded at a sustained pace over the last decades as a result of the acceleration of demographic growth and rural exodus. Nevertheless, this expansion occurred without the adequate planning or the implementation of essential urban services. The figures below show the distribution of dwellings (in grey), in particular the shantytowns which constitute large agglomerations along the coastline of Port-au-Prince. These areas are severely degraded and bereft of vegetation, unlike others (in red), which still are covered by vegetation. It should be pointed out that, prior to the 1980's, shantytowns were almost nonexistent in coastal areas (As in the case of Cité de l'Éternel in Annex 3).

**Figure 44:** Distribution of Dwellings on the Port-au-Prince Coastal Strip in 2007



Source: CATHALAC (2008)

Waste management and illegal occupation of the coastal-marine environment by human settlements have rapidly created major problems in the urban areas of Haiti. Most cities in Haiti are located on the coast and this worsens the anthropogenic pressures on it.

### 2.3.4 Sedimentation

Over the last decades, soil erosion caused by deforestation has intensified. All kinds of sediments

carried down by rainfall end up on the coast. A study carried out by UNDP in 1995 estimated that since 1958, 7.9 million m<sup>3</sup> of sediment load has ended up in the Port-au-Prince bay alone (Haiti Eco-Net, 1995).

The presence of these sediments in the coastal ecosystems contributes to the imbalance in the marine biological diversity. Some researchers attribute to this “coastal hyper-sedimentation, the necrosis of the coral platara, the progressive fossilization of the sea grass, and the scarcity of filtering organisms which migrate to less turbid areas (Saffache, 2006)”.

### 2.3.5 Emptying of Fuel Tanks

The problem of the emptying of fuel tanks into the territorial waters of Haiti is little-known and not well-documented. Some state that the situation is serious however without providing concrete evidence (Holly, op. cit.; Wargny 2004). In fact, the territorial waters of Haiti have been poorly monitored during the past decade, because the relevant authorities, responsible of the issue, have been dismantled.

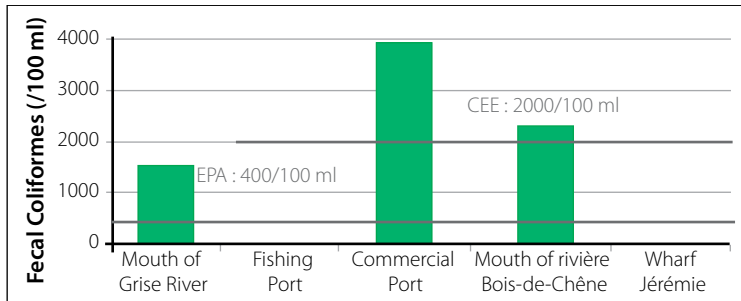
## 2.4 Impact on Ecosystems

The coastal and marine areas of Haiti, which are receptacles for all land-based waste and under all kinds of pressures, particularly from fishermen and other poachers, suffer greatly from human activities. These areas, thus modified, become unsanitary.

The “sewer” management pattern and the collective representation of the sea as a vast sewer, encourage the increasing contamination of the coastal and marine areas of Haiti. Information on the subject is lacking, as mentioned, and little research has been done

However, the few existing investigations on the issue show a worrisome situation. Le Brun (2000) emphasized that these studies showed the presence of faecal bacteria such as coliforms in sea water and that close to the coasts. Others have pointed to the existence of all types of waste, mainly plastics (UNESCO, 1998) and to the presence of used oil residue (MOE-MPCE, 2004).

**Figure 45:** Indicators of Faecal Contamination in the Port-au-Prince Bay



Source: LE BRUN. 2000. Component on "Research and Monitoring of the coastal and marine environment of Haiti". Final Report. Status of pilot sites and recommendations

### 2.4.1 Decrease in the Attractiveness of Beaches

Haiti has an enormous potential for marine and under-water recreational activities. However, the contamination of most of its coastal and marine regions has seriously affected its potential. Many beaches have proven to be unusable (MOE-MCPE, 2004), and to decide to carry-out activities such as deep-sea diving and other nautical sports (ski, surf), or even a simple dip in the sea, could result in exposure to serious health problems.

**Figure 46:** Accumulation of Waste on a Beach



Source: Antonio Perera, 2009

## 3. Forest Cover

Over the recent last few decades, there has been considerably reduction in the plant cover in Haiti. The most reliable sources have estimated the remaining cover to be between 1.5% and 2.6%

of the territory (UNDP/ECMU, 1998, Hilaire 2005). Others state that it is more than 5% (FAO, 2001). Generally, 16% of the national territory is thought to be completely devoid of vegetation<sup>36</sup>.

**Table 22:** Types of Vegetation and their Coverage in Percentage in Haiti

Types of vegetation	Percentage of Haitian territory
Agroforestry	18.3
Forests	2.6
Intensive cultures	44.1
Wetlands	1.4
Mangroves	0.7
Undergrowth	31.8
Pasture	1.1

Source: Hilaire, 2005

Figure 47 shows a predominance of mixed forests and a mosaic of vegetation over a large portion of the country. With respect to crop variation, these are found mostly in the south. The remaining broadleaf forests occupy only a small portion of the country. The rain forests are following the same trend as the broadleaf forests, making the country's situation in terms of forest coverage, a matter of concern. The picture below provides a clearer picture and depicts the harsh reality of a large part of the territory in Haiti. The question to be asked is: Was the country always like this?

**Figure 48:** Haitian Mountainside



Source: J.V Hilaire 2005

<sup>36</sup> www.ht.undp.org

Figure 47: Map on Land Occupation



Source: CNIGS, 2009

The evolution in the Haitian plant cover was rapid. According to information from 2003, in the 15<sup>th</sup> century, 85% of Haiti's territory was covered by trees (Barthelemy, 2003), this percentage falling to 75% at the beginning of the French colonization towards the end of the 17<sup>th</sup> century (Hilaire, 1995).

Throughout the colonial period, from 1664-1803, the natural low-lying natural forests were replaced by cane fields, while the mountainous areas, less accessible, with coffee. According to Magny (1991), the Haitian forestry coverage was estimated to be around 50% at the end of this period. Forest-

clearing activities may also be explained by the existence of a significant demand for wood energy for the traditional sugar cane distilleries (guildives), already in operation during the Spanish era (D'Ans, 1987).

At the beginning of the second half of the 1950s, forestry cover already occupied only 20% of the Haitian land space<sup>37</sup>. Less than 30 years later, in 1978, Haiti was already considered a sparsely-forested country (FAO, 2005a). Consequently, a study was conducted by the MOE and the BME (2007) to determine the state of the forest cover up until the year 2000, not only in Haiti, but also at regional level.

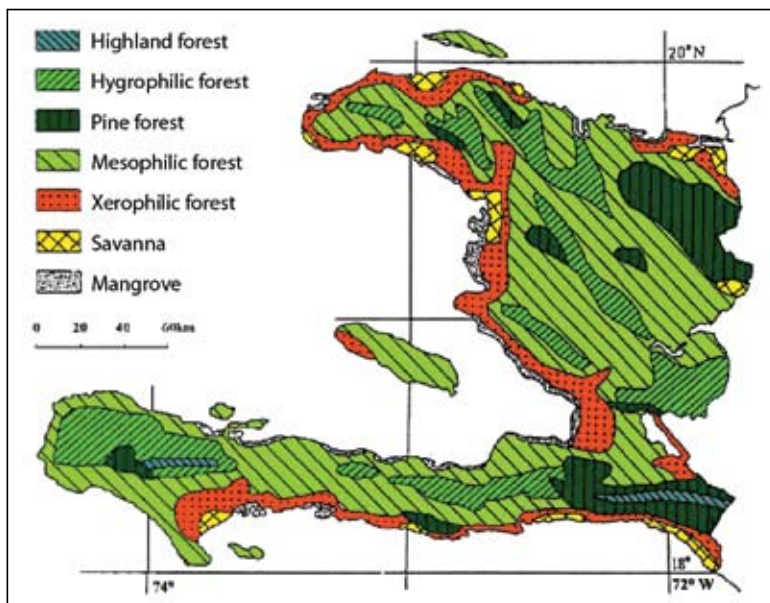
<sup>37</sup> www.ht.undp.org

**Table 23: Statistics on Forests**

Forest Areas and Changes	Haïti	Central America and the Caribbean
Total forest area, 2000 (000 hectares)	88	78,737
Natural forest area, 2000 (000 hectares)	68	76,556
Plantation area, 2000 (000 hectares)	20	1,295
Total area of solid land, 1950-1981 (000 hectares) {a}	70	138,063
Changes in the forest area:	-44%	---
Total, 1990-2000	-53%	-11%
Natural, 1990-2000	5%	-11%
Plantations, 1990-2000	----	0%
Original forest {b} as a percentage of total land area {c}	93%	67%
Forest area in 2000 as a percentage of total land area {c}	3%	29%
Area of forestry coverage (000 hectares), 2000.		
Note: Data concerning the forestry coverage is obtained using methodologies that are different from those used to calculate the forestry area above. These two types of calculations may vary significantly.		
<b>Soil area with forestry coverage:</b>		
Above 10%	2,251	175,478
Above 25%	1,196	134,045
Above 50%	225	72,537
Above 75%	85	38,012
<b>Ecosystem areas according to type:</b>		
Total land area	2,775	271,325
<b>Percentage of total land area covered by:</b>		
Forests	12%	34%
Shrubs, savannahs and grasslands	29%	41%
Cultivated land mosaic of cultivated land and natural vegetation	42%	22%
Urban and built-up areas	0.1%	0.1%
Sparse or unproductive vegetation; snow and ice	0%	1%
Swamps and water bodies of water	16%	3%

Source: MOE et al. 2007 (ESMAP) in Earth trends

**Figure 49: Map of Likely Vegetation in Haiti at the Beginning of the Colonial Period**



Source: HATZENBERGER, 2001

The table above highlights a 53% reduction in 2000 of the existing forest area in Haiti before 1990, while for the rest of the region, the reduction was only of 11% during the same period. It also shows that, in addition to being reduced, the areas covered by vegetation are excessively exploited. With regard to the country's ecosystems

### 3.1 Complex Origin of Degradation

The causes of the plant cover degradation in Haiti have been denounced by both experts and population. These are multiple and complex, and generally due to the low economic level of the majority of the population.

#### 3.1.1 Sustained Demand for Wood Energy

The first cause mentioned rests on one of the foundations of the Haitian economy: the energy habits of scores of small- and medium-sized enterprises, of the average Haitian, and possibly also, of almost all residents country.

More than 70% of the energy needs of the country come from wood or coal (SAINT-JEAN, 1998). This situation is all the more serious as there is presently no energy forest, which means that the supply of firewood is continually taken from the remaining wooded areas. In the year 2000 alone, the necessary production for this consumption was 1,978,000 m<sup>3</sup> of firewood and coal (FAO, 2005a). Yet, at present in Haiti<sup>38</sup>, between 15 and 20 million trees are still cut down each year.

However efforts have been made, in particular by the Mining and Energy Bureau (BME), to convert the laundries and bakeries' thermal combustion systems to other sources of fuel, such as diesel.

Nevertheless, the obstacles to these efforts are generally of a financial nature as the majority of small and medium size-enterprises do not have access to credit. Attempts at technology-transfer and of modifications within household energy-habits include improved wood or coal fireplaces,

or propane gas stoves (LPG) or kerosene stoves, solar water- heaters and stoves, and photovoltaic current generators. However, these efforts have not yielded any conclusive results, due to "institutional problems and the absence of fiscal and legal incentives" (MOE/BME, 2003).

#### 3.1.2 Agriculture

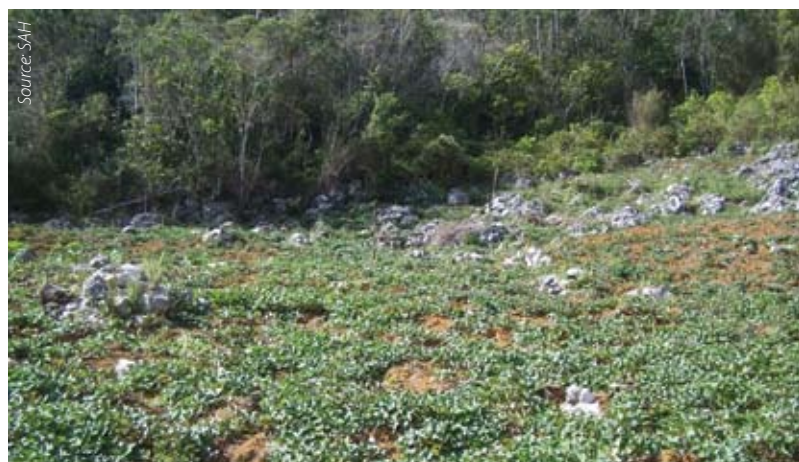
In the opinion of specialists, land-clearing would be the second cause of forest and woodland regression in Haiti. Farming requires land and this is also the most important economic activity in the country. Therefore, non-agricultural vegetation cover, found to be of little use, is razed and replaced by crops with greater market value.

Over the years, due to the population explosion, people have become more and more involved in farming and, in turn, similarly, more and more areas are cleared. On the other hand, the practice of land inheritance, throughout generations, by plot parceling, has led to land- clearing in order to gain additional space.

Another feature of Haitian agriculture is that the land is characteristically fallow for short periods. In order to maximize the income from his land and meet his many obligations, the farmer may ignore the positive impact of this practice. Thus, the productivity of the land declines yearly. Ultimately, the farmer is left with almost sterile plots.

Facing with this situation, the destitute farmer moves on to other unexplored areas and begins land-clearing activities, and the destructive cycle continues.

**Figure 50:** When Agriculture Nibbles into Forest Areas



<sup>38</sup> [www.ht.undp.org](http://www.ht.undp.org)

### 3.1.3 Fires and Forest Fires

According to available reports, and based on an analysis of the causes of the degradation of forest areas, seemingly fires are not a significant factor. However, in the past and regularly in summertime, major fires have broken out in the few forest reserves in Haiti (Forêt des Pins, Park La Visite, or Park Macaya). These are generally wildfires.

However, there have been cases of fires being deliberately set. This practice is the fastest way to clear an area for farming. Afterwards, with the slightest wind, almost all of the burnt trees collapse.

**Figure 51:** Forest Fire in La Visite Park



### 3.1.4 Demand for Wood in the Construction Sector

Another important second reason for widespread deforestation and land-clearing in Haiti is the demand of wood for construction purposes. This has intensified in recent years due to demographic pressure.

Wood is used mainly as struts and facings in construction. In 2000, construction needs in Haiti accounted for 14,000 m<sup>3</sup> of sawn timber (FAO, 2005).

In recent decades, the use of metal struts has been introduced into the country (FAO / EC, 2000),

however the shortage of this material has meant that this is not yet widespread.

**Figure 52:** Illegal Logging in a Pine Forest



According to some reports, some political regimes could have contributed to deforestation and tree-cutting in the country. To combat rebel activities and guerrilla warfare, the state autocratic authorities between 1957 and 1986 could have contributed significantly to the reduction of the plant cover in Haiti (DOMINIQUE, 2005). This theory is still today a matter for debate: What was the degree of participation or involvement of some political regimes in the process of deforestation in Haiti?

## 3.2 Impacts

### 3.2.1 Weak production capacity

The consequences of the situation described above are disturbing. Mountains form the bulk of the physical geography of Haiti, but such topography also predisposes the land to water erosion. Thus, the razing of the forest cover considerably increases this phenomenon, a situation which will be described in the next chapter.

The loss of vegetation has significantly affected the country's agricultural activities, and has changed its physical environment, i.e. the agro-biological environment.



It is a well-known fact that forest trees are important to soil improvement, to the biological control of pests and other diseases, to the promotion and establishment of microclimates favorable to cultivable rain-fed plants, and to the regulation of the water cycle and soil conservation. All these functions are affected by the destruction of a vegetation cover (SAFFACHE, 2001), as recognized by FAO (2001), which has declared that the degradation of natural resources threatens agricultural productivity.

In addition, the virtual absence of forests is not without consequences to a country's hydrologic ecosystems, and actually, the entire water cycle is affected. Despite the abundance of rainfall and fairly good spatial distribution, some springs and rivers which formerly had a constant flow in Haiti, now literally dry up during certain periods of the year (USSC, 1999). On the other hand, heavy rains cause the level of rivers to rise and floods have caused enormous loss of lives and of property. Several floods have been recorded over the last twenty years: in the south of the country in 1986, and in the capital in 1987 and 1988 (MAGNY, 1991). In the Southeastern region and in the Artibonite province, thousands of persons died as a result of floods in 2002, 2004 and 2008.

## 4. Biodiversity

The concept of biodiversity encompasses three overlapping components. These cover the range of ecosystems (ecosystemic diversity), of all species of living things (specific diversity) and the full spectrum of the genetic heritage (genetic diversity). In this regard, Haiti is particularly noteworthy. The country abounds in various species of fauna, flora and micro-organisms, which indicates a genetic heritage replete with varied ecosystems. However, as a result of overexploitation of the environment, the country's biodiversity continues to be eroded – a situation that requires urgent protection measures and careful attention.

The country is endowed with an enviable biodiversity which is an undeniable asset. (Erllich et al., 1986). In fact, its insularity and mountainous terrain give rise to a multiplicity of microclimates that some might call "biological or living jewels".

The main protected areas of Haiti represent approximately 0.5% of the territory. These are distributed throughout the country, as indicated in the following table:

**Table 24: Main Protected Areas in Haiti**

Name	Type of habitat	Area (hectares)	Year established
Fort Jacques and Fort Alexandre	Historical	9	1968
Fort Mercredi	Historical	5	1968
La Citadelle, Sans Souci, Ramiers	Historical and mountain site	2,200	1968
Sources Cerisier et Plaisance	Hot springs	10	1968
Sources Chaudes	Hot springs	20	1968
Sources Puantes	Hot springs	10	1968
Lac de Péligre	Artificial lake	100	1968
Parc La Visite	Tropical rain forest and pine forests	3,000	1983
Parc Macaya	Tropical rain forest and pine forests	2,000	1983
Forêt des Pins	Pine forest and mixed forestry reserve, harvesting currently illegal	5,500	1983
<b>TOTAL</b>	-	<b>12,854</b>	-

## 4.1 The Eco-regions of Haiti

Haiti possesses six ecological regions: the rainforest, the dry forest, the pine forest, the mangrove and the wetlands are the five land-based eco-regions. The marine eco-region contains animal and plant species as well as coral reefs<sup>39</sup>.

### 4.1.1 Rainforests

Rainforests originally occupied 3/5 of all original vegetation of Hispaniola. Presently in Haiti, the vestiges of these forests can be found on the Tiburon Peninsula in southern Haiti, of capital importance to the habitats in this region for the conservation of endangered species (World Wildlife Fund).

These forests are home to flora and fauna, some of which are endemic to Hispaniola or to a section of the island. Among the main fauna species are mammals such as the hutia or Zagouti (*Plagiodontia aedium*), endemic to the island and on the IUCN Red List. There is also the Solenodon (*Solenodon paradoxus*), endemic to Hispaniola<sup>40</sup>, birds such as the parrot of Hispaniola (*Amazona ventralis*) and the Trogon Damoiseau (*Priotelus roseigaster*), both endemic to Hispaniola and currently endangered, and some twenty types of bats, native to Hispaniola.

Unfortunately, forest fires, the use of plants as firewood, the expansion of farmland and of livestock grazing, as well as hunting have caused the destruction of their habitat and a net decline in the number of rainforests<sup>41</sup>.

### 4.1.2 Dry Forests

Vestiges of dry forests are still to be found in Haiti's Morne St Nicolas (Northwest). A variety of trees and shrubs such as Bayahondes (*Prosopis juliflora*), the gum tree (*Bursera simaruba*), the acassia (*Cassia macracantha*), tamarind (*Tamarindus indica*) and basswood (*Simaruba glauca*) can be found as well

as various varieties of cacti such as the (*Pilosocereus polygonus*).

**Figure 53:** An Example of Dry Forest



Bird life in Haiti is particularly remarkable, and we can cite: the dusky Thick-knee (*Burhinus bistriatus*), a very discreet specie, which feeds on insects and small lizards; the slave palm or palm bird of Hispaniola (*Dulus dominions*) which is endemic to the island; a parrot endemic to the island (*Amazona ventralis*) and the master-wood owl (*Asio stygius*) which is also endemic and on the list of critically endangered species (Latta et al, 2006). Human activities such as the expansion of agricultural and human settlements have greatly contributed to their reduction.

### 4.1.3 Pine Forests

Pine forests are to be found in La Visite Park (La Selle mountain range) and in the Pine Forest (Southeast Province). They are also present in Macaya Park (La Hotte mountain range, South Peninsula). One type of pine, the *Pinus occidentalis* is endemic to the island. These pine forests are found at elevations above 2,000 m (the La Selle

<sup>39</sup> [www.panda.org](http://www.panda.org) et [www.nationalgeographic.com](http://www.nationalgeographic.com)

<sup>40</sup> [www.panda.org](http://www.panda.org)

<sup>41</sup> [www.nationalgeographic.com](http://www.nationalgeographic.com)

mountain range at 2,680 m and the La Hotte mountain range at 2,347 m) which provide a temperature of a few degrees lower.

**Figure 54:** Pine Forest



These pine forests are home to several rare species of birds, many of which are endemic to Haiti. There are a large number of breeding birds such as: Ridgway's Hawk (*Buteo ridgwayi*), an endemic and critically endangered bird, the parrot or parakeet Mistress of Hispaniola (*Aratinga chloroptera*) endemic and threatened of extinction; the Tody Recorder (*Todus angustirostris*) endemic to the island; the Musician bird or Solitaire Whistler (*Myadestes genibarbis*), the La Selle Thrush (*Turdus swalesi*) and Mountain Tanager (*Xenoligea montana*), both endemic to Hispaniola, and threatened of extinction.

These forests, alike the previous regions, are not immune to the devastating effects of agriculture, free-range livestock rearing, use of fuel wood and the establishment of sawmills within the park<sup>42</sup>.

#### 4.1.4 Wetlands

Haiti has several wetlands, of which the most important are Étang Saumâtre (Brackish Pond), or Lake Azuei (170 km<sup>2</sup>) located in the West Province, near the Dominican Republic border, and Étang Miragoâne (Miragoâne Pond- 7 km<sup>2</sup>) located in the Province of Nippes, in the south of the country. Lake Azuei arose from the backflow of water from the sea and Étang Miragoâne consists of water trapped in a depression brought by major faults. Alike other significant wetlands, the following are noteworthy: Etang Bois-Neuf (Pond), located in the Artibonite Valley, the artificial lake of Péligre, located in the central part of the country; Saut-de-Barril in the Province of Nippes, and Trou-Caïman (Western Province) and other wetlands in the rice fields of the Artibonite Province.

**Figure 55:** Wetland



Wetlands, particularly Étang Saumâtre and Miragoâne, provide the habitat for many water dependent species. Brackish Pond is the primary home to some species of reptiles such as the American crocodile (*Crocodylus acutus*), and aquatic birds such as flamingos (*Phoenicopterus ruber*). In winter, the following migratory species settle there: Willet (*Catoptrophorus semipalmatus*), or Snipe Lesser Yellowlegs (*Tringa flavipes*), the Double-Banded Plover (*Charadrius vociferus*),

<sup>42</sup> [www.nationalgeographic.com](http://www.nationalgeographic.com)

Semipalmated Sandpiper (*Calidris pusilla*), the Great Blue Heron (*Ardea herodias*), the Snowy Egret (*Egretta thula*), Royal Tern (*Sterna maxima*), Caspian Tern (*Sterna caspia*), the Palmchat (*Dulus dominicus*).

These systems are however being increasingly degraded by the agricultural activities carried out upstream, leading to their eutrophication and gradual sedimentation caused by erosion and dumping of solid and liquid waste into the water. The mangroves, mentioned in previous chapters, have not been spared either.

#### 4.1.5 Marine Eco-regions

Marine ecosystems include the coasts, the continental shelf (coral reefs, which are home to many species of fish and crustaceans), beaches, mangroves and sea cliffs. There is little information available on marine ecosystems. We can nevertheless say that these ecosystems are facing high levels of exploitation, either through overfishing of marine species (including sea turtles and manatees) or by the destruction of the mangrove forests which constitute the many species's nurseries.

In regard to urban areas, the state of these environments is of great concern because they constitute a kind of receptacle for the disposal of all kinds of solid and liquid waste. Studies conducted by LAQUE and other tests carried out on the quality of water in the bay of Port-au-Prince, have revealed the presence of phosphate and nitrogen compounds as well as heavy metals resulting from direct wastewater disposal into the marine environment. Their presence represents a real threat to marine ecosystems and are the result of industrial and other activities (LAQUE, 2006). On the other hand, the presence of abnormally high concentrations of pathogenic micro-organisms,

directly responsible for infectious diseases such as fecal coliform contamination, has been reported (LAQUE, 2006).

Increasingly, anarchic construction patterns have led to non-compliance with most basic urbanization regulations and are, among others, one of the causes of this terrible phenomenon.

## 4.2 Very High Levels of Specific Diversity

In terms of global biodiversity, the Caribbean region is recognized as being richly endowed. This also applies to Haiti, a country with a large number of diverse endemic species of flora and fauna.

### 4.2.1 Flora

Scientific research has shown that the Haitian flora is very rich and unique. After Cuba, Haiti and the Dominican Republic are home to the most diverse flora in the Caribbean. Haiti owes this uniqueness to a series of natural events, among which are the constant sea-level variations and specific geomorphological features such as the succession of mountains, plains and highlands. These natural and physical characteristics have led to specific environmental factors that can change abruptly, even over short distances. These physical features are, therefore, the cause of an endemic flora diversity. According to the International Union for Conservation of Nature (IUCN, 1998), Haiti boasts 5,242 species of vascular plants, of which 37% are endemic to the country. It possesses nearly 330 species from the Asteraceae family, 300 species of the Rubiaceae family, 300 species of orchids, 330 species of grass, and 3 species of conifers (see table below). According to Hilaire (2000), in addition to these plant families, others are particularly rich in endemic species such as the Melastomataceae, Flacourtiaceae, Poaceae and Urticaceae, to name a few.

**Table 25: Comparative table of the number of plant species endemic to Haiti and the number of plant species recorded in the world**

Family of Flora	Number of species of flora endemic to Haiti	Number of species of flora inventoried across the world
Orchids	300	25,000
Asteraceae	330	13,000
Rubiaceae	300	10,000
Grass	300	
Conifers	3	

Source: [www.cbd.int](http://www.cbd.int) & [www.botany.org](http://www.botany.org)

### 4.2.2 Fauna

Haiti’s diverse fauna contains more than 2,000 species, three quarters of which are endemic to the country<sup>43</sup>. In 1999, a scientific mission from the Center for Marine Conservation (now the Ocean Conservancy), carried out an inventory on the natural resources of the offshore satellite island La Navase (7 km<sup>2</sup>). There, more than 800 species were found, including many endemic to the island, with some 250 previously unknown. Of the 90 species of spiders present on the island, 25 of these were unknown to the scientific world. Of the 227 species of fish, scientists found 5 unknown until then.

