

Survey of
Invasive Alien Plant Species on Gros Piton,
Saint Lucia, 2012

carried out under the project

Mitigating the Threats of Invasive Alien Species in the Insular Caribbean

Project No. GFL / 2328 – 2713-4A86, GF-1030-09-03

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Abstract

The aim of this survey was to establish the extent to which two invasive plant species had spread away from the main track where they were first observed. At the same time other alien plant species would be investigated to see if they posed a present or future risk to the flora of Gros Piton.

The survey recorded the presence/absence of observed alien plant species at 114 GPS-referenced points on Gros Piton during 6 field days in April 2012.

Results indicated that the immediate danger was posed by the two recent invasive plant species, *Tradescantia zebrina* and *Callisia fragrans*, both garden ornamentals, which had appeared half way along the trail. Large carpets had formed in the immediate area, replacing indigenous ground species but, at the time of the survey, had not spread far from the main trail.

The main and urgent recommendation was for the two plants species to be removed as fast as possible by the relevant authorities. Lack of action could result in the spread of the two species resulting in large areas of Gros Piton being affected, putting at risk both the very bio-diverse indigenous flora and also our World Heritage Status.

Another recommendation involved the setting up of a monitoring system in the Pitons Management Area to spot any new invasive plant species as soon as possible so that quick remedial action could be taken. This would require the training of a very small team of field-competent 'Pitons Rangers'.

A third recommendation was for continuing education through workshops and public meetings in the Soufriere area to raise awareness of floristic issues with the general public, local landholders and tourist businesses.

1. Introduction

UNESCO lists the Pitons Management Area, hereafter referred to as PMA, as a **natural** World Heritage Property (UNESCO, 2012a). This is based on its dramatic physical beauty and the richness of its marine and terrestrial flora and fauna. However a significant part of the terrestrial PMA consists of secondary woodlands, pastures, houses, tourist developments and farming. The terrestrial fauna is interesting but limited and coral reefs are found elsewhere. It is the steep slopes of both Pitons and Piton Mitan that are home to a rich and unique flora without which it is doubtful the property would have been given World Heritage status. And it is Gros Piton that has the richest flora - one of the few areas left in the Caribbean where native dry and moist forest remains more or less unmodified.

The consultant has recorded 254 indigenous flowering plant species on the Pitons not the meager 148 mentioned on the UNESCO web site. ([Plant Atlas of the Pitons, 2012](#), UNESCO, 2012a). This excludes common weedy herbaceous plants and plants only found on the flatter areas between and around the Pitons and alien plant species. Among the indigenous species there are 3 Saint Lucian endemic, 22 Lesser Antillean endemics and 35 Caribbean endemics. 46 species are only found or almost only found in the Pitons Management Area in Saint Lucia. Many species are extremely rare throughout their Caribbean range. ([Saint Lucian Plants, 2012](#))

Two new indigenous tree species were discovered during this survey by Melvin Smith, *Crateva tapia* (Figures 1 and 2) and *Erythroxylum oxycarpum*, emphasizing the wonderful floral biodiversity of Gros Piton. Specimens were collected and herbarium sheets prepared in order to voucher for these two new Saint Lucian records.

Thus it is of the greatest importance that this flora be protected. While it is unlikely any clearance of vegetation will be permitted on the steep slopes, there are other risks to the flora. One is fire; it is predicted that global warming will decrease rainfall in Saint Lucia and fiercer dry seasons along with increased visitor numbers to Gros Piton could increase the fire risk. Global warming may also lessen the number of nights that the upper slopes are covered in cloud, from which probably critical moisture is provided to the flora in dry spells. Another risk is the spread of alien

plant species onto the steep slopes, threatening and replacing native species. While there have been alien plants growing on Gros Piton for many years, the lead consultant has noticed the appearance and rapid spread of two new alien plant species around the trail.

Figure 1. *Crateva tapia* tree



Figure 2. *Crateva tapia* flowers



The project was initiated for this third reason, the risk of invasive species. Its aim was to survey Gros Piton for the presence of alien plant species and if necessary develop a practical plan to eradicate or control invasive alien plant species already present, and a management plan to lessen the risk of new aliens becoming established on Gros Piton along with a continuing monitoring program.

2. The Alien Plant Species of Gros Piton

2.1. Introduction.

The survey classified an alien species as one introduced in colonial times or after, in order to avoid the impossible task of deciding if plant species present in South and Central America arrived here by natural means or by deliberate or accidental Amerindian introduction. However Amerindian food crops (sour sop, sugar apple, guava for example) present on Gros Piton were considered aliens as they were almost certainly deliberately introduced.

Alien plant species are not usually invasive. Alien plant species may deliberately be brought in as cultivated species or accidentally. If they start reproducing in the wild they are said to be naturalized. Naturalized plant species can be common or rare, widespread or localized but they must reproduce in the wild. An invasive alien plant species is one which causes harm in some way. In the context of this report, an invasive alien plant species is one which has affected the indigenous flora on Gros Piton by significantly reducing the resources (usually space) available for some indigenous species.

The base of the steep sloped parts of Gros Piton was surrounded by the Caribbean Sea and cleared areas of gardens, wasteland and pasture along with two small settlements and a few houses. Alien plant species, both cultivated and wild, were common in the terrestrial area and along the southern coastal fringe of Anse L'Ivrogne. However unless these plants encroached more than a few meters onto the steep slopes, they were not included in this survey.

(This does not preclude the possibility of them doing so in the future, hence the need for continued monitoring.)

Two examples not included in the survey as they have not spread from around Fonds Gens Libres to the steep slopes are illustrated in Figure 3 and Figure 4.

Figure 3. *Clerodendrum chinense*, a cocoa weed from Africa

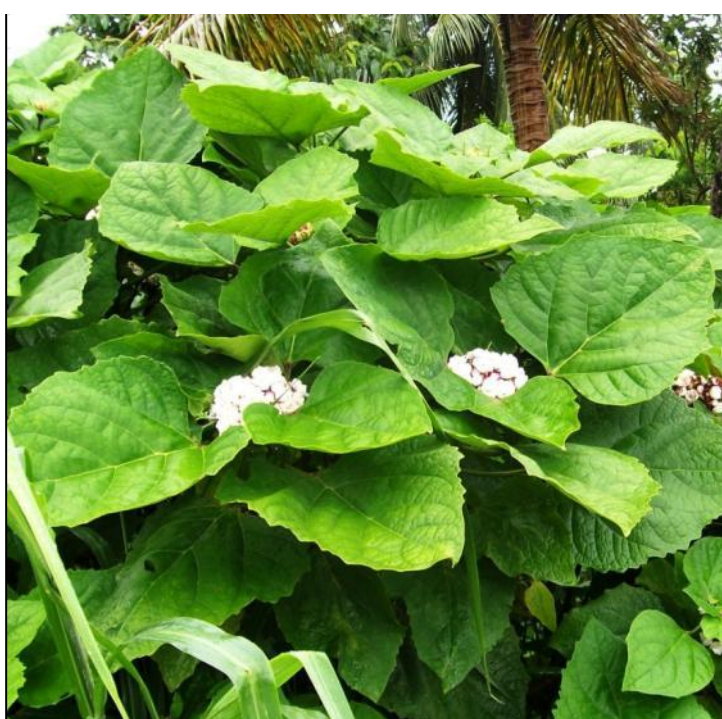


Figure 4. Black-eyed Susan, a weedy vine from Africa



Because the consultant botanists, Roger Graveson and Melvin Smith, had made somewhere in the range of 50 prior full day field trips to Gros Piton, often off-trail, over the previous 12 years, the indigenous and alien plant species were already known. This avoided the need to prepare dried specimens to be identified abroad, a costly process with results coming many months later, if at all. However the survey team was aware that indigenous or alien plant species not previously recorded for Gros Piton might be found.

2.2 The Known Alien Plant Species of Gros Piton

The following alien plant species were known prior to the survey to be present on Gros Piton.

