BUFF BAY AGROTOURISM PROJECT

TECHNICAL REPORT ON THE NATURAL HISTORY OF THE BUFF BAY VALLEY

Prepared By: ANN M. HAYNES-SUTTON PH.D. (asutton@cwjamaica.com)
For: INTERNATIONAL INSTITUTE FOR COOPERATION ON AGRICULTURE
P.O. Box 349, Hope Gardens, Kingston 6, Jamaica W.I. (Iica.jm@iica.int)
Date: 18 DECEMBER 2009

Table of Contents

BACKGROUND: 4

METHODS: 4

OBJECTIVES: 4

DESCRIPTION OF THE AREA: 4

GEOLOGY 4

SOILS 6

HISTORY 7

LAND USES 8

NATURAL ECOSYSTEMS 9

Coastal and marine ecosystems 9

Freshwater ecosystems 12

Forests 18

PLANTS 25

ANIMALS 25

Mammals 25

Birds 25

Reptiles (Appendix 5) 26

Amphibians (Appendix 6) 27

Fish 27

Arthropods 33

Folklore and natural history in the Buff Bay valley 40

DESCRIPTION OF BUFF BAY ROAD AND MAJOR TRAILS 43

BUFF BAY VALLEY ROAD 43

Lower Valley 43

HOLLYWELL TO CASCADE TRAIL (via Old Tavern) 68

SAMBO HILL TRAIL 74

LANCASTER 89

RECOMMENDATIONS 96

Themes 96

Points of interest for ecotourism 96

Globally Threatened Species 100

Sensitive areas requiring special protection 100

Integrating conservation, ecotourism and agriculture in the Buff Bay Valley 101

Interpretation 101

Signage 101

Museums and interpretation centres 102

Branding 103

BIBLIOGRAPHY 105

APPENDIX 1: TERMS OF REFERENCE 110

APPENDIX 2: NOTES ON PLACE NAMES 113

APPENDIX 3: ANNOTATED LIST OF PLANTS OF THE BUFF BAY VALLEY 116

APPENDIX 4: LIST OF BIRDS FOUND IN THE BUFF BAY VALLEY..... 131
APPENDIX 5: LIST OF REPTILES RECORDED FROM THE BUFF BAY VALLEY..... 132
APPENDIX 6: LIST OF AMPHIBIANS RECORDED FROM THE BUFF BAY VALLEY.. 133

BACKGROUND:

This report was prepared as part of a contract to prepare a natural history study for the Buff Bay agro tourism project. Terms of reference are included in Appendix 1.

METHODS:

This report was prepared following a series of field visits, interviews and a literature search.

OBJECTIVES:

The objectives of this report are as follows:

- To describe the main ecological features, flora and fauna of the Buff Bay Valley
- To describe linkages between the natural history and folklore or customs in the Valley
- To develop a profile map of the Valley which indicates interesting and outstanding natural history features
- To develop ecological maps along at least three selected hiking trails and places of interest describing important flora and fauna and areas for conservation
- To make recommendations regarding the application of the natural history to branding and promotion of the Valley attractions and products
- To identify any sensitive areas or species and make recommendations for their conservation.

DESCRIPTION OF THE AREA:

The natural history of the Buff Bay valley is rich and varied – the product of its climate, geology, history, socioeconomics and cultural heritage. The following description provides an overview of the main features of the natural history of the valley. A detailed description of climate, soils and land use capabilities may be found in Camirand (2005).

GEOLOGY

The Buff Bay Valley's landforms, drainage patterns, soils and susceptibility to natural disasters are all shaped by the underlying geology. The Buff Bay valley illustrates the main phases of Jamaica's complex geological history. There are three geological zones. The lower valley (from the edge of the island shelf to Tranquility is dominated by limestone. Above Tranquility, the rocks belong to the Wagwater group, which continues to Hardwar Gap where ancient lava flows can still be seen.

Volcanic eruptions: The geological history of Jamaica started 110-65 million years ago (mya), when one or possibly two arcs of volcanic islands formed under the sea. As they erupted they spewed out huge quantities of lava and ash, which accumulated, forming a thick layer of sedimentary rocks on the sea floor. This formed the shales of the Wagwater group (including the Wagwater formation and the Richmond Formation).

First uplift: Then, 65-50 mya geological processes began to fold the rocks and force them upward, creating mountains and valleys. The only remaining active volcanoes were in the Wagwater Trough which today runs from Port Maria to Bull Bay, including the Buff Bay valley. Their remnants of the last volcanoes in Jamaica can be seen at Hardwar Gap where they are known as the Newcastle Volcanics and along the coast west of Buff Bay at Lower Layton.

Subsidence: The volcanic period finally ended about 50 mya. Over about 5 million years Jamaica sank beneath the sea, where it remained for 33 million years. Meanwhile the skeletons of marine organisms living in the shallow seas above, slowly accumulated over the ancient bedrock as a layer of white limestone up to 2,400 m thick. It was during this period that the limestone of Sambo Hill and Haycock Hill were formed.

Second Uplift: Again the process was reversed and over 10 million years (from 12 to 2 million years ago) the land was forced up out of the sea, with much folding and faulting. The results can still be seen at many places in the lower valley, where the rock strata, which were once horizontal, lie at steep angles.

Erosion: About 2 million years ago the Buff Bay River formed and eroded the limestone to form alluvial deposits along the coast.

Although these events happened many millions of years ago, they are still affecting people's lives today. The geological history accounts for the dramatic and beautiful landscape, the large number of waterfalls and springs and rich volcanic soils of the upper valley, which contrast with the poorer soils on the limestone hills to the north. The complex geological history and the many stresses and strains that the rocks suffered in the process, have resulted in an area, which is dissected by many geological faults and at risk from earthquakes. Even more immediately, the shaley loose soils combined with the high rainfall, mean that the area has a very high risk of landslides.

Landslides: The middle and upper valley are highly vulnerable to landslides, which regularly block or destroy roads and damage property. The processes that cause landslips are not well understood, but they usually occur after earthquakes or heavy rain. They are more likely to occur on steep slopes on deforested land, in places where there have been fires. It seems that sometimes an impermeable layer forms and interferes with the drainage of water through the soil. When it rains heavily, water accumulates rather than draining away, and at some point the upper layer slides over the lower causing the landslide. The upper Buff Bay valley has been

particularly badly affected by landslides – the road has been blocked for many years by a series of slides. (See also Camirand 2005).

Several geological features are of interest to visitors to the area and are described and illustrated in Part II. They include:

The **Buff Bay Wall**: The edge of the coastal shelf which is particularly close to the shore near Buff Bay, and provides spectacular diving.

The **Buff Bay beach**: The stony beaches of Buff Bay form a dramatic landscape, with interesting features including the confluence of the White and Buff Bay Rivers just before they enter the sea north of the town. To the east one can see the old volcano of Lower Layton. To the west there is a very disturbed but still important remnant of a freshwater wetland.

Charles Town escarpment: there is a dramatic limestone hill to the west of Buff Bay, which runs parallel to the river ending dramatically north of Charles Town.

Plum Valley Cave: This small cave provides important habitat for bats, but is not suitable for visiting by tourists.

Quao's Village: Exposed rocks by the river show how the limestone has been deformed.

Tranquility: looking south from milepost 38 you can see the fault line that separates the limestone from the Wagwater group rocks.

Coolshade: sedimentary rocks in the river belong to the Richmond formation, which can be distinguished by their grayish yellow colour.

Cedar Valley: Cave.

One Drop Falls: Rocks in this area belong to the Wagwater formation – which can be identified by their reddish brown colour.

Hardwar Gap: Volcanic lava flows can be seen beside the road.

SOILS

Analysis of soils was beyond the scope of the present study. However the soils of the area are of importance, because of their influence on natural vegetation and agriculture as well as for their implications for trail design and carrying capacity. Panton *et al.* (1999) examined the soils of the upper watershed in the Holywell area as well as other sites in the Blue and John Crow Mountains National Park and their implications for the design and maintenance of trails and campsites. He noted that soils tend to be slippery when wet and dusty when dry. They recommended that this meant that exposed areas beside trails and campsites should be covered with vegetation where possible. Heavily used trails should be hardened with gravel.

HISTORY

The landscape of the Buff Bay valley is the result of the interactions of people with the landscape and natural resources of the area over the centuries.

Human activities in the valley probably began with the Tainos who arrived in Jamaica c. AD 600. No Taino remains have yet been found in the Buff Bay valley but there were settlements to the west in Port Maria. Perhaps the Tainos accessed the river mouth by canoe, following the river valley inland to hunt, explore the interior and worship. Maybe they even established the first trails to cross the island through the valley – one of the shortest routes across the island.

The Spanish arrived in the island with Columbus in 1494 and the first settlers arrived in 1504. They established many ranches, mostly on the south side of the island. There was limited land suitable for their purposes, and it seems unlikely that they did more than follow any Taino trails inland for hunting and in search of gold, and other metals. Maroon traditions suggest that the Spanish mined extensively in Portland (Fenton 1981). Meanwhile the Spanish released pigs, goats, sheep, horses, donkeys and cattle on the island, and no doubt these became established and started to change the vegetation. The hunting of these animals and the preservation of the meat through "jerking" (using the native Pimento *Pimenta dioica* which was abundant in this area) was also established during this period and may have formed the basis for the economy of the area (Carey 1997). During the Spanish period the Tainos were displaced from the coastal plains and may have moved inland into the more inaccessible parts of the east of the island, where they were joined by free black people and escaped slaves.

In 1655 the British took over the island and by 1674 several large grants of land were made in the Port Antonio area but there was little flat land suitable for sugar plantations. The best lands were under the control of Maroons, who hunted wild pigs and cleared the forest to plant food crops. The killing of a white planter in Buff Bay in 1713 led to increasing pressure on the government to control the Maroons and to promote white settlement in the Port Antonio area (Carey 1997). In 1734 the English moved into Nanny Town probably the largest Maroon village in the northeast, and the Maroons scattered. This provided the conditions for increasing English settlement of the area. At first the main products were indigo and livestock but towards the end of the eighteenth century coffee became the main crop.

By the early nineteenth century this was one of the premier areas for growing coffee. Pimento was also produced in the area. Most of the native forests of the lower and middle valley had been cleared and no doubt forest remained only on the steepest and most inaccessible hillsides. In 1770 the Maroons settlement at Old Crawford Town in the Upper Swift River was moved to Charles Town, where they were allocated 200 acres including rugged limestone hillsides for their mixed agriculture.

In the 1850s the coffee industry fell into serious decline, due to poor land use practices as well as the collapse of the international market. Many coffee plantations were abandoned and grew back into forest. The first Forest Reserves were created in the upper watershed in the

1940s and some areas were replanted with plantations of pines, eucalyptus and blue mahoe. The 1980s were another period of intense deforestation, with forested lands (even within the Forest Reserves) being cleared to plant pine and then coffee. Much of the pine that was planted was destroyed by hurricanes and has not been replanted. As a result of these activities large areas were cleared and remain unproductive nearly thirty years later.

LAND USES

The Buff Bay and Pencar watersheds have been classified as among the most highly damaged in Jamaica (Camirand 2005). Land use in the BBV is summarized in Table 1, which was taken from Camirand (2005).

Table 1: Land use by area in Buff Bay Pencar watershed (Camirand 2005)

AREA BY LAND COVER TYPE AND SUB-WATERSHED [Map 1 - 1:25 000 Scale]							
Land cover types		Watershed		Sub-Watersheds (HA)			
		HA	%	Buff Bay	White	Dry	Pencar
BA	Plantation - Banana	530	2.6			275	255
BB	Bamboo (*Bambusa vulgaris*)	1676	8.3	926	92	260	399
BH	Beaches	22	0.1		19		3
BI	Buildings / Infrastructures	534	2.6	189	170	75	100
BM	Forest Plantation - Blue Mahoe	29	0.1	29			
cc	Clear cut	37	0.2	11	4	12	10
CI	Plantation - Citrus	161	0.8		17	8	135
CN	Plantation - Coconut	229	1.1	40	75	70	44
CO	Plantation - Coffee	553	2.7	553			
CP	Forest Plantation - Caribbean pine	1507	7.4	518	116	381	492
ES	Forest Plantation - Eucalyptus saligna	1	0.0	1			
FC	Fields - Food crops	3332	16.4	1255	681	725	671
FT	Fields - Fruit trees garden	1751	8.6	315	124	575	736
GL	Grassland	224	1.1	96	19	63	46
HW	Herbaceous wetland	163	0.8		89	36	38
LM	Modified Closed Broadleaf Forest - Lower Montane [< 1000 m]	7506	37.1	2309	2086	2198	913
ls	Landslides	2	0.0	1		2	
MG	Mangrove Forest	84	0.4			84	
OT	Others	4	0.0			4	
PA	Fields - Pasture	739	3.6		90	202	447
PW	Plantation - Mixed	14	0.1	14			
RF	Riparian Forest - Liable to flooding	3	0.0			3	
RP	Riparian Forest - Permanently flooded	43	0.2		43		
tb	Total burn	2	0.0				2
tw	Total windfall	23	0.1	18		5	0
UM	Modified Closed Broadleaf Forest - Upper Montane [1000-1800 m]	1009	5.0	827		102	80
WB	Water bodies	81	0.4	29	4	23	24
Total		**20258**	**100**	**7130**	**3630**	**5104**	**4395**

Lower valley: The valley is very narrow at the coast and there are few remnants of the original vegetation. The town is immediately behind the beach. There is a subdivision to the east (with a finger of wet limestone forest on the escarpment behind) and a coconut plantation to the east. There are also gardens, food forests and smallholdings and woodlands used for selective harvest of timber.

Middle valley: coffee, smallholdings, settlements, forest plantations and ruinate lands with bamboo dominate the middle valley.

Upper valley: The upper valley includes extensive coffee plantations, forest plantations, some smallholdings holiday homes, and an hotel.

NATURAL ECOSYSTEMS

Coastal and marine ecosystems

Figure 1: Coastal ecosystems and Buff Bay town

Open water: The coastal shelf is particularly narrow along the Buff Bay coast. The vertical wall on the edge supports coral reef and offers spectacular sites for scuba diving that can be reached by swimming from the beaches or by boat.

Figure 2: Buff Bay coastline looking east from the river mouth

Beach: The beach at Buff Bay seems to be a forgotten resource. Although it is pebbly, so not very inviting for swimming, it offers dramatic views to the east and west. **The options for walking along the beach and for development of beach front restaurants, bars and accommodation should be explored.** At present the abandoned buildings are not very attractive but this could easily be changed. Vegetation along the beach includes the Beach Morning Glory (*Ipomoea pes-caprae)*, Almond (*Terminalia catappa)* and Sea Grape (*Coccocloba uvifera*).

Figure 3: Buff Bay coastline looking west from the mouth of the Buff Bay River

Figure 4: Beach pebbles are varied and colourful

River mouth: The Buff Bay and White Rivers join just before they enter the sea forming shingle and mud banks that attract egrets and shorebirds. The water is clear. There are many aquatic snails (*Thiara* spp.) and juvenile fish. This point is very important for the many species of fish and invertebrates (including shrimp) that migrate between the sea and the river at various points in their life histories. There are patches of Wild Cane (*Gynerium saggitatum*). The mouth of the river is partially blocked by a berm of sand and pebbles.

Figure 5: Mouth of Buff Bay River

Freshwater ecosystems

The Buff Bay River has its origins in a large number of small springs and fast flowing headwater streams high in the mountains (Figure 6). For most of its length it flows through a narrow gorge. The riverbed widens and becomes more gravelly as the river approaches the sea. The water quality in the river is reduced by pesticide and fertilizer use in the upper watershed and by sediments generated by erosion from exposed soils. Nevertheless the river supports several species of caddisfly and several other species generally considered to indicate good water quality.

Figure 6: Hydrography of the upper watershed

Headwater streams: The headwater streams are narrow and fast flowing. They support several unique species which are specially adapted to this habitat (Boon *et al.* 1986). The vegetation of the steep banks is particularly rich and the exposed stones support dense growths of lichen.

Figure 7: Headwater stream, Lancaster

Middle reaches: In the middle reaches the river flows in a deep gorge. The original vegetation has mostly been cleared and replaced with coffee and other crops. When it rains the silt from soil erosion turns the water brown.

Figure 8: In the upper watershed the river runs in a deep gorge

In some places the riverbanks are dominated by invasive species such as bamboo.

Figure 9: Banks with Bamboo

In other places there is good forest cover along the banks. Generally vegetation is lusher and trees are larger in gullies and along stream beds.

Figure 10: Wooded banks

The combination of shallow stony riffles and deep pools provides a variety of habitats for aquatic fauna. The aquatic fauna is particularly rich in the middle reaches.