**Figure 56:** South-Western Coast of La Navase Island



Source: [Haiti-2008](http://Haiti-2008)

- Mammals**

The two best-known mammals in Haiti are undoubtedly the Haitian hutia or Zagouti

(*Plagiodontia aedium*) and the giant shrew “Long Nose” (*paradoxus Solenodon*). La Tortue Island is home to a rodent species of the genus *Isolobodon* and an insectivore of the genus *Nesophantes* (REPUBLIC OF HAITI, 2004). In addition, in Haiti, there are 17 species of bats including seven taxa, with species and subspecies, which are endemic to the island. Other aquatic mammals to be found in Haiti include the Caribbean Manatee (*Trichechus manatus*), the Great Sperm Whale (*Physeter macrocephalus* and *P. catodon*), and the two species of Tropical Whales (*Globicephala macrorhynchus* and *G. melas*) (Mignucci-Giannoni, UNEP, 2001). Are also found various species of dolphins including the Atlantic spotted dolphin (*Stenella frontalis*) and pantropical spotted dolphin (*Stenella attenuata*). Until recently, existing data supported the presence in Haiti of the Caribbean monk seal (*Monachus tropicalis*), but after several years of research, the National Marine Fisheries Service of the United States, on June 6, 2008, officially declared this species to be extinct, due largely to hunting.

**Figure 57:** The Caribbean Manatee



Source: [www.usgs.gov](http://www.usgs.gov)

<sup>43</sup> [www.cdb.int](http://www.cdb.int)

**Figure 58:** The Long Nose, a mammal endemic to Haiti



• **Birds**

There are between 230<sup>44</sup> and 260<sup>45</sup> species of birds in Haiti. This diversity was recently confirmed by two scientific expeditions to Macaya Park in 2004 and La Viste Park in 2005<sup>46</sup> which revealed that there are about 12 species in danger of extinction.

**4.3 Unprecedented Losses**

The impact of the loss of biodiversity in Haiti is still little known. However, as previously explained, these threats have been converted into a disaster that could be described as “silent.” However until now, aside some experts in the field of biodiversity in Haiti, very few people seem concerned.

In the absence of scientific data on the issue of the biodiversity erosion and of its consequences, some assumptions can still be made. Regarding the wide-spread use of medicinal plants throughout the country, is it not reasonable to fear a possible exacerbation of some health problems as a result of the unavailability of these curative plants (Republic of Haiti, 2000)? Are not some ecological imbalances due to of the loss of biodiversity, given that species are inter-dependent? Does not the disappearance of some aquatic organisms increase the problem of malnutrition? These critical issues deserve special attention.

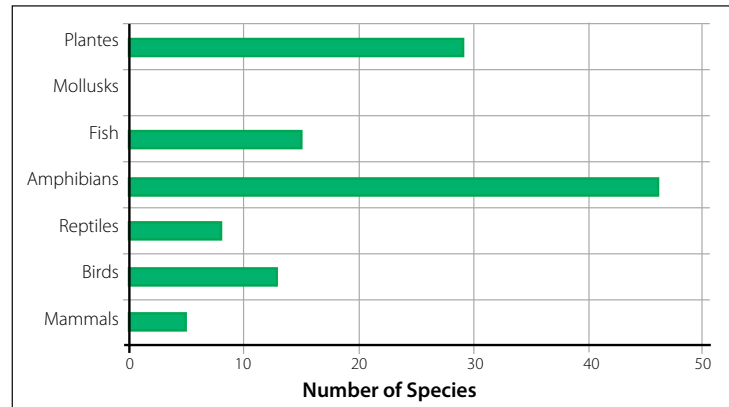
<sup>44</sup> [audubonhaiti.org](http://audubonhaiti.org)

<sup>45</sup> *Clements, in avibase.bsc-eoc.org*

<sup>46</sup> [birdlife.org](http://birdlife.org)

There seems to be quite a number of endangered species in Haiti, not only in terms of their quantity but also of their diversity. As mentioned earlier, nearly 12 species of birds, 28 species of plants, about 46 species of amphibians, 15 species of fish and some 10 species of reptiles and mammals (Figure 59) are in danger of extinction in Haiti.

**Figure 59:** Distribution of Various Endangered Groups in Haiti



Source: *The Red List of IUNC, 2008*

There is very little data on the possible phylogenetic modifications in Haiti. However, there is reason to believe, considering what is happening in some of the neighboring countries, that Haiti could suffer the same fate. The French Press Agency (AFP) published an article dated February 17, 2005, which was quoted by *Le Monde Diplomatique*, on a study carried out by the Central American Alliance for Protection of Biodiversity, and validated by the U.S. Laboratory “Genetic ID”. It reveals that 80% of corn, soybeans and grains analyzed in most Central American countries and in the Dominican Republic were genetically modified. Therefore, there is every reason to believe in the possibility of gene pollution in Haiti.

**5. Soils**

**5.1 Overall situation and main characteristics**

Haiti, as we know, has a steep relief. Indeed, its territory includes slopes that can reach, in some

places, angles of 45 degrees, i.e.100%. The table below gives an idea of the topography of Haiti, in percentages.

Moreover, the country is subject to frequent and heavy rainfall. Indeed, rainfall averages, as

previously indicated, 1,400 mm of rain per year, with some locations receiving up to 4000 mm! Rainfall, on average and annually, occurs over a period of six months, and a combination of these two factors, quantity and frequency, create a natural propensity to soil erosion.

**Table 26: Division of Haiti by relief**

Topography	Slopes	Surface area in hectares	Percentage surface area of country
Plains and plateaus	0% - 10%	806,250.00	29.5%
Plateaus and Foothills	10% - 20%	206,400.00	7.5%
Foothills and steep hills	20% - 30%	148,350.00	5.0%
Steep hills and Passes	30% - 40%	161,250.00	6.0%
Steep inclines	40% and plus	1,444,800.00	52.0%

Source: FAO<sup>47</sup>

Soil degradation seems to be one of the environmental problems Haiti must resolve as quickly as possible. Governments must pay careful attention to this issue because of its intensity and geographic extent. No soil is spared from degradation, even if the country seems to have a limited variety of soils.

According to FAO and MARNDR (1989), the Republic of Haiti globally only possesses four major types of soil, divided as follows:

- Coastal saline soils, not very extended;
- Alluvial soils: Located in the plains, and of variable nature depending on the lithology

of nearby mountains, these are alkaline and high in nitrogen and phosphorus, and low in potassium;

- Red soils from the hills: Made of clay resulting from the weathering of igneous rocks and massive limestone deposits, these are rich in silica;
- Black soils from the hills: These are formed from limestone and chalk and contain slight amounts of organic matter.

Each year, according to UNDP-Haiti, 42 million m<sup>3</sup> of soil<sup>48</sup>, equivalent to 12,000 ha of soil with a depth of 20 cm, are swept away. The government and some experts even talk of “desertification” in some regions (REPUBLIC OF HAITI, 2001).

<sup>47</sup> [ftp://ftp.fao.org/docrep/fao/010/a1250e/annexes/CountryReports/Haiti.pdf](http://ftp.fao.org/docrep/fao/010/a1250e/annexes/CountryReports/Haiti.pdf)

<sup>48</sup> [www.ht.undp.org](http://www.ht.undp.org)

Figure 60: Soil Erosion Risk



Source: CNIGS, 2009

Soil erosion is present in almost all regions of the country. Some are more affected than others, such as Grand’Anse, Southeast, West, Artibonite, North and Northeast, at risk of very severe erosion (Figure 60).

The problem is increased by the loss of the soils’ physical and chemical properties and, consequently, of their productive capacity. This progressive annual decrease has led to a shortfall in the agricultural productive sector (FAO, 2001), which until now had been the mainstay of the Haitian economy (REPUBLIC OF HAITI, 2001). This situation may be attributed to several factors.

## 5.2 Questionable Management of Agro-ecological Systems

### 5.2.1 Destruction of Plant Cover

As mentioned previously, Haiti has been undergoing sustained deforestation and land clearing for several decades, which has led to an unprecedented catastrophe in the history

of a continent nevertheless well-known for its vegetation reduction. Few geographical areas in the country have been spared. However, the uneven topography of the territory predisposes naturally to erosion, and, as a result, with the heavy rainfall in this tropical zone (average 1,400 mm/year), the country’s mountainous slopes are subject to soil erosion by water.

Figure 61: Degradation of Plant Cover on Steep Slopes



Source: Jean Vilmond-Hilaire 2007



## 5.2.2 Inadequate Farming Techniques

Agriculture, as mentioned, is one of the most important economic activities in Haiti, despite the many challenges the country has faced over the years. Agricultural practices are traditional and generally not convenient and new areas are often cleared out in forestry areas. These practices therefore contribute to the physical degradation of soils, notably through erosion, which reduces their physical and chemical capacities and, consequently, of their productivity levels.

### • Too short fallow periods

For the reasons mentioned above, farm incomes have declined steadily over decades and can no longer meet the needs of the farmer and his family. In order to try to counteract this situation, the farmer will seek more and more land, use intensive farming methods and lessen the duration of the fallow period<sup>49</sup>. This practice, once common in Haiti, has been significantly reduced to the point that it has almost disappeared (ROOSE, 1994). Nowadays, the least fertile land is left fallow for a year or two after a crop cycle of one to two years, while the most productive "benefit" from a fallow period of between two and six months (ROOSE, 1994).

This situation has contributed to the decline in soil fertility. According to HILAIRE (1995), soils in Haiti have lost 75% of their productive capacity.

### • Slash-and-burn fields

Haitian agriculture also suffers from a poor use of inputs such as fertilizers. For example, in Haiti, only 19,000 tons of fertilizers were used in 2003 (FAO / WFP, 2005). This obviously contributes to the weakening of agricultural productivity and, ipso facto, there is a consequent fall in revenue. The farmer who is unable to access fertilizers, an

important element of production, will therefore use practices such as the slash-and-burning of fields in order to improve soil quality. Despite the lack of reliable data on the issue, but taking into account the extent of the practice, there is no doubt that significant amounts of farmland are thus affected in Haiti.

It is well known that this harmful practice contributes to the degradation of soils, exacerbates the erosion phenomenon (SAFFACHE, 2001) and increases the loss of the productive capacity of soils in Haiti (ROOSE, 1994).

### • Inefficient land-use

Land management in Haiti, a largely mountainous country, repeatedly has been considered inefficient. It manifests itself by an irrational utilization of land, by the farming on slopes without the use of adequate soil-protection techniques, and by the building of settlements not compliant with regulations. This type of land management has persisted in the mountainous areas in Haiti, a situation worsened by demographical pressure.

## 5.3 Significant Impacts

### 5.3.1 Soil degradation

Soil degradation in Haiti, essentially manifest through its erosion and depletion, is considered as being responsible of a crisis extending well beyond agriculture. According to EMMANUEL et al (2007), the Cul-de-Sac Plain, affected by salinity as a result of excessive pumping, is a clear example of the possible impact of this problem, on agriculture as well as on other human activities in the area. A similar study was conducted on the coastal aquifer at Malpasse, which showed a high concentration of salt in both subterranean and ground water.

<sup>49</sup> In the 1960s, Paul Moral, in a now classic publication, *The Haitian Peasant* (1961), highlighted this situation.

### 5.3.2 Impact on Agricultural Production

It is well known that traditional agriculture –carried out almost without mechanical instruments and based on a multi-crop subsistence farming and animal breeding, as in the case of Haiti– cannot be practiced on land that has lost its top soil, i.e. its arable layer. Water erosion essentially affects this layer of soil as it is the first to be washed away.

This phenomenon of erosion, both in terms of its intensity and its scope, has quickly created a crisis in

the agricultural sector. In fact, the productivity of Haitian soils has shown a steady decline in recent decades due to increased erosion. The table below provides some indication of the magnitude of the problem. Some agricultural commodities have shown the following declines in production between 1980 and 2004: over 30% in the case of bean production (17,000 Mt) and coffee (13,900 Mt); of 21.4% for sorghum (25,790 Mt); and 12% with respect to the production of rice (14,710 Mt).

**Table 27: Comparison between some agricultural commodities' production (1980-2004)**

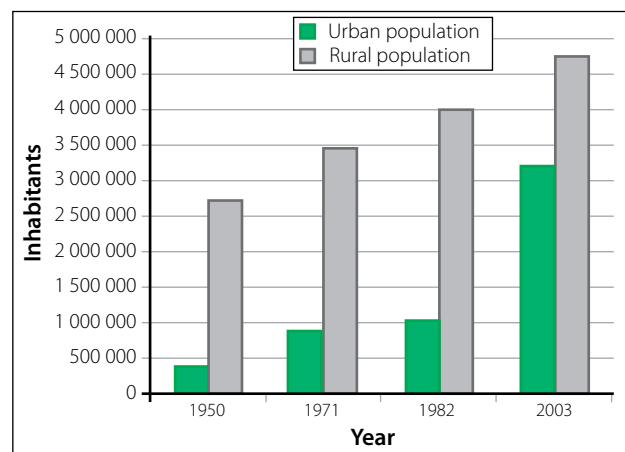
Products (en TM)	Year		Shortfall in 2004 compared to 1980
	1980	2004	
Bean	51,000	34,000	17,000
Rice	119,710	105,000	14,710
Sorghum	120,790	95,000	25,790
Coffee	42,900	29,000	13,900
Mango	326,000	261,000	65,000

Source: [www.faostat.fao.org](http://www.faostat.fao.org)

### 5.3.3 Rural Exodus

Agriculture, as mentioned before, has long occupied a special place in the Haitian economy – and this as far back as when the State was created. Only two centuries ago, the vast majority of the former slaves had made farming their main activity. However, according to statistics, it clearly appears that over the years there has been a decrease in the number of persons involved in agriculture. From 1950 to 2000, the percentage of the population involved in this sector declined from 85% to 62%, and in regard to the urban population, it increased from 12.17% to 36% during the same period<sup>50</sup>.

**Figure 62: Population growth in rural and urban Haiti between 1950 and 2003**



Source: IHSI, 2002 and 2004

Obviously, hasty conclusions should be avoided in establishing a relationship between the decline of the productive capacity of soils and the constant decrease in the percentage of the population involved in farming.

<sup>50</sup> [www.faostat.fao.org](http://www.faostat.fao.org)

The majority of those who no longer practice agriculture now find themselves living in cities. Actually, cities offer more opportunities for the unemployed than rural areas. In the words of Albertini (1987), "poverty in rural areas [of Haiti] is more acute than in urban areas."

### 5.3.4 Poor Infrastructure

All major Haitian cities, with one exception, are all located near the coast, and at very low altitudes. They are also surrounded by imposing mountain ranges which constitute the watersheds.

It is estimated that 16,000 MT of soil are washed away each year (Republic of Haiti, 2001). A large part of this soil passes through the major cities of Haiti, leaving mudslides on the roads and bridges which then become impassable (CPD, 2006). This also affects schools, hospitals and human settlements. The sediment-laden runoff also causes significant damage to the tourism infrastructures and water systems that supply drinking water to urban populations.

Sediment (sand, gravel, stones) interferes with the existing infrastructure and contributes to its deterioration. The most notorious example is the hydroelectric dam of Péligre, first in operation in the 1970s. In fact, "a numerical analysis of the HRV picture of SPOT revealed that in 2000, 27% of the watershed [of the artificial lake feeding the dam] comprised bare soil, 37% of its soil was cultivated or covered by sparse vegetation, and about 30% was covered by tree or shrub vegetation. The observation of aerial photographs from 1978 showed that for the first 22 years (1956-1978), the main sediment bank had progressed to cover almost 5.9% of the total surface of the lake and an analysis of the 2000 HRV image reveals that the sediment in the lake had increased by an additional 7.6 % with respect to the surface area of the lake. [...]. The farming practices of a growing number of upstream residents are one of the main causes of erosion of the watershed, and consequently of the increase in the rate of

lake sedimentation. (LOUIS et al, 2005). Therefore, this dam that used to supply the bulk of the country's electricity is working today at reduced capacity, contributing to less than one third of the electricity consumed in the country.

### 5.3.5 Affected Aquatic Ecosystems

The Haitian topography is such that its waterways have steep slope watersheds. Therefore, a large amount of debris coming from the mountain ranges inevitably ends up in one of these waterways.

As such, the continuing erosion of soil, due to deforestation and land clearing, contributes to the imbalance of many aquatic ecosystems in Haiti. Actually, the sediment carried by runoff following rainfall is discharged into rivers, modifying the riverbeds, damaging plants and destroying the habitat of aquatic animals. The Port-au-Prince bay is one clear example, where the runoff sediment has now filled it up to a height of more than 20 m, thereby reducing significantly the rate of catch by the fishermen in this coastal area, now devoid of its mangrove forests which used to serve as filters against sediment (Holly, in GEORGES, 2008). The problems of sedimentation of the Péligre hydroelectric dam constitute a very pertinent example.

## 6. Mining and Quarrying

### 6.1 Mining

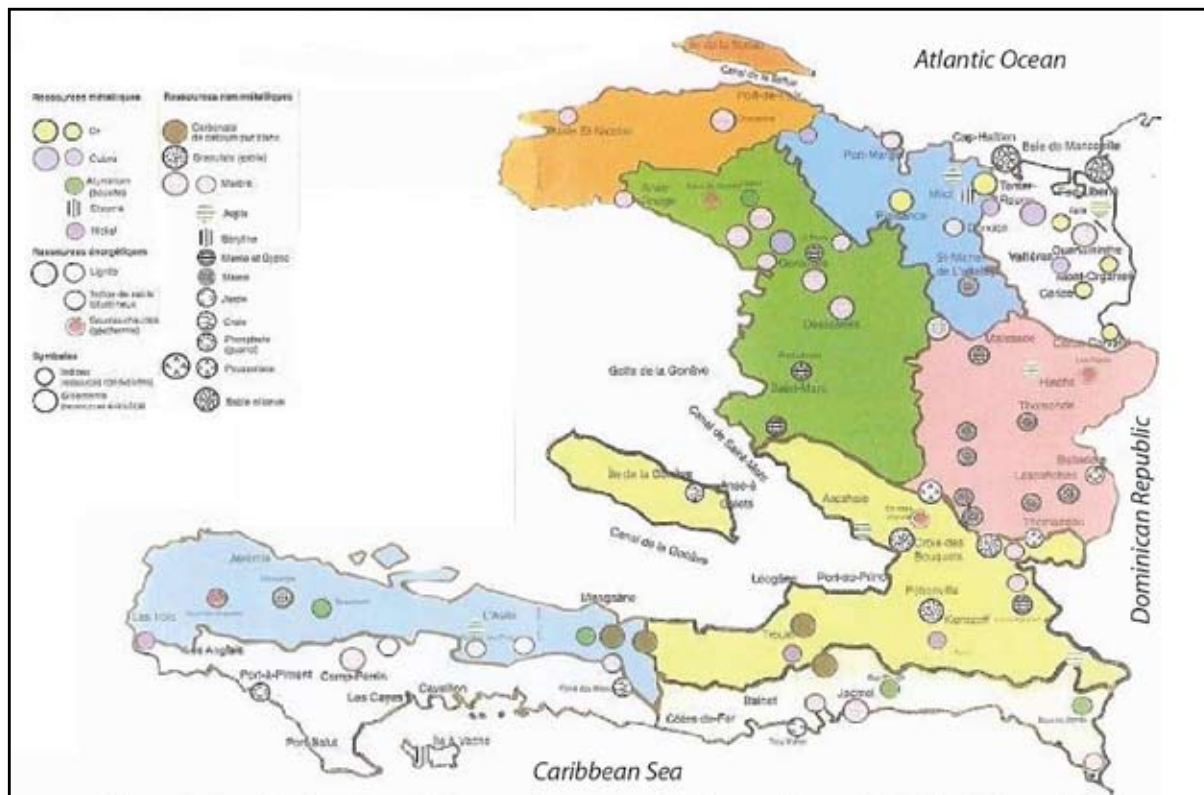
The Republic of Haiti is rich in mineral resources. There are deposits, either inventoried or already being exploited in several locations across the country. Bauxite extraction by the Reynolds mining company that operates on the Rochelois plateau at Miragoâne, and the copper extraction by the Canadian company SEDREN S. A. in the region of Terre Neuve, are examples, among others, that demonstrate the potential of the country in relation to this resource.

### 6.1.1 Types and Geographical Location of Mining Resources of Haiti

The country's mineral resources are well-known and have already been inventoried. They consist largely of metallic and non-metallic substances,

energy-producing substances (fossil fuels) and thermal substances. The chart below shows the location of the country's mineral resources. It should be noted that some provinces contain considerable potential in terms of deposits or indication of metals while others show more modest levels.

**Figure 63:** Location of major deposits and indication of metals in the Republic of Haiti



Source: BME, 2005

The following table highlights the country's metal resources.

**Table 28: Metal Resources in Haiti**

Types	Geographic location	Explanation
Gold	Grand Bois (District of Limbé)	Gold-Silver deposit of 3,500,000 tons of ore containing 2.4 g of Au/ton and 16 g Ag/ton
	Morne Bossa (Milot)	Existence of 1,400,000 t of ore with 2.5 g of Au/t and 15 g of Ag/t
	Trou du Nord	523,000 tons of ore with a content of 14.1 g of Au/t (data giving a preliminary estimate)

Types	Geographic location	Explanation
Gold& Copper	Mémé (Terre Neuve, Gonaïves)	Copper ore – 1,500,000 tons and a content of 2 g Au/t.
Copper	Douvray	85,000,000 tons of ore with 0.53% of Cu
	Blondin	50,000,000 tons with 0.50% of Cu
Nikel	Grand bassin; Presqu'île du Sud; Kenscoff; Trouin; les Irois	Some data obtained but not evaluated
Al	Paillant (South Miragoâne)	Presence of Al as laterite-type bauxite deposits, 2,500,000 tons with 51.1% aluminum et 2.93% silica still available after the period of mining by the company «Reynolds Haitian Mines» from 1957 to 1982.
Other Bauxite deposits	Beaumont (between les Cayes and Jérémie)	Deposit containing 48.0% Al <sub>2</sub> O <sub>3</sub> et 2.4% SiO <sub>2</sub>
	Savannah Zombie (Thiotte)	Deposit containing 48.0% Al <sub>2</sub> O <sub>3</sub> et 6.8% SiO <sub>2</sub>
	Fond Dambi (Gonaïves)	Deposit containing 49.3% Al <sub>2</sub> O <sub>3</sub> et 1.36% SiO <sub>2</sub>

Source: [www.bme.gouv.ht](http://www.bme.gouv.ht), 2005

Non-metallic mineral resources are used in several areas, notably in the construction and cement industries, as a raw material. Deposits of lignite, granite rocks, aggregate, deposits of limestone and marble, clay, gypsum and guano (material formed from the accumulation of seabird droppings) have been identified in many parts of the country. The following ores, among others, have been assessed: CaCO calabash (near Miragoane) at 7.5 million tons; at Paillant (South Miragoâne) at 140 million tons, and Pozzolana Vigie (Saut d'Eau) at 3,200,000 m<sup>3</sup>.

### 6.1.2 Status of Resources

The available data has revealed that the mining resources in Haiti are under-exploited. The minerals for the construction sector seem most exploited although most of these operations are carried out in the metropolitan area of Port-au-Prince.

With respect to legislation, the country possesses regulations on the operation of mines. These,

in force since 1976 and revised in 1990-1991, describe the conditions for granting prospecting, exploration and exploitation permits including the granting of concessions. In this context, a mining concession was signed by the Haitian government granting a concession to the Ste Genevieve Company (SGV) in 1997, and a research permit for a small gold mine at Faille B, and copper ore mines at Douvray and Blondin. To ensure that mining is carried out effectively, laws should not only be adapted to the country's existing situation, but should also be applied as to alleviate the current conditions prevailing in most of the quarries in exploitation.

### 6.2 Quarries

According to specialists, the quarrying and supply of building materials contribute to the environmental degradation in Haiti, yet despite this, extraction methods have not improved. Moreover, governments seem unable to resolve the situation.

Therefore, given the magnitude of the problem, the situation creates a constant risk and the extraction of building materials particularly threatens some highly-populated cities.

The lack of oversight in recent decades regarding the extraction of construction materials, has inevitably led to a significant degradation of the sites and to a serious ecological imbalance. Irrational mining, not to mention illegal of quarries in Haiti, has caused a serious impact on the environment.

### 6.2.1 Types and Location of Quarries

The material extracted from quarries is used mainly in the construction industry. This includes sand and rock, according to the national entity responsible for management of quarrying in Haiti (BME, 1998).

The extraction of these materials is limited to mountains and riverbeds. The mountains account for 80% of sand and rock production, while the other 20% is collected from riverbeds (HOLLY, 1999).

**Figure 64:** Carrière de sable dans la Fontamarat, Commune de Carrefour



The vast majority of quarries (80%) are located in Port-au-Prince (BME, 1998). Approximately fifty active quarries throughout the metropolitan area of Port-au-Prince produce 1.7 million cubic

meters of material whereas total production in Haiti is estimated at just over 2 million cubic meters.

### 6.2.2 Pressure from the Construction Industry

The construction industry, despite the difficult economic situation in Haiti, is still very active. In fact, the demographic pressure is such that it promotes the construction of all kinds of buildings.

This has meant that the number of quarries has increased during the past two decades at an accelerated pace. In fact, the number increased by 52% in the 1980s and by 17% during the first half of the following decade (ibid.), which however, showed a downturn in overall activity due to the economic measures taken by the international community against the country. The quantity of materials extracted from quarries was estimated at 2.5 million cubic meters per year in 2002 (REPUBLIC OF HAITI/SNU, 2002).

However, despite the ever-increasing demand for building materials, there could have been less environmental mutations due to quarrying, if laws and operational guidelines had been respected.

### 6.2.3. Geological Instability

Mountains provide most of the material produced from the quarries, and this has led to their over-exploitation. Some of these mountain ranges even possess slopes exceeding 40°, and there is little respect for the operating rules established by the Mines and Energy Bureau, the institution that controls the extraction of this resource. On the other hand, materials and techniques used in the extraction of construction materials are fairly rudimentary (ibid.).

Consequently, the sites become geologically unstable. There are some reports which mention (HOLLY op. cit.), that “mining in [certain quarries] is being carried out in areas at risk of landslides”.