Botanical Name	Common Name	Family
<i>Abrus precatorius</i> L.	Gwenn légliz	Fabaceae-Faboideae
<i>Bryophyllum pinnatum</i> (L.) Oken	Kawakté lézòm. Leaf-of-Life.	Crassulaceae
<i>Caesalpinia pulcherrima</i> (L.) Sw.	Fle Makata	Fabaceae-Caesalpinioideae
<i>Callisia fragrans</i> (Lindl.) Woodson		Commelinaceae
<i>Cyanotis cristata</i> (L.)D. Don		Commelinaceae
<i>Desmodium velutinum</i> (Willd.) DC.		Fabaceae-Faboideae
<i>Leucaena leucocephala</i> (Lam.) de Wit	Leucaena	Fabaceae-Mimosoideae
<i>Oeceoclades maculata</i> (Lindl.) Lindl.		Orchidaceae
<i>Tradescantia zebrina</i> hort. ex Bosse	Wandering Jew. Inch plant.	Commelinaceae
<i>Triphasia trifolia</i> (Burm. f.) P. Wilson	Ti Siton. Sweet Lime.	Rutaceae

Tecoma stans was classified as indigenous. Nevertheless it was included in the survey as some botanists consider it alien to the Caribbean. (Figure 5).

Figure 5. *Tecoma stans*



Figure 6. *Abrus precatorius*



Abrus precatorius

Gwenn legliz, native to the Paleotropics, is a Fabaceae (pea) species now pantropical with a tendency to become invasive in some countries, for example Hawaii (Wagner et al, 1999. p. 638). The (very toxic) seed are used in handicrafts and it has herbal medicinal uses. It is widely naturalized in secondary coastal deciduous seasonal forest in Saint Lucia. (Figure 6).

Bryophyllum pinnatum

Kawakté lézòm or leaf-of-Life is a succulent, cultivated and naturalized in Saint Lucia, and is globally widely naturalized and sometimes invasive, for example in Queensland, Australia (Batianoff and Butler, 2002). It has herbal medicinal uses. (Figure7).

Figure 7. *Bryophyllum pinnatum*



Figure 8. *Callisia fragrans*



Callisia fragrans

A hardy ground cover Commelinaceae, this species escapes around houses into wasteland in Saint Lucia. It is common on some islands of the Grenadines and invasive in some Pacific Islands such as Hawaii (Wagner et al, 1999. p. 1378). (Figure 8).

Caesalpinia pulcherrima

Fle makata is a popular garden ornamental often naturalized in the Caribbean (Howard, 1974-1989). It is naturalized and very common in the mouth of the L'lvrogne River; elsewhere in Saint Lucia it escapes from cultivation into adjacent dry wasteland and roadsides. (Figure9).

Figure 9. *Caesalpinia pulcherrima*



Cyanotis cristata

Of Asian origin this Commelinaceae species is widespread probably because of its herbal medicinal use. It was possibly brought to the Caribbean by Indian indentured labourers in the last century. (Figure 10).

Figure 10. *Cyanotis cristata*



Figure 11. *Desmodium velutinum*



Desmodium velutinum

Native to tropical Africa and Asia this Fabaceae (pea) species may have been introduced to the Caribbean as a forage crop (Tropical Forages, 2012). It is found in southwest Saint Lucia. (Figure 11).

Leucaena leucocephala

Native to southern Mexico, Guatemala and Belize, this species is globally naturalized or invasive (PIER, 2012), (Texas Invasives, 2012). It is often deliberately introduced as a source of green manure, charcoal, livestock fodder, and for soil conservation. (Tropical Forages, 2012). (Figure 12).

Figure 12. *Leucaena leucocephala*



Figure 13. *Oeceoclades maculata*



Oeceoclades maculata

Native to tropical Africa, this ground orchid is naturalized throughout the neotropics. It is considered invasive in Puerto Rico and the Virgin Islands (Invasive and Noxious Weeds, USDA, 2012). (Figure 13).

Tradescantia zebrina

Wandering Jew, native to Mexico, has a tendency to naturalize. It is invasive in some Pacific islands (PIER, 2012). It is established on Gros Piton and forms carpets replacing indigenous flora. Thus prior to the survey the consultant had classified this species as **invasive on Gros Piton**. (Figure 14).

Figure 14. *Tradescantia zebrina*



Figure 15. *Triphasia trifolia*



Triphasia trifolia

Possibly native to southeastern Asia, Sweet Lime is globally naturalized and invasive, for example in La Reunion Island (Lavergne, 2006). It is common in disturbed secondary and disturbed coastal deciduous seasonal forest and savannah in the southwest of Saint Lucia. It was probably introduced as a cultivated ornamental. (Figure 15).

3. The Survey

3.1 Methodology.

Given the limited resources available and the difficult terrain, a flexible rough and ready approach was decided upon:

- Cliff areas were not surveyed directly for obvious reasons. However visual scanning for alien plant species with binoculars was made from the base of cliffs.
- The main track and a few other short tracks were surveyed.
- Also the lower slopes were entered where possible from the various points of the base until cliffs were reached or the slopes became too steep or unstable.
- In addition forays were made from the main track again until conditions became too difficult or cliffs were reached.
- In this way representative areas of non-cliff areas were surveyed.
- GPS readings were taken at intervals with a Garmin eTrex handheld GPS. While progressing from one point to the next the survey team noted all alien plant species present. These were recorded on the record sheet at the next GPS point. In addition other basic data were recorded along with the main tree species observed.
- The record sheet had space for alien plant species not recorded before on Gros Piton as well as listing known alien plant species. (Table1). However no new alien plant species were found during the survey.
- The GPS points were downloaded directly into ESRI ArcGIS ArcMap 9.3 using the DNR Garmin extension. The points were then re-projected from WGS 84 to St. Lucia's 1955 British West Indies Grid and were then overlain on the 2009 aerial photograph of Gros Piton; the attributes attached to the points were then used to display the various species.

Table1. Survey Record Sheet

GPS point__ GPS co-ordinates_____ Date_____	
Canopy%_____ Canopy Height (m)_____ Field team_____	
Species	Present
Known aliens	
Tradescantia	
Callisia	
Oeceoclades	
Caesalpinia	
Tecoma	
Bryophyllum	
Triphasia	
Desmodium	
Abrus	
New aliens	
<u>Common trees</u>	

