

**Socio-Economic Baseline Survey of the Portland Bight Protected Area
(PBPA): Report Part 1 – The Hellshire Hills Dry Forest**

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About this document

This report will form the fourth of five deliverables of a consultancy awarded by the Caribbean Coastal Area Management Foundation (C-CAMF) to the Climate Studies Group, Mona (CSGM).

The purpose of the socio-economic survey is to:

1. Gather information on the socio-economic dynamics of forest users.
2. Collect primary data on the practices of individuals who use the forests so as to develop practical measures to reduce their impacts on conservation targets.
3. Estimate the number of individuals who directly and indirectly benefit from the use of the Hellshire Hills and Portland Ridge forests and their resources.
4. Assess variations in income sources and skill sets for different categories of forest users.

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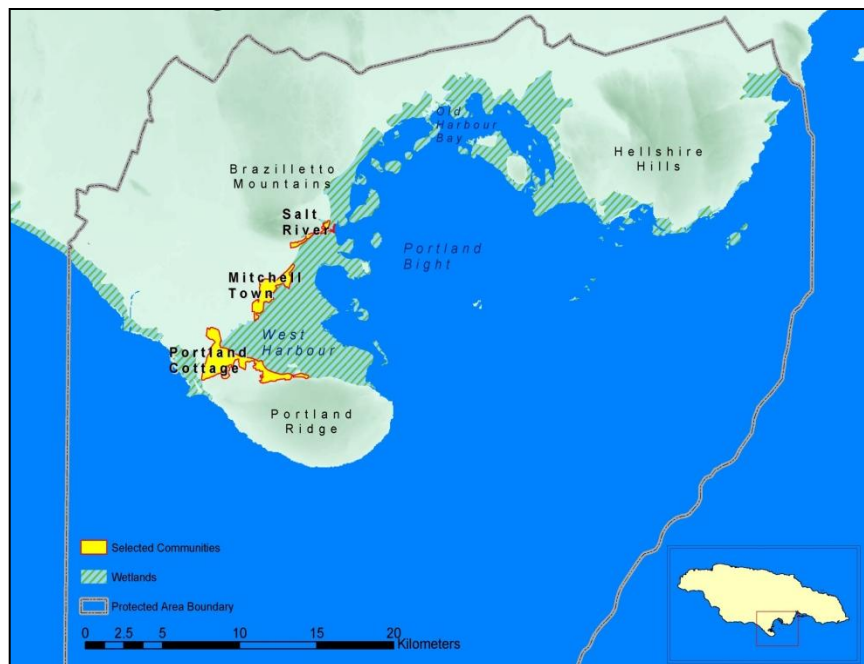
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1. INTRODUCTION

The Portland Bight Protected Area (PBPA) is Jamaica's largest protected area at 1,876 km² (724 mi²). Its 520 km² (200 mi²), sq. miles terrestrial area is 5% of Jamaica's land mass, and its 1356 km² (524 mi²), miles of marine space is 48% of the island's shelf (UNEP, 2009). The PBPA is habitat for birds, iguanas, crocodiles, manatees, marine turtles, fish and approximately 50,000 human beings. It contains two ports, part of three sugar estates, several fish farms, a bauxite-alumina plant, a feed mill, two power plants and other industrial and commercial entities (C-CAMF, 2012; UNEP, 2009).

The PBPA contains 211 km² (81.5 mi²) of dry limestone forest of which the Hellshire Hills forest reserve accounts for over 54% (115 km² 44.2 mi²) of it. The Hellshire Hills forest is situated on the south coast of eastern Jamaica. Its center lies roughly 10.5 km due south of Spanish Town, St Catherine and 20 km west of Kingston, two of the island's largest urban centers (Tole, 2002; Wilson & Vogel, 2000).

Figure 1: The Portland Bight Protected Area



Source: Hunt (2005).

The Hellshire Hills is a relatively dry area that receives precipitation averaging less than 100 cm annually (Wilson & Vogel, 2000). It is comprised mainly of rugged limestone hills that arise from the karst topography which makes up most of the island. Dry limestone scrub forest and cactus thorn scrub are the predominant types of vegetation in the area. The limestone in the Hellshire Hills is predominantly porous and this results in little surface retention of water in the area (Tole, 2002).

The Hellshire Hills is designated under the Urban Development Corporation (UDC) Act and managed by the UDC. The National Environment and Protection Agency (NEPA) signed a delegation instrument with C-CAMF in 2003 for management of the PBPA and subsequently signed a second instrument with UDC for the Hellshire Hills. These delegation agreements expired in 2008, however efforts are currently being made by NEPA to establish new arrangements in the form of a multi-agency Memorandum of Understanding for the PBPA (C-CAMF, 2012).

The Hellshire Hills represents a critical site for Jamaican biodiversity, especially for reptiles (Vogel et al., 1996). Its natural resources support the livelihoods of many individuals in the area and provide several ecological services, including protection from natural disasters, to which the area is especially prone (C-CAMF, 2012). Understanding the nature and magnitude of human threats to the Hellshire Hills' habitats is therefore a crucial first step in ensuring conservation of the area and the local ecosystems that it facilitates.

This study provides a quantitative assessment of the scale and extent of human pressures on the PBPA. The report is based on the results of fieldwork carried out in the Hellshire Hills forest and its environs from November 17th to 24th 2012. The field visits consisted of a series of focus group sessions, surveys, interviews and observations. The study aims to analyse forest use in the Hellshire Hills and Portland Ridge in order to support the development of practical measures to conserve the approximately 724 square miles of the PBPA.

The terms of reference for the consultancy were:

- To work with the University of the West Indies, C-CAMF, Forestry Department, Urban Development Corporation (UDC), Jackson's Bay and PWD Gun Clubs to prepare a literature review and summary of what is already known about the activities of forest users in Hellshire Hills and Portland Ridge and collect the information needed to develop and implement strategies to reduce the impacts of forest use.
- To derive an estimate of the number persons who are involved (directly and indirectly), in the use of the Hellshire Hills forest.
- To find out what they are doing, where they operate, where they come from and why they operate in the areas.
- To find out what other sources of income they have access to, other skills they have, and whether or not they would be interested in training or other sources of income.

- To interview enforcement officers and land managers to assess the difficulties they face in controlling illegal access to the forests.

A similar socio-economic survey will be carried out in Portland Ridge in order to provide comparable data, which will then be used to inform policy makers in preparation of a final comprehensive management plan for the PBPA and sub-area management plans for Hellshire and Portland Ridge.

The report is divided into five sections. Section two provides a review of the literature relating to activities which generally take place in the PBPA and section three gives a brief overview of the survey methodology. Section four presents the main findings from the socio-economic survey and section five provides some conclusions and discusses the implications of the survey results.

2. LITERATURE REVIEW

Most of Jamaica's remaining forests are currently under threat, primarily a consequence of human activities. Illegal forest fuelling, hunting, housing developments and limestone mining constitute the principal forms of human-induced habitat destruction of the PBPA (see, *inter alia*, Berke & Beatley, 1995; Folks, 2010; Levy & Koenig, n.d.; Tole 2002; and Wilson & Vogel, 2000).

The PBPA, and in particular the Hellshire Hills, represents one of the most important remaining natural areas in Jamaica. The PBPA provides habitat for at least 20 globally threatened species (CEPF 2010, cited by C-CAMF, 2012) while the Hellshire Hills supports Jamaica's only native extant land mammal, the Jamaican Hutia *Geocapromys brownii* (Wilson & Vogel, 2000). Wilson and Vogel (2000) find that numerous bird, invertebrate and plant species endemic to Jamaica are found in the Hellshire Hills. The area supports the last remaining population of the Jamaican iguana *Cyclura colei*, which was thought to be extinct by the mid 1900's but was rediscovered in 1970 and again in 1990 (UNEP, 2009). The Jamaican iguana was listed among the world's 100 most critically endangered species in 2012 (Wilson, 2013).

Some of the main sources for extracting wood and burning charcoal in Jamaica are its natural forests including the Hellshire Hills, the Braziletto Mountains, the mangroves of Portland Bight, and the Portland Ridge, all of which are a part of the PBPA (Folks, 2010). Wilson and Vogel (2000) observe that the Hellshire Hills forest is being destroyed at an increasingly rapid rate primarily as a result of tree cutting for the production of charcoal. The Jamaican Iguana Research and Conservation Group (JIRCG) reports having to maintain a near constant presence in the forest in order to divert charcoal burners away from the core iguana area (UNEP, 2009). There is, however, little existing information on the consumption and production of charcoal or fuelwood in Jamaica, as these activities take place in the informal economy which is unregulated by the government of Jamaica (Folks, 2010).

Peterson (1998) notes that charcoal burning contributes to the removal of about 50 km² of native deciduous and evergreen trees from Jamaican forests annually. In addition to charcoal burning, trees are cut for fence posts, yam sticks, sticks to make fish pots, and timber (Wilson, 2013). As a result, the productive potential of the more accessible areas of these forests is being continuously undermined by the rapid removal of trees for such activities. Though some of the forests will regenerate over time, for dry forests (such as Hellshire Hills and Portland Ridge) regeneration is likely to be slow and incomplete, especially in terms of the biodiversity (K. McLaren, in litt.).

An associated problem is that removal of trees is not distributed evenly amongst the island's forests (Peterson 1998). The activity tends to be concentrated in more accessible areas. Forested areas close to trails experience higher rates and frequencies of clearance than other areas. Peterson (1998) suggests that, in light of the present and anticipated future demand for fuel wood, there is a strong possibility that Jamaican forests could lose their potential to continue providing multiple economic and ecological benefits.

On the demand side, Passe and Hesse (1986) report that households, hotels, guest houses and supermarkets are among the primary consumers of charcoal in Jamaica. The UNDP (1988) asserts that charcoal demand is generally concentrated in parish capitals, especially in the urbanized centers of Kingston and Montego Bay. Folks (2010) argues that commercial charcoal and firewood use in Jamaica is primarily driven by the heavy reliance of some food establishments on the use of these products as fuel in the preparation of dishes. She explains that the consumer's taste for food prepared using charcoal and/or firewood is the underlying reason for the heightened preference by the vendors of forest related products as primary fuel sources. Folks (2010) estimates that (at the time of her study) there were approximately 35 restaurants along the Hellshire beach. From the 9 vendors that she interviewed, she derived that between 5 and 7 pieces of firewood (about the size of a bar stool leg) were consumed by each per day¹, about 2100 pieces of sticks were consumed weekly and about 424,666 annually.

In terms of operation, Passe and Hesse (1986) argue that charcoal production is concentrated in rural areas where the opportunities for work are limited. This assertion is also supported by Folks (2010). Folks (2010) also notes that charcoal/firewood production is concentrated in accessible areas where the resource base is available. She further asserts that the demand for firewood coupled with the close proximity of the Hellshire Hills to Half-Moon Bay has lured some owners of the fish restaurants along the Hellshire beach to themselves go and gather wood from the forest to supply their restaurants. Otherwise vendors purchase firewood from men who collect it from the forest and regularly sell it in the area for a living (Folks, 2010).

The burning of charcoal generates income for the players involved. The UNDP (1988) confirms that the amount of money earned by a charcoal burner depends on the number of bags that he/she can produce. This is further dependent on the amount of time spent cutting and gathering wood. The weight of a bag of charcoal however differs in accordance with the type of wood that is used. According to

¹ This quantity varies in accordance with the number of orders received by the restaurants throughout the day (Folks, 2010).

Folks (2010) among the main types of wood gathered and utilized to make charcoal are ‘mangroves, logwood, black jacket and acacia’. According to Wilson (2013), the best wood to make charcoal comes from hardwood trees which are grown in dry forests. These trees take a long time to reach maturity. Quality 'old-growth' dry forest is restricted to the Hellshire Hills and small sections of Portland Ridge. Most producers manage to produce about 30 bags of charcoal per kiln (UNDP, 1988).

Tole's (2002) empirical analysis of habitat loss and anthropogenic disturbance in the Hellshire Hills puts into context the statistical findings of Peterson (1998) and Folks (2010). His analysis suggests that communities with higher proportions of non-working age dependents, higher population densities and more reliance on fuelwood/charcoal for cooking needs had higher rates of deforestation, *ceteris paribus*, than did those communities with lower values for these variables. The study also finds support for a strong positive role of poverty in deforestation on the island. Tole's study concludes by suggesting that deprivation, arising from a lack of alternative opportunities for non-forest destructive livelihoods and inadequate incomes, is a significant contributor to deforestation on the island.