### 6.2.4 Vegetation

The extraction of building materials from the mountains requires direct contact with the bedrock, that is to say the subsoil area. In order to achieve this, vegetation is inevitably destroyed.

But enterprises do not always comply with these rules, as already mentioned, despite the existence of legislation with explicit prohibitions, also meaning that mining activities are under no protection or rehabilitation programme.

The obvious result of this lack of management within the quarrying sector is, among other things, the total disappearance of vegetation. It is no exaggeration to speak of “a lunar landscape” when speaking of quarry sites.

## 6.3 Serious Consequences

### 6.3.1 Destabilization of the Coastal Ecosystem

Quarries provide raw materials which, depending on their use, will undergo transformations and waste will be produced from the process. This waste, discarded indiscriminately, will be washed down to the sea during rainfall, via drains. Some say that this process contributes to the silting and sedimentation of coastal and marine areas<sup>51</sup>.

This results in the migration of marine animals and the destruction of their spawning grounds. Researchers say that, for example, conches have migrated to less turbid water (SAFFACHE, 2006). There is concern that fishing in Haiti has suffered severely from this problem and that coral reefs are also affected. There is not much quantitative information on the subject, however, it has been confirmed that sedimentation in Haitian waters is causing the necrosis of coral reefs. (Ibid and DESS, 2002).

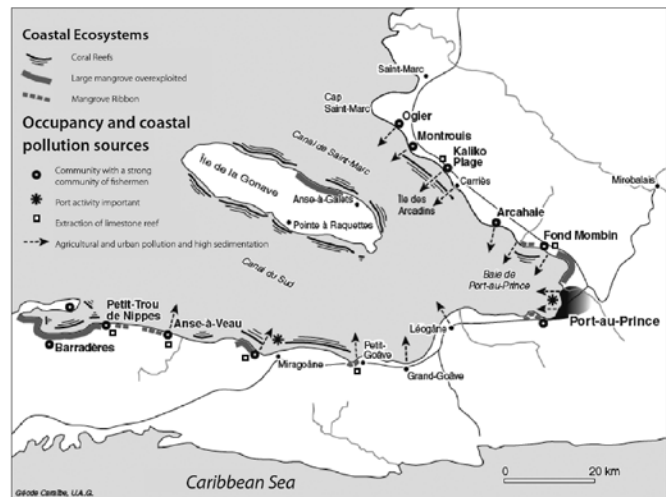
PELOSATO (2005) highlights the decline of coral reefs, together with a reduction of level of light penetration, and a decrease of photosynthesis as

well as in the level of oxygenation in the water. With specific reference to Port-au-Prince, this turbidity and extreme pollution could have caused the death of the coral reefs. Figure 65 shows the endangered ecosystems in the Gulf of Gonâve.

### 6.3.2 Falling Rocks and Landslides

Geological instability, resulting from the disorganized mining activities in quarries, sometimes leads to telluric movements. In fact, rockslides and landslides are very frequent, causing situations often bordering on disaster. Quarries can easily be transformed into dangerous places to work. GEORGES<sup>52</sup> say that landslides occur every day in the quarries, while SAFFACHE and al. (2002) state “that often, dwellings as well as workers are all swept away”.

Figure 65: Endangered ecosystems of the Gulf of Gonâve



Source: DESSE, 2003

### 6.3.3 Erosion

Mountainsides and riverbeds are ideal places for the extraction of construction materials however their geological and natural recovery process takes a long time. Moreover, there is no mechanism nation-wide for the rehabilitation of these environments.

Therefore, the degradation caused by the extraction itself is compounded by erosion from

<sup>51</sup> RÉPUBLIQUE D'HAÏTI/SNU, 2002

<sup>52</sup> Facts relating to the development of the mining sector in Haiti in UNDP/ECMU 1999.

rainfall, as in the case of the banks of the Grise River, to the north of Port-au-Prince (GEORGES. op.cit.). Among other things, a succession of “dismal” landscapes results from the chaotic management of quarries. The figure below shows a typical case of this type of management (BME, 1998).

**Figure 66:** A “dismal” mining landscape



## 7. Atmosphere

Air pollution in Haiti could be considered a secondary issue, compared to the magnitude of other environmental problems. This situation is not well-known and authorities have remained until now virtually silent on the issue. However the problem seems to be rising and deserves serious attention.

In Haiti, air pollutants are varied. These range from greenhouse gases (GHG) which cause an increase in atmospheric temperature, i.e. chlorofluorocarbons (CFCs), which in turn contribute to the destruction of the Ozone layer (MOE, 2001). Furthermore, it is believed that other compounds, such as solid aerosols, particles of dust from the roads, persistent organic pollutants (POP) released during the combustion of waste (furans, dioxins) or from spraying and application of pesticides and heavy metals are also present.

Moreover, the composition of the atmosphere varies depending if rural or urban, with pollution

more intense in urban areas, as a result of industrial activities and intensity of traffic. Available data indicate that approximately 40,000 vehicles use the country’s main inter-city highway, while less than 2,000 use the secondary highway and around 800 automobiles use the other networks (REPUBLIC OF HAITI, 2004).

Therefore, despite the lack of data, one can easily imagine the level of air pollution in the cities in Haiti, especially Port-au-Prince, where most of the country’s economic activity is centralized.

### 7.1 Multiple Sources

The emission of air pollutants results from multiple activities, the most obvious being: traffic, industrial and agricultural processes, domestic activities and the incineration of waste.

#### 7.1.1 Vehicular Traffic

Road traffic has increased in recent decades; during these last fifteen years, the car fleet has increased fivefold and represents about 200,000 motor vehicles, powered by fossil fuels (Republic of Haiti, 2004).

Furthermore, usually vehicles are poorly maintained, and the authorities confirm that very few drivers submit to the regulations regarding maintenance. They recognize, moreover, that “the situation is serious enough that regulatory actions be considered (MOE, 2001)”.

Very limited control is exercised over the system of motorized transport in Haiti, and this lack of control together with an increase in vehicular traffic, have contributed to air pollution. For example, in 1994 (BME 2001), emissions amounted to 92 Gg of carbon dioxide (CO<sub>2</sub>) and 39 Gg of sulfur dioxide (SO<sub>2</sub>) as a result of transport in Haiti.

Pollution, however, is concentrated mainly in cities since the inter-city and rural traffic is much less intense (Republic of Haiti, 2004).

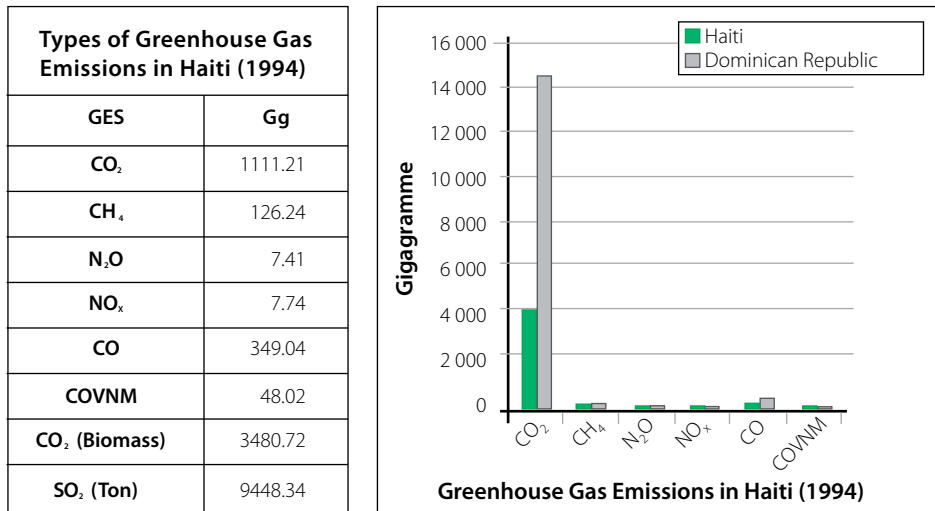


### 7.1.2 Industrial Activities

Industrial activities also contribute to the pollution of the atmosphere. Carbon dioxide CO<sub>2</sub> seems to be the primary air pollutant emitted by industrial activities. Therefore, based on data from 1998 to 2003<sup>53</sup>, industries represent 19% of CO<sub>2</sub> emissions

in the country while the areas of transport, electricity and housing account for 51%, 13% and 17%, respectively. In 1994, (MDE, 2000), the country contributed 9,448.34 Gg to air pollution from sulfur dioxide SO<sub>2</sub>. Overall, Haiti emits lower levels of CO<sub>2</sub> than the Dominican Republic (4,000 Gg as against 15,000 Gg) (Figure 67).

**Figure 67:** Greenhouse gases emitted in Haiti and Dominican Republic in 1994



Source: MDE, 2000

Many small and medium-size industries, notably traditional distilleries, bakeries, oil mills and laundries, mainly use firewood as energy source. According to Saint-Jean (1999), at the end of the last century, distilleries burned 240,000 tons of wood annually, bakeries 120,000 tons, oil mills 50,000 tons, and laundries, 20,000 tons.

It wouldn't be an exaggeration to say that carbon dioxide emissions from industrial activities result, to a large extent, from the combustion of wood.

### 7.1.3 Agricultural Pollution

Agricultural activities also seem to be responsible for air pollution in Haiti. Even if the use of pesticides and fertilizers is not widespread, it is feared that during their application, some of these accumulate in the atmosphere. On the other hand, the widespread practice in Haiti of slash-and-burn cultivation, which consists in

burning the plant biomass at soil level in order to improve it, contributes to air pollution by the release of CO<sub>2</sub> into the atmosphere.

### 7.1.4 Patterns of Household Energy Habits

Households also use wood or charcoal as energy sources. Wood is limited mainly to rural and marginal urban areas, unlike charcoal, which is widely used in urban areas. However, wealthier households may combine charcoal with propane gas.

For example, in 1994, according to the BME (2001), domestic activities resulted in emissions of about 29 Gg of the gas in the atmosphere. Also, over the same period, emissions of 10 Gg of methane, 18 Gg of methane volatile organic compounds (NMVOC) and 196 Gg of carbon monoxide were also caused by domestic activities. Compared to

<sup>53</sup> Haiti energy figures: <http://www.bme.gouv.ht>

emissions from other countries in the Caribbean region, these figures still remain relatively low.

### 7.1.5 Waste Disposal

The insalubrious situation of the urban agglomerations, these past twenty years, had been quite unusual until then. Nowadays, waste, mostly household, is accumulated at a rate that is far higher than the one at which it can be collected. To compensate for the inefficiency of disposal services, incineration is seen in many cases as the immediate solution. It should be noted that in addition to the organic matter they contain, waste is composed of other elements which, when incinerated, can cause modifications in the composition of the atmosphere.

Data is not available on gas emissions into the atmosphere, as a result of the burning of waste. However, due to the extent of this practice, it is believed that large quantities of various gases like carbon dioxide, furans and other dioxins, are emitted into the atmosphere.

## 7.2 Sanitary Impacts

The impact of air pollution in Haiti remains little documented and the issue is not even mentioned in the most recent reports from the national health services.

Several respiratory diseases are related to poor air quality. According to Holly (1999) "15% of deaths each year are caused by atrophy of the bronchi", and SAFFACHE (2001) notes that "the presence of tens of thousands of vehicles, with poorly-adjusted engines emitting into the atmosphere [various exhaust gases], are all factors that, in addition to dust from quarries, intensify the suffering of the most vulnerable and promote the development of respiratory diseases".

However, the lack of interest with respect to the problem should not prevent its due attention. With respect to the health problems in urban areas, air quality deserves special attention.

## 7.3 Significant Impact on Resources

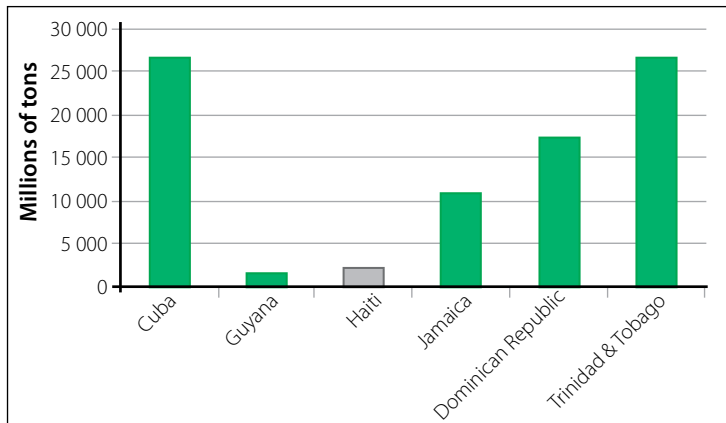
The consequences of air pollution on the environment and natural resources, resulting from human activities, are enormous, and the concentration of greenhouse gases causes significant climate change in poor countries, more vulnerable and generally unequipped to deal with the problem. The climatic occurrences in 2008 in Haiti have shown that the country is not immune to atmospheric disturbances. In fact, these disturbances are rising.

The increased intensity and frequency of storms are not without consequences, which include among others: the exacerbation of land degradation (between 1.5 million and 1.8 million cubic meters of silt<sup>54</sup> deposited in Gonâves, following the 2008 storms); the loss of habitat for aquatic species due to sedimentation; and the reduced quality of water (around 4,700 water wells rendered unsafe in this city in 2008).

As mentioned by UNDP in the World Report on Human Development (2008) "The Struggle against Climate Change: a Plea for Human solidarity in a divided world", one cannot neglect the role that Greenhouse gas emissions play in global warming, on one hand, and then their consequences on the increasing severity of extreme events, on the other. In Haiti, some weather phenomena, including natural disasters seem to have intensified. The CO<sub>2</sub> produced mainly from fossil fuel and deforestation, constitutes the anthropogenic element which most influences the climate change phenomenon, due to its strong atmospheric concentration (in relation to other Greenhouse gas emissions) and also due to the time it remains in the atmosphere. In this regard, Haiti seems to be better positioned than some other countries in the Caribbean region, in particular, Trinidad and Tobago, Cuba and the Dominican Republic, that emit, respectively, the highest amounts of CO<sub>2</sub> in the region (Figure 68).

<sup>54</sup> PNUD, 2008-2009. *Gonaïves, relèvement immédiat. Rapport consolidé.*

**Figure 68:** Total amounts of CO<sub>2</sub> emission by some countries in the Caribbean<sup>55</sup>



## 8. Constructions and Sanitation

Rapid population growth puts significant pressure on resources, in many ways. For example, excessive land parcelling leads to subsistence-farming, incapable of answering to the basic food requirements of farmers, and unregulated constructions on very steep slopes obstruct ravines. Such human activities heighten the country's vulnerability to natural disasters. Research and data also show that the rapid degradation is the result of unenforced standards and the State's weak control of these.

According to Colbert (2006), poverty, unchecked deforestation, the incapacity of the State institutions and the lack of ecological awareness on the part of a larger part of the population have plunged the main cities into a serious environmental stagnation which compromises all attempts at viable socioeconomic development.

The region of Port-au-Prince and other large cities such as Gonaives, Cap-Haïtien and Les Cayes suffer from the consequences of rural exodus and demographical pressure, including a lack of infrastructure in the health, energy, transportation, educational and communication

sectors. These cities, with more than half of the population of Haiti, therefore lack the capacity to promote the development of their respective communities.

Many institutions are involved in territorial planning, particularly the Ministries of Planning and External Cooperation (MPCE), of the Interior and Territorial Communities (MICT), of Public Works, Transport and Communication (TPTC), of Agriculture, Natural Resources and Rural Development (MARNDR), of the Environment (MDE) and of Economy and Finance (MEF), as well as of the Presidency and Prime Minister's Office through a new agency known as CIAT (Inter-Ministerial Land Planning Committee) created on March 19, 2009. The Committee has been given authority in matters of territorial management, urban planning, sanitation, equipment, water resource and watershed management and safety. Decentralised State services and NGO's are also likely to be involved in the issue.

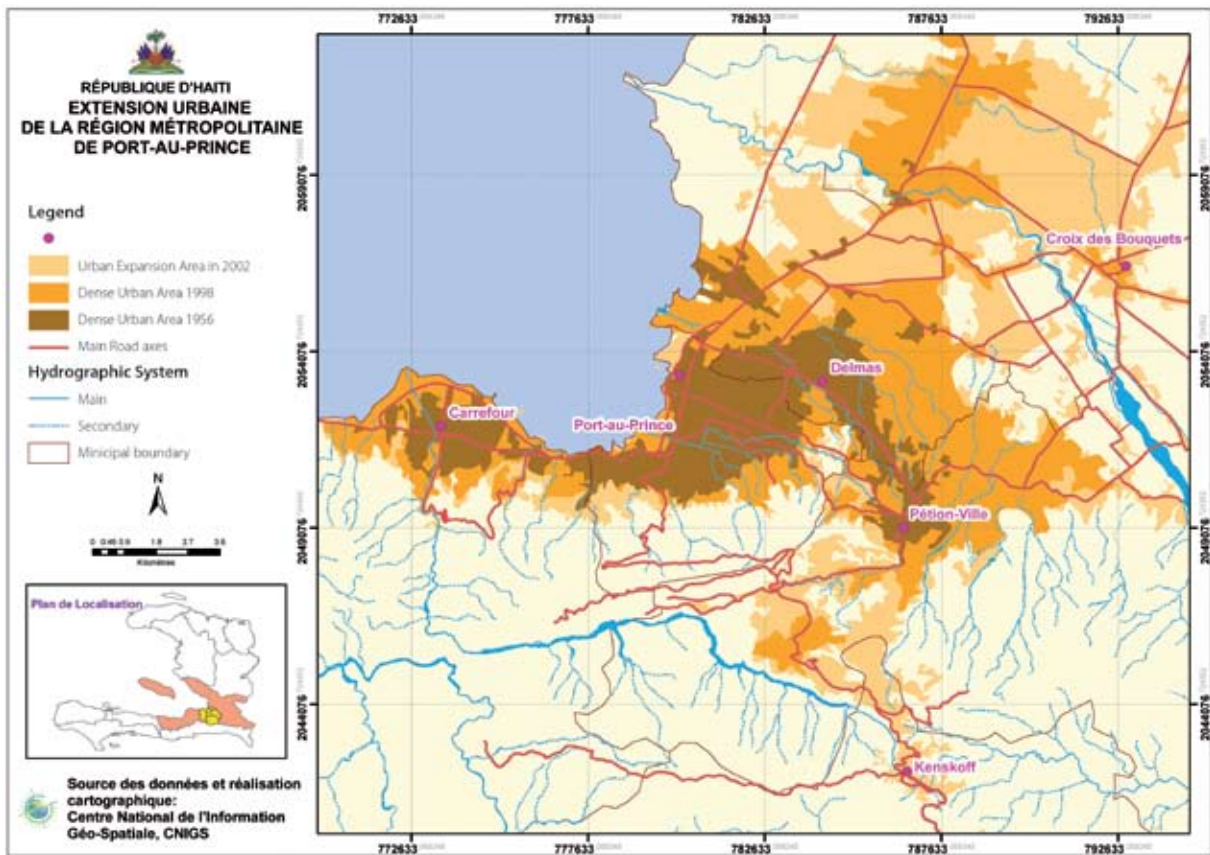
### 8.1 Urban development

Additionally, highways, under this new socioeconomic-urban division, favour the wealthier and industrial sectors and relegate the construction of dwellings in the poorer neighbourhoods and slums to the northeast, an area which suffers from inadequate drainage systems. The map below (Figure 69) shows the development of areas surrounding Port-au-Prince, which have practically doubled in size between 1956 and 1998, especially in the east and northwest, following the direction of highways. In 2002, the most urgent urban needs the city had to solve mainly involved the north and northeast zones of the capital, and less along the highway leading to Kenscoff.

The city of Cap-Haïtien, originally called Cap-Français (1697, Treaty of Ryswick), was quite important during the French colonisation, and

<sup>55</sup> <http://www.bme.gouv.ht>

Figure 69: Urban Development of the Metropolitan Region of Port-au-Prince



Source: CNIGS

several fortifications were built to protect it. At that time, the port was very prosperous, however the cultural and economic activities eventually declined when the status of the city as capital of Saint-Domingue was transferred to Port-au-Prince, at the time of the country's independence in 1804.

Its urban pattern is typical of the colonial era, with an orthogonal layout of streets and buildings turned towards the trade winds, in accordance with the urban architecture of 16<sup>th</sup> century colonies. The city had to be rebuilt many times due to numerous fires as well as earthquakes, the largest one occurring in 1842.

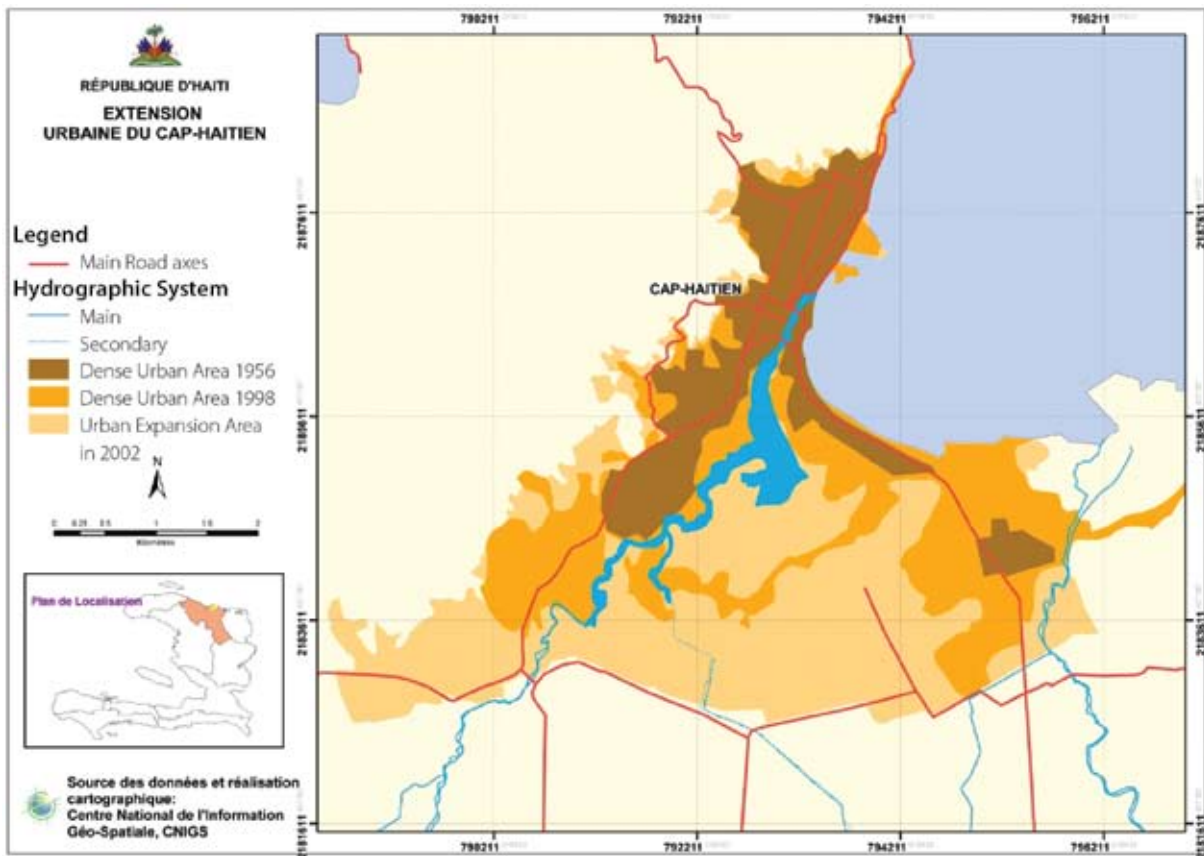
During the American occupation, Cap-Haïtien's food-processing industry promoted a certain economic development which attracted a massive influx of rural migrants to the city. Cap-Haïtien is now again a dynamic port-city, with

a thriving tourism sector thanks to its historical patrimony, beaches and fortifications.

Given its status of second city, the demographic increase in Cap-Haïtien is partly due to internal migration from all over the country. Contrary to Port-au-Prince, urban growth between 1956 and 1998, although considerable, is less than one following the year 2000. Since 1956, few coastal areas remain unoccupied and the city is spreading further inward, along the route of the two major highways. Between 1998 and 2002, the city extended southwards, and also southeast and southwest (Figure 70).

Gonaïves is Haiti's third city and the capital of the Artibonite Province. Commonly known as "Independence City", as it was there that Haiti declared its independence on January 1, 1804. It is also known for its voodoo Souvenance and Soukri sanctuaries.

Figure 70: Urban Development of the City of Cap-Haïtien



Source: CNIGS

The city has spread considerably. In 1956, the urban area was quite limited, encompassing namely the areas of Raboteau, Les Carreaux, Pointe Saline, Les Dattes and Bois-d'Homme. Since 1993, the city has grown towards the south, the southeast, the north and the northeast, the urban expansion reaching almost all outskirts, and between 1998 and 2002, progressing in the north, northeast, northwest as well as in the southeast (Figure 71). A similar situation occurs in the city of Les Cayes, with a significant growth during the same period (1998 to 2002) (Figure 72).

The city of Gonaïves developed on a plain with an altitude varying between 0 and 15.00 m above sea level. As a result of its topography and altitude, the risk of floods during the rainy seasons, due to the rise in water level of its main rivers, (La Quinte, La Branle, D'Ennery, Bassin and Ravine Parisse, Bayonnaise) increases even more during the hurricane season.