3.2. Comments on the Survey

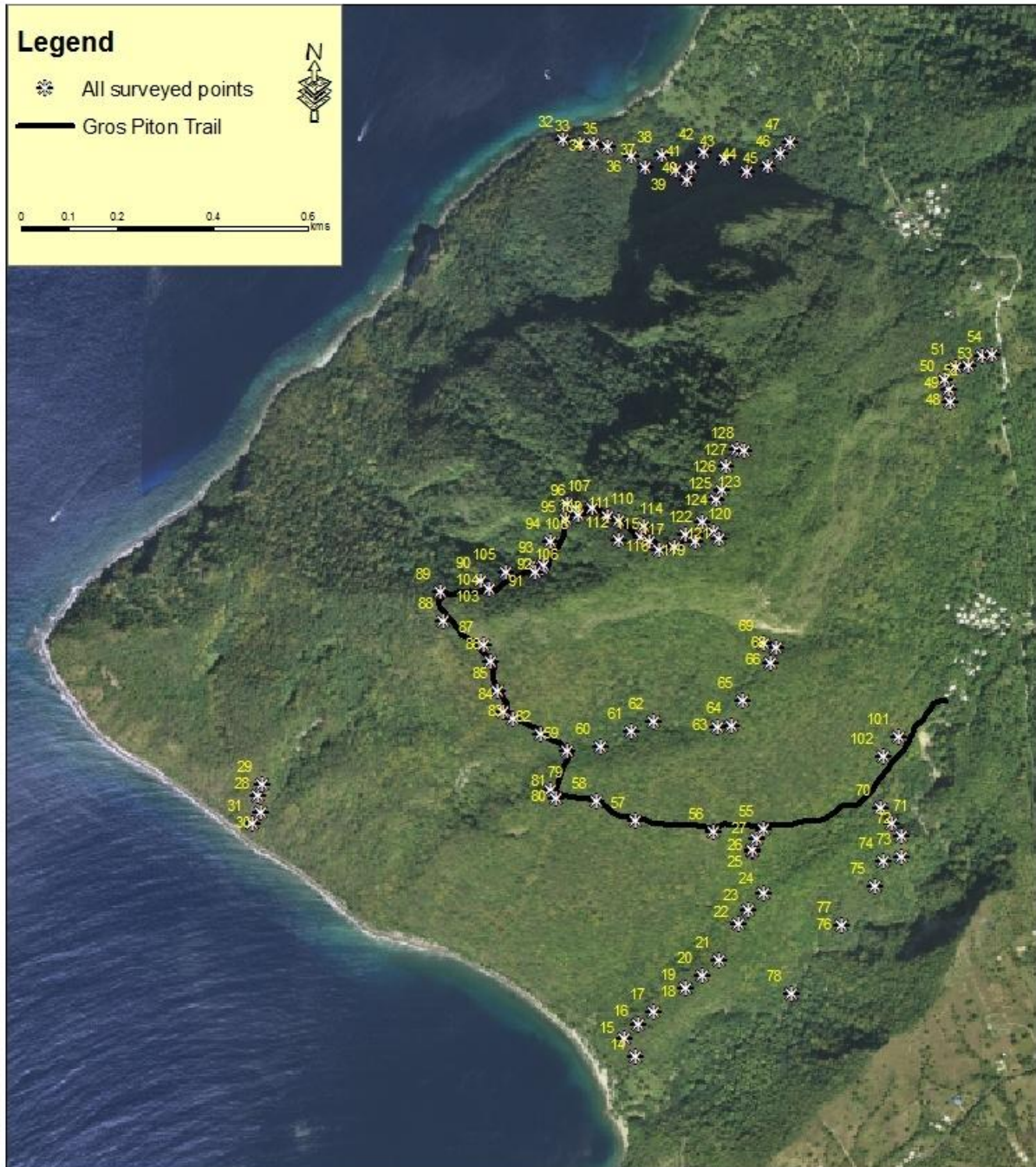
The survey was carried out by Melvin Smith over 6 field days in April 2012, accompanied by Roger Graveson and on one occasion with Peter Dennis, an experienced member of the Fond Gens Libres Guides Association.

Because of the danger of injury through falling rocks, Smith surveyed off trail locations by himself in contact with Graveson at a base point. This avoided the real danger of dislodged boulders hitting a survey member lower down the slope. Distance between points varied depending on the terrain. Results were recorded onto a sheet at each GPS point.

All movement off trail was very difficult and slow but critical to the survey. For example Survey Points 32 to 47 were along the northern coastal corner and took about 3 hours. Large unstable boulders with deep gaps between, very steep slopes becoming cliffs and fierce heat made movement difficult.

There were 114 Survey Points. Cliffs covered substantial areas of the east, south and north slopes. The major gap in the survey was the coastal lower slopes. Surveying was very difficult because of huge boulders along the beach and unstable steep slopes, often cliffs. Nevertheless entry was made at the northern and southern edges. (Map 1). A visual appraisal of the coastal area in between revealed a homogeneous canopy suggesting the vegetation was relatively uniform.

Map 1. GPS Survey Points



<p>Survey of Invasive Alien Plant Species on Gros Piton Saint Lucia, 2012 carried out under the project</p>	<p>GPS points of all Surveyed Plots</p>
<p><i>Mitigating the Threats of Invasive Alien Species in the Insular Caribbean</i> Project no. GFL/2328-2713-4A86, GF-1030-09-03</p>	<p>Consultant : Roger Graveson</p> 

3.3 The Results of the Survey

A sample of results is shown in Table 3.

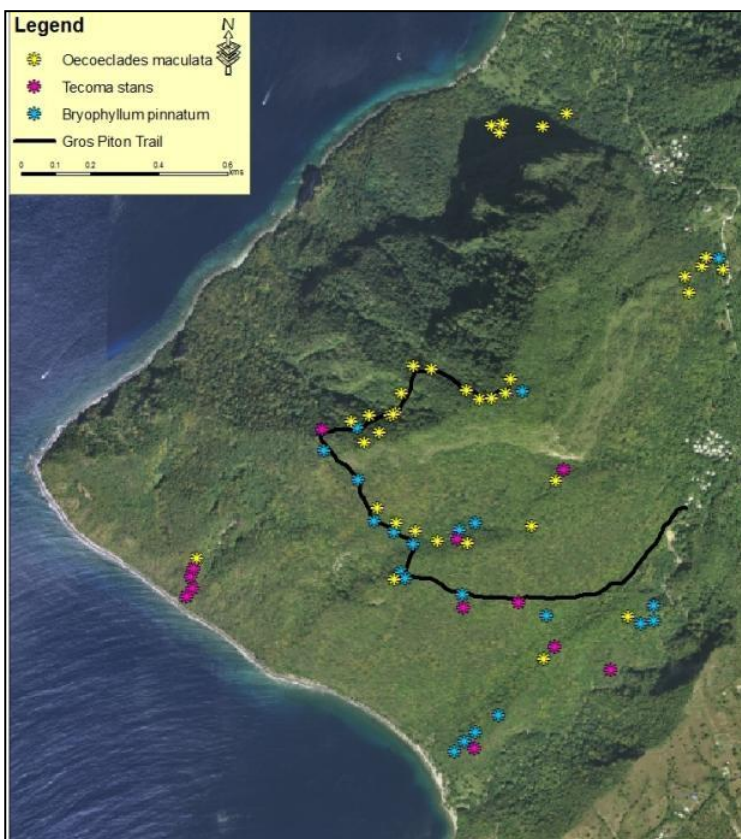
The full results are given as Appendix 2 and 3.

Table 3. Sample Results; “y” indicates presence

Northing	Easting	GPS	Tradescantia	Callisia	Oeceoclades	Tecoma	Desmodium
13.80005	-61.06711	14					
13.80039	-61.06734	15					
13.80065	-61.06707	16				y	
13.80088	-61.06675	17					
13.80134	-61.06614	18					
13.80133	-61.06613	19					
13.80157	-61.06582	20					
13.80185	-61.06548	21					
13.80254	-61.06512	22					
13.80281	-61.06492	23			y		
13.80310	-61.06462	24				y	
13.80391	-61.06484	25			y		y
13.80394	-61.06485	26					y
13.80414	-61.06476	27					
13.80498	-61.07438	28				y	
13.80519	-61.07432	29			y	y	
13.80467	-61.07433	30				y	

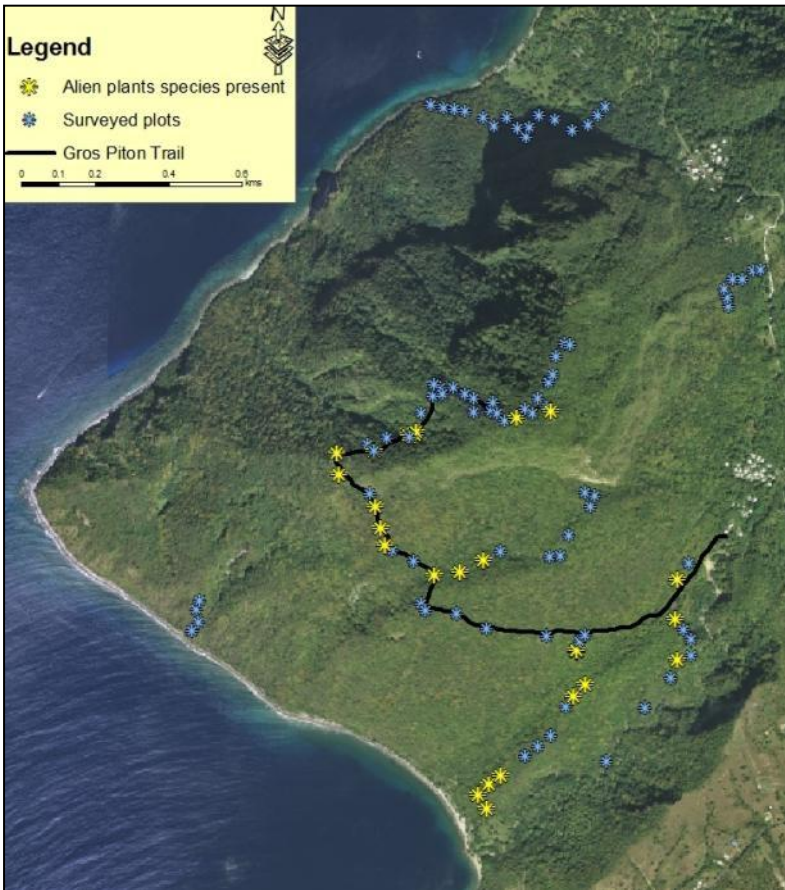
No unexpected alien plant species were discovered.

