Haiti – Dominican Republic

Environmental challenges in the border zone

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United Nations Environment Programme
P.O. Box 30552, Nairobi, KENYA
Tel: +254 (0)20 762 1234
Fax: +254 (0)20 762 3927
E-mail: uneppub@unep.org
Web: http://www.unep.org

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HAITI – DOMINICAN REPUBLIC

Environmental challenges in the border zone

United Nations Environment Programme

Table of contents

Foreword

The joint management of transboundary natural resources: a first step towards the resolution of binational environmental and social conflicts

The issues in the border zone of Haiti and the Dominican Republic are perceived in different ways by people living and working in the region. Some feel that despite the problems that may arise here, the area provides an opportunity for the people of our two countries to cooperate, share experiences and find joint solutions to shared problems. At the same time, others consider the border zone as a region where development opportunities are limited by poverty and isolation.

Notwithstanding these different perspectives, addressing the challenges in the border zone is important not only for the development of local communities, but also for the implementation of cooperation strategies and joint initiatives between the two countries. For this reason, the governments, development actors, and civil society in both countries have strengthened their efforts in the border zone and are building on successful initiatives that have already taken place.

Among these efforts, we would like to mention those initiatives adopted at both the community and government levels that seek to address the diverse challenges in the border zone, some of which have stemmed from the short-sighted exploitation of natural resources. At the same time, we welcome the efforts of the Joint Dominican-Haitian Bilateral Commission, a flagship initiative which will guide the implementation of joint interventions in the border zone. This initiative, which originates from the highest levels of both States, has catalyzed the development of an increasing number of binational programs.

In the environmental sector, momentum for joint programs has also grown. On 16 May 2011, the Ministry of Environment and Natural Resources of the Dominican Republic, the Ministry of Environment of Haiti, and the Norwegian Ministry of Foreign Affairs, signed a Declaration of Intent, in Ouanaminthe, for the Triangular Cooperation between the three parties, to support the Frontera Verde Programme. The first step in this cooperation was to implement the first phase of the Transboundary Natural Resource Management and Restoration Project, focusing on the Massacre and Pedernales Watersheds. Technical support in the implementation of this work is being provided by UNEP and UNDP. This commitment further highlights the willingness of our two governments to jointly address the problems associated with natural resource management in the border zone.

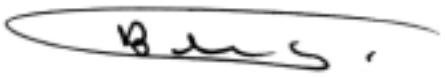
We are aware that in order to effectively address the challenges faced in the border zone, a deep understanding and an accurate analysis of the driving forces that have contributed to the present situation is necessary. For this reason, we welcome this report and analysis on the state of transboundary natural resources and how they are linked with different aspects of life both within the border zone and within our respective countries. This report provides information on natural resources and their role in trade, agriculture, human mobility, energy, among others.

This document provides up-to-date information and confirms the close relationship that exists between the state of transboundary natural resources, poverty, and recurring social conflicts. In this respect, this report is an indispensable tool that will inform decision making in the coming years.

We congratulate all those who contributed to the preparation of this report, both from our Ministries, UNEP, and other institutions. We invite all actors that are providing assistance, or that are asked to intervene in the border zone, to consult this report and to take into consideration its recommendations when carrying out future action. We are firmly committed and dedicated to take the conclusions and recommendations of this report to the highest levels of our governments. It will inform the work of the Joint Dominican-Haitian Bilateral Commission as well as guide the political decisions and actions undertaken in the border zone.

DR. JEAN FRANCOIS THOMAS

Minister of Environment, Haiti



DR. BAUTISTA ROJAS GÓMEZ

Minister of Environment and Natural Resources, Dominican Republic

Executive summary

This report presents the findings, conclusions and recommendations of an 18 month long assessment of the border between the two countries that share the Caribbean island of Hispaniola – Haiti, the poorest country in the Western Hemisphere and the Dominican Republic, a middle-income country. It is along this 380 km border that there is the most contact between the two populations, and the highest likelihood of tension and conflict between them. It is here too that there is the greatest opportunity to have a positive impact on the complex relationship between the two countries.

Paradoxically the challenges in the border zone are driven both by the interdependencies of the two countries and by the stark contrasts in the economic, social and environmental conditions. These differences manifest themselves in the chronic poverty and severe environmental degradation seen in many areas on the Haitian side of the border, as well as illegal transboundary exploitation of natural resources.

The United Nations Environment Programme (UNEP) and the United Nations Development Programme (UNDP) accompanied the Governments of Haiti and the Dominican Republic, through their Ministries of Environment, in undertaking a detailed assessment of the border area. The assessment covered both countries, however, emphasis was put on the Haitian side where the information is scarce and the environmental problems are more pressing.

This assessment has three complementary objectives:

- Firstly, it sets out to assess how the use of natural resources and environmental degradation in the border zone are contributing to disaster vulnerability, conflict risk, poverty and unsustainable practices. This also includes assessing how resource dependent livelihoods are responding to these challenges.
- Secondly, it presents an analysis of issues and trends, as well as of underlying driving forces, that affect the situation in the border zone.
- Finally, it provides practical recommendations for the two governments and their international partners on how to mitigate the identified risks, capitalize on the opportunities, increase transboundary environmental cooperation, and build resilience to identified areas of vulnerability.

The assessment team found that the key issues of concern identified in the border zone can be connected to four interlinked driving forces:

- Haitian poverty, food insecurity and underdevelopment affect virtually all parts of the border zone.
- Environmental degradation manifests itself mainly in soil erosion, deforestation, and a degraded marine environment.
- Weak governance, especially on the Haitian side of the border, affects all facets of the economy and society.
- Finally, the economic and resource inequalities between the two countries are the cause of many of the transboundary problems identified in the border zone.

Examples of some of the key issues in the border zone include the illegal extraction and trade of natural resources (mainly charcoal, but also firewood and marine resources), agriculture, and large numbers of people crossing illegally from rural areas in Haiti into the Dominican Republic in search of livelihoods due to the degradation of land and a surplus of labour on the Haitian side. Several of the noted problems, such as deforestation and soil erosion, are very large scale and have been developing for generations. Environmental degradation in the worst affected parts of the Haitian border zone is almost completely irreversible, due to a near total loss of vegetation cover and productive topsoil across wide areas.

Several of the identified issues related to the environment and the use of natural resources also present a short term but high instability and conflict risk to the relations between the two

countries. These issues include the uncontrolled transboundary charcoal trade; illegal farming and tree cutting on Dominican land in general and inside Dominican Republic protected areas in particular; unclear marine territorial delimitation and illegal transboundary fishing; and the flooding of land and infrastructure due to the rapid rise of Lake Azuei and Lake Enriquillo. The uncontrolled transboundary charcoal trade and tree felling has, for example, already triggered conflict that has led to violence.

At present the overall situation is gradually deteriorating. If current trends continue in the border zone, including practices similar to those which have already caused much of the degradation in Haiti, soil erosion and a reduction in land productivity will worsen significantly on the Dominican side of the border zone as well. This scenario could change dramatically as a result of shocks or sudden changes, such as natural disasters. Such a shock might accelerate the decline and further degrade the stability and development of the border zone.

Climate change is also expected to have a negative impact on the Caribbean in the long term: the average temperature, the variability of rainfall, and the frequency and average intensity of hurricanes are all expected to increase. All of these effects will have serious consequences for the area in question: an adjustment in precipitation rates alone would have a negative impact on rain fed agriculture, which is the mainstay of the border zone economy.

Most of the driving forces identified are national in scale, which means that it would not be viable to only develop stand alone environmental or local solutions. An integrated and larger scale approach is needed. For example rural food insecurity and extreme poverty are in part driving the unsustainable slash and burn agricultural practices on the Haitian side and triggering the associated extensive soil erosion and deforestation. Similarly, charcoal demand in the border area is low, but in Port-au-Prince it is high, thus driving the national charcoal economy. A national scale solution on energy is needed to resolve this matter. Finally, land tenure and tenant farming are major obstacles – farmers understandably are prepared to invest only in land they either own or can confidently control for longer periods.

On a more positive note the international relationship between Haiti and the Dominican Republic is quite good, with meetings up to the highest political levels taking place on a regular basis. Important progress has also been achieved by local and national initiatives, such as the financing of binational tree planting brigades within the framework of the Frontera Verde programme, commune level bi-national cooperation, and cooperation between local organizations and associations on both sides of the border. Sustainable agricultural programmes, such as ones that promote agroforestry, and the associated trade represent a major opportunity for poverty reduction in the border region. Such initiatives could provide a critical foundation for larger scale corrective action and investments in crisis prevention.

It is with this more positive outlook in mind that the report concludes with 14 detailed recommendations that should be developed and implemented by the two governments and their international partners. If implemented, the recommendations are expected to reduce chronic poverty and hunger in the border zone, while promoting more sustainable livelihood practices and enhancing the resilience of the population to shocks and stresses. They also set out to preserve peaceful relations between the two countries through increased national and local level bilateral cooperation that will reduce tensions over border zone issues.

The recommendations are divided into ten bi-national border zone recommendations and four Haitian national scale recommendations. Most solutions will need to be bi-national or at least bi-nationally agreed, due to the very high inter-connectivity of populations and issues across the border.

Bi-national border zone recommendations

1. **Protecting and increasing the vegetation cover –** Continue to financially and politically support the bi-national reforestation and agroforestry efforts. Increase technical assistance to improve the quality, consistency and sustainability of the re-forestation efforts and implement a more strategic program.

Deforestation resulting in severe land degradation is a significant problem in the border zone, therefore such investments are to be prioritized.

2. **Sustainable agricultural development –** Reform and develop the artisanal and small scale agricultural sector in the border zone to improve the sustainability of livelihoods. Moving beyond the destructive cycle of slash and burn agriculture requires long term and intensive investment in practical, technical support. Educational campaigns aiming at changing attitudes and building the capacity of local farmers are equally important.

3. **Transboundary river flood risk reduction –** Invest in flood containment and land use planning for affected Dominican and Haitian townships, based on a long term worst case scenario. The flash floods which have damaged Dominican and Haitian towns (Jimani, Fonds Verrets, Pedernales, Anse-à-Pitre) in the border zone are linked to severe and mostly irreversible degradation of the catchments in Haitian territory.

4. **Improve the sustainability of transboundary trade and the bi-national markets, while reducing their environmental impacts –** Support the existing bi-national markets and provide better opportunities for fair, profitable and more sustainable trade between the two countries. The impact of the bi-national markets is overall positive but they need reform and in some cases rebuilding, to reduce environmental impacts, improve equality, reduce conflict and increase trade.

5. **Border zone economic development and diversification –** Encourage the transition from subsistence agriculture and illegal and damaging activities to Micro, Small and Medium Enterprises (MSME) led local economic development in agriculture, fisheries and tourism. Boosting MSMEs and the service economy is a proven route for economic development and will draw local populations away from unsustainable livelihoods.

6. **Address the contamination of transboundary rivers –** Address the problem of rivers that are polluted by both solid and bacteriological waste and as a consequence spread disease.

7. **Improve existing transboundary co-operation mechanisms that deal with environmental issues and transboundary watersheds –** Build on the mechanisms and platforms for cooperation that already exist on various levels, to create a functioning network of cooperation, both across the border, as well as between the local and national levels. In order to galvanize the necessary political will, the overall cooperation framework should be chaired by the presidents of the two nations. In addition, there is a need to enhance the processes by which governments and projects share information. Lastly it is vital to build the Haitian Government's capacity to participate on an equal level in binational projects.

8. **Environmental governance for the regulation and control of the charcoal trade and other forest products –** Increase enforcement of Dominican and Haitian law on protected areas and forest conservation. Include an analysis on the potential impacts a suppression of the transboundary charcoal trade would have in Haiti.

9. **Strengthen the management of marine and coastal resources –** Reduce the decline of the marine and coastal environment in the border zone by ensuring that encroachment and practices that are degrading the state of the environment are not taking place, in particular in relation to overfishing and the cutting of mangroves.

10. **Lake Azuei and lake Enriquillo flooding analysis –** Undertake a hydrological data collection and analysis study on the causes of the rise in the level of Lakes Azuei and Enriquillo and their potential to keep rising.

Haitian national level investment recommendations

These recommendations are not new, rather they are part of existing initiatives at the Haitian national level, specifically the Haitian Strategic Plan for the Development of Haiti: Emerging Country by 2030 (Plan Stratégique de Développement d'Haïti: Pays émergent en 2030).[1] The four recommendations are selected from the development plan and

are considered to be the ones that are of most relevance for the situation in the border zone.

1. **Improving governance in rural areas –** Increasing the presence and role of the state in rural areas, while ensuring the continuous involvement of local stakeholders, covering a broad range of responsibilities including social services, policing, customs, town administration, agricultural and business development and environmental protection. The aim of this recommendation is to extend the state presence to rural areas, while prioritizing growth poles and sensitive areas such as the border.

2. **Non-agricultural economic development and diversification –** Providing viable alternatives to subsistence agriculture through large scale development of the manufacturing and service sectors, particularly in the main urban centres.

3. **Replace charcoal with LPG –** Implement an integrated programme of regulatory reform, incentives and enforcement to replace the use of charcoal (used for cooking) with LPG, supplemented by other alternative energy options (including renewables) and improved electrification of the country. The programme would focus on urban centres and Port-au-Prince in particular.

4. **Sustainable agricultural development and re-forestation –** Implement the Haitian National Plan for Agriculture, with a particular emphasis on sustainability. Replace unsustainable slash-and-burn and the cultivation of annual crops on steep slopes and degraded land with more sustainable forms of agriculture and tree planting, with a focus on agroforestry and energy cropping. Integrate erosion control measures into all agricultural landscapes. Extract greater value from remaining viable land with improved techniques and investments in agricultural value chain development.

The total estimated cost of the ten targeted bi-national level recommendations for the border zone is USD 136 million over five years. This is a small sum compared to the possible cost of the social and political crises – and the hunger and violence – that might result from the continued environmental degradation of the border area. Costs for the national level investments for Haiti will need to be detailed within the Haitian strategic plan for development.

In closing, the situation is already serious in the border area and continues to deteriorate. In the absence of significant corrective and preventative action, further decline and increased instability is likely. International development assistance and conflict prevention support will be required to part-finance the recommendations of this report. UNEP and UNDP are ready to help the Governments of Haiti and the Dominican Republic implement the recommendations of this report, and call for the support of international and national partners and donors.

Note on the text

For the sake of clarity, words that should be understood as terms carrying a specific technical meaning that is not necessarily a property of those words in ordinary usage, are defined in Annex I – Report terminology.

Part 1 Background

1 Introduction

1.1 A challenging time for the border zone

Challenges and opportunities

Relations between the neighboring countries of Haiti and the Dominican Republic have been and remain complex. An enormous disparity exist between them in social, economic, and environmental wealth. Despite their problems the countries are major trading partners and political relations between them have improved dramatically since 2010, thanks in part to the Dominican Republic's generosity towards the Haitian people following the earthquake of that year, and in part because of improvements in the political landscape of Haiti.

Nowhere are the inequality of the two countries and the complexity of their relationship more starkly obvious than along their 380 km border. The area around that border presents a long and rapidly lengthening list of challenges, which includes weak governance, severe environmental degradation, and a population that is profoundly vulnerable to natural disasters and food insecurity.

These many challenges are in part balanced by positive short term trends and opportunities: trans-boundary trade is substantial, levels of violence are relatively low, and there is substantive formal and informal cooperation between the two governments in their efforts to resolve several of the issues listed above.

A window of opportunity

During 2010 and 2011 the Government of Haiti, their immediate regional neighbours and the international community, were focused on helping the Haitian society to recover from the earthquake

Map 1. The island of Hispaniola

© UNEP

The differing levels of tree cover on either side of the Haiti-Dominican Republic border in the Artibonite river catchment is a highly visible symptom of a complex bi-national deforestation problem.

of January 12th, 2010. Now the Haitian Government is leveraging this increased international support in an effort to move beyond the most basic recovery of the areas damaged by the earthquake towards longer-term reform and development of the country as a whole. High on the government's list of priorities are economic development, the rule of law, environmental rehabilitation, and energy access.

Today, this approach is starting to deliver positive results. Business in Port-au-Prince is restabilizing, major business investments in the northeast of Haiti have been announced, and in the Southern Peninsula longer-term sustainable development programmes have begun.

Haiti and the Dominican Republic, supported by the international community should consider to actively re-focus on the development challenges along their shared border. The border zone is not an economic growth pole for either country, but it is a critical transport link, and home to several hundred thousand poverty stricken people. Perhaps most importantly, it is a significant source of tension between the two countries, and its fate might well determine both their futures. If the current situation stabilizes, both countries will continue to develop, but if it declines, then the stability of both countries, and the health of the relationship between them, will be in jeopardy.

1.2 Assessment context and design

The border between Haiti and the Dominican Republic presents a vivid contrast in the wealth and environmental status of two countries. The border area has been experiencing long term chronic environmental degradation, which has reached especially severe levels on the Haitian side of the border. In many areas, this degradation is undermining livelihoods and increasing disaster vulnerability, while the large disparities between the two countries have led to illegal transboundary

Map 2. Administrative map of the border zone

trade of natural resources, local level tensions, and an encroachment on Dominican land by undocumented Haitian migrants looking for economic opportunities. For these reasons, both governments requested UNEP to conduct an assessment of the border zone in order to identify key priorities for stabilizing the present situation and needs, in order to secure development goals.

Objectives

The **objectives** of the assessment and this report are:

1. To identify how the use of natural resources and environmental degradation in the border zone are contributing to disaster vulnerability, conflict risks related to the conflicting use of natural resources, poverty and unsustainable practices, as well as how resource dependent livelihoods are responding to these challenges.
2. To present an analysis on key environmental issues and trends, as well as underlying driving forces to contribute to determine the potential political, social, stability and development implications.
3. To provide practical recommendations for the two governments and their international partners to continue the work on mitigating the identified risks, capitalize on the opportunities, increase transboundary environmental cooperation, and strengthen the resilience to sources of vulnerability.

1.3 Assessment process

Geographical scope

The geographical scope of the assessment concerned the full length of the border zone, approximately 380 km from north to south. In general, this can be defined as a band stretching approximately 10-20 km on both sides of the actual border, depending upon available infrastructure, water courses, topography and the level of transboundary interactions between communities.

Some of the key issues identified in the border zone furthermore proved to be so tightly connected to national scale challenges in the two countries that the assessment team felt obliged to upscale the analysis from border zone to national level.

Assessment methodologies

There are no standardized methodologies for assessing transboundary challenges of the kind found in the border zone. Neither has a comprehensive analysis of the zone ever been conducted. In the absence of a methodological or comparative model, the assessment team designed its own framework based on relevant literature[i] and methods and then adapted it to the reality on the ground.

The methodology adopted by the assessment team also acknowledged the growing concern among national stakeholders and donors that the limited financial resources available for work on the border zone should be used to encourage practical action rather than further quantitative baseline studies. As a result, the methodological approach used in this report did not allow for extensive collection of new quantitative data. The approach, then, was essentially exploratory and relied on various sources of both qualitative and quantitative data, as well as anecdotal evidence collected during field missions. This allowed the team to reach the objectives of the assessment, while making the best possible use of the available resources, and remaining flexible and responsive to the realties they faced on the ground.

In order to have confidence in the collected qualitative data, and the analysis and conclusions drawn from it, the data was triangulated.[2] The use of this research technique, also known as *methodological triangulation*, ensures that no conclusion can be drawn from a single source without corroboration by others.[3] Therefore, only when interviews with members of the public on both sides of the border, accounts from government authorities, field observations and/or secondary data sources pointed in the same direction, could the assessment team draw conclusions on key issues, drivers and trends with a sufficient level of confidence.

Data was collected from:

- formal reports and surveys containing existing data (both qualitative and quantitative) .

i Literature included general literature on environment, natural resource management and development, reports emerging from work elsewhere in Haiti and the Dominican republic, as well as studies made on specific issues in the border zone.

A member of the assessment team collecting data in the field.

- field observations throughout the border zone on both sides of the border, with three missions which took place between May 2011 and April 2012.
- interviews with the local community members engaged in various livelihoods (farming, fishing, re-forestation, commerce, charcoal making), interviews with community leaders and representatives from livelihood associations and NGO's active in the border zone, as well as interviews with national government officials from both Haiti and the Dominican Republic.
- institutional knowledge from UN staff gained over the course of several years working in Haiti.
- findings from socio-economic case studies focusing on the Haitian side of the border zone in the Massacre watershed in the north and the Pedernales watershed in the south. These studies were conducted by the Earth Institute of Columbia University together with the Haitian State University.[4]
- studying satellite images of the border zone and comparing to field level observations

In addition the assessment team used a sustainable livelihoods framework to understand how livelihoods in the border zone are coping and responding to long-term degradation as well as short-term shocks and stresses.[5]

This framework is a useful analytical lens to understand vulnerabilities, livelihood assets, influencing factors, strategies and outcomes that should be taken into account when trying to understand the main factors that affect people's livelihoods. The framework also helps in explaining the relationships between these various factors, as well as how a more sustainable use of natural resources should be part of the solution when addressing the various challenges faced by livelihoods in the border zone. The framework was further used when developing the recommendations that focus on livelihood strategies and ways to build resilience among

Map 3. Areas visited by the assessment team during the course of the study

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Members of the assessment team interviewing a Haitian reforestation brigade in Capotille, in the Massacre watershed in the northern part of the border zone.

livelihood groups to the various vulnerabilities they face. Refer to annex III for a figure representing the sustainable livelihoods framework that was used.

The assessment process

The assessment commenced in April 2011 and was completed in 2013 with the finalization and publication of this report. The 4 stage process followed for the assessment is summarized below:

1) Background research and scoping mission

The initial part of the project involved reviewing the available literature pertaining to the border zone. It also included a scoping mission to the region in May 2011 that sought to identify and understand the key issues, geographical scope, and practical constraints on both sides of the border – all of which information was needed in order to design the appropriate assessment methodology.

2) Detailed information gathering and follow-up field missions

- This stage began after the scoping mission in May 2011. It included follow-up field missions to the border zone in November 2011 and April 2012, and set out to identify and gather additional information relevant for the study that was not available in the public domain. One such category of data refers to information the official record of which had been lost or destroyed during or after the 2010 earthquake and copies of which existed on paper or as institutional knowledge. Another category contained data that was in the possession of the authorities in one of the two countries and was available only on request.
- The field teams consisted of specialists from UNEP's Post Conflict and Disaster Management Branch, representatives of the Government of Haiti (Soils and Ecosystem Directorate of the Ministry of Environment), the Government of the Dominican Republic (representatives of the Ministry of environment) and UNDP personnel in Haiti. The field missions were complemented by shorter missions, as well as bi-national meetings with the two governments.

3) Analysis of findings and writing of the report

This stage was divided into four consecutive steps

a. *Background chapters.* Development of report structure and drafting of chapters including background and general information (chapters 1-3).

b. *Thematic analysis.* Reviewing and analyzing the collected data. Through triangulation of the various data sources, the team identified the key issues in respect to challenges and opportunities for the population in the border zone that deserved further research and analysis. Key issues were identified based on: a) issues that have an inherent transboundary dimension and linked to the use of natural resources, b) issues in the border zone that result in increased vulnerabilities for the people relying on natural resource dependent livelihoods, c) issues that are a source of tension between the two countries and that affect, or have the potential to affect, the stability of the border zone, d) issues that are a current source of cooperation which could be further amplified. This analysis informed the thematic chapters 4-8. The chapters all follow the same structure, beginning with a short general introduction of the topic in question, before moving on to the identified key issues, each treated in a separate sub-chapter. The treatment of the issues identified, however, differ within and between the chapters to some extent, mainly as a result of their scope and impacts in respect to transboundary dynamics.

c. *Strategic analysis.* The strategic analysis included a comparative analysis of the listed key issues, and the identification and assessment of underlying and crosscutting driving forces. Furthermore, this part of the analysis included an assessment of the potential for incidents, disasters and other destabilization tipping points. The strategic analysis also looked at how the identified key issues are linked to underlying driving forces. These topics are covered in chapter 9 of the report.

d. *Response development.* This step included the development of an overall proposed strategy for response, as well as the development and costing of detailed recommendations. These issues, as well as an analysis of how the recommendations link back to the key issues that were identified and a summary of key findings and conclusions are found in chapter 10 of the report.

4) Consultation and completion

- The final stage of the assessment process brought government officials and other key stakeholders together at two workshops – one in Port-au-Prince and one in Santo Domingo – for extensive discussions about the conclusions and recommendations of the project.
- The consultation process was followed by a report revision, finalization, lay-out and publication of the report in English, French and Spanish.

The target audience for this assessment is policy makers and planners in the two Governments and the international community supporting the Governments.

Report terminology

Throughout this report, the two countries of Haiti and the Dominican Republic are referred to separately as **Haiti** and **the Dominican Republic** respectively, and together as **the two countries**. At no point does the latter term refer to any other two countries.

The terms **Dominican** and **Haitian** should be understood as proper adjectives pertaining to national provenance in the most general sense, and not as carrying an association with the government of either country.

To further define that difference: the governments of the two countries are referred to as the **Dominican Government** and the **Haitian Government** throughout the report and not as *Haiti* or the *Dominican Republic*, nor as *Port-au-Prince* or *Santo Domingo*.

The **border zone, zone, border area,** and **area** are used interchangeably in the report – to avoid unsightly repetition – and should all be understood to refer to the geographical area defined in the 'geographical scope' section of the introduction, rather than to any political or territorial construct that is exterior to the report, as in the sense of the phrases *de-militarized zone* or *disaster area*.

The terms **Dominican side** and **Haitian side** refer to the two sides of the border area in particular and not to the two sides of Hispaniola in general.

Consultation workshops were held in both the Dominican Republic and Haiti with government counterparts, in order to validate the contents of the report.

The assessment uses a range of tools, methods and terminology to identify, categorize and analyze the wide range of issues noted, and to develop potential solutions. Annex I provides a glossary of key definitions and brief descriptions of the tools and methods used in this assessment and associated report terminology.

Report translation

The findings of the report have significant implications for both countries and the draft report has gone though a bi-national review and consultation process. In this context, translation accuracy and neutrality is very important. However, despite best efforts, not all words, phrases and inflections used either in this report and in the received feedback are directly translatable across the 3 languages. For the avoidance of doubt therefore, the English version of the report has been designated as the master version and the French and Spanish versions as authorized translations.

Chapter road map

Following this introductory chapter, Part I of this assessment also includes chapters 2 and 3. Chapter 2 provides an overview of both Haitian and Dominican country contexts, providing information on both countries' economies, physical attributes, histories, natural hazards, and environmental conditions. Chapter 3 focuses on the border region, looking at transboundary issues such as trade, cooperation, and migration.

Part II of the report (Chapters 4-8) deal with specific themes, such as agriculture, forestry and protected areas, freshwater resources, marine resources, etc. Within each of these categories, specific key issues and associated livelihoods responses are identified. Each chapter first gives a brief general overview of the theme in question, before individually presenting the key issues that were identified as part of the assessment process.

Part III then concentrates on the analysis of the information presented in Parts I and II of the report by analyzing the trends, linking the various issues together, and determining the common underlying driving forces to all of them. The identified issues and driving forces then inform the recommendations and conclusions that are covered in the final part of this report, in Chapter 10.

2 Haiti and Dominican Republic country context

2.1 Introduction

Similarities and stark contrasts

This chapter sets out the context for the two countries, pointing out common features and critical differences.

In short Haiti is classed as a Least Developed Country and a 'fragile state' in the UN-World Bank development index, while Dominican Republic is classed as a middle income country. The strongest similarities between the countries are in their geography and climate, as well as their vulnerability to natural hazards – the Island of Hispaniola lies next to a fault line and in the storm path of many hurricanes. The most dramatic contrasts are found in population density, stability, GDP, electrification, forest cover and the number of protected areas.

Table 1 summarizes selected key facts and statistics for the two countries, highlighting key differences which are considered to influence the dynamics between the two countries.

Table 1. Key facts and statistics for Haiti and the Dominican Republic

Parameter	Haiti	Dominican Republic	Comments
Geography			
Surface Area km²	27,750	48,730	76% difference
Rainfall range Min-Mean-Max mm.[6,7]	350-1400-4000	508-1708-2540	
Average temperature	25.0 Celcius	26.2 Celcius	
Society			
Ethnic composition: (Approximate) Percentage Black African – Mixed – Caucasian[8,9]	95% – 5% – 0%.	11% – 73% – 16%	
State Languages	Creole + French	Spanish	
Population (2011 estimate)[10,11] This figure excludes up to 1 million unregistered Haitian immigrants and workers residing in Dominican Republic.	10.1 million	10.1 million	
Population Density[12,13]	362.6/km²	205.4/km²	76% difference
Birth rates per 1,000 inhabitants (2010)[14]	27	22	22% difference
Fertility rates (No. children/woman) (2010)[15]	3.3	2.6	26% difference
Percentage population under 15 (2011)[16]	36%	31%	16% difference
Percentage urban population[17]	50%	71%	42% difference
Diaspora	Dominican Republic: 1 million[18] US: 600,000[19] Canada: 100,000[20] France: 50,000[21] The Bahamas: 80,000[22]	1.41 million[23]	
Remittances	$1.97 billion (2010) 26.6% of GDP	$2.91 billion (2010) 6% of GDP	
Governance			
Stability – Foreign Policy Failed State Index 2011[24]	5/60	84 – not at risk	1st/60 is worst
Corruption – Transparency International Corruption Perception Index 2011[25]	1.8 = 175/182	2.6 = 129/182	1st /182 is best

Table 1. Key facts and statistics for Haiti and the Dominican Republic (Continued)

Economy and Human Development			
Gross Domestic Product (2010 estimate) US$[26, 27]	7.4 Billion	51.7 Billion	700% difference
GDP per capita US$[28, 29]	755	5,214	
Agriculture as a percentage of GDP[30, 31]	25%	7.3%	
Human Development Index 2011[32]	159th /187	98th /187	1st/187 is best
Percentage living in poverty & extreme poverty (2010)[ii] [33, 34, 35]	76 & 56 (2003)	34.4 & 2.2 (2010)	
Inequality – Gini Coefficient 2001[36, 37]	0.59 = 8th /190	0.48 = 26th /190	1st/190 is worst
Life expectancy at birth (years)[38, 39]	62.5	77.4	14.9 years difference
Access to improved drinking water sources (2008)[40, 41]	63%	86%	
Literacy (15-24 year olds)[42, 43]	74 %	95 %	
Primary & secondary school attendance[44, 45]	50 & 19	86.1 & 32.5	
Installed MW power generation – design capacity	270 MW	3394 MW	
Access to electricity[46, 47]	12.5%	88%	
LPG Usage[48, 49]	2% of national household energy consumption	Used in 79% of households.	
Charcoal and Firewood Usage[50]	72% of energy demands satisfied by firewood or charcoal.	3.1 % of households use charcoal.	
Maternal mortality rate (per 100,000 live births)[51, 52]	300	100	
Infant mortality rate (per 100,000 live births)[53, 54]	70	21.3	
HIV/AIDS adult prevalence rate[55, 56]	1.9%	0.9%	
Contraceptive prevalence (ages 15-49, %)[57, 58]	32.0	72.9	
Environment and Natural Disasters			
Percentage Forest cover (FAO standards)[59]	4%	41%	
Number of Protected Areas[60, 61]	35	86	
Percentage Land Cover as Protected Areas[62, 63]	6% (Effectively 0.3%)	25.4%	
Yale University Environmental Performance Index 2010[64]	118/132	72/132	1st/132 is best
Germanwatch Climate Risk index 1991-2010[65]	5/190	7/190	1st/190 is worst
Disaster Risk Index (Average number of people killed per million inhabitants)(2000)	13.2	3.11	
Major earthquakes[66]	1751, 1771, 1842, 1887, 1904, 2010	1946, 2003	Haiti 2010 7.0 Ri.S

[iii, iv, v]

ii Poverty is defined by each country's poverty line. Extreme poverty, before 2005 was defined as living on less than $1 a day. In 2005, the World Bank defined extreme poverty as living on less than $1.25 a day.

iii The vast majority of the data contained in this table comes from the website of the World Bank's Open Data Initiative (http://data.worldbank.org/) and of the CIA Factbook (https://www.cia.gov/library/publications/the-world-factbook/). Information on forests and protected areas come from the Global Forest Assessment 2010 published by the FAO.

iv Data on natural disaster vulnerability come either from the country notes elaborated for both countries by the Global Facility for Disaster Reduction and Recovery or from the website of EM-DAT, an international disaster database (www.emdat.be).

v Indicators such as the Failed States Index, the Freedom in the World Survey and the Corruption Perception Index can be found at the following URL: www.foreignpolicy.com/articles/2011/06/17/2011 _ failed _ states _ index _ interactive _ map _ and _ rankings / http://www.freedomhouse.org/report/freedom-world/freedom-world-2012 / http://cpi.transparency.org/cpi2011/results/

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The environmental, economic and social divide between Haiti and the Dominican Republic is clearly visible throughout the border zone, as here close to the Artibonite River and the Dominican town of Pedro Santana.