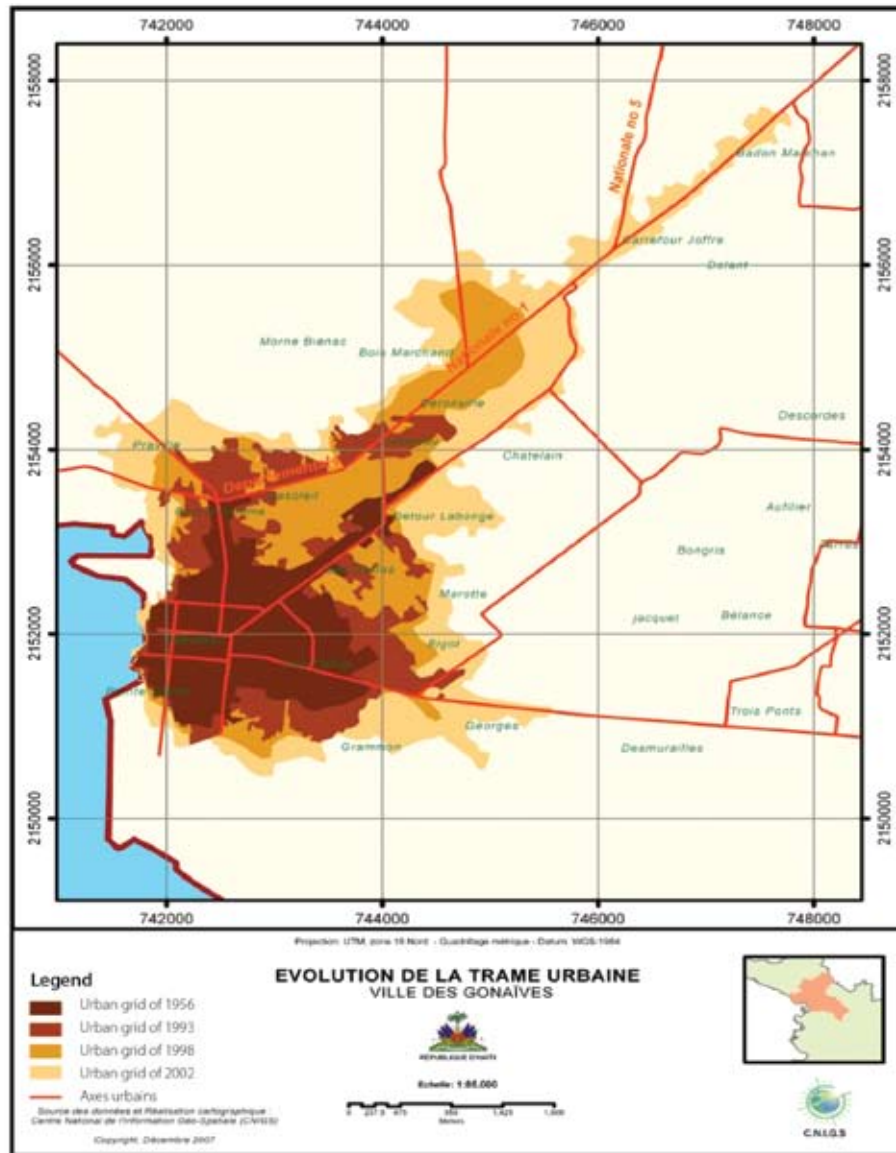
The destruction wrought by hurricanes Jeanne (September, 2004) and Fay (August 16-17, 2008), Gustav (August 27, 2008), Hanna (September 3, 2008) and Ike (September 7-8, 2008) reveal the city's vulnerability to natural disasters. These events also underline the environmental dangers to which coastal towns and cities are exposed.

Situated in the Southeast Province, Les Cayes, another important city, was founded in 1726 on the site of a Spanish market-place dating back to 1503<sup>56</sup>. It has been ravaged many times by hurricanes.

Urban growth in Les Cayes increased significantly in 1998 covering the city's western, southern and northern peripheries, as illustrated below. That year, a new distinct agglomeration emerged north of the city, and early 2002, a large number of dispersed constructions could be seen, all along the northwest highway (Figure 72). This growth

<sup>56</sup> <http://www.haiti-reference.com/geographie/villes/cayes.html>

Figure 71: Evolution in the Development of the City of Gonaïves



Source: CNIGS, 2009

is however inferior to that of Port-au-Prince, Cap-Haïtien and Gonaïves.

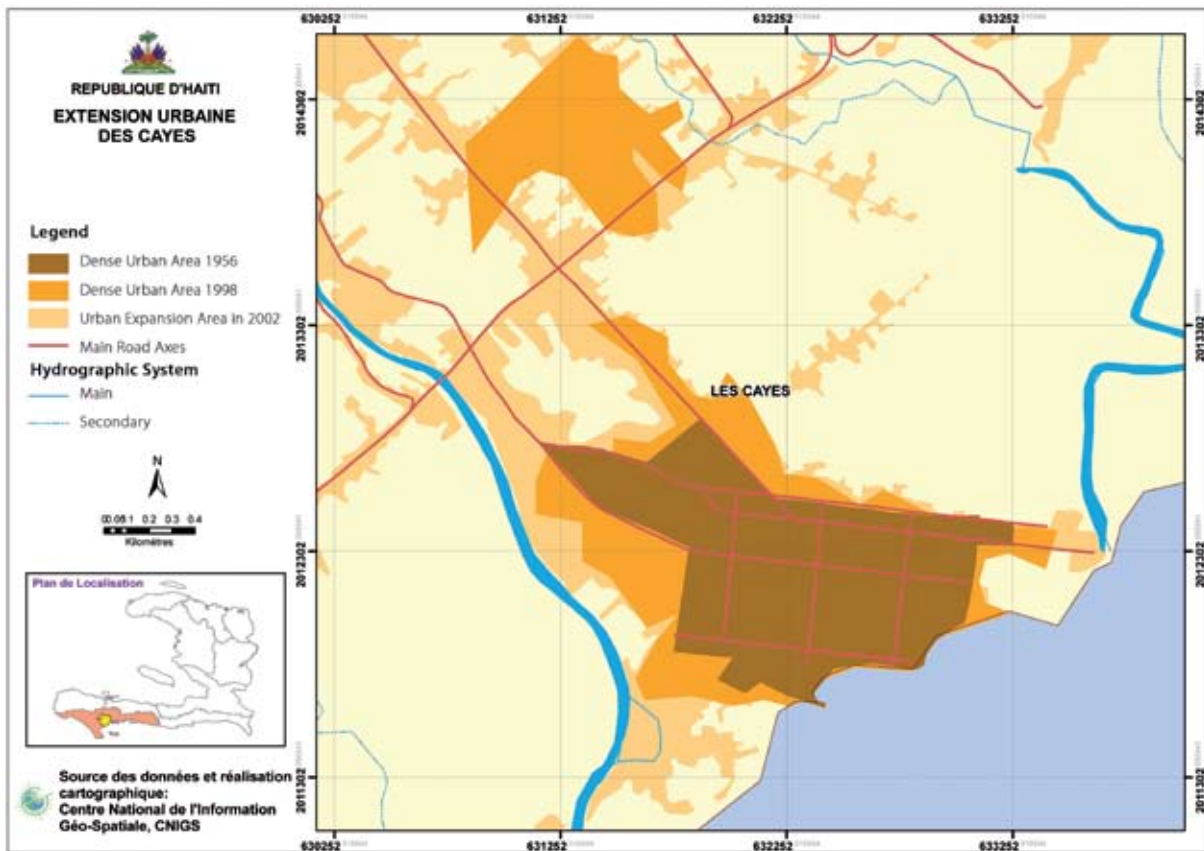
### 8.2 Housing in Haiti

The centralisation of economic activities in urban spaces, during the industrial revolution, has made urbanization an unavoidable issue in recent western economic development models (Emmanuel et al, 2000). According to Polese (1994) and quoted by Emmanuel in 2000, “urbanization seems to be the inseparable companion of economic development”. According to this document, “in

most urban areas of the modern world, significant urbanization resulting from demographic growth and population movements, is always followed by an economic development which facilitates, among other things, adequate coverage of basic social services such as drinking water, sanitation, education, health and housing”.

However, for many countries in the South, urbanization is far from synonymous with development as it is the source of enormous problems of infrastructure and services for cities without a strong economic foundation (Rousseau et al, 1998).

Figure 72: Urban Growth of the City of Les Cayes



Source: CNIGS, 2009

### 8.2.1 The Housing Problem

Theoretically, housing and health are closely related. Shelter is considered one of the fundamental needs of human beings, along with clothing and food. Proper housing is a condition of sound mental and physical health, and psychological security. It also protects its occupants from environmental hazards.

For several decades, Haiti has been undergoing an acute housing crisis due to various interdependent factors among which, the most important, is demographic expansion. It is particularly evident in large cities such as Port-au-Prince, Carrefour, Cap-Haïtien and Gonaïves. As is the case with other Southern countries, the housing problem in Haiti is very serious, both in terms of the issues at stake and challenges to overcome.

As the issue of housing is inextricably linked to the environment, to the population's lifestyle and to economic development in general, it must be

properly understood in order for decision-makers to take the appropriate measures.

Throughout the world, rural populations migrate to cities for diverse reasons. In developing countries, particularly in Haiti, migrants bring their rural way of life with them such as livestock-rearing and vegetable plots, often incompatible with city-life. This gives rise to problems such as: reduced agricultural production, improper disposal of waste and wastewater, haphazard construction without basic infrastructure, and the occupation of public spaces. The authorities do not have control of this global situation.

These practices have severe environmental and health implications including:

- **Significantly Deteriorated Housing Conditions**

Regulations governing construction have not been enforced for several decades and penalties

are no longer applied. As such, people build wherever they wish, on hillsides, in ravines, on protected lands and areas, completely ignoring current regulations.

- **Health Problems**

Health problems due to the transmission of emerging and/or re-emerging diseases such as yaws (in the South and Grand'Anse Provinces), dengue, diphtheria, and in certain towns in the West, Centre and Artibonite Provinces, diseases such as tungiasis (chigoe flea) or other skin infections, tuberculosis and meningitis, are common. A shortage of clean water, inadequate space and overcrowding exacerbate health problems and foster the spread of disease.

- **Contamination of Water Sources**

According to the World Development Report 2007/2008, Haiti is one of countries most affected by deficient housing and sanitation systems, considered a determining factor in the high mortality rate in Latin America and the Caribbean (Domersant, 2008). Poor wastewater management and the presence of human settlements close to water sources further contaminate these.

- **Blocked Waterways and Rivers**

Garbage and construction materials obstruct the drainage-systems, disrupting the normal flow of watercourses and causing frequent flooding throughout the country, particularly in urban areas.

## 8.2.2 Types of Housing in Haiti

### a) Urban Housing

Urban housing in Haiti comprises a diverse group of infrastructures, from isolated family dwellings situated downtown or in the suburbs, to those

joined together in apartments. These apartments consist of three, four and even five story-building, gathering several families together, often even various families sharing the same apartment. These are usually the types of residences of the middle and upper-middle class.

**Figure 73:** Residential Neighbourhood in Port-au-Prince



### b) Shantytown Dwellings

The shantytowns or slums are precariously built without answering to any of the established urban regulations. They usually lack basic infrastructure such as proper sanitation conditions, road networks, drainage systems, educational and health services and potable water.

### c) Rural Housing

- **Rural Settlements**

Rural settlements are small agglomerations called towns or market-towns with few financial resources, those limited primarily to agricultural activities. Life conditions, as a result of the absence of basic infrastructure such as roads and communication networks, educational and sanitary systems, are precarious. They are often isolated and hard to reach. Yet these towns have undeniable potential for development.



**Figure 74:** Shantytown in Port-au-Prince



Source: Jean Vilmond Lallière, 2007

**Figure 75:** Rural Settlement at Cerca Carvajal



Source: Floraine Décembre, 2008

- **Dispersed Rural Settlements**

Dispersed rural settlements are made of scattered dwellings. However, this type of settlement is disappearing as, due to demographic growth, housing developments are increasing rapidly, but without the minimal necessary conditions for the social, mental and even physical well-being of its residents.

**Figure 76:** Example of Dispersed Households at Cerca Carvajal



Source: Floraine Décembre, 2008

### 8.2.3 Topography and Construction

There are decrees and laws governing land use in Haiti, whether for the development of residential complexes or individual dwellings. Specific laws regarding high-rise buildings exist and technical distribution standards are also in place.

However, hardly anyone adheres to these codes and standards and this even applies to the authorities. As a result, people build everywhere: on the sides of watersheds, in riverbeds, on marshy lands and on coasts, and in protected catchment areas.

The picture below illustrates the construction situation in the city of Cap-Haïtien: slums on the seaside, at the foot of mountains and in marshy areas. In this picture, the main demarcation lines and the haphazard expansion of the city can be seen.

According to EPPLS, “taking into account “sub-standard” housing and “homeless people”, in 1995, 1,060,425 housing units would have had to be built in order to properly house the population”.

**Figure 77:** View from the City of Cap-Haïtien: Topography and Construction, 2007



Source: Unknown

### 8.3 Sanitation

Sanitation is the process which enables people a life in a healthier environment. As such, physical, institutional and social measures are deployed in different areas, such as the disposal and

treatment of run-off and wastewater, as well as of solid waste and excreta (UNICEF, 2008).

Sanitation is therefore essential to public health and in the struggle against a large number of diseases attributable to an unhealthy environment. It ensures the disposal and treatment of wastewater and excreta, thereby reducing environmental and health hazards.

Public and private sanitation in Haiti is generally inadequate, and the development strategies, adopted by the Haitian governments in the 70's and 80's, have not successfully improved the standard of living (UniQ and CHSRH, 2000). On the contrary, in the early 1990's, the economic slump and widespread poverty resulted in a degraded environment and the poor provision of basic services in water and sanitation.

Furthermore, with globalisation, Haiti now consumes a surprising amount of imported products contributing to an unprecedented proliferation of waste which adds up to the diverse sanitation and environmental problems the country was already facing.

### 8.3.1 Waste

#### a) Types of Waste

In industrialised countries, waste is generally classified empirically on the basis of five main complementary approaches (Mehu and Grelier-Volatier):

- 1) Dangerous or presumed harmless (hazardous, toxic, non-hazardous, inert waste etc.);
- 2) Source (by sector or industrial activity, sole generating operation, associated product). Categories include:
  - Household waste
  - Municipal waste
  - Medical waste
  - Industrial waste
  - Agricultural waste

- 3) Characteristics (inflammable, fermentable etc.) often associated with one or more possible sub-types;
  - Organic waste
  - Inorganic waste
- 4) Nature or content (plastics, arsenic-contaminated waste, paint waste etc.);
- 5) Regarding consumer goods, the purpose of the product before the "end of its useful life" (batteries, solvents, packaging).

Developing countries, including Haiti, tend to produce little industrial waste and the other types of waste are composed at least by 70% of organic materials.

#### b) Solid Waste Disposal

Around 3,500 m<sup>3</sup> of household waste is generated per day in Port-au-Prince and 600 m<sup>3</sup> per day in the other eight large towns: Cap-Haitien, Gonaïves, Les Cayes, Saint-Marc, Verrettes, Jeremie, Port-de-Paix and Limbe<sup>57</sup> (Thonart et al. 2002).

Although attitudes seemed to be evolving, the general public does not seem to consider waste collection and its effective, environmentally-friendly treatment as a hygienic, environmental and socio-cultural necessity. As a result, waste management is still in its early stages and everything remains to be done. In 1998, Jean-Marie Binette stated that "30 to 50% of the capital's waste is collected and sent to the only existing landfill, Truitier", and the "50 to 70% which is not collected is dumped into sewers, gullies or on street corners or simply burnt in the streets and in unregulated dumps." According to the Ministry of Environment, only 35% of urban waste is systematically collected (MDE, 1998). In 2005, it increased to 42% in Port-au-Prince. According to a study done by Willerval in 2006, in the secondary cities, only 39% of the waste is disposed of.

In Haiti's cities, waste management is essentially carried out by the State through City Councils or

<sup>57</sup> <http://www2.ulg.ac.be/cwbi/projets/atlas/pays/Haiti/haiti.htm>

City Halls responsible of the gathering of rubbish, with the support of the MTPTC, which cleans the sewage canals and removes alluvia. The SMCRS is responsible for collecting, transporting and treating solid household waste. However, it remains largely untreated and simply dumped at Truitier, a legal landfill which should be regulated. Recently, the private sector has ventured into the waste collection business and some, among others, of such companies are: Tropical Recycle, Let a Gogo, Boucard Pest Control, PATAN, Yele Haiti, Sanitec and Cooperation Housing Fondation (CHF).

**c) Some Key Elements of Haiti's Waste Management Structure**

The establishment of a legal framework is not the only necessary requirement for effective waste management; law enforcement has to be guaranteed. As such, it is vital to have a responsible independent authority, and with the sufficient financial means to carry out its duties.

**d) Legal and Regulatory Framework**

According to Cohpeda (1995), some of the more important regulatory provisions currently in force on solid-waste management in the Metropolitan Zone of Port-au-Prince are:

Decree of March 3, 1981 establishing a public agency called the "Metropolitan Solid Waste Collection Service" (SMCRS);

Decree of March 3, 1981 establishing an Framework-Law on waste management and elimination which also provides for sanctions;

Executive Order of April 21, 1983, declaring a portion of land, situated at the Truitier Residence, a rural sector at Varreaux in the community of Delmas, as a landfill and treatment and disposal area of the waste collected in the Metropolitan zone and close surroundings;

Executive Order of April 21, 1983, defining the intervention zone to be covered by the Metropolitan Solid Waste Collection Service (SMCRS);

Article 258 of the Constitution of 1987: "No one shall bring into the county any waste of foreign origin whatever its nature";

Executive Order of October 9, 1989 establishing the authority of the Ministry of Public Works, Transport and Communication over the Metropolitan Solid Waste Collection Service.

In light of the prevailing situation in the Metropolitan area of Port-au-Prince, do we not have reason to question these regulations? Garbage is piled up in the streets, in gullies and sewage canals. What has become of sanctions? Against whom will they be enforced? Furthermore, what is meant by waste management if garbage is only dumped at Truitier and rarely incinerated? As the popular saying goes, "one man's junk is another man's fortune."

**e) Experiments Conducted at Country-level**

Haiti has already implemented some waste management initiatives. The country organised specialized-training and carried out experiments in the areas of composting and biogas. Several institutions such as universities, NGO's and local organisations, participate fully in these efforts.

**Ecotoxicological:** waste from La Saline, paint and health in 2007, MEEGE-UniQ: Earthworms, corn and bean seeds were introduced into soils taken from La Saline (ashy soil: waste burning) and also from a paint factory, and finally from a control- soil. Different mixtures of soil at different proportions were used. The experiment showed that at any proportion of soil from La Saline or from the paint factory, the earthworms did not survive and the seed germination process was very slow and even withered.

**Composting (MEEGE, FSAE-UniQ):** A composting experiment carried out in Damien and Belladere using the ADEME method. The aim was to enable the biological transformation of refuse which could be used afterwards towards organic soil enrichment.

**Biogas Production:** These experiments were carried out at the Dondon Agricultural School in Damien, but unfortunately were short-lived and abandoned half-way.

**f) Experiments in Progress**

A research team was created on the issue of “waste” at the *Water Quality and Environment Laboratory (LAQUE)* of Quisqueya University (UniQ). As key stakeholders in this project and leaders of various investigations, the team has rapidly acquired the necessary experience, particularly in the field of composting, to intervene in other current projects, as the one of OXFAM, within the Eau-Cap project, in Jacmel and Saint-Marc.

The UNDP has also established a composting project at Carrefour-Feuilles where interns have been trained. The Quisqueya University was responsible of its scientific follow-up, which would allow the intervention to be renewed in order to make it sustainable.

### 8.3.2 The Issue of Potable Water

Two systems have been put in place regarding the supply of potable water in the country:

- CAMEP – Metropolitan Autonomous Potable Water Plant, created in 1989 under the authority of the Ministry of Public Works, is responsible for supplying the areas of Port-au-Prince, Piéton-Ville, Delmas and Carrefour. Its management system still is inadequate and characterized by institutional instability, a lack of investment capacity, low output and insufficient revenue collection. In Port-au-Prince, CAMEP’s network serves all official neighbourhoods, but not the squatter settlements.
- SNEP, National Potable-Water Service, created in 1977, was originally intended to supply the smaller towns of all regions throughout the country. However, since 1989, it only serves the regions not covered by CAMEP.

According to GRET, in 2000, of Port-au-Prince’s 2.5 million inhabitants, only 27,500, or 1.4% of the population were officially connected to CAMEP’s potable-water supply network, although the water-table on the periphery of the city was capable of supplying the entire population.

Water, as healthcare and education, has long been considered a basic service. The price of

water billed to the public is generally substantially lower than its true cost and revenue collection is not systematic. Additionally, only the middle and upper classes, mainly in the urban areas, are usually supplied with potable water. The chronic deficit in State revenues hinders the expansion of the water supply network and ensures only a minimum level of maintenance and quality control.

Vast segments of the population are forced to obtain fresh water by other means. Some take the risk of drinking from contaminated rivers or decrepit wells and their health often suffers the consequences. Others connect illegally to the public water network. But sooner or later, most end up buying water from private suppliers, legal or illegal, who make attractive profits by carting or trucking water to the poor neighbourhoods. Several studies show that the prices charged by these suppliers can be up to 30 times higher than those paid by households connected to the public network (Constance, 1999).

### 8.3.3 Sewage Disposal

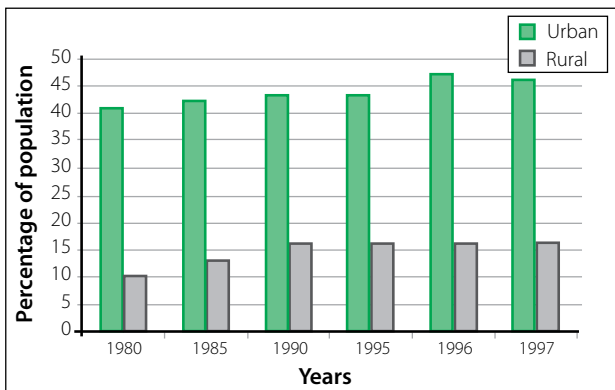
Compared to industrialised nations, in developing countries the load of wastewater pollution contained in the effluents of the urban sanitation systems is discharged practically unchanged into the ecosystems. The inherent danger of these effluents to the ecosystems is apparent in the two management methods explained below. However, it is generally more acute in developing countries because of insufficient or non-existent dilution.

#### a) Disposal of Excreta in Urban Areas

Most people in the metropolitan areas do not have a septic tank and are not connected to the sewage system. Excreta directly pollute the natural environment (mangrove forests, riverbeds, underground through cesspools) which of course has repercussions on the quality of water (Les Amis de la Terre, 2005).

The following graph shows the evolution in excreta disposal conditions across the country from 1980 to 1997.

**Figure 78:** Excreta Disposal in Haiti



Source: From PAHO/WHO data, 2003. State of the PWSS Sector as at December 31, 2002.

**b) Disposal of excreta in rural areas**

The situation of the management of excreta in rural areas in Haiti is chaotic. Latrines are often simply holes which do not comply with established standards (distance from water sources, direction of flow and water-table level, rules of maintenance and hygiene, respect of users' privacy etc.).

**Figure 79:** Communal latrine built by an international NGO



**Figure 80:** View of a latrine, Belot 1 (Rural)



This situation significantly impacts public health and the health of the population in Haiti. According to PAHO/WHO " nowadays, diarrhoeal diseases, partly due to the consumption of water contaminated by bacteria of faecal origin, still represents one of the two major causes of death in children under 5" (MSPP-PAHO/WHO; MSPP, 2004).

Other infectious diseases due to "faecal peril" such as cholera, typhoid, intestinal helminthiasis, intestinal protozoa and intestinal schistosomiasis still claim victims in Haiti. Studies have also indicated health risks for immune-deficient persons exposed to the cryptosporidium oocysts in the drinking water distributed in Port-au-Prince and its surrounding areas (Bras, 2005). Nowadays, many institutions involved in emergency situations, during and even after, advocate treating water with chlorine. However, it has also been suggested that the chlorine treatment of water, like that distributed by the water company, is susceptible to cause, due to the presence of faecal coliforms, the formation of trihalomethanes, considered to be carcinogenic substances (Emmanuel et al, 2000).

## 9. Natural Hazards

Haiti is located in a subduction zone<sup>58</sup>, where winds from different directions converge, and at the heart of a tropical region, exposing it to serious environmental hazards. Furthermore, the population's land occupation patterns increase its vulnerability to hazards and risks which, in the past, have turned into catastrophes.

**Figure 81:** Gonaives in the aftermath of the 2008 hurricanes



### 9.1. Main Natural Hazards in Haiti

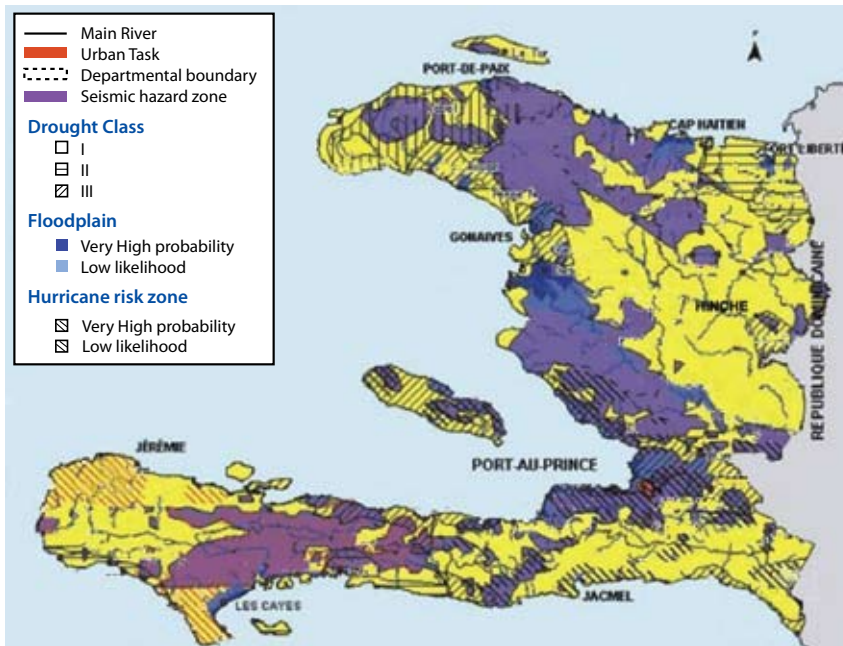
Geomorphological and hydrometeorological natural hazards are becoming the most troubling

environmental dangers. The former are essentially earthquakes, landslides and land collapses<sup>59</sup>. Volcanic activity manifests itself by the existence of hot and sulphur springs. The latter take the form of hurricanes, floods and drought.

As far as hurricanes are concerned, Haiti has the highest risk index (12.9) among small island developing-states in the region, including the Dominican Republic (2.79), Jamaica (1.45) and Cuba (0.16). Weather events over the past years have confirmed this extreme vulnerability with more than 20,000 victims, 6 million disaster victims and the destruction of more than 60% of constructions (UNDAF, 2009-2011; CNSA, 2009).

For the past 50 years, hurricanes have been the most active among natural geomorphological events, severely affecting the country. Haitians still remember deadly hurricanes such as Hazel in 1954 (410 deaths), Flora in 1963 (5,000 deaths), Gordon in 1994 (1,122 deaths), George in 1998 (242 deaths) and Jeanne in 2004 (3,000 deaths) (Mathieu et al., 2002).

**Figure 82:** Natural Hazards in Haiti



Source: From a modified map by Mathieu et al, 2002.