The forests of the PBPA are also affected by housing developments which are constantly expanding in eastern Hellshire and around the Longville estate in the north-eastern Braziletts (C-CAMF, 2012). A historical review of the UDC's work shows that the organization is constantly implementing work on housing developments in the Hellshire Hills area. According to UDC (n.d.), development of the area dates back to as early as 1974 when nine miles of roadway was established in Hellshire and 500 acres of developable land were opened up to the public. In 1979, the first 200 units of the Hellshire Park Estate housing development were constructed and by June 1983, a further 216 houses were constructed in Hellshire Heights. The Cave Hill Estate, comprising of about 162 two-bedroom duplex units, was completed in March 1997 and between 2006 and 2007, 165 two bedroom housing developments were completed in Hellshire Glades. An additional 45 two-bedroom units and the preparation of 8 lots in the Hellshire Glades housing development was initiated in 2008. Housing developments in Hellshire Hills present a concern for environmentalists who question the UDC's ability to enforce environmental protocols (Coleman, 2006).

Tole (2002) also claims that widespread incursions by poor residents from surrounding areas are becoming more frequent in the Hellshire Hills. The combination of unwelcoming terrain, lack of water and harsh heat which historically sheltered areas such as the Hellshire Hills from permanent settlement (Tole, 2002) is seemingly increasingly being overlooked. Individuals exploit the dry limestone forests

and mangroves for food, fuelwood/charcoal, fence-posts and yam sticks (Espeut, 1999). Slash and burn agriculture and illegal forest felling constitute the principal forms of human-induced habitat destruction. The eastern Hills bordering the Kingston Metropolitan Area are also under threat from squatter settlements and commercial development.

Quarrying of limestone can result in the complete removal and destruction of the ecological structure of forests. Quarrying often results in disturbance of the forest's periphery, a loss of associated biodiversity in the excavated areas, increased run off of storm water and changes to drainage and recharge of aquifers. Further disturbances may also arise from the construction of roads to access quarrying sites. It is to be noted that on April 19, 2011, the Ministry of Energy and Mining granted three licenses to quarrying companies in the Hill Run area to excavate limestone along the forest's periphery.² Several new roads have also been constructed in the PBPA to support the quarries (C-CAMF, 2012). These actions will likely impact the ecology of the Hellshire Hills and may lead to the extinction of several endemic species such as the iguana (Wilson & Vogel, 2000).

In summary, the literature suggests that there are private economic benefits to be derived from exploiting the resources of the Hellshire Hills, albeit at the expense of its ecology. Any foreseeable increases in demand and/or greater reliance upon firewood and charcoal by commercial users across the island will likely also result in large volumes of wood being continuously extracted from the forests. The continued extraction of logs, charcoal, firewood and other timber related activities destroy the forest. Veen (2013) notes that timber harvesters not only cut the trees, but sometimes also extract the roots leaving empty rocks behind. Evidence of an increase in demand for charcoal could be inferred from recent media reports of a seizure of approximately 40 container loads of charcoal which were destined for export (Reynolds, 2013; Wilson, 2013). The inference is that charcoal production in Jamaica has the potential to be a large-scale activity which provides good business opportunities through its export. Veen (2013) associates the recent news of charcoal being exported with a significant increase in the number of kilns that have been observed in the Hellshire Hills.

Noting the environmentally devastating implications of charcoal burning and firewood production, the Residential Consumer End User Survey (RCEUS) of 2007 recommends that policies be created to support the environment against such actions. The RCEUS recommends that alternative livelihoods should be explored for those individuals who directly and indirectly depend on the

² The companies are Mogul Construction, Dennis Montaque and Mogul Construction and Transport Ltd.

production and sale of charcoal for a living. According to Wilson (2013), dry forests like the Hellshire Hills will never be able to recover fully from the damages sustained from activities affecting the plants and animals of the area including charcoal burning, firewood harvesting, hunting, quarrying and urbanization. “Striking a balance [then] between the need for people to earn a living and preserving the ecosystem is a most pressing need in the area which is under serious threat from development” (Serju, 2012).

3. METHODOLOGY

3.1 Sampling Design

For the purpose of this study, a “forest user” is taken to be any individual (or entity) that accesses the Hellshire Hills forest and/or utilizes its resources for leisure and/or for economic gains. Though desirable, a sampling frame for such individuals could not be obtained for this study, therefore, a non-probability sampling design, namely snowball sampling, was used. Despite not being probability sampling, snowball sampling was particularly useful in this study as the social group being interviewed included members who were more inclined to hide their identity for legal reasons (see Corbetta, 2003).

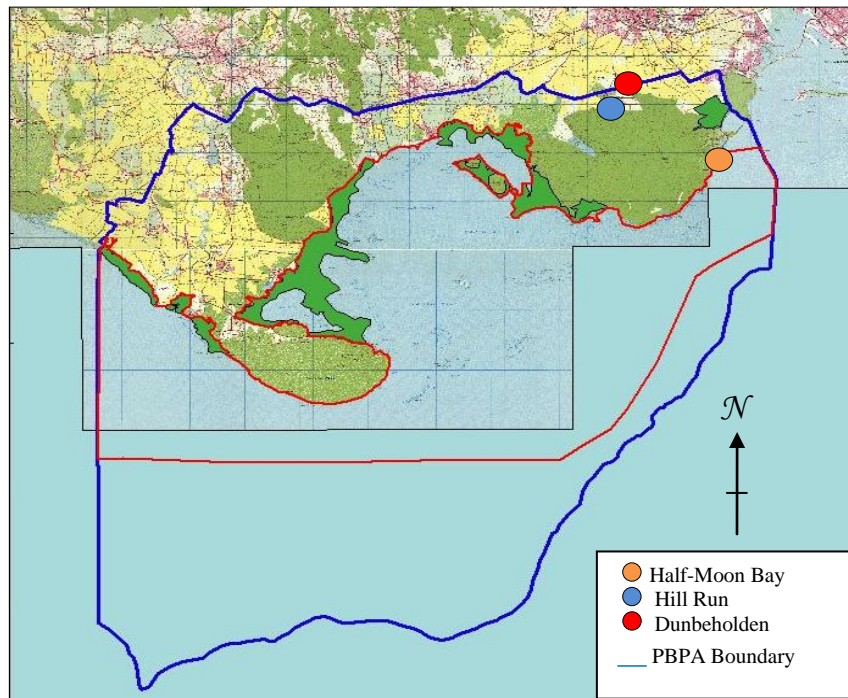
The survey design, in part, involved identifying subjects for inclusion in the sample by referrals from other subjects. The process began with a small number of persons who were themselves users of the Hellshire Hills forest (the desired requisite). These key individuals were then asked to identify and introduce to the survey team other persons who they knew were also using the area. As the process continued, the number of subjects increased significantly.

In support of the snowballing methodology, the survey team also patrolled sections of the Hellshire Hills’ northern, eastern and southern margins in search of forest users to interview. Strategic points (three sites in total) were monitored in order to intercept and interview individuals who were either exiting or entering the forest at these points. If no individual was observed using the forest at a particular entry/exit point, the location was revisited at a later date. A brief description of each site and the motive for selecting the site is given below while a visual description is presented in Figure 2:

- **Hill Run:** This is a residential community which is located on the north edge of the Hellshire Hills forest. As discussed in Section two, areas of Hill Run have been legally designated as quarrying zones and at least three licensed quarrying companies extract limestone from the area. There are several fishing ponds adjacent to the forested area and these are used for fish farming. From information obtained from the UDC rangers and the JIRCG (hereafter designated as the local contacts) Hill Run is the most active site in terms of forest use because it is larger relative to the other access points and there are limited persons to effectively monitor it. There is also a road linking Hill Run to Manatee Bay and this provides access to the forest for some users who drive to specific points and then branch off by foot into the forest.

- **Half-Moon Bay:** This area is a long, wide strip of white sand fronting on the eastern border of the Hellshire Hills forest.³ It is the easternmost fishing beach in the Portland Bight Protected Area. The nearest bathing beach to Kingston, St. Andrew and St. Catherine is situated in Half-Moon Bay and on weekends and public holidays, large numbers of people converge to swim, play and eat fried fish. The demand for food cooked on open fires by these many patrons creates an equally high demand for the firewood which is used to prepare the food. Half-Moon Bay was therefore seen as a good location to intercept and interview the forest users who supplied forest related products such as firewood from the nearby Hellshire Hills to the vendors on the beach.
- **Dunbeholden:** This is a small residential community which is located north northeast of Hill Run and on the border of the Hellshire region of the PBPA. According to the local contacts, the majority of persons who hunt came from this area.

Figure 2: Sampling Locations



Source: CCAMF (2012)

³ The area is locally referred to as Hellshire because of its geographical proximity to the Hellshire Hills.

Table 1 below gives a summary of the sampling dates and locations.

Table 1: Sampling dates by sampling locations				
Sampling dates	Sampling locations			Total
	Dunbeholden	Half-Moon Bay	Hill Run	
November 17, 2012	3	11	-	14
November 20, 2012	-	-	16	16
November 24, 2012	-	1	4	5
Total	3	12	20	35

3.2 Survey Instrument

The socio-economic study of those individuals who use the Hellshire Hills forest involved the following:

- a) A mapping exercise using basic mapping techniques.
- b) Discussions with the key forest users which primarily focused on finding out information on the extent of timber related activities and hunting in the forest by different persons.
- c) A socio-economic questionnaire which was designed to obtain information specifically relating to the Terms of reference (see Table 2 below). Details of the socioeconomic survey instrument and the interview with enforcement officers (a UDC ranger) are presented in the Appendix.

3.3 Limitations

Ideally, it would have been better if this survey had covered 100% of all persons who use the Hellshire Hills forest. Unfortunately, however, the fieldwork was constrained by limited time and the limited number of enumerators that could be employed. Also, despite reassurances that the data collected would be treated confidentially, some individuals, cognisant that they were illegally obtaining products from the forest, feared that the data would be used to identify them. Consequently, collecting information on firewood collection and the burning of charcoal and on hunting are likely to be under-reported.

In some instances, individuals who were heard using the forest could not be interviewed because the thickness of the forest prevented the team from reaching them. For that reason, though the survey team could hear trees being cut, the persons doing the cutting could not be accessed to be interviewed.

The design adopted for this study has the disadvantage of selecting individuals who are socially most active and most visible. This means that the survey may have underestimated those less active

individuals who utilize the area seasonally and/or it may have overlooked those who are more discrete with their practices. Furthermore, there is a risk that the chain of selection may have been channelled along pathways that were too specific. So, if for instance the initial sets of interviewees were charcoal burners, they likely referred only other charcoal burners. In order to avoid these risks, it is generally necessary to impose constraints based on what is already known of the phenomenon being studied (see Corbetta, 2003 for details).

Finally, respondents were asked to recall the amount of individuals that they observed using the forest during the last 12 months. Some inaccuracies are likely to have occurred when questioning elderly individuals about details from activities that happened months ago.

Table 2: Research questions and methodologies used to address the questions	
Research Question	Research method used to address question
How many people are involved (directly and indirectly) in the use of the Hellshire Hills?	<input type="checkbox"/> Questionnaire items 6, 8 and 13. <input type="checkbox"/> Interviews: UDC Rangers and JIRCG.
What activities take place in the Hellshire Hills and/or surrounding areas?	<input type="checkbox"/> Questionnaire items 7, 9, 10 and 13. <input type="checkbox"/> Interviews: UDC Rangers and JIRCG. <input type="checkbox"/> Field observations.
Where do individuals operate in the Hellshire Hills?	<input type="checkbox"/> Questionnaire item 3. <input type="checkbox"/> Field observations. <input type="checkbox"/> Interviews: UDC Rangers and JIRCG .
Regarding those individuals who use the Hellshire Hills, where do they come from and why do they operate in this area?	<input type="checkbox"/> Questionnaire items 4, 5, 7, 8, 11, 12 and 14. <input type="checkbox"/> Interviews: UDC Rangers and JIRCG .
Regarding those individuals who use Hellshire Hills' resources for economic gains, what other sources of income do they have?	<input type="checkbox"/> Questionnaire item 15.
For those persons who use the forest, what formal skills/qualifications do they have?	<input type="checkbox"/> Questionnaire item 16.
Would forest users be interested in being re-trained or in other sources of income?	<input type="checkbox"/> Questionnaire item 17. <input type="checkbox"/> Interviews: UDC Rangers and JIRCG .
What are some of the difficulties faced in controlling illegal access to the forests?	<input type="checkbox"/> Field observations. <input type="checkbox"/> Interviews: UDC Rangers and JIRCG .