2.2 Environmental status

The state of the environment in Haiti and the Dominican Republic is a sobering study in contrasts. These countries, which had very similar environmental baselines in 1800, have evolved into very different societies and the current state of the environment in each country reflects that difference.

Haiti

The environment in Haiti in 2012 is in a chronic crisis that has developed over the past 50 years. Environmental degradation is so severe and widespread that it is now a key driving factor in food insecurity, rural poverty, the spread of disease, and flood vulnerability.[67]

Over the last six centuries, the forest cover in Haiti has shrunk considerably. Studies estimate that in the 15th century, 85% of Haiti's territory was forested,[68] the remaining cover is today estimated to be 2-4% of the territory, with rapid deforestation having taken place in the past few decades.[69,70]

There are many reasons for this environmental deterioration. The exploitation techniques used by farmers have often been detrimental. There has been a demographic explosion, and much of the population uses firewood or charcoal as its main source of energy. There is a complex land tenure system, which is disadvantageous to soil conservation and tree planting. Lastly there is a pervasive absence of awareness about the environment among the general population and a chronic lack of efficiency within the relevant governing institutions.[71]

Subsistence agriculture serves as a good example of the process of environmental deterioration. Right across the country, land has been cleared for subsistence farming, even the very steep mountainsides and areas with thin and low-fertility soils. Haitian subsistence agricultural practices do not traditionally include a strong focus on soil conservation or augmentation, so steep slopes are tilled without terracing or drainage control and small plots of land are replanted year after year. Livestock rearing is usually open, with animals

wandering over depleted fields and unprotected slopes.

The consequences of this progressive disappearance of Haitian forests are dramatic. Haiti is very vulnerable to water erosion because it is a mountainous country: two-thirds of rural areas contain slopes of an angle of more than 20 degrees.[72] Deforestation increases this vulnerability to erosion, and large amounts of the nation's topsoil have been washed into the ocean.[73] This reduction in soil volume and vegetation cover has reduced the infiltration capacity of the river catchments, so more water runs off quickly rather than sinking into the soil and subsoil. As a result the country is more vulnerable to extreme events such as flooding and the rapid depletion of rivers in dry periods, which in turn reduce the amount of crops and transform farmland into wasteland.[74]

The coastal and marine shore environment of Haiti is also severely damaged. Inshore waters have been overfished and polluted by sewage, large numbers of mangrove trees have been cut, and coral reefs have been badly damaged and in some places destroyed entirely.[75]

Urban environmental issues, such as solid waste management, are highly visible and problematic. There are no sewage networks in any Haitian urban centres and the rivers and gullies are used as both latrines and waste disposal sites. Rivers are used for bathing, washing clothes and sometimes for drinking water and so are vectors for disease in general, and cholera in particular.

The population as a whole is becoming more aware of the environmental crisis, and understands its root causes well, and there has been substantial international investment in environmental rehabilitation. Nevertheless, underdevelopment, instability, and the absence of political will, have combined to thwart an effective and durable response to that crisis.

Dominican Republic

The Dominican Republic is in much better condition environmentally than Haiti. The expansion of agricultural plantations and an increase in charcoal production have reduced the forest cover from about 75% of the overall territory in 1922[76] to 12% in the early 1980s. Today, however, it reaches about 40%[77] and that recent increase is due to three main factors:

- Large-scale reforestation programmes (e.g. *Plan Nacional Quisqueya Verde)*
- The conversion from charcoal and wood dependency to gas for cooking
- The effective enforcement of laws and regulations

Recent surveys show that the forest cover is continuing to increase throughout the country, but that the increase is slower in the border zone than it is in the rest of the country.[78] The main cause of deforestation in the border zone is still the illegal production of charcoal. Deforestation has, however, been halted in this part of the country, largely due to the strict enforcement of laws, and an increased awareness in local communities of the damage done by the charcoal trade.[79, 80]

Even though most of the country is vulnerable to flooding, access to water is often scarce in the Dominican Republic. Uncontrolled development, above all in urban areas and at tourist destinations, has seriously threatened the water supply. In some areas the groundwater has been so depleted and contaminated by seawater that desalinization plants have been installed. Another source of contamination is the Dominican Republic's poorly regulated industrial sector, which has boomed over the last four decades.

The coastline is also threatened in certain areas. Beaches are eroding and the flow of eroded soil sediment into the sea damages coral reefs. Bearing in mind the importance of tourism as one of the most important sectors of the Dominican economy, these are critical national issues.

2.3 Geography, Geology, Climate, Hydrology

The geography of Hispaniola

The island of Hispaniola has a surface area of 76,420 km^2 and is the second largest island in the Caribbean Sea. Located between the latitudes of 20 and 17 degrees north, the island is highly mountainous, with four major mountain ranges running generally west-northwest to east-southeast. The mountains are commonly steep and the

highest peaks in Haiti and the Dominican Republic are at 2680 and 3098 metres above sea level respectively.

One critical difference between the two countries is that the Dominican Republic has much more flat and gently sloping land than Haiti. In Haiti the plains at the base of the mountains are generally relatively small. In comparison, the eastern and northern half of the Dominican Republic is dominated by relatively flat land that is suitable for agriculture. All major cities in both countries are found either on the coast or on the flat alluvial plains.

The original land cover in both countries was sub-tropical forest with some wetlands. However, more than four centuries of agricultural land clearing have seen this forest cover reduced dramatically. The deforestation rate has been much more severe on the Haitian side, where a mere 3.7 per cent of forest cover remains (FAO classification system). The same metric for the Dominican Republic is approximately 40 per cent.[81] Mangrove forests also remain along the shores but are generally reducing in extent.

Geology and soils

The surface of Hispaniola is composed mainly of marine sediments, with sparse outcrops of older metamorphic rocks. The marine sediments are generally very rich in limestone, and light in appearance, hence the pale hue of much exposed ground in both countries.

The soils of Hispaniola reflect the geology and topography: soils were originally generally thin and limestone rich in the steeper hills and deeper and better quality in the alluvial plains. Only a minority of the mountainous regions with metamorphic geology have originally deep and/or good quality soils, although all regions in Haiti are now badly affected by soil erosion and thin soil cover is the norm.[82] Soil depletion and erosion is also a significant issue in the Dominican Republic, although not to the same extent as in Haiti.

The climate on Hispaniola is as diverse as its topography: there are great variations in both temperature and rainfall because the island consists of low-lying areas separated by mountain ranges that rise as high as 3000 meters.

Climate

The different parts of Hispaniola see major variations in annual rainfall as a result of topography, prevailing winds, and the sporadic nature of tropical storms and hurricanes. The wettest areas are the peaks of the highlands along the southern coast, where rainfall can exceed 4000 mm, whilst the driest areas are in the northwest, where rainfall can drop to 350 mm per annum. All parts of Hispaniola experience a drier season from December to April.

At the national level, year round average temperatures are 25° C for Haiti and 26.2° C for the Dominican Republic. Temperature variations are linked to the seasons but also to the extent of cloud and altitude: the hottest regions are the dry plains near sea level where temperatures commonly exceed 35° C and the coldest regions are the wet mountain peaks where temperatures rarely exceed 20° C and can drop to 10° C degrees or lower.

Climate Change

Haiti has recently ranked 6th at the 2012 Climate Risk Index developed by the research institute Germanwatch.[83] This indicator analyzes the impacts of extreme weather events of the last 20 years and identified Haiti as one of the most affected countries in the world. The Dominican Republic also ranks high on the same risk index, being one of six Caribbean countries in the world's top 40 climate "hot spots".[84] With a possible increase in the frequency and severity of storms and a decrease in average rainfall[85], the impacts of changing global and regional weather patterns is likely to further increase the vulnerability of the island to extreme weather events.

Climate change projections for Haiti and the Dominican Republic are very similar. Both countries anticipate increased average temperatures of approximately 0.7-1.0° C by 2030 and continued increases thereafter.[86, 87] Both countries also anticipate significant reductions in rainfall: up to 11% by 2030 and 23% by 2050.[88, 89] Projections, however, vary greatly, highlighting the high level of uncertainty in respect to the effects of climate change on the island. The combination of increased temperature and decreased rainfall may well lead to water deficits and greatly reduced runoff/stream flows in both countries.[90]

More interesting, however, are changes that have already taken place. In Haiti, UNEP field enquiries have recorded significant anecdotal evidence from farmers of increased rainfall variability and later starting dates for the wet season. This is supported by studies showing that Haiti's average monthly rainfall volumes have considerably decreased and its patterns changed between the beginning of the 20th century and that of the 21st century.[91, 92] Data from 1900-1930, 1930-1960, 1960-1990, had similar rainfall patterns. The three periods were characterized by two peaks, one between March-May and another between August-October.[93] These numbers contrast with those of the 1990-2009 period. During this period, rainfall patterns have significantly changed, showing only one yearly peak in the month of September. Average monthly rainfall is the lowest compared to the three previous 30-year periods at 106 mm, and yearly average rainfall during this period is the lowest at 1269 mm. The 1990-2009 period has experienced a decrease in average yearly rainfall of 368 mm compared to the preceding period. The 1990-2009 period has also seen the most extreme rainfall variability, presenting both the lowest (8.9 mm) and the highest (478 mm) monthly rainfall averages amongst all four 30-year periods analyzed.

The Dominican Republic has experienced similar rainfall patterns as Haiti. Its yearly peaks have changed from two a year, around March-May and August-October, to only one in the month of September.[94] Even when the 1930-1960 period experienced lower average monthly and yearly rainfall, the 1990-2009 period experienced the most extreme monthly rainfall volumes amongst the four 30-year periods compared, with a low of 13 mm and a high of 471 mm.[95] The 1990-2009 period experienced a decrease in average yearly rainfall of 275 mm compared to the 1960-1990 period.

Temperature patterns in Haiti also seem to have changed throughout the course of the 20th century and into the 21st century. Haiti's average monthly temperatures have gradually increased throughout the four periods mentioned. The 1900-1930 and 1930-1960 time periods had an average temperature of 24.3° C. For the 1960-1990 period, average temperatures increased by 1° C to an average temperature of 25.3° C, and increased

once again for the 1990-2009 period to an annual average temperature of 25.4°C.[96]

The Dominican Republic has experienced similar temperature patterns as Haiti. Average temperatures in the Dominican Republic have increased by around 1.2°C from the 1930-1960 to the 1960-1990 time period. Between the 1960-1990 and 1990-2009 time periods, however, temperatures decreased by 0.3°C to a yearly average of 24.7°C.[97]

In summary, climate change for Hispaniola is expected to result in an overall drier and hotter climate, with more severe dry seasons with lower stream flows, and exacerbating existing health, social and economic challenges.

Hydrology

The majority of the rivers in the mountainous regions of Hispaniola are short and steep. This means that water flow rates at any particular time are governed mainly by recent rainfall (days to hours) rather than annual rainfall. Flash floods can occur in a matter of hours and the same rivers can run almost dry for two months in the dry season. Flow variations of 100 times or more are not uncommon. The level of responsiveness reduces with increasing size, the larger rivers with large catchments are much more stable than the smaller rivers.

At the national level Haiti has substantial fresh water resources, divided between 30 main watersheds.[98] However it also has national scale, chronic water problems including degraded catchments, water scarcity, flooding and bacterial contamination of water sources.

The different Departments of Haiti see major variations in annual rainfall as a result of topography, prevailing winds and the sporadic nature of tropical storms and hurricanes. The wettest areas are the peaks of the highlands along the southern coast, where rainfall can exceed 4000 mm, while the driest areas are in the northwest Departments, where rainfall can drop to 350 mm per annum. All parts of the country experience a drier season from December to April.

The Pedernales river, that forms the border in the southern part of the island, has a low water flow during large parts of the year and is easy cross on foot. The water flow can, however, increase dramatically within hours as a result of heavy rains falling in the mountains a couple of kilometers from the low lying coastal areas.

Natural river flow variability due to climate and topography has been greatly exacerbated by land degradation: deforestation and agriculture on steep slopes have resulted in massive soil erosion throughout virtually all Haitian river catchments. This is particularly true on the Haitian side, but can also be seen in the Dominican side of the border. The central province of Elias Piña is, for example, experiencing increased water shortages, which is one contributing factor to why some landowners have sold their land and moved to the cities.[99, 100]

The availability of water varies greatly across the Dominican Republic because of the country's diverse geography and climate.[101] Most of the water used (67%) comes from surface water sources, while the rest comes from ground water (33%).[102] The Dominican Republic has 60 watersheds, with most of its territory vulnerable to floods.[103]

Despite the fact that the Dominican Republic has substantive water resources – 20 billion m^3 of surface water resources per year and groundwater resources of 1.5 billion m^3 – the country still suffers from water related issues similar to those endured by its neighbour Haiti. Water can be scarce in the Dominican Republic because so much of it is used for irrigation and the population uses more of it per capita.[104] The current water demand of 10 billion m^3 represents almost half of the total freshwater resources available. This chronic overexploitation is reflected in increased competition for surface water allocation as well as in unsustainable groundwater extraction.

In the last 20 years, water use has increased fourfold due to the country's economic and population growth. The most water intensive sector is agriculture, representing 8 billion m^3 per year, around 80 percent of the total water use and a threefold increase in the last couple of year. Water is also generously used for tourism (hotels, resorts, golf courses) as well as for domestic use.[105]

2.4 Natural Hazards

A very high vulnerability to natural hazards

Both Haiti and the Dominican Republic are highly vulnerable to natural hazards. The Dominican Republic ranks 24th amongst the 173 countries assessed in the WorldRiskIndex, having a "very

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Of all the Caribbean Islands, Hispaniola is the most susceptible to hurricanes.

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Flooding in cities and towns is a common occurrence throughout the island, often causing severe damage and deaths as a result of insufficient infrastructure to respond to high surface water flows.

high" risk to natural hazards, with Haiti ranking 32nd.[106] Although the Dominican Republic's natural hazard exposure is higher than that of Haiti, Haiti is ranked as the 10th most vulnerable state to natural hazards having a higher vulnerability due to its high susceptibility, and lack of coping and adaptive capacities, rather than from the mere occurrence of natural disasters. This means that Haiti can significantly reduce its natural hazard vulnerability by improving its public infrastructure, economic capacity, governance, and public services.

The key natural hazards for both countries are:

- Hurricanes and associated major floods and landslides.
- Tropical storms and associated flash floods.
- Earthquakes.
- Droughts.

Statistics show that a major disaster (such as cyclones, floods and droughts) affects Haiti every 5-7 years and that internationally recognized disaster hits it every 2 years. Overall, between 1980 and 2010 Haiti experienced 74 natural hazards (tropical storms, floods, landslides, epidemics and earthquakes).[107] Haiti's is also the country with the highest relative vulnerability to tropical cyclones amongst the Small Island Developing States, followed by the Dominican Republic in second place, making Hispaniola the most susceptible island to hurricanes in the Caribbean.[108, 109] In 2008, for example, four hurricanes affected nine of Haiti's ten departments within one month, impacting an estimated 8 percent of its population (about 800,000 people) and causing major damages in all sectors.[110]

Disaster data from the Dominican Republic indicates 40 natural hazard events for the period 1980 to 2008, which affected 2.65 million people with total economic damages estimated at US$2.56 billion. Tropical storms and floods have had the greatest impact in the country, causing respectively US$2.51 billion and US$44.2 million dollars damages.[111] The number of people killed is estimated at 1,446, 42% of whom were killed by storms, 55% by floods and the remaining 3% by epidemics.[112]

Earthquakes

Hispaniola is located on the border of two tectonic plates: the North American Plate and the Caribbean plate. Two major, active fault lines cross most of the island from west to east,[113] leaving both Haiti and the Dominican Republic equally exposed to earthquakes. The island has a long history of severe earthquakes, the latest being the devastating 7.0 Richter Scale event of 12th January 2010, which had an epicentre just 30 km west of Port-au-Prince. This earthquake killed 225,000 people, injured 300,000 more, and left a million homeless and displaced.[114] Port-au-Prince sustained massive damage and economic losses to Haiti were estimated at US$7.8 billion, which is 122% of its GDP. It is important to note that Hispaniola has experienced several earthquakes of this intensity over the last 300 years and further earthquakes are expected, with the northern region currently facing the highest risks.[115] A study suggests that future earthquakes near Port-au-Prince could be similar or larger in magnitude than the 2010 earthquake.[116] All the northern part of the Dominican Republic has a high seismic risk,[117] with some studies claiming that Dominican seismic risk is higher than that of Haiti.[118]

2.5 Society

Hispaniola population evolution and ethnicity

Hispaniola has not seen large-scale immigration since the end of the 17th century. Migration since that time has been largely limited to internal movement and emigration. As a result, the social foundations of both Haiti and the Dominican Republic were laid early in the history of Hispaniola. During this time, both the African and Caucasian populations were spread across the island and mixed relatively freely. As a consequence, ethnicity today in Hispaniola is not fully defined by the boundary between Haiti and the Dominican Republic. People of African and mixed background are found in both countries, with much more of the former in Haiti and much more of the latter in the Dominican Republic.[119]

Haitian population

The population of Haiti is currently estimated at approximately 10 million with a population density of 362.6 inhabitants/km^2.[120] The ethnic composition of the Haitian population is 95% black and 5% Caucasian and mulatto (mixed African and

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The earthquake that struck Haiti in January 2012 caused unprecedented damage to the capital Port-au-Prince, and killed 225,000 people.

Caucasian descent).[121] The mulatto minority is relatively powerful and economically more secure than the majority.

Over the years, a demographic explosion has occurred in Haiti. Its population was estimated at 5,000 inhabitants in 1804[122] and had reached 3.2 million within one hundred and fifty years. The population then almost tripled between 1950 and 2005 and is now estimated at around 10 million people.[123] The population is very young: 35% of people are under the age of 15, and every year, 200,000 people reach that age.

Half of the Haitian population lives in urban centers[124], of which the most populous are Port-au-Prince (home to 25 percent of the population of Haiti and representing 62% of all urban population)[125], Jacmel, Gonaïves and Cap-Haitien.

Dominican population

In 2011 the population of the Dominican Republic was 10.1 million, with a population density of 205.4 persons/km^2. The registered Dominican Republic population is ethnically very mixed with 11% African, 73% mulatto, and 16% Caucasian. These figures, however, do not include up to one million illegal Haitian immigrants and temporary workers.[126] Just as large numbers of Haitians come over the border to the Dominican Republic so, many Dominicans migrate from Hispaniola entirely, usually to the USA.

Just like its Caribbean neighbors, the Dominican population is very young (31.4% are aged under 15) and birth (19.67 births/1000 inhabitants) and fertility rates (2.44 children/woman) remain high.[127]

The Dominican population is now predominantly urban[128] as a result of a rural exodus. Indeed, the number of people living in urban areas increased from 62% of the total population in 2000 to 71% in 2010.[129] Most of those people live in the capital, Santo Domingo (2.2 million inhabitants), San Pedro de Macoris and La Romana in the south and Santiago de los Caballeros, in the north.

2.6 Environmental Governance

Hispaniola governance and stability interlinkages

The governance and stability situations in Haiti and the Dominican Republic have been historically very independent of each other. Each country has managed its affairs and endured its own crises with relatively limited interaction with its neighbor. The Dominican Republic has managed to move beyond a long dictatorship to develop rapidly and relatively stably over the last 30 years, whilst Haiti unfortunately moved from a long lived dictatorship to major instability and social-economic decline. This independence is however now effectively at an end. One in 10 inhabitants of the Dominican Republic is a temporary or illegal immigrant from Haiti, and the Dominican Republic is now a major player in the post-earthquake reconstruction effort.[130]

Environmental governance in the Dominican Republic

In the Dominican Republic, most major environmental issues are covered by the general or framework law 64-000, which came into effect in August 2000. It covers issues such as air and water quality, pollution control, habitat and species conservation, protected areas, and environmental impacts. The design and implementation of the regulatory regime is overseen by the Ministry of Environment and Natural Resources, which was created to bring all public institutions dealing with environmental issues under one umbrella.

The legislature has been obliged to develop many specific or "sector" laws pertaining to the details of the broad topics referred to in 64-000, but the length of that process has delayed the address of urgent environmental issues.

The Constitution of the Dominican Republic, (which was proclaimed on the 26 January 2010), makes specific and extensive reference to the environment and natural resources.[131] In it, reforestation of the country and protection and conservation of forests, high river watersheds and endemic, native and migratory biodiversity zones are declared as national priorities.

A cornerstone in the national process towards sustainable development has been set forth by Organic Law 1-12 on the National Development Strategy for the Dominican Republic 2030.[132] Of particular relevance is section 2.4.3, which pertains to the sustainable development of the border zone (see sub-sections 2.4.3.1 – 2.4.3.6). In general the law envisages a society with a sustainable

consumption and production culture that protects the environment and natural resources, and can adapt to climate change. The strategy also looks to de-centralize the management of natural resources by creating 31 provincial and 6 municipal directorates of the environment and natural resources.

Environmental governance in Haiti[133]

The critical state of the environment of Haiti is closely related to the country's deep-seated institutional, political and governance problems. Despite the abundance of Haitian legislation on the environment and the number of institutions involved in environmental management, Haiti has a long history of weak environmental governance.

There are a number of texts that define the legal framework for effective environmental management in Haiti – from local bylaws and government decrees to the Constitution itself. However, the focus of Chapter II of Title IX of the Framework-Law of the Haitian Republic is limited to the natural environment, and most of the relevant decrees and bylaws pertain to the protection of natural resources, sanitation and urbanization.

It remains difficult to extract a set of standards or guidelines on environmental management from this legislation because the laws were passed at different periods and in different circumstances. The vast majority of them, although still in force, date to the 19th century, when the environment, economic and demographic conditions were very different. However, the task of updating the legislation cannot be accomplished without the will to apply the law. Furthermore, applying Haitian environmental laws is challenging, which means there is little tradition of jurisprudence.

The ministries concerned with managing natural resources are the Ministry of Agriculture, Natural Resources and Rural Development (MARNDR), the Ministry of Health, the Ministry of the Interior, the Ministry of Planning, and the Ministry of Public Works. 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 this ministry still has no organic law, which represents a significant obstacle in the performing of its duties. However, the 2006 Framework Decree on Environmental Management, although far from being an organic law, does establish the responsibilities of this Ministry in relation to the other stakeholders in the sector.

The "Environmental Action Plan" (PAE) developed by the Ministry of Environment in 1998 is still the main document in which the Haitian government has specifically identified programmes and provided guidelines towards the management of the environment. However, 14 years later, none of these programs have been implemented systematically.

Despite the fact that the environment has been identified as one of the five priorities of the current administration, the Haitian Ministry of environment currently lacks the financial support and technical capacity to provide leadership or to enforce the law. The government, supported by international organisations and NGOs, has made several efforts to address this situation, but has met with little success.[134]

3 The border region and transboundary activities

3.1 Introduction

The border zone is unique. Culture, language, and law, as well as conditions of trade, work, and life vary tremendously from one side of the border to the other. As the border zone is the location for the most intense interaction between the two populations it is also the area of both countries most prone to tensions relating to natural resources. However, there is also a good deal of transboundary cooperation and there is plenty of potential for improvement.

Haitians and Dominicans see the border zone in very different ways. Compared with the rest of the Dominican Republic, the border region is poor and isolated. Many Dominican nationals are leaving this part of the country for the cities. In contrast, many Haitians see proximity to the Dominican border as an opportunity to trade, work, farm vacant land, or get access to basic services in the Dominican Republic. Many of them emigrate.

This chapter presents the border zone in detail, covering geography, socio-economics, migration, trade and transboundary cooperation and aid projects. The purpose of this chapter is to present the status quo, rather than to offer analysis of the zone's many thematic issues. That analysis can be found in subsequent chapters in Part II.

3.2 Border zone geography

The border between the two countries extends along a 380 km line that ranges from sea to steep mountains over 2000 m high. It crosses areas with very high and very low rates of precipitation and widely varying soils and geological substrates. The border area includes 5 out of the 6 climatic zones of the country (arid, medium aridity, humid, high hills, and high altitude).These conditions have created a mosaic of ecosystems and habitats, making the border area at once an interesting ecology, and one that is difficult to regenerate.

For the purpose of this study, the border zone has been divided into four areas, based on **watershed** boundaries. These areas are separated by the three main mountain ridges on the island, running in an east-west direction across the border:

1. The northern coast and the Massacre watershed in the north.
2. The Artibonite watershed and Central Plateau.
3. The area surrounding the two lakes Azuei and Enriquillo.
4. The southern coast and the Pedernales watershed in the south.

Each of the four areas also includes one of the four main border crossings between the two countries. These are (from north to south): 1.Ouanaminthe-Dajabón, 2. Belladere-Comendador-Elías Piña; 3. Malpasse-Jimaní, 4. Anse-à-Pitre-Pedernales. Each east-west crossing occurs at low points in the valleys between the east-west trending mountain ranges.

The Northern Coast and Massacre watershed

The bi-national Massacre River watershed forms the natural boundary between Haiti and the Dominican Republic in the North. The two border towns of Dajabón (Dominican Republic) and Ouanaminthe (Haiti) are the largest towns along the border and are the transit point between the second largest cities of the two countries, Santiago in Dominican Republic and Cap Haïtien in Haiti.[135]

The Massacre watershed starts in the high rainfall and steep mountains of the Cordillera Central, with the majority of the catchment located on the Dominican side. The forest cover in this catchment is relatively intact, resulting in relatively regular seasonal flows of the Massacre River. North of the mountains the catchment levels out into a large coastal plain and finally into extensive coastal wetlands including mangrove swamps. Annual rainfall in the mountains can exceed 2000 mm, as compared to an average of 750 mm in the coastal plain.[136]

Livelihoods in this area include small-scale agriculture on the Haitian side, with larger scale agriculture on the Dominican, semi-natural pastureland, charcoal production, salt production, the harvesting of mangroves for fuel and fishing.

Map 4. The border between Haiti and the Dominican Republic

Map 5. Distinct areas of the border zone

Map 6. The northern coast and the Massacre watershed

Map 7. The Artibonite watershed and the Central Plateau

The population in this watershed is approximately 170,000 on the Haitian side and 62,000 on the Dominican. Contrary to most other areas on the Haitian side of the border zone, the urban population in this area has grown much faster than the rural population. An estimated 60% of the population lives in and around the border city of Ouanaminthe, which has experienced a population increase of more than 20% per year in recent years.[137] Employment opportunities linked to bi-national trade is thought to be the main driver of this rapid urbanization.

The Artibonite watershed and the Central Plateau

The central parts of the island along the border zone are very mountainous with steep mountains rising to over 2000 m above sea level. This is one of the poorest parts of the whole island. It is also the area that has seen some of the most intense deforestation and erosion of soils, particularly on the Haitian side.

The Plateau Central is a vast basin bordered in the North by the Massif du Nord, in the West by the Black Mountains, in the South by the mountains of Trou d'eau and in the East by the San Juan Basin. This is also the area where the island's (and the Caribbean's) largest and longest river, the Artibonite, has its headwaters. The river starts as numerous tributaries on both the Dominican and Haitian side of the border. It also partly forms the border with the two countries, before turning west and flowing across Haiti into the Caribbean Sea, south of Gonaïves, on the West coast of Haiti.

The population in the whole Haitian Central department (stretching far away from the border zone) amounts to appr.680,000, while the neighbouring Dominican province of Elias Piña has approximately 70,000.[138, 139] No reliable information, however exists on specific areas along the border, with the exception of the community of Belladère, which has approximately 90,000 inhabitants. The population increase on the Haitian side of the border zone is estimated at 3.9%, and urbanization rates in the largest border town in the region, Belladère – with 16,000 inhabitants – is estimated at 11% per year.[140]

The main land use and source of income for the population of both countries is small-scale agriculture, and there is some trade in, and production of illegal charcoal.

The Lakes

The area around the two lakes Azuei and Enriquillo, situated in the central part of the border, is of particular importance for several reasons:

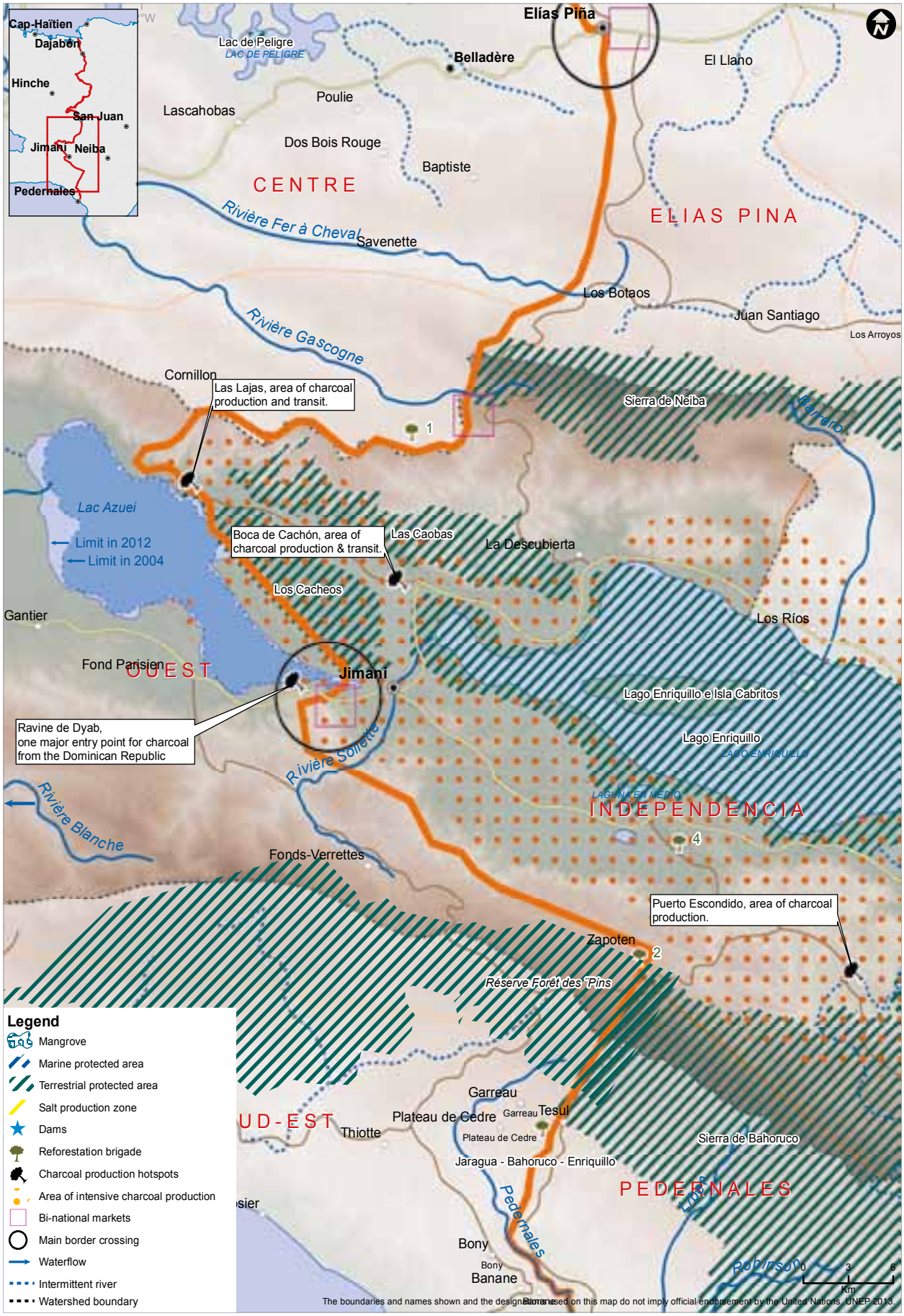
- The main road connecting the capitals of the two countries passes through this area – at the border of Jimaní-Malpasse – and is currently under threat due to rising lake levels.
- That border crossing is the point at which most goods are exchanged between the two countries.
- This part of the border zone has an intense illegal charcoal trade between the two countries.
- The area has several problematic transboundary watersheds. Floods from the tropical storm Jeanne in 2004 – to offer vivid evidence of the problems – killed hundreds of inhabitants from the Haitian mountain town of Fond Verrettes and partially destroyed the Dominican town of Jimani. These flood waters originated in the deforested Rivière Soliette watershed in Haiti.