<sup>58</sup> Subduction is a process that takes place when two tectonic plates converge. Subduction zones are therefore, characterised by powerful earthquakes and spectacular volcanic activity.

<sup>59</sup> PRÉPETIT, Claude. s.d. Landslides in Haiti. Roneotyped document.

Before the earthquake on January 12, 2010, there had been little seismic activity in the previous decades, although this had been frequent in the past. In the 18<sup>th</sup> century, for example, the city of Port-au-Prince was completely destroyed twice by earthquakes (Corvington, 1975), and Cap-Haïtien was devastated once in the 19<sup>th</sup> century, according to Pierre-Louis (1980).

All Haitian regions are not affected by the same types of natural disasters or to the same extent. Accordingly, risks are low in some regions and much higher in others (Figure 82).

According to Mathieu et al (op. cit.), the western and southern parts of Haiti are prone to hurricanes, floods and earthquakes. The North and Artibonite Provinces are also highly vulnerable to floods and earthquakes. The Northwest Province has an average risk of endemic drought, while the Southeast and Grand'Anse Provinces are at risk of hurricanes and floods. Thanks to a low gradient, the Northeast and Center Provinces seem to be the least susceptible to natural hazard risks (Annex 2).

## 9.2 Vulnerability to Natural Threats

The occurrence of natural hazards in Haiti has become almost unavoidable due to the geographic location and configuration of the country. However, Haitians have had to pay dearly the impacts of such hazards, not so much because of their violence but because of a poor environmental management leading to environmental degradation, and of inadequate practices of land occupation. Intensified by poverty, the country remains fragile in the face of natural disasters.

### 9.2.1 Environmental Degradation

It is a known fact that Haiti's environment is undergoing a crisis as evidenced by its uncommon deterioration. Aside from the inherent problems that this deterioration brings, it also amplifies the country's exposure to the threat and severity of natural hazards.

Natural hazards, in the form of aggressive and extreme rainfall during the rainy and hurricane seasons, contribute greatly to soil degradation. According to INESA (2008), factors such as the intensity and duration of rainfall, the nature and cationic content of clay minerals in the soil, the topographical conditions (Haiti is 80% mountainous) and land use practices can aggravate soil degradation. These are considered to be some of the human-induced causes of soil degradation.

**Figure 83:** Watershed in Gonaïves



Actually, even mild disturbances have disastrous consequences in Haiti. Thus, despite their well-deserved reputation of "hurricane breakers" because of their ability to reduce wind speeds, Haiti's numerous mountain ranges have not been able to protect the country, these last years, from the destruction of low-intensity hurricanes. Hurricane Gordon (1994) for example, which the Haitian people remember all too well, did not strike the country with full force. It is reasonable to assert that these are far from natural disasters, but are largely human-caused.

### 9.2.2 Land Use

The haphazard use of land space in Haiti, much like environmental degradation, can increase the impact of natural disasters on the country. The slightest landslide or rainfalls, even outside the rainy or hurricane seasons, bring the country on the verge of catastrophe.

Caused by poverty, overpopulation and poor land management, the territory is undeniably used in an arbitrary and extreme manner (MICT-DPC, 2001). In urban areas, for example, the smallest plot of land, no matter its configuration, is occupied and used without the least concern for regulations (DPC, 2005). As previously mentioned, although building codes exist in Haiti, there is no compliance due to the weakness of the relevant authorities.

### 9.2.3 The Poverty Factor - A Risk Amplifier

In a large part, the major risk seems to be rooted in the great social vulnerability. We certainly

cannot eliminate all the unpredictable elements in risk-management however when evacuation procedures, preventative measures and the population's capacity to cope and face disasters are deficient, impacts then become enormous and long-lasting. Haiti is far behind its closest neighbours in terms of the consequences of these events on the population. The poorest communities, those who have the least resources and who live in the most hazardous areas such as hills, coasts and riverbanks, are clearly the most vulnerable and most affected. The table below presents a partial comparative assessment of hazards as well as vulnerability to Hurricanes Gustav and Ike.

**Table 29: Partial Assessment of Hazards and Vulnerability to Hurricanes Gustav and Ike, 2008**

	Gustav	Ike
Date, duration and place of formation	August 25 - Sept 02, 2008 16.3 N - 17.0 W	Sept 01-14, 2008 17.60 N - 39.50 W
Trajectory	South of the Greater Antilles and Gulf of Mexico	North of the Lesser Antilles, Cuba and Gulf of Mexico
Minimum pressure recorded and date	955 hPa on 30/08/2008 at 12:00 GMT	935 hPa on 04/09/2008 at 9:00 GMT
Maximum wind speed (at landfall)	225 km/h on 30/08/2008 in Cuba	193 km/h on 08/09/2008 approaching Cuba
Types of cyclone and phase	Tropical storm then Category 4 hurricane	Category 3 hurricane
Cyclone diameter	370 km	800 km
Casualties	8 people dead in the Dominican Republic, 66 in Haiti, 11 in Jamaica and 7 in Louisiana: 92 in total.	66 killed in Haiti, 4 in Cuba, 52 in the United States: 122 in total
Warning and evacuation procedures	United States - yes, Cuba - yes, Haiti - few	United States - yes, Cuba - yes, Haiti - few

Sources: <http://echogeo.revues.org> et <http://www.nhc.noaa.gov/2008atlan.shtml> (consulter le 08/04/09)

### 9.3 Human-Caused Disasters

It is difficult to control natural hazards. It is however, possible to protect ourselves from them. In the case of Haiti, mitigating the population's vulnerability to natural hazards seems to be a secondary issue even if these are becoming more perilous (Goldenberg, Stanley B. et al. 2001).

As such, when hazards turn into reality, the term "natural disaster" is no longer appropriate. Today, there is no doubt as to the human origin of climate change.

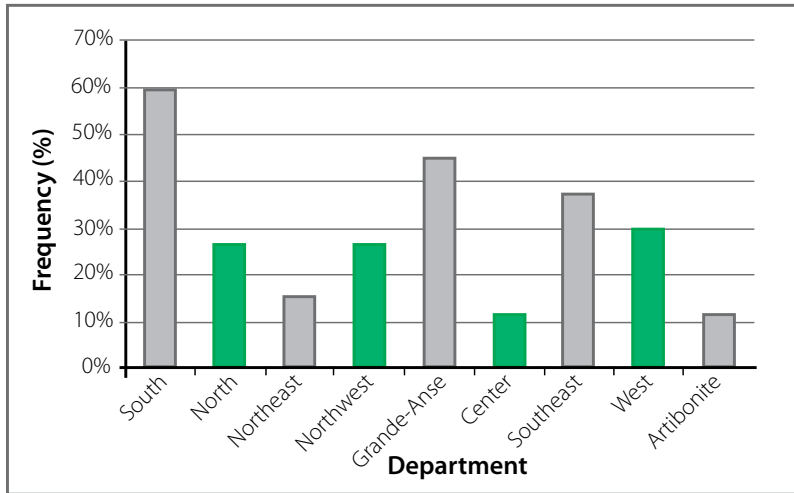
For many years and even centuries, Haiti has experienced major natural disasters, which became more pronounced between 1900 and



2004. During that period, the country recorded the 50 greatest disasters of its history, suffering 17 hurricanes, 26 major floods and 7 droughts. The Southern Region is the most vulnerable to hurricanes, with a frequency of 59% for the South

Province, 44% for Grand’Anse and 37% for the Southeast Province. At 30%, the West Province’s hurricane frequency is almost half that of the Southern Province (USAID, 2007 in CCI 2004).

**Figure 84:** Hurricane Frequency by Province in Haiti (1954-2001)

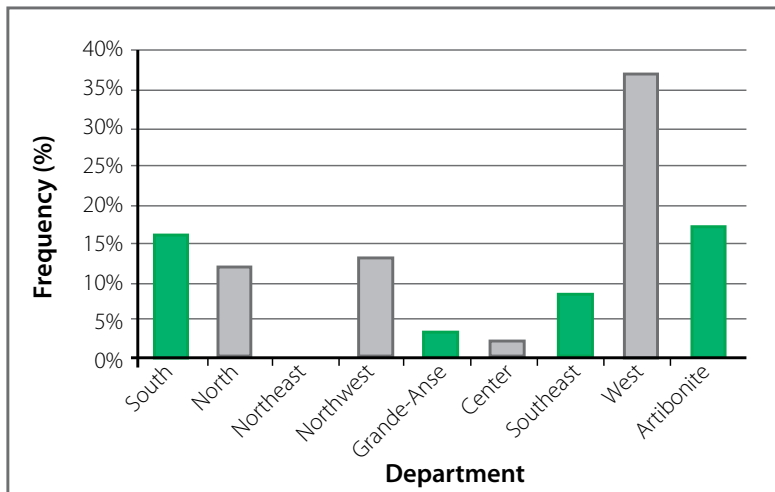


Source: USAID, 2007

Contrary to its history of hurricanes, the West Province’s history of floods over a 40-year period shows that it is the most vulnerable to this hazard, experiencing 36% of all floods occurring from

1968 to 1997. Other provinces were also affected, namely Artibonite, South, Northwest and North with a frequency of about 10% (Figure 85).

**Figure 85:** Flood Frequency by Province (1968 - 1997)



Source: USAID, 2007

These floods have caused important losses, in human lives as well as material. The following

table gives a balance sheet of these floods with a summary of damages suffered.

**Table 30: Historical Balance Sheet of Floods in Haiti**

Date	Place	Damages
November 14, 1963	Grande Rivière du Nord	Almost 500 victims
May 20, 1972	Cayes Region	20 missing and considerable physical losses
June 10, 1984	Port-de-Paix	
June 1, 1986	Cayes Region	20,000 hectares affected, several thousand homes damaged
October 23, 1986	Gonâve Island	31 dead, 906 homeless, over 380 homes destroyed or damaged
April 27, 1987	Port-de-Paix	131 families affected
May 8, 1987	Thiotte in the Southeast, Delmas and Caradeux in Port-au-Prince	Thiotte: 3 killed and hundreds homeless. Areas of Delmas and Caradeux in Port-au-Prince: 21 families affected
January 27, 1988	Northwest	According to the Pan American Health Organisation (PAHO), over 15 lives were lost and thousands of persons lost their homes, farms and livestock
June 20, 1988	Estere in Artibonite	500 families affected
October 8, 1988	Leogane Plain	40 families affected
February 23, 1989	Gonâve Island	4,945 families affected, 1,527 homes destroyed and 1,640 damaged.
May 24-27, 2002	South Peninsula, town of Camp Perrin and areas of Azile and Anse-à-Veau were the most affected.	31 dead, 14 missing and over 7,000 victims in the South Province according to the Office of Civil Defence, as quoted by Haiti-Press Network, June 5, 2002
May 23-24, 2004	Southeast Haiti, Mapou Belle-Anse, Bodary and Fonds-Verrettes.	1,232 dead, 1,443 missing and 31,130 victims according to the latest figures published by Haitian civil defence on June 8, 2004. The hardest hit areas are: Mapou Belle-Anse with 432 people dead, Bodary with 350 people dead and Fonds-Verrettes with 237 people dead. All three areas are located in the Southeast Province. The tragedy of this disaster compelled the Boniface/Latortue interim government to proclaim May 28 a national day of mourning.
October 4, 2005	Various regions including Petion-Ville and Grand Goave in the West Province.	The floods caused significant losses. The government provided no figures on this disaster.
October 25, 2005	Several regions in the Northwest including the communities of Port-de-Paix, Bassin-Bleu, Anse-à-Foleur and Saint-Louis du Nord.	Floods caused by torrential rains in several Northwestern regions. Livestock and crops were swept away and one person was killed.

Date	Place	Damages
November 22 and 23, 2006	Grand Anse, Nippes and Northwest Provinces.	Heavy rains triggered flooding in the Grand'Anse, Nippes and Northwest Provinces. Several public buildings were flooded and some road structures damaged including the bridge at Ravine Sable (Bonbon Community) which collapsed.
March 17, 2007	Grand Anse: Jeremie, Abricots, Bonbon, Carcasse (Les Irois). Southeast: Jacmel. West: Cite Soleil, Delmas, Port-au-Prince (Carrefour-Feuilles, Canapé Vert). Northwest: Port-de-Paix, Saint-Louis du Nord, Anse-à-Foleur. North: Cap-Haitien Northeast: Ferrier, Ouanaminthe.	8 people dead and some 360 families seriously affected
May 8-9, 2007	North, Northwest and South Provinces.	Torrential rains brought significant damage to several regions of the country. The town of Ouanaminthe was particularly hard-hit and the bridge connecting Haiti (from Ouanaminthe) to the Dominican Republic (Dajabon) was severely damaged.
September 1, 2008	The city of Gonaives, several towns in Jacmel, and many towns in the Northeast, South and Southeast were flooded.	Heavy rains caused by Tropical Storm Hanna triggered major flooding in Gonaives, in the west of Haiti, where thousands of persons had perished under similar circumstances 4 years ago. "The city is under 2 metres of water in some places", said the Director of Civil Defence, "since yesterday evening a number of persons have had to seek refuge on rooftops to escape the rising waters." On Tuesday morning, official figures mentioned one death.
October 20, 2009	Heavy rains in Port-au-Prince and its outlying areas.	The community of Carrefour in a suburb, south of the capital, was completely flooded.

Source: <http://www.haiti-reference.com/geographie/milieu/desastres.html>

In Haiti, earthquakes occur less often than floods. However, earthquakes have already struck the country's major cities (Table 31) causing significant damage. The city of Port-au-Prince has a very high earthquake risk due to a large fault

which extends under the mountain Morne-de-l'Hopital, overlooking the city. This risk, of course, became a reality last January 12th, 2010, as we all know too well.

**Table 31: Earthquakes in Haiti**

Date	Place	Remarks
1564		Source: Jules Troussel, Nouveau Dictionnaire encyclopédique universel illustré, 1886-1891, volume 3, p. 214
1684		<a href="http://en.wikipedia.org/wiki/List_of_natural_disasters_in_Haiti">http://en.wikipedia.org/wiki/List_of_natural_disasters_in_Haiti</a>
1691		<a href="http://en.wikipedia.org/wiki/List_of_natural_disasters_in_Haiti">http://en.wikipedia.org/wiki/List_of_natural_disasters_in_Haiti</a>
October 18, 1751	Port-au-Prince	Two violent earthquakes shook Port-au-Prince for about three minutes. Aftershocks continued for more than two months.
June 3, 1770	Port-au-Prince and the Southern regions.	The capital was destroyed and the ground split open in several places. Hundreds of bodies were found under the rubble.
May 7, 1842	Cap-Haitien and all the Northern regions.	"[Cap], where all the homes were masonry-built, was nothing more than a pile of rubble under which almost 10,000 persons were buried..." (Bellegarde, Dantès. The Hatian Nation, p. 110).
September 23, 1887	Northern regions of Haiti	Destruction of the Port-de-Paix church.
1904	Northern Haiti, Port-de-Paix and Cap-Haitien	The cities of Port-de-Paix and Cap-Haitien were affected. (Séisme en Haïti, la bonne carte tectonique, <a href="http://sciences.blogs.liberation.fr/home/2010/01/s%C3%A9isme-en-ha%C3%Afti-la-bonne-carte-tectonique.html">http://sciences.blogs.liberation.fr/home/2010/01/s%C3%A9isme-en-ha%C3%Afti-la-bonne-carte-tectonique.html</a> )
1946	Earthquake in the northeast of the Dominican Republic accompanied by a tidal wave in the Nagua region.	Haiti is also affected. <a href="http://en.wikipedia.org/wiki/List_of_natural_disasters_in_Haiti">http://en.wikipedia.org/wiki/List_of_natural_disasters_in_Haiti</a>
October 27, 1952	Anse-a-Veau in the Province of Grand'Anse	The earthquake claimed 6 lives and made thousands homeless.
June 24, 1984		Magnitude 6.7 earthquake on the Richter scale.
January 12, 2010	Northern part of the West Province, some regions in the Southeast and Nippes Provinces	Magnitude 7.0 earthquake on the Richter scale. The strongest earthquake in over two hundred years, it practically destroyed the capital. The epicentre was located 17 km from the Southern entry of Port-of-Prince, near Template: Unité de Port-au-Prince at a depth of 10-15 km. About a dozen aftershocks measuring between 5.0 and 5.9 were recorded in the hours that followed.

Date	Place	Remarks
January 20, 2010	West Province and some regions in the Southeast Province.	According to Civil Defence, 222,517 Haitians were killed, 310,900 injured and millions of others badly affected. (Report of February 23, 2010).

Source: <http://www.haiti-reference.com/geographie/milieu/desastres.html>, [http://en.wikipedia.org/wiki/List\\_of\\_natural\\_disasters\\_in\\_Haiti](http://en.wikipedia.org/wiki/List_of_natural_disasters_in_Haiti)

The Mines and Energy Bureau (BME) has long recognised the risk of earthquakes occurring in Haiti. However, according to a study done by Claude Prépétit on behalf of the BME<sup>60</sup>, the social and economic hardships that have taken hold in the country have made it difficult for the Haitian authorities to put advice to practical use and implement the measures considered necessary in order to respond to warnings.

The January 12, 2010 earthquake demonstrated again the vulnerability of Haiti and of its population when stricken by major natural hazards. The urgent need for proper preventive measures to mitigate human and physical losses, the improvement of construction standards and their compliance, and the implementation of public awareness programmes on emergency procedures in the event of disasters, are all priority actions which need to be taken immediately.

The density of the affected area, low quality of constructions and an inadequate urban planning, together with the superficial depth and intense magnitude of the quake increased the repercussions. At the end of February, Haitian Civil Defence figures put the death toll at 222,517 persons, with 310,900 injured and millions otherwise affected. The IBD estimates that the cost of reconstruction could be as high as \$14 billion.

The experts from the French *Institut de Physique du Globe de Paris (IPGP)* explain that the earthquake

took place on the northern boundary between the Caribbean and North American tectonic plates. "The plates converge at a rate of about 20 mm per year. If the sliding had been occurring regularly, there would not have been an earthquake" explains expert Robin Lacassin of the IPGP, "but the movement causes tremendous friction which deforms the rocks and then, due to the effect of the built-up pressure, the plates suddenly slide 2 metres and an earthquake occurs.

In regard to the island of Hispaniola, the movement between the two plates is distributed over several faults including two major fault systems (see Figures 86 and 87) - the Septentrional Fault in the north and the Enriquillo Plantain-Garden Fault in the south - each one of these absorbing about 7mm of the stress caused by the movement per year.

Seismic records showed very elevated figures, with a peak of 7.0 on the Richter scale. Two aftershocks followed closely, with a first peak of 5.8 and a second of 5.3. The peculiarity of this quake is that it took place close to the surface, its wave therefore spread very quickly and intense shaking was felt. The quake was also felt in the Dominican Republic and Cuba, namely in Santiago and Guantanamo.

The position and mechanism of the origin of the earthquake indicate a senestral fault rupture on the Enriquillo Fault (with a minor overlapping

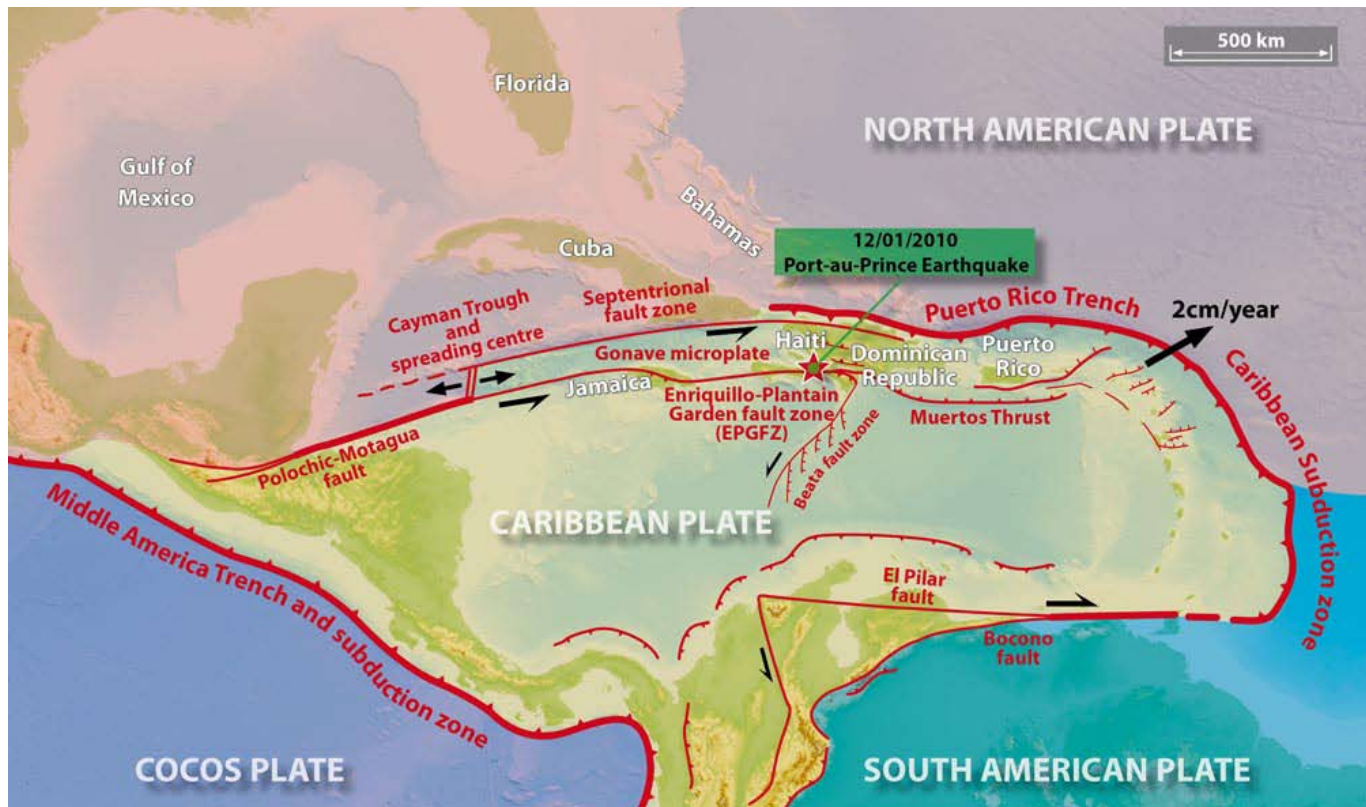
<sup>60</sup> <http://www.bme.gouv.ht/alea%20sismique/Al%E9a%20et%20risque%20sismique%20en%20Ha%EFti%20VF.pdf>

component). This fault, in an E-W direction, extended for 300 km from the Enriquillo Lake in the Dominican Republic, to the western extremity of the Tiburon Peninsula, passing less than 20 km from the south of Port-au-Prince. The earthquake affected a 70 km long segment along the fault and the seismic slip was probably between one and two metres. This fault had not produced any major earthquakes over the last ten years but is

likely the source of the historic quakes<sup>61</sup> of 1751 and 1770 (Table 31).

The IPGP specialists emphasize that the Enriquillo-Fault ruptured along a segment measuring less than one third of its total length, and the other segments of the fault, situated to the east and west of the rupture are also likely to break in the decades to come, producing earthquakes equal to, or slightly above, a magnitude of 7<sup>62</sup>.

Figure 86: The Tectonic Plates of the Region

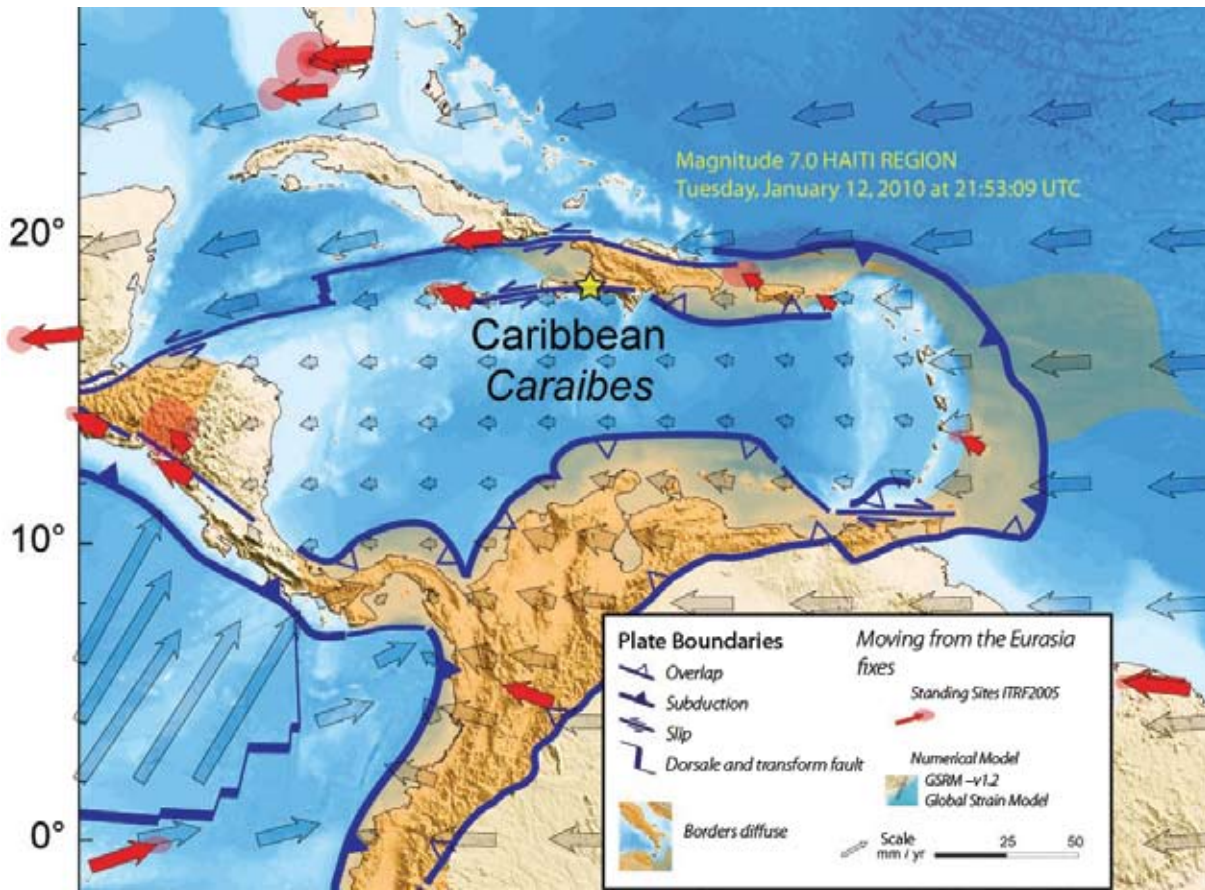


Source: Institut de Physique du Globe de Paris (IPGP) <http://www.ipgp.fr/pages/040114.php>  
[http://www.ipgp.fr/pictures\\_lib/3218.jpg](http://www.ipgp.fr/pictures_lib/3218.jpg)

<sup>61</sup> <http://www.ipgp.fr/pages/040114.php>

<sup>62</sup> <http://www.ipgp.fr/pages/040114.php>

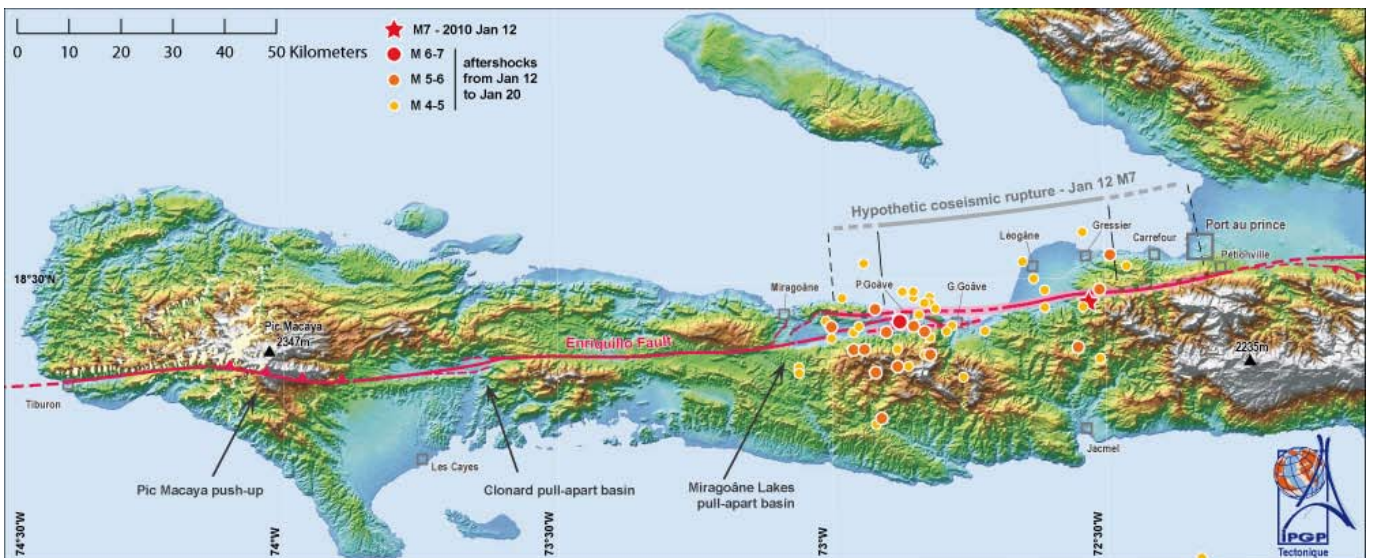
Figure 87: Explanatory Diagram of the January 12, 2010 Earthquake



Source: <http://sciences.blogs.liberation.fr/home/2010/01/s%C3%A9isme-en-ha%C3%Afti-la-bonne-carte-tectonique.html>, <http://sciences.blogs.liberation.fr/a/6a00e5500b4a648833012876d45bb2970c-pi>,

Figure 88 shows the location of the aftershocks recorded after the January 12, 2010 quake in relation to the Enriquillo Fault, and their magnitude.