The flatter areas of south-west lower slopes had patches of alien mango, soursop, grapefruit, coconut and sugar apple trees, presumably persisting, and seeding in the immediate area, in abandoned gardens. None of these species had spread any distance from the garden.



Map 2.

Oeceoclades maculata, *Bryophyllum pinnatum* and *Tecoma stans* (if considered alien) were widely distributed over Gros Piton.



Map 3

The remaining alien plant species had a more localized distribution, mainly around the main trail, close to the Anse L'Ivrogne Beach and Fond Gens Libres. This suggested that human activities were responsible for the arrival of these species on Gros Piton.

It was encouraging that on the survey points away from the trail and the Anse L'Ivrogne-Fond Gens Libres area, no alien plant species were found other than the widespread *Bryophyllum pinnatum* and *Oeceoclades maculata*.

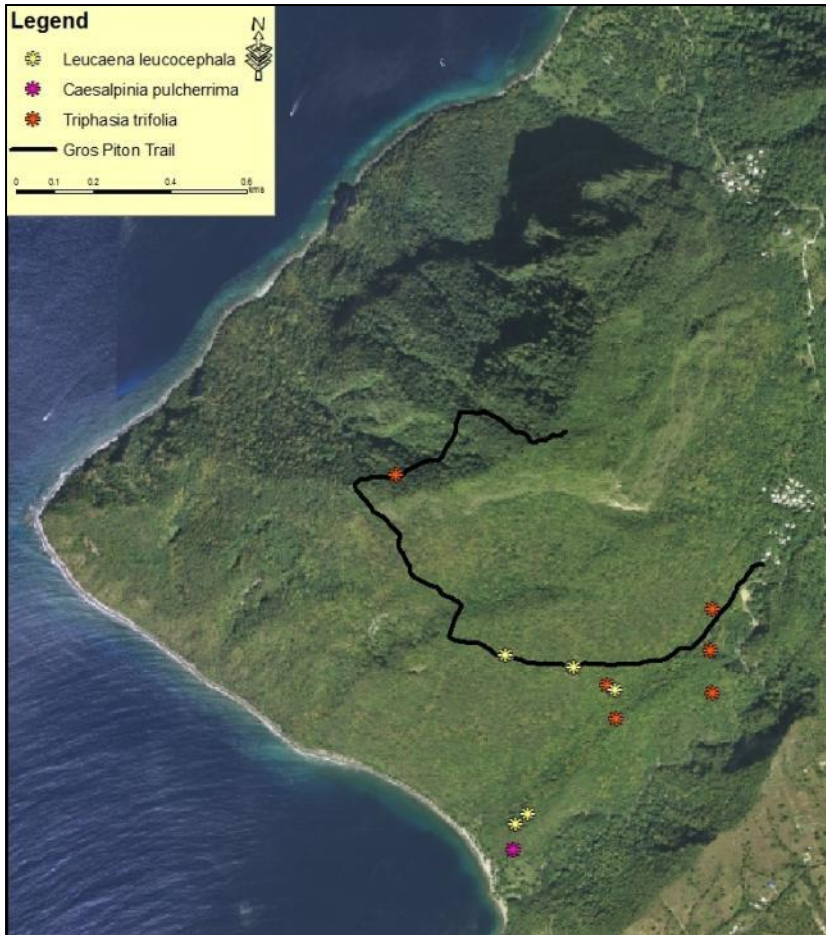


Map 4

Desmodium velutinum is found close to the trail, especially around abandoned gardens.

Abrus precatorius is mainly found close to the track to Anse L'Ivrogne

Escaped and persisting alien fruit trees are present in and around abandoned gardens

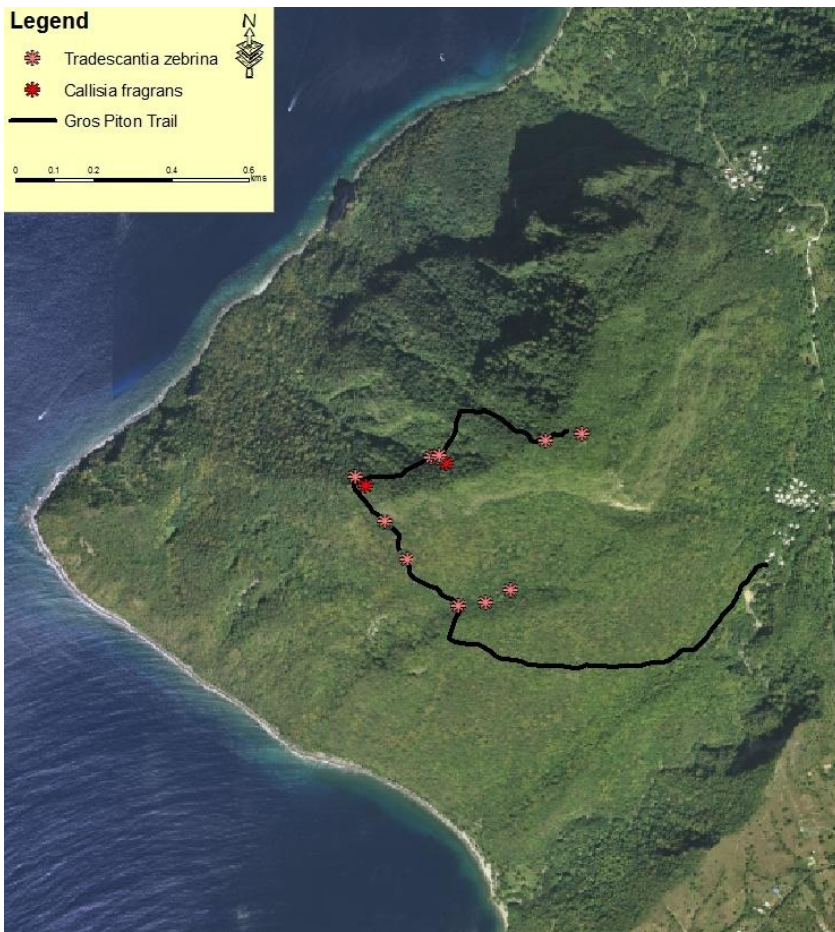


Map 5

Leucaena leucocephala is quite common around a disturbed section of the main trail and on the track to Anse L'Ivrogne.

Triphasia trifolia is found mainly around the first part of the trail.

Caesalpinia pulcherrima is only found very close to the Anse L'Ivrogne floodplain.



Map 6

Tradescantia zebrina forms dense carpets along a substantial length of the main track and a side track to an abandoned garden.

Callisia fragrans is more localized, reflecting its more recent arrival, but again forms dense carpets.

Neither species appears to have spread more than a few metres from the main trail. **(But this is not certain).**

4. The Flora of Gros Piton

4.1 Introduction

In order to be able to analyze the results, it was necessary to first classify the vegetation of Gros Piton.

The survey collected information on the main trees observed close to each GPS point. Using the same methodology and the same vegetation classes used in the Graveson's 2009 report "The Classification of the Vegetation of Saint Lucia", each point was then allocated to a vegetation class.

The UNESCO web site states (UNESCO, 2012a):

The dominant terrestrial vegetation (of the Pitons) is tropical moist forest grading to subtropical wet forest, with small areas of dry forest and wet elfin woodland on the summits.