All of the watersheds in this area drain inland, towards the two lakes. The lakes Enriquillo and Azuei, lie below sea-level, with the Lake Enriquillo being the lowest point in the Caribbean (39 m below sea-level).[141] Lake Enriquillo is also the largest lake in the Caribbean. Its watershed encompasses around 3,500 km^2 and its surface is estimated at around 200 km^2. Lake Azuei is slightly smaller, with a surface area of approximately 170 km^2.[142, 143]

The lakes are saline, have no natural outlet, and have been formed in the fault line running along the southern edge of the island. They have been experiencing rising water levels for the past 10 years, with a rise of up to one meter per year, which has caused major problems for both countries. The reasons for this rise are unknown, but possible causes include variations in rainfall, catchment degradation, and tectonics.[144] (This issue is covered in detail in Chapter 6.)

The Dominican population amounts to approximately 55,000 (in the Independencia Province).[145] No reliable number exists for the Haitian side,

Map 8. The area surrounding the lakes



Map 9. The southern coast and Pedernales watershed

although it is estimated to be much higher than the population on the Dominican, in line with other border areas. The main towns on the Haitian side of the border are Fonds Parisienne and La Source and several smaller towns are scattered on the plain and up in the mountains.

Agriculture and large scale illegal charcoal production and trade are the main land uses and livelihoods in the area. Dominican protected areas are one of the main sources of the wood for this trade. (This issue is presented in detail in Chapter 5.)

The Southern Coast and Pedernales watershed

The Pedernales River Basin is located in the border zone in the south of the island. Water flows start in the mountains on both the Haitian and Dominican side and flow to the southern coast. The Pedernales River is the largest watercourse in the area and forms the southernmost part of the international border between the Dominican Republic and Haiti. The source of the river is in the mountains on the Dominican side in Bahoruco, and its watershed covers an area of 174 km^2. The watershed comprises an area of high mountains that stretches along some 70 km in a northwest-southeast direction. It is relatively flat in its western part, where the slope descends gently southward. At an altitude of approximately 500 m, at the level of Las Mercedes, a plateau is formed. To the north, the slope is larger and exceeds an angle of 40 degrees in many places. Another plateau exists at about 1,000 m and spans much of the northern side, being interrupted by gullies. Water levels in the river rise rapidly in response to precipitation and may go dry during the dry period. The Pedernales River is one of the few rivers on the Pedernales Peninsula which contain water for most of the year.

The estimated population of the area is approximately 21,000 on the Dominican side of the basin[146]. On the Haitian side, no reliable information of the population numbers for the whole watershed can be found, but the population has reached approximately 30,000 in the community of Anse-à-Pitre, two thirds of whom live in the countryside. That population is increasing by roughly 3.7% per year.[147]

In the Provincia de Pedernales (Dominican Republic) Annual precipitation ranges from about 600 mm on the southern coast to 2,000 mm on the slopes of the Sierra de Bahoruco[148]. This area is also the home of two important protected areas. One is the Sierra de Bahoruco, which is situated in the north of the watershed, and which stretches over the mountain ridge into the area of the Lakes and connects to one of the few protected areas in Haiti – Forêt des Pins. The other is the marine protected area of Jaragua, in the Dominican Republic, on the southern tip of the Pedernales Peninsula.

The Pedernales watershed yields ample evidence of the environmental differences between the two countries in the border zone. The watershed can be divided into three distinct zones, with distinct environments:

1. Mountainous.
2. Mid-altitude.
3. Dry coastal.

3.3 Border zone socio-economics and migration

The border between Haiti and the Dominican Republic is increasingly porous and unregulated with distance away from the main border crossing stations. Interactions relating to trade, agriculture, legal and illegal use of forest and marine resources, education and medical needs, occur between the populations of the two countries.[149]

Haiti

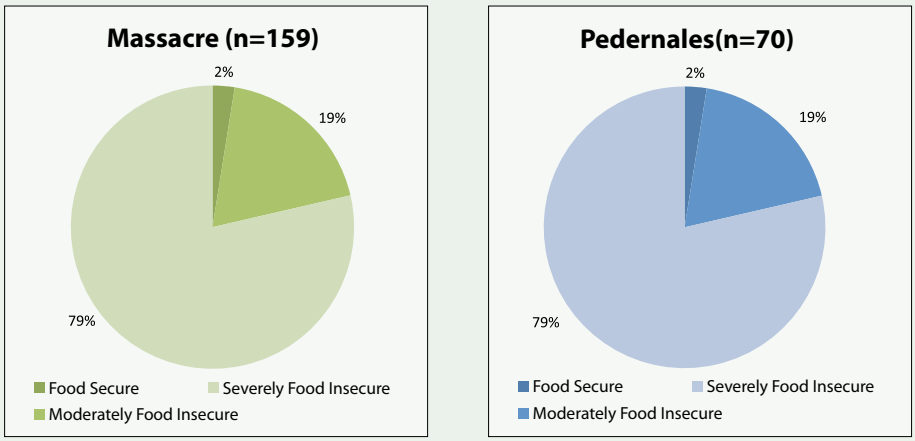
In Haiti, the border departments are the North-West–, Central–, West– and South-East departments. The border region attracts Haitians from other parts of the country who are looking to take advantage of the additional employment and trade opportunities that can be found both closer to and over the Dominican Republic border.[150] As a consequence, villages in the Haitian border zone have seen their populations increase in the last ten years and urbanization rates are high. The population of the city of Ouanaminthe, for example, grew by 20% per year.[151] The effects of this movement of people can be felt over the border as Haitians enter and settle on vacant land in the Dominican Republic. Case study 1 also highlights the level of

Case study 1. Food insecurity in the border zone

Socio-economic surveys of the Haitian side of the two watersheds, Pedernales and Massacre, were undertaken by the Earth Institute of Columbia University and the Haitian State University. They found that food insecurity was the main concern of most households. The lack of sufficient food to cover the daily needs of the population drives much of the cross-border movement, and the expansion of detrimental practices, such as charcoal production, seen in these areas. In respect to household concerns, food insecurity was followed by lack of money, bad health and poor education.

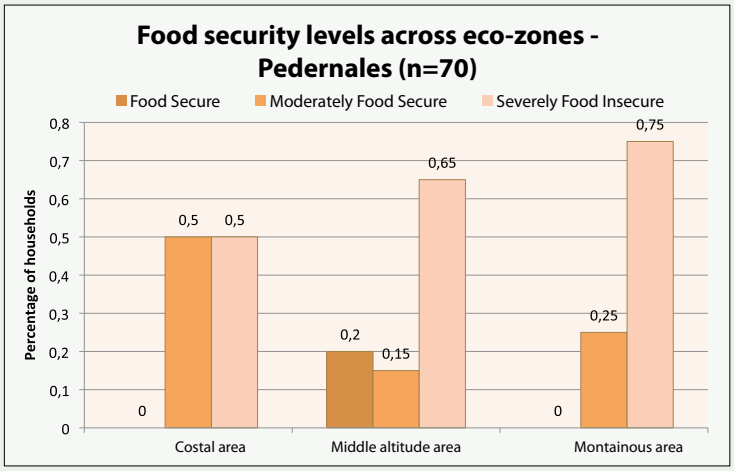
Figure 1 shows the level of food insecurity in the Massacre and Pedernales watersheds. It clearly shows that a large majority of the population are experiencing a lack of sufficient food. 'Severely food insecure' is here defined as a household that has experienced running out of food or going to bed hungry at some point over the past 30 days. 'Moderately food insecure' is defined as a household that has cut back on quantity by reducing the size of meals or number of meals, rarely or sometimes, but not running out of food, or going to bed hungry.

Figure 1. Food insecurity in the Massacre and Pedernales watersheds.



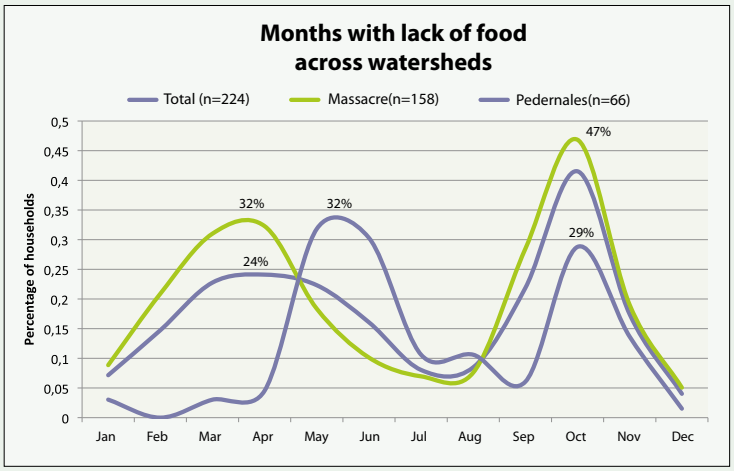
In terms of demographics, having a higher number of children relates positively to higher food insecurity scores in the Massacre watershed, while gender seems to be independent from food insecurity levels. Interestingly there appear to be significant differences in food security across eco-zones. There is a higher prevalence of people who are severely food insecure in the middle altitude and mountainous areas (Figure 2), which suggests important differences in the livelihood possibilities and levels of vulnerability between areas and communities in the watershed.

Figure 2. Differences in food insecurity within the Pedernales watershed



Levels of food security also vary throughout the year, with two peaks of food insecurity for each watershed. The first one occurs at the end of the dry season in March – April in the Massacre area and slightly later, in May – June, in the Pedernales watershed. The second food insecurity peak is common to the two watersheds and takes place in October and November. It has a more powerful impact on the Massacre watershed (Figure 3).

Figure 3. Seasonality of food insecurity



The household surveys also included information of livelihoods. Farming (defined as generating at least 40% of the total household income) and charcoal production, have a strong positive relationship with food insecurity. Families engaged in commerce were generally more food secure and not as poor.

food insecurity on the Haitian side of the Massacre and Pedernales watersheds, a main concern for many Haitian households.

The population on the Haitian side of the border zone has increased much more quickly than it has done in the rest of the country. The populations of the communities in the border zone for which data is available have grown by nearly 4% per year, compared with 1.3% across the country as a whole.[152, 153, 154] The Haitian population in the border zone is very young: 68% of people are under 25 – a much higher percentage than in the rest of the country.[155] The relative youth of the border population shows the attraction of the border zone for young – often unemployed – Haitians.

Dominican Republic

In the Dominican Republic, the border provinces are Montecristi, Dajabón, Elías Piña, Independencia, Pedernales, Bahoruco and Santiago Rodríguez, and these seven provinces represent 22% of the national territory. However, only 5.2% of the total Dominican Republic population lives there, leaving the region with a relatively low population density. The Dominican population has a long history of internal migration away from the rural areas towards the cities. This is particularly true in border zone provinces, which are the poorest rural parts of the Dominican Republic.

According to a UNDP study on the socio-economic context of the Dominican border region,[156] the border provinces of Dominican Republic show levels of poverty higher than the national average. Close to 28% of the Dominican border population live in extreme poverty, while 54% live in poverty. The incidence of extreme poverty in the border zone is twice that of the rest of the country. In the Dajabon and Pedernales provinces, extreme poverty reaches 27.6% and 25.9% respectively, while poverty reaches 51.6% and 57.5%.[157] Another study shows similar results, highlighting the weaker and poorer states of provinces along the border. For example, malnutrition rates for children below the age of five are higher in the border provinces (ranging from 16 – 23%) than in the average of the country (10%).[158]

Migration

The great majority of the migration by land between the two countries is Haitians travelling to the Dominican Republic, both legally and illegally. The limited migration in the opposite direction is mainly Dominican businessmen and skilled labour on short term visits.

Large scale short-term and long-term migration from Haiti to the Dominican Republic occurs all along the border zone. Some of the Haitian migrants spread out throughout the Dominican Republic, looking for work as unskilled labour in

the agriculture, construction or tourism industry.[159] A majority of Haitians crossing the border, however, stay in the border region, where the main source of income is to work within agriculture as unskilled labour (see chapter 4 for more on transboundary agriculture).[160] It is estimated that up to one million Haitians live in the Dominican Republic, and that more than 90% of the agricultural workforce are Haitians, the majority of them undocumented migrants.

Many Haitians cross the border for short periods of time. There are five main reasons for this:

- Purchasing food.
- Looking for employment or land to farm.
- Engage in trade at the bi-national markets that exist along the border.
- Take advantage of services offered on the Dominican side, such as schools, hospitals or universities.
- Engage in illegal activities such as charcoal making or collection of firewood.

The border zone is the poorest and least accessible part of the Dominican Republic; many Dominicans have sold or are leasing their land and have moved to the cities.[161] Nevertheless the Dominican side of the border area is still more prosperous than most places in Haiti, and so is attractive to Haitians in search of a livelihood.

When seen together, the Haitian and Dominican population and poverty trends for the border zone indicate that a very significant change is taking place. Simply put, Illegal immigrants from Haiti are replacing the vacating Dominican rural underclass in the border zone. The pace of this change increased dramatically after the 2010 earthquake, when a surge of Haitians immigrated illegally to the Dominican Republic.[162]

3.4 Transboundary trade

Trade is one of the key features of the border zone, connecting the two countries, and creating interdependencies between the two populations. Haiti is the Dominican Republic's second most important trade partner, receiving 16.9% of its exports in 2011.[163] The most frequently traded goods were cotton fabrics (appr. 38%), steel rods (6%), cement (4%), and food, for example wheat flour and rice.[164] The Dominican Republic is Haiti's third most important export destination.[165] The most common Hatian exports are cotton products (71%), ropes (7%), mobile phones (5%), pants (4%), and shirts (3%).[166]

In 2010, 872 million US dollars worth of goods passed though official channels from Dominican Republic to Haiti, and 24 million US dollars worth went the other way.[167] The real volume of trade is of course much larger than those numbers suggest, as there is a great deal of unofficial trade between the two countries.

Commerce is important to the people of the border area. Only agriculture generates more income, and there are 14 bi-national markets scattered around the border, the largest of which are those at Ouanaminthe-Dajabon, Comendador (Elias Piña)-Belladére, and Pedernales-Anse.[168] Twelve of these fourteen bi-national markets are in the Dominican Republic but most of the vendors are Haitians, who either live in the Dominican Republic or who have crossed the border on market day.

The agricultural products that are most frequently sold by Haitians to Dominicans in those bi-national markets are avocadoes, pois congo, mangoes, livestock, such as goats, cows and free-range chickens, coffee, passion fruits, chadeques, oranges, rice, corn, garlic, beans and clairin (a strong, alcoholic drink).[169] There is a healthy trade in fish at both the coastal extremities of the border area. Generally speaking Dominicans buy big fish that are destined for restaurants and hotels, whereas Haitians tend to buy smaller, cheaper fish that they consume at home.

The increase in trade between the two countries is a very positive development that presents the people of the border area with opportunities to create better living conditions for themselves, gain access to capital, and to improve relations between communities on both sides of the border.

There is a good deal of illegal trade between the two countries and it is driven entirely by the difference between the two import tariff regimes. Goods that are cheap on one side of the border – because they are subsidized or lightly taxed – can

be sold for a profit on the other side. It is estimated that more than 70% of the agricultural produce sold across the border by Haitians to Dominicans was not produced in Haiti but was imported there from abroad.[170] Rice imported and subsidized from the USA, for example, is cheaper than that which is available in the Dominican Republic. Similarly, imported chemical fertilizer that is sold to Haitian farmers at subsidized prices is also sold to farmers in the Dominican Republic at higher prices. The other significant illegal trade is that in charcoal, which is discussed in more detail in chapter 5.

The value of goods traded unofficially between the two countries is estimated to be at least equal to that of goods traded officially.[171] A study conducted in 2001 estimated that the value of official agricultural trade between the two countries was USD 10 million per year, while that of the informal agricultural trade was 40 – 60 million US dollars.[172] In accordance with the latter figure another study, conducted between July 2004 and June 2005, estimated that the value of agricultural goods crossing the border through informal trade at the main border crossings amounted to 46 million US dollars.[173] Illegal trade is similar in character to legal trade, in that the majority of goods sold – more than 80% – were sold from the Dominican Republic to Haiti.

The customs of the two countries have an important role to play in respect to the cross-border movement of people, as well as the cross-border trade of various goods.

The regional UNEP office has been supervising the implementation of the "Green Customs Initiative" (GCI), the purposes of which are "to enhance the capacity of customs and other relevant enforcement personnel to monitor and facilitate the legal trade and to detect and prevent illegal trade in environmentally-sensitive commodities covered by the relevant conventions and multilateral environmental agreements (MEAs)."[174] This global initiative was designed to inform customs officials around the world about the international legal context in which they work.[175]

The Dominican Republic has a Green Customs Unit that is dedicated to the enforcement of rules

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The bi-national market in Ouanaminthe-Dajabon is the largest of the 14 markets in the border zone. Trade and smaller scale commercial relationships between the two populations bring important income to both, and also serve to connect them by building mutually beneficial interdependencies.

relating to the trade in commodities that are set down in the Multilateral Environment Agreements among other laws. The unit works very closely with other ministries and in particular with the Ministry of Environment.

3.5 Transboundary cooperation

In the past, both governments have tended to ignore the border zone as a focus for development, unless their attention was drawn to it by a security issue. However, that attitude has now changed. Both governments are concerned about the potential for instability in the area and increasingly cooperate with one another formally and informally.

Although they are by no means equal in level, scale, funding, continuity or impact, the four most important transboundary mechanisms identified by the assessment team are:

- The Joint Dominican-Haitian Bilateral Commission.
- Border development agencies.
- Local level cooperation platforms.
- The Parliamentary border commission.

The Joint Dominican-Haitian Bilateral Commission ("Commission mixte binationale")

The commission was created in 1996 and is the only existing bilateral and political decision-making forum (chaired by the two Presidents in plenary session and by relevant ministers when thematic commissions meet), which address all themes related to cooperation (including the environment) between the two countries.

In a positive development, the presidents of the two countries have met several times in 2012, and have signed accords dealing with border security and trade, the most significant of which are:

- *Memorandum of understanding between the ministries of planning.*
- *Memorandum of understanding on border security.*
- *The Bolivarian fund for solidarity with Haiti.*
- *Memorandum of understanding on cross-border transportation.*

In Dominican Republic, the Joint Commission has an Executive Secretary who works under the aegis of the Ministry of Foreign Affairs, is funded by the EU, and has the mandate to propose, design, formulate and channel funding to projects. There is no such office in Haiti.

Border development agencies

Both countries have development agencies that deal exclusively with the border area. In the Dominican Republic there is the General Directorate for Border Development (DGDF), and in Haiti there is the Transboundary Development Commission (Fonds interministériel pour le développement transfrontalier).

The two agencies are very different. The Dominican entity has staff working all along the border, whereas the Commission in Haiti for the last few years consisted of just one man with little or no financial means and has now been closed. The Haitian Government plans to replace the commission with a national council that will coordinate the management of transboundary issues called the Conseil national de coordination de la gestion transfrontalière. So at the time of writing the DGDF does not have a Haitian counterpart but despite that it does assist Haitian border communities on an ad hoc basis.[176]

Local level cooperation platforms

At the local level, the mayors and other authorities have daily and often very constructive contact with their counterparts on the other side of the border, defusing tensions and settling disputes. One such example can be found in case study 2.

These relationships are mostly informal but there are some more institutionalized structures like the Association of the Mayors of the Border, the members of which live right along the Haitian border, or the Intermunicipal Transboundary Committee, which was created when mayors from Elias Piña province (Dominican Republic) and Plateau Central (Haiti) started working together to find and solve shared problems. One more notable example of institutionalized co-operation is that of fishermen who have formed associations in Pedernales (Dominican Republic) and Anse-à-Pitre (Haiti). That phenomenon is dealt with in chapter 7.

Case study 2. Comité Intermunicipal Transfronterizo (CIT) – Cooperation between mayors in the central border zone

Elias Piña in the Dominican Republic has long been the poorest province of the Dominican Republic: 47% of the people there live in extreme poverty and 31% of them are illiterate.[177] In 2006 a group of newly appointed mayors met to try to solve some of their communities' problems and concluded that their success would depend upon their collaborating effectively with their Haitian counterparts. So in 2008 12 mayors – six from each side – formed the Intermunicipal Transboundary Committee (Comité Intermunicipal Transfronterizo [CIT]).[vi]

In the beginning the committee's operations were quite small – they cleaned parks and improved roads and paths. But over the years the projects have grown more ambitious. They have repaired crucial cross-border trading routes, created job opportunities for women, restored buildings, set up micro-credit schemes for farmers and small businesses, improved access to water resources, given young Haitians the chance to study in the Dominican Republic, and built one plant to purify water as well as another to process fruit.[178]

This transboundary initiative is unique. It is an institutionalized network of local authorities that spreads across the border area that is driven by the engaged mayors and public officials, led by the mayor of Elias Piña, Mr. Luis Miniel, rather either of the central governments, from which it receives little funding or support. It relies to a great extent on its own efficiency and on the relationships it has built with national and international organizations. The improvement of the Commendador (Dominican Republic) – Belladère (Haiti) road was, for example, carried out in co-operation with, and partly funded by, development organizations. Interestingly the committee also secured money for the project from city coffers, and from local traders and businessmen whose interests will be served by the road.

Comité Intermunicipal Transfronterizo

This local level cooperation initiative involving six Dominican and six Haitian communities in the central parts of the border zone, engages in activities that range from improving roads and facilitating access to markets, all the way to engaging women in small scale business and microcredit schemes. Their overall aim is to alleviate poverty in the central border zone.

The committee members are motivated by their shared belief that their cooperation can function as the engine that will lift the people of the border area out of poverty. At the forefront of their strategy is an effort to facilitate the movement of and trade in agricultural and artisanal goods both across the border and to other parts of the two countries. And although the committee has not resolved any disputes, it has strengthened relationships and helped resolve many problems before they develop into deeper conflicts.

This cooperation is, however, still to a large extent dependent upon personal relationships between a fairly small amount of people. Indeed cooperation stalls whenever a new mayor is appointed in any of the constituent towns. Only a greater degree of formalization would guarantee its survival.

Haitian Parliamentary Commission for Border Development

Created in 2007 this commission plays a key role in helping parliamentarians understand the importance of the border region and its economic potential. In 2008, it organized a national forum on borderland issues that secured funding for infrastructure projects in Belladère, Ouanaminthe, and Anse-á-Pitre.[179, 180] Although the commission is less active today than it once was, it could well have an important role to play in developing the border zone, and in fostering transboundary cooperation.

3.6 Development aid in the border area

There is no permanent register of development aid projects in the border area. As a result, any listing can only be considered a snapshot, and is likely to be incomplete. This assessment found seven relevant projects:

- Revegetation and transboundary natural resources management project (MPP) – This project is part of an overall initiative called Frontera Verde, which aims to reforest the border

vi The towns involved were Pedro Santana, Bánico, Comendador, El Llano, Hondo Valle and Juan Santiago in the Dominican Republic, and Cerca-la-Source, Thomassique, Thomonde, Lascahobas, Belladère and Savannette in Haiti.

area, and consists of four main components: reforestation, capacity building, activities demonstrating sustainable socio-economic activities, and bi-national cooperation.

- Libon Verde – The two goverments, supported by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), are starting this project which will be similar in character and purpose to the MPP.
- Caribbean Biological Corridor – This EU, Global Environment Facility (GEF) and World Food Programme (WFP) funded project aims to define and then create a biological corridor between Cuba, Haiti and the Dominican Republic in an effort to restore ecosystems and reduce biodiversity losses.[181]
- UNDP ART initiative – This local development, which has so far been largely focused on the Dominican Republic, has recently become active in the border area, working to reinforce the capacities of women in the north of the border.[182]
- Bi-national Project in the Artibonite Watershed – The aim of this project is to resolve water-related conflicts in the bi-national Artibonite River basin and to develop a joint bi-national action plan for the management of shared resources in the Artibonite watershed.[183]
- Nuestra Frontera – Fwontyè Nou – This Pan American Development Foundation initiative aims to reduce poverty, strengthen relations between Haiti and the Dominican Republic, and promote collaboration in the border area.[184]
- International Organization for Migration's (IOM) Cross-Border & Migration Management project – IOM Haiti is running some migration management programmes that pay particular attention to border management, assisting voluntary return, fighting human trafficking, and strengthening cross-border and regional cooperation on migration management and border security.[185]

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As this sign points out, the Revegetation and Transboundary Natural Resources Management Project (MPP) has brought together the two governments, three UN organizations, and the government of Norway to work jointly to increase transboundary cooperation and to ameliorate the situation in the border zone.

Part 2 Identification and Analysis of Key Issues

4 Agriculture – the dominant activity in the border zone

4.1 Introduction

Agriculture is the most important economic activity in the border zone in both countries. In Haiti it is overseen by the Ministry of Agriculture, Natural Resources and Rural Development (MARNDR), and in the Dominican Republic by the Ministry of Agriculture.

Within this section, the term *agriculture* refers to farming and livestock keeping only and not to forestry or fishing, which are addressed in sections five and seven respectively.

Haiti

Farming is the dominant economic activity and livelihood option in the border zone. Farming on the Haitian side of the border zone appears to follow the Haitian national model, with slash-and-burn agriculture being the most widely used technique. Farms vary in size, from 0.25 – 5 ha. with an average of 1.5 ha.[186] Farmers commonly rely on sharecropping to secure access to land. Sharecropping is a form of leasing ("métayage" or "moitié-moitié") in which an owner offers his land to a farmer for cultivation in exchange for a portion of the harvest. When not sharecropping, farm workers are often hired as laborers.

Agricultural productivity is very low because the land is degraded, the plots are small and there are few if any modern agricultural inputs. Most farms in the zone are owned by families practicing subsistence agriculture to produce corn, manioc, rice, sorghum, beans, sweet potato and plantain, coffee and beef.[187]

Dominican Republic

The border zone is among the poorest regions in the Dominican Republic and has the highest concentration of poor households in the country. A large part of the population there, rely on agriculture for their daily subsistence. Poverty levels are highest in the Elias Piña province in the central parts of the border zone, where 82 per cent of the population live in poverty. Levels of poverty are at their lowest in the Dajabon province in the north, where 56 per cent live below the poverty line.[188]

Most farms in the zone are small and farmers practice slash-and-burn techniques to produce annual crops, which is in contrast with the situation in the Dominican Republic as a whole, where agriculture is increasingly mechanized and often on a large scale. Large scale agriculture within the border zone is confined to the northern parts of the Massacre watershed.

Traditionally many Dominican farmers grow fruits such as oranges, lemons and avocados, which require years of cultivation. In contrast, Haitians farming land in the Dominican Republic produce mainly beans and corn which require only a short stay in the country.[189] Small scale crop farming in Dominican Republic generally follows the Haitian model in that the moitié-moitié land leasing system is the most common, but there are also other arrangements, like renting the land for ¼ – as opposed to half – of the crops, or Haitians simply squatting on land vacated by Dominicans.[190]

4.2 Key issues

Three key issues were identified for the agricultural sector, which are relevant to the border zone and so are addressed in this report:

- Land tenure.
- Land degradation.
- Transboundary agriculture.

The agricultural sector in Haiti and the Dominican Republic has a plethora of other national scale

Satellite image 1. *The scale of agriculture differs greatly between the two countries as can be clearly seen here in the north of the border zone. Farms in the Dominican Republic are getting bigger and are increasingly mechanized while their Haitian counterparts remain small and still have few modern agricultural inputs.*

and local issues. These include, for example, trade liberalization and a flood of cheap or externally subsidized imports,[191, 192] vulnerability to natural hazards, policy weaknesses (particularly in Haiti), as well as weak supply chains and limited post-processing possibilities for agricultural produce in Haiti. These issues, do not, however fall under the scope of this study, as they were not identified in the assessment process as being specific to the border zone, or fulfill the criteria used for determining key issues, as detailed in chapter 1.3.

4.3 Land Tenure

Understanding and addressing the issues related to land tenure is important in order to develop successful strategies for agricultural practices, not only in the border zone, but throughout the two countries.

Much of Haitian land officially belongs to the state, but there is no functioning national cadastral system. Left with no alternative, many peasants cultivate state lands or harvest wood from them illegally. In rural Haiti, informal arrangements regarding land tenure are more important than formal titles, which are demonstrably more expensive and less flexible. Land tenure ranges from direct access by virtue of ownership to indirect access through tenancy or usufruct. According to a USAID study, investment decisions are based on the duration of access to a plot regardless of formal tenure. Duration of access depends on a farmer's social capital, economical means and position in the society.[193] The Haitian Institute of Agrarian Reform (INARA), which researched land tenure, concluded that "the judicial system is incapable of guaranteeing land tenure security even for those able to take full advantage of it".[194] This situation reduces incentives for people to make long term and productive investments on plots of which they might be dispossessed. The resulting land insecurity also "creates a reticence or even the fear of investment and promotes the emergence of conflict and violence."[195]

This lack of a functioning land tenure system in Haiti creates several different problems. Some of the most outstanding are: a) unclear land tenure systems that result in the depletion of resources as farmers are only prepared to invest in land that they own or can confidently control for long periods (including depletion of forest resources, lack of erosion control and the development of unsustainable agricultural practices); b) physical aggression and/or lack of collaboration of different individuals and groups claiming the property of the same lands; and c) absence of the land owners (or their representatives) of large areas of land (locally called "grandons"), leaving large land areas without control or appropriate use.

The issue of land tenure is not creating as significant problems in most parts of the Dominican territory. This is partly as a result of a modern and functioning cadastral system,[196] although some problems, for example in respect to land ownership involving overlapping claims exist. The border province of Elias Piña seems to be the exception in this regard in the Dominican Republic, where problems relating to land tenure seems to be particularly prevalent.[197] According to government officials, very few people here own the lands they use. Usually, problems occur when farmers have been using government lands, as under normal circumstances ownership of the land, over time, would go by right to the person farming it. That process could well be contested by the government not least because, as in Haiti, the system is not formalized, and it often results in problems and conflicts over land ownership in this province.[198]

4.4 Land degradation

Land degradation is widespread, but varies greatly in severity, right across the border zone. In general, land degradation is much more severe and widespread on the Haitian side, however there are significant degradation hotspots on the Dominican side as well. The most severe degradation is noted in the northern and central parts of the Haitian border zone.

The most common forms of degradation noted are: a) topsoil loss through erosion; b) soil nutrient depletion and compaction; and c) watercourse drying and bed expansion. Soil erosion is noted in all of its forms: sheet, rill and gully erosion.

Deforestation and vegetation loss are the first steps to degradation: trees removed are not replaced with adequate perennial vegetation cover and water erosion proceeds rapidly. Reduced water retention results in flash flooding which transports

sediment and widens the watercourses, but also results in rapid drying out of the watercourse between flood events.

Field observations by the assessment team noticed that the worst degradation in the Haitian border zone is almost completely irreversible, due to a near total loss of productive topsoil across wide areas. While vegetation is still visible in such areas, the productivity of the remaining exposed subsoil is so low that agriculture would not be economically viable and reforestation will be difficult.

Land clearing for agriculture, including the use of fire (slash-and-burn) is one of the main drivers for land degradation in the border zone. On both sides of the border, land is usually cleared by slashing and burning. Any trees that can be used as fuel or in the production of charcoal are removed and the remaining brush and rough grasses are set on fire. The remaining ash acts as a fertilizer and gives the soil a short term fertility boost. Annual crops are then planted in time for the rainy season. However, as most agricultural land in the border zone is sloped, the rains rapidly remove the ash and topsoil. In addition fire usually spreads beyond the fields targeted in the process, often resulting in uncontrollable forest fires, which further degrade the land.

In the absence of soil conditioning and conservation, the depleted soils on cleared land commonly drops in productivity after 1-3 years.[199] It is then no longer in a state suitable to produce sufficient crops and is commonly left uncultivated for a number of years. In the interim the land may self-revegetate. However, in many cases it is subject to grazing by cattle, sheep and goats, which suppresses brush and tree re-growth and results in an exposed landscape of very short grasses and animal trails.[200, 201]

Due to a shortage of land, farmers often try to start another slash and burn cycle before sufficient vegetation cover and fertility has returned. The land is by then so degraded that it proves unproductive – a situation that has direct and obvious consequences for food insecurity and poverty in

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Land degradation in general and severe erosion in particular are visible throughout the border zone, and are especially severe on the Haitian side.

