## Vetiver Briquette FEASIBILITY REPORT

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### **Executive Summary**

As part of the Côte Sud Initiative, the United Nations Environment Programme (UNEP) commissioned Carbon Roots International (CRI), a green charcoal enterprise in Haiti, to analyze the feasibility of implementing a vetiver charcoal initiative in the South Department. The present analysis assesses the technical and commercial feasibility of implementing an enterprise designed to use vetiver waste as the primary feedstock for green charcoal production. The report analyses the industry landscape in Les Cayes and the greater South Department, availibility of vetiver biomass, cost and timeline of various applicable business models, and technical efficacy of vetiver waste as a feedstock for charcoal energy.

As previous cooking fuel and cook stove initiatives have shown, a successful green charcoal venture needs to offer a product that compares favorably to wood charcoal in both price and quality. To have a meaningful impact and sustain itself financially, the venture should also be able to scale in a cost-effective manner. CRI's operations in Cap-Haitien set the standard for what a sustainable charcoal initiative can and should accomplish. Based on this experience, it is expected that a vetiver charcoal initiative should aspire to produce a minimum of 15 metric tons of charcoal a day. Furthermore, a successful green charcoal initiative should be able to reach profitability while selling charcoal at a price no higher than the cost of wood charcoal (currently 500 HTG per sack).

The South Department presents several obstacles to managing a successful green charcoal business at scale. These include the lack of a fully operational port and airport, as well as a lack of major retailers of industrial machinery and supplies. However, with the exception of Port-au-Prince and Cap-Haitien, these obstacles are neither unique to the region, nor are they insurmountable. Furthermore, the region's charcoal market operates in a similar fashion to other areas in Haiti and could likely support a new charcoal supplier.

Similar to the traditional charcoal market, the vetiver industry is largely informal, operating with very little oversight or transparency. Several major vetiver distillers control the market for vetiver roots, and competition among them is intense. Partially because of this, the quantity of vetiver waste produced in the region is largely unknown. Estimates indicate that the amount of post-processed roots available for charcoal production is low, due to the likelihood that distillers will soon use the majority of their processed roots for on-site energy. Similarly, sugarcane waste is in short supply in the region, as few sugarcane distilleries operate in the area. The lack of vetiver roots and sugarcane bagasse could be offset by the large quantity of vetiver leaves and corn waste produced in the region. However, the decentralized nature of vetiver leaf and corn production will mean that finding, aggregating and transporting both to a central facility for processing will be difficult and costly.

The enterprise model used to design a green charcoal initiative will also have a large impact on how successful the initiative is likely to be. This report compares three distinct vetiver charcoal business models to assess how certain aspects of each model could affect the initiative's timeline, milestones, and continued financial sustainability. In comparing a decentralized cooperative-owned model, a centralized distiller-owned model, and a centralized third party model, it appears that the cooperative model is the least likely to produce a quality vetiver briquette at scale. Furthermore, the analysis finds that a third party model is the most likely to focus on marketing and sales, a crucial aspect of increasing demand for sustainable charcoal.

To better understand the efficacy of vetiver as a feedstock for charcoal production, this report presents the findings from field trials performed by CRI at its facility in Cap-Haitien. CRI tested the performance of vetiver leaves and grass at various stages of charcoal production, from pyrolysis and briquetting to cooking. Results showed that charcoal made from vetiver roots were ineffective, due to the quantity of dirt and other sediment attached to the roots even after pyrolysis. Conversely, vetiver grass performed very well across the board, indicating that as an energy source, it would be just as effective as sugarcane bagasse.

Due to the unsuitability of vetiver root charcoal and the lack of vetiver root available in the near future, it is not recommended that a vetiver briquette initiative be implemented in the South at this time. Should a vetiver briquette initiative move forward in the future, it is recommended that vetiver leaves be considered more prominently as a source of biomass, and that a third party enterprise manage the initiative, so as to improve its likelihood of scaling as both a manufacturer and retailer of sustainable charcoal.



For this study, CRI tested the performance of vetiver leaves and grass at various stages of charcoal production

## Introduction

It is estimated that over 90% of the Haitian population is reliant on biomass (primarily wood-based charcoal and firewood) for cooking fuel, signifying that Haitians likely use over 3,000 metric tons of charcoal a day, or 1.09 million tons each year.<sup>1</sup> This reliance on wood charcoal has reduced Haiti's forests to 1-3% of original stands, wreaking havoc on Haiti's wildlife and soil fertility while also reducing the supply of cooking fuel.<sup>2</sup>

Finding a viable alternative to wood charcoal should, therefore, be a major priority. Based on its success, UNEP recognized the potential of using vetiver waste as an energy source for sustainable charcoal in the South Department, and commissioned CRI to assess the feasibility of launching a green charcoal enterprise in the region.

This study evaluates the technical and commercial feasibility of implementing a vetiver briquette initiative in the South. To do so, the report first defines a successful green charcoal venture in Part I, outlining how it should function and what it should be expected to accomplish. Understanding what the vetiver briquette project should achieve, the report then addresses the major factors that are likely to affect the venture's success. Part II assesses the Southern region's infrastructure and key resources, as well as the two local markets most pertinent to a green charcoal venture, the charcoal market, and the vetiver industry. Part III addresses feedstock availability, or the quantity of root and leaf biomass available for charcoal production per annum. The report also assesses the availability of a variety of other agricultural by-products that could be used to augment vetiver, such as corn, sugar cane, and cassava.

After assessing feedstock availability, the report compares three distinct business models to identify what business structure and operational model best supports a vetiver briquette venture in reaching scale and having a lasting impact. The three models are 1) Distiller-Owned, 2) Cooperative-Owned, and 3) Third Party-Owned. In this section, the costs and timelines required to meet major milestones are addressed by evaluating key business variables, including input costs and revenue.