Figure 11: River above Coolshade

Waterfalls offer a specialized environment with special challenges to fauna especially migratory species.

Figure 12: Roadside falls

Lower reaches: Below Tranquility the river runs through limestone. There are several species of Caddisflies (Trichoptera) - indicating relatively good water quality, but some other indicator species including Mayflies and Stoneflies are less common than expected. Green algae grow in some of the pools, suggesting nutrient enrichment.

Figure 13: Buff Bay River near Quao's Village

Below Charles Town the river is wider. Caddisflies are less abundant.

Figure 14: Buff Bay River near Woodstock

The Buff Bay and White Rivers join just before they enter the sea. The mouth may occasionally be partially blocked by a berm created by long-shore drift.

Figure 15: Buff and White Rivers enter the sea

Forests

Forest types vary with altitude and geology. Camirand (2005) provides a summary of the dominant tree species in the Buff Bay Pencar watersheds but does not break it down according to different types of forest or natural forest versus forest plantations (Figure x). The main forest types are riverine forest (found on the river banks at low elevations), lower montane forest on limestone, upper montane forest on limestone (referred to as limestone forest in this report) and upper montane forests on shale which is applied to forests above 1000 m. Lower montane forests are classified as occurring below 1000 m, upper montane above 1000 m.

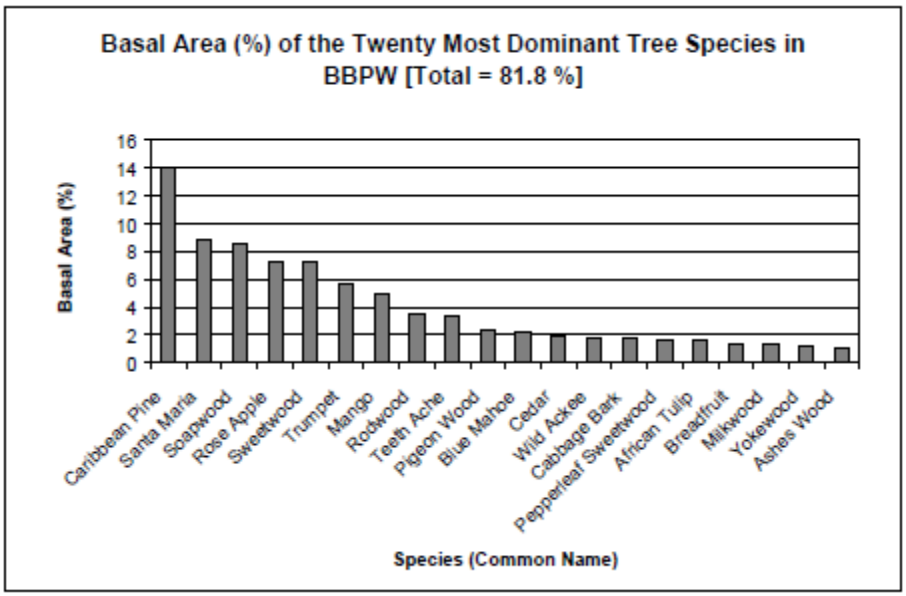

Figure 16: Basal area of dominant tree species

Riverine Forest: The flat lands surrounding the banks of the lower reaches of the river where the town of Buff Bay is now situated probably once supported riverine forest. The remnants can still be seen in the large trees that line the river, including large Guango trees (*Samanea saman)* and the attractive endemic Maccafat palm *(Acrocomia spinosa*). The river is widest at this point but still stony and fast flowing.

Figure 17: Maccafat palms at Woodstock

Limestone forests: The original vegetation of the hills of the lower and some of the middle watershed was lower and upper montane forest on limestone. Remnants of this forest can still be seen close to the town east of the Woodstock subdivision on a sharp limestone escarpment. The healthy-looking canopy provides a very attractive back drop to the town. Although this area is being selectively logged, it still supports large trees. Common trees in this area include Silk Cotton (*Ceiba pentandra),* Guango and sweetwood (*Octoea* spp.). Cedar (*Cedrella odorata)* is also present. There are many creepers and shrubs. Several species of endemic birds can be seen in the woods, including Jamaican Tody (*Todus todus)* and White-chinned Thrush (*Turdus jamaicensis*). On the west of the river the forests extend to Haycock Hill.

Figure 18: Limestone forest behind Woodstock

Figure 19: Sawmill at Woodstock

Figure 20: Cotton trees at Woodstock

Figure 21: Limestone forest behind Charles Town

To the east of the river forests appear more disturbed. The slopes of Sambo Hill have been cultivated and selectively logged. Most of the largest remaining trees are Mango trees (at least along the trail). Cotton trees are uncommon. As one ascends the trail, Royal Palms become more common. Below the summit there is an area of the introduced Roseapple. The forest at the summit resembles forests of the Cockpit Country with many endemic species (see trail description). Similar vegetation is reportedly found on the summit of Haycock Hill (G. Proctor pers. comm..).

Lower Montane forest on shale: There are few undisturbed remnants of lower montane forests on shale that once dominated the middle levels of the watershed. Most of this habitat has been converted to coffee or other crops. Bamboo tends to dominate abandoned lands, stopping natural regeneration.

Figure 22: Deforested hillside with coffee

Upper montane forest on shale: Good quality forest still persists in the upper watershed. This forest includes many endemic species of trees, shrubs, vines, orchids and bromeliads. Common species include the Soapberry (*Clethera occidentalis).* Yacca (*Podocarpus urbanus)* is a characteristic species in this habitat. Humidity and rainfall are high and many trees are draped with Old Man's Beard (Spanish Moss) (*Usnea* spp.). The ground and rocks may be covered with *Selaginella* sp., mosses or lichens. Endemic birds are abundant.

Figure 23: Upper montane forests above Cascade with cultivation in the foreground

Figure 24: Upper montane forest – the understorey.

Forest plantations: Many of the slopes have been planted with forest plantations of Caribbean Pine (*Pinus caribbea*), Eucalyptus (*Eucalyptus* spp.) and Blue Mahoe (*Hibiscus elatus).*

PLANTS

Although Jamaica has more than 3,000 native plants, of which nearly 1,000 are endemic species, many of the most familiar plants are exotic species, introduced from abroad for various reasons. This is true of the flora of the Buff Bay Valley but, perhaps surprisingly, many native and endemic species can be seen along the road margins and there is much to fascinate a botanist or indeed anyone who is interested in plants. The transition from the relatively dry plant communities on limestone in the lower valley to the wet communities on shale in the upper valley contributes to the overall diversity and interest of the area from a botanical point of view.

The plants of the area include many A list of common plants of the Buff Bay Valley with notes on their uses and folkloric properties is included in Appendix 3. This includes endemic, medicinal, horticultural plants and plants used for "spiritual" purposes (including obeah or "science"). A description of the common roadside plants is given in the section on the Buff Bay road.

ANIMALS

Mammals

The only native mammals currently present in the valley are bats. These include cave bats that roost in the Maroon/Plum Valley/Charles Town cave and probably other bats that do not roost in caves. It is possible that the Jamaican Hutia (*Geocapromys brownii)* was once present in the limestone hills but local people do not think it is still there and no sign was observed. Introduced mammals include the Small Indian Mongoose (*Herpestes javanicus),* as well as rats, mice, cats and dogs. Delano Douglas (the Maroon guide to Sambo Hill) spoke of a "Bush Rat" which lives in tree roots on the hill but is it not clear which species he meant.

Birds

The avifauna of the Buff Bay valley consists of about 90 species. A checklist of birds for the valley is included in Appendix 4. The lower and middle sections of the valley could theoretically support many of Jamaica's endemic species of birds. However, very few birds were observed during the hikes. This may be due to hunting. The upper watershed is one of Jamaica's premier birding spots and 23 of Jamaica's 28 to 30 endemic species can be seen there. Species of special interest to birders in this area include the Jamaican Blackbird Nesopsar nigerrimus, the Crested Quail Dove (*Geotrygon montana),* Ring-tailed Pigeon (*Patagioenas caribea)* and the Greater Antillean Elaenia *(Elaenia fallax).* Two birding trails are recommended – from Section to Silver Hill Gap and from Section to Newcastle. These sites offer world-class birding and are interest to all types of birders.

Figure 25: Loggerhead Kingbird

Reptiles (Appendix 5)

According to the literature (Hedges unpublished) at least 13 species of reptiles could occur in the Buff Bay Valley, many of which use habitats close to the coast (Appendix 5). Detailed assessment of the current status of these species (many of which are globally threatened) was beyond the scope of this study. Common reptiles that were observed during the field trips included (*Anolis garmani)* the large green lizard and (*Anolis opalinus).*

Figure 26: ***Anolis garmani***

Amphibians (Appendix 6)

Assessment of the status and distribution of frogs was beyond the scope of this project. Hedges (unpublished) suggests that 11 species of frog could occur in the valley. One species that depends on rocky streams has not been collected recently and could be extinct. Common species include the introduced (*Eleutherodactylus johnstoni)* and the endemic (*Eleutherodactylus pantoni).* In some places it may be possible to see the small holes in shale banks where male frogs of the species *Eleutherodactylus nubicola* guard the eggs laid by the females.

Fish

Fishermen reported that they catch Mountain Mullet (*Agonostomus monticola*), and fish they call Bullhead (*Dormitator maculatus*), Mudfish, Sandfish, Hognose and Drummer and eels (*Anguilla rostrata*) in the river. There are also mosquito fish (Ticky-ticky) (*Gambusia* spp.) and Suckstone Gobies (*Sicydium plumieri*). Fishing methods include fish traps set in dams made of stone that can take several days to construct, and fishing at night using spear guns. A list of fish recorded from Portland rivers is provided in Appendix 7. This list was derived from Aiken (1987).

Figure 27: River fish for sale in Charles Town

Figure 28: River Fish

Figure 29: River fish

Figure 30: River Fish

Figure 31: River Fish

Figure 32: River Fish

Figure 33: Dam constructed to channel fish into traps

Several of the species of fish are migratory, spending part of their life in the sea. American Eels Anguila migrate to the Sargasso Sea to breed. Mountain Mullet *Agonostomus monticola* is a catadromous species i.e. it migrates from the sea to freshwater to spawn. This migration usually corresponds to the rainy season (John et al. 2006).

Another fish that migrates up river to spawn is the Suckstone Goby.

Figure 34: Suckstone Goby

"Sicydium adults spawn in headwaters where females deposit their eggs on the substratum under supporting structures such as boulders, stones and crevices or even among vegetation. The eggs are attached to these structures with adhesive filaments. These eggs are then fertilised by the male gobies which also protect them from predation. After about two days the eggs hatch and the larvae drift downstream. Spawning occurs in every month of the year but peaks during the rainy seasons when the increased volumes of the river water carry the larvae downstream to the river mouth. It is in these brackish or marine environments that the larval and post-larval stages remain for one lunar month. At about the last quarter of the moon phase, post-larvae appear along the sea shore as they approach the river mouth. The post-larvae then metamorphose into juveniles.

Upon completing the juvenile stage the fish aggregate in large numbers and set out on the journey back to the headwater regions of their ancestors. They normally move inconspicuously below the water surface. However in areas where the channel is constricted, - such as the Great River Dam or Yallahs Fording- massive shoals of these young fish become visible as they congregate along the banks, walls and boulders. These goby juveniles have specialized pelvic discs and tails that are used to climb physical barriers, even outside of the water, in order to migrate upstream." John *et al.*, 2006

In good years in some parts of Jamaica the migration of millions of the post-larvae can be a great spectacle. People go out with containers and nets to scoop up the "fryers" which are considered a delicacy.

The American Eel is another migratory species, which is seasonally abundant in the Buff Bay River. A fisherman reported that he caught 20-40 per night in the season. Eels have a very interesting life history.

"The American Eel (*Anguilla rostrata*) is a catadromous fish, outstanding because of the scale of its migration and the morphological and physiological changes that occur during its life. *A. rostrata* is distributed across coastal areas and streams in the West Atlantic, from Canada in the north to Trinidad in the south. It occurs in Jamaica, however its specific distribution across the island is unknown (We have observed a child catching an eel in upper Rio Grande with a simple hook and line). The eel's life cycle begins with spawning Sargasso Sea in the south-west Atlantic. Sexually mature eels migrate from streams across their range for this annual mass spawning event between February and April. It is assumed that adult eels die after spawning. The first stage in the life cycle, called a leptocephalus, drifts and swims towards the continental shelf where it metamorphoses into a "glass eel" because of its transparency.

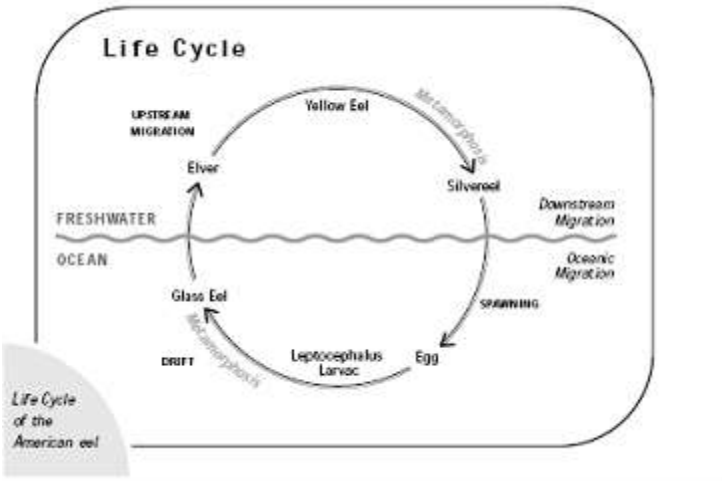

Diagram showing *A. rostrata*'s life cycle. (taken from Communications Directorate Fisheries and Oceans Canada, 2000)

Upon reaching coastal areas, glass eels become pigmented and are known as "**elvers**". Many elvers swim upstream into rivers and streams in search of less crowded or better quality habitat and replace eels that have already matured and left the river. However, a proportion of the elvers remain in estuaries. Elvers mature into adults which are called "yellow eels". *A. rostrata* may remain in freshwater ecosystems for up to 15 years before sexual maturity and embarking on the spawning migration." John *et al.* 2006.

Arthropods

Terrestrial Insects

The most commonly observed insects include butterflies, beetles, cicadas and dragonflies. This represents a tiny proportion of the undoubtedly rich insect population. Butterfly and dragonfly watching are increasing in popularity among North American and European tourists.

Butterflies and moths (Lepidoptera): Common butterflies include Zebra (*Heliconius charitonius simulator),* Chequered Skipper (*Pyrgus oileus),* Jamaican Satyra (*Calisto zangis),* various swallowtails including the Thoas (*Papilio thoas*) and various Sulphurs. A list of butterflies of the Blue and John Crow Mountains National Park with a brief description of each species was included in Panton *et al.* 1999.

Dragonflies (Odonata): In some parts of Jamaica "dragonflies are preserved in rum to prepare a lotion as a relief from their imagined stings and general aches and pains." Dragonflies prey on smaller insects such as mosquitoes which they catch on the wing (Natural History Division, 2004).

Beetles (Coleoptera): The endemic glossy flower beetle (*Macraspis tetradactyla)* feeds on flowers. Its larvae live in rotten wood (Natural History Division 1992) was found on the Lancaster trail.

Figure 35: Flower beetle

Euglossine bees (Apoidea): Bright blue irridescent Euglossine bees (which were seen on the Sambo Hill) trail are important pollinators, especially of orchids. The males have specially adapted legs which they use collect aromatic fragrances from orchids and other specially adapted flowers (including *Anthuriums*). "The chemicals are picked up using special brushes on the forelegs, transferred from there by rubbing the brushes against combs on the middle legs, and finally these combs are pressed into grooves on the dorsal edge of the hind legs, squeezing the chemicals past the waxy hairs which block the opening of the groove, and into a sponge-like cavity inside the hind tibia" (Wikipedia, 2009). The males release the fragrances to attract females in territorial courtship displays (Cameron, 2004).

Cicadas (Long-Day Crickets): The loud calls of the cicadas are an unmistakable part of the Jamaican summer at lower altitudes. Cicadas are large insects with prominent eyes and membranous front wings with thick veins. Most common species in Jamaica are brown or black. The sounds are made by males which have thin "windows on their abdomens (called timbals). To make the calls they vibrate their stomach muscles rapidly, to make the timbals resonate. The sound is amplified by the space in their large abdomens. Some species can produce up to 120 decibels – one of the loudest insect sounds in the world. The males call to attract females. They are most active during the heat of the day when the call most frequently. They also have an alarm call which they make if seized by a predator such as a bird.

Most cicadas live 2-5 years. The female lays her eggs in a twig. When they eggs hatch into flightless nymphs fall to the ground and burrow into the ground, where they stay for years, going through several moults, and feeding by sucking on plant sap, before emerging above the ground and moulting into adults with wings.