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Lacking productive topsoil this land in Haiti is now barren and no longer suitable for farming.

the area. Faced with a failure to secure sufficient food and income from crops, Haitian farmers in the border region, as elsewhere, look for other sources of income, like charcoal production, or migrate to the cities or across the border to the Dominican Republic. In addition land degradation leads to water shortages, which in turn reinforce poverty and help to drive the rural exodus.

The long term result of this destructive cycle is highly visible throughout the hills of Haiti in general, and in the border zone in particular. The hillsides are a patchwork of cropped fields, and bare, degraded, or partially recovering land with short, rough vegetation. Sheet erosion has removed a large percentage of the topsoil and deep rills and gullies are prevalent.

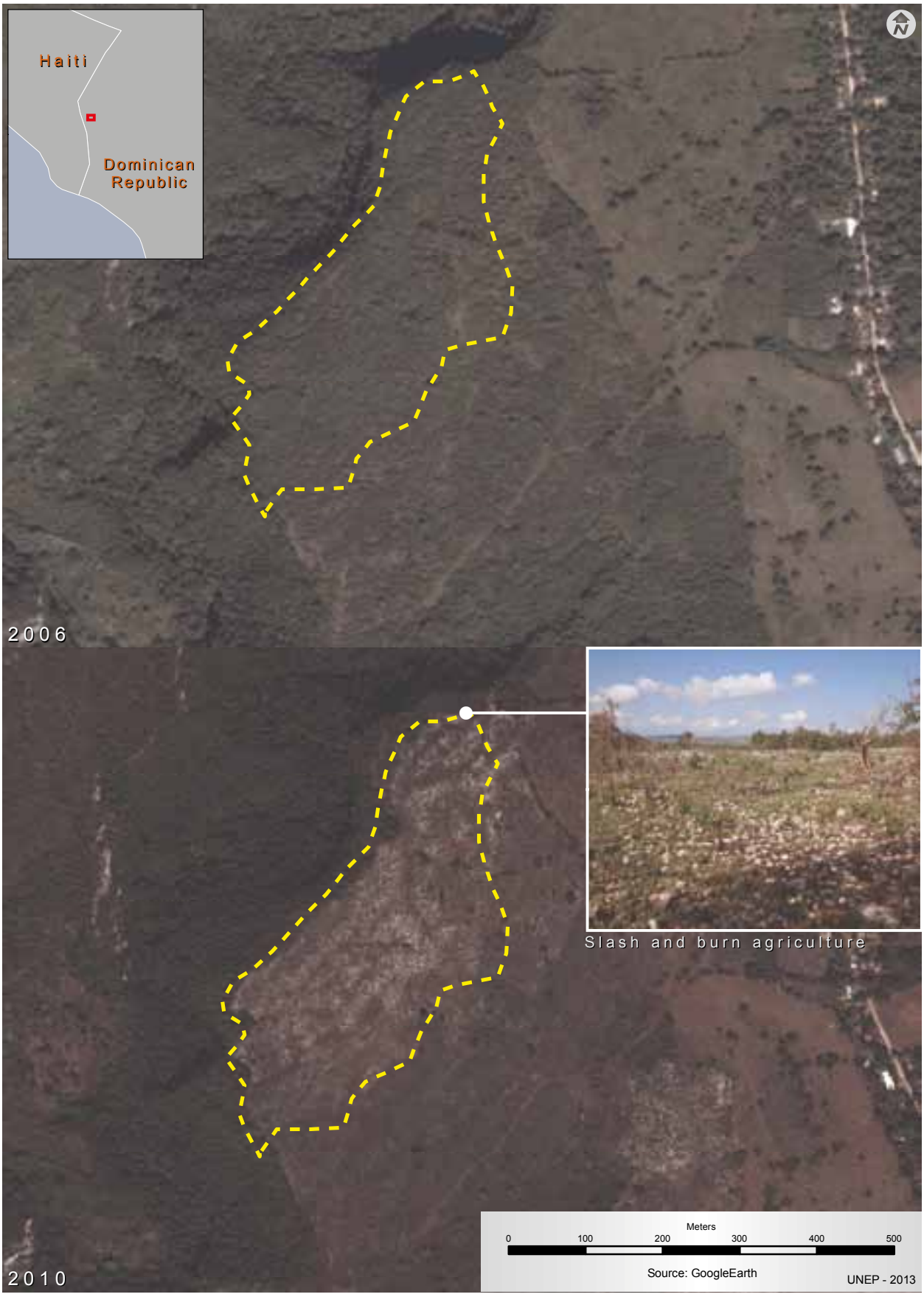
A near total absence of erosion control measures for cleared land on slopes is another driver causing land degradation,[202,203] as is tree cutting for energy – both charcoal and fuel wood, and including the practice of burning the forest to justify the cutting of dead trees (dealt with in more detail in chapter five).

It is important to note that destructive land use and land degradation is also common on the Dominican side of the border. The key differences with Haiti are that the land degradation is more localized and the cycle is generally at an earlier stage. Destructive practices are used mainly by Haitian immigrants, albeit often working in co-operation with Dominican landowners. Nonetheless, based on observed trends, selected parts of the Dominican Republic are heading into exactly the same severe land degradation situation as is observed in Haiti.

4.5 Transboundary agriculture

The main direction of people engaged in trans-boundary agriculture is from Haiti to the Dominican Republic. The large majority of farmers and agricultural laborers in the Dominican Republic in general, and in the border zone in particular, are Haitians, most of them having come to the country illegally.[204,205] Their main agricultural practice is slash and burn, and their main crop is beans.[206] Some of them farm as tenants or sharecroppers, others squat on private or public land – including

Satellite image 2. *Here on the Dominican side of the Pedernales watershed, the cleared hillsides and other signs of slash and burn agriculture – common sights throughout the border zone – are clearly visible. Slash and burn is usually practiced by Haitians farming under a crop sharing agreement with a Dominican landowner.*



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Slash and burn agriculture and overly intensive farming cycles have degraded the land by leaving the topsoil exposed to heavy rain, which washes it away. In addition, these practices frequently result in forest fires.

protected areas – some cross the border for a short period of time, others have settled in the Dominican Republic. Indeed some Dominican communities have large, well-integrated Haitian populations.[207]

The cross-border dynamic in agriculture is, however two-way. Some Dominicans engage in farming activities in Haiti, usually providing Haitian farmers with seedlings and materials, and tasking them with cultivating land. The crops – in particular rice in the northern and central provinces – is then sold back to Dominicans at a low price.[208]

Social issues linked to transboundary agriculture

Several issues arise from the fact that many Haitians regularly cross the border illegally to work in agriculture and farm the land on the Dominican side. It is worth noting that the numbers increased dramatically following the earthquake in Haiti in 2010.[209, 210, 211] The main concern for Haitians crossing the border is the lack of rights that they enjoy once in the Dominican Republic, whereas Dominicans are concerned about governance and security, particularly where Haitians are settling illegally on vacant land and in protected areas.

Many Haitians complain of being robbed or arrested when they return to Haiti after a stint of migrant work and there are some accounts of illegal immigrants being forced to work in agriculture, although this is a bigger problem in the construction sector. A study conducted in 2009 found that 21% of the Haitian construction workers interviewed reported that they had had at some time been forced to work while in the Dominican Republic.[212, 213]

Most agriculture related labour problems occur in sugar cane production. Approximately 80% of sugar cane workers are of Haitian descent and are often recruited by Dominicans in Haiti, sometimes with the promise of well-paid work, and then brought across the border illegally and undocumented.[214] The conditions sometimes border on those of forced labor, and there are some accounts of Haitian workers being rounded up and forced to work on the sugar plantations for less than US $2.50 a day, and of employers withholding wages.[215]

5 Forest resources and terrestrial protected area management

5.1 Introduction

Forestry and protected area management issues in the border area are truly transboundary in nature and an important source of conflict. Essentially the demand for timber for energy and forested land for farming is much stronger on the Haitian side, whereas the bulk of the remaining timber and effectively all of the government managed forested land is on the Dominican side. The border is porous and governance is effectively absent on the Haitian side and variable on the Dominican side. As a result there is a large scale, illegal cross border movement of charcoal and fuel wood from the Dominican side to Haiti and destructive invasion of Dominican forests and national parks.

The critical issue specific to forest resources and protected areas is that incidents of tree cutting, charcoal making, fire clearing, and crop planting have the potential for generating violent conflict at the local level. People have already been killed as a result of this issue.

Resolving this issue should be a top priority for both governments. This chapter explores this and other interlinked forestry and protected area management issues and opportunities in detail.

Agriculture also has affected national parks and protected areas in the Dominican Republic, although the problem has decreased substantially in recent years, as delimitations have been agreed

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Many Haitians cross the border illegally to farm inside Dominican protected areas.

and are enforced by the government. There are still, however, many people crossing over from Haiti farming illegally and cutting trees and producing charcoal inside the parks.[216]

5.2 Key issues

The five key issues identified and dealt with in detail in this chapter are:

- Forest clearance on private land in the Dominican Republic and forest fires.
- The uncontrolled transboundary charcoal trade.
- Collection of fuel wood.
- Protected areas management & biodiversity.
- Reforestation efforts.

On the positive side, the improvement of the management of forestry resources on both sides of the border presents opportunities for greater cooperation across the border. The clearest example is the MPP reforestation programme but there are others such as the development of sustainable livelihoods from fruit, coffee and honey production and plant nurseries for example.

5.3 Forest clearance on private land in the Dominican Republic and forest fires

A substantial fraction of the forest remaining on the Dominican side of the border zone is privately owned. A range of regulations are in place concerning the right of private owners to cut trees and clear land. It is clear, however, that this practice is not under control, at least in the border zone. Both Dominicans and Haitians are implicated, so this is a clear transboundary issue.

The most common form of forest land clearance happens when Dominican landowners (often absentee) and Haitian laborers join forces to produce charcoal or farm under a sharecropping or land leasing arrangement. Trees are cut for charcoal and afterwards the land is cleared of brush and rough grass by burning. Annual crops are planted for 1-3 years, after which the land is temporarily abandoned, allowing some level of tree regrowth before the cycle is repeated.

This well-established practice has four clear negative impacts:

- Intense degradation of the farmed plots.
- Forest fires started from plot burning.
- Exporting the Haitian destructive system of land clearance and use back into the Dominican Republic.
- Eroding resource governance in the Dominican Republic.

Slash and burn agriculture, for example, resulted in a record 72 forest fires in 2011, and 32 fires during the first four months of 2012, in Elias Piña Province (Dominican Republic) alone.[217] According to some accounts, forest fires resulting from slash and burn agriculture cause even more deforestation on the island than tree felling for energy production purposes.[218] Most of these fires occur in the Central Mountain Range, the Sierra de Bahoruco, or in adjacent protected areas, during the dry season (Feb-April and July-August). The fires usually happen at the time when peasants are clearing the land by slashing and burning.[219] During community interviews, the assessment team was also informed that forest fires, including fires inside national parks, are sometimes deliberately started by people who then use this as an excuse to harvest the dead trees. Forest fires occur in both countries and frequently spread across the border. The team was also told by reforestation brigades that they are working to sensitize communities to the dangers of using fire to clear land.[220]

5.4 The uncontrolled transboundary charcoal trade

An estimated 75% of the Haitian population still rely on firewood and charcoal for their daily energy needs. While charcoal is produced in the rural countryside, most of it is consumed in urban areas with an estimated 80% of it in Port-au-Prince alone. Rural inhabitants usually rely on firewood rather than charcoal for cooking. Therefore, the production of, and transboundary trade in charcoal are largely driven by the demand for it in Haitian cities. [221] [222]

Despite the fact that a large portion of the charcoal consumed in Haiti is produced there, a substantial proportion of it is also produced in the Dominican Republic and imported illegally and

Satellite image 3. *In the Massacre Watershed, Haitian farmers lease land from Dominican landowners to farm beans and to keep the land clear. Slash and burn is their method of choice, which, results in erosion and land degradation. The law is unhelpful here in that it is in the interest of the Dominican landowner to keep vegetation down, because if it grows above a certain height he is no longer allowed to clear it for agricultural use.*

without any form of control into Haiti. The total amount of charcoal produced in the Dominican Republic and taken to Haiti is roughly estimated at 50,000 tons per year,[223] and constitutes a trade worth approximately USD 15 million (assuming a price of USD 300 per ton).[224]

Widespread charcoal production and trade along the border

Transboundary trade in charcoal happens all along the border and mostly on a small scale: individual people or small groups in Haiti cross the border either to cut trees for charcoal kilns in Haiti, or to produce the charcoal in kilns in the Dominican Republic, before transporting it across the border. Reportedly, although charcoal production in the Dominican Republic is physically carried out by Haitians, it is nearly always under the supervision of, or in collaboration with, Dominicans, be they land owners, truck drivers, forest parks guards, or army officers, who receive part of the profits.[225,226]

This trade is a main driver causing deforestation on the Dominican side of the border zone. Government authorities in Elias Piña Province, for example, mentioned that last year they found 32 charcoal kilns in one day, all of them manned by Haitians.[227]

Charcoal production and law enforcement

There seems to be a total absence of regulation and enforcement on the Haitian side. All of the actors involved in charcoal production that were interviewed by the team mentioned that they had no interaction with Haitian authorities whatsoever. On the Dominican side however, the trade involves risks. Intermediary sellers whom the assessment team interviewed mentioned that producers

Charcoal is produced in charcoal kilns – such as this one in the lower part of the Pedernales Watershed – that turn wood into charcoal by drying it.

run the risk of being either imprisoned, seeing their production or cattle confiscated, or paying substantial amounts of money to Dominican officials in order to be released.

Field interviews on the Haitian side also show that charcoal production is a livelihood coping mechanism, especially for households that have lower asset values and higher risks of experiencing food insecurity. Such households are significantly more likely to produce charcoal, as a last resort to generate some income. Case study 3 provides examples of the smaller scale charcoal production that is taking place in the northern and southern parts of the border zone, where there is a relatively small amount of transboundary trade in charcoal. That is true of the Massacre watershed in the north because state control is tighter there and of Pedernales watershed in the south because there are no roads on which to take charcoal from there directly to Port-au-Prince. On the Haitian side of these two areas dry forest is also still abundant in the coastal regions, which is suitable for use in domestic charcoal production.

In the bi-national market of Dajabón in the north of the island, the assessment team only saw one charcoal maker who had had to obtain permits through tax payments for all charcoal bags. However, according to interviews in Ouanaminthe in the Massacre watershed, the main transboundary trade of charcoal is happening mainly at night time or far away from border control posts where the border is porous. Two to three tons of charcoal is

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Roadside stacks of charcoal bags are a common sight on the Haitian side of the Massacre Watershed – here they line the main road between Ouanaminthe and Cap Haitien.

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Two sailing boats arrive, on average, per day, to this site, called Ravin de Dyab in Haiti, a couple of kilometers from the border. Each boat is loaded with about 200 bags of charcoal, which adds up to approximately 2,800 bags entering Haiti from the Dominican Republic per week at this one site alone.

reported to transit every week from the Dominican Republic to Haiti in the Ouanaminthe area.[228]

Some accounts also suggest that since the 2010 earthquake, people have gravitated in greater numbers to charcoal production zones, but the assessment team has not, however, been able to verify that suggestion.

Charcoal trade "hotspots"

Compared to the smaller scale uncontrolled charcoal trade that is widespread throughout the border zone, larger scale and more organized forms of this activity is concentrated mainly in the forest areas around Lakes Azuei and Enriquillo, and is more specifically concentrated in Boca de Cachón, Las Lajas, Tierra Nueva, Puerto Escondido and Bahoruco.

An EU funded, cross-border project that, in 2009, studied the charcoal trade in the area around Lakes Azuei and Enriquillo,[229] found that charcoal produced in this area of the Dominican Republic (in the region of Boca de Cachón) is loaded on trucks and transported to the Dominican shores of Lake Azuei. From here it is shipped off to Haiti in boats that cross the lake, arriving on the southern Haitian shore, to a location called Ravin de Dyab, lying next to the main road connecting the border zone with Port-au-Prince. The charcoal's final destination is Port-au-Prince, and more specifically the wholesale and retail markets of Croix de Bossales and Salomon. The assessment team observed thousands of bags of charcoal, which had been brought over from the Dominican Republic, stacked at the side of the road in Ravin de Dyab, and estimated the number of bags

being transported from the Dominican Republic to Haiti to be approximately 2,800 bags per week at this one site alone.

The same EU funded project concluded that 86% of the charcoal produced in or transiting that area, originated in the Dominican Republic.[230] The illegal charcoal trade produces 22,170 tons or 362,000 bags a year, an amount[231] that corresponds to approximately half the estimated amount of charcoal traded between the two countries. This figure also exceeds the Dominican Republic's total domestic charcoal consumption (i.e. 310,000 bags).[232]

Charcoal Value Chain

The same EU funded study, as referred to earlier, found that the charcoal value chain is estimated to generate employment for 150,000 people across Haiti, including 67,000 charcoal makers, either on a full time or part time basis.[233] Primary producers receive approximately 50% of the total income generated; truck and boat drivers receive 25%, local intermediates 13%. "Tips and gifts" represent 12% of the total amount and are distributed among all actors.[234] According to a study, the value chain of transboundary charcoal trade/production in the Lake Azuei and Enriquillo area is relatively simple. The chain is composed of 200 mainly Haitian charcoal producers who are assisted by a minimum of 12 Dominican truck drivers,[235] and produce approximately 37,000 bags of charcoal a month, which are then sold to at least five traders/retailers who store them on the west bank of the lake before transporting them to Port-au-Prince.[236]

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A member of the assessment team interviews Haitian charcoal producers in the north of the border zone. The more isolated and underemployed a community is the more likely it is to get involved in charcoal making.

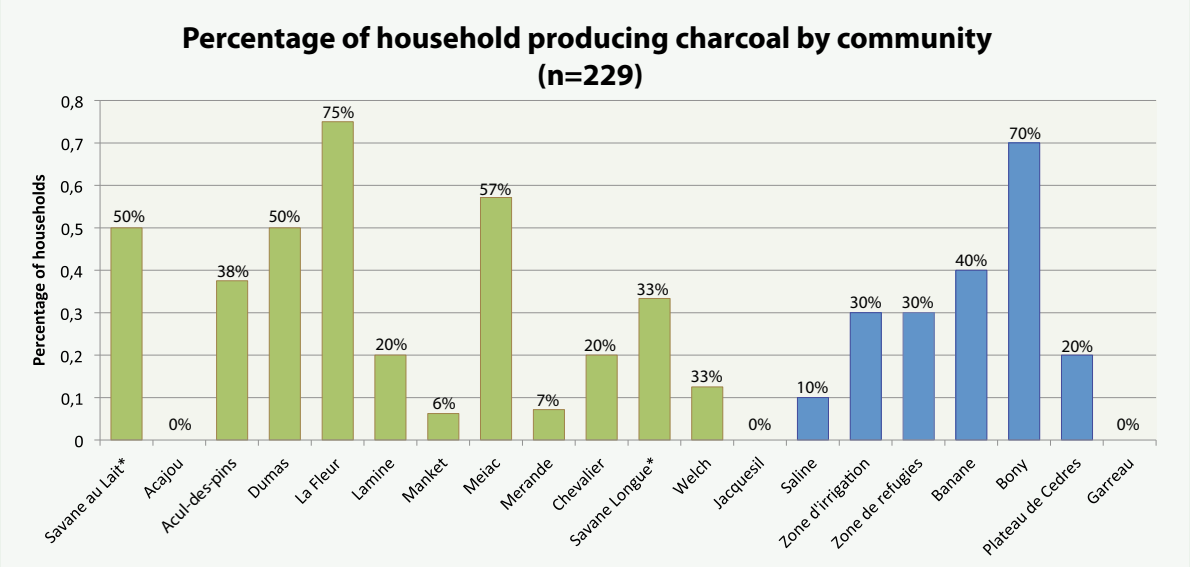
Case study 3: Charcoal production in Haitian communities in Massacre and Pedernales

Though time consuming and labor intensive, charcoal is an important cash crop for rural households. In the two watersheds an average of 28% of households are engaged in charcoal production. Five out of the 20 communities surveyed, reported that at least 50% of the households were engaged in the production of charcoal at some point in the year (Figure 4).

Most of the charcoal produced in the Haitian part of Massacre and Pedernales is being produced from bayahonde (*Prosopis juliflora*), a fast-growing exotic invasive tree species able to survive in harsh, dry conditions. Logwood (*Haematoxylum campechianum*, also known as "bloodwood" or "Campêche") is the next most common tree used. Fruit producing trees such as Caimito or mango trees are also used, but producers are preferentially cutting down older, less productive trees of these varieties.

Villages closer to transportation infrastructure, larger agglomerations or markets, seem less dependent on charcoal production. On the other hand, more isolated and rural communities with easier woodland access and more limited job opportunities appear more likely to engage in this activity as it requires neither formal education nor large capital investments. Some communities in the upper watershed area in the Pedernales watershed are notable exceptions to this trend. This is believed to be a result of the local coffee production, which represents an important source of income in these communities. The fact that coffee plants need shade probably explains why farmers are protecting the tree cover in this area. Female-headed households also seem less likely than male-headed households to earn income from charcoal production.

Figure 4. Percentage of households producing charcoal by community in the Massacre and Pedernales watersheds



Nearly 8 out of 10 charcoal producers have noticed a sizeable decrease in the quantity of wood available in the past two years, probably because charcoal producers do not plant trees to replace those they have destroyed. Moreover, they do not allow the two to three years trees need in order to grow back to their normal size. Rather they cut them before they reach maturity, taking poorer quality wood, which means in turn that more wood is needed to produce similar amounts of charcoal.

Most small-scale Haitian charcoal producers interviewed in these two watersheds, make their charcoal in Haiti. Only 9% of the Haitian charcoal producers interviewed collect or buy their wood in the Dominican Republic, while just 5% produce charcoal in the Dominican Republic, and when they do, it is always under the supervision or in collaboration with Dominicans, with whom revenues are shared. If caught, the Haitians risk being severely punished, with several accounts of cases of mutilation or murder killing over the past ten years.

The households interviewed in both watersheds had, been producing charcoal for an average of 14 years. However, nearly half of the charcoal producers in the Pedernales watershed started producing charcoal at some point in the past five years, which suggests that this activity is relatively new for a significant amount of the population living in this watershed.

Despite its importance, charcoal production is not liked as a livelihood. Virtually all of the charcoal makers interviewed would rather do something else, if they had the choice: charcoal production is perceived as being bad for health, physically demanding, poorly paid, illegal in some cases, and having negative impacts on the environment.

5.5 Collection of fuel wood

Fuel wood is a large scale and transboundary deforestation driver. The Haitian population on both sides of the border uses fuel wood as their primary energy source for cooking and use highly inefficient open fires. The Dominican rural population also uses fuel wood, but has access to Liquified Petroleum Gas (LPG). LPG is also used by the residential sector in Haiti but accounts for less than 2% of the total final energy consumption in the country as a whole.[237, 238]

Fuel wood is often in the form of branches and logs that are collected in the vicinity of the household. However, the need for fuel wood often far exceeds local supply, with people having to journey further afield, including over the border to find the fuel wood they need, as can be seen in case study 4. A minority of wood is also bought at local markets.

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This farmer had just chopped down one of the last trees in sight, explaining that the land here – on the Plateau Centrale, not far from the Artibonite River and the border with the DR – is no longer suitable for farming because most of the topsoil is gone.

Case study 4. The use of fuel wood among the rural population

Surveys of the households of families living on the Haitian side of the Massacre and Pedernales watersheds, show that fuel wood is the primary source of energy for Haitians in these two areas. More than 70% of households in the Pedernales watershed use fuel wood use as their primary energy source, and in the Massacre watershed it is 80%. The use of LPG or mixed sources of energy is negligible, as can be seen in figure 5.

Differences in fuel wood collection habits also provide a proxy for fuel wood scarcity and deforestation in these two watersheds. 16% of surveyed households in the Pedernales watershed buy wood from the market, compared to 0% in the Massacre watershed. 33% of surveyed households in the Pedernales watershed cross the border to collect fuel wood compared to 10% in the Massacre watershed, which indicates that wood is much scarcer in parts of the Pedernales watershed than it is in the Massacre watershed.

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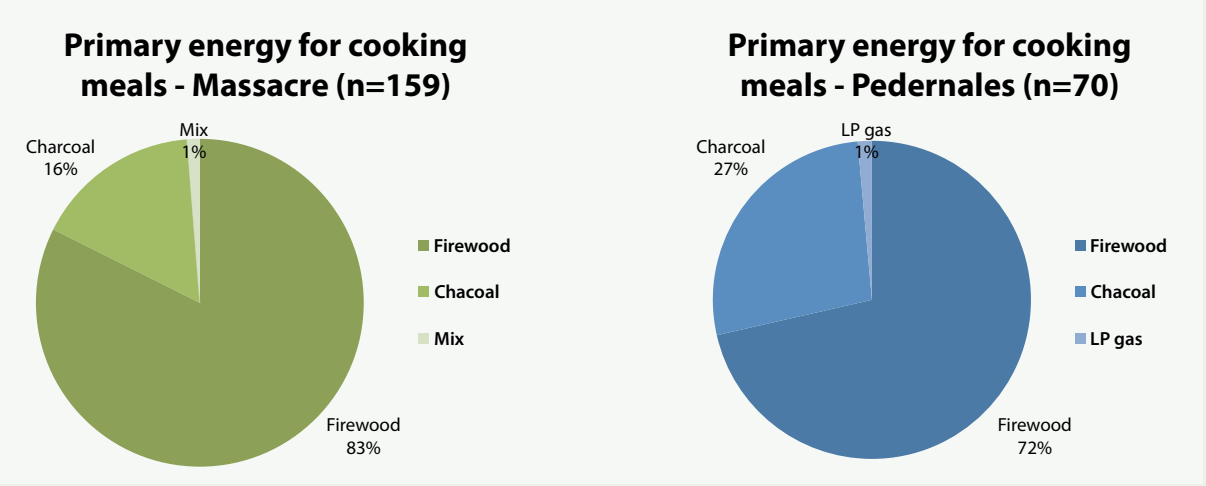
The majority of rural households in Haiti use firewood as their main source of energy.

Figure 5. Primary energy source used for cooking meals in the Massacre and Pedernales watershed



Satellite image 4. *The border between Haiti and the Dominican Republic is clearly visible, where it runs next to the Artibonite river, close to the Dominican town of Pedro Santana. Charcoal production, slash and burn clearances, and forest fires have left the land denuded of trees, and rain has washed away the topsoil.*

5.6 Protected area management and biodiversity

Map 10. Protected areas in the border zone

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Illegal tree cutting for fuel wood inside protected areas in the Dominican Republic is a common phenomenon, such as seen here in the Sierra de Bahoruco national park.

Dominican protected areas close to the border are being significantly degraded by illegal activities conducted by Haitian immigrants, often with the collusion of Dominicans. This is a problematic situation which has already provoked small scale but deadly conflict between Haitian immigrants and Dominican park guards.

In the Sierra de Bahoruco National Park in early 2012, in the southern part of the border, a park ranger was killed by a Haitian charcoal maker who had been apprehended inside the park boundaries. This incident created tension between the communities, as well as retaliation that saw at least one Haitian killed.[239] This case also highlighted the existing difficulties that can frustrate cross border cooperation: Dominican authorities see that there is little they can do if a criminal flees over the border to Haiti.[240] Similarly, several Haitians described cases of mutilation or killing that have taken place over the past ten years, when Haitian charcoal makers have crossed into the Dominican Republic.[241]

Environmentally detrimental activities occurring within protected areas are generally the same as elsewhere in the border area: land is cleared for agriculture, there are forest fires, firewood is collected, and charcoal is produced. One feature that is specific to land surrounding protected areas and observed in the vicinity of the Sierra de Bahoruco National Park is that of illegal settlements. Haitian farmers have moved into these areas on a semi-permanent basis, establishing small communities with churches and schools.[242]

The positive news is that the rate of deforestation has decreased substantially in the past years in and around Dominican protected areas in the border zone.[243,244] The borders of the parks have been formalized and enforced. Sensitization campaigns have increased consciousness among the local communities on the importance of protecting the forest cover, and the environment in general.[245,246] However the enforcement of regulations within the Dominican protected areas is still somewhat inconsistent. Episodic strong enforcement at some

locations is contrasted with a degree of tolerance in others.

The most important protected area in the Haitian border area is the Forêt de Pins in the south. This protected area, as well as other protected areas in Haiti are under extreme pressure.[247] In practical terms the enforcement of the Forêt de Pins national park is non-existent and it has been rapidly degraded and encroached, resulting in Haitians instead crossing the border into the adjacent Sierra de Bahoruco Park on the Dominican side.

There is a need to halt the degradation and strengthen the protected area systems in the tremendously bio-diverse border zone. The area's diverse geomorphology yields a great range of habitats that in turn sustain a wealth of flora and fauna so great that the border zone's endemism and diversity indices are the highest in the Caribbean. The area boasts forests that range from sea level to over 2000 m; bodies of water and wetlands that are considered the most important of the insular Caribbean; and a wide variety of agroecosystems

The natural resources found in those various ecosystems are of considerable value to the border zone's human inhabitants, who use them for firewood, charcoal, building materials, food and medicine. Biodiversity also plays a notable role in the production of ecosystem services and in tourism development of the area due to its aesthetic value.

It is worth noting how little is known about the species living in the area, particularly on the Haitian side. As each new scientific expedition to the area identifies a great number of species it reminds the people of both countries and the scientific community at large, of this alarming dearth of knowledge.

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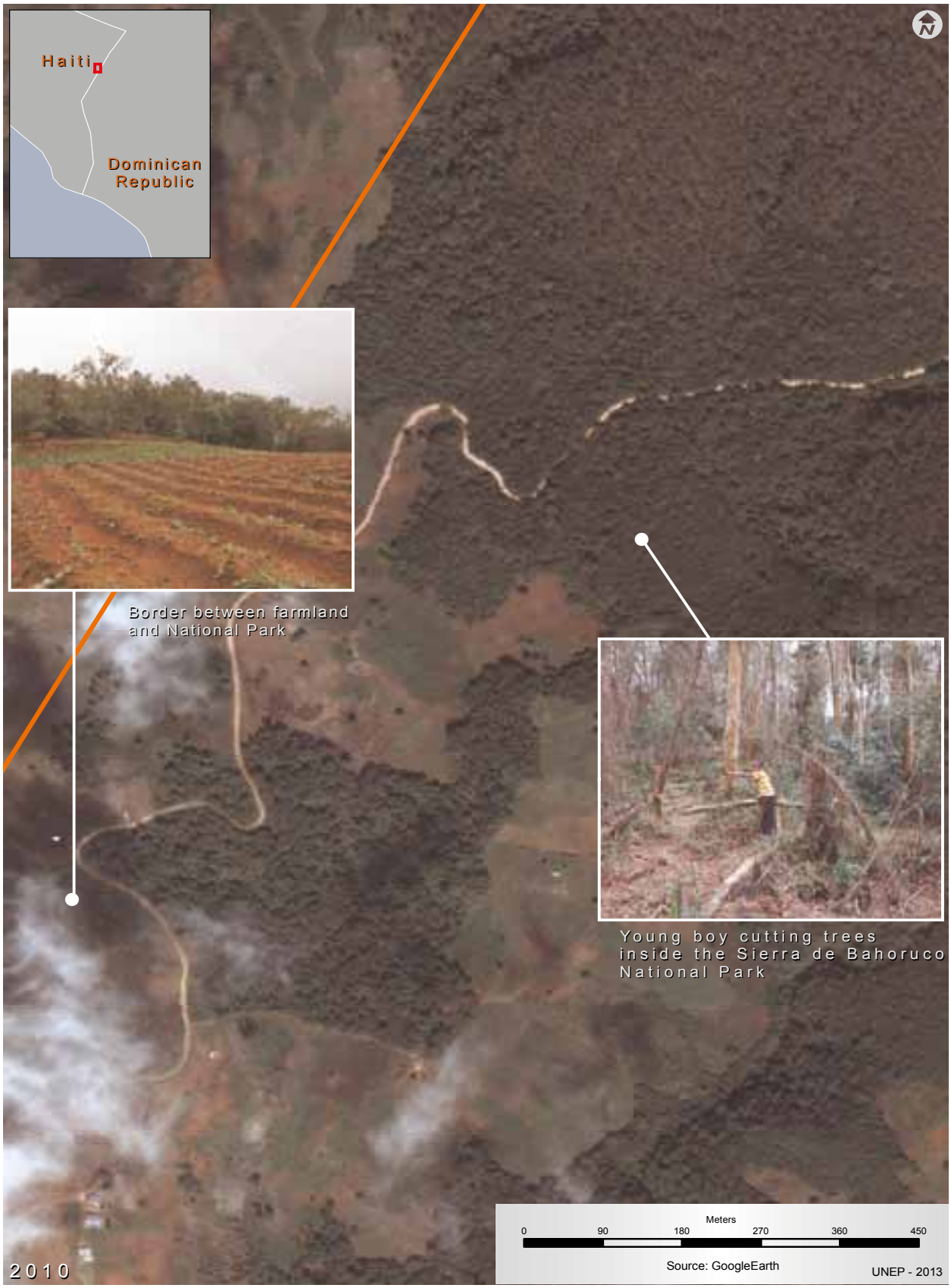
Some of the Haitians who cross into the Dominican Republic farm as tenants or sharecroppers, others squat on private or public land – including protected areas. Many settle and build small communities and some Dominican communities have large, well-integrated Haitian populations, with their own schools, such as this one just outside the Sierra de Bahoruco National Park.