Figure 88: Diagram of Aftershocks Linked to the January 12, 2010 Earthquake.



Source: [Institute de Physique du Globe de Paris \(IPGP\), http://www.ipgp.fr/pages/040114.php](http://www.ipgp.fr/pages/040114.php), [http://www.ipgp.fr/pictures\\_lib/3206.jpg](http://www.ipgp.fr/pictures_lib/3206.jpg)

### 9.3.1 Loss of Human Lives

A logical consequence of inadequate risk-management is the inescapable loss of human lives. Haiti is no exception to this rule. In fact, as Mathieu (2002) points out, during the last century the eight main hurricanes claimed the massive toll of 11,104 deaths, and over the last four decades of the 20<sup>th</sup> century, the most significant floods caused the loss of 835 lives. In 2004 alone, three floods, in the West and in the Southeast of the country (Fond-Verettes and Mapou) and another in Artibonite (Gonaives), occasioned approximately 2,500 to 3,000 deaths.

With an average rainfall of 1,400 mm per year, Haiti receives a volume of 40 billion m<sup>3</sup> of water, of which 90% ends up in the sea due to little infiltration and the exacerbation of impervious

surfaces, as well as the gradual depletion of vegetation cover (Lebrun, 2004). In general, cities are much affected by rainfall, even if it rains only for a short period of time. For example, during the month of October 2003, in the community of Tabarre<sup>63</sup> (CRA, 2004) some enterprises were submerged under 2 metres of water and more than 1,900 hectares of land were affected by rainfall in 1998, 1994, 1954 and 1909. In October 2007, a flood also seriously affected most residents in the area.

The risk of floods is higher in coastal areas and on the plains where the problems are generally more serious and the level of vulnerability amplified. The table below gives the number of victims and deaths caused by Haiti's major hurricanes. The death toll caused from the 2004 hurricanes was unprecedented.

**Table 32: Major Hurricanes Occurring in Haiti**

Date	Name	Zones Affected	Wind Speed km/h	Impact	Estimated Losses in
Sept 18-19, 1816	NA	West Province, Gulf of Gonave [Source: Madiou, Thomas. Histoire d'Haiti. Tome V: 1811-1818; p. 368]	NA	Significant damage in the countryside, the West Province and in the Gulf of Gonave	US\$
Nov 12, 1909	NA	West Province, Cul-de-Sac Plain	NA	Almost 150 victims in the Cul-de-Sac Plain	NA
Aug 12, 1915	Galveston	Southeast and the South Peninsula Significant damage in Jacmel and Jeremie	76	1,600 victims	NA
Oct 21, 1935	NA	Southeast, South Peninsula, Grand Anse	NA	About 2,000 - 2,150 deaths, 250,000 disaster victims	NA
Oct 11-12, 1954	Hazel	All regions in Haiti were affected	249	Thousands dead	NA

<sup>63</sup> A community in the Metropolitan Region of Port-au-Prince.



Date	Name	Zones Affected	Wind Speed km/h	Impact	Estimated Losses in
Oct 3, 1963	Flora	South and West Provinces	240	Nearly 5,000 deaths and varying types of damages	180,000 million (USAID, 2007)
Aug 24, 1964	Cleo	South coast particularly Les Cayes, Camp-Perrin and Arniquet regions	150	192 dead, 80,000 victims	17 million in physical damage
Sept 29, 1966	Ines	South and West Provinces of Port-au-Prince, Marigot to Grand Goave	170	Thousands of victims (67,000 according to USAID) 480 dead	20,000
Aug 5, 1980	Allen	Swept the South coast particularly Les Cayes region	270	200 dead	400 million
Sept 11, 1988	Gilbert	South coast particularly the following regions: Anse-a-Veau, Camp-Perrin, Cavaillon, Cayes, Ile-a-Vache, Jacmel, Jeremie, Kenscoff, Port-Salut	NA	30 dead and thousands of victims, according to the United Nations Office for the Coordination of Humanitarian Affairs	
Oct 12-13, 1994	Gordon	Southeast Province and the Southern Peninsula	NA	2,000 dead or missing people according to UNEP	NA
Sept 23, 1998	George	Southeast and Northwest regions of Haiti	NA	147 dead, 34 seriously injured, 40 missing and 167,500 persons affected in one way or another	NA
May 23, 2004	Tropical storm	Southeast		3,000 dead, 6,000 victims	NA
Sept 10, 2004	Ivan	Southern Peninsula and West coast	NA	3 persons including a 10 year old child swept away by waves at the port of Gonaives	Significant physical damage from flooding

Date	Name	Zones Affected	Wind Speed km/h	Impact	Estimated Losses in
Sept 18-19, 2004	Jeanne	Northern strip, Upper Artibonite, Gonaives, Northwest		1,870 dead including 233 after the floods. The hardest hit city has 1,500 deaths, 2,620 injured, 846 missing and 300,000 victims. (Source: Civil Defence dated October 4, 2004)	NA
July 6-7, 2005	Dennis	Southwest coast, Southern cities (Bainet, Grand Goave, Les Cayes)		Over 500 made homeless	
Oct 17-18, 2005	Wilma	Western and Southern Haiti		Between 7 and 10 dead according to government figures.	
Oct 23, 2005	Alpha	Southern Peninsula including the Grand Anse and Nippes Provinces		More than 12 deaths, according to a government report published at the end of October	Landslides and flooding caused by the hurricane
Aug 16, 2008	Fay	All regions of the country were affected			
Aug 26, 2008	Gustav	Southern Peninsula including the Grand Anse and South Provinces		At least 77 deaths and 8 people missing, significant physical damage. On Tuesday September 2, 2008, it was estimated that 15,000 families were affected by the storm which destroyed 3,000 homes and damaged 11,458 others	

Date	Name	Zones Affected	Wind Speed km/h	Impact	Estimated Losses in
Sept 1, 2008	Hanna	The Artibonite and Northeast Provinces		The Office of Civil Defence reported that 50 deaths had been recorded in Artibonite, 12 in the West, 16 in the South, 3 in the Southeast and 1 in Nippes. Several towns including Gonaives were flooded.	
Sept 6, 2008	Ike	The North and Northwest Provinces	ND	Heavy rains triggered by the hurricane caused the loss of about 20 lives including 13 children in Cabaret (West Province)	

\*NA = data not available

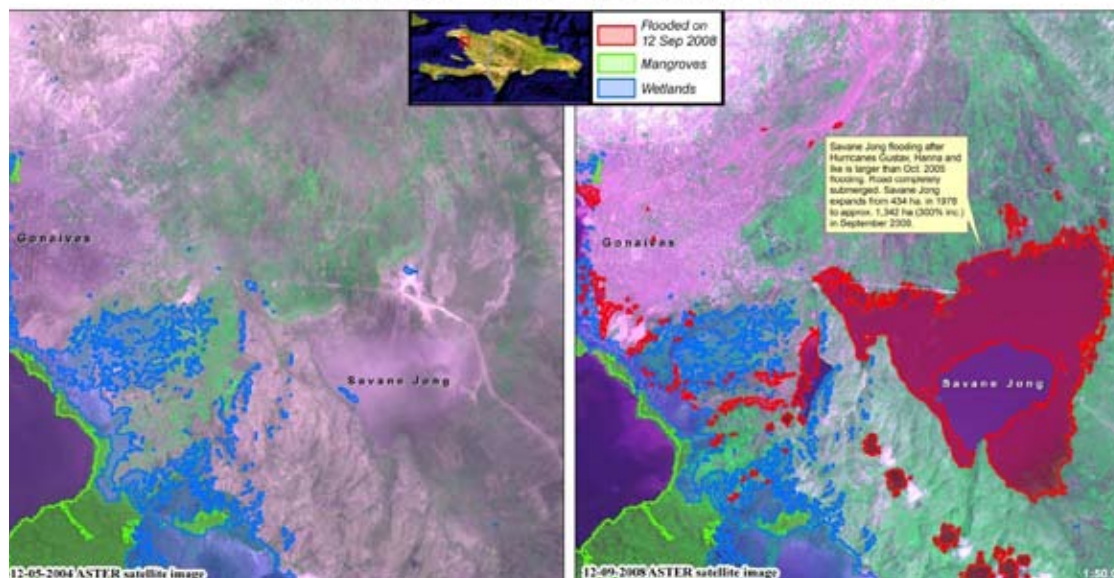
Source: USAID, 2007

The city of Gonaives is a clear example of a flooded zone. Figure 89 shows a large quantity of accumulated water in the Jong savannah (in red) in September 2008, which led to considerable deterioration of its surface area in comparison to

how it was before the 2004 floods (left). The Jong savannah and the city of Gonaives are connected to a vast swamp, a situation which contributes greatly to the vulnerability of the urban centre to floods.

**Figure 89:** Flooding in Gonaives and surroundings in 2004

Pre- and Post- Hurricanes Gustav, Hanna and Ike



Source: CATHALAC, 2008

Geomorphological phenomena such as earthquakes have also left immense damages. The January 12, 2010, earthquake affected the Western, Southeast and Nippes Provinces. Near the end of February, figures showed that 220,000 lives had been lost, 311,000 persons had been injured and 869 were still missing. Of the survivors, 1,237,032 have taken shelter in makeshift camps, in or around Port-au-Prince, and 511,405 outside of Port-au-Prince.

As a result, centres such as Port-au-Prince, Jacmel, Jacmel Valley, Leogane, Petit Goave, Grand Goave, Gressier, Carrefour, Kenskoff, Ganthier, Miragoane and Tomazeau were affected, and landslides occurred along Highway 2 and the road leading to Jacmel between Grand Goave and Petit Goave. Several hospitals and public buildings were either destroyed or greatly damaged.

Natural disasters also increase the level of poverty in the country, as the following data demonstrate:

in 1964 for example, Tropical Cyclone Flora may have caused US\$180 million in damages, while Hurricane Gordon, between US\$80 million and US\$180 million in 1994 (ibid). The reconstruction of the areas hit by the January 12 earthquake is estimated at more than US\$1,44 billion.

**Figure 90:** Makeshift camp in Port-au-Prince (West Province), two months after the earthquake on January 12, 2010



Source: Antonio Perera, 2020

# SCENARIOS, PRIORITIES AND FUTURE ACTIONS

## CHAPTER 3



Photography: Antonio Pereira



## 1. Policy Responses

Generally, environmental management is commonly perceived as a distinct issue, unaffected by decisions made in other sectors, and operating according to its own, particular codes and rules. However, it is clear that some policies, adopted apparently without any referral to the environment, can nevertheless significantly contribute to its modification, just as much as specific environmental policies.

### 1.1 Public Environmental Policy

Haiti was actively involved in the renewed interest on sustainable environmental management which emerged throughout the world during the turbulent decade of the 1970's. The numerous conferences and warning admonitions, during that decade and the first half of the following one, attest to this. However, the environment only started to become an everyday concern in the second half of the 1980's.

The 1990's played a crucial role in bringing about awareness and general involvement on environmental management. In fact, more and more people are becoming active in environmental management in Haiti, due to the dual effect of the country's worsening environmental crisis and the media coverage of the international efforts to protect the environment following the "United Nations Conference on Environment and Development" (UNCED) (also known as the Rio Summit) in 1992.

It became apparent that there was a need for organised action. Thus, an «*Environmental Action Plan*» (PAE) was developed by the Ministry of Environment, created in 1994. Today, the PAE is still

the only document where the Haitian government has specifically identified programmes and provided guidelines towards the management of the environment.

However, more than 10 years later, none of these programmes has been systematically implemented, thus making it impossible to evaluate the actions outlined in the PAE.

An environmental management plan should be structured around the development objectives of a country. In fact, the definition of its major pillars should, at the very least, be aligned with its choice of development paradigm. However, there were none at the time the PAE was first drafted and it was not until 2008 that a "National Development and Poverty Reduction Strategy Paper (DSNCRP)", valid until 2010, was produced. The document set out the following environmental policies:

- Promotion of alimentary and economic security of Haitian communities, security of the ecosystem as well as the implementation of sound and effective inter-institutional coordination mechanisms to ensure a harmonious management and cohabitation between the population and environmental resources;
- Management of the environment on a partnership basis, forging alliances with the civil society to achieve responsible and sustainable resource management, yet without neglecting the issues of regulation, oversight, follow-up and monitoring.

Since 1996, the Haitian government has signed several international protocols and conventions as listed in the table below.

**Table 33: International Environmental Protocols and Conventions signed by Haiti**

Date	Titre
1996	Framework Convention on Climate Change
1996	Convention on Biological Diversity
1996	Convention on the Law of the Sea
1996	Convention to Combat Desertification
2000	Cartagena Protocol on Biosafety
2000	Vienna Convention for the Protection of the Ozone Layer
2000	Montreal Protocol on Substances that Deplete the Ozone Layer
2001	Stockholm Convention on Persistent Organic Pollutants
2005	Kyoto Protocol to the United Nations Framework Convention on Climate Change

Source: *Human Development Report 2007*.

## 1.2. State Instruments for Environmental Management

### a) Legal Instruments

Research and the compilation of documents have revealed the abundance of Haitian legislation on the environment. From the Constitution to government decrees and local bylaws, there are a number of texts which define the legal framework for effective environmental management in Haiti.

Chapter II of Title IX of the Framework-Law of the Republic focuses on the environment although unfortunately, it is reduced and limited to the natural environment. The decrees and bylaws established on environmental management mainly concern the protection of natural resources, sanitation and urbanisation.

It remains difficult to extract a set of standards or guidelines on environmental management as these laws were passed at different periods and in different circumstances. These were mentioned in the "**Framework Decree on Environmental Management**", in the January 2006 issue of *The Monitor*.

The vast majority of these, although still in force, date back to the 19<sup>th</sup> century, even if the environment, economic and demographic conditions of the time are far different from those today. The coercive measures, often economic in nature, have not evolved and the objectives

targeted by the laws are often no longer relevant to the Haitian reality. Most of these laws are therefore completely outdated or inapplicable, and should either be removed from the legislation or revised.

However, the task of updating the legislation cannot be accomplished without the will to apply the law. Nowadays, most environmental laws are never applied. In addition, their non-application creates a lack of jurisprudence, an essential necessary element in the revision of the legislation.

### b) Instruments at the Institutional Level

The 2006 Law on Environmental Management suggests a new system-based management which should be articulated along the lines of the National System of Environmental Management (SNGE). According to the SNGE, this responsibility should be shared by the various Ministries including the Ministry of Environment, the Government and Civil society through diverse political and participatory mechanisms.

Traditionally, Ministries are the institutions intervening on the issue of environment conservation: the Ministry of Agriculture, Natural Resources and Rural Development (MARNDR), the Ministry of Health, the Ministry of the Interior and the Ministry of Public Works. The MARNDR, until the Decree of 2006, was in charge of environmental policies (water, soils, forest, biodiversity), and the Ministry of Planning continues to be responsible for territorial management. The Ministry of the Interior and Local Governments (Collectivités



Territoriales), once in charge of national security, was responsible for enforcing the law against environmental infractions, carried out through the Army. Today, this ministry still participates in environmental management. There are also agents known as health officers and under the authority of the Ministry of Health, who are involved in this task. In 1979, the Institute for the Preservation of National Heritage (ISPAN), an autonomous agency, was created under the aegis of the Ministry of Tourism, and in 1988, the National Heritage Commission was founded with the Director of ISPAN as its President.

Additionally, agencies, such as OPPJ and DRIPP, were allowed to administer particular development projects, under the supervision of the MARNDR.

The establishment of the Ministry of Environment in 1994 added another stakeholder to the sector of environmental management in Haiti. It should be noted that more than 15 years later, this ministry still has no organic law which becomes an obstacle in the performing of its duties. The 2006 Framework Decree on Environmental Management of 2006, far from being an organic law, however establishes the responsibilities of this Ministry in relation to the other stakeholders in the sector.

In addition to the MDE, there are other public participating institutions, such as the National Institute for Land Reform (INARA), the National Centre of Geo-Spatial Information (CNIGS), (formerly the Remote Detection and Geo-Spatial Information System Unit-UTSIG), as well as the Economic and Social Assistance Fund (FAES), which are the most long standing. Quite recently, the MDE set up a structure which should evolve into the National Environment and Vulnerability Observatory (ONEV). The environment management sector has also benefitted from the assistance of international cooperation agencies, NGO's and citizen organizations, for example:

- **International Cooperation**

International cooperation is either bilateral or multilateral. In the first case, the cooperation agencies are under the authority of their respective embassies. The United States Agency

for International Development (USAID) and the Canadian International Development Agency (CIDA) are the primary aid agencies funding development initiatives in Haiti. International support is also provided by the many United Nations agencies operating in Haiti. The current United Nations Development Assistance Framework focuses on three priority areas namely: (i) Governance, with 26.52% of the funding; (ii) Sustainable Human Development with 65.05% and (iii) Environmental and Natural Hazard Management with 8.43%. The European Union, the Organisation of American States (OAS), Inter-American Development Bank (IDB) and the World Bank are some of Haiti's other multilateral partners.

- **Local and International NGO's**

Haiti, just as other «Southern» countries, has been overtaken by many international NGO's. Despite the existing legal framework designed to monitor these activities, it is impossible today to ascertain the number of NGO's operating in Haiti. Also, many institutions function as NGO's but are registered as associations or foundations in order to avoid legal complications. This has created a situation where it is difficult to know the purpose of many of these organisations, what they do or how they operate.

- **Citizen Organisations for the Protection of the Environment and Development**

The Haitian civil society's participation in environmental governance began after the fall of the Duvalier dictatorship. A number of citizens had then formed various types of associations between 1985 and 1986, but almost all of these, created during a period of patriotic fervour, ceased to exist shortly after. On the environmental issue, only the Friends of Nature Federation is still in operation but it has been reduced to a few individual members. Nowadays, other associations have emerged and play an important role in the environmental governance of the country. They are active mainly in environmental education and community development, and on the protection of natural environments.

## c) Economic-Level Instruments

• **Economic Liberalism**

According to the prescriptions of the *Washington Consensus*, Haiti adopted Structural Adjustment Policies (SAP) in the early 1980's and reinforced them during the 1990's. This decision, recommended by the Bretton Woods institutions, was characterised by a programme of trade liberalisation, the rationalisation of the civil service and privatisation of government assets<sup>64</sup>.

This policy, considered by some as liberal<sup>65</sup> and by others as neoliberal<sup>66</sup>, was viewed, by the most optimistic, as necessary to the stabilisation of the Haitian economy. Unfortunately, it did not achieve this objective. Worse yet, in some instances, it has pushed the Haitian economy into a maelstrom from which it is not easy to emerge.

In fact, it championed a trade liberalisation and the implementation of reduced custom duties which only contributed to the incapacitation of the Haitian economy. As such, it seems that "the Haitian commercial regime which has been shown to be one of the most open of the LDC exchange regimes",<sup>67</sup> was to the detriment of the country's economy.

This decision also contributed to the erosion of the foundations of the agricultural production in particular, and according to FAO<sup>68</sup> "in such an open-trade system, Haiti is extremely uncompetitive. Its weak productivity contributes to raise costs or to lower output in the agricultural sector, thereby reducing Haiti's opportunities to enter international markets".

For this reason, the Haitian farmer, faced with unfair competition from his foreign counterparts who benefit from subsidies, turns to other crops or gives up farming entirely. In many cases, this

"liberalisation forces many rural people to migrate to the cities or elsewhere<sup>69</sup>".

• **Conclusion**

Just as the Interim Cooperation Framework (ICF), never enforced but however renewed until 2006, the DSNCRP was to be valid for two years, one of which had already been spent awaiting its implementation, the reason why some imply that the DSNCRP remains just another document. Meanwhile and despite efforts, all were conscious of the country's deteriorating economic and environmental conditions, and some critics were arguing that the State has failed, nevertheless international assistance, or as some would even call it, foreign occupation.

In such a context, the immediate solution has seemed to be, until now, extensive projects in need of workers. In 2009, an increase in the minimum wage was discussed in the Haitian Parliament, the global economic crisis seemed to have stabilised, the price of oil had fallen, and more than 250 million US dollars had been invested in Haiti since hurricanes devastated the country in 2008.

However, the next hurricane season was fast approaching... what then would be the possible scenarios?

## 2. Scenarios for Haiti

The situation of the Haitian environment, as presented, seems bleak, the result of a high population growth rate and poor management of natural resources. This situation is directly related to Haiti's overall vulnerability to natural disasters. The lack of coordination by those institutions intervening in the sector does not help to counteract this dismal state of affairs. Along these lines, scenarios were developed as means to help

<sup>64</sup> UNDP. 2002. *Human Development Report*

<sup>65</sup> UNDP. 2003. *The Economic and Social Situation of Haiti in 2002*

<sup>66</sup> PAPDA. 1997. *Structural Adjustment Programme in Haiti: Responses and Alternatives*

<sup>67</sup> GOVERNMENT OF HAITI. 2003. *Examining Trade Policies in Haiti. Government Report*

<sup>68</sup> FAO. 2001. *The State of Food and Agriculture*

<sup>69</sup> REPUBLIC OF HAITI/UNITED NATIONS SYSTEM. 2003. *Haiti: Integrated Emergency Response Programme Targeting Vulnerable Groups and Communities in Haiti.*

gain insight into the possible future of the Haitian environment, based on three hypotheses: that the current situation progresses, regresses or is maintained. The scenarios can be used towards better decision-making by identifying alternatives, the combination of driving forces as well as of uncertainties.

Several elements were used to develop the scenarios: demographic growth, energy needs, the state of the environment, urban development in coastal areas, the socioeconomic situation and centralisation of economic activities. From these elements, the scenarios that have emerged may show what the possible future of the Haitian environment could be.

The first scenario is referred to as the “**Environment in Shambles**”. Under this scenario, the situation has worsened; efforts are ineffective and provide no solution to the country’s numerous environmental issues. The scenario briefly portrays a situation of dismay on any environmental scale.

The second scenario “Nothing New” shows a similar situation as the present one. This means that the different driving forces (population growth, energy needs etc.) continue to evolve in a similar way: those increasing will continue to increase, and those in decline will continue to regress.

The final scenario “Hope Emerges” presents the best environmental situation with considerable progress in environmental management. The conditions which foster this improvement are sustainable, allowing the country to attain a lasting development.

## 2.1. SCENARIO 1: Environment in Shambles

Conditions have deteriorated over the years. There are no family-planning programmes in place. Energy needs have largely surpassed the capacities of suppliers and no strategy has been identified to overcome this major deficiency. Environmental degradation is exacerbated due to poor quality of water and of air, as well as increased pressure on forests and on biodiversity in general. On a socio-economic level, the situation worsens not only as far as education is concerned but also in terms of health, infrastructure, services, employment opportunities and the escalation of damage caused by natural disasters. The centralising of activities in the urban centres only increases the pauperisation of non-urban areas, the rural exodus and the growing presence of slums on the periphery of the urban economic centres.