Figure 36: Shed Cicada exoskeleton

Aquatic Insects

Several insects have larval stages that are aquatic. These include dragonflies (Odonata), caddisflies (Trichoptera), mayflies and stoneflies. An abundance of larvae of caddisflies, mayflies and stoneflies is generally considered to be a bio-indicator of clean water in a stream or river. In the Buff Bay River caddisfly larvae appear abundant, with several different species, but mayflies (Ephemoptera, with three filaments or cerci on their abdomens) and stoneflies (Plecoptera, distinguished by the 2 long filaments or cerci that extend from their abdomens) are rare.

Figure 37: Caddisfly larvae (Species A)

Figure 38: Caddisfly larvae (Species B found in headwater streams)

Figure 39: Caddisfly larvae (Species C)

Crustaceans

The most common crustaceans in the Buff Bay rivers and streams are shrimps, also known as Jonga, which live under the rocks in the streams. They are popular as food and are caught by hand (or destructively and dangerously using chemicals) and stewed or used to make soup. They have an interesting life history, which includes migration (see below).

Figure 40: *Macrobrachium* sp. (Jonga)

"Macrobrachium spp. are anadromous spending most of their life cycle in freshwater streams while larval stages reside temporarily in estuarine waters. Gravid females remain in stream headwaters and release planktonic larvae which drift downstream to estuarine regions. The larval stages remain planktonic for approximately 12 weeks after which they begin to metamorphose into juveniles. The juveniles are benthic and migrate upstream into freshwater. Hunte (1980) and March *et al* (1998) noted that release and hatching of eggs and larval drift occurred during the night so as to reduce the effects of predation and hence decrease larval and juvenile mortality." John et al. 2006.

Crabs: Several species of crabs are found in the valley. The most common is the large land crab (locally known as Hard Ears Crab) (probably *Gecarcinus ruricola*), which spends its life in the forests but migrates to the sea to spawn. Each female produces up to 85,000 eggs, which hatch in the sea. The small crabs spend some time in the sea before migrating back up stream to spend their lives feeding on leaves and fallen fruits in the forests.

The endemic Jamaican Mountain Stream Crab *Sesarma bidentatum* is common in the upper reaches of the Buff Bay valley.

Figure 41: *Sesarma bidentum*

Aquatic Molluscs

Two species are very abundant. These are *Thiara granifera* and *Melanoides tuberculata* which are found in large numbers in the lower and middle reaches of the river. The latter is unusual because it is parthenogenic – unfertilized females can produce fertile eggs.

Figure 42: Thira sp.

Figure 43: Aquatic mollusk

Residents report that Bussu *(Neritina punctulata)* were once abundant in the Buff Bay river but their populations have been much reduced because of the use of pesticides on coffee in the middle and upper watershed. This species is popular as food and has an interesting life history.

"The gastropod *Neritina punctulata* is yet another migratory invertebrate present in Jamaican streams. These snails belong to the family Neritidae are quite abundant in tropical regions such as Indo-Pacific islands and the Caribbean. In the Caribbean neritids have been found in Jamaica, Dominican Republic, Dominica, Costa Rica, Guadeloupe, St. Lucia, St. Vincent and Martinique. In Jamaica *N. punctulata* has some nutritional and economic value and is traditionally harvested in northern Blue Mountain streams. However, its exploitation may be increasing with commercial harvesting in support of events such as the annual Bussu Festival held in Portland parish.

N. punctulata has a similar anadromous migratory pattern to *Sicydium* and *Macrobrachium*. The female snail lays her eggs in streams. The eggs hatch after 20-22 days and the planktonic larvae produced are carried to estuaries or the sea where they develop into juveniles for approximately one year. These juveniles then migrate back to the freshwater systems. Other observations also suggest that some neritids migrate back to freshwater ecosystems as larvae, attach to substratum and then continue their development. Several studies regarding the downstream and upstream migrations of neritid snails have been conducted. However until recently mass or gregarious migrations of snails have not been described. Schneider and Frost (1986) described the mass upstream movement of juvenile neritids in a Costa Rican stream and it would be interesting to investigate whether these kinds of migrations occur in Jamaican streams." (John *et al.* 2006).

Terrestrial Mollusks

Jamaica has a globally important heritage of biodiversity in its land snails. So far more than 561 species have been identified and 505 of these are endemic. "This is an extraordinary level of diversity for an island of only 11,500 square kilometers (about the size of Connecticut and smaller than Israel). For comparison, the United States east of the Mississippi River has only 431 native species of snails and slugs." (Rosenburg, 2005 http://clade.ansp.org/malacology/collections/jamaica/index.html) Common species in the Buff Bay valley include *Pleurodonte* spp. some of which were reportedly eaten by Tainos.

Figure 44: Land snail (*Pleurodonte* sp.)

Folklore and natural history in the Buff Bay valley

Folklore relates to natural history in several ways. These include traditional uses (e.g. herbal medicines, wild caught or harvested foods and obeah), legends or stories about places, superstitions and traditions. The folklore of the Buff Bay valley would be expected to be rich, as it draws from the folk traditions of the Maroons (who themselves incorporated both African and Taino beliefs into their traditions) as well as Jamaican's in general.

Medicinal uses and obeah

Many of the plants of the area have medicinal uses (Appendix 2). Some are specific to the area others are widespread across Jamaica. Many of the same plants that are used medicinally are also believed to have "spiritual" powers e.g. Silk Cotton trees, Leaf of Life etc. These are summarized in Appendix 3. A detailed discussion of Jamaican traditional beliefs related to folk medicine can be found in Payne-Jackson and Alleyne (2004).

Traditions about specific places

There are undoubtedly many local stories about specific locations in the valley. However a full exploration of this topic was beyond the scope of this study. No doubt many traditions will relate to Nanny and Quaw (the Silent Hunter). One story was related to me by Delano Douglas on Sambo Hill. At the summit, one of the viewpoints is called Pushover Point. According to the story, Nanny lured English soldiers up to the top of the hill by lighting a fire. When they got there they were intoxicated by the smoke (which contained special herbs) and fell or were pushed over the precipice.

Traditions about places in general

In many parts of Jamaica rivers are associated with stories about river spirits, sometimes known as River Muma or mermaids. In the valley they are known as mermaids and many stories are told about them, although people always qualify their stories by saying that they do not believe them.

Beliefs and superstitions about species

Generally in Jamaica there are many superstitions about lizards other animals and plants. One that is widespread in Jamaica is that Silk Cotton trees are associated with spiritual powers in various ways. This was reflected in special respect for a Silk Cotton tree near Charles Town.

Figure 45: Bird mural at Maroon Museum

DESCRIPTION OF BUFF BAY ROAD AND MAJOR TRAILS

BUFF BAY VALLEY ROAD

The road from Buff Bay to Section travels in a narrow gorge from sea level to more than 1000m in about 37 km (23 miles) through a range of geological formations. The landscape is spectacular and its history is fascinating.

Lower Valley

Buff Bay town

Buff Bay town is potentially full of interest for the visitor, but it needs interpretation. The history of the town, with its relationship to the Maroon "problem" and slavery, its layout, and the interesting buildings (church and courthouse) combine with some beautiful vernacular architecture, and some interesting vegetation to form the basis for an interesting walking tour. Increased awareness of the potential of the town and the need for conservation is urgently needed.

The old Royal Palm trees that used to line the street in front of the church were recently felled for no apparent reason. Judging from the size of the stumps these trees were very old, possibly as old as the church itself. Royal Palms are native to this area, but they were also planted as a symbol of colonial power. **One remains (in the courthouse garden) and this should be protected with a Tree Preservation Order**.

Figure 46: Buff Bay Tow. Note the one remaining Royal Palm. Several other venerable specimens in front of the church were felled in October 2009 – an inexplicable act of vandalism. One of the stumps can be seen in the foreground.

There is another very old tree on the main street, which also needs protection. Other trees in the town centre include ackees, mangos and almonds. Trees add considerably to the beauty of towns, and provide shade for people on foot. **The remaining trees should be protected with Tree Preservation Orders[1] and more trees planted (including replanting of the Royal Palms in front of the church.**

[1] Tree Preservation Orders can be used to protect specific trees or groups of trees. The Orders are made under the Town and Country Planning Act on the recommendation of the relevant Parish Council.

Figure 47: Old Tree in Buff Bay town needs protection

Kildare

The first settlement after the town is Kildare. On the hills to the east is the Kildare coconut plantation. Along the road are several large trees, including Guangos and Poincianas (*Delconix regia*). These add to the beauty of the area and the best specimens should be identified and protected if possible. Tree planting along the road in general should be encouraged.

Behind Kildare the Buff Bay River is at its widest, running between broad banks of shingle.

After Kildare the road narrows and there is a vertical bank on the east, with many endemic ferns and other plants. Looking west at this point there is the steep escarpment that marks the point at Craigmill where the White River enters the Buff Bay River valley.

Figure 48: Escarpment N of Charlestown. Note Royal Palm, and Guango tree in middle ground, wooded hills to the right (north) and deforested hills to the left (south).

Charles Town

Charles Town was established in 1770 as new settlement for Maroons from Old Crawford Town. In Charles Town the smallholdings on either side of the road support food forest, with bananas and plantains and many large fruit trees (including coconuts, ackee, breadfruit and citrus).

Figure 469: Food forest in Charles Town. Note dense growth of *Tillandsia recurvata* on the electricity wires

The Charles Town Cultural Complex includes a museum, which focuses on Maroon culture. The museum does not at present attempt to interpret the natural history of the area. **The possibility of expanding this aspect of the museum, with a focus on the interactions between the Maroons and nature, should be explored.**

Figure 470: Turkey Vulture in Charles Town museum

Plum Valley

As the road passes through Plum Valley there is another vertical cliff on its east, probably formed when the road was cut. This cliff supports many interesting and attractive endemic species of plants including the terrestrial bromeliad *Pitcairnia bromeliifolia*, the attractive shrubby herb Jamaican Fuschia (*Lisianthus* sp.), which has bright yellow flowers*, Pilea* spp. with their showy and attractive foliagem and many ferns. All these species have horticultural potential. Unfortunately due to the narrowness of the road it is not easy or advisable to show visitors these plants in this location.

Figure 51: Pitcairnia bromeliifolia grows by the road in Plum Valley

Maroon Cave/Plum Valley Cave/Charlestown Cave

The cave is right beside the road. There is a small entry hole with a narrow passage into a larger chamber. Up a small ladder is a larger chamber, where the bats roost. The conditions in the cave are very unpleasant. The ground is wet and covered with guano. The air is full of small flies and the walls are crawling with a huge population of American Cockroaches *Periplaneta americana*. The enclosed conditions and large bat population mean that this cave is a high risk area for *Histoplasmosis*, a serious lung disease carried by bats (Jamaica Caving Organization report, in litt.). The Jamaica Caving Organization has investigated and mapped the cave (see below). Their findings contradict the popular belief that the cave is very long and emerges in another valley. In fact it is quite short.

The old ladder in the cave suggests that guano has been mined from the cave for a long time. Maroons reportedly plan to expand guano mining from this cave to support the greenhouse operation on Sambo Hill. This would endanger the bat population. **Further work is needed to determine the species of bats, size of the bat population, and whether any native cave fauna persist in the cave.**

The bats are of great ecological importance to the ecology of the area, so it is important that the population should be protected. Therefore the Maroons should be strongly encouraged to find alternative sources of fertilizer. **All visits to the cave should be strongly discouraged both because of the high risk of infection and because of the risk of disturbing the cave fauna. However it is possible that watching the evening emergence of the bats from the cave could be a minor attraction for visitors. Careful management would be needed.**

Figure 52: Mouth of Maroon Cave. Note Lobelia, Pilea and ferns on the rocks.

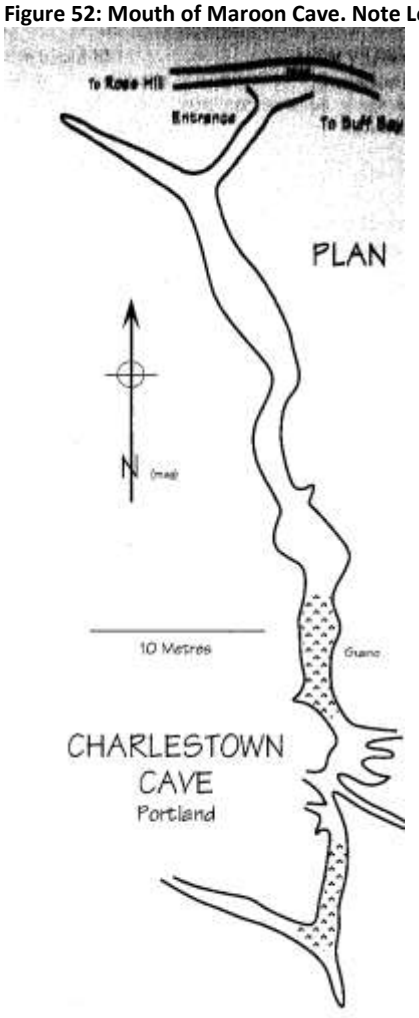

Figure 53: Map of Maroon/Charles Town Cave (Source: Fincham, 1997)

Base of the Sambo Hill Trail

The trail to Sambo Hill leaves the main road in Charles Town (see Sambo Hill Trail).

Quao's Village

The Quao's Village eatery is surrounded by a garden with several attractive large trees, including ackee, guava, mango, cedar, and wild ackee (*Cupania glabra*).

Figure 54: Garden at Quao's Village. Note large trees.

Quao's Village swimming hole and river

The river banks are fringed with large trees, including Guango. There are also patches of Wild Cane. In the river there are many fish (including Mountain Mullet, drummer, suckstone gobies and eels) (see section on fish for information on their life histories). Of special interest in this area are the methods that are used to catch fish, including using dykes to channel fish into bamboo fish traps[2]. The demonstration of this method is of potential interest to visitors. Fish are also caught at night using fish guns. Shrimps (known as jonga) are caught by hand. The riverbanks are limestone. Although limestone forms in horizontal layers as sediments accumulate on the bottom of the sea, in this area the layers are slanted at about 45 degrees, showing how much they have been deformed by the movements of the earth's crust in the area.

[2] Catching fish using traps in rivers is generally illegal under the Wildlife Protection Act unless approved traps are being used. The process of approval includes the type of trap that can be used in a specific river.

Figure 55: Riverbed below Quao's Village

Figure 56: Limestone rock at Quao's Village. Note that the layers were horizontal when they were formed and over the succeeding millennia have been pushed up by movements of the earth's crust.

Figure 57: Fish trap. Note how river stones have been used to channel the water towards the bamboo trap.

Rose Hill Travel Halt

The Rose Hill Travel halt was previously a very attractive flat area beside the river with many large shady trees. Unfortunately most of the trees have been felled. Surviving large trees include West Indian Almond, Ackee and Guango. **All remaining trees should be labeled and retained. The possibility of including an interpretational sign featuring the river ecology beside the river here or in another spot should be considered.**

Tranquility – Milepost 38

At milepost 38 the steep cliff to the south is the position of one of the geological fault lines that divides the limestone to the north and the Wagwater Formation to the south.

The milepost itself is of interest. Mileposts are relicts from the days when most people travelled on foot or by buggy. They always bear a number and a distance in miles from a major destination (in this case probably Kingston). **Care should be taken to preserve existing mileposts when roads are widened or repaired.**

Coolshade

At Coolshade it is possible to cross the river over a small bridge and go down to the water. The rocks in this area are Richmond Formation, including a variety of rocks, shales and aggregates. Large trees along the banks include large Wild Tambrin *Pithecellobium ungis-catti*,

which has bright red pods and black seeds. **There are several small bridges over the river along its length. Their design and history probably warrant further research.**

Figure 58: Richmond Formation rocks by river above Coolshade. Note highly fractured rocks and dense growth of vines on the banks that are exposed to the sun.

Balcarres – Cannon Rock: Just above Balcarres there is a steep cliff above the road known as Cannon Rock, perhaps because of the frequent rockfalls in this area.

Balcarres – Landslide:
Between Balcarres and Silver Hill is the first major landslide. **This could provide an opportunity for an interpretive sign on landslides.**

Figure 59: Landslide, Balcarres. Note that the area surrounding it was apparently deforested, which probably contributed to the problem.

River views and land use in the upper valley

Above Coolshade the river runs in a narrow gully, steep on both sides. It is fringed by large trees and bamboo. The shale banks are often in ruinate woodland. Further up on the slopes there are small and large plantations of coffee, with patches of bananas, cocoa and other crops. There are also many forest plantations including Caribbean Pine, Eucalyptus and Blue Mahoe.