Satellite image 5. *Farmland borders the Sierra de Bahoruco National Park, in upper Pedernales Watershed. The Haitian protected area Forêt de Pin is just across the border. The formalization of park boundaries and improved law enforcement have slowed the pace of the deforestation of Dominican protected areas but Sierra de Bahoruco remains under a lot of pressure. Charcoal production, felling and stripping for fuel wood, and illegal farming all pose threats to the park's forests.*



Enough is known, however, to be certain that the genetic diversity of plants is under threat. Haiti, for example, has more than 200 varieties of mangos, but is in the process of losing many of them as only a few species are commercially valuable.

5.7 Reforestation

Today the forest cover in the Dominican Republic is estimated at approximately 40% of the land surface, compared to only 12% in the 1980's and approximately 4% in Haiti.[248,249] The reversal from deforestation to reforestation occurred as a result of a large-scale program of reforestation and the promotion of alternative sources of energy, specifically LPG and electricity.

Recent surveys show that the forest cover continues to increase in the whole country, but that the increase is slower in the border zone than in the rest of the country.[250] This positive trend has been more apparent in recent years, as the population living in the border zone has started using resources more consciously, and the state is enforcing its directives more vigorously than it used to do.[251]

Generally, the sentiment among authorities and community members alike throughout the border zone is that the establishment of Dominican (and now Haitian) reforestation brigades has had a very positive effect in ameliorating the negative trend of deforestation. Brigades are generally composed by eight to ten members from the local community, with every member working in the brigade earning approximately 300-350 pesos a day (USD 8). Every brigade is headed by a chief *(capataz)*, who in a vast majority of cases is a woman. Box 1 gives more details of the composition and use of reforestation brigades in the border zone.

There are several reasons for this success. Partly, it is because the creation of the brigades have created a source of income to the members of the brigades, as well as related livelihoods, including plant nurseries and fruit production. Also the work of the brigades has ripple effects in the communities where they operate, in respect to awareness building, and increased consciousness of issues among the local population.[252] Some of the members of the reforestation brigades previously were engaged in producing charcoal, providing good examples of alternative and more sustainable livelihood options to this detrimental practice. Some members of reforestation brigades also noted that they try to sensitize their communities to the risk of forest fires inherent in the use of fire as a clearance technique.

The challenge, however, is to retain these positive effects in the long run and how to use the available resources better. Issues to address include ensuring the long term survival rates of trees; preventing the felling of recently planted trees; and discouraging people in these communities from returning to charcoal production in the event that financing for the reforestation efforts is phased out.

As noted by Mr. Cornelio Acosta Monegro, Frontera Verde Executive Director, the survival rate of recently planted trees vary between different

Box 1: Reforestation brigades in the border zone

At the time of writing, there are 62 reforestation brigades in the border zone (46 in the Dominican Republic and 16 in Haiti). In the Massacre watershed, there are currently five Dominican brigades and nine Haitian brigades. In Pedernales, there are three Dominican brigades and three on the Haitian side, although all of them mostly are composed of Haitians working on both sides of the border, due to the lack of Dominican population in this area. Additionally there are 12 active Dominican brigades in the Elias Piña province, four in the Independencia province, nine in Restauracion and one in Monte Cristi.

The bi-national reforestation brigades are also the main tool for executing the MPP project. The selection methodology of members working in the brigade is not set: in the case of the Haitian brigades of Capotille, the choice was made by the CASEC (the mayor) and the project technician. In others, members have been chosen after community consultations, but modalities are not clear. The various brigades are, however, always to be led by a woman *(capataz)*.

At the time of writing people selected to serve in the brigades have to be able to provide 1.25 "kawo" of land to the project for reforestation activities. This requirement is, however, problematic, as it excludes many households from this cash-for-work scheme, many of which are in the greatest need of intervention, and who are the most likely to engage in charcoal production for income generation.

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Members of the assessment team meet the two bi-national reforestation brigades that operate in Zapoten, which borders the national parks of Sierra de Bahoruco in the Dominican Republic and Forêt de Pins in Haiti. These two brigades are among the most successful in the border zone, with reported survival rates of trees reaching 95%.

brigades, reaching 95% in the Pedernales watershed, but only 40% in Pedro Santana. The level of technical assistance received by the brigades also varies significantly from one brigade to another, which has clear repercussions for the successful implementation of the project. In Capotille for example, where trees have been growing well, a Haitian technician oversees the plantation activities daily. However, this is one of the only Haitian technicians that have been involved in project monitoring to date. In some places visited by the assessment team, especially towards the center of the country, the border population seemed to receive only sporadic technical assistance and seemed unaware of basic plantation techniques.

It seems that in most cases sites have been selected for planting because the land there is available and the owner of that land is willing, rather than for a strategic criterion such as the vegetation cover or high vulnerability to erosion. Moreover, it seems that the exploitation or harvesting rights as well as the obligations of the landowners has not been clearly set out. Landowners are authorized to harvest mature trees but there is no mechanism to ensure that they harvest or replant in a sustainable way. There are no contracts between the entity running the reforestation efforts and the landowner, and it is not at all clear how the system for sharing revenue among community members is supposed to function.

In addition, it appears that the selection of tree species used is guided mainly by forestry criteria such as rapidity of growth and fire resistance. Ecological and conservation factors or the possibility of creating income generating activities (fruit trees, and communal plant nurseries) were not taken into account in the original project design, but have been added to some extent at a later stage. For example, in areas where forest has never existed, the regeneration of original shrubs should be encouraged instead of creating tree

plantations that the habitat will not sustain. The promotion of native species in nurseries could also be encouraged: currently, only a few native high value timber species are being planted by reforestation brigades (e.g. mahogany, cedar). This would bring positive results not only in terms of conservation but also of survival rates of planted species.

Members of reforestation brigades expressed on numerous occasion their desire to plant more fruit trees as well as to establish more nurseries in order to provide additional "green job" opportunities.

There is clear statistical evidence of forest recovery in the Dominican Republic as a result of energy policy, governance and reforestation investments. The early evidence from the Frontera Verde project is that the reforestation investments are working in the border zone as well. The establishment and use of reforestation brigades also is a positive example of bi-national cooperation on an issue of mutual concern. The current MPP project, has for example brought together both local community members and officials, as well as ministries of environment, with the aim of jointly working to improve the situation in the border zone.

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Dominican and Haitian reforestation brigades have done a great deal to reverse the negative trend of deforestation in the areas they have targeted. At the same time the brigades offer alternative livelihoods to the people in the communities in which they are active.

6 Freshwater resources and flooding

6.1 Introduction

The border zone is moderately well endowed with water resources. The important permanent rivers (from north to south) include the Massacre, the Artibonite and the Perdenales. In addition there are multiple rivers and streams that are transient and effectively dry in the dry season (known as *arroyos* in Spanish). Finally there is Lac Azuei, known as the Etang Saumâtre in Haiti, which forms the Haiti-Dominican Republic border in the Cul-de-Sac Valley. Lac Azuei is brackish, so although it is an important water feature it is not a fresh water resource. Despite the amount of available water resources, shortages can still be severe in particular regions throughout the year and broad scale water shortages are experienced right through the dry season.

Change in the availability of fresh water is already a major concern for farmers and communities in the central parts on both sides of the border zone.[253] Water levels have decreased here mainly due to changes in precipitation and in runoff rates, erosion, as well as sedimentation of canals, which have in turn changed the physical characteristics of the rivers.[254]

There are two types of transboundary rivers and river sections in the Haiti-Dominican Republic border zone:

- **Riverine borders –** where the border is the river itself, or runs close and parallel to the rivers, as true for the Massacre River, parts of the Artibonite River network, and the Pedernales River. In these instances, the ownership and water allocation rights remain unclear between the two countries.
- **Border crossing rivers –** where one nation is upstream and the other downstream.

This distinction is important, both in terms of key issues and potential solutions. Responsibility for catchments with riverine borders is shared and sometime blurred. In contrast, the allocation of responsibility for border crossing rivers is clear: responsibility and ownership changes at the border.

6.2 Key issues

Transboundary water resources are a subject of high interest in both countries. There are several serious issues but only limited tensions. In general most issues are of mutual interest to be addressed and the potential for cooperation is clear. The most difficult issues are linked to floods and borders that cross rivers, where actions or lack thereof in one country directly impacts the other.

The four most important issues noted in the assessment were:

- Transboundary river flooding.
- Water scarcity, access and pollution.
- Lake Azuei and Lake Enriquillo flooding.
- Transboundary dams and water extraction.

6.3 Transboundary flooding

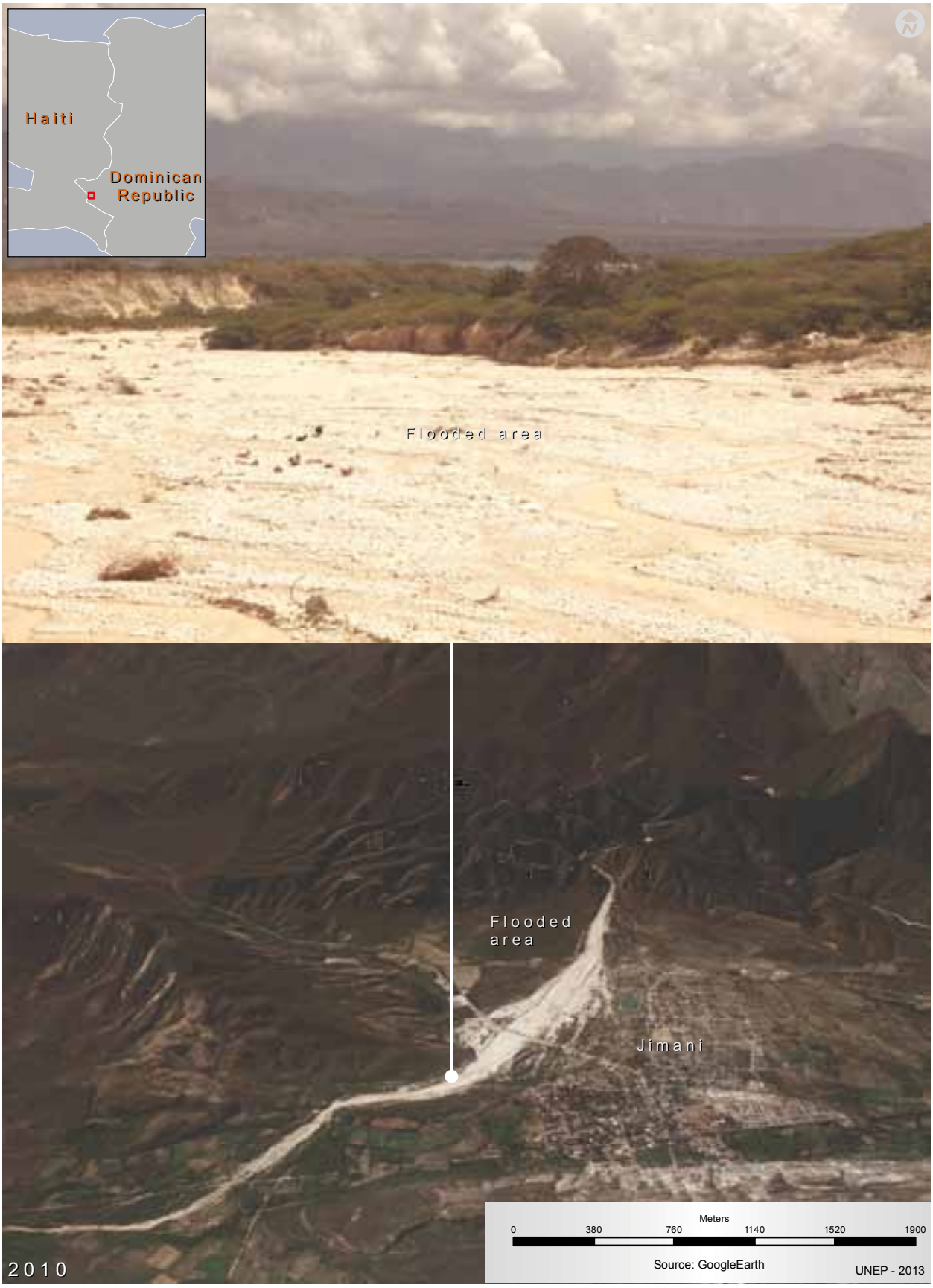
The phenomenon of flash flooding in Hispaniola is well understood. High rainfall events in the upper parts of degraded catchments result in very rapid rises in river levels. The flood peaks which can last from hours to a few days at most, breach river banks and impact settlements in and adjacent to the flood plains. This is a nationwide problem in Haiti and a problem in some specific areas in the Dominican Republic.

A rarer problem is that of floods caused by hurricanes and tropical storms. In these cases, very heavy and widespread rainfall – over a period of hours or even days – simply overwhelms the entire catchment and widespread flooding occurs all along the floodplain, with water levels taking up to days to fully recede.

Transboundary flooding is a very localized subset of the larger problem of flooding in Hispaniola. In select cases, rainfall in one country causes floods and damage in the other.

The importance of this transboundary issue is catchment specific. It is not, for example a major issue for the Massacre watershed, but is an important issue for the Artibonite watershed, the areas around the lakes and the Pedernales watershed. However the impact of "normal" heavy rainfall in the Dominican Republic upon Haiti is mitigated by remaining forest cover and the Peligre Dam.

Satellite image 6. *Just before reaching Lake Enriquillo, the Soliette/Arroyo Blanco river has created a floodfan, threatening the Dominican town of Jimani. In 2004, a flashflood in the river first destroyed the Haitian town of Fonds Verrettes, before crossing the border and flooding the Dominican town of Jimani, leaving death and destruction in its wake.*



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Signs of the destruction wrought by the flashflood of 2004 can still be seen along the riverbed of the Soliette/ Arroyo Blanco River where it passes the Haitian town of Fonds Verrettes.

The issue is most critical however for the Soliette/ Arroyo Blanco and Pedernales Rivers, draining into Lake Enriquillo and the Caribbean Sea respectively. Both of these rivers have very heavily degraded, steep catchments in the Haitian southeast mountains – a region prone to heavy rainfall due to prevailing winds bringing moisture laden air from the Caribbean Sea. Both rivers also have Dominican towns located next to the riverbeds, on alluvial fans at the base of the catchments: Jimani for Soliette/Arroyo Blanco and Pedernales for the Pedernales River (with Anse-à-Pitres on the Haitian side). Both sites have experienced damaging floods in the past.

The forecast for these three towns is very negative: major flooding can be expected to continue for the foreseeable future, even if there is investment in mitigation. The technical rationale for this forecast is that both of the potentially viable flood risk reduction measures (reforestation/soil conservation and micro-dams) will not fully work in these specific cases, and the flood control dams of the size that would be needed to make a difference are simply not economically viable.

First, reforestation and upper catchment soil conservation investments may help cap but will not reduce the current flood risk levels. At best, they will retain the remaining soil and flood risk levels will not increase. This is because it is soil, not trees, which retain the bulk of the rainfall and encourage infiltration in high rainfall events. Trees simply protect the soil from rain damage. However for the Soliette/Arroyo Blanco and Pedernales watersheds, much of the soil is already lost and transported as sediments by the rivers either to Lake Azuei, to Lake Enriquillo, or to the Caribbean Sea.

Second, micro-dams in the upper catchments, if very widespread and well built, will mitigate general flash flooding, but will not mitigate hurricane or major storm related flooding risks. Micro-dams are small semi-permeable dams built across tributaries in the upper part of catchments. Generally they are either dry or have a low flow leaking through the wall via drainpipes. In the event of short-term heavy rainfall, they do rapidly fill up and retain water for some time, thereby extending the drainage time and reducing the flood peak. As a result micro-dams can reduce the flash flooding risk – for some rainfall events. However hurricanes and major storms tend to bring heavy rain for extended periods and this both overwhelms the micro dam storage capacities and damages the structures through very heavy and fast flows.

Finally, localized flood channel containment measures (gabionage and channel excavation) will work only in part. These types of very local

interventions if well designed do work for all but the largest events but do require regular maintenance and rebuilding/excavating after each flood.

In the above cases, the recommended flood risk mitigation strategy is a balanced combination of investments in mitigation, retreat, which would mean the abandonment of the most vulnerable areas, and the reconstruction of infrastructure away from the flood risk.

6.4 Water scarcity, access and pollution

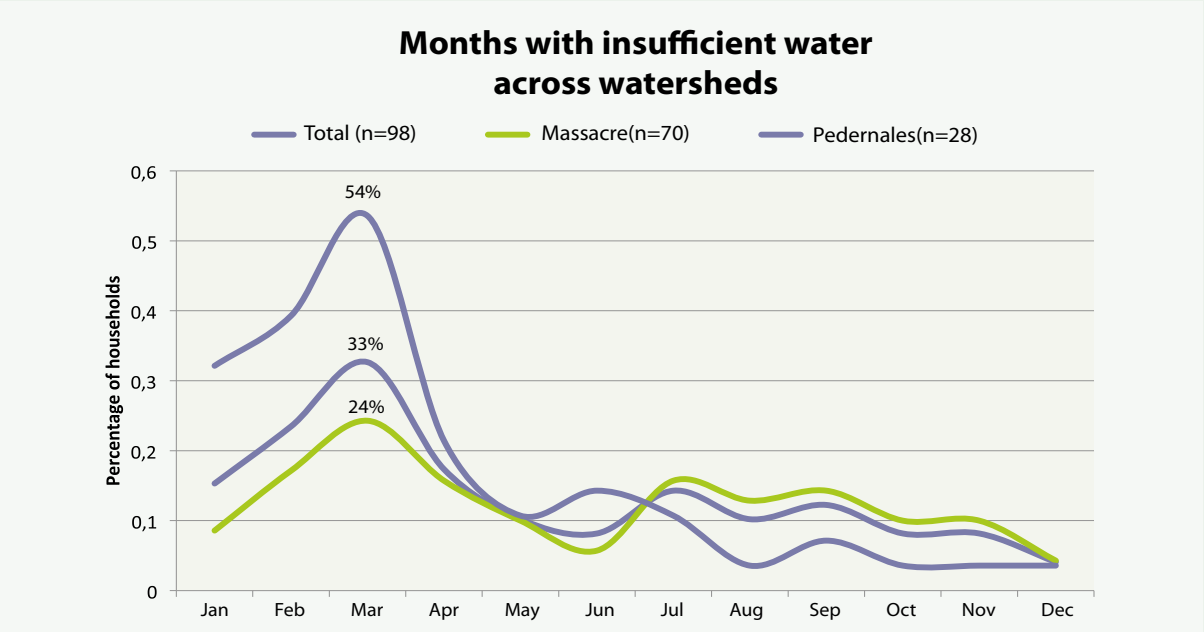
Water scarcity refers to an absence of sufficient amounts of water in the environment, while water access refers to the availability of suitable water for the use of the population. It is, in other words, possible to have abundant water in the environment but insufficient access, particularly in respect to clean drinking water.

Case study 5. Water insecurity in two Haitian watersheds

Household surveys in the Massacre watershed in the north and the Pedernales watershed in the south of the border zone give a good indication of the situation in respect to water shortage. About four in ten people in both watersheds have suffered from a lack of water availability for either drinking or bathing/cooking over the past 12 months. However, while this level is consistent across the Massacre sub-watersheds, there is dramatic divergence within Pedernales. In the Pedernales watershed, the mountainous areas are significantly more exposed to water insecurity, with 75 per cent of the respondents answering that they have had insufficient water availability, than the two other eco-zones, where only 20-30% of households reported suffering from water shortages.

As can be seen in Figure 6, the lack of water directly corresponds to the dry season, from December to April. People interviewed in the Pedernales watershed are significantly more likely to report insufficient water access from January to March than in Massacre, suggesting a stronger impact from the climate variability and the dry season in the Southeast.

Figure 6. Seasonality of water insecurity



The number and variety of sources of drinking water also diverges across the watersheds on the Haitian side of the border. The prevalence and accessibility of public taps or tube wells in most Massacre communities might explain the higher proportion of respondents drinking ground water in the Northeast. When tap stands are not available or too far away from households, families obtain their water from rivers, even though they generally understand the higher risk of contamination.

In contrast, the proximity and apparent higher quality of the surface water in the Southeast leads to higher surface water consumption in the Pedernales watershed. The technical director of the MPP in Pedernales noted that the source of the river is in the Dominican Republic, where deforestation is limited, and perhaps that is why the quality of water was significantly better than in the Northeast. Bottled water does not appear to be a viable alternative in either watershed.

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Refuse from landfills and untreated domestic waste, pollute the Massacre River, from which it was safe to drink as recently as the 1970s. A key problem is people's attitudes toward waste handling on both sides of the border, which highlights the need to raise people's awareness about the issue.[260]

Water scarcity is a major issue in the central and driest areas of the border zone, including the plateau centrale in Haiti and the Elias Piña Province in the Dominican Republic. Elias Piña is, for example, experiencing decreased rainfall and river water shortages, which is a contributing factor to landowners selling their land and moving to the cities.[255,256] Without detailed analysis it is not possible to pinpoint and weigh the various causes of the shortages, but both hydrology and local perceptions indicate that one of the main causes for such shortages are related to land degradation resulting in increased run-off rates and reduced water retention. This in turn results in rivers drying out quicker in general and completely in the dry season. Another reason seems to be changing rainfall patterns, as discussed in chapter 2.

Case study 5, highlights the levels of water insecurity in two regions on the Haitian side of the border.

Water pollution is another widespread and transboundary problem. It is essentially endemic to both countries due to inadequate waste management, sanitation and wastewater treatment. There is no long-term comprehensive data on the quality of the rivers in the border area, but there is abundant anecdotal evidence of pollution.[257,258] Rivers are used on both sides of the border as solid waste disposal sites, as laundries, bathrooms and latrines. All permanently flowing rivers observed by the assessment team had high levels of visible pollution (garbage, foul water) in their downstream parts, and are obvious sources of bacterial contamination. The border zone does not at present host large-scale manufacturing; so industrial wastewater pollution is not yet an issue.

A specific source of pollution is the bi-national markets, which are poorly organized and have low standards of sanitation. They produce high volumes of garbage which trickles down into, as well as is disposed of in the water streams.[259]

The largest practical impact of water pollution in the border zone is on health: bacterially

contaminated rivers are disease vectors, which is an issue of serious concern now that cholera is widespread in the region.

The governance problem presented by pollution in the rivers of the border area rivers is unique in that is necessarily the shared responsibility of the two countries, neither of which has the motivation or means to clean up the rivers on their own. Therefore, the issue is an opportunity for cooperation, albeit a difficult one.

Reduction of water pollution in the Massacre, Artibonite and Pedernales rivers in Haiti would require major improvements in governance on both sides and widespread and major investments in solid waste management, sanitation and wastewater treatment. Given the current economic constraints, this is considered unlikely to occur in the short to medium term at least – so the current pollution status of the transboundary rivers is also unlikely to change.

On the Dominican side, the General Directorate of Border Development has developed proposals and is trying to mobilize funding for municipal sewage treatment for the effluents from Dajabon that are currently draining into the Massacre River. This is a very positive step, but represents only a small fraction of the required investments.

6.5 Lake Azuei and Lake Enriquillo flooding

Lake Azuei and Lake Enriquillo are both terminal lakes: they are located in the same tectonic depression and have little or no exit drainage. Water escapes the lakes mainly through evaporation; some also escapes from Lake Azuei via groundwater flows to the east (towards Lake Enriquillo). As a result both lakes are saline, as continued evaporation increases the concentration of salts and there is no flushing drainage. Lake Azuei used to be an exclusively Haitian water body.

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Investments that have been made in the last five years to provide Haiti with modern custom and immigration facilities along the main road connecting the two countries are now inoperative and partially submerged as a result of the rising water levels in Lake Azuei.

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The main road connecting Port-au-Prince and Santo Domingo has been raised several times where it follows the shores of Lake Azuei, but that solution can only be seen as temporary as the lake's water levels continue to rise.

During a slow but sustained flooding process the lake has expanded into the Dominican territory and is now several kilometers into the Dominican Republic, making delineation of the border difficult because it is understood in some places as the lake shore, which is clearly a moving geographical feature.

Since 2004, both lakes have visibly risen above historical levels. Level changes in Lac Azuei have not been accurately tracked but are reported unofficially to be in the order of 1m per year at peak periods (please refer to map 8 for the changed shoreline of lake Azuei). This has caused a number of problems. The main southern transboundary route between Port-au-Prince and Santo Domingo runs along the south side of Lac Azuei and is also the main transport link for goods being traded and transported between the two countries. Since 2008, the route has been gradually submerged on both the Haitian and Dominican Republic sides. The road has been raised by earthworks several times and is still cut frequently, and many warehouses and some houses in the area have been submerged. Agricultural land has been flooded on both sides of the border, with the greatest losses being Haitian land at the west end of the lake. Multimillion investments that have been made in the past five years to provide Haiti with modern custom and immigration facilities are also now inoperative and partially submerged.

The cause of this rise has not been technically assessed. Nonetheless it is possible to make an interim professional judgment, based upon hydrological principles and anecdotal evidence gathered on site reconnaissance visits.

Interpretation of the potential causes of the Lac Azuei flooding

Studies conducted after the 2010 earthquake show that there has been no change in the earth's

crust substantial enough to be the main cause of the lake level rise. Although it is true that the number and intensity of the flow of the springs surrounding Lake Azuei increased immediately after the earthquake, these changes would have been due to temporary alterations in the water table rather than to a permanent shift in the tectonic situation itself. There is also no recent change in the groundwater exit flow status, as there have not been any recent major drainage works. Instead the rise is probably due to increased river water, groundwater and sediment flows into the lakes with no corresponding change in exit flows/ evaporation. In summary, increased inputs but static outputs result in rising water levels.

There are at least four potential causes for the interpreted increased input flows:

- Permanent increases in river water and groundwater run-off percentages – The majority of serious deforestation and soil erosion in the mountainous catchments surrounding the lakes has occurred since the 1970s. Deforested and eroded catchments retain much less water than healthy catchments. As a result, the water that falls as rains flows more quickly to the catchment end points – the lakes, rather than recalculating in the mountains via evaporation from soils after rainfall and evapo-transpiration (tree respiration).
- Short term increases in rainfall – 2004, 2005 and 2008 all saw major hurricane and tropical storm strikes on Haiti. The 2008 storms in particular struck the Southern Peninsula and caused heavy flooding in southern Haiti. It is possible

It is clear from this picture of the mountains above Lakes Azuei and Enriquillo that farmers have been working these steep hillsides without any form of erosion control and as a consequence the land is severely degraded.

that the rise in lake levels is in response to recent and temporary increases in rainfall.

- Medium to long term changes in rainfall patterns – A second rainfall theory under review by scientists studying Lac Enriquillo is that regional climate change is driving a long term increase in rainfall or change in rainfall patterns in this specific region of the island.[261]
- Historical sediment inflows from land degradation – A large scale influx of sediment over the last decades may have reduced the volume of the reservoir and so increased the lake water levels.

Based on the above interpretation, both countries have a major problem with Lac Azuei. At the very least, this issue warrants technical monitoring and further analysis to inform an appropriate response, including engineering solutions to reduce inflow and eventual drainage. A precautionary approach would also assume that lake levels will continue to rise.

6.6 Transboundary dams and water extraction

At present the issues of transboundary dams are limited to the Artibonite catchment in Haiti.

The Peligre Dam in the Artibonite catchment provides domestic water and irrigation to over 3.5 million people, 30-50% of Haiti's current electrical capacity (installed capacity of 47 Megawatts), and is the only large dam in Haiti. Downstream, the Artibonite valley is the country's main production centre for rice and staples, with more than 34,500 ha of irrigated land. Over the last few decades a very large volume of silt has been deposited in the Peligre Reservoir. That sedimentation is due to land degradation in the upper catchment. The water storage capacity has as a result decreased by 53% between 1972 and 2010 and its capacity to produce energy has also been reduced.[262]

Discussions are ongoing about building a dam on the Rio Joca, one of the main tributaries of the Artibonite River. Dominican authorities see it as part of an integrated vision for the development of the border region.[263] Law No. 128-01, which authorizes the issuance of up to USD 500 million in government bonds, mentions the building of the Joca Dam as one of the projects in which these funds can be used.[264] Potential other dams on the Dominican side include: Recodo Dam, Monte Grande Dam, El Tamarindo Dam, and Río Sanate Dam.[265] Other potential dams are the Don Miguel Dam, Arroyo Capotillo Dam, Jobo Viajaca Dam, and Laguna Saladillo Dam.[266]

There are only a few water extraction points on the transboundary rivers. On the Massacre River, for example, the Dominicans have four water extraction locations, while the Haitians have none. The Haitians use some water upstream, but no irrigation schemes exist on the Haitian side.[267]

There is no bi-national mechanism in place that would deal with issues related to water sharing and future dam construction. Given the extremely high dependence of Haiti on the Artibonite River, this is a potentially a serious issue.

7 Coastal and marine resources

7.1 Introduction

Dominicans and Haitians living in the coastal areas are interdependent: Haitians buy fishing gear and fuel oil for their boats from the Dominican Republic and also sell a part of their catch across the border[268]. Haitians and Dominican also both infringe on a daily basis on respective territorial waters. Haitians generally fish close inshore, whilst Dominicans fish both inshore and further offshore.

With 1,700 km of sea coast and 22,000 ha of inland waters, fishing is an important activity for many households in Haiti, with 50,000 people working either full time or part time within this sector.[269] The sector is not, however, well developed and confronts major constraints such as low quality equipments, lack of the infrastructure needed for processing, conservation and commercialization, as well as insufficient credit sources.[270]

Artisanal fishing is a sector that largely has been an underestimated source of livelihood in the south-east department of Haiti. Close to 3,300 families are involved in this activity, and artisanal fishing provide a direct livelihood to 20,000 persons, with an additional 10,000 involved indirectly in this sector.[271] From an economic standpoint, artisanal fishing creates an annual turnover of more than 200 million gourdes (approximately EUR 5 million).[272]

The fishing sector in the Dominican Republic is comprised of approximately 8,400 fishermen, and 3,300 boats, of which 98% are artisanal. Annual production amounts to 11,000 tonnes, putting pressure on the marine and coastal fishing resources of the Dominican Republic. This yearly production is not sufficient to fulfill national demand, requiring the import of approximately 34,000 tonnes of seafood every year.[273] As fishing makes a minimal contribution to GDP (0.5%), fisheries receive little institutional and economic support.[274]

7.2 Key issues

Coastal and marine resources are issues of serious transboundary concern, creating clashes and tensions between communities on both sides of the border, as well as between Haitian fishermen and Dominican authorities. At the same time it is a key opportunity for co-operation, as described by the example of the cooperation between the fishermen associations in Pedernales (Dominican Republic) and Anse-à-Pitre (Haiti), in case study 6.

The five main issues that were identified are:

- Illegal transboundary fishing and overfishing.
- Mangrove cutting for wood and creation of salt pans.
- Marine protected areas & biodiversity.
- Transboundary trade in marine species.
- Contamination of estuaries, coastal lagoons, and the sea.