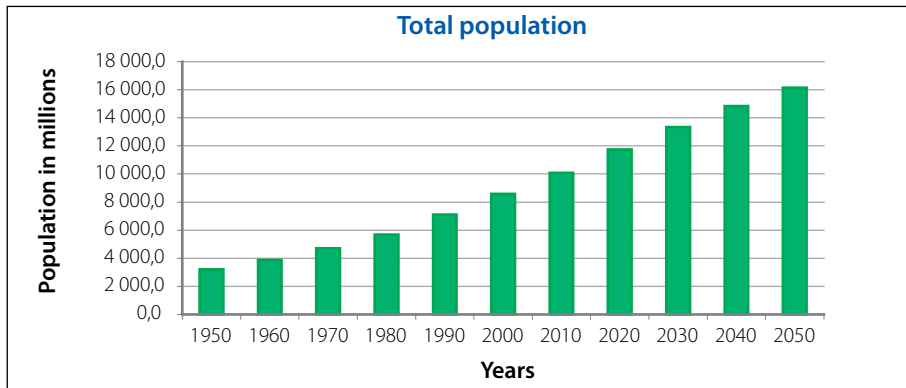
**Table 34: Scenario 1: “Environment in Shambles”**

Driving Forces	Descriptions
Population Growth	<p>Family sizes are increasing and the population is growing at higher rates. The population’s needs are more acute and their effect on the environment is considerable.</p> <p>The rural exodus is at its highest point causing an unprecedented explosion in the cities with a major lack of adequate basic services and rising pressure on environmental resources.</p> <p><b>- Food</b></p> <p>The need for food is growing rapidly while national production is diminishing due to soil degradation, resulting in further imports and international food aid.</p> <p>Energy consumption tends to increase as it is linked to population growth. Unprecedented forest clearing is taking place in order to fulfil energy needs. Reliance on forest, water and fossil resources is accelerating as are CO<sub>2</sub> emissions.</p>

Driving Forces	Descriptions
Energy Needs	<p>The government has not yet found a solution to the country's energy problem. As such the population's demand for energy remains extremely high while the supply continues to decrease.</p> <p>The provision of hydroelectric power is greatly affected by the phenomena of erosion and sedimentation. Demand for energy exceeds supply which means less people have access to electricity.</p>
State of the Environment	<p><b>- Marine and Coastal Environments</b></p> <p>The most serious problems which could impact the coastal zone are the increased destruction of beaches and the uncontrolled clearing of mangroves for construction and charcoal producing purposes; the risk of extinction of certain marine species and the complete loss of others; the growing vulnerability of coastal towns; the destruction of food and natural reserves particularly coral reefs and the decline of aquatic biodiversity.</p> <p><b>- Water Resources</b></p> <p>Water tables are extremely contaminated due to the lack of wastewater treatment as well as organic and chemical pollution.</p> <p>The occurrence or the intensifying of phenomena such as the salinity of aquifers, the flow reduction or even the drying up of water sources greatly impact the sanitary quality of the population's water. Further water shortage could also be observed in several areas around the country.</p> <p><b>- Forest Cover and Diversity</b></p> <p>Increasing population pressures and their effect on the environment have reached their highest point. More and more trees are cut down each year as the research on alternatives to charcoal as an energy source was not very successful.</p> <p>Soil is deteriorating further and vegetative cover has been greatly reduced. Erosion begins to extend to areas previously spared. None of the measures to protect natural resources is enforced.</p> <p>Mountain watersheds are deprived of vegetative cover, in addition to forest clearing in order to expand areas for farming; the overexploitation of natural resources runs the strong risk of jeopardising new animal and plant species.</p> <p>Biodiversity continues to be mercilessly exploited. New animal and plant species are in danger of extinction. Anthropogenic pressure threatens the country's protected areas yet the Ministries of Environment and Agricultural and Legal regulations have not come together to put legally-binding measures in place.</p> <p><b>- Air Quality</b></p> <p>Throughout the country, the proliferation of second-hand vehicles unequipped with catalytic converters contributes significantly to air pollution. Increased charcoal production and the lack of monitoring of factories are major sources of polluting emissions. Frequent open burning of refuse negatively affects air quality.</p>

Driving Forces	Descriptions
Urban Growth in Coastal Areas	<p>People increasingly settle in the cities, particularly Port-au-Prince, thereby increasing the contradictions and contrasts in the urban areas. Environmental components such as water, air, the sea and the coast are threatened. In addition, a large part of the population becomes even more vulnerable as they continue to settle in high-risk coastal areas.</p>
Socioeconomic Situation	<p><b>- Education</b></p> <p>Education is also inadequate both in terms of its quality and its ability to grasp or meet the needs of the population. The government does not carefully monitor the operations of educational establishments through the Ministry of Education, even though a large number of these and their services are often of dubious quality.</p> <p><b>- Health</b></p> <p>Health services are unable to meet the demands of the rapid rise in population growth.</p> <p><b>- Employment</b></p> <p>Poverty alleviation efforts are unsuccessful. Government services are insufficient and do not really help to improve the socioeconomic situation of vulnerable communities. International aid is reduced and the population becomes poorer, the vast majority in desperate need.</p> <p>60% of the annual budget is financed by the international community which has only disbursed a minute portion of funds. Grants for some unfinished projects employing a large number of labourers have run out.</p> <p><b>- Natural Disasters</b></p> <p>The country's capacity to cope with natural disasters is weak. It becomes more dependent on international aid to prepare for the hurricane season which requires great human and logistical resources. The population becomes more and more vulnerable, despite the goodwill of the government which has to contend with major external economic constraints.</p>
Centralisation of Economic Activities	<p><b>- Economic Centers</b></p> <p>There is a rapid growth of slums on the periphery of the economic centres as well as additional pressure on the environment and housing. All this is linked to a lack of basic services and other infrastructures.</p>

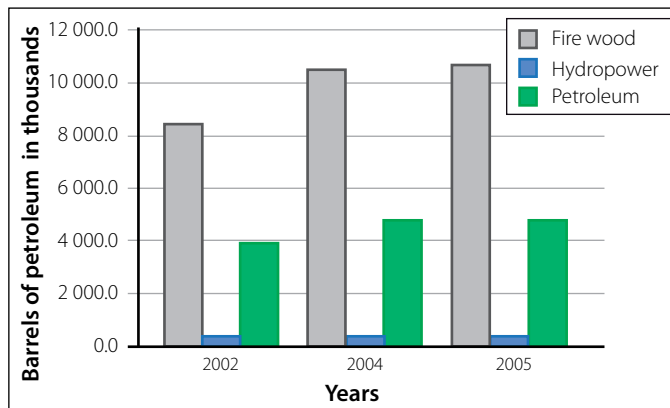
**Figure 91:** Evolution of the Haitian Population 1950 to 2050



Source: [http://websie.eclac.cl/anuario\\_estadistico/anuario\\_2008/esp/index.asp](http://websie.eclac.cl/anuario_estadistico/anuario_2008/esp/index.asp)

In 2009, Haiti's population was 9 million people – 16 million by the year 2050. It is projected to reach twice the number of 1970.

**Figure 92:** Supply of Renewable and Non-Renewable Energies

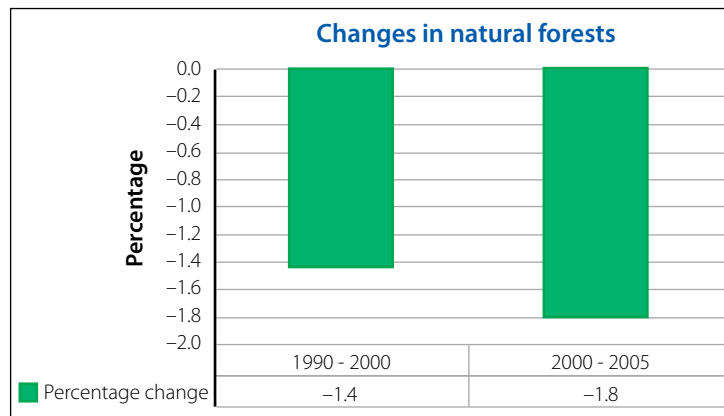


Source: [http://websie.eclac.cl/anuario\\_estadistico/anuario\\_2008/esp/index.asp](http://websie.eclac.cl/anuario_estadistico/anuario_2008/esp/index.asp)

The world's supply of renewable energy cannot compare to that of wood energy; hydroelectricity remained stagnant from 2002 to 2005 and shows

no signs of improving. The need of non-renewable energy sources, such as oil, comes close behind wood energy sources.

**Figure 93:** Variation rate in Natural Forest Areas



Source: [http://websie.eclac.cl/anuario\\_estadistico/anuario\\_2008/esp/index.asp](http://websie.eclac.cl/anuario_estadistico/anuario_2008/esp/index.asp)

The country's natural forest cover has gradually been reduced between 1990 and 2005, shrinking by 1.4% between 1990 and 2000 and by 1.8% between 2000 and 2005.

## 2.2. SCENARIO 2: Nothing New

The second scenario focuses on a situation where the current trends are maintained. While the

government could adopt initiatives to alleviate the problems, a reversal of the situation seems unlikely. The wood resources are increasingly pressured with countermeasures showing little results; water-resource management is neglected; forests are diminishing; and the effects of natural disasters are more severe. Waste management is still ineffective as in the case of coastal-zone management.

**Table 35: Scenario 2: "Nothing New"**

Driving Forces	Descriptions
Population Growth	<p>The population continues to grow at the same pace as in previous years creating an increasing demand for food. Various food products have to be imported to cope as national productivity is insufficient because the agricultural sector has yet to make efficient use of technologies.</p> <p>Urban migration is on the rise leading to a centralisation of activities in the main urban centres.</p>
Energy Needs	<p>The government devises methods to promote and increase access to renewable energy including subsidies (e.g. propane gas etc.). The Bureau of Mines and Energy (BME) benefits from capacity strengthening to enable it to better implement the government's energy programmes and strategies. The cost of all forms of energy, however, remains high.</p> <p>Considerable pressure continues to be exerted on wood resources (wood energy) and oil import trends remain the same.</p> <p>Energy needs grow while some electricity plants, particularly the hydroelectric plants lose capacity due to dredging of rivers and sand erosion from lakes.</p> <p>Energy needs are responsible for emitting 156.77 Gg of CO<sub>2</sub> (UNEP, 2008) as the State increasingly turns to fossil energy sources (opening of three new thermal plants in Port-au-Prince, Gonaïves and Cap Haïtien).</p>
State of the Environment	<p>The government makes sound environmental management its priority and advocates the enforcement of most of the environmental laws, decrees and conventions which have been voted or signed.</p> <p><b>- Marine and Coastal Environments</b></p> <p>Protected coastal areas still do not exist in Haiti and nothing indicates that this will change. Beaches are further polluted as activities on the coast are barely regulated and like other areas on the coastal strip, extremely threatened by urban growth. Haiti's population is largely unaware of the need to preserve its coastal heritage.</p> <p><b>- Water Resources</b></p> <p>There are no provisions for the protection of water sources and catchment areas, human settlements continue to grow there triggering the establishment of a number of drinking water treatment businesses throughout the capital and other major urban centres. Existing legislation is not enforced which results in escalating pollution, especially of rivers by the dumping of industrial waste. Environmental monitoring is unsubstantial and the small-scale measures implemented only produce mixed results.</p>

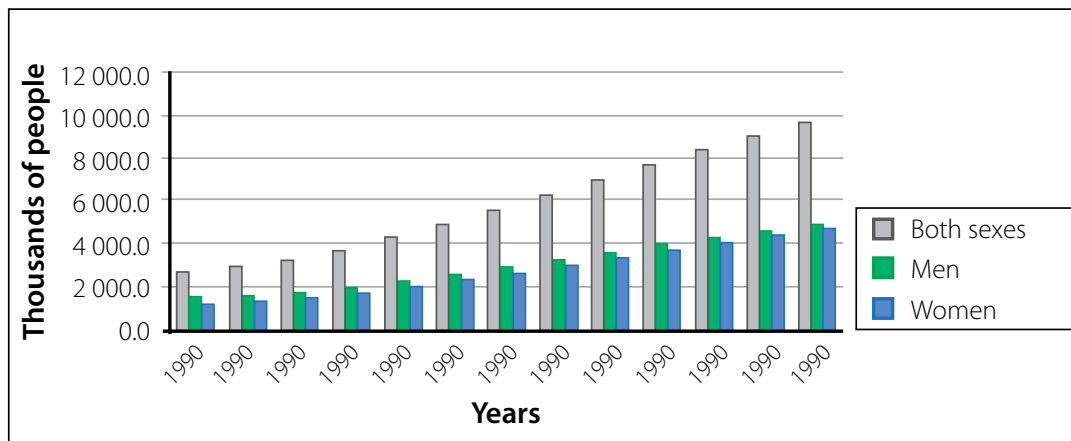
<p>State of the Environment</p>	<p><b>- Forest Cover and Biodiversity</b></p> <p>One of the major challenges to sustainable solutions lies in the fact that Haiti is generally unable to ensure the continuity of its environmental restoration and conservation programmes when institutional political changes take place.</p> <p>Few national actions intended to protect biodiversity are carried out. Despite the endangered status of some indigenous species, no efforts have been made to protect them.</p> <p>Very little of the budget is allocated to management and conservation activities designed to preserve vegetative cover and biodiversity.</p> <p>International conventions signed by the State as well as local environmental laws are rarely enforced.</p> <p>Little research is done on indigenous species and biological inventory.</p> <p><b>- Air Quality</b></p> <p>Industrial emissions continue to increase moderately. Fumes from charcoal production (deforestation) are greater in the rural areas. There are tentative efforts to offset carbon through reforestation. Pressure on forests due to additional human settlement also has a negative effect on these efforts.</p>
<p>Urban Growth in Coastal Areas</p>	<p><b>- Waste</b></p> <p>Garbage collection is irregular. Microenterprises specialised in recycling and composting were created to treat waste. International organisations join the efforts but field reports still indicate mixed results. Overlapping occurs in certain areas where the population is ill-informed on waste management.</p> <p><b>- Infrastructures and Services</b></p> <p>Services and infrastructures are all centralised. The provision of basic services is lacking in many rural areas. Indeed, some have only been able to benefit from minimal facilities due to the efforts of local and international organizations.</p>
<p>Socioeconomic Situation</p>	<p>Educational standards, particularly at elementary level have not really improved. Both the establishment of school facilities and the necessary innovations are slow in coming. Current measures have faced barriers due to traditionalism and opposition to change. To overcome these obstacles, the government plans to set up mechanisms which will help bridge the gaps in educational standards.</p> <p><b>- Health</b></p> <p>Insufficient health services in rural areas; the main hospitals are located in the cities. Public information programmes on preventive measures are lacking in remote areas throughout the country.</p> <p>Low sanitation coverage giving rise to numerous microenterprises offering water treatment in order to counteract this deficiency.</p> <p><b>- Employment</b></p> <p>The majority of those of working-age, whether trained or untrained and with or without experience, is unemployed. However, there could be the possibility of a need for trained personal in technical fields such as construction, information technology (creating specific programmes for specific domains), geology and telecommunications.</p>



<p>Socioeconomic Situation</p>	<p>Political stability is returning and seems lasting. The country tries to reposition itself on a global level in ecotourism and the seaside resort industry.</p> <p><b>- Natural Disasters</b></p> <p>Natural disasters that hit Haiti tend to cause enormous damage compelling the government to institute a national risk and disaster management plan as well as public awareness campaigns on hurricane preparedness. However, these measures are not adequately applied, perhaps because of a lack of inter-institutional coordination. There is almost a complete lack of early warning systems.</p>
<p>Centralisation of Economic Activities</p>	<p><b>- Economic Centers</b></p> <p>Few free-zones exist; the major tourist attractions, especially the seaside ones such as Labadee (in the north) visited by large cruise ships, could be more developed. These coastal areas are largely affected by pollution.</p>

The graph below shows a projection of Haiti’s working-age population from 1990 to 2050.

**Figure 94:** Economically Active Population

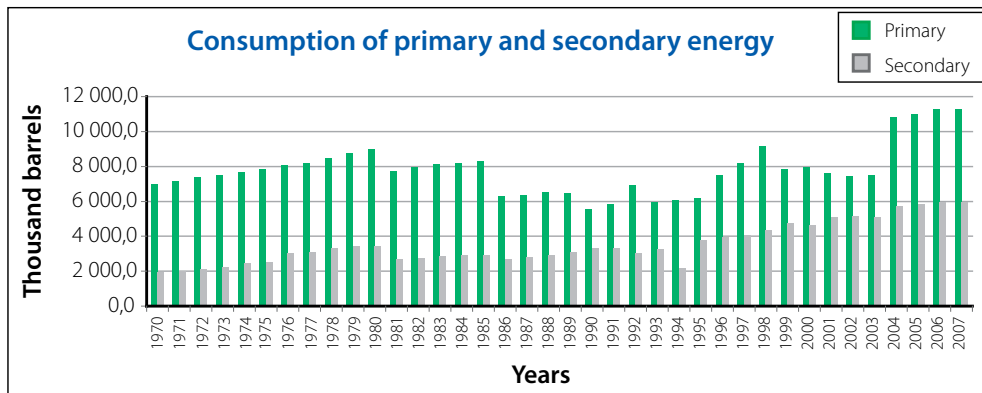


Source: [http://websie.eclac.cl/anuario\\_estadistico/anuario\\_2008/esp/index.asp](http://websie.eclac.cl/anuario_estadistico/anuario_2008/esp/index.asp)

The graph refers to people of working age (15 years and older) whether or not employed. The number of people of working age will continue to grow and will double in 2050 compared to

2010, requiring additional sources of employment namely, new industrial zones, more tourist areas, and the developing of the rural areas in order to avoid increased rural exodus.

Figure 95: Energy Consumption

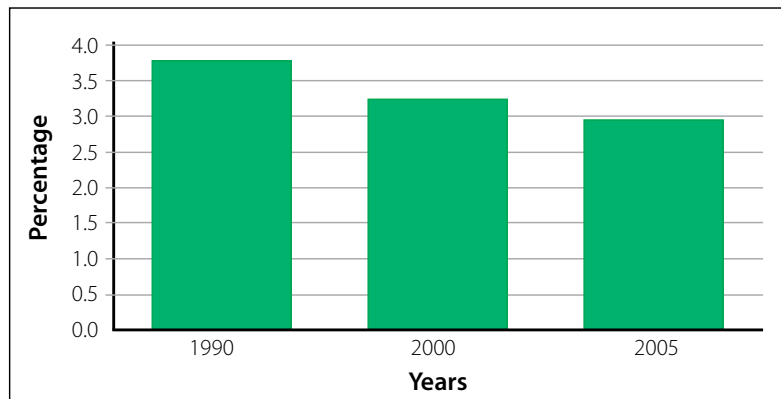


Source: [http://websie.eclac.cl/anuario\\_estadistico/anuario\\_2008/esp/index.asp](http://websie.eclac.cl/anuario_estadistico/anuario_2008/esp/index.asp)

Energy consumption continues to rise. The consumption of primary energy rose from 7 million barrels in 1970 to more than 11 million barrels in

2006. This trend is likely to continue in the years to come.

Figure 96: Evolution in the Forest Area



Source: [http://websie.eclac.cl/anuario\\_estadistico/anuario\\_2008/esp/index.asp](http://websie.eclac.cl/anuario_estadistico/anuario_2008/esp/index.asp)

Since 1990, the same trend has been observed at national scale: forest areas are gradually diminishing, from approximately 4% in 1990 to about 3% in 2005.

Environmental management is made a priority by stakeholders and decision-makers, which in turn has a positive effect on other sectors such as health, natural resources, agriculture and the provision of services.

### 2.3. Scenario 3: Hope Emerges

Haiti's environmental situation has improved dramatically compared to previous years.

Table 36: Scenario "Hope emerges"

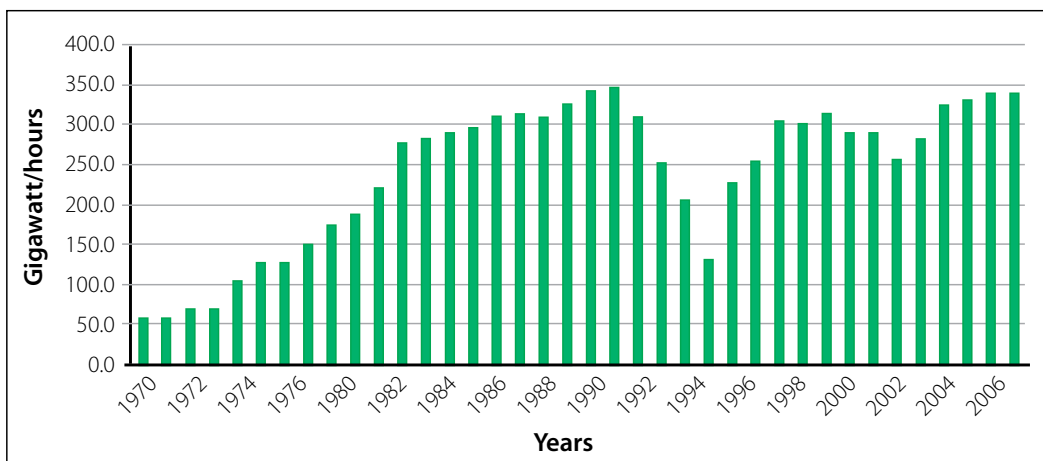
Driving Forces	Descriptions
Population Growth	<p>The population growth rate is appropriate and its effects on the urban and rural environment subside. Demographic rate is reduced considerably compared to previous years. All the other priority areas show exemplary progress, namely a fall in urban migration linked to improved basic services in rural areas, increased national agricultural output due to job creation. Facilities and infrastructure are upgraded even in the most remote areas. The quality of life improves as life expectancy moves from 60 to 76 years by the year 2050.</p> <p>The State controls the growth rate by implementing information and family-planning programmes.</p> <p><b>- Food</b></p> <p>Haiti embarks on the transformation of the raw materials it produces thereby reducing wastage as well as food insecurity. Adding value to some products extends the life of the product for the market.</p>
Energy Needs	<p>Current trends, marked by rising consumption and heavy reliance on fossil fuels (oil and charcoal), must be reduced in the future. This step will be evidenced by the development of renewable energies (wind, biogas, solar, hydropower) over fossil fuels, enabling Haiti to lower CO<sub>2</sub> emissions and improve air quality.</p> <p>Haiti must plan to establish agencies to promote renewable energies as well as enact revised laws with a view to achieving sound, sustainable management of the energy sector. This will require a population aware of the importance of energy conservation.</p>
State of the Environment	<p>The existing environmental legislation is developed and becomes an effective tool in the management of the country's natural resources. The relevant government agencies uncompromisingly carry out their duties, performing quality control of businesses involved in harvesting natural resources.</p> <p><b>- Marine and Coastal Environments</b></p> <p>A network of protected marine areas will be established in order to ensure protection of the coast. Plans are also made for the implementation of programmes on the regular cleaning of beaches, that people made aware of the importance of protecting the beaches, that coastal areas be developed while preserving the environment's natural condition and that natural resources be used in a controlled manner in order to provide employment for people in the areas concerned.</p> <p><b>- Water Resources</b></p> <p>The State commits itself to the managing of water resources. Vegetative cover above rivers is considerably restored which will entail less anthropic stress on environmental resources. This will help replenish underground water reserves and improve the country's hydroelectric power. Wastewater is treated before it is discharged into watercourses. More effective waste management is adopted and water catchment areas are protected from the effects of urbanization.</p>

<p>State of the Environment</p>	<p><b>- Forest Cover and Biodiversity</b></p> <p>A number of protected green areas are created or enhanced. Forests are better managed and energy resources are subsidised throughout the country. Neglected spaces are restored with vegetation and the landscape seems renewed in many areas.</p> <p>A national system of protected sites is established which results in the reduced loss of the habitats of vulnerable animal and plant life. Measures on the saving endangered species and the protecting of migratory species are emphasized. Importance is given to the developing of a biological corridor. These measures will be accompanied by public information campaigns to promote the participation of the population.</p> <p>The pressure on the country seems to be noticeably relieved and Haiti is on its way to sustainable development. Small, scattered, very short-term projects are replaced with ones lasting several years which are likely to produce more viable results in the short, medium and long term. With the demographic parameters decreasing, the possibilities are endless in terms of strengthening the socio-economic parameters boosted by good political and environmental governance.</p> <p><b>- Air Quality</b></p> <p>The government promotes initiatives to monitor and control the sources of industrial emissions as well as open dumps.</p>
<p>Urban Growth in Coastal Areas</p>	<p><b>- Waste</b></p> <p>Selective waste collection, as well as the treatment and reprocessing of waste (compost) are important objectives. The government could also consider the production of methane gas as well as encourage the reduction of the amount of waste produced through public awareness programmes.</p> <p><b>- Infrastructure and Services</b></p> <p>Housing should be equipped with basic services (water, electricity, telephone and internet). The construction of a first-rate transport infrastructure (roads, highways, railways) will be essential in the future not only for the improvement of public transport but also for the reorganisation of the sector.</p> <p>The reform of the system of excreta management including the installation of modern sanitary facilities is another important area of focus. The government commits to increase availability to these facilities to the most vulnerable population thereby reducing the number of persons without access to sanitary disposal of excreta.</p> <p><b>- Wastewater Management</b></p> <p>The setting up of water treatment and water purifying plants will enable the preservation of the quality of bodies of water where wastewater is generally discharged.</p> <p>The sanitation coverage of the population is greatly improved: sewage systems are upgraded in both urban and rural areas; the State adopts a strict approach to the quality of drinking water and to the protection of water sources especially in terms of human settlements nearby.</p>

<p>Socioeconomic Situation</p>	<p><b>- Education</b> Modern schools are built in each community. The outcome is positive with better success rates in State exams. In addition, many more schools are endowed with modern libraries and computer laboratories.</p> <p><b>- Health</b> Environmental conditions improve as a consequence of a decrease in environmental pollutants. Public health improves in that there are fewer sick people (less skin diseases etc.) and health coverage is better and more effective. Children are considered a top priority. Food quality is ensured, leading to an improved quality of life.</p> <p><b>- Employment</b> The establishment of a minimum wage as well as cost of life adjustments foster the economic development of the people. Job-fairs are organized in order to help secure employment and a regulation of the labour market facilitates employment.  The government implements environmental monitoring programmes and sets up early warning systems in high risk zones. Protected areas are administered by a management committee. Waste is collected, sorted, treated and reprocessed in Port-au-Prince as well as in other cities.  Investor trust strengthens with the return of socio-political stability and the state encourages investment in the country by creating a lasting and modern infrastructure such as roads, ports and airports, among others. Different regions of the country are opened up and developed according to their geographic and economic potential.</p>
<p>Centralisation of Economic Activities</p>	<p><b>- Economic Centers</b> Development is fostered in all sectors namely agro-processing, textiles, construction and telecommunications through the creation and upgrading of industrial zones. Research centers and eco-tourism sites will also be developed.</p>

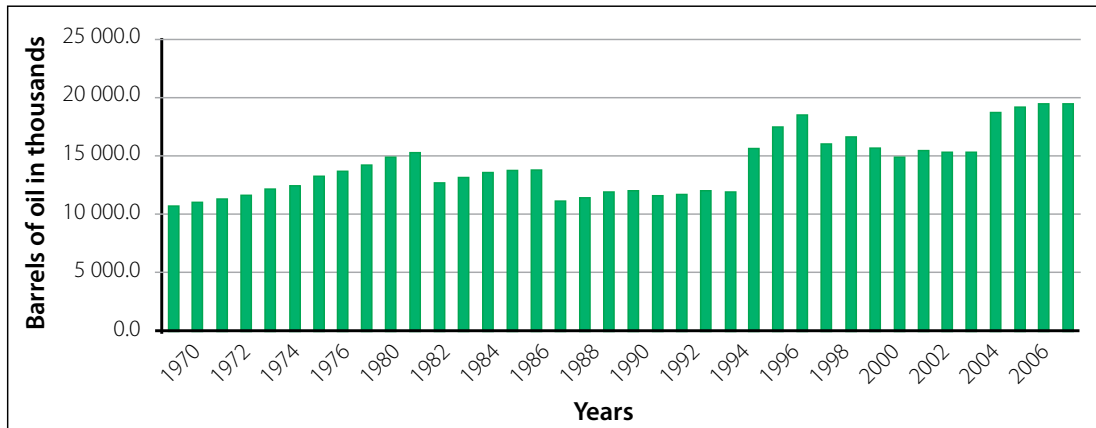
The figures below show the supply and consumption of electric power in Haiti.