Roadside Waterfalls

Along the road there are many small rivers and waterfalls that feed into the Buff Bay River far below. These are beautiful but a source of concern for the residents as in heavy rain they can block the roads.

Figure 60: Roadside falls. Note the dense vegetation and the almost block-like faulting (cracks) in the rocks.

Views to the north - Haycock Hill

As one ascends the valley the view is dominated by Haycock Hill, a limestone hill whose peak is more than 1200 m high. The upper reaches of this hill still apparently include good quality forest and the absence of roads suggests that it may be relatively undisturbed. The forest at the peak is reportedly very similar to forests of Cockpit Country (G. Proctor, pers. comm.).

Figure 48: Haycock Hill. Note that the upper slopes are well forested.

Figure 62: Calliandra is a serious threat to roadside plant diversity because it takes over very quickly. It grows out into the roads.

Views to the south

Views to the south include the forested slopes of Mount Horeb and the main ridge of the Port Royal Mountains. Catherine's Peak can be distinguished because of the communication towers on its peak.

Fish Dunn Falls at Avocat

The Fish Dunn Falls include a steep drop into a deep pools suitable for swimming. The falls are surrounded by secondary vegetation including small and large trees and a dense growth of

shrubs and vines. **This site provides another opportunity for interpretation of the ecology of the river and signage and leaflets could be provided.**

Figure 49: Fish Dunn Falls

Cedar Valley Cave

Further investigation is needed to describe this cave.

One Drop Falls

The vegetation around the falls shows signs of disturbance, with a high density of exotic species. The trail on the left passes first through a Guinea Grass patch. Grasses are not a part of the natural ecosystem in this area. Common shrubs include *Goldfussia colorata* and there are patches of Ginger Lilies and Bamboo.

Figure 50: One Drop Falls and surrounding vegetation – mostly exotic

Cascade to Section

This piece of road includes the largest landslides and major rehabilitation works are on-going to try to repair them. This corresponds to an area of shaly soils, extensive deforestation and high rainfall – all of which contribute to high risk of landslides.

Upper Montane Forest on Shale

Above Cascade the road enters the Forest Reserve and some relatively undisturbed upper montane forest on shale, with many species of native trees, heavily covered with epiphytes including bromeliads and orchids. Ferns are abundant.

Bird watching

In the forested areas birds are abundant and there is much to interest birdwatchers including many of Jamaica's endemic birds. All areas where there is forest on either or both sides of the road are good for birding, especially where there are gullies and large trees. Generally experience shows that the best birding is along the roads and there is little need to go onto the trails.

Blue Mahoe plantations

The road also passes through plantations of Blue Mahoe. These trees are large and well established and provide excellent habitat for endemic birds including the Crested Quail Dove and Ring-tailed Pigeon.

Figure 51: Blue Mahoe plantation

Yacca grove:

Figure 52: Yacca grove

A short cut to the road above Section passes through a patch of the endemic Yacca (*Podocarpus urbanus*) including large trees heavily draped with the lichens including Old Man' Beard (*Usnea* sp.).

Section to Silver Hill road

The road from Section to Silver Hill Gap is a good and convenient route for birding and many endemic bird species can be seen beside the road. The hillside above the road supports dense secondary growth of mainly native plants with some patches of pine plantation. Below the road is mostly abandoned coffee plantation - deforested with bamboo and occasional pine plantations.

Coffee

The Blue Mountain coffee grown in this area is some of the best in the world. Due to the high rainfall and frequent cloud cover, shade coffee cannot be grown in this area. However growers such as the Twymans (Old Tavern) are producing organic coffee.

Figure 53: Coffee plantation

Summer homes and Green Hills Field Station

Due to the cool climate in this area, people from Kingston have established summer homes in this area. This has provided them the opportunity to grow many exotic flowers typical of cool climates. Azaleas make a wonderful show along the roadside.

Figure 54: Garden flowers

Gullies

The largest trees and densest vegetation are found in the gullies and stream beds that cross the road. These are also the favourite haunts of the elusive Jamaican Blackbird, which can often first be detected by the sound of falling leaves, which it tosses from the bromeliads as it searches for prey such as worms and insects. There are also many endemic species some of which are showy, such as the aptly-named Hotlips.

Figure 55: Hotlips

Roadside Rocks

Rocks along the roadside provide important habitats for orchids, ferns, mosses and lichens. Some of the lichens are particularly attractive in this area (see also the section on plants).

Figure 56: Lichen growing on roadside rocks is a special feature of the very damp environment

Invasive species

Along the road from Section to Holywell the forest has been much altered as a result of clearing over the years. This has provided habitat for many invasive species to get established. Invasive species are generally species that are not native to the country and therefore have no natural predators or control mechanisms. Once they get established they stop native species re-establishing themselves. They often take over large patches of forest and thereby

significantly reduce biodiversity. Examples of invasive species along the road include three species of Wild Ginger, Net Fern (or Bracken), *Calliandra calothursus* (recently planted by Forestry Department), *Goldfussia colorata* and *Pittosporum undulatum*.

Figure 57: Invasive Wild Ginger

Figure 58: Wild Ginger. This attractive plant out-competes native species and takes over cleared areas preventing native trees from getting reestablished.

Figure 59: Invasive fern (bracken). Its chemical defences prevent other species from growing.

Figure 60: Mock Orange (*Pittosporum).* This invasive plant, spread by birds is replacing native species in the forest.

HOLLYWELL TO CASCADE TRAIL (via Old Tavern)

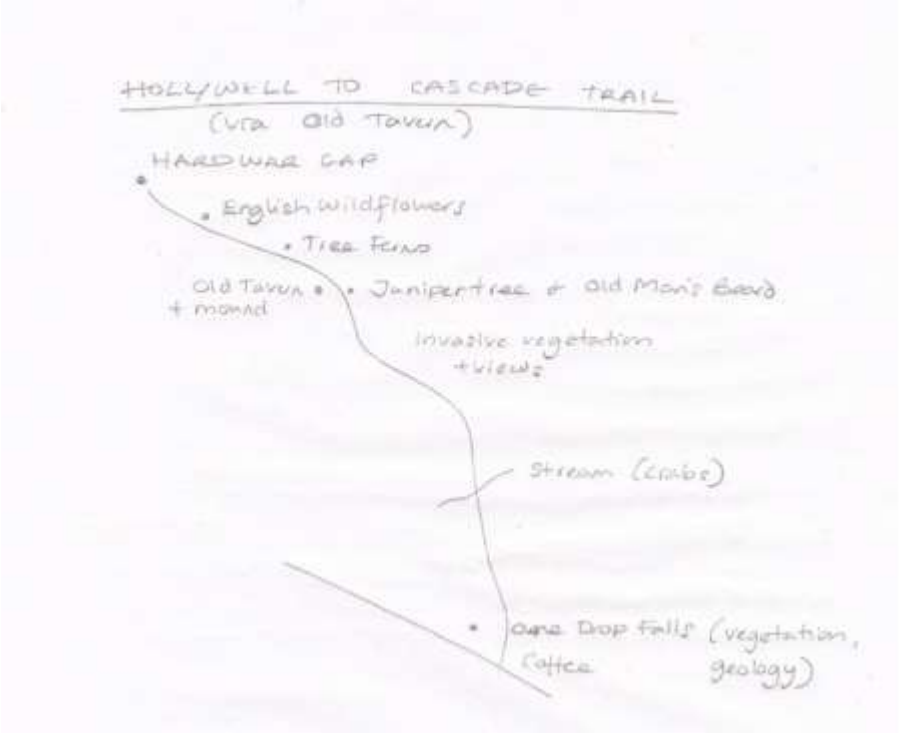

Figure 61: Map of trail showing main features

Figure 62: Hollywell gate

This trail passes through Old Tavern coffee estate, cultivation and ruinate woodland.

Figure 63: Old Tavern and mound

English wildflowers

Figure 64: White Clover

Along the trail several English wildflowers can be found including White Clover and Ribwort Plantain. Wild Strawberries may also be found. These plants arrived in Jamaica with hay that was imported to feed the horses.

Tree Ferns

Tree ferns are one of the most attractive elements of the forest in this area. Most are endemic. They tend to grow in patches in the forest where tree falls, fires or other disturbance has opened the canopy. There is a large patch of tree ferns on along this trail.

Figure 65: Tree Fern

Figure 66: Tree ferns

Figure 67: Mountain stream

Streams

The trail crosses a spring. Caddisfly larvae and also endemic crabs can be found under the rocks.

Figure 68: Sesarma bidentatum

Figure 69: Caddis

Figure 70: Trail with invasive ferns

Figure 71: Trail with Busy Lizzie (Impatience) another non-native species

The rocks close to the One Drop Falls belong to the Wagwater Formation. This includes “red to reddish brown or purple and occasionally greenish-grey conglomerates, breccias, sand stone and mudstone” (Porter et al. 1982). These dark rocks close to the falls are highly faulted.

Figure 72: Wagwater Formation rocks

SAMBO HILL TRAIL

The Sambo Hill Trail starts in Charles Town. The route goes through disturbed limestone forest up to the top of the hill, where the forest is less disturbed and similar to Cockpit Country with spectacular views in all directions. Generally the largest trees are Mangoes.

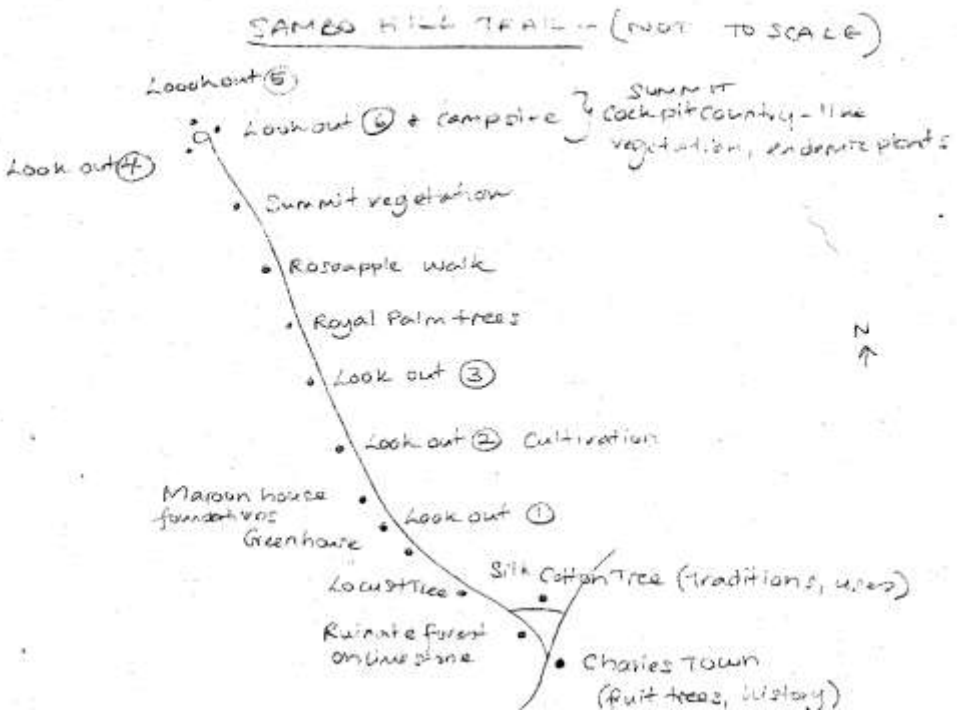

Figure 73: Map of Sambo Hill trail showing main features

The lower part of the trail passes through disturbed lower montane forest on limestone.

Figure 74: Woodland at base of trail

Sambo Hill is formed of White Limestone. In most places the limestone is highly fractured limestone.

Figure 75: Limestone rocks

A few fossils shells can be seen in rocks along the trail – a reminder that the limestone was formed under the sea.

Figure 76: Fossil shells

Traditional techniques of building dry stone walls have been used to maintain the trail.

Figure 77: Dry stone wall

The trail passes close to the greenhouses that will be used to grow vegetables once the water supply has been installed.

Figure 78: Greenhouse

Common trees along the lower trail include Red Bead Tree, Maiden Plum, Sweetwoods, cedar, mango, and pimento.

Figure 79: Viewpoint 1: Looking northeast to Orange Bay

As the trail progresses up the hill there are several view points, looking towards the coast and Hope Bay.

Figure 80: Viewpoint 2 – Looking northeast to Spanish River and Orange Bay

Figure 81: Lookout 3 - Woodland with sweetwood

Old stone foundations provide evidence of Maroon settlements.

Figure 82: Maroon house foundation – note circular shape

Yams growing throughout the forest also provide evidence of past cultivation.

Figure 83: Yam vine

Currently the main use of the area is selective harvest of timber trees and extraction of medicinal plants and craft materials.

Figure 84: Chainy root

There is also some slash and burn cultivation.

Figure 85: Plot being prepared for cultivation

Further up the trail the vegetation begins to change and there are more Royal Palms.

Figure 86: Royal Palms

Including some very large ones. The shoots of young Royal Palms are eaten – this accounts for the local name of Mountain Cabbage. The trunks are used for making drums. Leaves were once used for thatching.

Figure 87: Large Royal Palm

Higher on the trail trees are generally quite small, although a pair of mango trees known as the “Twin Sisters” are quite large.

Figure 88: On the trail

The large green lizard sometimes known as the Jamaican Venus Lizard (*Anolis garmani)* is abundant along the trail. Birds are rarer than expected, probably due to hunting.

Figure 89: green lizard

Below the summit there is an extensive area dominated by exotic invasive Roseapple trees. These trees are usually large but in this area they are small and scrubby. Cacoon vines are abundant, and the ground is scattered with the large seeds. Cacoon seeds are large and attractive. They are used to make jewelry and can be eaten.

Figure 90: Roseapple walk

Above the Roseapple walk, the vegetation changes again, with more native flora. The rock formation is also different, as it is the distinctive highly eroded sharp-edged limestone known as honeycomb rock. The forest is noticeably more diverse and the density and variety of bromeliads and orchid increases. The woodland at the summit includes many species that are also found in the Cockpit Country including the very beautiful Jamaican Poinsettia *Euphorbia punicea*, Frangipani *Plumeria* sp., a *Phyllanthus* (which lacks leaves and bears its flowers and small green fruits on the edges of flattened stems).

Figure 91: Euphorbia punicea – the Jamaican Poinsettia is an attractive small tree with outstanding horticultural potential. It produces nectar and attracts many birds.

At least three species of orchid were observed at the summit. Other epiphytes included several species of *Guzmania* (with orange bracts), *Hohenbergia* and *Tillandsia*, *Syngodium auritum*, and *Philodendron* spp..

Figure 92: Orchid[3]

[3] Photograph courtesy of Robert Kerr.

Trees included Thatch Palm (*Thrinax* sp.) which formed a thicket to the east of the peak, Rodwood (*Eugenia* sp.). There were also several herbs and climbers including *Bidens trelawniensis.*

Butterflies seen on the summit included *Papilio thoas melonius* the Jamaican Swallowtail. Red-billed Streamertail Hummingbirds and Arrow-head Warblers were also present. Tree frogs were heard during the day.

The view to the north included Orange Bay and the Spanish River Bridge.

The second lookout point has a very steep escarpment and probably corresponds with "Pushover Point" where it is said that Nanny lured troops by making a fire using herbs that so intoxicated them that when they smelled it they fell off the cliff.

The return walk followed the same route except that close to Charles Town a diversion was made to see a very large and undoubtedly old Silk Cotton tree, that is held in superstitious regard with strict instructions from the elders that it should not be felled.

LANCASTER

The road to Lancaster passes through disturbed lower montane forest over shale. The largest trees are mangoes. There are also Hog Plums and several other species of trees. The relatively open conditions along the road provides habitat for many interesting shrubs and herbs and several species of butterflies and beetles were seen.

The native anthurium *Anthurium grandifolium* can be seen along the trail.

Figure 93: Native Anthurium

There are many attractive wild flowers along the trail including *Urena lobata* a native hibiscus.

Figure 94: Urena lobata

The *Chamaecrista glandulosa* is endemic.

Figure 95: Chamaecrista glandulosa

Womanwood *Dendropanax arborea* is a common epiphyte and a good bird feeding tree.

Figure 96: Womanwood. An epiphytic tree. Its fruits are eaten by birds.

There are several species of bromeliads along the road including two species of Guzmania.

Figure 97: Guzmania sp.

There is also a white flowered form.

Figure 98: Guzamania sp.

Several butterflies were seen along the trail including common species such as the Tropical Chequered Skipper *Pyrgus oileus*

Figure 99: Chequered Skipper

The Jamaican Satyr *Calisto zangis* is the most common butterfly in the area. The false "eyes" on its wings are amazingly realistic.