4. SURVEY RESULTS: USERS OF THE HELLSHIRE HILLS FOREST

4.1 Introduction

A total of 35 users were interviewed for the socio-economic survey of the Hellshire Hills. Each interview lasted about 10 – 15 minutes. The results of the survey are presented as follows:

4.2 SOCIO-ECONOMIC SURVEY: An Overview

Of 35 questionnaires which were completed, a total of 20 persons were interviewed in Hill Run, 12 in Half-Moon Bay along the Hellshire Beach and 3 in the Dunbeholden community.⁴ This distribution of users is in accordance with the claims of a UDC ranger who was interviewed (hereafter referred to as “the ranger”). He alleged that the majority of persons who use the Hellshire Hills forest come from Hill Run and Hellshire (see Phillip, 2013). Tables 3 to 8 provide some basic features of the individuals surveyed.

4.2.1 Age-Sex Distribution

The majority of persons interviewed were males, accounting for over 97% of the 35 respondents (Table 3). The age-sex distribution is characteristic of an aging population of users: nearly 46% (16) of the individuals surveyed were 55 years of age or older whereas only 17.1% (6) were below 35. If the sample was representative, then this would imply that the majority of persons who uses the Hellshire Hills are elderly males.

Table 3: Age-sex distribution of sample			
Age Group (Years)	Sex		Total
	Male	Female	
18-24	-	1 (2.9%)	1 (2.9%)
25-34	5 (14.3%)	-	5 (14.3%)
35-44	8 (22.9%)	-	8 (22.9%)
45-54	5 (14.3%)	-	5 (14.3%)
55-64	13 (37.1%)	-	13 (37.1%)
65 and over	3 (8.6%)	-	3 (8.6%)
Total	34 (97.1%)	1 (2.9%)	35

Notes: Percentages are based on the total number of persons interviewed. Source: Fieldwork (2012)

⁴ The number of persons interviewed at each site does not necessarily reflect the number of users accessing the forest through those points. This is because the sampling methodology adopted is not strictly random.

Table 4 further illustrates that most users of the Hellshire Hills forest are in their late 50's to early 60's. Over 31% of those sampled were between 55 and 64 years old. About 26 (74%) of users interviewed indicated that they have been using the Hellshire Hills forest for more than 10 years. Of the 35 persons interviewed, 5 have been using the area for under a year. The new users were spread across age groups.

Table 4: Length of use of Hellshire Hills by age group							
Length of use	Age group						Total
	18-24	25-34	35-44	45-54	55-64	65 and over	
Less than 1 year	1 (2.9%)	1 (2.9%)	1 (2.9%)	1 (2.9%)	1 (2.9%)	-	5 (14.3%)
1-3 years	-	-	-	-	1 (2.9%)	-	1 (2.9%)
4-6 years	-	1 (2.9%)	1 (2.9%)	-	-	-	2 (5.7%)
7-10 years	-	-	1 (2.9%)	-	-	-	1 (2.9%)
More than 10 years	-	3 (8.6%)	5 (14.3%)	4 (11.4%)	11 (31.4%)	3 (8.6%)	26 (74.3%)
Total	1 (2.9%)	5 (14.3%)	8 (22.9%)	5 (14.3%)	13 (37.1%)	3 (8.6%)	35 (100%)

Notes: Percentages are based on the total number of persons interviewed. Source: Fieldwork (2012)

The data presented above are generally supported by observations made by the ranger. He reports that the majority of persons whom are confronted on a day-to-day basis in the Hellshire Hills are usually males aged 35 years old or more.

Overall, the results suggest that not many new persons were moving into forest use between 2002 and 2011. One possible reason is that there was no major increase in the demand for forest related products such as charcoal in that period (see Folks, 2010). However, a noteworthy portion of the sample indicated that they have only started using the Hellshire Hills forest since 2012. Despite being too short to be interpreted as a trend, this result suggests the need for on-going assessments of the Hellshire Hills forest. This pattern is also supported by the speculations of the forest ranger interviewed. He suggested that the recent economic hardship is one of the reasons why people have resorted to using the forest to generate income.

4.2.2 Skills, education and formal training

A large portion of the sample (45.7%) indicated that they did not have any sort of skill, training or formal qualification (see Table 5). Among those who indicated that they had formal qualifications

were 3 of the 5 persons interviewed on the limestone quarry in Hill Run – two⁵ had degrees from the University of the West Indies, while the other had a high school certificate. Only 8.6% of the users of the Hellshire Hills forest sampled had obtained secondary level education and 2.9% had received vocational training.

On the other hand, over 37% (12) had experience as the only means of qualification in their respective fields of employment. This means that over 80% (28) of the sample had no official certificate of qualification. These results are not entirely surprising especially seeing that the majority of the sample are elderly (born before independence); it may be a reflection of the widespread unavailability of secondary education in the colonial period.

Table 5: Level of skill/training/qualification by age group							
Level of Qualification	Age Group						Total
	18-24	25-34	35-44	45-54	55-64	65 and over	
None	-	3 (8.6%)	5 (14.3%)	3 (8.6%)	4 (11.4%)	1 (2.9%)	16 (45.7%)
Informal training (experience, apprenticeship, etc.)	-	2 (5.7%)	3 (8.6%)	1 (2.9%)	6 (17.1%)	1 (2.9%)	12 (37.1%)
All age school	-	-	-	-	-	1 (2.9%)	1 (2.9%)
Secondary/High school	1 (2.9%)	-	-	1 (2.9%)	-	-	2 (5.7%)
Vocational training	-	-	-	-	1 (2.9%)	-	1 (2.9%)
UWI	-	-	-	-	2 (5.7%)	-	2 (5.7%)
Total	1 (2.9%)	5 (14.3%)	8 (22.9%)	5 (14.3%)	13 (37.1%)	3 (8.6%)	35

Notes: Percentages are based on the total number of persons interviewed. Source: Fieldwork (2012).

4.2.3 Physical Health

Only 3 respondents – 2 males and a female – reported having some sort of physical challenge. Of these 3 respondents, 2 reported disabilities that were minor and included a fractured wrist and asthma. The third person did not report his specific disability.

4.2.4 Users' Origin

According to the ranger, the majority of persons who utilize the Hellshire Hills' resources come from Hill Run, Braeton, Greater Portmore and/or the neighbouring Hellshire communities (Half-Moon Bay). More specifically, he observes that while charcoal burners and pig hunters mainly come from Hill Run, Phoenix Park and/or Braeton, those who collect firewood mostly come from either Hellshire or

⁵ A Mechanical Engineer who was operating at the quarrying site and the other a Manager of the site.

Braeton. The ranger also suggested that the individuals who cut *Lignum vitae* (*Guaiacum officinale*) trees originate from outside of the parish for the most part. These individuals come from the resort areas on the northern side of the island including Montego Bay in St James, Ocho Rios in St Ann, and Trelawny. This claim is also supported by Veen (2013).

From Table 6, the majority of respondents (82.9%) lived in St Catherine, the parish in which the Hellshire Hills forest is situated. Over 57% of respondents were from communities bordering the forest - Hill Run and Half-Moon Bay (8 and 12 persons, respectively). Despite the dominance of those persons who reside in the St Catherine area, the survey also captured outer-parish users of the Hellshire Hills forest reserve. About 5.7% of the interviewees indicated that they travelled from as far as St Elizabeth to use the area, while 3 came from the Kingston and St Andrew area. One respondent came from as far as St Thomas to use the forest.

Table 6: Community/district of origin by parish of origin						
Community/district of origin	Parish of origin					Total
	Kingston	St. Andrew	St. Catherine	St. Elizabeth	St. Thomas	
Balaclava	-	-	-	1 (2.9%)	-	1 (2.9%)
Dunbeholden	-	-	3 (8.6%)	-	-	3 (8.6%)
Half-Moon Bay	-	-	12 (34.3%)	-	-	12 (34.3%)
Hill Run	-	-	8 (22.9%)	-	-	8 (22.9%)
Palmetto Drive	-	-	1 (2.9%)	-	-	1 (2.9%)
Red Hills	-	1 (2.9%)	-	-	-	1 (2.9%)
Spanish Town	-	-	2 (5.7%)	-	-	2 (5.7%)
Did not disclose	2 (5.7%)	-	3 (8.6%)	1 (2.9%)	1 (2.9%)	7 (20%)
Total	2 (5.7%)	1 (2.9%)	29 (82.9%)	2 (5.7%)	1 (2.9%)	35

Notes: Percentages are based on the total number of persons interviewed. Source: Fieldwork (2012)

In regards to the modes of transportation, Table 7 indicates that 23 respondents travelled to the Hellshire Hills on foot (54.3%) or by bicycle (11.4%). These statistics are perhaps reflecting the fact that the majority of the respondents live in close proximity to the forest. A total of 4 interviewees claimed that they usually access the forest by boat, two of whom were fishermen by profession.

The survey revealed that 8 persons (22.9%) utilize motor cars to travel to the area while 4 (11.4%) used small vans. However, as Table 8 illustrates, the majority of persons who use cars and vans access the forest through Hill Run. Considering the information gathered from the ranger, this tendency could be attributed to the fact that there is a road running directly through the forest which links Hill

Run from the north of the Hellshire Hills forest to Manatee Bay on the south. The ranger added that persons usually drive their vehicles on this road up to certain points and then branch off into the forest by foot to conduct their activities. They would later return to the vehicles which would then be used to transport the resources gathered in the forest to their intended destinations. He further said that charcoal burners also use donkeys to transport charcoal to Hill Run or Braeton where the charcoal would be stored and retrieved at a later date.

Table 7: Most common modes of transportation to Hellshire Hills by parish of origin					
Modes of transportation	Parish of origin				
	Kingston	St Andrew	St. Catherine	St. Elizabeth	Total
On foot/walk	-	-	19 (54.3%)	-	19 (54.3%)
Bicycle	-	-	4 (11.4%)	-	4 (11.4%)
Car	-	1 (2.9%)	5 (14.3%)	2 (5.7%)	8 (22.9%)
Boat	-	-	4 (11.4%)	-	4 (11.4%)
Small van	2 (5.7%)	-	2 (5.7%)	-	4 (11.4%)
Total	2 (5.7%)	1 (2.9%)	34 (87.2%)	2 (5.7%)	39

Note: This question allowed for multiple responses therefore 39 reflects the total number of responses and not the sample size (35). Percentages are based on the total number of persons interviewed, 35.

Table 8: Access points by modes of transportation to Hellshire Hills						
Location	Modes of transportation					
	On foot/walk	Bicycle	Car	Boat	Small van	Total
Dunbeholden	1 (2.9%)	-	1 (2.9%)	-	1 (5.7%)	5 (14.3%)
Half-Moon Bay	9 (25.7%)	-	-	3 (8.6%)	-	13 (37.1%)
Hill Run	9 (25.7%)	2 (5.7%)	6 (17.1%)	-	2 (5.7%)	21 (60%)
Total	19 (54.3%)	2 (5.7%)	7 (20%)	4 (8.6%)	4 (11.4%)	39

Note: This question allowed for multiple responses therefore 39 reflects the total number of responses and not the sample size (35). Percentages are based on the total number of persons interviewed, 35.