7.3 Illegal transboundary fishing and overfishing

The main source of marine territorial tensions between the two countries identified in both the north and the south were Haitian fishermen crossing illegally into fishing areas belonging to the Dominican Republic, and Dominican fishermen entering Haitian waters in better boats with which they can fish further offshore than their Haitian counterparts, creating tensions and frustrations among fishermen on both sides of the border. Haitian fishermen are frustrated about not being able to address the problem of Dominican fishermen coming in on Haitian waters and fishing with better equipment. While Dominican fishermen in Pedernales (in the south), and government officials in Montecristi (in the north) on the other hand raised the common problem of Haitian fishermen conducting illegal fishing that depletes the fish stocks, and catching protected species (including turtles) on the Dominican side of the border.[275]

The northern coastal border area also suffers from problems in relation to unclear delimitations of the maritime border between the two countries. The border of the Exclusive Economic Zone (EEZ) is not clearly defined so it is not obvious at what point a boat has crossed the border. The delimitation of territorial seas is much clearer in the south and both sides know when they are fishing outside their territorial waters.

Overfishing practices on both sides of the border were also observed among Haitian fishermen in

both the north and the south coasts of the border zone. The fish stock is reportedly decreasing in size and volume. Haitian fishermen are taking smaller and smaller fish by reducing the mesh size of their nets. When engaging in such harmful practices on the Dominican side of the border, this is a particular concern among Dominican fishermen, creating tensions between Haitian fishermen and Dominican authorities.[276] All the fishermen interviewed by the assessment team on both the Haitian and Dominican side of the border mentioned a decrease in the number of fish, and most fishermen interviewed in the border region have also noticed that the size of fish has reduced. UNEP work in this field has consistently noted low catches and a predominance of juvenile fish netted by Haitian shoreline and inshore fishermen. Such practices, when used over time, lead to the destruction of breeding stock and overfishing of the existing marine resources.

The fish catches are considerably better in the south where some fishermen reported that they could earn a living just from fishing, while in the north they had to engage in additional livelihood practices as well – mainly farming, charcoal making, small trade or salt production. One reason why the fish stocks are more plentiful in the south may be the fact that the Jaragua national park exists close to the Dominican side of the border, providing a protected area for fish stocks to rejuvenate.

There is no government surveillance or enforcement with respect to coastal and marine resource management in Haitian territorial waters, which means fishermen from both countries operate freely on the Haitian side of the border.

Dominican fishermen generally cross the Haitian marine border to fish pelagic (deep water) species that are under exploited in Haiti. These include

Fishermen have reduced the mesh size of their nets and overfished in general, all of which has resulted in smaller and smaller catches.

tuna, sea bream, yellowtail, hake, marlin, and swordfish. This includes the placement of semi-permanent DCPs (Dispositif de Consentration de Poissons – a type of off-shore fishing structure) in Haitian waters for their own use.[277]

The many Haitians, who cross the border to fish, run the risk of being caught by the Dominican coast guard or police. If they are caught, especially if conducting illegal activities, such as fine netting or catching protected species, their fish and in some cases their equipment, are confiscated, or they are imprisoned for days.

7.4 Mangrove cutting and salt production

Mangroves are important nurseries for fish and marine life that protect the coastline from erosion and trap sediment. They are relatively abundant on the north coast of Hispaniola, including in the border area. There are very few mangroves along the southern coast of the border zone, but there are large numbers further west on the Dominican side of the Pedernales watershed between the city of Pedernales and Cabo Rojo.

The already degraded mangroves of the border area are under further threat from people felling them for fuel and clearing to make way for salt production. Those threats are serious in Haiti[278] but less so in the Dominican Republic, where the majority of the damage is historical and the authorities are actively protecting the remaining mangrove stands.

In Haiti, the main threat to the mangrove is cutting for use as fuel wood. There are even semi-commercial fuel wood operations that supply bakeries and laundries in Cap Haïtien. Although both mangrove cutters and fishermen live in the same communities, fishermen do not generally participate in the cutting of mangroves – they say that they know that it is detrimental to their fishing livelihood.

Artisanal salt production takes place on the Haitian side of the border area. Only limited quantities of

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Salt is being produced on an industrial scale in areas once occupied by mangroves. Here large salt flats can be seen close to the city of Montecristi on the Dominican side of the border.

Satellite image 7. *Mangroves are known to protect the coastline from erosion and to provide important nurseries for fish and marine life, but they are still under threat not only from people felling them for firewood, but also from artisans looking to clear them to make way for salt production facilities, as can be seen here, close to the Haitian town of Jacquesil.*

© UNEP

Mangroves are being cut to be sold as firewood in Haitian cities

relatively poor quality salt are produced due to the basic technology used. Some villages such as Jackzyl and Caracol received some support to dig salt lagoons from a WFP project, but communities mentioned that additional support would still be needed to improve production. Further support to boost Haitian salt production is, however, not recommended by this study, due to the very detrimental effects it has on the mangrove cover and fish stocks. In addition artisanal salt production will not produce salt that can compete in the market place with the quality and amounts harvested in industrial salt production.

In the Dominican Republic, approximately half of the mangroves that originally grew in the border area have long since been removed and the space they once occupied is now taken up by salt production fields, some of which still operate on an industrial scale.

One protected area in the Dominican Republic – the Wildlife Sanctuary Laguna Saladilla – preserves important mangrove and wildlife habitats, and the mangroves close to Montecristi attract income from tourism. The productivity of this ecosystem is crucial for fishing livelihoods on both sides of the border. The main remaining threat to the mangroves in this area is illegal mangrove cutting by Haitian day visitors and immigrants.

7.5 Marine protected areas and biodiversity

At present only the Dominican Republic has marine protected areas, including national parks in both the northern and southern border regions. Early discussions are ongoing to develop a very large Haitian marine protected area centered around the Bay of Caracol.

In the north, the marine resources on the Dominican side are protected in part by Montecristi National Park, which includes both land and marine areas. A key part of this park is the complex of seven islands (Siete Hermanos), which

is important for biodiversity conservation in the Caribbean and part of the Atlantic as they host large scale breeding grounds for marine birds (mainly gannets and boobies from the Sulidae family). The protection of the surrounding marine areas, however, seems to be effective only during the six month bird breeding season during which the Dominican Republic National Park authorities actively patrol the islands.

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A fisherman in the Haitian border city of Anse-à-Pitre showing his catch. Fishermen reap the benefits of having a marine protected area close by on the Dominican side of the border that acts as a breeding ground.

In the south, the Dominican Jaragua Land and Marine National Park, is situated close to the border. Anecdotal evidence from fishermen on both sides of the border is that this protected area may be having a major positive impact on fishing yields. Marine parks with no-take zones act as sanctuaries for fish to breed and grow, guaranteeing a steady supply of mature fish to regional fisheries.

The border zone's marine and coastal biodiversity can be found in four main ecosystems: 1) the insular shelf, where there are a great variety of endemic species of corals and marine grasslands, and where the species that hold significant economic interest for fisheries are concentrated. 2) Mangroves and coastal lagoons, which are considered to be among the most important ecosystem groups for the reproduction of species of economic interest. 3) Beaches, which are important not only for tourism but also because species – such as turtles and marine birds – nest there. Some of the beach zones in the northern part of the border area include islets that are of critical regional importance for bird reproduction. 4) Rocky coastal cliffs, which are also very important for bird reproduction.

7.6 Transboundary trade in marine species

Trade in marine species across the border is important and a clear opportunity for increased cooperation in the border zone. Dominican fishmongers are for example present in the Haitian market of Anse-à-Pitre, buying much of the large fish and high-value species (lobster, crab, lambis) to resell them on the Dominican market. In October 2007, from 500 to 1000 pounds of fish were exported from Anse-à-Pitre daily. Haitian fishermen buying ice and fuel in Pedernales also sell their products in the Dominican Republic. Dominicans also cross the Haitian border to sell the fish they cannot sell in the Dominican Republic because they are too small to be permitted to be sold in the Dominican Republic.[279]

Formal transboundary cooperation on this transboundary trade is relatively limited and this is currently causing problems. One particular issue noted in both the north and south was the lack of formal/state sanctioned dispute mediation mechanisms.

Against this generally negative background, there are however, some cooperation exceptions and success stories. The most significant of these is the transboundary cooperation between Haitian and Dominican fisheries associations on the southern coast, as can be seen in case study 6.

Case study 6. Cooperation between fishermen associations

On the Haitian side, a capacity building project started in 2007 has supported the development of 40 fisheries associations in the South East Department, which collectively cover 90% of the fishing population[280]. The association closest to the border is APPA (Asosyasyon pechè pou pwoteksyon ak anviwonman Anse a Pit), based in Anse-à-Pitre. The association consists of 100 fishermen and owns five fishing boats, one trammel fishing net, as well as a generator and batteries in order to fish at night. To be able to use this equipment and benefit from support and assistance in case of equipment damage or illness/death in the family, each member has to give 5% of the income coming from their catch to the association.

On the Dominican side of the border, in Pedernales, the fishermen association "Asociation Pescadores Agustin Munoz", has existed for 12 years, and today has 100 members. This association today works in close cooperation with its Haitian counterpart, and has formalized the cooperation between Haitian and Dominican fishermen to include transfer of information and knowledge of fishing techniques.

The cooperation between the fishermen associations have also resulted in the banning of the sale of the smallest size fishes on the bi-national market, and on-going work on trying to increase the mesh size used in fishing nets. The Dominican association has, furthermore, worked as a contact and dispute resolution mechanism between Haitian fishermen and Dominican authorities, if for example a Haitian fishing boat has been seized by Dominican authorities. This formal agreement between the two associations is reported to have improved relations between Haitian and Dominican fishermen considerably.[281]

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Fishermen's associations on both sides of the border in the cities of Pedernales and Anse-à-Pitre work together on issues related to sharing of best practice and fishing techniques, dispute resolution and trade.energy.

7.7 Contamination of estuaries, coastal lagoons, and the sea

Most of the pollution in the border zone's coasts and estuaries comes in the form of household waste from cities. Ouanaminthe, Dajabon, and Montecristi are the most significant in the northern coastal zone; Pedernales and Anse-à-Pitre are the most significant cities in the southern coastal zone. Similarly Lakes Azuei and Enriquillo are polluted – via the watersheds that drain into them – by the inhabitants of cities and villages, and by the traders and customers at the binational markets. The condition of the lakes is a lot worse than that of the rivers or the coast for the simple reason that the lakes do not drain, causing a sustained increase in contamination.

Water pollution in the border zone is essentially organic and is usually domestic or industrial sewage. However, the water ways also suffer as phosphorated detergents, fertilizers, pesticides, and herbicides drain into them from cleared and irrigated, agricultural land, as well as from runoff after fires or tree felling.

The mining developments that are anticipated in the border zone could represent a chemical threat, particularly if the use of chemicals in extraction processes remains unregulated. Special attention must be given to the organometallic compounds of mercury, which are used to mine gold, and are highly toxic when swallowed or inhaled.

Whatever the future holds for chemical pollutants, the contaminants that currently flow from the border zone out into the ocean, are damaging the reproductive capacity of crustaceans and fish and so reducing the supply of seafood on the island.

8 Environmental aspects of trade, employment and industry

8.1 Introduction

Transboundary trade and labour migration are key livelihoods for Haitians in the border area and are also important to the Dominican border community, partly because the Dominican agricultural sector is now largely dependent upon cheap Haitian immigrant labour.

Transboundary trade and labour migration between the two countries is currently a relatively peaceful and mutually beneficial process, but it also provokes discrimination, environmental degradation and significant tensions at both the local and the national level.

There is currently very limited industry in the border zone. This will change however if the recent progress in exploration for gold and silver leads to the opening of large mines in the region, and when the development of an Industrial Park in the Northeast department of Haiti that was inaugurated in October 2012, continues. Such operations will provide economic opportunities, while also having environmental impacts to be managed in the areas where operations are taking place.

When looking at employment opportunities in the border area it is also worth remembering the jobs in reforestation and watershed management that have been created under the auspices of the various bi-national initiatives that have already been mentioned (MPP project, the Caribbean Biological Corridor, the Artibonite project, etc.).

8.2 Key Issues

The key trade, employment and industry issues identified in the border zone are:

- Bi-national markets and their environmental aspects.
- Rural population increase and transboundary migration.
- Environmental aspects of mining and industrial development.

8.3 Bi-national markets and their environmental aspects

A large number of self-employed Haitians as well as family enterprises trade actively on the Dominican side of the border area on a day trading basis while still living in Haiti. A substantial portion of this trade takes place in the 14 bi-national markets that have been established throughout the border zone. The largest of these markets is the bi-national market of Ouanaminthe-Dajabon, that is further described in case study 7.

Overall this trade is considered to be a very positive activity that should be further encouraged. At the same time, measures are also needed to combat and discourage the trade in illegal and damaging goods, such as charcoal, subsidized fertilizer and banned chemicals, as well as the negative environmental aspect of the markets. Involve the UNEP Green customs initiative to train customs and enforcement officers on the control of trade in environmentally sensitive commodities.

The current state and placement of the bi-national markets are a source of concern. They are currently not having the necessary infrastructure or organized in a way that would provide the possibility of controlling them, resulting in the markets being sources of pollution to the local waterways and the environment. Goods are, furthermore, often being sold in unhygienic conditions, increasing the risk of disease.

In relation to the trade of natural resources, the UNEP regional office of Latin America and the Caribbean has an on-going initiative called "Green Customs Initiative" (GCI). The objectives of the initiative are "to enhance the capacity of customs and other relevant enforcement personnel to monitor and facilitate the legal trade and to detect and prevent illegal trade in environmentally-sensitive commodities".[282]

The Dominican Republic already has a dedicated Green Customs Unit, but nevertheless the assessment team identified a need in both countries to improve the ways in which they control the trade in environmentally sensitive commodities. Both countries could enhance the training and equipment given to officials working at the border and keep the traders and members of the

private sector better informed. Customs personnel working in both Ouanaminthe (Haiti) and Dajabon (Dominican Republic) listed the following areas that require tighter regulation: charcoal, chemicals (agropesticides, hazardous wastes), plastic and other solid waste.

Another acute political problem to address involves the legal and policy vacuum regarding the status, obligations and rights of the Haitian traders operating in Dominican territory and the inequity, abuse and corruption associated with their presence. In short, Haitian traders often are or feel mistreated and exploited by Dominican authorities and by elements of the Dominican business community.

During market days merchants and buyers from both countries are to be allowed to enter the marketplace on equal terms. 12 of the 14 markets are, however, located on Dominican territory, creating some problems for Haitian merchants, who carry both money and merchandise. This makes them easy targets for thieves, and dishonest soldiers and custom officials. Haitians have no right to complain, once they have crossed the border, and no authorities to turn to for help, as no such authority exists on the Haitian side.[283] The main complaints of the Haitian population, when visiting the bi-national markets on the Dominican side include:[284]

- Arbitrary fees demanded by customs and military officials.
- High taxes demanded for places in the market, in the case of Belladère.
- Confiscation and theft of Haitian merchandise.
- Verbal and physical abuse, as well as unofficial collection of taxes by soldiers and customs authorities.
- Un-paid debts by Dominicans who buy Haitian merchandise on credit, and the inability of Haitians to get Dominican authorities to act on their behalf.

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Bi-national markets provide an opportunity for small scale farmers to sell their produce to inhabitants on both sides of the border. A major problem, however, exist in respect to the lack of rights of Haitian merchants once they have crossed the border into the Dominican Republic.

Case study 7. Cross-border trade in the market of Ouanaminthe – Dajabón

In parallel with the formal trade between Haiti and the Dominican Republic, informal transactions between the two countries have become increasingly important in recent years and attract merchants of both nationalities to several of the bi-national markets. Studies conducted in 2001 estimated the value of official agricultural trade between the two countries to USD 10 million per year and the informal agricultural trade to USD 40-60 million.[285]

Of the 14 bi-national markets along the border, the market of Dajabón – Ouanaminthe is the main place for informal trade between Haiti and the Dominican Republic.[286] This particular market also represents 56% of the total value of Haitian informal exports to the Dominican Republic.[287] Between 2004 and 2005 over USD 5 million worth of products passed from Haiti to the Dominican Republic through this market.[288]

The market is located mainly on Dominican territory and operates twice a week. Each market day, Dominican border officials allow Haitian producers, sellers and consumers to cross the border without controlling their identification. Inside the market, a space is reserved for Haitian merchants, who pay a certain sum for each square meter they use.[289]

The goods exchanged there are mostly agricultural produce. Mainly bananas, eggs, onions, shallots and mirlitons are sold by Dominicans to Haitians. Haitians sell mostly rice, green beans and garlic, but also seasonal products such as avocado, grenadia and bitter orange, to the Dominican Republic.

Despite being by far the largest market, Dajabón – Ouanaminthe is not specialized in the trade of animals, except for poultry. More than 50% of the trade in livestock (such as goat, beef and pork) happens in Hato Viejo. 37% of it happens in Tilory, and 11% of it in Capotille. In 2001, exports of animals represented 11% of the value of total exports from Haiti to the Dominican Republic.[290]

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The bi-national market of Ouanaminthe-Dajabon is the largest of the 14 bi-national markets.

8.4 Rural population increase and transboundary migration

Rural overcrowding, severe forms of environmental degradation, and lack of livelihood options on the Haitian side of the border are driving transboundary migration towards the Dominican Republic. The management and treatment of Haitian migrants in the Dominican Republic is a high profile transboundary issue. After the earthquake the number of Haitians living in the Dominican Republic increased by 15%. Haitian migrants now represent approximately 10% of the entire Dominican population.[291] The use of detrimental practices by the migrants, like those which have caused much of the environmental degradation in Haiti, such as soil erosion and productivity losses, are now damaging areas on the Dominican side of the border.

At the same time, Haitian migrant labour strongly supports the Dominican economy through low-cost labour, while it provides livelihoods for hundreds of thousands of Haitians, which also is supporting the Haitian economy through remittances. The largest single problem for Haitian migrant workers in the Dominican Republic is mistreatment and exploitation by their Dominican employers. This is particularly acute for illegal migrants, who make up the majority of working migrants since the post earthquake surge of 2010. Problems noted include a failure to pay salaries, poor work and living conditions, forced expulsions, and intimidation.

It is a particular problem in the border area. The Dominican side of the area has a high population of Haitian agricultural laborers and the border posts themselves are flashpoints for abuse and conflict. Haitians returning home after a period of illegal work in the Dominican Republic are frequently both

carrying money, and missing their documentation, which makes them highly vulnerable to theft and extortion.

The combination of having no rights on the Dominican side and, in the absence of effective state institutions, no recourse to justice on the Haitian side, migrant labourers are left with little or no opportunity for redress.

On the Dominican side, there is a general view that many of the problems encountered, both social and environmental, originate from the Haitian side of the border, nurturing mistrust towards Haitians. Dominican complaints and fears about Haitians can be summarized in two categories: delinquency and intimidating behavior, and fear of economic and demographic "invasion".[292] Since the earthquake, there has been an influx of unemployed Haitians and a real, rather than perceived, increase in the incidence of robbery and violent crimes committed by Haitians.[293]

Haitians are mainly employed to work in jobs that Dominicans do not want to do themselves. Nevertheless, the most frequently articulated Dominican fear about the Haitians concerns the "takeover" of many economic niches, including not only rural agricultural field labour, but also urban construction sites.[294] For the Dominicans living in the border area, the Haitian presence within various sectors is a valuable and valued source of field labourers who will work for lower wages then Dominicans. However, local and national media often portray this labour force as an "invasion" (albeit sometimes "peaceful invasion"),[295] which risks increasing the tensions between Haitians and Dominicans. Dominican authorities also complain about the lack of Haitian authorities. Haitians who have committed crimes in the Dominican

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Many Haitians – or people born in the Dominican Republic but of Haitian descent – live in rural parts of the Dominican side of the border zone. Many of them are uneducated and live in poverty, such as this woman in the Pedernales watershed, who has four children, none of whom attend a school.

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Evidence that Dominicans are leaving the border zone and moving to the cities can be seen in some areas in the border zone: like this vacant house in the small Dominican border town of Mencia in the Pedernales Watershed.

Republic, they point out, can escape justice simply by returning to Haiti.

Since the outbreak of cholera in Haiti in 2010, the Dominican authorities have taken a more hostile approach towards Haitians in the border, and established more border controls. As a consequence Haitians find it harder to cross the border, even when they are looking to trade in the bi-national markets or to access medical care.

8.5 Environmental aspects of mining and industrial development

Despite expert confirmation of the presence of deposits of precious and base metals on Hispaniola, mining has previously not been a key source of income for either country. This is about to change because recently, the price of precious metals has increased and a large gold mine has opened in the Dominican Republic. Mining may well present both countries not only with opportunities, but also with risks. There are, after all, many places around the world where mining has caused environmental damage and social unrest. Indeed, political unrest led to the closure of Haiti's last copper mine in the early 1970's.[296,297] Despite these caveats, if economical, environmental and social concerns are handled correctly, mineral exploitation can bring much needed revenues to the country, and create job opportunities for both skilled and unskilled labour.

Mining is an important potential issue for the border area because the geology of interest runs east-west and the formations that contain gold and other minerals on the Dominican side, are also present on the Haitian side. Mining companies active in the Dominican Republic, such as Eurasian Minerals, claim that Haiti has mineral potential similar to that of the Dominican Republic.[298]

Mining activities in the Dominican Republic have greatly increased since 2010. The main minerals concerned are gold, copper (the exploration of which is concentrated in the Eastern Cordillera and the Central Cordillera) and nickel (mainly in the belt

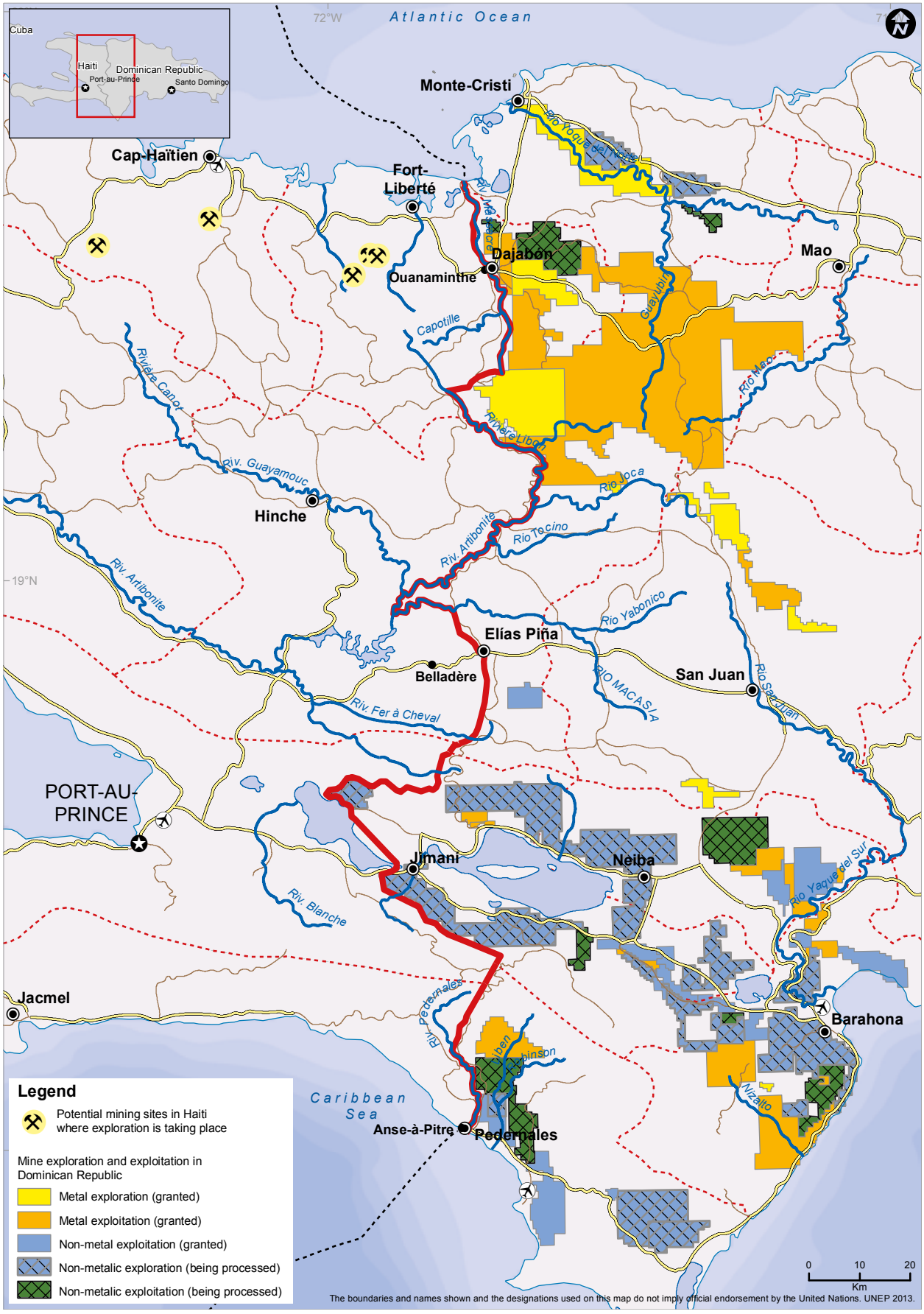
between these two cordilleras), but the island also has some bauxite deposits used for the production of aluminium.[299]

At the time of writing, the export of minerals is more important to the Dominican economy than that of sugar, coffee, cacao or tobacco combined, and is second only in importance to goods from the free trade zones.[300] Barrick Gold is in the process of opening the Pueblo Viejo gold mine. It will be situated about 150 km from the border and will afford access to an estimated 20.4 million ounces of gold, which has a current market value of approximately USD 34 billion.[301] It is expected to be the fourth largest gold mine in the world, with production estimated at approximately one million ounces of gold per year mined during the first five years of production. In addition to gold, the proven and probable reserves at the site are estimated at 117 million ounces of silver, and 157,881 tons of copper, with current market values of USD 3.7 billion and USD 1.2 billion respectively. The Pueblo Viejo mine is a good example of stakeholder cooperation – including the Dominican Federation of Municipalities, financing entities, NGO's and the local communities, – working together to create workable solutions to issues related to the new mine.[302]

There has already been some exploitation of bauxite reserves in the Pedernales watershed close to the border. These operations, which exploited raw bauxite and exported it to North America for processing, closed down approximately four years ago, but are expected to start up again in the near future.[303]

Bauxite – the raw material for aluminum – was mined in the Dominican Republic, adjacent to the Sierra de Bahoruco national park and close to the border with Haiti, until four years ago. With raw material prices on the rise, operations are likely to resume in the near future.

Map 11. Mining exploration and exploitation licensees close to the border in the Dominican Republic and Haiti



Mineral exploration is starting in Haiti.[304] Several exploration and development licenses have already been signed, including:

- the exploitation of silver-gold deposits in Morne Grand Bois and Morne Bossa.
- the exploration and exploitation of a gold deposit in Failles.
- the exploration and exploitation of copper deposits in Douvray and Blondin.
- the prospection for copper and gold in the regions of Mémé and Casséus.

The first environmental provisions related to mining in Haiti were established in 1974, obliging the beneficiary of a mining claim to protect the environment or face sanctions. These provisions are still in force in the form of the "Code Minier" today. The potential issues linked to the start of large scale mining in the border zone include:

- Displacement of communities and associated unrest.
- An explosion of damaging and unregulated artisanal mining.
- Environmental damage as a result of harmful processes or leakage of residues from the mining process.
- Uncontrolled local migration to mining sites, "boom towns" with associated social and environmental issues.
- Land grabbing and property speculation.

When new mining concessions are granted, several issues related to natural resources governance should be taken into consideration:

- land tenure.
- transparency and accountability.
- public participation in the decision-making process.
- sharing of mining revenues.
- the capacity of the relevant authorities to review the environmental impact assessments of any proposed investments.

Industrial development is another issue that provides both an opportunity, as well as risks for the border zone if not handled correctly. In October 2012, the government of Haiti, the Inter-American Development Bank, the U.S. State Department and the Clinton Foundation inaugurated the Caracol Industrial Park (CIP) – a modern manufacturing facility of 246 ha in northern Haiti close to the border with the Dominican Republic.

The CIP is a USD 300 million project, designed to promote investment, to increase the availability of electricity, and to create jobs in the region. As with other large scale industrial developments, environmental and social impact assessments should be taken into consideration, in order to avoid potential negative effects to the surrounding environment and livelihoods, as well as to ensure the support of the local population.

Part 3 Analysing trends and causes

9 Strategic Analysis

9.1 Purpose and methodology

The purpose of the strategic analysis exercise was to assist in the development of workable solutions to the many identified key issues. The analysis has three main components:

1. Comparative analysis of the listed key issues and opportunities.
2. Identification and assessment of underlying driving forces.
3. Assessment of the potential shocks and stresses (environmental, disasters, market, social etc.).

9.2 Issue comparative analysis

Table 2 below provides a basic comparative analysis of the list of key issues identified in Part II. It is acknowledged that the comparative analysis is qualitative and therefore cannot be used to conduct a quantitative ranking and determine the potential magnitude of the risk. However, the analysis does provide useful indications for prioritization and solution development.

For each key issue, the table identifies the scale, the strength of the evidence base, the current trend and level of predictability, and the associated level of instability risk.

Triangulation of collected qualitative data was used to reach the findings presented in Table 2. The various sources used during the assessment process formed the evidence base for the identified key issues. When this data, collected from various sources was cross-examined, and when multiple sources pointed in the same direction the specific trends and instability risks could be identified, as described in chapter 1.3.

The results and implications of the analysis are summarized as follows:

Key issues: Serious instability risks are noted on both sides of the border, but the situation is very asymmetric. Local issues noted on the Haitian side are largely representative of national scale issues. In sharp contrast, many of the issues on the Dominican side are largely caused by or associated with an overspill of Haitian population into Dominican territory. Despite being politically sensitive this finding is undeniable.

Scale: The issues span all scales: from local to bi-national, with most issues being at least departmental in scale. This indicates that very focused investments are needed for selected hotspots and very large scale investments will be needed to address the multiple department, national and bi-national scale issues.

Evidence base: The strength of the evidence base is generally relatively strong, with some small but clear gaps. This indicates that overall there is only a limited need for further research and data collection on most issues. The evidence base is generally sufficient to enable the design of solutions, and investments in practical action. The flooding from Lake Azuei is a notable exception to that statement.

Trends: The overall trend noted is ongoing slow decline, with one issue, the flooding of Lake Azuei and Lake Enriquillo, noted as worsening rapidly**.**

Trend predictability: Most trends appear relatively predictable, with strong evidence of an ongoing slow decline stretching back for up to 30 years; possibly more. Migration trends are less stable and predictable.

Instability risk: Several of the key issues present a short term high bi-national instability risk. The tensions as well as violent conflicts reported to the

Table 2. Key issues identified in the report

Key Issue	Scale	Evidence base	Trend	Trend Predictability	Short term binational instability risk
Agriculture					
Land degradation	Binational	Strong	Slow Negative	High	Low
Transboundary agriculture	Binational	Strong	Slow Negative	Medium	Medium
Land tenure	Haiti biased	Strong	Stable	High	High
Forestry and protected area management					
Forest clearance and forest fires	Binational	Strong	Slow Negative	Medium	Medium
Uncontrolled transboundary charcoal trade	Dominican local to Departmental	Strong	Slow Negative	Medium	High
Collection of Fuel wood	Binational	Strong	Slow Negative	Medium	Medium
Protected area management and biodiversity	Binational	Strong	Slow Negative	Medium	High
Reforestation	Binational	Strong	Positive	Medium	None
Water resources and flooding					
Transboundary river flooding	Binational local – 2 hotspots	Strong	Stable	High	Low
Water scarcity, access and pollution	Binational local	Moderate	Slow Negative	Medium	Low
Lake Azuei and Lac Enriquillo flooding	Binational local	Weak	Rapid Negative	Low	High (instability)
Transboundary dams and water extraction	Binational	Weak	No Evidence	No Evidence	Medium
Coastal and marine resources					
Illegal transboundary– and overfishing	Binational	Strong	Stable	High	High
Mangrove cutting for wood and creation of salt pans	Binational local hotspots	Strong	Slow Negative	Low	Low
Marine protected areas and biodiversity	DR local hotspots	Strong	No Evidence	No Evidence	Medium
Trade in marine species	Binational	Strong	Positive	Low	Low
Contamination	Binational	Weak	No Evidence	No Evidence	Low
Environmental aspects of trade, employment and industry					
Bi-national markets and their environmental aspects	Binational	Strong	No Evidence	No Evidence	High
Rural population increase and transboundary migration	Binational	Strong	No Evidence	No Evidence	High
Environmental aspects of mining and industrial development	Binational	Moderate	No Evidence	No Evidence	Medium

assessment team are all small scale, essentially clashes between individuals and smaller groups. On their own, they have a relatively low risk of escalation at the local level. The main risk of escalation comes from such cases inflaming existing tensions at the national level, triggering wider conflict perhaps driven by the media or escalated for political motives. This risk should not be under-estimated, as perceived injustices in individual cases can have powerful triggering effects where tensions are already high, even if the two situations are otherwise unrelated.