Figure 100:: *Jamaican Satyr*

The Forest Reserve at Lancaster includes timber trees such as Blue Mahoe, Silky Oak and Caribbean Pine, There are also some wild trees including the Soapberry *Clethera occidentalis.* This species gets its name from its traditional use as a sudsing agent for washing.

Figure 101: Clethera occidentalis (Soapberry).

The ruins of the old house and coffee works are surrounded by ruinate woodland and forest plantation with a few large timber trees. The isolated location, and lack of light pollution in the area, suggests that this would be a very good location to do walks at night to see Jamaican Owl, moths, fireflies, sleeping birds and other wildlife species that are often forgotten.

Figure 102: Lancaster ruins

The stream running through the property is very attractive and supports larvae of several species of caddisflies as well as probably shrimps and crabs.

Figure 103: Stream

An old mango tree on the way to the ruins should be identified for conservation. It is very interesting because it supports an unusual variety of epiphytes including mosses, several

lichens, a fungus, three species of bromeliad, two species of orchid, a mistletoe, a cactus and several creepers.

Figure 104: Botany tree

RECOMMENDATIONS

In the text above, recommendations are highlighted in **bold.**

Themes

The natural history of the Buff Bay valley suggests the following themes for interpretation

- **Reef to Mountains** – landscape transitions and impacts of human activities and ecological services (including the history of coffee cultivation – social, cultural and environmental impacts in Jamaica).
- **Biodiversity and endemism**: While the valley (especially the upper valley and the summits of the various hills) are of outstanding national and global importance for many groups of animals and plants, the groups that are of most interest to visitors are birds, butterflies, dragonflies and plants (especially orchids). Of these, birds are currently the group that attracts most visitors, and most birders who visit the area visit the Newcastle-Section road. Unfortunately Jamaica is still a relatively minor destination for birders despite the fact that it has more endemic species than any other Caribbean island. There is increasing interest in butterflies and dragonflies – but so far few specialist tours are arranged to view them. Botanical tours are quite popular internationally but Jamaica does not seem to attract many of them, perhaps because there are few people who are qualified or available to lead such tours.

  Overall it seems likely that any expansion of tourism around natural history will be geared towards expanding the more general market – locals and foreigners with a general rather than specific interest. This will require good interpretation, including carefully designed signage, well trained guides and good materials as well as marketing. Some of the species are rare and vulnerable, and therefore care should be taken not to exceed carrying capacity for sensitive sites.
- **Geological history:** So far there are no places in Jamaica except the University of the West Indies campus where there are any attempts to interpret Jamaica's complex and interesting geology. The valley is rich in interesting sites.
- **Folklore and traditions**: Many people are interested in folklore, although locals may be bashful about sharing such information. Current interest in folk healing and the abundance of such traditions in the valley suggest that this could be an interesting theme for the valley.

Points of interest for ecotourism

Places of special interest for tourism are summarized in Table 3. Additional activities that have been identified as a result of the study include

- the Buff Bay coastline,
- interpretation of fishing at Quao's Village,
- the possibility of bat watching at Plum Valley Cave,
- night walks at Lancaster,
- scheduled bird or botany walks at Hollywell or Section.

Table 3: Summary of areas of special interest for ecotourism

SITE NAME	FEATURES OF INTEREST	THEME	RECOMMENDATIONS
Buff Bay Coastline	Diving and snorkeling on the wall, coastal walks and views	Biodiversity Geology	To be discussed
Buff Bay Town	Old trees	Human activities	Guided walk through town (could be combined with the above) Could the courthouse be turned into a museum?
Sambo Hill trail	Wet limestone forest Maroon ruins Herbal plants and folklore	Biodiversity Human activities Geology (fossils, different types of limestone) Folklore	Guided walk Trail markers Special conservation measures for forest at summit
Maroon Museum	Possible site for interpretation of natural history	Herbal plants and folklore Biodiversity	Discuss options for increasing coverage of natural history and folklore
Maroon/Charles Town/Plum Valley Cave	Bats, vegetation on cliffs	Biodiversity	Watching exodus of bats at dusk (to be evaluated) Guano mining and other visits to interior of cave to be strongly discouraged.
Quao's Village	Garden: Trees River: fish and fishing methods, shrimp and aquatic fauna, geology	Biodiversity Human activities Geology	Interpretation of biota of lower river, migration of aquatic animals Label trees in garden Assess feasibility and sustainability of serving fish and shrimp from river at restaurant
Rose Hill Travel Halt	Garden: Trees and plants River: Swim hole	Biodiversity Folklore	Label trees Story-telling sessions
Tranquility (milepost 38)	Geological fault line – boundary between limestone and Wagwater Formation	Geology	
Coolshade (river banks)	Aquatic biodiversity	Biodiversity Geology	Determine who owns the land? Is there public access?
Cannon Rock, Balcarres	Cliff	Geology, folklore	
Balcarres	Landslide	Geology, impacts of human activities	
Balcarres to Hollywell	Deforestation and soil erosion	Biodiversity, impacts of human activities	
Fish Dunn Falls	Waterfall	Biodiversity and folklore	
Lancaster	Campsite and trail	Biodiversity, impacts of human activities	Possible moonlight walk for biodiversity Botany tree
One Drop Falls	Waterfall	Biodiversity, geology	

SITE NAME	FEATURES OF INTEREST	THEME	RECOMMENDATIONS
Mahoe to Holywell	Bird watching, botany, vistas, coffee, invasive species	Biodiversity, human impacts, geology	Bird walks (consider a scheduled walk once a week on a Saturday/Sunday)
P*odocarpus* woodland	Botany	Biodiversity	
Mahoe Plantation	Botany	Biodiversity, human impacts	
Section to Silver Hill gap	Bird watching, upper montane forest on shale	Biodiversity, human impacts	
Hardwar Gap	Vista south to Kingston, Newcastle volanics	Biodiversity, human impacts, geology	
Old Tavern	Tree ferns, invasive plants	Biodiversity, human impacts	Trail markers

Figure 105: Map of main features of valley

Globally Threatened Species

Despite the extensive disturbance of the more accessible parts of the valley, many globally threatened species still find a refuge there. These include the Ring-tailed Pigeon *Patagioenas caribea* and Jamaican Blackbird *Nesopsar nigerrimus* (Haynes-Sutton, 2009). Hedges (undated) recommends that the majority of the amphibians and reptiles of the area should be considered as threatened. Conservation measures for these species should focus on habitat protection. It is important that all remaining patches of natural forest should be conserved intact. Some of them may need special interventions to remove or contain invasive species.

Sensitive areas requiring special protection

Natural Forests: very few areas of old growth forest remain in the valley. Therefore any area with large trees should be protected as far as possible. This is particularly important in the upper watershed. Also measures should be considered to protect forest on the banks of rivers and gullies. A minimum band of natural vegetation 50 m on either side of a watercourse is recommended. The limestone forest on the summit of Sambo Hill requires further assessment by a botanist and special recognition because of its unusual flora. Forests on Mount Horeb are also important. Other conservation measures to protect forest include not allowing any new trails to be created.

Forest plantations: There are several forest plantations on very steep slopes in the upper watershed that appear to be reaching maturity. Ideally these should not be harvested or if harvest is to be allowed no clear-cutting should be allowed. There are many areas in need of replanting. When replanting, foresters should always use native species. Exotic invasive species such as *Caliandra callothursus*, Logwood *Haemotoxylum campechianum, Erythrina* spp. and unsuitable species such as Caribbean Pine *Pinus caribea* and *Eucalyptus* spp. should never be used (*contra* Camirand 2005). The abundance of attractive and interesting plants on the roadsides and trails is one of the attractions of the area. Unfortunately this abundance is threatened by several activities. These include the Jamaican habit of digging up plants from roadsides to take home. This can be very destructive. There is also the risk of plant collectors (specially orchid collectors) removing rare plants. Vulnerable sites such as the summit of Sambo Hill may need special protection.

Caves: Human access to caves threatens bat populations. Therefore no guano mining or tourism should be allowed in bat caves.

Rivers and streams: Use of pesticides and fertilizers and bad land use practices that contribute to erosion all threaten the aquatic life of the rivers. The use of organic farming techniques or at least minimum use of agricultural chemicals is recommended. Soil conservation measures should be promoted.

Integrating conservation, ecotourism and agriculture in the Buff Bay Valley

Camirand (2005) provides a detailed analysis of the topography, soils, climate, socio-economics and status of the forests of the Buff Bay Pencar watershed. Based on this analysis he recommends that soil and water conservation should be the highest priority in these areas. He recommends the expansion of agroforestry using simple measures to enhance productivity and the chances of success. These include:

- "Tree enriched windbreaks (timber belt) or boundary to protect field crops
- Live fences for pasture
- Contour hedgerow intercropping and barrier hedges with nitrogen fixing trees
- Plantation crop combinations with mixed fruit and timber trees
- Contour hedgerow with fruit & timber trees on erosion-control structures (vegetative structures, ditch and bank)
- Mixed multi-storey tree and crop combinations (vegetative barriers, ditch-and-bank)
- Live mini-check dam construction for gully beds up to 84% slope." Camirand 2005

Most of these measures will also enhance biodiversity, especially if native species are used and exotic invasive species (especially *Calliandra callothurus*) are avoided. Other measures to enhance biodiversity include planting species that attract birds and butterflies in gardens and for landscaping. As far as possible the present project should use native species for any planting including for landscaping at attractions.

Interpretation

Signage

Signage is expected to include:

- **Information** - signs that provide essential information including names of places including all villages, directional signs, trail heads, trail markers, no entry signs where applicable, markers for points of special interest.

Figure 106: Trail marker – from a National Trust site in the UK

- **Interpretation** – signs that interpret natural history features including viewpoints and information about flora and fauna on a trail.

Figure 107: Outdoor sign – example from Rutland Water (UK)

Museums and interpretation centres

The establishment or expansion of museums and interpretation centres should be considered. Possible sites include the Buff Bay Courthouse, Charles Town Maroon Museum and at Hardwar Gap.

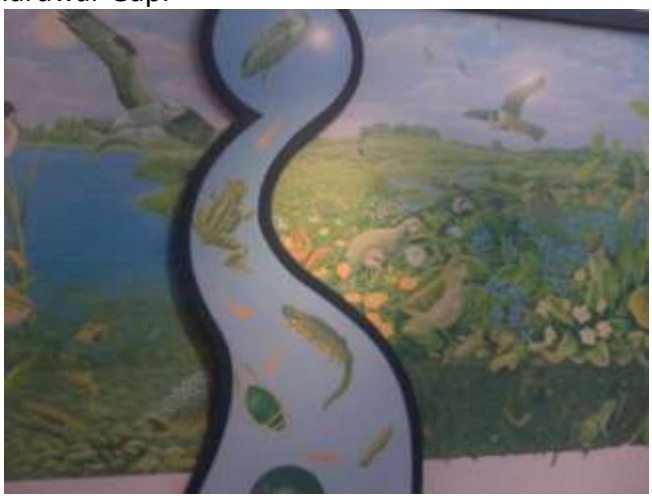

Figure 108: Indoor sign showing fauna of a river – example from Rutland Water (UK)

Materials

Some existing materials include the Natural History Society's Guide to the Blue and John Crow Mountains, and the JCDT's laminated card on endemic birds of Jamaica. The recently published photographic guide to the birds of Jamaica (Haynes-Sutton et al. 2009) is also a useful resource for visitors. The Society for the Conservation and Study of Caribbean Birds expects to publish a laminated card on the Birds of Jamaica in 2010 and this will be a very useful resource for travelers to the area. Garraway and Bailey's book "Butterflies of Jamaica" (2005) provide adequate coverage of the butterflies but a laminated card would be very useful for visitors.

This still leaves big gaps, especially for wildflowers and trees of the area, which are not well covered by existing popular books such as Warner (2004, 2009). The possibility of producing laminated cards with the common species should be considered. This might include a single card covering a few common species of plants and animals for the whole area, special cards for the major groups or cards designed for the specific trails (i.e. cards for Sambo Hill, Lancaster and Cascade to Hollywell). A booklet on the natural history of the Buff Bay valley is another possibility. This report could form the basis for such a book. A DVD on the natural history and traditions of the area would also be helpful.

The design of training materials for the guides is another issue. All the guides requested more materials especially on the plants. The pictures taken as part of this study could be collated and provided on laminated cards or DVDs. They could also be provided with copies of the field guide to birds (Haynes-Sutton *et al.* 2009).

Branding

Characteristic features of the area that could be used in branding of the area include the concept of the valley as a link from the mountains to the sea. Characteristic plants include the endemic bromeliads, especially *Pitcairnia bromeliifolia* which is abundant on the rocks of the lower and middle valley. It was not in flower during the present survey but the flowers are showy. Unfortunately the flowering season is brief.

Figure 109: Pitcairnia

Other characteristic flowers of the valley include the native begonias and heliconia. The tree fern is one of the most charismatic plants of the upper valley.

Figure 110: Tree fern

Figure 111: Oxalis - an attractive wildflower

Figure 112: Rubus rosifolius - the red fruits are delicious

BIBLIOGRAPHY

Adams, C.D. 1971. The Blue Mahoe and other bush. An introduction to plant life in Jamaica. Sangster's Bookstores, Kingston, Jamaica.

Adams, C.D. 1972. Flowering plants of Jamaica. University of the West Indies, Mona, Jamaica.

Ahmad, R. 1993. Landslide susceptibility zones of the watershed. *In:* CIDA & Forestry and Soil Conservation Department, *"Trees for Tomorrow" Project: Land Use Study. Pencar/Buff Bay Watershed Management Unit.* Ministry of Agriculture, Kingston.

Aiken, K, 1987. A brief introduction to the ecology of the freshwater fishes of some north coast rivers in Portland. Natural History Notes of the Natural History Society of Jamaica.

Aiken, K. 2004. Reproduction, diet and population structure of the mountain mullet, *Agonostomus monticola*, in Jamaica, West Indies. Environmental biology of fishes. 53 (3):347-352.

Boon, P.J, Jupp, B.P. & Lee, D.G. 1986. The benthic ecology of river in the Blue Mountains (Jamaica) prior to construction of a water regulation scheme. Arch. Hydrobiol. (Suppl. 74) 3:316-355.

Botosaneanu, L. & Stock, J.M. 1982. Les *Cyathura stygobies* (Isopoda, Anthuridae) et surtout celles des Grandes et Petit Antilles. Bijdragen tot de Dierkunde 52: 13-42.

Brown, M. and Heineman, B. 1972. Jamaica and its Butterflies. E.W. Classey, London.

Cameron, S. 2004. Phylogeny and biology of neotropical orchid bees (Euglossini). Annual Review of Entomology 49: 377-404.

Camirand, R. 2005. Water and soil conservation plan for Buff Bay Pencar Watershed Management Unit, Jamaica. Draft report prepared for Forestry Department, Ministry of Agriculture, Kingston.

Caribbean Natural Resources Institute (CANARI) 2006. Report On A Study To Evaluate Existing Incentives In The Buff Bay/ Pencar Watershed, Jamaica.

CIDA & Forestry and Soil Conservation Department. 1993. *"Trees for Tomorrow" Project: Land Use Study.*Pencar/Buff Bay Watershed Management Unit. Ministry of Agriculture, Kingston.

Fincham, A. 1997. Jamaica Underground. The Press University of the West Indies, Kingston 7, Jamaica.

Gloudon, A. & Tobisch, C. 1995. Orchids of Jamaica. The Press, University of the West Indies, Mona, Jamaica.

Hawkes, A.D. & B.C. Sutton. 1974. Wild Flowers of Jamaica. Collins and Sangster's Bookstores, Kingston, Jamaica.

Hartnoll, R.G. 1968. The freshwater grapsid crabs of Jamaica. Proceedings of the Linnean Society of London. 175 (2): 145-169.

Haynes-Sutton, A., Downer, A. & Sutton, R. 2009. A photographic guide to the Birds of Jamaica. Christopher Helm, London.

Garraway, E. & Bailey, A. 2005. Butterflies of Jamaica. Macmillan Education, Oxford, UK.

Gupta, A. 1975. Stream characteristics in eastern Jamaica: an environment of seasonal fl ow and large floods. *American Journal of Science,* **275**: 825-847.

Hodges, M. (ed). 2008. Guide to the Blue and John Crow Mountains. The Natural History Society of Jamaica, Ian Randle Publishers, Kingston, Jamaica.

Hostache, G. 1983. La vie dans les eaux douches de la Guadeloupe – poisons et crustaces. Parc National de la Guadeloupe. Guadeloupe.

Hyslop, E.J 1999. Research into the Biology of Jamaican Freshwater Macroinvertebrates and Fishes - Directions and an Overview (Abstract Only). *In* R. Robinson & H. Reichgelt (Eds) Proceedings of the Fourth Conference Faculty of Pure and Applied Science, University of the West Indies, Mona Campus, Jamaica.