The description uses a confusing mixture of terms from the Holdridge vegetation classification system (Holdridge, 1967), Beard's classification system (Beard, 1944, 1949, 1955) and non-technical terms (dry forest) and it is also incorrect.

From the results of the field survey and subsequent analysis, and using terms derived from Beard's classification system, the vegetation classes were determined to be as follows;

- The great bulk of non-cliff areas of Gros Piton was covered by **Deciduous Seasonal Forest**. The taller trees lost their leaves in the dry season, although many of the smaller trees were evergreen.
- Towards the summit it transitioned into **Semi-evergreen Seasonal Forest**, in which there was a partial loss of leaves in dry spells.
- There were also ledges and fissures in the cliff areas which had a special flora which the consultant termed **Rock Ledge Vegetation**.
- There was no **Lower Montane Rainforest**, although a few rainforest species plants were present on the summit.
- **Elfin shrublands** are only found on high summits of the Mount Gimie Range, not on Gros Piton.

4.2 Semi-evergreen Seasonal Forest

A small flattish area on the summit and around the final part of the trail was classified as **Semi-evergreen Seasonal Forest**. This in simple terms was "moist forest" in which canopy trees typically lost some of their leaves in dry spells.

Extremely biodiverse, it was quite different in appearance from the typical secondary semi-evergreen seasonal forest remnants seen in agricultural areas and by rivers below the rainforest reserve and also from Lower Montane Rainforest although a few species are found in both classes.

It was thus a unique type of **Semi-evergreen Seasonal Forest**.

Tall trees dominated with sufficient light penetrating the canopy to allow an almost complete rock and ground cover particularly of ferns and anthuriums; many anthurium and bromeliad epiphytes were also present. Night mist was frequently observed, providing a supply of moisture even during dry spells. This class of vegetation appeared to more or less primary forest. (Figure 16).

Figure 16. Semi-evergreen Seasonal Forest.



4.3 Deciduous Seasonal Forest

Deciduous Seasonal Forest is “dry forest” and covered large areas of Gros Piton. The canopy trees typically lose their leaves each dry season, giving a barren appearance to the steep slopes. This allows extra light to reach the ground and encourage potential invasion by drought-tolerant, light-loving plants.

Among this vegetation class there were also smaller cliff areas whose vegetation at least partially belongs to the Rock Ledge vegetation class.

There were three sub-divisions:

4.3.1 Coastal Deciduous Seasonal Forest

The very steep coastal lower slopes were dominated by a few species, particularly *Bursera simaruba*, *Lonchocarpus punctatus*, and *Guapira fragrans*. Relatively few tree species were found in this inhospitable habitat and herbaceous ground cover and epiphytes were sparse or absent. Many tree trunks were scarred by falling boulders and there were large piles of boulders covering the ground. Although-species poor, this subclass was probably primary climactic forest, with no sign of human disturbance. (Figure 17).

Figure 17. Typical Coastal Deciduous Forest on Gros Piton



4.3.2 Upper Deciduous Seasonal Forest

At an elevation of above 350m on the coastal side of Gros Piton there were a greater variety of tree species, and a thin herbaceous ground cover with some anthuriums and epiphytes. Slopes were generally somewhat gentler and boulders appear more stable. Occasional huge mango tree close to the trail testified to human movement but there were few signs of old gardens and the forest was probably also more or less primary. Natural disturbances such as landslides and hurricanes prevented parts of it from being classified as climactic deciduous seasonal forest. (Figure 18).

Figure 18. Typical Upper Deciduous Seasonal Forest on Gros Piton



4.3.3. Secondary Deciduous Seasonal Forest

On the lower south-west slopes human activity was more marked with abandoned gardens and evidence of old coal pits. *Croton micans* was common over one of the most degraded areas and there was little leaf canopy. Herbaceous ground cover and epiphytes were almost absent. Thus this area was classed as **Secondary Deciduous Seasonal Forest**. (Figure 19).

Figure 19. Typical Secondary Deciduous Seasonal Forest on Gros Piton



4. 4 Rock Ledge Vegetation

Large areas of Gros Piton were covered by barren cliff with small ledges and fissures. (See cover page image).

These ledges and fissures were home to a special flora: a few stunted trees, small shrubs and herbs. *Agave caribaeicola* was common along with cacti, bromeliads and some succulent herbs.

At the base of high cliffs there was a relatively well-watered zone resulting from dripping water, home to a very special flora of herbaceous plants which was included in this vegetation class.

Figure 20



Figure 21



Figure 22



Figure 23

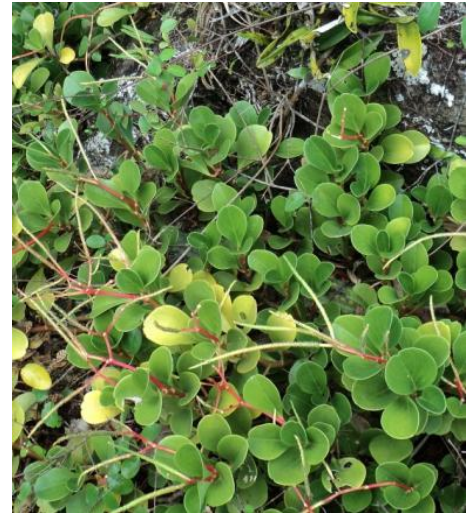


Figure 20. The tiny bromeliad, *Tillandsia pardoi*, found in Saint Lucia only on a few cliffs on Gros Piton.

Figure 21. Typical vegetation of open, rocky spots around cliffs.

Figure 22. *Salvia lamiifolia*, only known from Martinique and Saint Lucia, growing at the lush base of a high cliff.

Figure 23. *Peperomia magnoliifolia*, in Saint Lucia is only found on the Pitons.

5. Preliminary Assessment of Invasiveness of Alien Plant Species

This assessment takes in to account the known distribution of the species on Gros Piton, the vegetation classes it is associated with, its growth habit, and its abundance on Gros Piton and around Saint Lucia.

Tecoma stans

Found in Deciduous Seasonal Forest and on Rock Ledges, most common close to the sea.

If this species were classified as an alien plant species, then it would be considered as naturalized or possibly mildly invasive along the littoral where its abundance suggests it might be competing for space with the indigenous very rare tree, *Crateva tapia*. It is commonest in the most isolated coastal area and its spread is by wind-dispersed seeds.

The consultant considered *Tecoma stans* an indigenous plant species.

Cyanotis cristata

Observed in the past along the trail from Anse L'Ivrogne to the main track in Secondary Deciduous Seasonal Forest. It was not observed during the survey, probably because it is an annual and dies off during the dry season

This naturalized plant species poses no risk at present to indigenous plant species on Gros Piton.

Caesalpinia pulcherrima

Very common in the L'Ivrogne river delta but had barely spread to the slopes of Gros Piton. However it does escape into very dry vacant lots on the north of the island so some spread into the Secondary Deciduous Seasonal Forest is possible.

This naturalized plant species poses no risk at present to indigenous plant species on Gros Piton.

Desmodium velutinum

Found occasionally along the trail especially in areas with abandoned gardens in Deciduous Seasonal Forest.

This species has been present for at least 10 years and probably much longer. It has shown no sign of increasing its population density or spreading.

This naturalized plant species poses no risk at present to indigenous plant species on Gros Piton.

Abrus precatorius

Common only on the coastal slope around Anse L'Ivrogne In Secondary Seasonal Deciduous Forest and Coastal Deciduous Seasonal forest, absent elsewhere.

Its localized distribution was a surprise as it is normally a common species of coastal deciduous seasonal forest.

This naturalized plant species poses no risk at present to Indigenous plant species on Gros Piton.

Leucaena leucocephala

Quite common along the first part of the trail in Secondary Deciduous Seasonal Forest especially in a degraded (previously heavily-charcoaled) area dominated by *Croton micans*.

Typically this species colonizes disturbed and cleared dry areas. If these areas are allowed to regenerate the species becomes much less common. It does not appear to invade mature Deciduous Seasonal Forest.