**Figure 97:** Consumption of Electric Power



Source: [http://websie.eclac.cl/anuario\\_estadistico/anuario\\_2008/esp/index.asp](http://websie.eclac.cl/anuario_estadistico/anuario_2008/esp/index.asp)

Figure 98: Supply of Electric Power

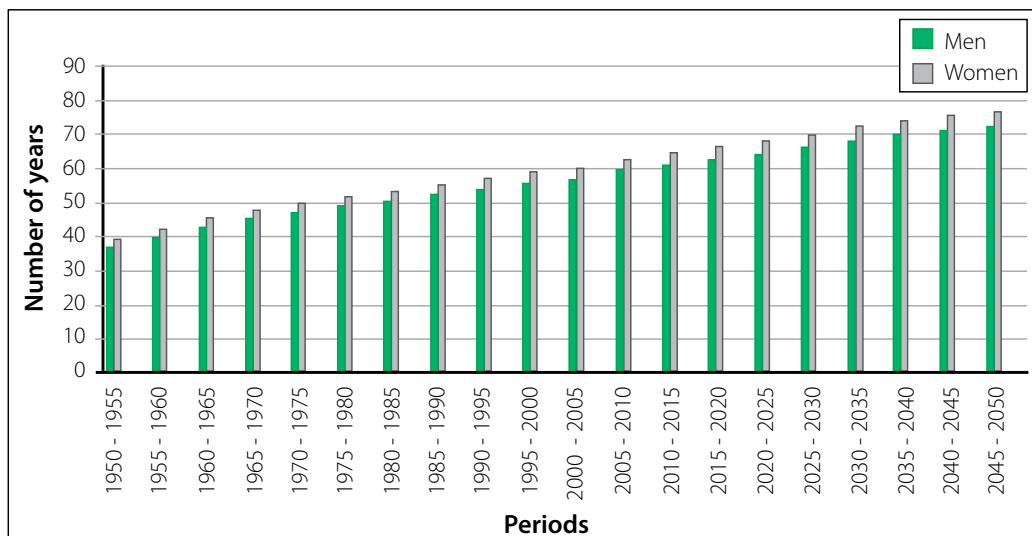


Source: [http://websie.eclac.cl/analisis\\_estadistico/analisis\\_2008/esp/index.asp](http://websie.eclac.cl/analisis_estadistico/analisis_2008/esp/index.asp)

Figures 97 and 98 show that Haiti's consumption of electric power grew from 50 gigawatts hour (GW-h) in 1970 to 340 GW-h in 2006, an increase of more than 500%. The country must undertake initiatives to reduce its electric energy consumption

and incorporate renewable energies, namely wind, hydroelectric, solar and biogas. Haiti can decrease its CO<sub>2</sub> emissions from electric energy by developing its supply of renewable energy.

Figure 99: Life Expectancy in Haiti

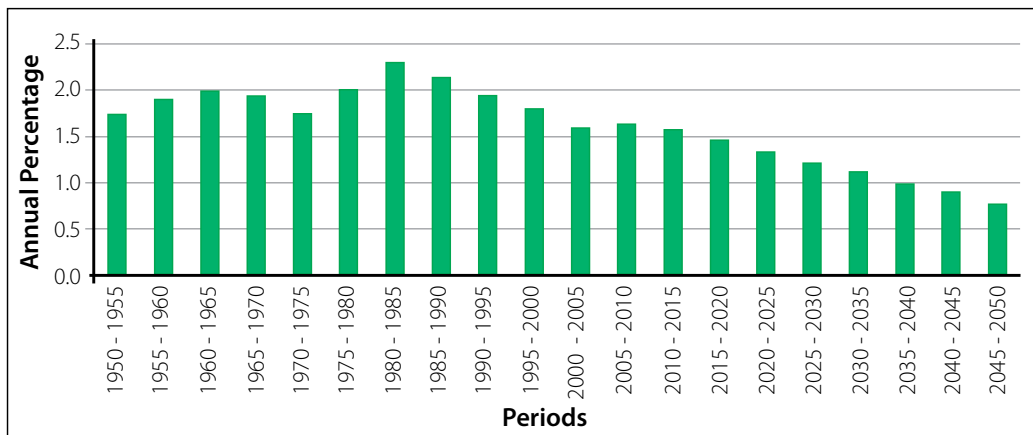


Source: [http://websie.eclac.cl/analisis\\_estadistico/analisis\\_2008/esp/index.asp](http://websie.eclac.cl/analisis_estadistico/analisis_2008/esp/index.asp)

In 2010, life expectancy in Haiti is estimated at 49 years for men and 52 years for women. It is projected to increase to between 71 and 76 years

respectively in 2050 depending on the improved socioeconomic and environmental conditions in the country.

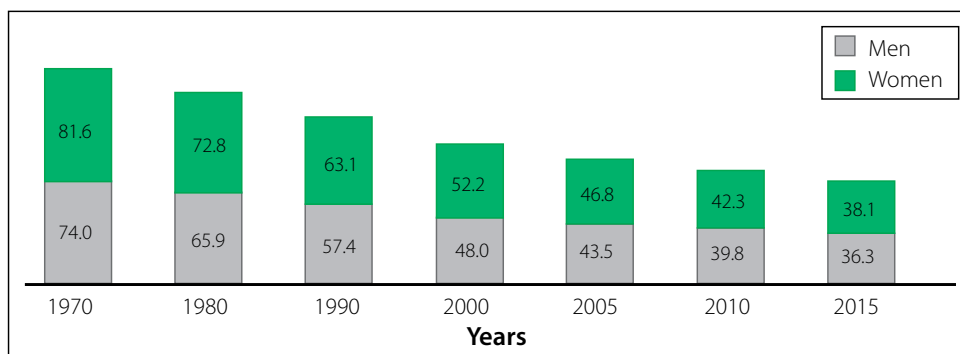
Figure 100: Population Growth Rate



Source: [http://websie.eclac.cl/anuario\\_estadistico/anuario\\_2008/esp/index.asp](http://websie.eclac.cl/anuario_estadistico/anuario_2008/esp/index.asp)

A reduced growth rate is crucial to mitigating the environment and its natural resources. current pressure exerted by the population on the

Figure 101: Percentage of Illiterate Population



Source: [http://websie.eclac.cl/anuario\\_estadistico/anuario\\_2008/esp/index.asp](http://websie.eclac.cl/anuario_estadistico/anuario_2008/esp/index.asp)

Literacy is essential to a development process. In fact, reducing illiteracy (to less than 40% in 2015) could be a major tool in the integration and use of new vital technologies to the country's development.

In conclusion, through such scenarios, we have tried to show what the future could hold for environmental management in Haiti. The first one represents the worst case, marked by poor territorial management and should be rejected by governments or decision-makers.

The second shows that initiatives could be put in place but with mixed results. To be effective, the government would have to set up better control mechanisms susceptible to have an effect on the environmental main driving forces. Finally, the last scenario is a reflection of a normalized situation, the ideal one to the country's development. It shows that proper environmental management, including a better administration of natural resources, of demography and energy needs, is key to sustainable development.

### 3. Priority and Future Actions

« Face the future »

Jerry Tardieu

The Future Ahead. The Challenges of  
Globalization  
and the Defeatism of Haitian Elites

The degradation of the Haitian environment is largely linked to the extreme poverty of the majority of its population. As such, it is undeniable that the restoration of the Haitian environment is highly dependent on an equitable economic development, where both rich and poor have access to its benefits, and respectful of the environment. Some would call this “sustainable development”.

However, the components of such a scenario have proven difficult to master. Does this mean that the Haitian environment must inexorably continue to suffer according to the economic tribulations of the country? The evidence suggests so.

Nonetheless, it is also true that although things cannot quickly and radically be changed, it would however be possible to curb the degradation and even improve the situation through effective environmental management. This is the logic underlining the measures proposed below, without being exhaustive.

#### 1. Declare an environmental state of emergency

The average Haitian seems to be more interested in the environment since the devastating and deadly floods of 2004 and 2008. However despite their importance, it seems that the rigours of daily life tend to overshadow the necessity of immediate, wide-ranging actions.

Nevertheless, it remains essential to declare an environmental state of emergency in Haiti.

#### 2. Explore and mobilise possible sources of funding to restore and protect the environment

Environmental restoration and protection programmes risk failure without the appropriate financial support. These cannot rely solely on public funds, which are already inadequate, in order to meet the plethora of needs. Therefore, the entire country should commit itself to fulfil the financial requirements of environmental management.

In this perspective, it is vital to seek additional funding sources. For example, it would be wise to think of the use of environmental services in such a way that these could yield funds to be reinvested in the restoration and protection of the environment and as such implement the FREH as established by law.

#### 3. Develop public-private Haitian collaboration on environmental management, within a formal framework of public/private partnership

Until now, the private sector has hardly been involved in environmental management. It is evident, however, that it should remain a key player in the solution of the Haitian environmental crisis, in part through its significant financial means.

It would be to the country's interests to request a major participation on its part, much more than in the past.

#### 4. Involve local government in environmental management

Until now, most local governments have only been ascribed secondary roles in environmental matters. As such they have not been able to demonstrate the full extent of their capabilities.

It goes without saying that these play an important role in environmental management, an undeniably daily and ongoing task.

#### 5. Create synergy among the main organisations working in the field of environmental management

It is important to coordinate activities among the main environmental organisations, as synergies



enhance effectiveness and prevent duplication of activities.

6. Establish a group of environmental negotiators in charge of dialogue with the international community on environmental restoration and protective programmes

Efforts to mobilise the international community in the struggle to save the environment must be carried out in a professional manner. Negotiations must therefore be led by experts in environmental matters.

There is therefore a clear need to establish a group of negotiators specialised on environmental issues.

7. Undertake an extensive training-programme of specialists on the main environment-related fields

Haiti has a respectable pool of environmental-management specialists. It would be useful to increase their number as well as to train other professionals in specific areas.

The availability of this "critical mass" of specialists would facilitate the development of environmental-management systems specific to the country, which would enhance the effectiveness of better-adapted initiatives.

8. Promote scientific research and create a database on the Haitian environment

Contrary to popular belief, not many studies have been carried out until now on the Haitian environment. Data on various aspects of the environment remain inexistent. It is inconceivable that effective environmental management be carried out without a profound knowledge of the environment situation.

It is therefore fundamental to carry out scientific studies in specific areas, those where there is a need for essential data and information.

9. Implement the Environmental Action Plan

"The Environmental Action Plan" (PAE), drafted some years ago, has been little applied. Yet, the document could be useful in improving environmental management if its propositions and 10 programmes were adopted.

The PAE advocates:

- National capacity-building on environmental management;
- A sustainable development energy programme;
- Public education on the environment and sustainable development;
- Conservation and the sustainable-utilization of biodiversity;
- Management of strategic watersheds;
- Integrated management of coastal and marine zones;
- Environmental sanitization;
- Management of natural disasters;
- Sustainable-development activities support;
- Effective management of mines and quarries.

### Who will coordinate these actions?

Launched at the end of 2008 by the Ministry of Environment, The National Environment and Vulnerability Observatory (ONEV)<sup>70</sup>, would be the most appropriate entity to coordinate the above-mentioned actions. It would have to be permanent and equipped with the necessary means to carry out its mandate effectively and efficiently, and also need to forge partnerships with other specialised public and private stakeholders in the environmental sector. Some possibilities would be: CNIGS, MARNDR, MICT, TPTC and other environment-related national and international organisations.

<sup>70</sup> *Le Nouvelliste*, 2008.

# CONCLUSION AND RECOMMENDATIONS

The environment in Haiti, with its huge potential, has unfortunately suffered the degradation of its natural resources, a largely man-made degradation.

The regressive decline of vegetative cover has a series of impacts on environmental components such as soil erosion, the silting-up of its coasts and the sedimentation of water-bodies. Soils must be replenished in order to mitigate the impact of rain and the phenomena of erosion. Government interventions still remain inadequate and with mixed results.

The population's demand for wood energy puts pressure on the vegetative cover. Some efforts to decrease the consumption of charcoal include the utilization of propane gas and the manufacturing of briquettes made from solid waste (such as the Carrefour-Feuille Project). However these initiatives are minimal.

Soil degradation, due to excessive land-clearing, is one of the most visible environmental degradation phenomena, particularly in steep watershed areas. Mitigation measures are needed in order to address the extensive deterioration of the majority of the main watersheds. The enforcement of the legislation, such as the Convention to Combat Desertification, is crucial to the deployment of measures against soil degradation. The State will have to adopt soil and water conservation measures including on farming and grazing areas, and impose a seasonal ban on erosive crop cultivation. Other zones will need long fallow periods due to their significant degradation.

Given that Haiti will experience a severe shortage of fresh water in 2025, decision-makers will have to pay greater attention to the state of water resources. The problem is not in term of quantity but of management. This poor management is in correlation with an uneven geographical distribution of rainfall which has exacerbated the demand for water in most regions. Qualitatively speaking, the situation is not much better, marked by polluted drinking water and increased salt water intrusion. As a result, it is vital that both preventive (to combat and control sources of pollution) as well as rehabilitation measures (disaster areas) be adopted. Initiatives are taken, but still too weak to effectively resolve the current situation. The main challenges remain the monitoring of potable water and the effective management of this resource. It is important that this supervision be applied to production and sale of treated water as well.

Additionally, the monitoring of the sand and sediment levels of lakes, ponds, rivers, and streams, as well as enforcement and also up-dating of laws are essential. Public awareness-campaigns on the importance of superficial water bodies should also be prevalent. So far, responses to these issues have been weak.

The Haitian coastal environment, in particular on the periphery of major urban centres, is a dumping-ground for sewage as well as for the sediments coming from the mountain watersheds. It also suffers from the effects of uncontrolled construction and land occupation, including the overexploitation of its marine resources and mangrove forests, particularly on the continental shelf. This pollution also destroys the beaches' attractiveness. Some of the measures to counteract such problems should include: protected marine and urban areas, the control of coastal erosion by upstream watersheds, and improved knowledge and technological skills of those exploiting such resources. Until now marine conservation activities are barely visible and thus consequently difficult to assess.

The country's energy resources rest chiefly on wood and its by-products. Wood is used on a national scale and everywhere (coasts, plains, mountains), as much in homes (rural and urban), as in micro-enterprises (bakeries, dry cleaners, lime-kilns, mills, brandy distillers, essential oils etc.). Nonetheless, the over-exploitation of forests to satisfy the demand for energy create numerous environmental problems, namely soil degradation due to loss of vegetative cover, water erosion, silt-up of lakes and ponds, and decreased hydroelectric capacity. Many initiatives have been developed in this sector, for example new power-plants in several cities, and feasibility studies have been conducted on wind energy particularly in the north. Nevertheless, Haiti will have to improve its use of renewable energy (hydroelectricity, wind, solar), and increase, throughout the country, other possible alternative options, such as propane gas and the use of briquettes made from solid waste (based on its experience, the Carrefour-Feuilles Project is an experiment which should be repeated in other cities).

The air in Haiti is not heavily polluted from industrial activities as the country is hardly industrialised. Actually, the main source of air pollution is largely linked to vehicle emissions, seemingly without widespread health implications. However, stricter control measures of the main sources of air pollution, namely vehicles unequipped with catalytic converters should be enforced.

Quarrying activities and their consequential waste are generally responsible for the degradation found in most regions, especially in coastal areas. The legislation covering these activities is ignored by most users, who take advantage of the State's weak enforcement, regardless of the topography or of the intended use of the soil. As a result of the level of degradation, the State will have to use strict measures in regard to exploitation methods and areas suitable or unsuitable for exploitation, including binding measures on the restoration of exploited sites.

In regard to housing in Haiti, one could say that anarchy reigns. No space is specifically reserved for construction and dwellings are found everywhere – on river banks, on floodplains, on geologically unstable lands. The associated problems, namely of sanitation and basic services, are more critical in some areas than in others. Challenges are enormous and a viable solution could be an ample territorial management-programme. It would be necessary to decide which governmental agency would be in charge: could it be the Prime Minister's Office through CIAT?

One cannot discuss the degradation of Haiti's environment without emphasising the influence of disasters on its exacerbation. Haiti's geographical location, its land occupation patterns and generalized poverty are the main factors which increase Haiti's vulnerability to the risk of disasters and climate change. The occurrence of disasters in Haiti has caused extensive material damage including a significant loss of human lives. However, some progress has been achieved on the issue through the development of a National Risk and Disaster Management Plan (PNGRD) and local and community Civil Protection Committees, allowing decision-makers to improve their capacity to cope with natural disasters. Public awareness-campaigns on hurricanes and mitigation projects have also been successful.

Nevertheless, the implementation of actions often presents some weaknesses, as for example, a lack of coordination and the overlapping of activities by the institutions involved in risk and disaster management. These deficiencies can be attributed to an overhead governance problem.

In summary, decision-makers will have to establish response mechanisms in order to face the major environmental challenges in Haiti, those characterised by anthropic pressures on its natural resources. Some possible mechanisms have already been mentioned, but others will have to be anticipated in order to ensure better intervention and management of Haiti's environment. Among these, we could mention the following:

- Institutional strengthening;
- Public-awareness and educational programmes;
- Implementation of early warning systems;
- Establishment of weather stations in high risk zones;
- Vulnerability studies on a national scale;
- Rehabilitation programmes for the marine and coastal environment;
- Implementation of systems to combat erosion (land, gully);
- Implementation of systems to regulate watercourses;
- Creation and management of protected areas;
- Implementation of replenishing and reforestation programmes (planting, sowing, pest control);
- Definition of the role of the various actors participating in environmental management in Haiti.

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# Annexes





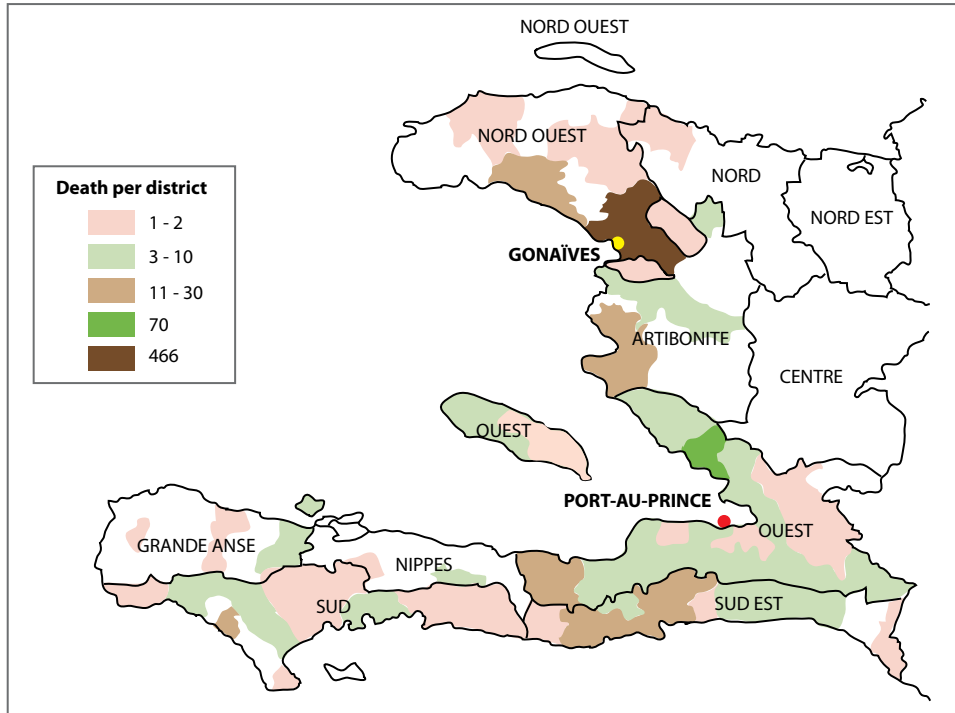


## Annex 1. Volume of main agricultural commodities produced between 2000 and 2005

Crops	2000	2001	2002	2003	2004	2005
Paddy Rice	130,000	103,000	107,000	108,500	105,000	105,000
Maize	202,500	180,000	179,400	182,000	198,000	200,500
Sorghum	98,000	80,000	89,600	91,000	95,000	100,000
Potato	9,600	11,000	10,200	10,500	11,500	13,000
Sweet Potato	180,000	174,000	175,000	180,000	175,000	200,000
Cassava	337,740	332,000	330,000	330,000	340,000	400,000
Yam	200,000	197,000	189,700	191,000	199,000	220,000
Banana	322,500	290,000	308,000	310,000	300,000	300,000
Banana Fig	150,000	150,000	150,000	138,000	138,000	140,000
Taro	86,000	86,000	86,000	90,000	90,000	92,000
Mazombel	30,000	30,000	30,000	40,600	40,600	40,000
Bean	33,150	32,900	32,500	35,000	34,000	40,000
Peanut	21,000	21,000	20,000	22,000	22,000	24,300
Congo Beans	54,000	54,000	53,000	24,500	24,500	25,000
Unknow beans	39,000	39,000	37,000	20,000	20,000	20,200
Coconut	27,000	24,000	24,000	24,500	25,500	25,000
Castor Bean	1,500	1,100	1,260	1,260	1,300	1,300
Sesame Seed	3,800	3,800	3,250	3,200	4,200	4,200
Seed cotton	860	720	700	700	900	900
Cotton seed	1,500	1,200	1,400	1,400	1,400	1,400
Cabbage	9,000	8,000	7,200	7,500	9,000	14,000
Lettuce	600	500	468	470	600	800
Spinach	400	650	650	650	700	850
Tomato	6,000	2,300	1,500	1,500	2,250	2,450
Onion	6,000	3,700	4,000	4,000	4,100	6000
Garlic	550	520	400	400	600	600
Green Coffee	30,000	28,000	27,000	30,000	29,000	35,000
Cocoa Beans	4,500	4,300	4,950	4,950	4,800	4,800
Sisal	5,700	5,650	5,200	5,200	6,000	6,000
Raw Tobacco	550	500	500	500	550	560
Pineapple	3,690	2,800	2,480	2,500	3,500	3,800
Avocado	45,000	42,000	51,100	51,000	47,000	54,000
Mango	250,000	250,000	249,000	500,000	260,000	261,000
Grapefruit	12,750	7,000	5,000	5,000	8,750	10,000
Lemons & Limes	25,000	20,000	23,400	22,000	22,100	26,000
Manadarin	7,930	7,000	7,360	7,300	8,000	11,000
Orange	25,000	20,000	24,750	23,000	26,000	30,000
Sugar Cane	800,000	1,008,100	595,000	600,000	1,050,000	1,050,000

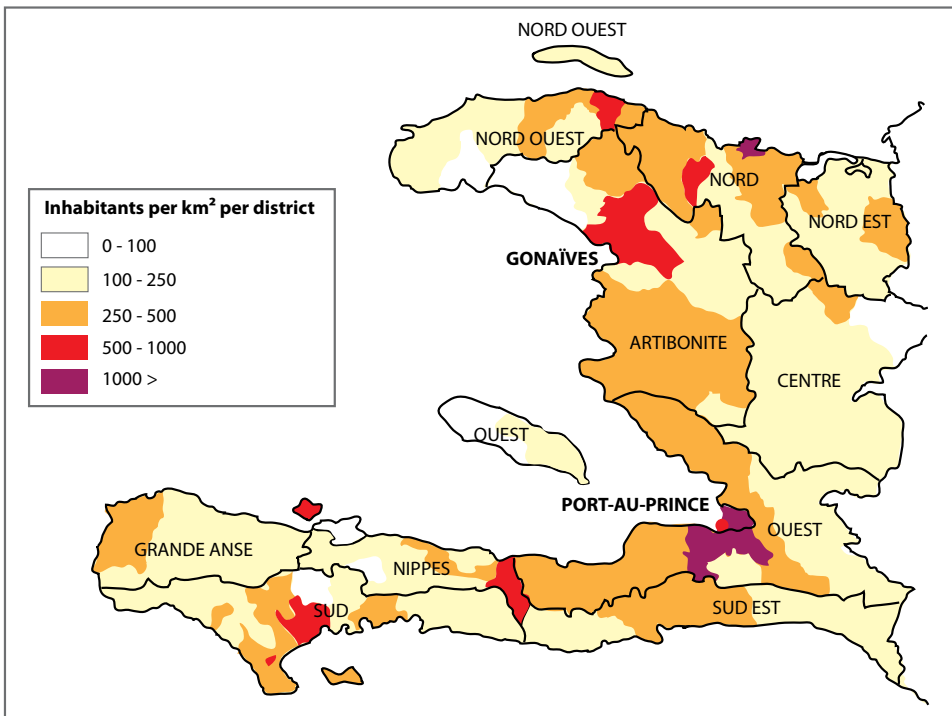
Annex 2. Thematic Maps

Figure 1: Human Balance Map, 2008



Source: République d'Haïti, 2008<sup>71</sup>

Figure 2: Map on Demographic Density



Source: République d'Haïti, 2008 et CATHALAC, 2008

<sup>71</sup> Rapport d'évaluation des besoins après désastre cyclones Fay, Gustav, Hanna et Ike avec l'appui de la Banque Mondiale, du système des Nations Unies et de la Commission Européenne.

Annex 3: Harry Truman and Cité l'Eternel Boulevard, 1980



Source: Régine et al, 2006; UNFPA et al, 2006



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