The most serious economic risk is presented by the flooding of Lake Azuei and Lake Enriquillo, as this has in the past closed the border temporarily and may do so again, with serious economic consequences to Haiti and significant but lesser impacts on the Dominican Republic. This is not an instability risk per se, on the contrary the crisis would probably force co-operation between the two countries. Nonetheless an extended closure of the Malpas border would be very economically damaging for Haiti and this damage might in turn trigger instability.

Positive developments: There are some clear positive trends, including reforestation programmes, transboundary cooperation and increased binational trade in the border zone. The most positive aspect of the Dominican-initiated reforestation activities, including the Frontera Verde / MPP initiative, is that it builds on a model of reforestation that has been tested and proven to work over a number of years in the Dominican Republic. In addition, many of the identified transboundary cooperation and trade initiatives are owned and led by local people, and are cost-effective and so it should be economically viable to support and improve them without depending on aid.

9.3 Identification of underlying driving forces

The 20 identified key issues do not have 20 different causes. On the contrary, the many different issues are considered to be linked to or manifestations of only four closely interlinked driving forces:

1. Haitian poverty, food insecurity and underdevelopment.
2. Environmental degradation, in particular on the Haitian side of the border.
3. Weak governance.
4. Haiti-Dominican Republic economic and resource inequalities.

Table 3 summarizes how the identified key issues are linked to the four identified underlying driving forces.

1) Haitian poverty, food insecurity and under-development

These are considered to be the core driving forces for virtually all of the issues noted. The driving forces manifest themselves particularly when looking at the high dependence on subsistence agriculture combined with high population growth in the area and underdevelopment in the energy sector.

Maintaining an adequate and sustainable livelihood from subsistence farming is a challenge in all countries: in Haiti it is now close to impossible. This is due to a combination of: a) very high rural population density (estimated at over 250/km^2) with a population that is growing much faster than the average of the country, resulting in very small land holdings; b) moderate to low quality soils, that have been further degraded as a result of man-made activities; and c) insufficient agricultural investments and inputs. The net result is that rural families cannot generate an adequate livelihood or grow sufficient food from their own landholdings. Without education and other employment opportunities, artisanal farming families are caught in a poverty and food insecurity trap.

This combination of land shortages, poverty and labor surplus generates a large and mobile rural labour force. The people in that labour force have negligible capital and are continually looking for livelihood opportunities away from their own landholdings – both in Haiti and across the border. In the border zone, the available jobs are all relatively unskilled, low paid, highly insecure, and often environmentally destructive. The list of them includes sharecropping, farm laboring, coastal fishing, fuel wood harvesting and charcoal production.

Table 3 Summary of how key issues are linked to the identified underlying driving forces

		Underlying Driving Forces			
Category	**Issues**	**Haitian poverty, food insecurity, and underdevelopment**	**Environmental Degradation**	**Weak Governance**	**Haiti-DR Economic and Resource Inequalities**
Agriculture					
	Land degradation	X	X	X	
	Transboundary agriculture	X	X	X	X
	Land tenure	X	X	X	X
Forestry and protected area management					
	Forest clearance & forest fires	X	X	X	X
	Uncontrolled transboundary charcoal trade	X	X	X	X
	Collection of fuel wood	X		X	X
	Protected area management&biodiversity	X	X	X	X
	Reforestation	X	X		
Water resources and flooding					
	Transboundary river flooding		X		
	Water scarcity, access and pollution	X	X	X	X
	Lake Azuei and Lake Enriquillo flooding		X		
	Transboundary dams and water extraction				X
Coastal and marine resources					
	Illegal transboundary– and overfishing	X	X	X	X
	Mangrove cutting for wood and creation of salt pans	X		X	
	Marine protected areas & biodiversity			X	X
	Trade in marine species		X		X
	Contamination		X	X	
Environmental aspects of Trade, Employment and Industry					
	Bi-national markets and their environmental aspects	X		X	X
	Rural population increase and transboundary migration	X	X	X	X
	Environmental aspects of mining & industrial development			X	X

Extreme poverty is a key driving force leading to unsustainable practices and further environmental degradation.

It is important to note the scale of this mobile labour force and the source region. With unemployment in Haiti estimated to be in the order of 41% or four million people,[305] the potential mobile rural labour pool searching for alternatives is crudely estimated to be well over one million.

Finally, population growth needs to be factored into any proposed solution. The current estimated growth rate of the population of Haiti is 1.3% per annum, with a projected growth of 25% over the next 20 years, reaching a population of 12.5 million by 2030.[306] The growth rate in the border zone is much higher than this, between 3-4 %, in most areas along the border zone. It is clear that the artisanal farming population on the Haitian side of the border zone has already surpassed sustainable numbers, so all future growth adds to the mobile labour pool.

This large and growing mobile labour force has critical implications for solution development. For example, targeted investment in livelihood creation in Haitian communities close to the border will have only limited impact if the issues noted on both sides are driven by the mobile labor pool drawn from all over rural Haiti.

2) Haitian environmental degradation

The three most important forms of environmental degradation are: deforestation, soil erosion and marine environmental degradation.

Environmental degradation on the Haitian side of the border zone already has had three substantial material impacts: a) it has dramatically lowered the productivity of farming and forestry land; b) increased the severity of river flood peaks; and c) has decreased the fish stocks in the coastal waters. Lowered productivity has fed into the problems of artisanal farmers further exacerbating rural poverty and unskilled labour mobility. The increased flooding has already impacted the towns of Fonds Verrettes, Jimani and Pedernales / Anse-à-Pitre.

Deforestation and devegetation of sloping land is a primary cause of much of the problem. The deforestation process is not complete anywhere in the border zone, however it is

A charcoal kiln made from the last few pieces of wood to be found on a barren hillside in the central parts of the border zone is a sad example of extreme environmental degradation.

much further advanced in a much larger area on the Haitian side of the border. Deforestation linked to the illegal charcoal business is a major issue for the Dominican Republic. The deforestation and devegetation, combined with soil tilling and overgrazing has resulted in soil erosion, which is the direct cause of the farming productivity losses and increase in flood peaks. The irreversibility of soil erosion is a major factor for solution development – it is already too late for much of the Haitian side of the border zone and it is vital that the same degree of loss is not extended further – on either side of the border.

The underdevelopment of the energy sector in Haiti drives the charcoal business in both Haiti and the Dominican Republic and all of its consequences. Charcoal produced by artisanal means is highly inefficient, expensive and environmentally destructive. The Dominican Republic has successfully moved beyond artisanal charcoal for its domestic energy market through a combination of governance and provision of a better alternative in the form of LPG: this is yet to happen in Haiti.

The critical point about charcoal in the border zone is that it is a net exporter and local demand is not significant. Essentially it is the charcoal demand in Port-au-Prince that drives the entire charcoal economy. This has critical implications for solution development – the energy demand issue cannot be solved in the border zone. Suppressing the supply in the ongoing presence of strong demand is not considered a viable solution on its own.

3) Weak governance

This is a truly crosscutting issue, affecting all parts of economy and society. This is an issue for both Haiti and the Dominican Republic, but much more acute for Haiti.

On the Haitian side of the border, weak governance is manifested as an effective absence of the state, and financial destitution where

it is present. The Haitian population simply cannot turn to the state for justice or adequate services. As a result the population both suffers and is not adequately controlled on common interest issues such as environmental protection. In the border zone on the Haitian side there is effectively zero environmental governance.

On the Dominican side, the legislative framework and institutional capacity in the Dominican Republic are overall more than adequate and the presence of the state is visible throughout the border zone. Parts of the border zone are, however, impacted by governance lapses in the form of petty corruption. This not only enables the illegal charcoal industry to thrive – despite its very clear illegality – but also increases the risk and damages the Dominican environment. A second issue is local under-resourcing of enforcement. The Dominican Government has allocated insufficient staff and funds, for example, to adequately address deforestation on private land and in protected areas in the border zone.

4) **Haiti-Dominican Republic economic and resource inequalities**

It is the inequality of economic opportunities and of the remaining natural resources that underlies many of the more complex issues noted in the Haiti – Dominican Republic border zone.

The natural resources remaining in the Dominican Republic side of the border zone (agricultural soils and forests) were originally the same as that of Haiti, but are now generally far superior due to a complex mix of factors, including environmental degradation on the Haitian side and improved governance on the Dominican side.

The Dominican side also provides much more employment opportunities, as well as uncultivated land than the Haitian side of the border. Additionally, as the border zone is not a high opportunity economic region for Dominican citizens, and development elsewhere in the Dominican Republic has generated many non-farming business and employment opportunities, there has been

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Entering the Haitian border town of Belladère.

a marked out-migration of the Dominican population from rural areas and a major reduction in artisanal farming of marginal land by Dominican Republic citizens. This out-migration has opened up vacant agriculture land on the Dominican Republic side of the border zone that attracts in-migration of Haitian farmers.

Multiple factors have combined to cause significant infiltration/worker migration of Haitian citizens into the Dominican Republic side of the border zone. These include a large and growing mobile Haitian unskilled labor force, relatively lax border controls, reduced and damaged natural resources on the Haitian side, significant remaining natural resources on the Dominican side, and out-migration of Dominican citizens from the Dominican side of the border.

9.4 Shocks

National or regional growth or decline is not always a smooth process. It is also tightly linked to the resilience of the state, its population and related livelihoods to be able to respond to vulnerabilities, such as absorb economic, social and political disturbances, as well as anticipate and recover from natural hazards, climate variability and environmental degradation. Decline in particular can be abrupt, as it was in Haiti after the 2008 floods, the 2010 earthquake and during the cholera epidemic. Several of the border zone issues have the potential to be affected negatively by such shocks and acute stresses.

Collectively incidents including both disasters, conflicts, epidemics and economic and social unrest are labeled shocks. Given that this assessment has established that there is a large scale, slow decline in progress and the environment is and continues to be degraded, then the potential for tipping points within that context needs to be established. Tipping points are incidents and events that result in a material worsening of pre-existing problems and trends, resulting passing critical thresholds beyond which the system is governed by new processes and structures. For example, a forest fire in an already partly deforested mountainous area is a shock, and will result in a rapid drop in forest cover and extensive bare soil, resulting in turn in a tipping point for accelerated and irreversible soil erosion in specific areas.

Table 4 lists and describes the key identified potential shocks, that may potentially affect the Haiti-Dominican Republic border zone

In respect to the first incident listed in Table 4 "Hurricane and river flooding", climate change is likely to further worsen the situation in the long run. A model predicting the effect of anthropogenic warming on the frequency of Atlantic hurricanes found that the incidence of Category 4 and 5

Table 4. Key potential shocks identified

Shock	Likelihood – frequency	Principal impacts	Scale
Hurricane and river flooding	High – every 5 years or less	Economic and environmental destruction	Departmental-binational
Earthquake	Low – every 50-200 years	Economic destruction + broad impacts	Departmental-binational
Cholera outbreak	High – cholera is now endemic in Haiti.	Social and economic & political inc. border closures	Departmental-binational
Haiti internal political instability – riots	High – Annual frequency or higher since 1990	Social, economic & political inc. border closures	National
Violent conflict between Haitian and Dominican Republic citizens	High – small scale incidents occur annually at least	Social with potential for political escalation	Binational – localized
Large scale forest fires	Moderate – every 2-20 years	Social, economic and environmental	Local
Drought	High – every 5 years or less	Social, economic and environmental	Binational

Atlantic storms will double in the next century.[307] Nevertheless this forecast is not universally accepted, as the debate continues regarding the links between climate change and the frequency and average energy of hurricanes in the Caribbean. Other forecasts with relation to climate change are increased temperatures and increased rainfall variability and intensity.[308, 309, 310] This, in turn will all have a negative impact on rain fed agriculture, the mainstay of the economy of the border zone.

In summary, there is a high potential for some sort of shock in the border zone on at least an annual basis, although it is impossible to predict the location, scale and intensity. Over a period of 20 years, for example, this level of vulnerability translates into a near certainty for several shocks, both minor and major. This has critical implications for forecasting and development planning – essentially any forecasts and plans for the border zone need to take into account the vulnerability and resilience levels of the local population, as well as the high probability for shocks that will affect the current situation negatively.

Part 4 The way forward

10. Findings and Recommendations

10.1 Key findings

Key findings of this study are listed below. There is strong evidence of the ongoing vulnerability of the region to slow decline, as well as to shocks that may rapidly accelerate that decline thereby degrading the stability and development status of the border zone.

- Several of the noted problems in the border zone, such as deforestation and soil erosion, are very large scale and have been developing for several generations. Degradation in the worst parts of the Haitian border zone is almost completely irreversible, due to a near total loss of vegetation cover and productive topsoil across wide areas. Based on observed trends, including the use of detrimental practices similar to those which have caused much of the degradation in Haiti, soil erosion and productivity losses are forecast to increase significantly in the Dominican side of the border zone.

- The three direct causes of land degradation in the border zone are the same as for the rest of Haiti and for parts of the Dominican Republic: a near total absence of erosion control measures for cleared land on slopes; land clearing for agriculture, including the use of fire (slash-and-burn agriculture); and tree cutting for energy – both charcoal and fuel wood. Illegal charcoal trade or slash and burn agriculture occurring across the border is nearly always made possible by alliances between Dominicans and Haitians.

- Climate change could increase the frequency and average energy of hurricanes in the Caribbean, a situation that would leave Haiti and the Dominican Republic even more vulnerable than they are at present.[311] Other forecasts with relation to climate change are increased temperatures and increased rainfall variability, which would have a negative impact on rain fed agriculture, the mainstay of the economy of the border zone. The forecast therefore is for climate change to worsen the current situation in the long term.

- Several issues related to the environment and the use of natural resources present a short term high instability risk in the relations between the populations of the two countries. These include illegal charcoal trade; illegal farming and cutting of trees on Dominican land and inside Dominican Republic protected areas; unclear marine territorial delimitation and illegal transboundary fishing; and flooding of land and infrastructure due to the rapid rise of lake Azuei and lake Enriquillo.

- On the opportunity side, important progress has already been achieved by a limited number of ad hoc local and national initiatives, such as the Frontera Verde tree planting brigades, commune level bi-national cooperation and cooperation between livelihood associations on both sides of the border. Sustainable agricultural programmes such as agroforestry, and associated trade also represent a large opportunity for poverty reduction in the border region.[312] However it was well noted that most of these commendable efforts are at continual risk of reversal and even collapse due to financial shortfalls or a lack of political or institutional support.

- The 20 key issues identified in the border have four main underlying driving forces: Haitian poverty, food insecurity and underdevelopment; environmental degradation; weak governance; and Haiti-Dominican Republic economic and resource inequalities. Most of these driving forces are national in scale. This means that it would not be viable to only develop stand alone environmental or local solutions – instead an integrated and larger scale approach is often needed. For example rural food insecurity and extreme poverty are in part driving the unsustainable slash and burn agricultural practices on the Haitian side and the associated massive soil erosion and deforestation. Similarly,

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A charcoal kiln burning inside the forest on the Dominican side of the border seen from the vantage point of a denuded hillside on the Haitian side of the border, a couple of km outside of the Dominican town of Pedro Santana.

local charcoal demand is not significant in the border zone. It is the demand in Port-au-Prince which is driving the whole charcoal economy, calling for a national scale solution on energy. Finally, land tenure and tenant farming are major obstacles, farmers understandably are prepared to invest only in land they either own or can confidently control for longer periods.

Most solutions would need to be bi-national or at least bi-nationally agreed, due to the very high inter-connectivity of populations and issues across the border.

10.2 Preface to the recommendations

The value and impact of this assessment is completely dependent upon the follow up actions that it provokes. The analysis indicates both a difficult situation at present and worse to come in the absence of successful interventions for the issues noted. There is a solid economic rationale for early interventions: acting now may avoid damaging instability and also much more expensive interventions at a later date.

It is acknowledged however that economic and other resources are limited in both countries. The extent of feasible international assistance is also relatively limited compared to the scale of the issues noted. Hence selection of an appropriate strategy for response and prioritization will be key. Finally, the responsibility for many issues is shared, however recommendations are more effective if they are clearly assigned to specific parties in each government with the mandate for their implementation. The international community is

requested to help provide resources and build capacity.

In this context, the recommendations are presented in two parts:

- **Border zone:** Detailed recommendations for the border zone only and that apply either to both governments or require very close cooperation between the Governments to be implemented successfully or avoid generating unnecessary conflicts. These recommendations are targeted at issues that are very much border specific and/or represent the spillover of Haitian national issues into Dominican territory.
- **Haitian national level:** Detailed recommendations for national level investments for the Government of Haiti only. These recommendations target well known existing Haitian specific issues, with the main emphasis on selection of investments that will also help resolve issues in the border zone.

There are no recommendations for national level investments for Dominican Government alone – all relevant recommendations are bi-national. This is because all proposed recommendations for the Dominican government will have substantive implications for the large population of Haitian citizens visiting, living and working in the Dominican Republic – and therefore the Government of Haiti must be engaged.

The target audience for these recommendations consists of policy makers and planners in the two governments and the international community supporting those governments. The detailed

Table 5. Summary of the key recommendations, duration and cost estimates. The table also contains the prioritization of the recommendations, as detailed by the Haitian and Dominican government counterparts (I being the highest priority and III the lowest).

	Recommendations	Description	Schedule (years)	Cost/year (M USD)	Priority (Haiti)	Priority (Dominican Republic)
Bi-National Border Zone Recommendations						
	Practical Action					
1	Protecting and increasing the vegetation cover	Continue support to bi-national reforestation efforts	5+	2	I	I
2	Sustainable agricultural development	Reform and develop the artisanal and small scale agricultural sector in the border zone	5	3	II	I
3	Transboundary river flood risk reduction	Invest in flood containment and land use planning for affected Dominican and Haitian townships	2	5	III	II
4	Improve sustainability of transboundary trade and bi-national markets, while reducing their environmental impacts	Support and improve conditions of existing bi-national markets to promote sustainable trade	3	8	III	III
5	Border zone economic development and diversification	Encourage the transition from subsistence agriculture to MSME led local economic development	5+	5	II	I
6	Address pollution of transboundary rivers	Address the problem of solid and bacteroligical waste contamination in transboundary rivers	3	2	III	II

Table 5. Summary of the key recommendations, duration and cost estimates. (continued)

	Recommendations	Description	Schedule (years)	Cost/year (M USD)	Priority (Haiti)	Priority (Dominican Republic)
	Improving Cooperation and Governance					
7	Improve existing transboundary cooperation mechanisms that deal with environmental issues and transboundary watersheds	Build on, and expand, existing cooperation mechanisms and platforms. Emphasize information sharing and building the capacity of the Haitian government to work on bi-national projects.	5+	2	II	III
8	Environmental governance and regulation and control of the charcoal trade and other forest products	Increase enforcement of Dominican and Haitian laws related to forest conservation and protected areas	5+	5	I	I
9	Strengthen the management of marine and coastal resources in the border zone	Take steps to reduce the ongoing decline of the marine and coastal environment	5+	2	III	II
	Research and Analysis					
10	Lake Azuei and Lake Enriquillo flooding analysis	Research the causes for the rise of the sea level in Lakes Azuei and Enriquillo	2	0,5	I	III
Haitian National Level Investment Recommendations						
1	Improving governance in rural areas	Increase the presence of the state in rural areas, while ensuring the involvement of local stakeholders	as per nat. strategic plan	as per nat. strategic plan	II	
2	Non-agricultural economic development and diversification	Provide alternatives to subsistence agriculture	as per nat. strategic plan	as per nat. strategic plan	II	
3	Replace charcoal with LPG in urban centres	Implement an integrated programme to replace the use of charcoal and study the potential impacts a ban on the charcoal trade will have in Haiti	as per nat. strategic plan	as per nat. strategic plan	II	
4	Sustainable agricultural development and reforestation	Promote sustainable agricultural practices and tree planting	as per nat. strategic plan	as per nat. strategic plan	II	

recommendations include estimates of the costs generated and of the schedules. In addition they nominate the owners of the recommendations, that is to say the parties responsible for their implementation. Donors and UN agencies can support either governments, but are not recommendation owners. The recommendations are followed by a proposed overall response strategy. This strategy can be applied to prioritizing both the detailed recommendations provided and also to any other proposed interventions in the border zone.

Table 5 summarizes the key recommendations suggested by this report. The recommendations have been developed based on the analysis laid out in the previous chapters, in order to present informed suggestions for actions by the two governments and their international partners. If implemented, the recommendations are anticipated to:

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Children playing outside their home in the small town of Meillac by the Massacre River in the north of the island.

- reduce chronic poverty and hunger in the border zone, while promoting more sustainable livelihood practices and enhancing the resilience of the population to shocks and stresses.
- preserve peaceful relations between the two countries through increased national and local level bilateral cooperation while reducing tensions over border zone issues.
- contribute in a small but useful manner to the national scale sustainable development and stability of both countries.

The recommendations aim to address the identified key issues and underlying driving forces that affect the situation in the border zone. Annex IV summarizes how the 14 recommendations detailed in this chapter set out to address the identified underlying driving forces. For an analysis on how the key issues identified are linked to the underlying driving forces, please refer to table 3 in chapter 9.3.

10.3 Bi-national border zone recommendations

Introduction

The bi-national and border zone recommendations listed below apply either to both governments or require very close cooperation between the governments to be implemented. Although many of the underlying problems these recommendations set out to address are originating, or are more severe on the Haitian side of the border, it is in the interest of both countries to invest in their implementation, and to further invest in an integrated strategy for managing the border zone.

The recommendations are in line with the objectives set out in the Haitian Strategic Plan for the Development of Haiti: Emerging Country by 2030, as well as the Law No. 1-12 on the National Development Strategy of the Dominican Republic 2030.[313, 314]

Ten recommendations are provided under three themes. The individual recommendations are designed for minimal overlap in budget and implementation, however there are many strong linkages and synergies – the whole is larger than the sum of its parts.

Practical action

1. Protecting and increasing the vegetation cover.
2. Sustainable agricultural development.
3. Transboundary river flood risk reduction.
4. Improve the sustainability of transboundary trade and the bi-national markets, while reducing their environmental impacts.
5. Border zone economic development and diversification.
6. Address pollution of transboundary rivers.

Improving cooperation and governance

7. Improve existing transboundary cooperation mechanisms that deal with environmental issues and transboundary watersheds.
8. Environmental governance and regulation and control of the charcoal trade and other forest products.
9. Strengthen the management of marine and coastal resources in the border zone.

Research and analysis

10. Lake Azuei and Lake Enriquillo flooding analysis.

Practical action

1. Protecting and increasing the vegetation cover: Continue to financially and politically support the bi-national reforestation efforts. Reform efforts as needed to improve Haitian and Dominican Government ownership, while ensuring a participatory approach among affected communities. Increase technical assistance to improve the quality, consistency and sustainability of the re-forestation efforts and implement a more strategic re-forestation program.

Design & scope

a. Focus re-forestation activities to areas most vulnerable and erosion prone (steep slopes etc) rather than just where land is available.

b. Expand the species list targeted for reforestation to respond to local demand and provide self sustaining livelihood options through strategic planting of various species of trees (fruit trees,

Plant nurseries that have been set up in the border zone furnish the re-forestation brigades with saplings.

honey production etc.) and the creation of communal tree nurseries.

c. Expand the species listed for reforestation to include trees suitable for fuel wood collection, and also charcoal production in some Haitian areas.

d. Include contracts with the landowners to ensure survival of planted trees and sustainability. Also continue to support re-forestation activities with technical assistance, including technicians visiting the sites on a regular basis.

e. Extend the scope of work beyond reforestation to include installation of erosion control features with integrated revegetation. Examples include contour lines of elephant grass and bamboo planting integrated with rock gully plug installations.

f. Include the most vulnerable population in the work of the brigades in reforestation, and take into consideration the periodic vulnerability of the population. This includes removing the requirement of having to be able to offer at least 1.25 carreau of land for the project, in order to be able to become a member of a brigade, as it is removing a critical number of needy households to this cash for work project, as well as households that are likely to be engaged in charcoal production.

g. Schedule short term employment interventions if possible for when there is the greatest need. For example energy, water and food insecurity occur specific times of the year, when alternative solutions are mostly needed.

h. The cooperation and exchange of information between the various international reforestation and rehabilitation projects on-going in the border zone should be increased, in order to avoid overlap and increase the value for money spent.

i. Prioritize upper catchment reforestation for transboundary catchments to cap existing flood risks (see below).

Rationale

Land degradation is a major issue in the border region and deforestation is ongoing. Increased forest cover can arrest further degradation. Labour intensive reforestation projects can provide short-term alternative livelihood opportunities and thereby decrease pressure on illegal transboundary deforestation and charcoal production. Re-forestation brigades have also shown to be able to increase awareness on more sustainable practices within the communities where they work, while the on-going MPP project has proven to be a good platform for transboundary cooperation on the ministerial level between the two countries.

Cost: US$ 2 million per annum

Schedule: 5 years+

Responsibility: Ministry of Environment Haiti. Ministry of Environment and Natural Resources Dominican Republic.

2. Sustainable agricultural development: Reform and develop the artisanal and small scale agricultural sector in the border zone to improve sustainability and livelihoods.

Design & scope

a. Train farmers in sustainable practices and crops that are suitable for the various locations and climates existing along the border zone. Examples including fruit tree grafting and planting, agroforestry, improved seeds, seed storage, crop rotation, fertilizer use and drip irrigation.

b. Supplement technical support with logistical and financial support for widely disseminated small scale investments such as fruit seedlings, improved seeds, fertilizer, seed bins, drip irrigation equipment.

c. Introduce agricultural micro-credit.

d. Address the issue of land tenure in the isolated parts of the border zone on the Dominican side (Elias Piña province) where this still is a key problem. (Haitian land tenure is a national scale priority).

e. Strengthen the capacity of farmer organizations to enable spreading of best practice, pooled support, shorter supply chains between the producers and end customers and economies of scale in implementing the introduced reforms and improvements.

f. Strengthen the capacity of communities to better utilize organic waste.

g. Enforce a ban on the use of slash and burn agriculture whilst presenting viable alternatives.

Rationale

At present artisanal and small scale agriculture in the border zone (both sides of the border) is

both environmentally damaging and limited in productivity. Moving beyond the destructive cycle of slash and burn agriculture requires long term and technically intensive investment in both practical support and changing mindsets.

Cost: US$ 3 million per annum

Schedule: 5 years

Responsibility: Ministry of Agriculture Natural Resources and Rural Development Haiti. Ministry of Agriculture and Ministry of Environment in the Dominican Republic.

3. Transboundary river flood risk reduction: Invest in flood containment and land use planning for affected Dominican and Haitian townships on a long term worst case scenario

Design & scope

a. Map and control the downstream areas of high flood risk zones. This will need to extend to formal demarcation of zones, relocation of housing and prohibition of further development.

b. Invest in improved/flood-resilient critical roads and bridges in the flood zones.

c. Invest in flood containment infrastructure: gabions and revetments, to channel the floodwaters past towns and high value areas and infrastructure.

d. Invest in better understanding the causes of the floods and in establishing functioning early warning systems for communities at risk.

Rationale

The flash floods which have previously damaged selected Dominican and Haitian towns (Jimani, Fonds Verrets, Pedernales, Anse-à-Pitre) in the border zone are linked to severe and mostly irreversible degradation of the catchments in Haitian territory. These risks must therefore be considered permanent and not reducible via low-cost upstream interventions. Further degradation of the watersheds may be partly controlled by reforestation, so these catchments should be targeted as priority for the Frontera Verde initiative. Note that though this is a major issue faced by towns in both countries, it is only a transboundary issue in selected cases.

Cost: US$ 5 million per annum

Schedule: 2 years

Responsibility: National Emergency Commission and the National Water Resource Institute of the Dominican Republic. Haitian Ministry of Environment.

4. Improve the sustainability of transboundary trade and the bi-national markets, while reducing their environmental impacts: Support the existing bi-national markets while providing better structures and opportunities for fair, profitable and more sustainable trade between the two countries.

Design & scope

a. Re-design the current structures of the bi-national markets and re-build new ones on neutral ground, which would lead to equal treatment, as well as reduce the pollution of nearby watercourses, and improve the hygienic conditions of facilities thereby reducing the risk of bacterial contamination.

b. Improve the negotiating power of small-scale farmers through support of the formation of farming cooperatives.

c. Stop the illegal/grey transboundary trade in environmentally sensitive goods, as well as subsidized products targeted for use in one country only (fertilizer, rice).

d. Involve the UNEP Green Customs Initiative to train customs and enforcement officers on the control of trade in environmentally sensitive commodities.

Rationale

The bi-national markets are the largest and most important sites of border zone petty trade. Their impact is overall positive but they need reform and in some cases rebuilding, to reduce their environmental impacts, improve equality, and reduce conflict. Improved policing of transboundary trading in general (both at the markets and the main freight border crossings) is needed to suppress trade of subsidized and environmentally harmful goods.

Cost: US$ 8 million per annum

Schedule: 3 years

Responsibility: Ministry of Industry & Commerce, Ministry of Environment & Natural Resources, municipalities, and the General Directorate of Customs in the Dominican Republic. Ministries of Commerce and Interior in Haiti.

5. Border zone economic development and diversification: Encourage the transition from subsistence agriculture and illegal and damaging activities to micro–, small– and medium sized enterprises (MSME) led local economic development in agriculture, forestry, fisheries, commerce and tourism.

Design & scope

a. Extend existing successful technical assistance and microcredit schemes into the border zone. Initially target the large unmet demand for microcredit from existing under – capitalized MSMEs.

b. Link assistance to environmentally sustainable livelihood options, such as agroforestry, sustainable fisheries, agricultural processing and eco-tourism.

c. Link assistance to disadvantaged and at risk groups, such as women, youth and communities partly dependent upon illegal or transboundary activities.

d. Invest in tourism in the border zone for the target market of international tourist day and short term trippers from the Dominican Republic. Potential attractions include historical sites, mangroves, reef and wreck diving, music and handicrafts. Establish transboundary links to ensure a coherent package and adequate care of tourists whilst in Haiti.

Rationale

At present there are no large scale manufacturing enterprises in the border zone and relatively limited potential for them being established in the future, given the current emphasis on the Caracol region. The border zone local economy is therefore currently dependent upon MSMEs, petty trade and unsustainable subsistence livelihoods. Boosting MSMEs and the service economy is a proven route for economic development and drawing local populations away from unsustainable livelihoods. Field reconnaissance, interviews and household surveys all found that a lack of small scale capital is currently one of the greatest obstacles for MSMEs in both countries in the border zone. The border zone has niche tourism potential, which at present is completely unexploited.

Cost: US$ 5 million per annum

Schedule: 5 years+

Responsibility: Ministries of Industry & Commerce, Tourism, Environment & Natural Resources, and municipalities in the Dominican Republic. Haitian Ministries of Commerce and Industry, Interior and Local Authorities, and Tourism.

6. Address pollution of transboundary rivers: Reduce the amount of solid and bacteriological waste in transboundary rivers and phase down the threat to public health posed by waterborne diseases.

Design & scope

a. Ameliorate the bi-national governance structures that deal with transboundary watersheds.

b. Conduct basic measuring and assessments of the water quality, type of contamination and main sources of pollution in the transboundary rivers

c. Focus on municipal management of solid waste and bacteriological contamination

d. Invest in basic waste management education within communities bordering the water courses in both rural and urban areas.

e. Provide the necessary waste handling infrastructure.

Rationale

Water pollution is a widespread problem in transboundary rivers. It is endemic to both countries due to their inadequate waste management, sanitation and wastewater treatment. The pollution in these rivers comes from households, villages and cities, and is such that the water spreads disease and is unsuitable for domestic use in many areas, especially downstream.

Cost: US$ 2 million per annum

Schedule: 3 years

Responsibility: Ministries of Environment & Natural Resources, Public Health and Welfare, municipalities, National Institute of Potable Water and Sewage in the Dominican Republic. Ministry of Environment and Ministry of Public Health and Population of Haiti.