Iremonger, S. 2002. A guide to plants in the Blue Mountains of Jamaica. The University of the West Indies Press, Kingston 7, Jamaica.

Kimberly J. & A. Bailey. 2006. The Aquatic Exodus**:** An Overview of Migratory Species in Jamaican Freshwater Systems. Ref.

Leiba, N.S. & Hyslop, E. The effects of a salinity gradient on benthic macroinvertebrate communities in Spanish and Buff Bay Rivers and the recovery of these organisms from major flooding and dredging events. *In* R. Robinson & H. Reichgelt (Eds) Proceedings of the Fourth Conference Faculty of Pure and Applied Science, University of the West Indies, Mona Campus, Jamaica.

MacGillivray. C.M. 2007 A Relative Potential Erosion Detection (PED) model for the upper Buff Bay catchment, parish of Portland, Jamaica: A Geographical Information System application. Scripta Geol., Spec. Issue 6 (2007).

McDonald, M.A., Healey, J.R. & Prasad, P.V. 1994. Appendix 4. An experimental investigation of the effects of forest clearance, agriculture and agroforestry on water runoff, soil conservation and sustainability. *In:* Healey, J.R. & Tanner, E.V.J. (eds.), *ODA FRP Annual Report: The Protection Role of the Jamaican Catchment Forest and their Resistance to and Recovery from the Impact of Hurricane Gilbert.* University of Wales, Bangor.

McDonald, M.A., Healey, J.R., Prasad, P.V. & Stevens, P.A. 1996. Appendix 2. The effects of forest clearance on soil and water resources and an investigation of the use of contour hedgerows for soil conservation in the Blue Mountains of Jamaica. *In:* Healey J.R., McDonald, M.A. & Prasad, P.V. (eds.), *ODA FRP Annual Report. On-Farm Research for the Development and Promotion of Improved Agroforestry Systems for Steeplands in the Caribbean.* University of Wales, Bangor.

McDonald, M.A., Riksen, M.J.P.M., Versteeg, J.W.C. & Graaf, J. de. 1993. A socio-economic survey of the farming community in the Cinchona/Westphalia district of the Blue Mountains of Jamaica. *In:* Healey, J.R. & Tanner, E.V.J. (eds.), *ODA FRP Annual Report: The Protection Role of*

the Jamaican Catchment Forest and their Resistance to and Recovery from the Impact of Hurricane Gilbert. University of Wales, Bangor.

MacGillivray. 2007. PED model, Buff Bay catchment, Jamaica. Scripta Geol., Spec. Issue 6.

McGregor, D.F.M. 1988. An investigation of soil status and landuse on a steeply sloping hillside, Jamaica. *Singapore Journal of Tropical Geography,* **9**: 60-71.

Martin, T. R., Wolf, K. & Hyslop, E. P-16 Habitat Partitioning, Diet and Radula Structure of *Neritina punctulata*, "Bussu", in Two Portland Rivers. Downloaded from

McGregor, D.F.M. 1995. Soil erosion, environmental change and development in the Caribbean: a deepening crisis? *In:* Barker, D. & McGregor, D.F.M. (eds.), *Environment and Development in the Caribbean: Geographical Perspectives:* 189-208. The Press, University of the West Indies, Mona.

McGregor, D.F.M. & Barker, D. 1991. Land degradation and hillside farming in the Fall river basin, Jamaica. *Applied Geography,* **11**: 143-156.

McGregor, D.F.M., McCoubrey, A. & Stidwell, R. 1998. Developing an index of land degradation: some Jamaican examples. *Caribbean Geography,* **9**: 137-147.

Meikle, P. 1998. Rural change and agricultural sustainability: the Rio Grande Valley Project, Portland, Jamaica. *In:* McGregor, D.F.M., Barker, D. & Lloyd Evans, S. (eds.), *Resource Sustainability and CaribbeanDevelopment:* 273-295. The Press, University of the West Indies, Mona.

Muchoney, D., Iremonger, S. & Wright, R. 1994. Rapid Ecological Assessment Blue and John Crow Mountains National Park, Jamaica. The Nature Conservancy, Arlington, VA, USA.

Natural History Division. 1992. The flower eaters (*Macraspis tetradactyla*). Jamaica Journal 24(2): 62.

Natural History Division. 2004. Dragonflies and damselflies of Jamaica. Jamaica Journal 28 (2-3): 90.

Payne-Jackson, A. & Alleyne, M. 2004. Jamaican Folk Medicine – A source of healing. University of the West Indies Press, Mona, Jamaica.

Panton, C. A., G. Gayle, and A. Thompson. 1999. Eco-tourism in the Blue and John Crow Mountains National Park of Jamaica, West Indies: Biophysical Assessment. The Research Technical Bulletin Series(T-141):8-31. North Carolina A&T State University School of Agriculture, Greensboro, NC.

Proctor, G.R. 1985. Ferns of Jamaica. British Museum (Natural History), London.

Riley, N.D. 1975. A field guide to the butterflies of the West Indies. Collins, London.

Stiling, P. 1999. Butterflies of the Caribbean and Florida. Macmillan Education, London.

Warner, M. 2004. Flowers of Jamaica. Macmillan Education, Oxford, UK.

Warner, M. 2007. Herbal Plants of Jamaica. Macmillan Education, Oxford, UK.

Wright, S. 2002. Characterization of an at-risk population in the Buff Bay watershed and existing and potential benefits from forest use. CANARI Technical Report 307.

APPENDIX 1: TERMS OF REFERENCE

TERMS OF REFERENCE
NATUAL HISTORY STUDY
BUFF BAY AGRO-TOURISM PROJECT

DR ANN HAYNES-SUTTON

Term of Contract: June 15, 2009 to July 24, 2009

Contractor: IICA Office in Jamaica

Duty Station: IICA Office located in Hope Gardens

Background

The Inter-American Institute for Cooperation on Agriculture (IICA) is commissioning a natural history study of the Buff Bay Valley in Portland to support the implementation of an Agro-Tourism Project, which is funded by the European Union-Government of Jamaica Rural Diversification and Enterprise Development in the Traditional Banana Growing Communities of Jamaica. The project will develop tourism attractions in rural communities in the Buff Bay Valley of Portland, and also establish linkages between farmers in these communities and the hotel sector. Main activities of the project include:

Assessing the places of interest, infrastructure and attitudes toward tourism in the Valley

Selecting sites that can be packages as tour attractions based on the assessment. Attractions are based on the natural environment, historical background and farming livelihood of the communities

Conducting a study of the historical background of the Valley

Constructing facilities for the attractions/ tours, such as tourist halt, bathroom facilities, clearing of trails, erecting signage

Training of community members to improve their capacity to manage the activities

Guiding and training selected groups of cottage agro-processors and craft-makers to improve their standards such that items for sale are available to visitors

Working alongside farmers to forge a marketing relationship with the hotels. This will include strengthening farmers organizations, collecting data on what and how much is being grown, reviewing crop selection and assisting with good agricultural practices

The Natural History Study

Under the guidance of the Buff Bay Agro-Tourism Project Coordinator, the Consultant will be responsible for collecting, documenting and disseminating information on the ecology of the Buff Bay Valley in particular for the sites selected for development as attractions. The Valley has a unique and

diverse ecosystem rich in endemism which needs to be documented for the purpose of conservation and sustainable use under the project. This documentation will help with carrying capacity determinations and impact management of project activities. The information gathered will be integral to the operation of attractions/ tours in the valley, providing the basis for interpretative information to visitors and branding products from the community. Given the emphasis on sustainable resource use of agro-tourism project, some emphasis on the conservation of ecologically sensitive areas of the valley is important.

Scope of Work of the Natural History Consultant

The Consultant agrees to undertake the following:

Conduct 'desk research' on the natural history of the valley

General ecological description and profile map of the Valley indicating outstanding features (based on their ecological sensitivity, uniqueness and/or aesthetic appeal)

Meet with key informants in the valley to identify unique and important elements of natural heritage of the area.

Link the natural history to other dimensions of heritage in the Valley. Of particular importance are those features that are linked to local folklore

Transfer the methodology and expertise of identifying and documenting flora and fauna to at least two (2) community members, who will act as research assistants to this consultancy

Preparation of an interpretative natural history and conservation map (along selected hiking trails and around points of interest/attractions) for use as a training manual for guides and corridor managers

Preparation of a final Report – with recommendations regarding the conservation of the areas' natural heritage and listing any outstanding features that can be used in product branding and promotion of the Valley

Document the findings in an easy-to-read, user friendly format

Present the findings of the research to community members; this should be ideally for use in an audio/visual format

Outputs of the Natural History Consultancy

Present a work plan for the study which should include:

An approach/ methodology to conducting the study

A schedule of activities

Procedures for selecting research assistants/ apprentices

A Technical Report to be used by the Project Management Unit and the Community Steering Committee. The Technical Report will include:

Documentation and description of the main ecological features and flora found throughout of the Buff Bay Valley

Linkage of natural history to folklore or customs in the Valley

Profile map of the Valley which indicates interesting and outstanding natural history features

An ecological map along at least three selected hiking trails and places of interest describing important flora and fauna and areas for conservation

Recommendations regarding the application of the natural history to branding and promotion of the Valley attractions and products

An easy-to-read summary report of the findings outlined in the Technical Report. The summary report will be geared toward community representatives

Visual presentation of the findings from the study in a manner to community representatives

At least two persons from the Buff Bay Valley trained as research assistants/ apprentices in the documentation of natural history.

Responsibilities of IICA

IICA agrees to undertake the following:

Consult with the Consultant and provide necessary information to enable the team to carry out this consultancy

Inform the community of the activities being pursued in this consultancy

Assist the consultant in identifying suitable persons to serve as research assistants

Supervision

Under the overall supervision of the IICA Representative, Dr. Ann Haynes-Sutton will report directly to the Buff Bay Valley Agro-Tourism Project Coordinator, Robert Kerr, who will act as the Institute's local supervisor.

APPENDIX 2: NOTES ON PLACE NAMES

Many place names in the Buff Bay valley, as in most of Jamaica, reflect the names of the properties into which the land was originally divided up. Some properties were named after their owners, others after the owner's properties in England or the places they came from. Others were named for significant features such as trees or fruit. Early Quakers tended to name their properties after the qualities they wished would find on their properties.

Buff Bay: The origins of this name are not known.

Kildare: Named after a place in Ireland

Charles Town: probably named after someone, but so far there is no evidence of Charles's identity

Sambo Hill: May have been named after Captain Sambo one of the "loyal black shot" - a slave who was instrumental to the British success against the Maroons in the First Maroon War.

Plum Valley: Probably named after the fruit.

Cotton Tree: Probably named after an important tree.

Rose Hill:

Tranquility: Probably a Quaker name.

Coolshade: Possibly a shady spot

Galloway: Probably named for a place in Ireland

Balcarres: Named after the Earl of Balcarres and Crawford, Governor of Jamaica 1795-1804, who owned the property (as well as Marshall's Pen, near Mandeville) and operated it as a coffee farm.

Mullet Hall: Probably named for the fish in the river.

Silver Hill: Silver deposits have been found not far away at Mount Holstein, 4 miles from Shentomee, so it is not too fanciful to think that there were (or the owners hoped there were) silver deposits on or near the property.

Fish Dunn Falls: No information is available.

Shentamee: No information is available.

Avocat: Avocat was one of the Haitian emigrees who came to Jamaica after the revolution in Haiti, bringing coffee planting technology.

Birnhamwood: Probably named after a place in eastern Scotland near Dundee (mentioned in Shakespeare's Macbeth "Birnhamwood shall come to Dunsinane" which is interesting because this refers to the Scottish warriors camouflaging themselves in vegetation in order to attack. This is the same practice used by the Maroons. Many Scots came to Jamaica to act as book keepers, overseers and gardeners on estates.

Spring Hill: Local people say there are many springs in this area.

Wakefield: Probably named after the place in England, in West Yorkshire.

Cedar Valley: Probably named after the trees.

Green Hill: Probably named for its appearance

One Drop Falls: The falls do indeed make a single, very long drop.

Cascade: Named after the waterfall.

Padhouse: Where people would store the pads for their donkeys and prepare them for the trek into the hills to harvest produce.

Hardwar Gap: There are several theories about this name. Including that it was named after a General Hardwar or that it the name derives from an Indian word for beautiful which sounds something like "haridware".

APPENDIX 3: ANNOTATED LIST OF PLANTS OF THE BUFF BAY VALLEY

FAMILY	SCIENTIFIC NAME	COMMON NAME	DISTRIBUTION	LOCALITY	TRAIL	GROWTH HABIT	NOTES
Acanthaceae	*Brillantiasia owariensis*		Introduced	Upper	Section to Holywell	Herb	
Acanthaceae	*Goldfussia glomerulata*		Introduced	Upper	Cascade to Section	Shrub	
Acanthaceae	*Ruellia tuberosa*	Duppy Gun	Native	Coastal	Buff Bay	Herb	
Acanthaceae	*Thunbergia alata*	Black-eyed Susan	Introduced		Lancaster trail	Vine	
Acanthaceae	*Thunbergia fragrans*	Nightshade			Sambo Hill trail	Vine	
Anacardiaceae	*Comocladia pinnatifolia*	Maiden Plum	Native	All	all	Tree	Noxious - many people are allergic to it
Anacardiaceae	*Mangifera indica*	Mango	Introduced	lower	all	Tree	
Anacardiaceae	*Mangifera indica*	Mango			Sambo Hill	Tree	Most of the largest trees are mangoes
Anacardiaceae	*Spondias dulcis*	June Plum			Sambo Hill	Tree	Edible fruits
Anacardiaceae	*Spondias mombin*	Hog Plum	Native		Lancaster trail	Tree	Edible fruits
Apocynaceae	*Plumeria sp.*	Frangipani	Endemic	Lower	Sambo Hill	Tree	Only on summit of Sambo Hill.
Araceae	*Anthurium cordatum*		Native		Lancaster	Herb	Road to Lancaster
Araceae	*Dieffenbachia*				Sambo Hill	Herb	Green and white garden plant
Araceae	*Philodendon schottii*				Lancaster	Vine	
Araceae	*Philodendon sp.*		Native	Coastal	Buff Bay	Vine	
Araceae	*Syngonium auritum*		Native	Coastal	Buff Bay	Vine	
Araceae	*Syngonium auritum*				Sambo Hill	Vine	
Araceae	*Syngonium auritum*				Lancaster	Vine	

FAMILY	SCIENTIFIC NAME	COMMON NAME	DISTRIBUTION	LOCALITY	TRAIL	GROWTH HABIT	NOTES
Arailaceae	*Dendropanax arboreus*	Angelica Tree, Galipee	Native		Lancaster trail	Shrub	Bird feeding tree
Arailaceae	*Dendropanax arboreus*	Woman Wood			Sambo Hill	Shrub	
Arailaceae	*Dendropanax spp.*				Sambo Hill	Epiphyte	
Arailaceae	*Schefflera alpina*	Umbrella plant	Endemic	Upper	Section to Holywell	Shrub	
Asclepidaceae	*Asclepias curassavica*	Red head	Native		Lancaster trail	Herb	
Asteraceae	*Ageratum conyzoides*		Native	Upper	Holywell to Cascade	Herb	
Asteraceae	*Bidens*	Spanish Needle			Sambo Hill	Herb	
Asteraceae	*Bidens pilosa*	Spanish Needle			Lancaster trail	Herb	
Asteraceae	*Bidens trelawniensis*		Native		Sambo Hill	Vine	Climbing vine
Asteraceae	*Conostegia montana*				Lancaster trail	Herb	
Asteraceae	*Emilia javanica*	Cupid's shaving brush	Introduced		Lancaster trail	Herb	
Asteraceae	*Erigeron karwinskianus*	Rockside Daisy	Native	Upper	Cascade to Section	Herb	
Asteraceae	*Galinsoga quadriradiata*		Native	Upper	Holywell to Cascade	Herb	
Asteraceae	*Mikania micrantha*	Quacko Bush			Sambo Hill	Vine	
Asteraceae	*Mikania micrantha*	Quacko Bush	Native	lower	Plum Valley	Vine	
Asteraceae	*Mikania micrantha*				Lancaster trail	Vine	Tea used for colds
Asteraceae	*Wedelia trilobata*	Marigold			Sambo Hill	Herb	
Asteraceae	*Wedelia trilobata*	Marygold	Native	All	all	Herb	
Begoniaceae	*Begonia glabra*		Native	Upper	Cascade to Section	Shrub	Horticultural potential
Begoniaceae	*Begonia minor*	Begonia	Endemic	Upper	Cascade to Section	Shrub	Horticultural potential
Begoniaceae	*Begonis sp.*	Begonia			Sambo Hill	Shrub	Horticultural potential
Bignoniaceae	*Catalpa longissima*	Yokewood	Native	Coastal	Buff Bay	Tree	Timber