4.3 SOCIO-ECONOMIC SURVEY: Use and extent of use of the Hellshire Hills forest

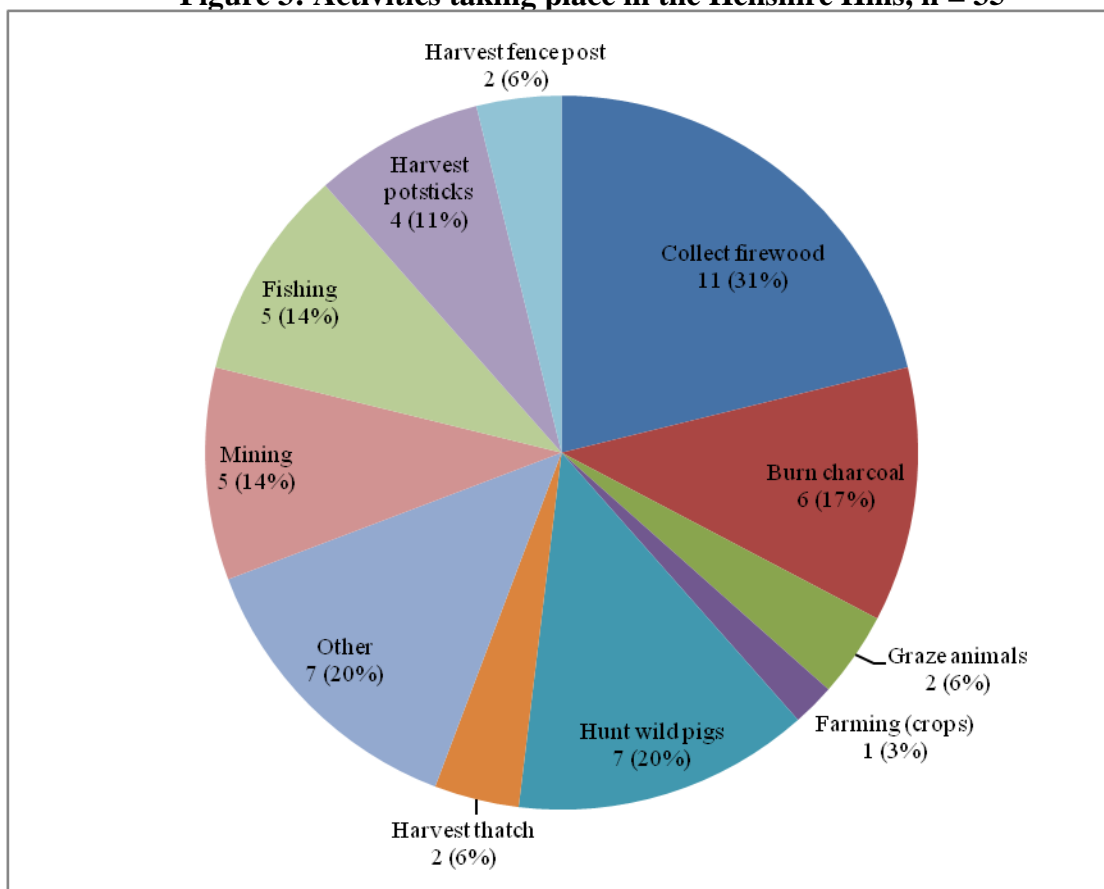
The results presented in this section focus on the socio-economic benefits of the activities carried out in the Hellshire Hills forest and/or along its periphery. Figure 3 and Table 9 provide summaries of use and extent of use of the Hellshire Hills forest by the individuals surveyed.

4.3.1 Firewood and Charcoal

When both primary and secondary activities are taken into account, the most common use of the Hellshire Hills as reported by the interviewees is the collection of firewood; about 31% of the respondents collected firewood from the area (see Figure 3). Twenty percent reported that they hunted wild pigs and a further 17% said that they made charcoal.

In accordance with these results, Veen (2013) reports that charcoal burning is a major activity taking place deep inside the Hellshire Hills, even close to its core. The ranger reports that individuals most frequently use the Hellshire Hills forest to burn charcoal, cut *Lignum vitae* trees or remove dry tress to make of firewood.

Figure 3: Activities taking place in the Hellshire Hills, n = 35



Note: This question allowed for multiple responses. Percentages are however based on 35, the total number of persons interviewed. The “Other” category includes hunting goats, sheep and cows and raising chickens. Source: Field work (2012).

The frequent occurrence of firewood gathering and/or charcoal burning is perhaps a consequence of the high demand for, and heavy reliance upon, firewood and charcoal by commercial users along the nearby Hellshire beach in Half-Moon Bay as reported by Folks (2010). Of the 11 respondents who

collected firewood from the Hellshire Hills, two were vendors who used the firewood gathered to prepare seafood at their own restaurants along the beach. Moreover, 6 of these 11 individuals reported that they primarily sold the firewood gathered to vendors along the beach. The ranger supports this premise and reports that most of the firewood collected from the Hellshire Hills is used to supply fish restaurants along the Hellshire beach.

Only 4 of the 11 firewood collectors surveyed reported that they also gathered pot sticks as a secondary activity in the forest (see Table 9). 3 of the 4 used the pot sticks to assist in enhancing their primary livelihoods (two were fishermen and the other a restaurant owner who caught his own fish) while the fourth earned a living from relying entirely on what he does in the forest (he also harvests and sells fence posts to individuals).

Table 9: Primary use of Hellshire Hills by secondary use of Hellshire Hills									
Primary use of Hellshire Hills	Secondary use of Hellshire Hills								
	Collect firewood	Burn charcoal	Harvest thatch	Harvest pot sticks	Harvest fence posts	Hunt wild pigs	Fishing	Other	Total
Collect firewood	-	-	1 (6%)	4 (24%)	1 (6%)	-	-	-	6 (35%)
Burn charcoal	-	-	-	-	-	-	1 (6%)	-	1 (6%)
Graze animals	1 (6%)	1 (6%)	-	-	-	-	1 (6%)	-	3 (18%)
Farming (crops)	-	1 (6%)	-	-	1 (6%)	-	-	-	2 (12%)
Hunt wild pigs	-	-	-	-	-	-	-	3 (18%)	3 (18%)
Other	1 (6%)	-	-	-	-	1 (6%)	-	-	2 (12%)
Total	2 (12%)	2 (12%)	1 (6%)	4 (24%)	2 (12%)	1 (6%)	2 (12%)	3 (18%)	17

Notes: Percentages are based on the total number of persons who indicated that they conducted at least two activities in the Hellshire Hills forest, 17. Source: Fieldwork (2012).

4.3.2 Hunting

Hunting wild pigs is the second most commonly practiced activity in the Hellshire Hills forest amongst the sample of persons interviewed; approximately 20% (7) of the interviewees carried out this activity, of which 6 listed hunting pigs as a primary purpose for visiting the forest. Although all the pig hunters consumed their game, some (43%) also sold excess portions of it to households for profit.

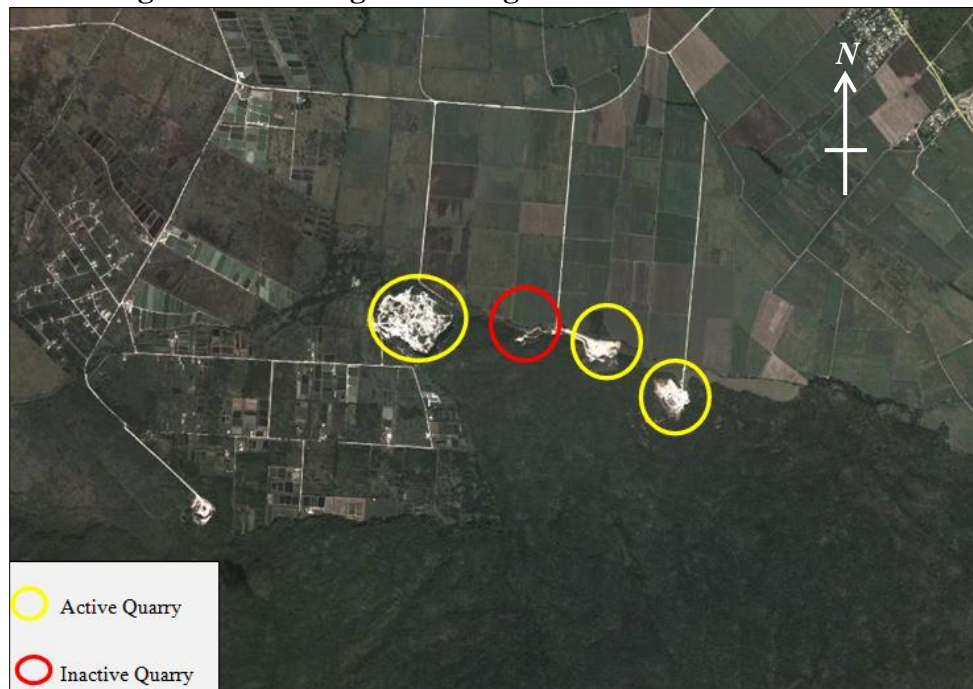
Analysis of the responses given by the 7 pig hunters interviewed, suggest that hunting wild pigs is done frequently (71.4% hunt at least once per week), deep into the forest (5 of the 7 travel more than 3 miles into the forest to hunt) and by only experienced individuals (all 7 have been using the forest for more than 10 years). The ranger reports that hunting wild boars is done much deeper into the forest than where he could access.

4.3.3 Other Activities

Crop farming and animal grazing were among the least popular activities carried out by the sample; only one person each practiced these activities in the Hellshire Hills. The crop farmed was gungo peas and the animals grazed were goats. The ranger said that forest users scarcely cut thatch. This assertion was confirmed by the survey which reveals that only two (6%) individuals in the sample reported ever harvest thatch.

Aside from the small scale operations of gathering firewood, burning charcoal and hunting wild pigs, among other things, limestone mining is also done on the forest's periphery, however on a relatively larger scale. An expanding portion of the northern side of the Hellshire Hills forest has been significantly affected by limestone excavation in recent times. The north side of the Hellshire Hills is legally designated as a quarry zone and as at April, 2011, there have been three quarrying companies licensed and operating in Hill Run (see Figure 4). The UDC ranger interviewed, however, reports that he observes 5 operational sites in Hill Run. This implies that either there are unlicensed quarrying companies operating in the area or that some the companies are operating at multiple sites within the general Hill Run area. An impact of this activity is the scarring on the landscape as depicted in Figures 5 and 6.

Figure 4: Google satellite image of mining zones in Hill Run and environs



Source: Mines and Geology Division of the Ministry of Energy and Mining, Jamaica (2013).

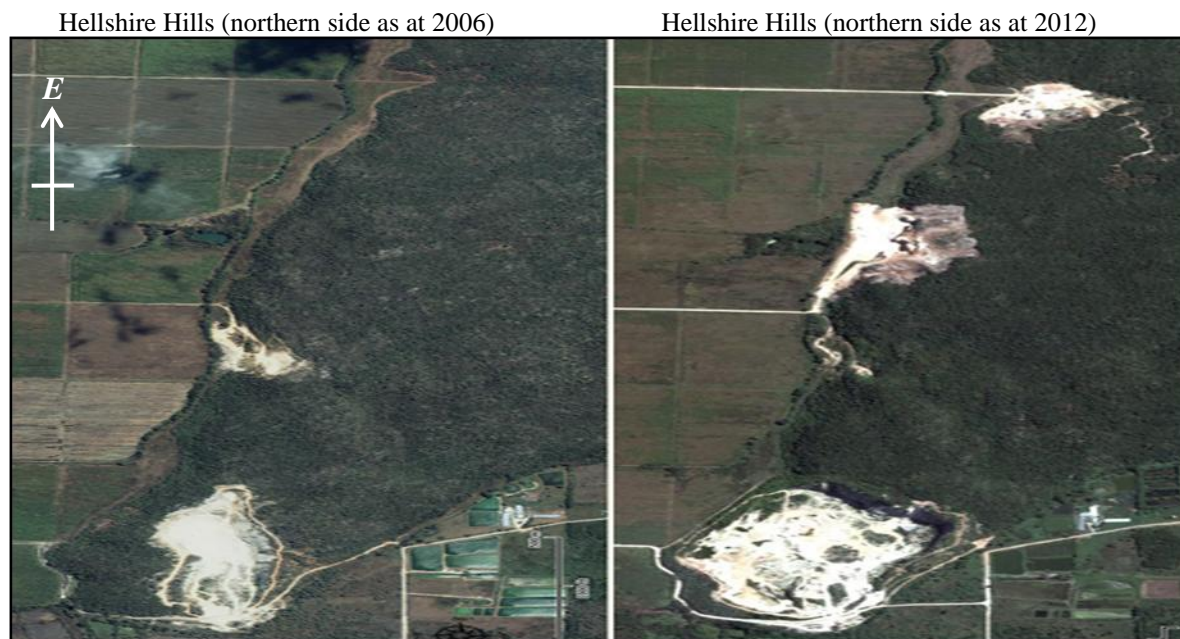
Figure 5: Limestone excavation site on the north side of Hellshire Hills in Hill Run



Source: Fieldwork (2012).

To date, the quarrying companies have affected a relatively small portion of the forest. Nonetheless, Figure 6 suggests that the sites are expanding which has significant implications for the forest and its biodiversity.