Finally, the technical feasibility of transforming vetiver waste (both distilled roots and raw leaves) into charcoal briquettes is evaluated by testing vetiver waste for charcoal production. The report presents the methodology and findings field tests performed at CRI's charcoal facility in Cap-Haitien. Based on the findings of these trials and the analysis above, the report provides a recommendation on whether or not a vetiver briquette initiative is feasible and what approach is recommended for implementing such a project.

<sup>1</sup> Carbon Roots International market analysis: If Haiti's population is 10,500,000 (*Trading Economics*); 90% (charcoal users) equal 9,450,000. Households of approximately 6 members use approximately 2 kg of charcoal a day. Thus 1,575,000 households use a total of 3,150,000 kg of charcoal a day, or 3,150 metric tons.

<sup>2</sup> McClintock, Nathan. (2003) "Agroforestry and Sustainable Resource Conservation in Haiti: A Case Study." North Carolina State University.

# Building a "Green" Charcoal Enterprise

#### **Defining Success**

Haitians likely consume over a million tons of charcoal each year and Haiti's charcoal production could be responsible for cutting up to 12 million trees annually.<sup>1</sup> At this rate, Haiti is likely to lose, at the minimum, more than 700 hectares of forests per year annum.<sup>2</sup>

Providing Haitians with a sustainable and viable alternative to wood charcoal is crucial. However, very few organizations have succeeded in producing and distributing viable charcoal alternatives in Haiti.<sup>3</sup> This is due to the the preference of some development organizations and funders for charcoal alternatives (e.g. charcoal made from corn husks or sugarcane bagasse) and Haitians' preference for an affordable and familiar product (i.e. charcoal made from wood). Furthermore, manufacturing and distributing new cooking technologies is often expensive. Imported goods and labor, continuous research and development, as well as inefficient business models contribute to a high price tag per unit. Although demand for cooking fuel is relatively inelastic, Haitians do not seem willing to pay for new or improved cooking technologies, especially when they require behavioral change.<sup>4</sup>

Similar to other clean cooking fuels, "green charcoal" briquettes, made from agricultural waste products, directly combat deforestation. Unlike other novel cooking technologies, they are attractive to Haitian consumers because they are both cheap and familiar in functionality. CRI's pilot program in Cap-Haitien has shown that green charcoal can be manufactured locally and sold to Haitian consumers at a price comparable to wood charcoal. Furthermore, the growing demand for CRI's product, "Chabon Boul," has proven that a green charcoal enterprise can be financially sustainable.<sup>5</sup>

For green charcoal to have a meaningful impact on deforestation, scale and urgency is key. Replacing only 5% of the wood charcoal consumed in Haiti would require 150 metric tons of green charcoal a day.<sup>6</sup> By operating as a for-profit enterprise with acute focus on quality, efficiency and costs,

<sup>1</sup> Erickson analysis based on Malimbwi et. al. 19% "tree-to-charcoal" yield in Tanzania. Malimbwi, Rogers & Zahabu, Eliakimu. (2008). "Woodland and the charcoal trade: the case of Dar es Salaam City." Sokoine University of Agriculture.

<sup>2</sup> Butler, Rhett. (2006). "Haiti." Mongabay.

<sup>3</sup> Confino, Jo & Paddison, Laura. (2014). "Cookstove designs are failing the poorest communities." The Guardian. http://www.theguardian.com/sustainable-business/cookstoves-design-poor-communities-refugees-unhcr-ikea.

<sup>4</sup> Sagbo, Nicaise. (2014). "Economic Analysis and Willingness to Pay for Alternative Charcoal and Clean Cook Stoves in Haiti." University of Kentucky.

<sup>5</sup> Based on CRI sales data and financial projections. CRI is currently generating revenue from charcoal sales and expects to be profitable by end of 2016.

<sup>6</sup> CRI analysis based on Haiti's charcoal consumption of 3,000 metric tons of charcoal per day.

CRI will soon produce between 10 - 15 tons of charcoal a day at its first factory in Cap-Haitien. A minimum of 15 tons per day is the viable production capacity expected for profitability. This is also the realistic goal for the equipment and scope of the initial pilot facility. Future factories in Haiti will be designed and equipped to produce more than 15 tons of briquettes per day.

Considering this production goal, any new successful vetiver charcoal venture should:

- 1. At scale, produce at least 15 metric tons (MT) of charcoal per day.
- 2. Sell charcoal at a price no higher than the current price of high-quality wood charcoal. Currently this amounts to 25 gourdes/marmite or 500 gourdes/sack, however inflation and scarcity are already causing prices to increase.
- 3. Be operational and earning revenue within six months. The longer a program takes to begin operations, the longer and more difficult it will be for that program to troubleshoot issues and improve production and distribution.
- 4. Prioritize positive social and environmental impact, including a focus on the well-being and development of the community and the health of the environment. A green charcoal initiative should focus on operational efficiencies and product quality, but no aspect of the business



Vetiver plants in La Favette, South Department, Haiti

## Landscape Analysis

Haiti's South ("Sud") Department spans over an area of 2,794 square kilometers, stretching from Tiburon to Côtes de Fer, with a population of around 700,000.<sup>1</sup> Agriculture is the region's largest industry, recognized for having one of the greatest crop varieties in the country. Corn is grown extensively, but the area also produces peanuts, peppers, mangoes, bananas, beans, yams, peas, rice and sorghum, along with a variety of livestock.<sup>2</sup>

The South has received little attention from international aid groups compared to the rest of the country, likely because the 2010 earthquake had comparatively low impact in the region. Donors such as Norway, IDB and the GEF, in addition to others, have contributed funds for development in the south. The Norwegian Government has contributed a total of \$40 million to development projects in the south.



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