Improving cooperation and governance

7. Improve existing transboundary co-operation mechanisms that deal with environmental issues and transboundary watersheds: Build on the mechanisms and platforms for cooperation that already exist on various levels, to create a functioning network of cooperation, both across the border, as well as between the local and national levels. The overall cooperation framework, under which the other mechanisms should exist, should on the highest level be chaired by the presidents of the two nations, in order to ensure necessary political will and allocation of resources.

Design & scope

a. Use the findings and recommendations of this study to inform on-going initiatives under the Joint Dominican-Haitian Bilateral Commission ("Commission mixte binational haitiano-dominicaine"), including the memorandum of understanding between the ministries of planning, the memorandum of understanding on border security, the Bolivarian fund for solidarity with Haiti, as well as the memorandum of understanding on cross-border transportation.

b. Strengthen the Haitians' capacity to interact on an equal level with their Dominican counterparts on national and community level cooperation mechanisms, ranging from the bi-national commission to community level mayors associations. This process would involve improving information sharing and technical training and sourcing of operational funds.

c. Emphasize information sharing between the two countries, as well as information sharing and coordination between on-going and future projects in the border zone.

d. Formalize and support the existing local level informal transboundary cooperation mechanisms, and that currently to a large extent is based on interpersonal relationships, to ensure the long-term survival of such successful initiatives. This would include the bi-national commune/mayors forums and partnerships between livelihood groups from both sides of the border (associations of fishermen and beekeepers etc).

e. Create dedicated policing, conflict resolution and information exchange mechanisms at the different levels, from national to local, including cooperation between authorities of both countries to resolve disputes and combat cross-border illegal activities and crimes.

f. Ensure any large scale mining, energy or water resource projects with the potential for transboundary impacts are integrated into the agenda of the high level cooperation mechanisms.

g. Promote open exchange of information and the development of joint projects on the bi-national level. This includes improving the management of transboundary natural resources: fish stocks, forests and water.

Rationale

Transboundary/bi-national co-operation structures already exist on various levels, but lack resources for effective implementation. Existing mechanisms include the Joint Dominican-Haitian Bilateral Commission, the border development agencies, the Haitian parliamentary commission for the border, bi-national projects implemented by international organizations, associations of mayors in the border zone and informal cooperation between community leaders and livelihood groups. These various mechanisms and structures represent good cooperation/conflict resolution platforms which should be further strengthened and institutionalized, as they are perceived positively by stakeholders in both countries.

However, all stakeholders point out the lack of balance between Haiti and the Dominican Republic, where most of the Haitian structures currently lack human, financial and technical capacities and to some extent suffer from a lack of political weight and backing. In addition, the flow and exchange of information on the border landscape is still insufficient, be it across the border or from the local to the national level in Haiti.

Cost: USD 2 million per annum

Schedule: 5 years+

Responsibility: Ministry of Foreign Affairs in the Dominican Republic and in Haiti.

8. Environmental governance and regulation and control of the charcoal trade and other forest products: Increase enforcement of Dominican and Haitian law on protected areas and forest conservation.

Design & scope

a. Better protect forests and national parks and reserves in or near the border in the Dominican Republic against illegal settlements, agricultural clearing and charcoal production.

b. For regulation and control of the charcoal trade, focus on the Dominican side of the border zone near Lake Azuei. Aim for long term full suppression of the trade rather than episodic crackdowns. This includes confronting the problem of Dominican landowners involved in the production and complicity of government and border officials who allow the trade to take place.

c. Create buffer zones surrounding the protected areas

d. Strengthen provincial (Dominican Republic) and departmental (Haiti) offices of the Ministries of environment.

e. Develop plans to control conflict, avoid human rights violations and deal with transboundary issues in the course of enforcement.

f. Investigate the possible impacts of any sanctions against – or indeed the total suppression of – the charcoal trade. Of particular importance is the question of what consequences such measures would have for the Haitian population, much of which is dependant on charcoal for daily energy, and some of which relies on the charcoal trade for subsistence. Consider options to reduce the risk of unrest during period of transition from charcoal to more sustainable sources of energy.

Rationale

The Dominican Republic has adequate laws for the management of protected areas and soil and forestry conservation, however they are not being adequately enforced in the border zone, and serious degradation is ongoing. Major complications in this task are widespread rural poverty and underemployment, corruption and the presence and involvement of large numbers of Haitian legal and illegal immigrants.

On the Haitian side, protected areas also suffer from a lack of necessary funds, resources and political support for protected area management. Suppressing the transboundary charcoal trade will most likely result in some level of unrest among the large number of Haitians who rely on charcoal for their daily energy needs. The impacts of such a suppression is therefore to be well understood and mitigating actions are to be considered.

Cost: US$ 5 million per annum

Schedule: 5 years+

Responsibility: Ministry of Environment and Natural Resources in the Dominican Republic. Ministries of Interior – both countries.

9. Strengthen the management of marine and coastal resources in the border zone: Slow the decline of the marine and coastal environment in the border zone by preventing encroachment and stopping practices that degrade the environment.

Design & scope

a. Build a conflict resolution mechanism pertaining to the transboundary use and trade of fish and other marine resources by creating thematic dialogue tables between relevant actors at the local level, as well as by organizing a formal coordination platform at a high political level. The latter should be tasked with managing conflict, resources, and territory delimitation, and should actively seek the participation of government authorithies, private sector, fishermen associations etc.

b. Reinforce the relevant directions in the Haitian ministries, such as the Direction of Fisheries in the MARNDR, which is understaffed throughout, including at the departmental level.

c. Enforce existing – and create new – protected marine areas in which functioning fishing bans are in place, so as to slow or halt the depletion of fish stocks while remaining mindful of the economical health of the communities that rely on those stocks. Establish such protected areas in collaboration with fishermen associations, in order to ensure buy-in and successful implementation of the protected areas.

d. Ban the cutting of mangroves for the establishment of new salt pans

e. Provide incentives for switching from the use of mangrove as firewood to other energy sources

f. Create and formalize fishing agreements between the two countries, where money is exchanged for access to fishing areas.

g. Develop the capacity of public sector institutions and local organizations for the conservation and the management of coastal and marine resources.

h. Promote the environmental sanitation of the coastal zone and develop its tourism potential.

i. Restore degraded coastal areas through reforestation with endemic, native and/or naturalized coastal-marine species.

Rationale
The marine and coastal environment is being degraded, mainly by overfishing, unsustainable fishing practices, the cutting of mangroves for firewood, contamination, and salt production. Both Haitians and Dominicans infringe on one another's territorial waters daily. Haitians generally fish close inshore, whilst Dominicans fish both inshore and further offshore. While coastal and marine resources provide excellent opportunities for income generation and cooperation of a transboundary nature, these resources are also issues of serious transboundary concern, creating clashes and tensions between communities on both sides of the border, as well as between Haitian fishermen and Dominican authorities.

Cost: US$ 3 million per annum

Schedule: 5 years+

Responsibility: Ministry of Environment and Ministry of Agriculture, Natural Resources and Rural Development in Haiti. Ministry of Environment and Natural Resources in the Dominican Republic.

Research and analysis

10. Lake Azuei and Lake Enriquillo flooding analysis: Undertake a hydrological data collection and analysis study on the causes of the rise in the level of Lakes Azuei and Enriquillo and its potential to keep rising.

Design & scope
a. Start immediately with installation of a basic level monitoring system and follow up with more detailed analysis of the lake and its catchments.

b. Only develop recommendations for large scale investments once the root causes and options are established with reasonable certainty.

Rationale
The lakes have been steadily rising – up to one meter per year since 2004 – for reasons that are still largely unknown. The rise has caused a number of problems. Since 2008, the main transboundary route between Port-au-Prince and Santo Domingo has been gradually submerged on both the Haitian and Dominican sides, and agricultural land has been flooded on both sides of the border.

Cost: US$ 0.5 million per annum – for the assessment only

Schedule: 2 years

Responsibility: Ministry of Environment in Haiti. Ministry of Environment and Natural Resources in the Dominican Republic.

10.4 Haitian national level investment recommendations

The recommendations specifically for Haiti are not new, rather they are concerned with reinforcement and endorsement, as well as the prioritization of existing initiatives at the Haitian national level, specifically the Haitian Strategic Plan for the Development of Haiti: Emerging Country by 2030 (Plan stratégique de développement d'Haïti: Pays émergent en 2030 – hereafter referred as the "strategic plan").[315] This strategic plan is, as it should be, very ambitious and broad reaching, however financing its implementation and prioritization is an ongoing issue.

In this context, Haitian national level investment recommendations are limited to the four top priorities most relevant to the border zone:

1. Improving governance in rural areas
2. Non-agricultural economic development and diversification
3. Replace charcoal with LPG in urban centres
4. Sustainable agricultural development and reforestation

A cross-cutting theme for all recommendations is to shift the development model towards a "green economy", enabling development whilst stabilizing and conserving the remaining natural resources.

1. **Improving governance and community participation in rural areas:** Increasing the presence and role of the state in rural areas, while ensuring the involvement of local authorities, community leaders and civil society, covering a broad range of responsibilities including social services, policing, customs, town administration, agricultural and business development and environmental protection.

Design & Scope:

a. As per the strategic plan. Relevant paragraphs to refer to in the Haitian Strategic Plan for the Development of Haiti are Programme 4.4 (Modernize the administration) and Programme 4.5 (Decentralize the administration).

Rationale: The very limited presence and influence of the Haitian state in rural areas was noted throughout the assessment and weak governance was noted as a root cause behind a wide range of issues. There is no substitute for the presence of a functioning and supportive state. The emphasis on this recommendation is to extend the state presence out to rural areas, with prioritization on growth poles and sensitive areas such as the border.

Cost, schedule and responsibility: As per the Strategic Plan.

2. **Non-agricultural economic development and diversification:** Providing viable alternatives to subsistence agriculture through large scale development of the manufacturing and service sectors, particularly in the main urban centres.

Design & Scope:

a. As per the strategic plan. Relevant paragraphs to refer to in the Haitian Strategic Plan for the Development of Haiti are, among other, Programme 1.4 (renovate urban areas), Programme 2.4 (invest in industrial development), Programme 2.5 (modernize the service sector and make it more dynamic), Programme 2.6 (support the development of the tourism sector), and Programme 2.7 (take advantage of existing mineral and energy resources).

Rationale: The Haitian side of the border zone has clearly already exceeded its sustainable holding capacity based on subsistence livelihoods. Agricultural and MSME development has the potential to slightly ameliorate this issue, but will be insufficient given the current population density and ongoing growth rates. Large scale employment needs to be created elsewhere in Haiti, in urban zones more suitable for a manufacturing and service economy.

Cost, schedule and responsibility: As per the Strategic Plan.

3. **Replace charcoal with LPG:** Implement an integrated programme of regulatory reform, incentives and enforcement rapidly to replace the use of charcoal for cooking with LPG, supplemented by other alternative energy options (including renewables) and improved electrification of the country. The programme would focus on urban centres and Port-au-Prince in particular.

Design & Scope

a. As per the strategic plan. Relevant paragraphs to refer to in the Haitian Strategic Plan for the Development of Haiti is programme 1.2 (environmentally sound practices), and in particular sub-programme 1.2.4 that deals with the use of wood and charcoal for energy use and the need for an intervention plan supporting a change towards the use of LPG gas, as well as programme 1.6 (increase the electrification of the country).

b. Streamline with other on-going initiatives or initiatives that are commencing, such as the *The Bolivarian Fund for Solidarity with Haiti* that is targeted to include the buying and disbursement of 2 million gas canisters and gas cookers to households in need in Haiti, and strengthening of the Haitian national electricity grid.

c. Invest in catalyzing long term large scale and economically sustainable growth of the LPG market rather than short term grant based injections of materials or unsustainable gas price subsidies.

d. Collaborate with the private sector on distribution networks etc.

e. Collaborate with Dominican authorities to learn what has worked, and what has not, based on their experiences in implementing a similar scheme.

f. Once a system is in place in main urban centers, expand to rural areas.

g. In the long term, aim for various alternative energy options, including increased electrification through hydro and wind power.

Rationale The over-dependence of Haiti on charcoal for cooking has been long recognized as a national scale problem. It is now a significant bi-national problem as well. Supply oriented solutions such as reforestation and protected area management cannot succeed without parallel demand reduction. At present the most viable alternative to charcoal for cooking is LPG, which already has a small market share in Haiti and dominates the cooking energy market in the Dominican Republic. The Haitian Government has already developed a national strategy paper and short term action plan for LPG expansion, but it is yet to be implemented.

Cost, schedule and responsibility: In line with the strategic plan.

4. Sustainable agricultural development and re-forestation: Implement the Haiti 2010 National Plan for Agriculture, with a particular emphasis on sustainability. Replace the unsustainable cultivation of slash-and-burn, annual crops on steep slopes and degraded land with tree planting, with a particular emphasis on agroforestry and energy cropping. Integrate erosion control measures into all agricultural landscapes. Extract greater value from remaining viable land with improved inputs and techniques and investments in agricultural value chain development.

Design and Scope:

a. As per the 2010 National Plan, as well as programme 1.2 (environmentally sound practices) and 2.2 (modernize and make agricultural practices and livestock keeping more dynamic).

Rationale: Agriculture is still the mainstay of the Haitian economy so there is major scope for improvement, simply by broadly applying existing proven techniques. The need for reforestation and land tenure reform is also clear. National capacity in reforestation is already extensive, with insufficient funding and land tenure being the main obstacles at present.

Cost and schedule: In line with the strategic plan.

Responsibility: Haiti Ministry of Environment and Ministry of Agriculture, Natural Resources and Rural Development, Inter-ministerial committee for territorial management (CIAT).

10.5 Implementation and financing of the recommendations

The recommended strategy for responding to the many issues noted in this report is as follows:

1. Once priorities have been agreed by the two governments and partner organizations to this assessment, and endorsed by the issuing of this report, the focus should be on financing, detailed design and then implementation of practical action. The analysis indicates high levels of certainty for most issues and trends – further research and analysis is only warranted in a limited number of cases.
2. For pragmatic financial reasons, both governments should be realistic in terms of what can and should be achieved within the border zone. Very large amounts of funding could in theory completely fix many of the issues noted, however this would unduly drain resources away from other national scale priorities. Communities and civil society should also play a key role in the implementation on the ground.
3. Divide the necessary investments into two types, both addressing the key issues and underlying driving forces identified in this study:

   A. Multiple tightly targeted national and bi-national investments in the border zone. These investments are recommended in some detail in this report.

   B. Up to 5 tightly targeted single theme and major investments at the national level for Haiti, which, if fully successful, will also extend to resolving many issues in the border. These investments should be drawn from existing Government owned national plans and so are referenced but not detailed in this report.
4. Adopt a conflict-sensitive approach to contain the risks of destabilization associated with interventions, in order not to exacerbate pre-existing tensions or create new ones. This includes interventions to address issues such as illegal charcoal production and illegal fishing in Dominican and Haitian territory, as

well as encroachment onto Dominican territory by illegal Haitian migrants to access natural resources and better economic opportunities.

5. Anticipate and manage the highly political implications of several of the recommendations. Note that several of the longer term solutions will have difficulties at the start of implementation. Work proactively to control political opportunism and avoid the rise of damaging antagonism between communities.
6. Integrate monitoring of the follow up of all of the recommendations into the terms of reference of an existing bilateral working group of ministers and/or senior government officials. Ensure clear single point ownership and leadership of specific recommendation or actions.
7. International donors should address the issues noted on a whole island basis, and provide funding for bi-national initiatives contributing to an integrated approach, rather than only providing financing for one of the countries.
8. Given the existing strong national ownership of the issues and the long duration of the recommendations international development agencies should focus on the provision of upfront technical assistance and capacity building to enable long term independent implementation of the recommendations by a combination of the two governments and local organizations.

Prerequisites for implementation

The majority of recommendations presented here have two prerequisites for implementation:

1. Integration into government policy and strong bi-national cooperation. These recommendations have been jointly developed and approved by the United Nations and the two governments.

The chances of implementation however will be greatly improved if each owner fully adopts their specific list of recommendations and acts to integrate them into existing national budget and communication processes and plans. The recommendations requiring bi-national implementation should be further implemented under the auspices of the joint bi-national commission and included in budget and communication processes and plans of both countries.

2. All of the recommendations require financing and some also require technical assistance. The support of the international community will be needed for partial financing and implementation of these recommendations. Only partial financing is requested as it is important that government ownership of the recommendations is clear – and this is best demonstrated by commitment of some of their own resources, however limited they may be.

The United Nations and its partners stand ready to support the Governments of Haiti and the Dominican Republic on demand to help implement the above recommendations.

Annexes

Annex I – Report terminology

Arguments refer to its definition in the critical thinking model. Presenting an argument in this context refers to presenting a set of facts and premises as reasons for a **conclusion**.

Coping strategies are behavioral efforts that people employ to tolerate, reduce, minimize, or overcome stressful events or shocks. They are short-term responses to specific shocks such as droughts.[316] Coping strategies have to be differentiated from adaptive strategies which involve a long-term change in behaviors as a result of a shock or stress.[317] These can be related to food, water, or energy shocks.

Direct causes are used to explain a specific phenomenon, such as the direct causes of land degradation in the border zone.

Driving forces are in this study defined as the underlying forces that drive the livelihood responses and key issues observed in the border zone. As an example poverty in Haiti is considered to be a driving force behind Haitian emigration to the Dominican Republic.

The **evidence base** is the sum of material facts and other input such as interview opinions, field observations and secondary data sources that provide the substantiation for a particular conclusion. The **degree of confidence** in a particular conclusion is linked to the evidence base. An evidence base can vary both in depth (amount of information) and uniformity (the level of uncertainty and evidence potentially for and against specific arguments and conclusions).

Forecasts are **decision support tools:** they assist decision makers in visualizing future conditions or the future status of conditions based on prevalent trends. They help to identifying appropriate preparations or interventions. They are particularly useful in strategic planning where levels of uncertainty are high and data is relatively limited.

Key issues are topics of current concern in the border zone and sometimes dispute. They can be both acute (short term or episodic) and chronic (long term, continuous) in nature. Partly negative issues are also sometimes labeled as **challenges** and completely negative issues are commonly labeled as **problems**.

Livelihoods are the capabilities, material and social assets, and activities required for a means of living. It is considered sustainable when it can cope with and recover from stresses and shocks, and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resources base on which it relies.[318]

Opportunities are identified as favorable or potentially favorable circumstances or periods, normally presented in the context of potential future actions. In this context, some issues also present opportunities.

Shocks are generally unforeseen events (incidents, disasters, or conflicts) that have profound consequences on people's livelihoods. Examples of shocks are droughts, earthquakes, or violent conflicts.

Stresses are conditions that put pressure on people's livelihoods. They are of a different degree than shocks both in magnitude (less extreme) and suddenness (less sudden).

Themes are different thematic areas in which key issues fall under. Examples of these themes are agriculture, forest resources, freshwater resources and flooding, and coastal and marine resources.

Tipping point is a point at which a system undergoes a fundamental change and becomes governed by new processes and structures, often resulting in a material worsening of pre-existing problems and trends.

Trends are observed or interpreted general directions and tendencies over time for specific issues. They can be positive, negative, or stable. Trends can be either quantitative, for example historical rainfall records, or qualitative and subjective, such as the overall mood of current Haiti-Dominican

Republic intergovernmental relations compared to the past. The predictability of trends can vary, from high to very low – essentially unpredictable.

Triangulation of data is a research technique that is used in this study to ensure that no conclusion can be drawn from a single source without corroboration by others.

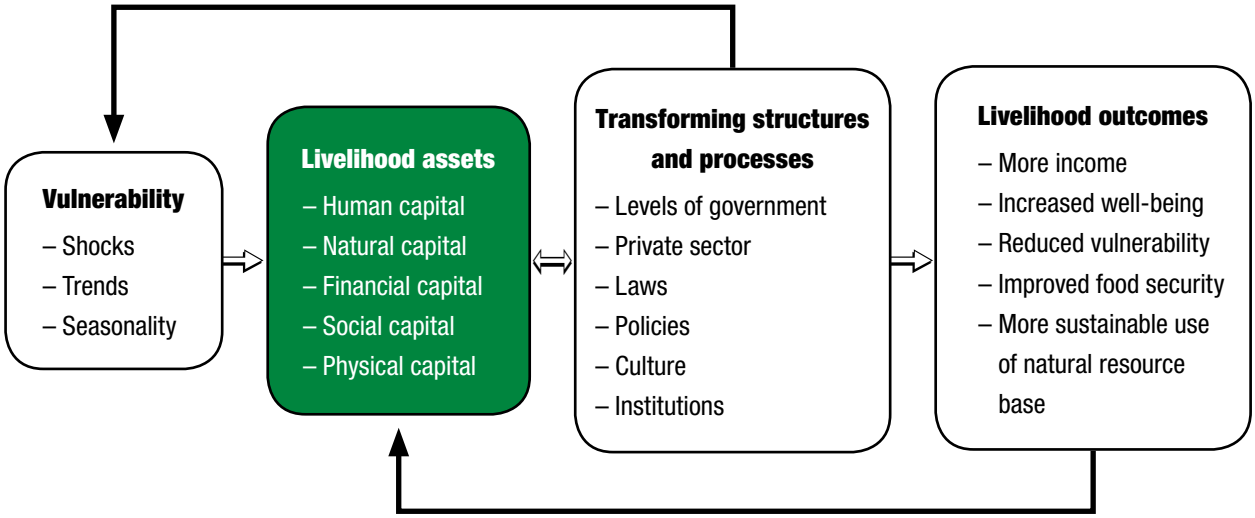
The term **watershed**, meaning 'an area or ridge of land that separates waters flowing to different rivers, basins, or seas or an area or region drained by a river, river system, or other body of water,' is here used to refer to the various watersheds in the border zone, as defined in the 'geographical scope' section of the introduction.

Annex II – List of Acronyms and Abbreviations

APPA	Asosyasyon pechè pou pwoteksyon ak anviwonman Anse a Pit
CASEC	Conseil d'Administration de la Section Communale
CBMM	Capacity Building for Migration Management
CIAT	Inter-ministerial committee for territorial management
CIP	Caracol Industrial Park
CIT	Comité Intermunicipal Transfronterizo
DCP	Dispositif de Concentration de Poissons
DGDF	General Directorate for Border Development
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organization of the United Nations
GCI	Green Customs Initiative
GDP	Gross domestic product
GEF	Global Environment Facility
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
INARA	Haitian Institute of Agrarian Reform
IOM	International Organization for Migration
LPG	Liquefied petroleum gas
MARNDR	Ministry of Agriculture, Natural Resources and Rural Development
MEA	Multilateral environmental agreements
MPP	Revegetation and transboundary natural resources management project
MW	Megawatt
NGO	Non-governmental organization
PAE	Environmental Action Plan
MSME	Micro, Small and Medium-sized Enterprises
UN	United Nations
UNDP	United Nations Development Programme
UNDP ART	UNDP Articulation of Territorial and Thematic Networks of Cooperation for Human Development initiative
UNEP	United Nations Environment Programme
WFP	World Food Programme

Annex III – Sustainable livelihoods framework

Sustainable livelihoods framework, based on original framework developed by the Department for International Development (DFID).[319]



Annex IV – Table connecting the recommendations to the driving forces

Level	Category	#	Recommendations	Underlying Driving Forces			
				Haitian poverty, food insecurity, and under development	Environmental Degradation	Weak Governance	Haiti-DR Economic and Resource Inequalities
Binational Border Zone Recommendations							
	Practical Action						
		1	Protecting and increasing the vegetation cover		X		X
		2	Sustainable agricultural development	X	X		X
		3	Transboundary river flood risk reduction	X	X		
		4	Improve sustainability of transboundary trade and bi-national markets, while reducing their environmental impacts	X		X	
		5	Border zone economic development and diversification	X	X	X	X
		6	Address pollution of transboundary rivers		X	X	
	Improving Cooperation and Governance						
		7	Improve existing transboundary cooperation mechanisms that deal with environmental issues and transboundary watersheds	X	X	X	
		8	Environmental governance and regulation and control of the charcoal trade and other forest products		X	X	
		9	Strengthen the management of marine and coastal resources in the border zone	X	X	X	X
	Research and Analysis						
		10	Lake Azuei and Lake Enriquillo flood analysis		X		
Haitian National Level Investment Recommendations							
		1	Improving governance in rural areas		X	X	
		2	Non-rural economic development and diversification	X	X		X
		3	Replace charcoal with LPG in urban centres	X	X		
		4	Sustainable agricultural development and reforestation	X	X		X

Annex V – References

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Annex VI – Acknowledgements

Contributors

Claudia Adames	Ministry of Environment and Natural Resources, Dominican Republic
Nicolas Cisneros	United Nations Environment Programme Post-Conflict and Disaster Management Branch
Paul Judex Edouarzin	United Nations Environment Programme Haiti Office
Belkis Fernandez	Ministry of Environment and Natural Resources, Dominican Republic
Lucile Gingembre (primary author)	United Nations Environment Programme Post-Conflict and Disaster Management Branch
Dennis Hamro-Drotz (primary author)	United Nations Environment Programme Post-Conflict and Disaster Management Branch
Mariot Jean	Ministry of Environment, Haiti
David Jensen	United Nations Environment Programme Post-Conflict and Disaster Management Branch
Andrew Morton (primary author)	United Nations Environment Programme Post-Conflict and Disaster Management Branch
Lucas de Muelenaere	United Nations Environment Programme Post-Conflict and Disaster Management Branch
Antonio Perera	United Nations Environment Programme Haiti Office

Senior Government Officials Contributing to the Document

Joseph Ronald Toussaint	Ministry of Environment, Haiti
Jaime David Fernandez Mirabal	Ministry of Environment and Natural Resources, Dominican Republic
Patricia Abreu Fernandez	Ministry of Environment and Natural Resources, Dominican Republic
Manuel Serrano	Ministry of Environment and Natural Resources, Dominican Republic
Max Antoine II	Fonds Interministériel pour le Développement Transfrontalier, Haiti
Pierre André Gédéon	Ministry of Environment, Haiti

Interviewed Persons

Cornelio Acosta	Ministry of Environment and Natural Resources, Dominican Republic
Jacobo Acosta	Fishermen association "Agustin Munoz"

Joseph Astrel	Ministry of Environment, Haiti
Jean Robert Badio	Ministry of Agriculture, Natural Resources and Rural Development, Haiti
Jose Enrique Baez Ureña	Quisqueya Verde, Dominican Republic
Edna Blanc Civil	UNDP, Dominican Republic
José Cristino Castillo	Ministry of Agriculture, Dominican Republic
Ijoassin Clemont	Ministry of Trade and Industry, Haiti
Robert Crowley	Oxfam Artibonite Project
Patricia Dore Castillo	Joint Dominican-Haitian Bilateral Commission
Yves Duplan	UNDP Haiti
General Florentino	General Directorate of Border Development (DGDF), Dominican Republic
Rafael Gomez	Ministry of Environment and Natural Resources, Dominican Republic
Fernan Felix Gonzalez Sanchez	Ministry of Environment and Natural Resources, Dominican Republic
Villaire Guerrier	MPP project
Claude Latendresse	Spanish Development Cooperation Agency
Lance S. Leverenz	Pan American Development Foundation
Olga Lobetty Gomez	Ministry of Environment and Natural Resources, Dominican Republic
Jocelyn Louissaint	Haitian State University, Faculté d'Agronomie et Medecine Veterinaire
Emmanuel Luceny	Docemont local authorithies
Policarpio Medrano Volquez	Export and Investment Center for the Dominican Republic(CEIRD)
Rodolfo Meindez Ramirez	Ministry of Environment and Natural Resources, Dominican Republic
Luis Miniel	Mayors association, Elias Piña
Maria Eugenia Morales	UNDP, Dominican Republic
Patrick Nicolas	Oxfam Artibonite Project Haiti
Sergio Novas	UN UNDP ART initiative
Daniel O'Neil	Pan American Development Foundation
Julio Ortega Tous	Joint Dominican-Haitian Bilateral Commission
Rosa Pares	UNDP, Dominican Republic
Pierre Pelissier	Ouanaminthe local authorities
Cesar Peralta	Ministry of Environment and Natural Resources, Dominican Republic
Mariana Perez	DIARENA, Dominican Republic

Claude Phanor	MPP project
Martin Rapilly	Oxfam Artibonite Project
Adelita Romain	National Observatory of Poverty and Social Exclusion, Haiti
Wilner Romain	Ministry of Agriculture, Natural Resources and Rural Development, Haiti
Claudia Francesca Santos Averez	General Directorate of Border Development (DGDF), Dominican Republic
Ronel Seran	UNDP Haiti Small Grants Programme
Miliciades Serra	Mencia village elder
Arnoux Séverin	Ministry of Agriculture, Natural Resources and Rural Development, Haiti
Jose Luis Socias	General Directorate of Border Development (DGDF), Dominican Republic
Enzo di Taranto	Office of the UN Secretary General, Dominican Republic
Mayor Nelson Urena	General Directorate of Border Development (DGDF), Dominican Republic
Nicasio Vina	Caribbean Biological Corridor, UNEP

Socio-Economic Survey Team

Paola Kim-Blanco	Columbia University, Earth Institute
Hilaire Buissereth	Haitian State University
Manouchka Charlescar	Haitian State University
Ernst David	Haitian State University
Jean Carls Dessin	Haitian State University
Vivener de Verlands Edmond	Haitian State University
Joseph Graci Gracius	Haitian State University
Marie Keltelie Hilaire	Haitian State University
Marrio Hilas	Haitian State University
Alexandra Morel	Columbia University, Earth Institute
Joseph Muhlhausen	Columbia University, Earth Institute
Gemeline Romelus	Haitian State University
Neecholson Richard	Haitian State University
Kevin Tschirhart	Columbia University, Earth Institute

Translators

Spanish	Cabessa Translations
French	Johanna Danis

Cartographic Information

Yves Barthelemy	OBSCOM

Workshop Participants – Haitian Consultations

Ernst Abraham	Haiti Christian Service (SCH)
Serge Baazebeis	Ministry of Environment
Dwinel Belizaire	Ministry of Environment
Edna Blanc Civil	UNDP, Haiti
Manassé Elusma	Quisqueya university
Pierre André Gédéon	Ministry of Environment
James Goetz	GIZ
Etienne Hérard	UNDP/UNEP
Astrel Joseph	Ministry of Environment
Jean Max Milien	Act Alliance
Martine Mathieu	Ministry of Environment
Fritz Nau	Ministry of Environment of Haiti
Patrick Nicolas	Oxfam Quebec
Vilherne Petit-Frère	Ministry of Environment of Haiti
Claude Phanord	Cooperation Suisse
Seth Pierre	Helvetas
Ronald Placius	Ministry of Foreign Affairs
Nadine Narcisse	Ministry of Environment
Glerenem Pampan	Ministry of Environment
Ludner Remarais	Bureau of Mine and Energy (BME)
Laméry Samuel	Ministry of Environment
Marie France Sifrin	Ministry of Environment
Starry Sprenkle	Christian Aid
Lionel St. Jean	Ministry of Environment
Martha Syvertsen	UNDP Haiti
Jean Andre Victor	L'Association Haïtienne de Droit de l'Environnement (AHDEN)

Workshop Participants – Dominican Consultations

Patricia Abreu Fernandez	Ministry of Environment and Natural Resources
Cornelio Acosta	Ministry of Environment and Natural Resources
Claudia Adames	Ministry of Environment and Natural Resources
Ana Carolina Beras	UNDP, Dominican Republic

José Cristino Castillo	Ministry of Environment and Natural Resources
Robert Crowley	Oxfam
Marisol Difo	Haiti-Dominican Joint Bilateral Commission
Teresa Disla	Ministry of Environment and Natural Resources
Belkis Fernandez	Ministry of Environment and Natural Resources
Glenys Gonzalez	Ministry of Economy, Planning and Development
Rosa Lamelas	GIZ
Luc Maille Lefranc	UNDP
Isabel Martinez	UNEP
Máximo Peña de León	Ministry of Industry and Commerce
Manuel Serrano	Ministry of Environment and Natural Resources
Antonia Tapia	Center for Export and Investment (CEI-RD)
Roberto Vargas	UNEP / Caribbean Biological Corridor

Editor

Joel Dowling

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United Nations Environment Programme
P.O. Box 30552 Nairobi, Kenya
Tel: +254 (0)20 762 1234
Fax: +254 (0)20 762 3927
Email: uneppub@unep.org

UNEP