Figure 6: Limestone quarrying along the periphery of Hellshire Hills

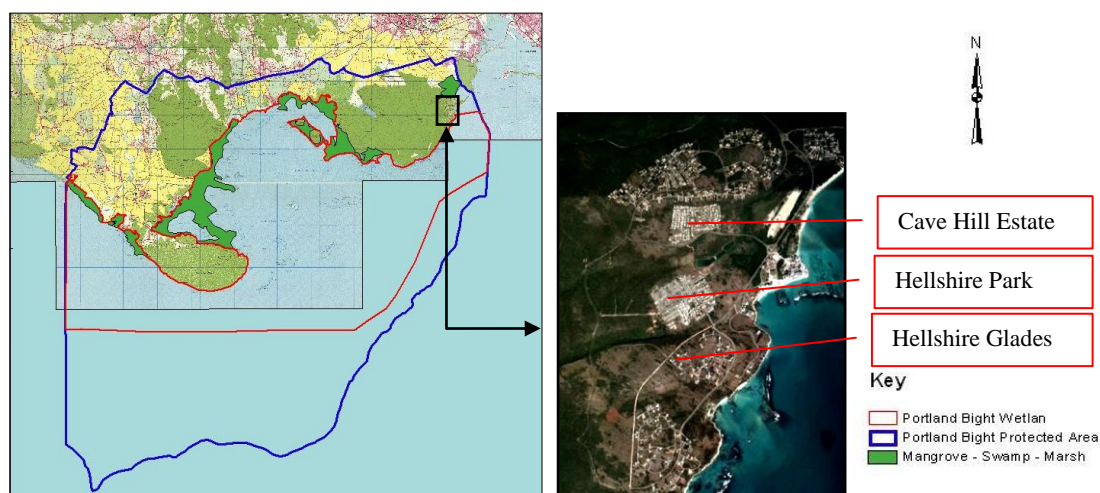


Source: National Land Agency (2012)

Source: Google maps (2012)

Equally noteworthy is the fact that a number of housing units are being constructed on the south-eastern side of the forest as depicted in Figure 7 (see also Section two for a more detailed discussion of housing development in the PBPA). This has caused disturbances in density and distribution of the site's vegetation, as well as for the local biodiversities in the surrounding areas where the housing developments are taking place.

Figure 7: Location of housing developments in Hellshire relative to the Hellshire Hills and the PBPA



Source: Fieldwork (2012), C-CAMF (2012), Google Earth (2012).

4.3.4 Equipment used to cut trees

Trees in the Hellshire Hills are generally harvested using machetes; over 94% of the respondents who cut trees use machetes. About 8.6% of the respondents however claimed that they used both chain saws and machetes. One person was observed using a hand saw.

4.3.5 Intensity of Use

Two residents of St George's Cliff in Hellshire were interviewed and their comments documented. These individuals confirm that the UDC, which employs rangers to enforce laws in the Hellshire Hills, has been monitoring the area quite intensively in recent times and this has led to a substantial decrease in the number of individuals seen using the Hellshire Hills forest. This claim was supported by the ranger who added that increased patrolling, with the assistance of police officers and even soldiers, have successfully deterred some individuals from using the area. In response to this

increased monitoring however, he noted that other users have instead ventured deeper into the forest where the likelihood of detection is much lower.

The residents further observed that rather than cutting green trees, the few persons who they observe using the Hellshire Hills often resort to collecting materials from dead trees to get firewood or to make charcoal. This again was confirmed by the ranger who declared that although the collection of any type of wood or tree is prohibited in Hellshire Hills, they are sometimes lenient with those individuals who collect dead trees, especially when this activity is restricted to only the fringe of the forest.

On the other hand, the survey revealed that the majority of the persons interviewed used the forest quite frequently; about 70% (21 persons) visited the Hellshire Hills and/or its periphery at least once per week to conduct various activities. Moreover, of these 21 “frequent users”, half of them have been using the area for more than 10 years (see Table 10). Also interesting is the distribution of frequent users in regards to depth of penetration. According to Table 11, more frequent users of the Hellshire Hills forest either operate on the fringes of the area or deep inside the forest, more than 3 miles in. This finding confirms the assertions of both the ranger and of the residents of St George’s Cliff, Hellshire. Only 23% of the people sampled penetrate the forest by up to 3 miles.

Table 10: Length of use by frequency of use					
Length of use	Frequency of use				Total
	Once per week or more	Once per month or more	Once or twice every 2-3 months	Once every six months	
Less than 1 year	2 (6.7%)	-	-	1 (3.3%)	3 (10%)
1-3 years	1 (3.3%)	-	-	-	1 (3.3%)
4-6 years	2 (6.7%)	-	-	-	2 (6.7%)
7-10 years	1 (3.3%)	-	-	-	1 (3.3%)
More than 10 years	15 (50%)	3 (10%)	2 (6.7%)	3 (10%)	23 (76.7%)
Total	21 (70%)	3 (10%)	2 (6.7%)	4 (13.3%)	30

Note: The 5 persons who worked on the limestone quarry in Hill Run were excluded from the analysis presented in this table. Percentages are thus based on a sample size of 30. Source: Field work (2012).

Regarding the less frequent users, 10% of the respondents (3 persons) said that they use the area once or more per month, 6.7% (2 individuals) claimed that they use the forest once or twice every two to 3 months, and 13.3% (4 respondents) said that they use the area about once every 6 months.

Table 11: Depth of penetration by frequency of use					
Depth of penetration	Frequency of use				Total
	Once per week or more	Once per month or more	Once or twice every 2-3 months	Once every six months	
Close to but not inside	9 (30.3%)	1 (3.3%)	-	-	10 (33.3%)
Less than 1 miles	1 (3.3%)	-	-	2 (6.7%)	3 (10%)
Between 1 and 3 miles	2 (6.7%)	-	1 (3.3%)	1 (3.3%)	4 (13.3%)
More than 3 miles	9 (30%)	2 (6.7%)	1 (3.3%)	1 (3.3%)	13 (43.3%)
Total	21 (74.3%)	3 (10%)	2 (6.7%)	4 (13.3%)	30

Notes: The 5 persons who worked on the limestone quarry in Hill Run were excluded from the analysis presented in this table. Percentages are thus based on a sample size of 30. Source: Fieldwork (2012).

4.3.6 Estimating the number of persons involved

Excluding the 5 respondents who work on the limestone quarries in Hill Run, the survey directly gathered information on 30 users of the Hellshire Hills forest. This figure is reasonably close to the estimated 35 recurrent users reported by the ranger. In obtaining an estimate of how many other individuals are involved in the use of the forest (directly or indirectly), each respondent was asked to reveal the number of persons that usually accompany them on their visits to the forest. Of the 30 users, 17 said that they are usually accompanied by other persons on their visits to the area. The number of accompanying individuals ranged from 1 additional person to 9. However, the majority of the 17 respondents said that they usually go to Hellshire Hills with no more than 3 persons on each visit; 13 individuals gave this response (see Table 12). Table 12 also shows that persons who use the forest to collect firewood or to hunt wild pigs are more likely to do so with a convoy than those who use the area for other activities. In the end, the 17 persons revealed that there may be as many as 49 accompanying individuals. Mathematically, this equates to about 79 users of the Hellshire Hills forest.⁶

In support of the prior estimates, crude assessments of the number of forest users are also ascertained from observations provided by each respondent. When asked to give estimates regarding the number of other persons seen using the forest while in the area during the last 12 months, the respondents' estimations range from a minimum two other observed individuals to a maximum of 100 (see Table 13).

⁶ The survey directly gathered information on 30 users (excluding the 5 miners) and indirectly on the 49 accompanying individuals. One must be cautious when interpreting these estimates however especially in light of the fact that the sample size is relatively small and that a non-random sampling technique was adopted. Also, the possibility of including duplicates is not completely eliminated.

Table 12: Primary use of forest by number of Accompanying individuals								
Primary use of forest	Number of accompanying individuals							Total
	One	Two	Three	Four	Five	Seven	Nine	
Collect firewood	2	2	1	-	-	-	-	5
Burn charcoal	1	1	-	-	-	-	-	2
Hunt wild pigs	-	2	-	-	1	1	1	5
Harvest thatch	-	-	-	1	-	-	-	1
Fishing	1	-	-	-	-	-	-	1
Other	1	-	2	-	-	-	-	3
Total	5	5	3	1	1	1	1	17

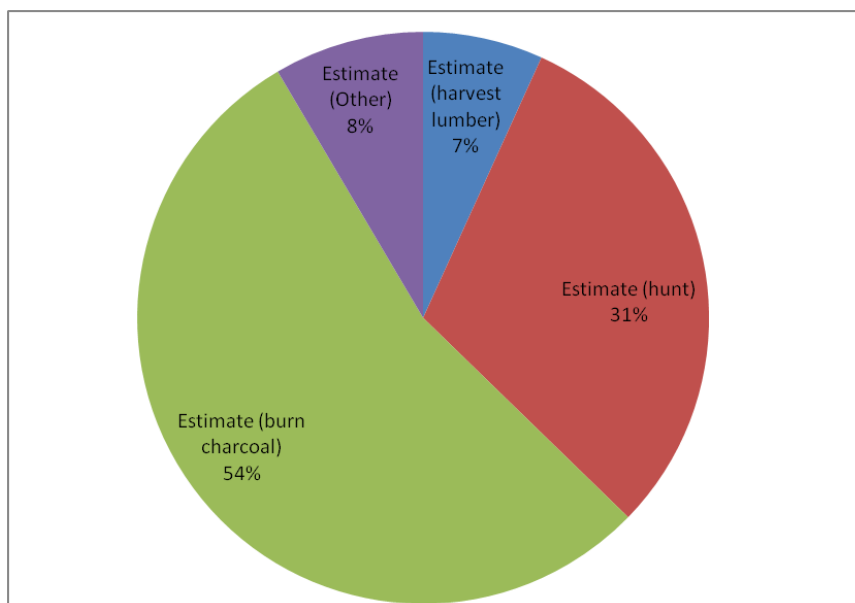
Table 13: Number of other individuals observed by activities observed in the Hellshire Hills during the last 12 months					
Number of other individuals observed	Activities observed in the Hellshire Hills during the last 12 months				Total
	Charcoal/Firewood	Hunting	Harvesting Lumber	Other	
2	1	1	2	-	4
3	2	3	-	1	6
4	1	2	1	1	5
5	-	1	-	-	1
6	1	2	1	-	4
7	-	-	-	1	1
10	2	2	-	-	4
15	-	1	-	-	1
20	1	-	-	-	1
30	-	2	-	-	2
31	1	-	-	-	1
50	2	1	-	-	3
60	2	-	-	-	2
70	1	-	-	-	1
100	1	1	-	-	2
Number of respondents	15	16	4	3	38
Average observation	32	18	4	5	21**

*Notes: Cell “ij” represents the number of respondents who observed “i” number of other individuals doing activity “j”. Only appropriate responses that could be analyzed were included in the construction of this table. This question allowed for multiple responses so the number of responses (38) will not necessarily reflect the number of respondents (35). **This figure represents a weighted average of column 1 by column 6.*

By weighing the number of other individuals observed in the forest by the number of respondents who reported those estimates and then averaging, the following estimates are derived: on average, about 32 other persons were seen either burning charcoal or gathering firewood over the last 12 months in the Hellshire Hills forest while 18 on average were seen hunting and 4 harvesting lumber (see Table 13). A similar weighted average of the totals column in Table 13 works out to be approximately 21 other individuals seen in Hellshire Hills.

Relative to all other activities observed, the making of charcoal and gathering of firewood again accounted for the majority of the activities which were observed taking place in the Hellshire Hills during the last 12 months by the respondents; over 54% of all activities observed in the forest by the interviewees related to either charcoal or firewood (see Figure 8). The observed number of individuals range from a minimum of about 9 persons (2 for charcoal/firewood, 2 for hunting, 4 for logging and 3 for other activities) to at most 213 (100 for charcoal/firewood, 100 for hunting, 6 for logging and 7 for other activities). Considering these estimates, the results imply that roughly 49 persons burn charcoal and/or collect firewood (17 actual and 32 implied). This is reasonably close to the Veen's (2013) estimate of between 60 and 70 persons who he observes regularly burning charcoal on a weekly basis. Additionally, it implies that roughly 25 persons hunt in the area (7 actual and 18 implied).

Figure 8: Estimated number of other individuals seen using the Hellshire Hills forest during the past 12 months (proportioned by observed activity); Estimate (n) = 59



Source: Field work (2012).