This species poses a potential threat to indigenous plant species in the event of a fire, catastrophic wind event or large landslides. Massive numbers of seeds are already present in the affected area and could quickly spread to areas where canopy trees have fallen. Its rapid growth and ability to produce seed at a very young age would enable it to initially dominate the re-growth. It could also be argued that it would cause a rapid greening of affected areas and actually help the canopy trees (*Bursera simaruba*, *Loncocarous punctatus*, *Guapira fragrans*) establish themselves. However on balance, it is much better to allow regeneration by indigenous plant species - this presumably has happened successfully before.

This species poses a potential threat to Indigenous plant species in the event of severe disturbances such as fires, catastrophic wind events or large landslides.

Triphasia trifolia

Found mainly in Secondary Deciduous Seasonal Forest, most common close to the sea around Anse L'Ivrogne but occasionally elsewhere.

This species is quite common in very disturbed deciduous seasonal forest in the south-west of Saint Lucia, especially around Black Bay. There are many small plants on south-west Gros Piton, suggesting a relatively recent arrival on Gros Piton. This species, locally naturalized on Gros Piton, may well continue to increase its population density and also spread into areas not yet affected.

There is a possibility of this species becoming common enough to be considered mildly invasive.

Bryophyllum pinnatum

Common in virtually all open and semi-open rocky areas, it was more or less absent from the Evergreen Seasonal Forest on the upper slopes but reappeared on the open parts of the summit. Rarer in the northern part of Gros Piton.

This species is perfectly naturalized on Gros Piton. It is mildly invasive in that it covers a sufficient surface area of rocky spots to reduce the area available for indigenous ground cover species. It may have moved into Gros Piton from gardens in the La Pointe and Fond Gens Libres area and thus has not yet fully colonized the northern rocky areas. However it can be expected that it will do so in the future.

This species is widely naturalized and possibly moderately invasive on Gros Piton

Oeceoclades maculata

A remarkable species found in all vegetation classes and all areas of Gros Piton, except the extreme littoral. It has a low population density but could be considered mildly invasive in that it competes sometimes for space with the indigenous ground orchid *Spiranthes elatum*.

This species is widely naturalized and possibly moderately invasive on Gros Piton

Tradescantia zebrina

Found only along a section of the trail around the look-out facing Petit Piton in the upper level of the Deciduous Seasonal Forest. Forming dense carpets and spreading fast since its arrival about 8 years ago.

This garden plant covers a much larger area than *Callisia fragrans* due to its earlier arrival. Any part breaking off roots and forms a new carpet. It has not spread more than 5 m. away from the trail except for a short distance along a side footpath. While the carpet is not as deep as with *Callisia fragrans* it still replaces indigenous ground species. It could certainly spread through the Upper Deciduous Seasonal Forest but **might** not thrive in the Coastal Deciduous Seasonal Forest or on Rock ledges as it seems to require some moisture. It also **might** not thrive in the shady conditions on the summit. However nothing is certain.

This species is an aggressive invasive that if left untreated could affect the flora of large areas of Upper Deciduous Seasonal Forest and possible other vegetation classes.

Callisia fragrans

Found only along a small length of the trail close to the look-out facing Petit Piton in the upper level of the Deciduous Seasonal Forest. Forming dense carpets and spreading fast since its arrival about 2 years ago.

This garden plant appeared on the look-out facing Petit Piton about two years ago. It has formed many independent carpets in the local area and any part that breaks off can form a new carpet. It also produces flowers and fruits; dissemination of fertile fruits would make eradication impossible but at the moment no spread to areas away from the trail has been observed. As it is very drought-tolerant, potentially it could cover rock ledges and the whole Deciduous Seasonal Forest, although it might not thrive in shady moist parts of the summit. It forms deep carpet outgrowing all indigenous ground flora. In addition the rosette pattern of the foliage serves to absorb moisture from mist or showers and prevent it from reaching the ground. Thus it could have an impact on trees and shrubs as well. Already invasive in some countries, this species could have a devastating impact on all of the Deciduous Seasonal Forest and Rock Ledge Vegetation.

This species is an aggressive invasive that if left untreated could eventually devastate the flora of the whole Deciduous Seasonal Forest and Rock Ledge Vegetation, the major part of the surface area of Gros Piton.

6. Recommendations

The recommendations below are in response to the problems of invasive plant species on Gros Piton. However, these recommendations are also relevant to all Crown Lands in the Piton Management Area.

6.1. Issues That Require Immediate Attention

This section is concerned with the two invasive species, *Callisia fragrans* and *Tradescantia zebrina*. Other alien plant species do not pose any immediate threat but might do so in the future.

The area infested is hopefully still relatively small and accessible so total eradication is probably possible. Another favourable factor is that re-infection from outside is unlikely as other cultivated populations are found only at the base of the Pitons and can only return if carried by people. Also, cleared areas would be colonized by indigenous species and not by other invasive species, which is sometimes the case.

There is little information on the control of *Tradescantia zebrina* and *Callisia fragrans* although they are occasionally reported as invasive in other countries (Section 2.2). The Invasive Species Coordinator at the Forestry Department, Dr. Ulrike Krauss, has indicated to the consultant that she will communicate with experts around the world to determine the best management approach to these plants, particularly on the feasibility of cost-effective eradication.

Some other Commelinaceae are well-known invasives. One species, *Tradescantia fluminensis*, closely related to *Tradescantia zebrina*, is invasive in New Zealand and control measures have been evaluated and tested. It is likely that similar techniques would work against *Tradescantia zebrina* and are certainly worth considering. (Appendix 1).

An action committee needs to be organized quickly to determine the logistics of the plant removal. The Forestry Department, with its overall responsibility and its expertise, should lead. Other organizations directly involved include the Soufriere Foundation (including a representative from the Tet Paul trail which is on Piton Mitan) and a Pitons Management Area representative.

The consultants would also make themselves available. The main issue will be funding; although it is not expected to be very expensive, funds will be required for labour and proper disposal of plant material and possibly sprays and spray equipment. In addition, funds must be available for follow-up work where pockets of re-growth occur. At least one of the organizations listed above has income derived from the PMA and all have a vested interest in the floristic health of Gros Piton.

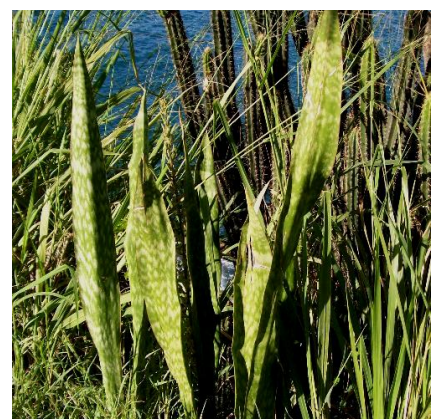
6.2. Issues That Require Attention In The Near Future

Even if these two species are eradicated, this will not be the end of the story. Re-infestation is possible and the arrival of new alien plant species is almost certain. In addition, presently non-invasive alien species, already present on Gros Piton, might become invasive. While it is not possible to predict all alien plant species that might become invasive, there are two species, cultivated very close to the Pitons, already well-known globally to thrive on dry rocky hills, *Tradescantia spathacea*, Moses-in-the-cradle, and *Sansevieria* species, Mothers-in-law tongue. (Figures 24 and 25).

Figure 24. *Tradescantia spathacea*,



Figure 25. *Sansevieria* species



In addition, though not known to be invasive, *Xiphidium caeruleum* has the characteristics needed to invade Gros Piton - highly drought resistant, rock-loving and carpet-forming. (Figure 26).

It is growing within a few meters of the base of Gros Piton in a garden along the main trail.

Figure 26 *Xiphidium caeruleum*



Thus there is a need for the continued monitoring of Gros Piton (and the lower slopes of Petit Piton) so that new arrivals can be spotted and dealt with quickly and existing alien species' population changes observed. How this can be achieved is considered in Section 6.3.

6.3. Educational and Monitoring Issues

6.3.1 Monitoring of Crown Lands

Given the admirable democratic traditions of Saint Lucia it is unlikely that changes can be forced on private landowners around the base of Gros Piton. Attempts to do so will probably be counterproductive.