FAMILY	SCIENTIFIC NAME	COMMON NAME	DISTRIBUTION	LOCALITY	TRAIL	GROWTH HABIT	NOTES
Bignoniaceae	*Spathodea campanulata*	African Tulip Tree	Introduced	Lower	Sambo Hill	Tree	Showy red flowers, bird feeding
Bignoniaceae	*Spathodea campanulata*	African Tulip Tree	Introduced	Lower	Buff Bay	Tree	Showy red flowers, bird feeding
Bombaceae	*Ceiba pentandra*	Silk Cotton	Native	Coastal	Buff Bay	Tree	Many superstitions. Canoes
Bombaceae	*Ceiba pentandra*	Silk Cotton			Sambo Hill	Tree	
Brassicaseae	*Nasturtium officinale*	Water Cress	Introduced	Upper	Holywell to Cascade	Herb	Salads
Bromeliaceae	*?*	Urbania?	Native		Sambo Hill	Epiphyte	
Bromeliaceae	*Guzmania*			Upper	Section to Holywell	Herb	Salads
Bromeliaceae	*Guzmania*				Sambo Hill	Epiphyte	
Bromeliaceae	*Guzmania fawcettii*		Endemic	Upper	Section to Holywell	Epiphyte	Horticultural potential
Bromeliaceae	*Hohenbergia*		Native		Lancaster trail	Epiphyte	Horticultural potential
Bromeliaceae	*Hohenbergia sp.*	Hohenbergia	Native		Sambo Hill	Epiphyte	Keystone species
Bromeliaceae	*Pitcairnia bromeliifolia*	Pitcairnia	Endemic	Lower	Sambo Hill	Epiphyte	
Bromeliaceae	*Pitcairnia bromeliifolia*		Endemic	lower	Lower Valley	Epiphyte	Horticultural potential
Bromeliaceae	*Tillandsia balbisiana*					Epiphyte	
Bromeliaceae	*Tillandsia fendleri*		Native	Upper	Section to Holywell	Epiphyte	
Bromeliaceae	*Tillandsia recurvata*		Native		Middle valley	Epiphyte	
Bromeliaceae	*Tillandsia recurvata*				Charlestown	Epiphyte	Grows on powerlines
Bromeliaceae	*Tillandsia spp.*	Tillandsia	Native		Sambo Hill	Epiphyte	3 spp +
Cactaceae	*Rhipsalis baccifera*	Mistletoe	Native		Sambo Hill trail	Epiphyte	Spiritual powers - carried in pocket as charm to bring good luck and protection from evil people
Caesalpinaceae	*Bauhinia*	Bullhoof	Native	lower	Sambo Hill	Tree	

FAMILY	SCIENTIFIC NAME	COMMON NAME	DISTRIBUTION	LOCALITY	TRAIL	GROWTH HABIT	NOTES
	divaricata						
Caesalpinaceae	*Chamaecrista glandulosa*	Broom Cassia, Jamaican Broom	Endemic?	Middle	Lancaster trail	Herb	
Campanulaceae	*Hippobroma longiflora*	Madam Fate			Sambo Hill	Tree	Roots very poisonous especially to horses
Campanulaceae	*Hippobroma longiflora*	Madame Fate	Native	lower	Plum Valley	Herb	
Campanulaceae	*Lobelia sp.*	Lobelia	Native		Plum Valley	Herb	
Campanulaceae	*Lobelia sp.*	Lobelia	Native		Holywell to Cascade	Shrub	
Campanulaceae		Lobelia			Sambo Hill	Herb	Use to cure liver spots, stain will heal wounds caused by science
Capparaceae		Capparis			Sambo Hill	Tree	
Clethraceae	*Clethera occidentalis*	Soapwood	Native	Upper	Section to Holywell	Tree	
Club Mosses	*Sphagnum sp.*				Section to Holywell	Moss	
Combretaceae	*Terminalia catapa*	Almond	Introduced	lower	Sambo Hill	Tree	
Combretaceae	*Terminalia catappa*	Almond	Introduced	Coastal	Buff Bay	Tree	
Commelinaceae	*Comellina erecta*	Water Grass	Native	all	Lancaster trail	Herb	
Commelinaceae	*Tradescantia zebrine*	Wandering Jew (Wana Dew)	Introduced	All	Sambo Hill	Herb	
Commelinaceae	*Tradescantia zebrine*		Introduced	All	Plum Valley	Herb	
Convulvulaceae	*Ipomoea*				Sambo Hill	Vine	ternata? Endemic
Convulvulaceae	*Ipomoea spp.*				all	Vine	
Crassulaceae	*Bryophyllum pinnatum*	Leaf of Life	Introduced	all	Sambo Hill	Herb	Healing - most ailments (specially colds). Spiritual - write person's name on leaf and hide it under rock and they will not prosper

FAMILY	SCIENTIFIC NAME	COMMON NAME	DISTRIBUTION	LOCALITY	TRAIL	GROWTH HABIT	NOTES
Cupressaceae	*Juniperus lucayana*	Mountain Juniper	Native	Upper	Holywell to Cascade	Tree	
Cyathaceae		Tree ferns	Native		Section to Holywell		Horticultural potential
Cyperaceae		bulrush			Sambo Hill	Sedge	
Dioscoreaceae	*Dioscorea polygonoides*	Wild Yam	Native		Sambo Hill	Vine	very common in limestone woodlands, assumed to be present
Dioscoreaceae	*Dioscorea rotundata*	White Yam			Sambo Hill	Vine	Includes Lucea, Negro and White Yams
Dioscoreaceae	*Rajania cordata*	Wild Yam	Native		Sambo Hill	Tree	locally common in limestone thickets, assumed to be present
Euphorbiaceae	*Euphorbia punicea*	Jamaican Poincettia	Endemic	Lower	Sambo Hill	Tree	
Euphorbiaceae	*Phyllanthus eximus*		Endemic		Sambo Hill	Tree	Interesting growth habit
Euphorbiaceae	*Tragia volubilis*	Cowitch	Native	Lower	Sambo Hill	Vine	
Euphorbiaceae		Spurge			Lancaster trail	Tree	
Fabacea	*Gliricidia sepium*	Quick Stick	Introduced	lower	Lower Valley	Tree	Living fence posts
Fabacea	*Moghania strobilifera*	Wild Hops	Native		Lancaster trail	Shrub	
Fern	*Adiantum spp.*	Maidenhair fern			Sambo Hill	Fern	Horticultural potential
Fern	*Dicranopteris pectinata*	Net fern/bracken	Introduced	Upper	Section to Holywell	Fern	Invasive
Gentianaceae	*Lisianthus*	Jamaica Fuscia			Sambo Hill	Shrub	
Gesnariaceae	*Achimenes erecta*	Wild Achimenes	Introduced	Upper	Section to Holywell	Herb	Horticultural potential
Gesnariaceae	*Gesnaria alpina*		Endemic	Upper	Section to Holywell	Herb	Horticultural potential
Gesnariaceae	*Rytidophylum tormentosum*	Search-me-heart	Endemic	All	all	Herb	Used to treat palpitations
Gleicheniaceae	*Dicranopteris*	Bracken, Ferril,	Introduced	Upper	Holywell to	Fern	Invasive

FAMILY	SCIENTIFIC NAME	COMMON NAME	DISTRIBUTION	LOCALITY	TRAIL	GROWTH HABIT	NOTES
	pectinata	Net fern			Cascade		
Graminae	*Bambusa vulgaris*	Bamboo	Introduced		Sambo Hill	Shrub	
Graminae	*Bambusa vulgaris*	Bamboo	Introduced	Upper	Holywell to Cascade	Shrub	
Graminae	*Gynerium sagittatum*	Wild Cane	Native		River	Grass	
Graminae	*Gynerium sagittum*	Wild Cane	Native	Riverine	Buff Bay	Grass	Tainos used it to make arrows and walls for houses
Graminae		Climbing Bamboo			Sambo Hill	Shrub	
Gramineae	*Panicum maximum*	Guinea Grass	Introduced		Sambo Hill	Grass	
Gramineae	*Pennisetum purpureum*	Napier Grass			Sambo Hill	Grass	
Guttiferae	*Clusia flava*	Tar Pot			all	Scrambler	Bird feeding
Guttiferae	*Clusia havetiodes*	Strangling Fig	Endemic	Upper	Sambo Hill	Tree	
Guttiferae	*Clusia sp.*	Tarpot			Sambo Hill	Scrambler	
Guttiferae	*Clusia sp.*		Native		Lancaster trail	Scrambler	
Iridaceae	*Trimezia martinicensis*	Butterball	Native		Lancaster trail	Herb	Horticultural potential
Lauraceae	*Ocotea sp.*	Pepper Sweetwood			Sambo Hill	Tree	
Lauraceae	*Ocotea spp.*	Sweetwood	Native	Coastal	Buff Bay	Tree	
Lauraceae	*Octea patens*	Capberry Sweetwood	Native	Upper	Cascade to Section	Tree	Timber
Legume	*Macroptilium lathyroides*		Native	Coastal	Buff Bay	Herb	
Leguminosae	*Adenanthera pavonina*	Red bead tree	Introduced	Lower-middle	Sambo Hill	Tree	Beads used to make neckaces
Lichens	*Usnea sp.*	Old Man's Beard	Native		Section to Holywell	Lichen	
Malvaceae	*Hibiscus elatus*	Blue Mahoe	Native	Middle-Upper	Middle valley	Tree	Timber mostly plantations
Malvaceae	*Hibiscus rosa sinensis*	Shoe Black	Introduced	Upper	Section to Holywell	Shrub	
Malvaceae	*Hibiscus sp.*	Shoe Black			Sambo Hill	Shrub	

FAMILY	SCIENTIFIC NAME	COMMON NAME	DISTRIBUTION	LOCALITY	TRAIL	GROWTH HABIT	NOTES
Malvaceae	*Malvaviscus arboreus*	Mahoe Rose, Sugar Bark	Native	Upper	Cascade to Section	Shrub	Horticultural potential
Malvaceae	*Sida acuta*	Broom Weed		Coastal	Buff Bay	Herb	
Malvaceae	*Sida acuta*	Broomweed			Sambo Hill	Herb	
Malvaceae	*Urena lobata*	Bur Mallow	Native		Lancaster trail	Shrub	Horticultural potential
Marcgraviaceae	*Marcgravia brownei*		Endemic	Upper	Section to Holywell	Vine	Horticultural potential
Melastomataceae	*Clidemia hirta*		Native	Upper	Section to Holywell	Herb	Horticultural potential
Melastomataceae	*Conostegia montana*		Native	Middle	Middle valley	Herb	
Melastomataceae	*Meriana purpurea*		Native	Upper	Holywell to Cascade	Shrub	Horticultural potential
Melastomataceae	*Miconia*				Sambo Hill	Shrub	
Melastomataceae	*Miconia sp.*			Upper	Cascade to Section	Shrub	
Meliaceae	*Cedrella odorata*	West Indian Cedar	Native	Coastal	Buff Bay	Tree	Timber tree, bird habitat
Meliaceae	*Cedrella odorata*	West Indian Cedar			Sambo Hill	Tree	
Mimosaceae	*Entada gigas*	Cacoon vine	Native		Sambo Hill trail	Vine	Can be eaten, used in crafts
Mimosaceae	*Mimosa pudica*	Shamy lady		Coastal	Sambo Hill	Herb	
Mimosaceae	*Pithecellobium*	Bread and cheese		Lower	Sambo Hill	Vine	
Mimosaceae	*Pithecellobium arboreum*	Wild Tambrin	Native		River	Tree	
Mimosaceae	*Pithecellobium arboreum*	Wild Tambrin	Native		Sambo Hill trail	Tree	
Mimosaceae	*Samanea saman*	Guango	Native	Lower	Buff Bay riverine	Tree	Timber
Mimosaceae	*Samanea saman*	Guango	Native		Sambo Hill	Tree	
Mimosaceae	*Samanea saman*	Guango	Native	Lower-middle	Middle valley	Tree	
Moraceae	*Artocarpus altilis*	Breadfruit	Introduced	Lower-middle	Sambo Hill	Tree	Food crop

FAMILY	SCIENTIFIC NAME	COMMON NAME	DISTRIBUTION	LOCALITY	TRAIL	GROWTH HABIT	NOTES
Moraceae	*Cecropia peltata*	Trumpet Tree	Native	Coastal	Buff Bay	Tree	Bird feeding
Moraceae	*Ficus sp.*		Native	Upper	Section to Holywell	Tree	Bird feeding
Moraceae	*Ficus spp.*		Native	All	Sambo Hill	Tree	
Moraceae		Trumpet Tree			Sambo Hill	Tree	
Myrtaceae	*Eucalyptus spp.*		Introduced	Middle	Middle valley	Tree	Timber
Myrtaceae	*Eugenia sp.*	Rodwood	Native	Upper	Cascade to Section	Tree	
Myrtaceae	*Pimenta dioica*	Pimento	Native		Sambo Hill trail	Tree	Spice
Myrtaceae	*Pimenta dioica*	Pimento			Sambo Hill	Tree	No longer harvested much, wood was cut for charcoal so trees less abundant,
Myrtaceae	*Pimenta dioica*	Pimento			Sambo Hill	Tree	
Myrtaceae	*Psidium guajava*	Guava	Native	Upper	Holywell to Cascade	Tree	Edible fruits, bird feeding
Myrtaceae	*Psidium guajava*	Guava			Sambo Hill	Tree	
Myrtaceae	*Syzygium jambos*	Roseapple	Introduced		Sambo Hill trail	Tree	Fruits eaten, bark and twigs made into baskets
Orchidaceae	*Jacquiniella teretifolia*	Moss Orchid	Native	Upper	Cascade to Section	Epiphyte	Horticultural potential
Orchidaceae		Ground orchid	Introduced		Sambo Hill	Herb	
Orchidaceae		Orchids			Sambo Hill	Herb	Various, eliphytic with small white flowers, larger brown/orange flowers
Oxalidae	*Oxalis corniculata*	Yellow Sorrel	Native		Lancaster trail	Herb	Horticultural potential
Palmae	*Acrocomia spinosa*	Maccafat	Endemic	Riverine	Buff Bay	Tree	Horticultural potential
Palmae	*Cocos nucifera*	Coconut	Introduced		Sambo Hill	Tree	
Palmae	*Cocos nucifera*	Coconut	Introduced	All	all	Tree	
Palmae	*Roystonea*	Royal Palm,	Endemic		Sambo Hill trail	Tree	Horticultural

FAMILY	SCIENTIFIC NAME	COMMON NAME	DISTRIBUTION	LOCALITY	TRAIL	GROWTH HABIT	NOTES
	altissima	Mountain Cabbage					potential
Palmae	*Roystonea altissima*	Royal Palm			Sambo Hill	Tree	Bird feeding, specially pigeons. Mountain cabbage.
Palmae	*Thrinax sp.*	Thatch Palm			Sambo Hill	Tree	Bird feeding, specially pigeons. Thatch Cabbage.
Papaveraceae	*Bocconia frutescens*	Celandine	Native	Upper	Section to Holywell	Shrub	Bird feeding
Papaveraceae	*Bocconia frutescens*	Celandine			Lancaster trail	Shrub	
Papilionaceae	*Mucona sloanei*	Horse-eye Bean	Native		Sambo Hill	Vine	Children rub dark band on wall until it get hot, then press it against skin
Papilionaceae	*Shuteria vestita*		Introduced	Upper	Section to Holywell		
Papilionaceae	*Trifolium repens*	White Clover	Introduced	Upper	Holywell to Cascade	Herb	
Passifloraceae	*Passiflora*	Passionflower			Sambo Hill	Vine	
Passifloraceae	*Passiflora ligularis*	Granaditta	Introduced		Lancaster trail	Vine	
Phytolaccaceae	*Rivinia humilis*	Bloodberry	Native	lower	Plum Valley	Herb	Used as dye or cosmetic
Piperaceae	*Piper aduncum*	Jointer	Native	Upper	Section to Holywell	Shrub	
Piperaceae	*Piper amalgo*	Jointer			Sambo Hill	Shrub	
Piperaceae	*Piper amalgo var. nigrinodum*	Black Jointer	Native	Middle	Middle valley	Shrub	
Piperaceae	*Potomorphe umbellata*		Native	Upper	Holywell to Cascade	Shrub	
Piperaceae	*Potomorphe umbellata*		Native		Lancaster trail	Shrub	
Piperaceae		Piper			Sambo Hill	Shrub	Various species
Pittosporaceae	*Pittosporum undulatum*	Mock Orange, Wild Coffee	Introduced	Upper	Section to Holywell	Tree	
Plantaginaceae	*Plantago lanceolata*	Ribwort Plantain	Introduced	Upper	Holywell to Cascade	Herb	Came with hay from UK
Plantaginaceae	*Plantago major*	English Plantain	Introduced	Upper	Holywell to	Herb	Came with hay from