4.3.7 Motives for operating in the Hellshire Hills forest

Income

The survey suggests that the forest plays a significant role in sustaining the livelihoods of those individuals who use it (see Tables 14 and 15). Forest-related activities (including activities related to fuel, logging, hunting and farming) provide income for approximately 82% of the individuals surveyed and are considered the main sources of livelihoods for over half of the interviewees (Table 14). The analysis further reveals that 18% of the 33 persons who responded to this questionnaire item use the forest's resources for either personal consumption or as input in the production of other final goods. A further 30% (10 persons) generate income from forest activities to supplement their primary livelihoods.

Table 14: Forest activities constitute main livelihood by forest provide income			
Earnings from forest activities constitute main livelihood	Forest activities provide income		Total
	No	Yes	
Yes	-	17 (51.5%)	17 (51.5%)
No	6 (18.2%)	10 (30.3%)	16 (48.5%)
Total	6 (18.2%)	27 (81.8%)	33

Note: Two responses to this question were invalid and thus were omitted. Percentages are based on the total number of persons interviewed. Source: Fieldwork (2012).

Of the 6 respondents who said that neither their use of nor the resources gathered from the Hellshire Hills directly provides them with income, they all stated that their main sources of income were linked to fishing (4 were fisher folks and 2 sold cooked fish on the Hellshire beach). The activities which are carried out in the forest among these individuals are collecting firewood, harvesting thatch and harvesting pot sticks, among other things. From this it may be implied that the resources which are collected from the Hellshire Hills are used to support the fishing related activities from which these men earned their primary income.

Table 15 suggests that the majority of resources gathered from the Hellshire Hills are either sold directly to households or utilized for personal use. Only one individual said that he sold forest resources (charcoal) to merchants who then resold the goods elsewhere.

Table 15: Activity carried out in the Hellshire Hills by socio-economic benefit derived					
Activity	Socio-Economic Benefits				Total
	Sold directly to households	Sold to both households and merchants	Sold some to households and consumes the rest	For personal use only	
Collect firewood	5 (12.2%)	-	2 (4.9%)	4 (9.8%)	11 (26.8%)
Burn charcoal	2 (4.9%)	1 (2.4%)	1 (2.4%)	2 (4.9%)	6 (14.6%)
Graze animals	-	-	1 (2.4%)	-	1 (2.4%)
Farm crops	-	-	1 (2.4%)	-	1 (2.4%)
Hunt wild pigs	-	-	3 (7.3%)	4 (9.8%)	7 (17.1%)
Harvest thatch	1 (2.4%)	-	-	1 (2.4%)	2 (4.9%)
Harvest pot sticks	1 (2.4%)	-	-	3 (7.3%)	4 (9.8%)
Harvest fence posts	1 (2.4%)	-	-	1 (2.4%)	2 (4.9%)
Fishing	3 (7.3%)	1 (2.4%)	1 (2.4%)	-	5 (12.2%)
Other	1 (2.4%)	-	-	1 (2.4%)	2 (4.9%)
Total	14 (34.1%)	2 (4.9%)	9 (22.0%)	16 (39.0%)	41

Notes: This question allows for multiple answers, hence the total number of responses (41) will differ from the total number of valid respondents (30). Source: Field work, 2012

According to Table 16, the 10 respondents who classified income from forest-related activities as supplemental were generally employed in seasonal jobs. Two (20%) of these individuals indicated that they would rather be doing something else than continuing in their current fields of employment or to continue using the forest.

Table 16: Main livelihoods by preferred livelihood: Supplemental income earners				
Main livelihoods	Preferred livelihood			Total
	None	Farming crops	Playing Football	
Construction	1 (10%)	-	-	1 (10%)
Delivery man at Seprod	1 (10%)	-	-	1 (10%)
Fishing	3 (30%)	1 (10%)	-	4 (40%)
Help persons fishing	-	-	1 (10%)	1 (10%)
Technician	1 (10%)	-	-	1 (10%)
Works on a fish farm	1 (10%)	-	-	1 (10%)
Other	1 (10%)	-	-	-
Total	8 (80%)	1 (10%)	1 (10%)	10

Note: This table represents those individuals who earn income from forest activities but do not consider this income to be a main livelihood. Percentages are based on the 10 supplemental income earners interviewed. Source: Fieldwork (2012).

Table 17 below further depicts that the majority of persons who primarily use the forest to collect firewood or burn charcoal (7 and 3 respectively) have no preferred livelihood.

Table 17: Primary use of forest of Hellshire Hills by preferred livelihood						
Primary use of forest	Preferred livelihood					Total
	None	Farming	Mechanic	Playing Football	Taxi Driver	
Collect firewood	7 (23.3%)	1 (3.3%)	-	1 (3.3%)	-	9 (30.0%)
Burn charcoal	3 (10.0%)	-	1 (3.3%)	-	-	4 (13.3%)
Graze animals	1 (3.3%)	-	-	-	1 (3.3%)	2 (6.7%)
Farming (crops)	1 (3.3%)	-	-	-	-	1 (3.3%)
Hunt wild pigs	6 (20.0%)	-	-	-	-	6 (20.0%)
Harvest thatch	-	1 (3.3%)	-	-	-	1 (3.3%)
Other	4 (13.3%)	-	-	-	-	4 (13.3%)
Fishing	3 (10.0%)	-	-	-	-	3 (10.0%)
Total	25 (83.3%)	2 (6.7%)	1 (3.3%)	1 (3.3%)	1 (3.3%)	30

Note: The 5 respondents who worked on the limestone quarry were omitted from this table. Source: Fieldwork (2012).

Of the 52% of the sample (or 17 individuals) who consider their earnings from forest related activities to be their main sources of their livelihood, over 47% (8 individuals) had no alternate source of income; 6 of the 8 also had no preferred livelihood apart from what they were doing in the forest. 9 of the respondents supplemented the income earned from forest related activities with earnings from seasonal jobs in the construction and fishing industries; 1 occasionally participated in subsistence farming (see Table 18).

Table 18: Other livelihoods by preferred livelihood: Primary income earners						
Other livelihoods	Preferred livelihood					Total
	None	Farming	Mechanic	Own a Plaza	Taxi Driver	
Carpentry/ fishing	-	1 (5.9%)	-	-	-	1 (5.9%)
Chef	1 (5.9%)	-	-	-	-	1 (5.9%)
Construction	3 (17.6%)	-	-	-	-	3 (17.6%)
Dig pit	1 (5.9%)	-	-	-	-	1 (5.9%)
Farming (pigs, goats, callaloo)	1 (5.9%)	-	-	-	-	1 (5.9%)
Seasonal jobs (fishing, and tour guide)	1 (5.9%)	-	-	-	-	1 (5.9%)
Works on fish farm	-	-	-	-	1 (5.9%)	1 (5.9%)
None	6 (35.3%)	-	1 (5.9%)	1 (5.9%)	-	8 (47.1%)
Total	13 (76.5%)	1 (5.9%)	1 (5.9%)	1 (5.9%)	1 (5.9%)	17

Note: This table represents those individuals who earn income from forest activities and consider these activities to be main livelihoods. Percentages are based on the 17 full time income earners interviewed. Source: Fieldwork (2012).

Other Reasons for using the Hellshire Hills Forest

Apart from income, there were several other reasons for using the Hellshire Hills forest as highlighted by the respondents. Chief among them were proximity, accessibility, tradition and opportunity (see Tables 19 and 20).

- a) *Proximity of domicile*: Over 57% of the respondents reported that they lived on the periphery of the forest. There are several economic benefits that could be derived from living close to a forest reserve which has no clear borders or fences. Two of these benefits include: 1) the short distance provides users with the opportunity to access a seemingly free and abundant source of forest related products without detection and as frequently as they like, and 2) it significantly reduces or eliminates production cost for those persons who transport bags of charcoal (or other products) for consumption or sale to close by communities.
- b) *Accessibility*: A combined 26% of the respondents indicated that they use the Hellshire Hills because it is accessible: No physical barriers coupled with isolation means that the area is easy to access and hard to monitor. These were also given as the reasons for continued use of the Hellshire Hills by the ranger.
- c) *Tradition*: At least 9% of the sample stated that their families have been using the area for generations. For these individuals, it is apparent that the motive for using the forest relies more on carrying on a tradition rather than provision of an alternate livelihood. Family traditions may foster continued use of the Hellshire Hills even if doing so is not economically viable.
- d) *Lack of alternatives*. According to the ranger, a number of individuals caught using the Hellshire Hills try to justify their use by insisting that they have no other option. Indeed, some of the individuals interviewed relied entirely on the income generated from forest related activities to meet their daily needs; nevertheless this was in the minority (only 6 persons made this claim). Considering Jamaica's current macroeconomic instabilities and consistently high unemployment rates, coupled with the fact that most forest users are largely unskilled, uneducated and elderly, it is reasonable to suspect that this may become an increasingly important reason for continued (and new) use of the Hellshire Hills forest into the near future.

Table 19: Reasons for using the Hellshire Hills as opposed to other areas		
Reason	Responses	Proportion
Ease of access	6	17.1%
Quality of trees (species)	1	2.9%
Near to where I live	20	57.1%
Family tradition	3	8.6%
Other	8	22.9%
Isolation	3	8.6%
Total	41	

Note: Percentages are based on the total number of persons interviewed, 35. Source: Fieldwork (2012).

The availability of vast amounts of dead trees which are readily available to harvest for fuelwood and charcoal was also cited as a reason for continued use of the Hellshire Hills by both the respondents and the ranger.

Table 20: Other reasons for using the Hellshire Hills forest and/or its periphery	
Reason	Number of responses
General availability	3
Availability of crabs	1
Dry trees (wood)	1
Quality of limestone in area	2
Just saw the area	1
Knows pattern of animals in this particular forest	1
Only alternative	1
Security; no thieves	1
Type of soil (clay holds water better for pond fishes)	1
Unlike deep in the forest, there is no police here to stop me from cutting the trees	1
Works there	1
Total	35

4.3.8 Operational hotspots in the Hellshire Hills

The majority of charcoal burners who were surveyed said that they only operate on the fringes of the forest; about 4 of the 6 charcoal burners indicated that they conducted their activities close to but not inside of the forest (see Table 21). According to the ranger however, the majority of charcoal burners now operate closer to the center of the Hellshire Hills forest; charcoal kilns are often found after hiking southwards from Hill Run or northwards from Half-Moon Bay for approximately 4 hours either way.

The disparities between the survey's account of charcoal burners and the ranger's could be attributed to the fact that the research team could not penetrate the forest deep enough to interview those charcoal burners who utilized closer to the core of the forest. As such, only those on the fringes who were allowed to collect dead trees were interviewed. The ranger further added that apart from those users who advance deeper into the forest because of the increased surveillance on the outer fringes, others access the middle of the forest because of the wide availability of certain types of trees there (for instance 'acacia, logwood and prosopis' were specifically noted by the ranger).

Lignum vitae trees are also extracted closer towards the center of the Hellshire Hills. The ranger reports that Lignum vitae trees are used to make craft items and so individuals cut the trunks of these trees to take advantage of this financial opportunity. He further revealed that there is usually no regard for the size of trees cut; Lignum vitae trees from approximately 3 inches (8 cm) to 3 feet (91 cm) in diameter and from about 11 to 20 feet (335 to 610 cm) in height are extracted from Hellshire Hills to make craft items.

Table 21: Depth penetrated to conduct forest activities					
Activity	Depth of penetration				Total
	Less than 1 miles	Between 1 and 3 miles	More than 3 miles	Close to but not inside	
Collect firewood	-	2	7	2	11
Burn charcoal	2	-	-	4	6
Graze animals	-	-	-	2	2
Farm crops	1	-	-	-	1
Hunt wild pigs	-	2	5	-	7
Harvest thatch	1	-	1	-	2
Harvest pot sticks	-	1	3	-	4
Harvest fence posts	1	-	1	-	2
Fishing	-	-	-	3	3
Other	-	3	3	1	7
Total	6	8	21	15	50
<i>Notes: This question allows for multiple answers, hence the total number of responses (50) will differ from the total number of respondents (35). Source: Field work (2012).</i>					

The survey further reveals that the majority of firewood collectors are concentrated on the south-western section of the forest in the Half Moon Bay area. This was confirmed by the ranger who reports that the fish restaurants along the beach are supplied with the firewood gathered from the forest. Over 64% of these users (7 of 11 persons) report that they usually go beyond 3 miles into the forest to collect

this firewood. Furthermore, 3 persons went by boat to collect firewood in Manatee Bay on the southern tip of the forest.