However policing is certainly possible on the Crown Lands. Illegal marijuana farming was not seen to be a cause of the spread of alien plant species on Gros Piton but any extension of present plots by cutting bush should be monitored and dealt with.

Policing of the degraded Secondary Deciduous Seasonal Forest along the first part of the trail and down to the beach must ensure that no disturbance occurs including the cutting of posts. The continuing recovery of these areas from the effects of decades of charcoaling will reduce the populations of species such as *Leucaena leucocephala* and *Triphasia trifolia* and help reduce the risk of their further spread or of the appearance of new plant invaders of secondary forest.

A particular risk of the worst affected area, dominated by *Croton micans*, ti bonm blanc, is fire which would perpetuate the degradation of these areas. While foreign tourists and guides do not smoke on the trail the consultant has observed smoking by local tourists and 'farmers'. Certainly a large illustrative *No Smoking* sign at the beginning of the trail could do no harm.

6.3.2 Floristic and Wildlife Training

As mentioned in section 6.2 there is a need for continued floristic monitoring of the Gros Piton. This is not as straight forward as it seems. The indigenous flora (as documented in the consultant's Plant Atlas) is greater than on any Forest department Trail and very unusual - common dry forest trees such as *bwa den*, *kanpeche*, *bwa madam*, *bwa flambo* are almost absent, and many trees and shrubs present are virtually unknown elsewhere in Saint Lucia. Even the recognizable *Sloanea*, *chatannyés*, on the summit are not the same species as in the rainforest. It has taken the consultant 15 years to sort out the flora and only he and Melvin Smith are able to recognize the flora and hence spot any new arrivals. Thus it is imperative that one of the local agencies develop a policy that involves the recognition and training of a small number of persons **already active** in environmental matters. Their recognition and training would require input from the consultants. Botanical training would take place primarily in the field, with follow-up computer studies. Additional training would be in bird recognition. Although basic reading and writing skills are required, educational qualifications beyond that should not be a determining factor in selection.

These "Pitons Rangers" would have several roles:

- Monitoring of Crown Lands in PMA for invasive plants and bush clearance
- Training of Gros Piton guides and guides on other trails
- Acting as guides to visitors requiring specialist knowledge
- Visiting schools and communities to raise awareness of environmental issues
- Liaising with local landholders and tourist businesses to raise awareness of environmental matters, particularly the risk of spread of some types of garden ornamentals.

6.3.3 Education and Consultation

After the initial eradication of the two invasive alien plant species has been completed, there is a need for some sort of high-profile meeting/workshop in the Soufriere area to discuss the problems faced by the unique flora of the Pitons and the steps that have been taken to protect it. In addition there should be a series of local meetings open to the general public in which an illustrated lecture is given after which there is a question and discussion session. These public relational and educational activities will raise awareness in the community and also serve to show to UNESCO that the PMA World Heritage Status is being taken seriously.

Ongoing education and consultation will be through the proposed "Pitons Rangers" Office (Section 6.3.2).

7. Recommendations Summary

- Immediate action be taken to seek out internationally a method to remove the *Callisia fragrans* and *Tradescantia zebrina*.
- Subsequent prompt removal of all populations of *Tradecantia zebrina* and *Callisia fragrans*
- Follow-up monitoring and if necessary removal of any re-growth
- Training of a small number of interested persons in the flora and wildlife in the PMA so that the floristic health of the PMA can be maintained and improved in the future
- Organization of a workshop to discuss the floristic problems faced in the PMA with local interested parties.
- Organization of local meetings to raise awareness of the special and delicate nature of the Pitons flora.
- Updating by the Department of Forestry of the UNESCO web site of the PMA floral summary to reflect actual vegetation classes and the full known indigenous flora.

8. Discussion

Below is a quote from UNESCO's [List of World Heritage in Danger](#) (UNESCO, 2012b).

“The Galapagos Islands, which have been called a unique "living museum and showcase of evolution" were inscribed on the Danger List in 2007 because of threats posed by **invasive species, unbridled tourism and over-fishing.”**

The PMA has already had some private land management issues and does not need to combine them with an invasive plant species problem. It is in Saint Lucia's interest to tackle this problem effectively and promptly.

If this problem is not dealt with now, the two species will continue their spread and the problem will at some point come to the attention of UNESCO. Although invasive species can pop up without human facilitation, this is not the case on Gros Piton:

- the two species, *Callisia fragrans* and *Tradescantia zebrina*, appeared on Gros Piton **after** PMA received its World Heritage status
- they both were first seen on the cleared look-out facing Petit Piton, well away from where they are cultivated, almost certainly planted for “beautification”

Given also that the consultant has reported this infestation on several occasions over the last few years to the authorities to no avail, it would seem sensible to deal with this matter promptly.

Hopefully the next publicity given to invasive alien plant species on Gros Piton will be when TV cameras witness work teams removing the plants!

9. Acknowledgements

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- Ministry of Physical Development, Housing and Urban Renewal, Survey and Mapping Section, for use of aerial photos.

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Appendix 1. Some Ideas on Eradicating *Callisia fragrans* and *Tradescantia zebrina*

The following information relevant to the situation here is extracted from the *Tradescantia fluminensis* page of the Global Invasive Species Database (GISD) website.

Physical: Hand weeding and rolling the weed up like a carpet are considered suitable for removal of small infestations (Porteous, 1993) if care is taken to remove every last piece.

Integrated management: A combination of chemical and manual removal methods has been used with success in New Zealand, but has required repeated efforts to ensure continued control (Anon, 1995).

A detailed study has been made in New Zealand on the effectiveness of different chemical sprays. Although Grazon was the most effective, Roundup, available in Saint Lucia, at 3% solution was also very effective. Three sprays two months apart producing a 99.99% die-off. However this was on flat land. (McCluggage, T. 1998.)

This might help in formulating a possible management plan for Gros Piton:

Callisia fragrans could be removed first. It is less established and potentially more dangerous in that it can grow also in very dry forest. This species is much taller species, more like a pineapple, and would probably need physical removal. Plant material would need to be placed in heavy duty garbage bags, even double bagged and carried to Fond Gens Libres. It is essential that bags do not break and they would need to be inspected at Fond Gens Libres. As this species is often mixed with *Tradescantia zebrina*, both would need to be removed in these areas.

Once removal in one area is completed it should be sprayed with Roundup to kill small pieces left in rock crevasses and in earth. Some indigenous ground cover will also be killed but will quickly return from populations close by. Monthly or bimonthly minor spraying will be necessary to kill regrowth followed up with further checks as long as needed.

Tradescantia zebrina covers a much larger area and it may not be practicable to physically remove it off Gros Piton.

Thus spraying would probably be needed as described in the introduction. Again considerable labour is required to carry up the water. Spraying can take place section by section so that the trail is not unduly unsightly. There would be some temporary collateral damage to indigenous ground flora and perhaps minor effects on wild life. Follow-up inspections and spraying would continue as long as required.

An alternative method is to allow plant material to mulch in the garbage bags close to the trail. The plants contain enough moisture and the ambient temperature is high. The danger however is of bags being broken open and contents spread, particularly in bad weather events.