FAMILY	SCIENTIFIC NAME	COMMON NAME	DISTRIBUTION	LOCALITY	TRAIL	GROWTH HABIT	NOTES
					Cascade		UK
Podocarpaceae	*Podocarpus urbanii*	Mountain Yacca	Endemic	Upper	Cascade to Section	Tree	Timber
Polemoniaceae	*Cobaea scandens*	Cathedral Bells	Introduced	Upper	Section to Holywell	Herb	Ornamental escaped
Polygonaceae	*Antigonon leptopus*	Coralita	Introduced	lower	Lower Valley	Vine	
Polygonaceae	*Coccoloba sp.*		Native		Lancaster trail	Tree	
Polygonaceae	*Coccoloba swartzii*		Native	Upper	Cascade to Section	Tree	
Polygonaceae	*Coccoloba uvifera*	Sea Grape	Native	Coastal	Buff Bay	Shrub	May be eaten, bird feeding
Polypodiaceae:Oleandroideae	*Nephrolepis multiflora*		Introduced	Upper	Holywell to Cascade	Fern	
Pteridophyta	*Polypodium sp.*	Fern	Native	Upper	Cascade to Section	Fern	
Rosaceae	*Rubus ellipticus*	Cheeseberry	Introduced	Upper	Section to Holywell	Scrambler	
Rubiaceae	*Cephaelis elata*	Hotlips	Endemic	Upper	Section to Holywell	Tree	Horticultural potential
Rubiaceae	*Eugenia spp.*	Rodwood			Sambo Hill	Tree	
Rubiaceae	*Psychotria sloanei*		Endemic	Upper	Cascade to Section	Tree	
Rubiaceae	*Randia aculeata*	Box Briar, Indigo Berry, Ink Berry	Native	Coastal	Buff Bay	Scrambler	
Rubiaceae	*Rubus jamaicensis*	Bramble	Endemic	Upper	Cascade to Section	Scrambler	Fruits edible, bird feeding
Rubiaceae	*Spermacoce assurens*	Button weed			Lancaster trail	Herb	
Rutaceae	*Citrus sp.*	Lemon	Introduced	Upper	Section to Holywell	Tree	Fruits edible, bird feeding
Rutaceae	*Citrus sp.*	Lime			Sambo Hill	Tree	
Rutaceae	*Citrus sp.*	Seville Orange			Sambo Hill	Tree	
Rutaceae	*Zanthoxylum martinicensis*	Prickly Yellow			Sambo Hill	Tree	Timber, bird feeding
Rutaceae	*Zanthoxylum martinicensis*	Prickly Yellow			Sambo Hill trail	Tree	

FAMILY	SCIENTIFIC NAME	COMMON NAME	DISTRIBUTION	LOCALITY	TRAIL	GROWTH HABIT	NOTES
Sapidaceae	*Allophylus sp.*	Three in one			Sambo Hill	Tree	
Sapindaceae	*Blighia sapida*	Ackee		lower	Sambo Hill	Tree	Edible fruits, bird feeding
Sapindaceae	*Blighia sapidum*	Ackee	Introduced	Lower	all	Tree	
Sapindaceae	*Cupania glabra*	Wild Ackee			Sambo Hill	Tree	Bird feeding
Scrophulariaceae	*Calceolaria chelidoniodes*	Yellow Slipper Flower	Introduced	Upper	Section to Holywell	Herb	Ornamental escaped
Simaroubaceae	*Simarouba glauca*	Bitter Damsel	Native	Lower	Sambo Hill trail	Tree	Timber
Smilaceae	*Smilax balbisiana*	Chainy Root	Native		Sambo Hill trail	Vine	Used in Roots tonic
Solanacea	*Solanum torvum*	Susumber			Lancaster trail	Shrub	Food, bird feeding
Solanaceae	*Browallia americana*	Jamaican Forget-me-not	Native	Upper	Holywell to Cascade	Herb	Horticultural potential
Solanaceae	*Cyphomandra betacea*	Tree Tomato	Introduced	Upper	Section to Holywell	Tree	Edible fruits
Solanaceae	*Solanum torvum*	Susumber	Native	Upper	Section to Holywell	Shrub	Edible fruits, bird feeding
Sterculiaceae	*Theobroma excelsa*	Cocoa	Introduced	Middle	Middle valley	Tree	
Strelitziaceae	*Heliconia*	Wild Banana	Native		River	Shrub	
Strelitziaceae	*Heliconia caribaea*	Wild Plantain	Native	Upper	Cascade to Section	Herb	Horticultural potential
Tropaeolaceae	*Tropaeolum najus*	Nasturtium	Introduced	Upper	Holywell to Cascade	Herb	
Turneraceae	*Turnera ulmifolia*	Ramgoat Dashalong	Native	lower	Lower Valley	Herb	Horticultural potential, natural Viagra
Turneraceae	*Turnera ulmifolia*	Ramgoat Dashalong			Sambo Hill	Herb	
Ulmanceae	*Trema floridinum*		Native	Upper	Cascade to Section	Shrub	
Urticaceae	*Pilea microphylla v. microphylla*	Baby puzzle, Lace plant	Native	Upper	Holywell to Cascade	Herb	Horticultural potential
Urticaceae	*Pilea sp.*				Sambo Hill	Herb	White flowers
Verbenaceae	*Duranta erecta*	Angel's Whisper, Poison Macca	Native	Upper	Cascade to Section	Shrub	Horticultural potential
Verbenaceae	*Lantana trifolia*		Native	Upper	Section to	Herb	Horticultural

FAMILY	SCIENTIFIC NAME	COMMON NAME	DISTRIBUTION	LOCALITY	TRAIL	GROWTH HABIT	NOTES
					Holywell		potential
Verbenaceae	*Stachytarpheta jamaicensis*		Native	All	Sambo Hill trail	Herb	Horticultural potential
Verbenaceae	*Verbena bonairensis*			Upper	Section to Holywell	Herb	
Viscaceae	*Cissus microcarpa*	Wall Saddle			Sambo Hill	Vine	
Viscaceae	*Dendrophthora opuntiodes*	Scorny Ground	Endemic	Upper	Section to Holywell	Parasite	Bird feeding
Zingiberaceae	*Hedychium coronarium*	White Ginger Lily	Introduced	Upper	Cascade to Section	Herb	Ornamental, escaped
Zingiberaceae		Orange Ginger	Introduced	Upper	Section to Holywell	Herb	Ornamental, escaped

APPENDIX 4: LIST OF BIRDS OF THE BUFF BAY VALLEY (information from Haynes-Sutton et al., 2009)

FAMILY	SCIENTIFIC NAME	COMMON NAME
ARDEIDAE		
	Ardea herodias occidentalis	Great Blue Heron
	Ardea alba egretta	Great Egret
	Egretta thula brewsteri	Snowy Egret
	Egretta caerulea	Little Blue Heron
	Egretta tricolor ruficollis	Tricolored Heron
	Bubulcus ibis ibis	Cattle Egret
	Butorides virescens virescens	Green Heron
	Nycticorax nycticorax bancrofti	Black-crowned Night-Heron
CATHARTIDAE		
	Cathartes aura aura	Turkey Vulture
FALCONIFORMES		
ACCIPITRIDAE		
	Buteo jamaicensis jamaicensis	Red-tailed Hawk
FALCONIDAE		
	Falco sparverius	American Kestrel
SCOLOPACIDAE		
	Actitis macularius solitaria	Spotted Sandpiper
	Tringa melanoleuca	Greater Yellowlegs
	Tringa flavipes	Lesser Yellowlegs
LARIDAE		
	Thalasseus maximus maximus	Royal Tern
COLUMBIDAE		
	Patagioenas leucocephala	White-crowned Pigeon
	Patagioenas inornata exigua	Plain Pigeon
	Patagioenas caribaea	Ring-tailed Pigeon
	Zenaida asiatica asiatica	White-winged Dove
	Zenaida aurita aurita	Zenaida Dove
	Columbina passerine jamaicensis	Common Ground-Dove
	Leptotila jamaicensis jamaicensis	Caribbean Dove
	Geotrygon versicolor	Crested Quail-Dove
	Geotrygon montana montana	Ruddy Quail-Dove
PSITTACIDAE		
	Aratinga nana nana	Olive-throated Parakeet
CUCULIDAE		

FAMILY	SCIENTIFIC NAME	COMMON NAME
	Coccyzus pluvialis	Chestnut-bellied Cuckoo
	Coccyzus vetula	Jamaican Lizard-Cuckoo
	Crotophaga ani	Smooth-billed Ani
TYTONIDAE		
	Tyto alba furcata	Barn Owl
STRIGIDAE		
	Pseudoscops grammicus	Jamaican Owl
CAPRIMULGIDAE		
	Chordeiles gundlachii gundlachii	Antillean Nighthawk
NYCTIBIIDAE		
	Nyctibius jamaicensis jamaicensis	Northern Potoo
APODIDAE		
	Cypseloides niger niger	Black Swift
	Streptoprocne zonaris pallidifrons	White-collared Swift
	Tachornis phoenicobia	Antillean Palm-Swift
TROCHILIDAE		
	Anthracothorax mango	Jamaican Mango
	Trochilus polytmus	Red-billed Streamertail
	Mellisuga minima minima	Vervain Hummingbird
TODIDAE		
	Todus todus	Jamaican Tody
ALCEDINIDAE		
	Ceryle alcyon	Belted Kingfisher
PICIDAE		
	Melanerpes radiolatus	Jamaican Woodpecker
	Sphyrapicus varius	Yellow-bellied Sapsucker
TYRANNIDAE		
	Myiopagis cotta	Jamaican Elaenia
	Elaenia fallax fallax	Greater Antillean Elaenia
	Contopus pallidus	Jamaican Pewee
	Myiarchus barbirostris	Sad Flycatcher
	Myiarchus validus	Rufous-tailed Flycatcher
	Myiarchus stolidus stolidus	Stolid Flycatcher
	Tyrannus dominicensis dominicensis	Gray Kingbird
	Tyrannus caudifasciatus jamaicensis	Loggerhead Kingbird
	Pachyramphus niger	Jamaican Becard

FAMILY	SCIENTIFIC NAME	COMMON NAME
VIREONIDAE		
	Vireo modestus	Jamaican Vireo
	Vireo osburni	Blue Mountain Vireo
	Vireo altiloquus altiloquus	Black-whiskered Vireo
HIRUNDINIDAE		
	Hirundo (Petrochelidon) fulva poeciloma	Cave Swallow
	Hirundo rustica erythrogaster	Barn Swallow
TURDIDAE		
	Myadestes genibarbis solitarius	Rufous-throated Solitaire
	Catharus bicknelli	Bicknell's Thrush
	Catharus ustulatus swainsoni	Swainson's Thrush
	Turdus jamaicensis	White-eyed Thrush
	Turdus aurantius	White-chinned Thrush
MIMIDAE		
	Mimus polyglottos orpheus	Northern Mockingbird
STURNIDAE		
	Sturnus vulgaris	European Starling
PARULIDAE		
	Parula americana	Northern Parula
	Dendroica tigrina	Cape May Warbler
	Dendroica caerulescens caerulescens	Black-throated Blue Warbler
	Dendroica dominica albilora	Yellow-throated Warbler
	Dendroica discolor discolor	Prairie Warbler
	Dendroica palmarum palmarum	Palm Warbler
	Dendroica pharetra	Arrowhead Warbler
	Mniotilta varia	Black-and-white Warbler
	Setophaga ruticilla	American Redstart
	Helmitheros vermivorum	Worm-eating Warbler
	Limnothlypis swainsonii	Swainson's Warbler
	Seiurus aurocapilla furvivor	Ovenbird
	Seiurus noveboracensis	Northern Waterthrush
	Seiurus motacilla	Louisiana Waterthrush
	Geothlypis trichas trichas (brachydactylus)	Common Yellowthroat
Genus INCERTAE SEDIS		
	Coereba flaveola flaveola	Bananaquit
THRAUPIDAE		

FAMILY	SCIENTIFIC NAME	COMMON NAME
	Spindalis nigricephala	Jamaican Spindalis
EMBERIZIDAE		
	Tiaris olivacea olivacea	Yellow-faced Grassquit
	Tiaris bicolor marchii	Black-faced Grassquit
	Loxipasser anoxanthus	Yellow-shouldered Grassquit
	Loxigilla violacea ruficollis	Greater Antillean Bullfinch
	Euneornis campestris	Orangequit
CARDINALIDAE		
	Passerina cyanea	Indigo Bunting
ICTERIDAE		
	Nesopsar nigerrimus	Jamaican Blackbird
	Quiscalus niger crassirostris	Greater Antillean Grackle
	Molothrus bonariensis	Shiny Cowbird
	Icterus leucopteryx leucopteryx	Jamaican Oriole
	Icterus galbula	Baltimore Oriole
	Euphonia jamaica	Jamaican Euphonia

APPENDIX 5: LIST OF REPTILES OF THE BUFF BAY VALLEY

(Source; Hedges, unpublished)

GROUP	SCIENTIFIC NAME	LOWER	MIDDLE	UPPER	NOTES
Gallywasps	*Celestus molesworthi*	X			Coastal area only - critically endangered
Pauli Liazards	*Sphaerodactylus argus*	X	X	X	All
	Sphaerodactylus goniorhynchus	X	X	X	
Lizards	*Anolis garmani*	X	X	X	
	Anolis grahami	X	X	X	
	Anolis opalinus	X	X	X	
	Anolis reconditus			X	Local endemic
	Anolis lineatopus	X	X	X	
	Anolis valencienni	X	X	X	
Snakes	*Epicrates subflavus*	X	X		
	Hypsirrhynchus calliaemus	X	X	X	
	Hypsirhynchus polylepis	X			
	Trophidophis stejngeri	X			Possibly = Snake Boy (local name) described as thick snake, black above, silver grey below
	Typhlops jamaicensis	X	X	X	

APPENDIX 6: LIST OF AMPHIBIANS RECORDED FROM THE BUFF BAY VALLEY

Source: Hedges unpublished ms.

SCIENTIFIC NAME	LOCALITY	NOTES
Osteopilus brunneus	Whole watershed	
Osteopilus wilderi	Upper	
Eleutherodactylus andrewsi	Upper	Cloud forest only
Eleutherodactylus glaucoreius	Upper	
Eleutherodactylus gossei	Whole watershed	
Eleutherodactylus johnstoni	Whole watershed	Invasive
Eleutherodactylus nubicola	Upper	Parental care by male
Eleutherodactylus orcutti	Upper	Rocky streams only, possibly extinct
Eleutherodactylus pantoni	Upper	
Eleutherodactylus pentasyringos	?	
Eleutherodactylus planirostris	Whole	

APPENDIX 7: FISHES RECORDED FROM BUFF BAY, SWIFT AND RIO GRANDE RIVERS, PORTLAND (Abstracted from Aiken 1987)[4]

FAMILY	SPECIES	COMMON NAME	DISTRIBUTION	OCCURRENCE
Gobiidae	*Sicydium plumieri*	Suckstone Goby	Estuary to headwaters	Very common
	Awaous tajasica		Mid to lower reaches	Fairly common
Mugilidae	*Agonostomus monticola*	Mountain Mullet	Mid to lower reaches	Common
	Joturus pichardi	Hognose Mullet	Mid to lower reaches	Rare
	Mugil curema	White Mullet	Estuarine areas only	Uncommon
	Mugil cepahalus	Striped Mullet	Estuarine areas only	Uncommon
Eleotrididae	*Dormitator maculatus*	Bullhead, Fat Sleeper	Mid to lower reaches	Uncommon
	Bobiomorus dormitor	Bigmouth Sleeper	Lower to mid reaches	Uncommon
Gobiesocidae	*Gobiesox nudus*	Clingfish	Mid to lower reaches	Common
Cichlidae	*Tilapia (Oreochromis) mossambica*	African Perch	Mid to lower reaches	Common
Anguillidae	*Anguilla rostrata*	Atlantic Eel	Mid to lower reaches	Common
Sciaenidae	*Bairdiella chrysoura*	Silver Croaker	Estuary only	Rare
Carangidae	*Caranx chrysos*	Bar Jack	Estuary only	Uncommon
Syngnathidae	*Syngnathus rousseau*	Caribbean Pipefish	Estuary only	Rare

[4] The status of these species has not been recently assessed in the literature.