The exact operational sites of hunters vary especially since they have to track the wild pigs deep into the forest. The majority of pig hunters (6 of 7 persons) were interviewed in Hill Run and Dunbeholden and they mostly hunt more than 3 miles into the forest. Of the 7 activities listed as other, 5 relate to hunting (wild sheep, goats and/or cows) and these are also done deep inside of the forest. The ranger reports that hunting is done much further into the forest than even where they themselves can penetrate. As discussed earlier, large-scale quarrying is done on the fringes of the northern side of the forest while major housing developments are taking place on the south-eastern side in the Hellshire communities.

4.3.9 Supervision of the Hellshire Hills forest

Just over half (52%) of the respondents indicate that they have been confronted or challenged by a government official while visiting the forest (see Table 22).

Table 22: Confronted by authorities		
Confronted by authorities	Number of responses	Proportion
Yes	18	51.4%
No	16	45.7%
Total	34	97.1%

If the sample is representative, then this could imply that over half of the individuals who use the forest may not know that the area is protected. This is seemingly confirmed by the ranger who reports that most of the persons who use the area are not aware of the laws prohibiting use of the Hellshire Hills. As would be expected, the majority of confrontations were with UDC rangers (see Table 23).

The primary difficulty faced in controlling illegal access to the Hellshrie Hills seems to be the lack of resources. Basic yet critical items such as binoculars are limited while strategies such as overnight staking out in the forest to prevent use are no longer allowed by the UDC. According to the ranger, overnights are not allowed because persons who cut Lignum vitae trees are usually armed and dangerous and so security is sometimes a concern. Availability of food is also a concern for the rangers

on their daily hikes. Despite the challenges, the ranger reports that patrolling the area with the aid of the police force and the soldiers has made control of illegal access less difficult. Apart from the added manpower, forest users are usually intimidated by these law enforcers and so the fear of being jailed deters some users from accessing and utilizing the area.

Table 23: Agencies which have confronted users of the Hellshire Hills forest		
Agency	Number of responses	Proportion
Forestry Department	6	35.3%
UDC Ranger	9	52.9%
Police	2	11.8%
Total	17	

The vastness of the Hellshire Hills also presents a challenge to monitoring agencies such as the UDC and the Forestry Department. According to the interviewed ranger, there are only 3 UDC rangers to patrol all of Hellshire Hills. This facilitates persons accessing the area given that it is difficult for 3 persons to comprehensively monitor the 11,400 ha of the Hellshire Hills on a 24 hour basis.

As it relates to providing alternatives to the users of Hellshire Hills, the ranger reports that forest users were invited to identify idle UDC lands which could be developed for opportunities such as farming. Once these lands were identified, the UDC would then facilitate the user in exchange for their collaboration and agreement to stop using the Hellshire Hills. In terms of sustainability, the ranger reports that his organization continues to promote tree planting initiatives in the Hellshire Hills which are necessary for the continued existence of the forest reserve.

5 CONCLUSIONS AND ECOLOGICAL IMPLICATIONS

The purpose of this study is to provide a quantitative assessment of how the Hellshire Hills forest is utilized. This analysis is a necessary step in the development of practical measures to reduce human impacts on the conservation targets for the Portland Bight Protected Area. The survey reveals several critical features of the typical user of the Hellshire Hills, the activities which such users carry out in the area, and the challenges faced by monitoring and enforcement officers in preventing such usages.

On the subject of demography, the results of this study reveal that the users of the Hellshire Hills are mainly males, most of who are in their late 30s to early 60s. The majority of users are also largely uneducated, uncertified and unskilled. As such, efforts to curtail environmentally destructive practices in this area may need to concentrate on developing viable economic alternatives which are tailored to fit the needs and capabilities of low-skill elderly individuals and which are supported by public education and awareness initiatives.

In terms of origin, the study reveals that persons travel from as far as St James, St Ann and Trelawny to use the Hellshire Hills; these distant travellers mostly harvest the *Lignum vitae* trees for the production and sale of craft items in the resort areas of Jamaica. More noteworthy however is the fact that most of the more frequent users come from communities boarding the Hellshire Hills forest. The more popular communities include Hill Run, Braeton, Half-Moon Bay, Dunbeholden and Spanish Town. This may have implications for where and to whom enforcement and education initiatives should be targeted.

A major issue highlighted by the study is the poor delineation of the forest's boundary.⁷ As long as the boundaries of the area remain uncertain, it will continue to be problematic in identifying the lands to be managed and the land-use practices to be permitted (Berke & Beatley, 1995).

A number of local residents currently use the Hellshire Hills to derive various economic benefits. As much as 79 persons may have been benefiting from the wealth of the Hellshire Hills forest over the last 12 months. The results of this study suggest that at least 27 persons still access the forest at least once per week to work. About 27 individuals obtain all or part of their income from burning charcoal and/or from harvesting firewood, pot sticks, fence posts and thatch, among other things. Of these 27

⁷ Neither the forest's general boundary (where the Hellshire Hills forest starts) nor its Reserve area (where the protected species occupy) is clearly identifiable.

persons, 6 rely entirely on the income generated from forest related activities to meet their daily needs. It is therefore important to remain conscious of the fact that tightening forest regulations may severely affect economically vulnerable individuals who are dependent on the area (especially the elderly and the unemployed). This has to however be balanced against the fact that any increased reliance on the forest will also impact the availability and species composition of the forest's plants and animals which will inevitably deteriorate overtime if forest use is not sustainable.

Wilson (2013) suggests that tree farming may be a good idea to preserve the forest since farmed trees may eventually become the only source of burnable wood. The shortcoming of the proposal is that growing trees takes time; and the better (harder) the wood, the slower the growth rate. As a result, Wilson (2013) also concedes that tree farms, albeit an attractive solution, may not represent a remedy to the immediate crisis at hand. Fortunately several of the species used for charcoal burning grow quickly and coppice easily. Further investigations of the feasibility of sustainable harvest of these species in selected areas are needed. A previous attempt by C-CAMF to establish a fuelwood plantation failed because of sabotage by cattle grazers, who perceived it as a threat (Brandon Hay, pers. comm. 2013). Another problem that will have to be overcome is that people have free access to resources in the forest reserve but would have to pay to access wood from a managed plantation.

Veen (2013) suggests that the forest holds significant potential as it relates to being developed as an ecotourism site. He proposes that current forest users could be trained as tour guides and that replanting initiatives would become incentivised by the income that a healthy dry forest would attract from the tourists who visit the area. The viability of this proposal would be subject to accessibility, demand and carrying capacity. There may, however, also be other compatible uses which have not yet been sufficiently explored, for example, honey production.

A large proportion of the sample population hunts wild pigs in the Forest Reserve. While access to the area is generally prohibited, wild pigs are invasive species. As such, rangers and conservation groups such as the JIRCG encourage their capture, whether directly or indirectly (rangers do not prevent hunters from hunting wild pigs). However hunters may use dogs, which pose a threat to iguanas and other species. The JIRCG itself maintains trap lines in the core area of Hellshire Hills to capture cats, dogs and mongooses and also captures wild pigs (UNEP, 2009)).

The removal of dead trees may appear to have minimal impacts on the forest. However, the dead trees are of ecological importance. An economic valuation⁸ of the Hellshire Hills is needed so that its exploitation can be guided by sound economic and environmental principles (Wilson, 2013). Two economic valuations have been carried out for PBPA as a whole.

Limestone quarrying, particularly around Hill Run, appears to be quite extensive. The housing developments replace forests and increase access (and thus disturbance) to adjacent areas. Efforts should be made to limit further conversion of old growth forest to quarries or housing estates. There is a need for zoning of areas suitable for such uses.

The importance of effective monitoring and enforcement cannot be emphasized enough for the Hellshire Hills Forest Reserve. While environmental laws (the Forest Act and the Wild Life Protection Act) have long been in place to protect the area from trespassers, monitoring and enforcement have traditionally been weak and inadequate. Veen (2013) argues that not enough effort is put into completely eliminating use of the protected area, either at the national or at the local levels. Veen (2013) indicates that the forest is reportedly being destroyed at an increasingly rapid rate and if the indiscriminate use is not curtailed with the urgency it deserves, it will be lost forever.

The lack of resources is cited as a major limitation to curtailing illegal access of the Hellshire Hills. The vast land space also poses a challenge for monitoring agencies. Already some users are cutting deeper into the forest because this area is harder to patrol. Effective monitoring of the approximate 11,400 ha of dry forest would require more than the 3 full-time rangers currently employed, however, the cost of employing additional rangers could be prohibitive. Additionally, consideration would also have to be given to the cost of training and equipping the rangers. The use of the police and the army to support in detecting tree cutting and coal-burning activities in the protected area is seen as positive. While these measures have strengthened monitoring and enforcement capabilities, they represent only minor improvements. Serious consideration must be given to determining the most effective methodologies (including collaborations) to facilitate monitoring and enforcement. These may even include engaging the resource user in monitoring and enforcement (see for example Berke and Beatley (1995) or Osborn (1990)).

⁸ Monetary value of ecosystem services including water and carbon storage, among other things.

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APPENDIX A: Socio-economic and Climate Change Survey Questionnaire

This survey is being conducted by the **Climate Studies Group** of the **University of the West Indies Mona** on the behalf of the **Caribbean Coastal Area Management Foundation (C-CAM)**. We seek to understand how Jamaicans benefit from the use of the Hellshire Hills and/or the Portland Ridge forests and how this use can be made more sustainable. **Your name is not required**. The survey is **voluntary** and all responses are **confidential**. The survey should take approximately **15 minutes** to be completed.

SECTION I: FOREST USE

1. How long have you been using the *Hellshire Hills or Portland Ridge* area?

1. Less than 1 year ☐
2. 1-3 years ☐
3. 4-6 years ☐

4. 7-10 years ☐
5. More than 10 years ☐
6. Other (*Specify*) _____

2. How often do you visit the area (i.e. *Hellshire Hills/Portland Ridge*)?

1. Once per week or more ☐
2. Once per month or more ☐
3. Once or twice every 2-3 months ☐

4. Once every six months ☐
5. Once every year ☐
6. Other (*Specify*) _____

3. How far into the forest do you usually go?

1. Less than 1 mile into the forest ☐
2. Between 1 and 3 miles into the forest ☐
4. Other (*Specify*) _____

3. More than 3 miles into the forest ☐
4. Close to but not inside of the forest ☐

4. From how far do you usually travel to access this forest?

1. Parish: _____ 2. Community/district: _____ 3. Distance: _____

5. How do you usually get to the *Hellshire Hills or Portland Ridge* from your home?

1. On foot/walking ☐
2. Bicycle ☐
3. Motorbike ☐

4. Car ☐
5. Boat ☐
6. Other (*Specify*) _____

7. Truck ☐
8. Small van ☐

6. Do you usually travel alone on your trips to the forest?

1. Yes ☐ 2. No ☐

a. If no, how many persons usually travel to the forest with you? _____

7. What do you mainly do in the forest? (*Identify main use with 'P' and other uses with 'S'*)

1. Collect firewood ☐
2. Burn charcoal ☐
3. Graze animals ☐
4. Bee farming ☐

6. Hunt birds ☐
7. Hunt ducks ☐
8. Hunt pigs ☐
9. Harvest fence post ☐
15. Gather craft material ☐

10. Harvest lumber ☐
11. Harvest thatch ☐
12. Harvest plants: medicinal/orchids? ☐
13. Harvest pot sticks ☐
14. Other (*Specify*) _____

5. Farming (what type of crops?) _____

8. How do you usually benefit from what you do in the forest? (*For ALL options that apply, indicate 1, 2, 3 and/or 4 on the lines provided – see key below for the meaning of these numbers*)

1. Firewood _____
2. Charcoal _____
3. Grazed animals _____
4. Honey _____
5. Crops reaped _____

6. Birds _____
7. Ducks _____
8. Pigs _____
9. Fence posts _____
10. Craft materials _____

11. Lumber _____
12. Thatch _____
13. Plants: medicinal/orchids _____
14. Pot sticks _____
15. Other (*Specify*) _____

[**Key:** 1 = sell to individual 2 = sell to company 3 = collect for someone 4 = use for own purposes]