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Appendix 2. Distributions of Alien Plant Species on Gros Piton

Northing	Easting	GPS	Tradescantia	Callisia	Oeceoclades	Tecoma	Desmodium
13.80005	-61.06711	14					
13.80039	-61.06734	15					
13.80065	-61.06707	16				y	
13.80088	-61.06675	17					
13.80134	-61.06614	18					
13.80133	-61.06613	19					
13.80157	-61.06582	20					
13.80185	-61.06548	21					
13.80254	-61.06512	22					
13.80281	-61.06492	23			y		
13.80310	-61.06462	24				y	
13.80391	-61.06484	25			y		y
13.80394	-61.06485	26					y
13.80414	-61.06476	27					
13.80498	-61.07438	28				y	
13.80519	-61.07432	29			y	y	
13.80467	-61.07433	30				y	
13.80446	-61.07451	31				y	
13.81735	-61.06846	32					
13.81727	-61.06813	33					
13.81725	-61.06786	34					
13.81720	-61.06759	35					
13.81702	-61.06714	36					
13.81681	-61.06687	37					
13.81703	-61.06653	38					
13.81676	-61.06627	39			y		
13.81656	-61.06605	40			y		
13.81680	-61.06597	41			y		
13.81708	-61.06573	42					
13.81697	-61.06533	43					
13.81671	-61.06489	44			y		
13.81683	-61.06448	45					
13.81707	-61.06426	46			y		
13.81727	-61.06407	47					
13.81237	-61.06097	48			y		
13.81259	-61.06100	49					
13.81279	-61.06108	50			y		
13.81302	-61.06087	51					
13.81304	-61.06063	52			y		
13.81323	-61.06037	53			y		
13.81326	-61.06018	54			y		
13.80432	-61.06461	55					
13.80428	-61.06560	56				y	

Northing	Easting	GPS	Tradescantia	Callisia	Oeceoclades	Tecoma	Desmodium
13.80448	-61.06710	57				y	
13.80486	-61.06785	58					
13.80581	-61.06840	59	y		y		
13.80588	-61.06777	60	y		y		y
13.80617	-61.06716	61	y		y	y	y
13.80637	-61.06673	62					
13.80624	-61.06551	63					
13.80626	-61.06523	64			y		
13.80675	-61.06502	65					
13.80746	-61.06447	66			y		
13.80773	-61.06437	68				y	
13.80781	-61.06462	69					
13.80470	-61.06235	70					
13.80442	-61.06214	71					
13.80419	-61.06195	72					
13.80379	-61.06196	73					
13.80370	-61.06231	74			y		
13.80324	-61.06248	75					
13.80251	-61.06312	76				y	
13.80251	-61.06312	77					
13.80121	-61.06410	78					
13.80508	-61.06874	79			y		
13.80492	-61.06863	80					
13.80493	-61.06863	81					
13.80614	-61.06892	82			y		
13.80641	-61.06946	83			y		
13.80655	-61.06964	84	y				
13.80695	-61.06976	85	y				
13.80750	-61.06989	86	y				
13.80781	-61.07001	87					
13.80828	-61.07081	88	y				
13.80881	-61.07085	89	y	y		y	
13.80902	-61.07006	90			y		
13.80925	-61.06905	91	y		y		
13.80925	-61.06889	92	y		y		
13.80932	-61.06886	93	y	y			
13.80977	-61.06873	94			y		
13.81019	-61.06843	95					
13.81039	-61.06823	96					
13.80605	-61.06199	101					
13.80567	-61.06229	102					y
13.80886	-61.06991	103			y		
13.80886	-61.06991	104			y		
13.80918	-61.06958	105			y		
13.80919	-61.06901	106			y		
13.81048	-61.06840	107			y		

Northing	Easting	GPS	Tradescantia	Callisia	Oeceoclades	Tecoma	Desmodium
13.81025	-61.06817	108					
13.81040	-61.06790	109			y		
13.81024	-61.06761	110					
13.81014	-61.06739	111					
13.80979	-61.06740	112					
13.80982	-61.06696	113			y		
13.81004	-61.06692	114					
13.80976	-61.06682	115					
13.80959	-61.06663	116			y		
13.80965	-61.06633	117	y		y		
13.80987	-61.06610	118					
13.80976	-61.06592	119			y		
13.80993	-61.06558	120					
13.80981	-61.06545	121	y				
13.81012	-61.06579	122			y		
13.81054	-61.06550	123					
13.81053	-61.06550	124					
13.81072	-61.06540	125					
13.81116	-61.06533	126					
13.81147	-61.06511	127					
13.81145	-61.06497	128					

Appendix 3. Distributions of Alien Plant Species on Gros Piton (continued).

Northings	Eastings	GPS	Bryophyllum	Triphasia	Abrus	Leucaena	Fruit trees	Caesalpinia
13.80005	-61.06711	14			y			y
13.80039	-61.06734	15	y		y			
13.80065	-61.06707	16	y		y	y		
13.80088	-61.06675	17	y			y		
13.80134	-61.06614	18	y					
13.80133	-61.06613	19						
13.80157	-61.06582	20						
13.80185	-61.06548	21						
13.80254	-61.06512	22					y	
13.80281	-61.06492	23					y	
13.80310	-61.06462	24		y			y	
13.80391	-61.06484	25		y	y	y	y	
13.80394	-61.06485	26	y					
13.80414	-61.06476	27						
13.80498	-61.07438	28						
13.80519	-61.07432	29						
13.80467	-61.07433	30						
13.80446	-61.07451	31						
13.81735	-61.06846	32						
13.81727	-61.06813	33						
13.81725	-61.06786	34						

Northings	Eastings	GPS	Bryophyllum	Triphasia	Abrus	Leucaena	Fruit trees	Caesalpinia
13.81720	-61.06759	35						
13.81702	-61.06714	36						
13.81681	-61.06687	37						
13.81703	-61.06653	38						
13.81676	-61.06627	39						
13.81656	-61.06605	40						
13.81680	-61.06597	41						
13.81708	-61.06573	42						
13.81697	-61.06533	43						
13.81671	-61.06489	44						
13.81683	-61.06448	45						
13.81707	-61.06426	46						
13.81727	-61.06407	47						
13.81237	-61.06097	48						
13.81259	-61.06100	49						
13.81279	-61.06108	50						
13.81302	-61.06087	51						
13.81304	-61.06063	52						
13.81323	-61.06037	53						
13.81326	-61.06018	54	y					
13.80432	-61.06461	55						
13.80428	-61.06560	56						
13.80448	-61.06710	57	y					
13.80486	-61.06785	58						
13.80581	-61.06840	59	y					
13.80588	-61.06777	60						
13.80617	-61.06716	61	y					
13.80637	-61.06673	62	y					
13.80624	-61.06551	63						
13.80626	-61.06523	64						
13.80675	-61.06502	65						
13.80746	-61.06447	66						
13.80773	-61.06437	68						
13.80781	-61.06462	69						
13.80470	-61.06235	70		y				
13.80442	-61.06214	71						
13.80419	-61.06195	72	y					
13.80379	-61.06196	73	y					
13.80370	-61.06231	74	y	y				
13.80324	-61.06248	75						
13.80251	-61.06312	76						
13.80251	-61.06312	77						
13.80121	-61.06410	78						
13.80508	-61.06874	79	y					
13.80492	-61.06863	80	y					
13.80493	-61.06863	81	y					

Northings	Eastings	GPS	Bryophyllum	Triphasia	Abrus	Leucaena	Fruit trees	Caesalpinia
13.80614	-61.06892	82	y					
13.80641	-61.06946	83	y					
13.80655	-61.06964	84						
13.80695	-61.06976	85						
13.80750	-61.06989	86	y					
13.80781	-61.07001	87						
13.80828	-61.07081	88	y					
13.80881	-61.07085	89						
13.80902	-61.07006	90						
13.80925	-61.06905	91						
13.80925	-61.06889	92						
13.80932	-61.06886	93						
13.80977	-61.06873	94						
13.81019	-61.06843	95						
13.81039	-61.06823	96						
13.80605	-61.06199	101						
13.80567	-61.06229	102		y				
13.80886	-61.06991	103	y	y				
13.80886	-61.06991	104						
13.80918	-61.06958	105						
13.80919	-61.06901	106						
13.81048	-61.06840	107						
13.81025	-61.06817	108						
13.81040	-61.06790	109						
13.81024	-61.06761	110						
13.81014	-61.06739	111						
13.80979	-61.06740	112						
13.80982	-61.06696	113						
13.81004	-61.06692	114						
13.80976	-61.06682	115						
13.80959	-61.06663	116						
13.80965	-61.06633	117						
13.80987	-61.06610	118						
13.80976	-61.06592	119						
13.80993	-61.06558	120						
13.80981	-61.06545	121	y					
13.81012	-61.06579	122						
13.81054	-61.06550	123						
13.81053	-61.06550	124						
13.81072	-61.06540	125						
13.81116	-61.06533	126						
13.81147	-61.06511	127						
13.81145	-61.06497	128						