9. When cutting trees in the forest, do you use a 1. Chain saw ☐ or 2. Machete ☐ 3. Other _____

10. When harvesting thatch in the forest, do you cut 1. Only leaves ☐ 2. Whole plants ☐

11. Why do you come to this forest and not go elsewhere?

- | | | |
|--|--|--|
| 1. Easy access <input type="checkbox"/> | 4. Near to where you live <input type="checkbox"/> | 7. Isolation (<i>privacy</i>) <input type="checkbox"/> |
| 2. Quality of trees: size/species? <input type="checkbox"/> | 5. Family tradition <input type="checkbox"/> | 8. Don't know of anywhere else <input type="checkbox"/> |
| 3. Nobody stops you from getting in <input type="checkbox"/> | 6. Other (<i>Specify</i>) _____ | |

12. Apart from *Hellshire Hills/Portland Ridge*, do you go to any other area to _____ (*activity said in Q7*)? 1. Yes ☐ 2. No ☐

a. If yes, where? _____

13. To the best of your knowledge, approximately how many individuals do you see using the *Hellshire Hills/Portland Ridge* forest to do the following activities? (*Within the last 12 months*)

- | | |
|-----------------------------------|--|
| 1. Cut trees: <i>amount</i> _____ | 3. Burn charcoal: <i>amount</i> _____ |
| 2. Hunt: <i>amount</i> _____ | 4. Other activities (<i>Specify</i>) _____ <i>amount</i> _____ |

SECTION II: LIVELIHOOD AND TRAINING

14. Is this your main livelihood (*activity highlighted in Q7*)? 1. Yes ☐ 2. No ☐

15. What other livelihoods do you have? _____

16. Do you have any formal skill, training or qualification? 1. Yes ☐ 2. No ☐

- a. If yes, in what area(s) _____
- b. Level of qualification(s) _____

17. Is there any other livelihood/activity that you would rather be doing (*compared to your main livelihood highlighted in either Q14 or Q15*)? 1. Yes ☐ 2. No ☐

a. If yes, what? _____

18. On any of your visits to this forest, have you ever been confronted or challenged by any government official (*Forestry Department, Forest Ranger, Police, etc*)? 1. Yes ☐ 2. No ☐

- a. If yes, by whom? _____
- b. How do you feel about it? _____

SECTION III: CLIMATE CHANGE

19. Are you aware of the term "Climate Change"? 1. Yes ☐ from where? _____ 2. No ☐

a. If yes, please explain your understanding of the term _____

20. In your opinion has Climate Change had any impact on the forest? 1. Yes ☐ 2. No ☐

a. If yes, how? _____

21. For the *Hellshire Hills/Portland Ridge*, have you noticed a change in any of the following:

	Increased	Decreased	No change	Comments
1. Number of large trees				
2. Type of trees available				
3. Closed forest canopy (shaded areas)				
4. New plants in the area				
5. Number of wild pigs				
6. Number of birds				
7. Daytime temperatures				
8. Night-time temperatures				
9. Amount of rainfall				
10. Availability of roots, flowers & craft materials				
11. Other (<i>Specify</i>)				

22. Is your “effort” in the forest getting harder in any way because of the change(s) you have noticed?

1. Yes ☐ 2. No ☐ 3. Not sure ☐

a. If yes, what do you think is the cause of this? _____

23. Do you think you will continue using the forest for the next five years?

1. Yes ☐ 2. No ☐

a. State why _____

SECTION IV: DEMOGRAPHY

24. To which age group do you belong?

1. Under 18 ☐ 3. 25 – 34 ☐ 5. 45 – 54 ☐ 5. 65 and over ☐
2. 18-24 ☐ 4. 35 – 44 ☐ 6. 55 – 64 ☐

25. Sex? (*observe and record*) 1. Male ☐ 2. Female ☐

26. Do you have any disabilities? 1. Yes ☐ 2. No ☐ If yes, please list _____



End of interview. Thank you for your time!



APPENDIX B: Interview with land managers/enforcement officers: the Urban Development Corporation's forest ranger

1. **Name:** Seaton Phillip
2. **How long have you been a UDC Ranger?** I have been a ranger for the UDC since 2006.
3. **What are your primary duties as a UDC Ranger?** I patrol and survey UDC lands including the protected areas of Hellshire Hills and Goat Island. We really try to detect breaches and illegal activities and report them to the area manager of the UDC. We patrol the area using motorbikes or by walking.
4. **Where are your operational sites?** Mainly Hellshire. But we also cover Hill Run, Bushy Park, Old Harbour Bay, Braeton, Greater Portmore and the Hellshire Communities.
5. **What are the main activities that you have observed taking place in Hellshire Hills while patrolling the area?** Charcoal burning and the cutting of Lignum vitae trees. Firewood is also removed from the forest and used to fry fish in Hellshire. Persons hardly cut thatch in Hellshire Hills.
6. **How do these users usually access the forest?** Donkeys are usually used to transport charcoal to Hill Run and/or Braeton where the coal is stored and later picked up. The hunters usually access the forest on foot.
7. **Who carry out these activities and where do they usually take place?** (In terms of age) the persons who use the Hellshire Hills are 35 years old up. They are all males. In terms of where the activities take place:
 - By foot, charcoal burning is done about 4 hours deep inside the Hellshire Hills. Here you can find trees such as acacia, logwood and prosopis which are popularly used as wood for making charcoal. The more popular points of entry for charcoal burners are the Hill Run end and the Hellshire end. Our frequent patrols of the area have now caused these persons to move their operations deeper inside of the forest. As evidence of this, tacks closer to the edge of the forest have now been reforested.
 - Persons who cut Lignum vitae trees to make craft items also come to this area (4 hours by foot inside of the Hellshire Hills).

- Hunting wild boars is done further into the forest, much further than where rangers can go. JIRCG also sets traps to catch these boars because they are considered invasive. Along with boars, the hunting of wild cats is encouraged to reduce their effects on the iguana population.
 - Some collection of logwood for firewood is also done deep inside of the forest. They stop using the edges of the forest because of our increase presence in the general area and also because the types of wood that they usually use are no longer there.
 - Hill Run is the most active site because it has the heaviest traffic of forest users on a day-to-day basis. This is partly because the area is relatively large and there are limited persons to effectively monitor it. There is also a road linking Hill Run to Manatee Bay and it provides access for some users who usually drive up to certain points and then branch off by foot into the forest by foot.
8. **How many quarrying companies currently operate in Hill Run?** We do not have jurisdiction over the mining companies in Hill Run, however I know of about 5 such companies there.
9. **Where do the users of the Hellshire Hills come from?**
- Persons who cut the Lignum vitae trees usually come from Ocho Rios, Trelawny, Montego Bay and other resort areas of Jamaica. Persons in resort areas employ these forest users to cut the trees or they buy them from the users by the pound. The users cut the trunks of the Lignum vitae tree and leave the rest to die. This is done irrespective of size; trees from as narrow as 3 inches in diameter to as wide as 3 feet and as tall as 11 to 20 feet in height are harvested.
 - Charcoal burners come from Hill run, Phoenix Park, Braeton and Greater Portmore.
 - Hunters come from Hill Run and Braeton.
10. **Why do they operate in the Hellshire Hills?**
- Livelihood: The lack of jobs is the main reason contributing to why people use the forest. Forest users generally have no alternative and the current economic conditions have complicated this issue.
 - Accessibility: Apart from other forests, there is nowhere else in Jamaica where you can find the vast amounts of wood for fish frying or to make charcoal as you would find in Hellshire Hills. The area is also very large place and so it's hard to monitor. Therefore availability and accessibility are major reasons why people operate here.
11. **To the best of your knowledge, how many individuals do you think are involved in the use of the Hellshire Hills?** The number of persons confronted on a day-to-day basis is in the mid

30s. We see these persons in Hellshire, Hill Run and Old Harbour Bay; they mostly burn charcoal or collect firewood.

12. What are the main difficulties that you face in trying to control illegal access of the area?

- The lack of basic resources such as binoculars from the UDC and other interested groups such as NEPA is a problem.
- We do not have enough food to carry in the Hellshire Hills on our daily patrols.

Camping out in the Hellshire Hills is not allowed because of security reasons. This means that the distances covered on any particular day will have to be doubled on the following day if the area is to be effectively monitored. The lack of food on these trips further complicates this matter.

- Persons who cut Lignum vitae trees are usually armed with guns and so security is a concern when approaching them. Users from Braeton, Hill Run and Hellshire, though they do not usually cut Lignum vitae trees, they often alert those who do whenever we are on patrol in these areas. This makes it difficult to catch the persons who cut these Lignum vitae trees.
- The vast land space prevents good and effective management. Though the Forestry Department sometimes assists, we mostly have 3 persons to patrol the entire Hellshire Hills area. We also patrol the area with the assistance of the JCF (Jamaica Constabulary Force), the ISCF (Island Special Constabulary Force) or JDF (Jamaica Defence Force) sometimes. The security forces make it less difficult to control illegal use/activities in the area because they are intimidating and this discourages the users from returning.

13. Are there any laws prohibiting access and/or use of the area? Yes, laws are in place. The wild life protection act stipulates that Hellshire Hills is a protected area and so no form of cutting tool is allowed in the area. Also, access without permission is trespassing, which is illegal.

14. Why are these rules being ignored? The majority of persons who use the forest do not know of these rules.

15. Are the users of the Hellshire Hills allowed to collect dead/fallen/dried trees? The area is protected and so they are generally not allowed to remove any tree from the area, dead or green. We do however show lenience to the users who collect dead trees, especially if this is only done on the fringes of the forest. The wood collected is inspected nonetheless.

16. Are there clearly marked boundaries separating the protected area from other areas?

There are no clearly marked boundaries of the Hellshire Hills forest. The protected zones however where the iguanas are is hillier and this distinguishes the region.

17. To the best of your knowledge, are there opportunities for alternate ways to earn a living by the individuals who use the Hellshire Hills forest? Forest users have been invited to identify idle UDC land and to propose a business (such as farming) to the UDC. The organization would then facilitate these users and their proposals in exchange for their commitment to stop using the Hellshire Hills forest.

18. Do you believe that the users of the Hellshire Hills forest can learn to use the forest in a more sustainable way? Yes. The rangers have proposed to work with these individuals and to make certain plants available, such as Lignum vitae trees, to facilitate replanting days. They have to be willing to replant these trees while at the same time leaving certain trees alone. The charcoal burners for instance do not cut Lignum vitae trees. This will be sustainable if these trees are not allowed to be cut down.

APPENDIX C: Interview with the director of the Jamaican Iguana Research and Conservation Group (JIRCG): Rick van Veen

1. **How long has the JIRCG been operating in Hellshire Hills?** We have been operating in the Hellshire Hills for over 20 years now.
2. **What are the main activities that you have observed taking place in Hellshire Hills while in the area?** The activities taking place in the Hellshire Hills are nonstop and they involve between 100 and 200 individuals. Charcoal burning is a major activity taking place deep inside the Hellshire Hills, close to its core. On our weekly (and sometimes daily) hikes towards to core iguana areas of the forest, we observe anywhere between 60 and 70 persons here regularly cutting trees with chainsaws and burning charcoal. These users not only cut the trees, but they also extract the roots of the trees sometimes. This practice completely destroys the forest as only empty rocks are left behind when they are through. A good portion of the persons who cut charcoal are either from gangs in Spanish Town or individuals wanted by law enforcers. Gangs provide them with equipments and they in return provide the gangs and themselves with income generated from the sale of charcoal and other forests related products. There are also persons who collect firewood and those who hunt wild pigs. The recent news of charcoal being exported has been followed by a significant increase in the number of kilns that we see in the forest as of late, and this is all over.
3. **Where do the users of the Hellshire Hills come from?** Charcoal burners mainly come from Portmore while those who collect firewood come from Hellshire. The persons who cut Lignum vitae trees to make craft items and chopping boards come from Montego Bay.
4. **What do you think are the main difficulties faced by the authorities in trying to control illegal access of the area?** Not enough effort is put into eliminating use of the protected area, neither from the national nor the local levels. The forest is being destroyed at an increasingly rapid rate and if this indiscriminate use is not curtailed with the urgency it deserves, it will be lost forever.
5. **Do you believe that the users of the Hellshire Hills forest can learn to use the forest in a more sustainable way?** The forest holds huge potentials as it relates to being developed as an ecotourism site. The persons who are now users could be trained as tour guides and replanting initiatives would be incentivised by the income that a healthy dry forest would attract from the tourists who visit the area.