

# Baseline Vegetation Survey of Paria Springs Eco-lodge, Brasso Seco-Paria, Trinidad and Tobago.

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## ABSTRACT

A baseline vegetation survey was carried out on the site of a proposed eco-lodge and an area of contiguous forest in a neighbouring forest reserve near Brasso Seco-Paria. Tree species characteristic of abandoned cacao plantations were recorded on both the eco-lodge site and the adjacent forest, indicating disturbance and the possibility that the cacao plantation had extended over the forest reserve boundary in the past. Both the eco-lodge site and the adjacent forest had species characteristic of succession subsequent to disturbance, indicating that disturbance in the adjacent forest may be ongoing. Recommendations made for tree species to plant on the eco-lodge site so as to move the tree species community composition closer to a natural forest community composition and to attract wildlife for eco-tourists.

## INTRODUCTION

Many areas in Trinidad and Tobago that were producing cacao, citrus, coffee or mixed crop estates were abandoned in the 1900's. This was due to a number of interacting factors not least of which were declining prices for agricultural products and greater opportunities in other sectors. An overwhelmingly superior economic use for abandoned agricultural land in Trinidad and Tobago is yet to emerge and so a variety of activities are being carried out, including, cedar forestry, christophene cultivation and eco-tourism. This study looks at the tree species on an abandoned cacao estate and the adjacent state forest, with a view to establishing a more natural forest on the abandoned estate for the purpose of eco-tourism.

Originally, the natural forest that covered the abandoned cacao estate and the adjacent forested area belonged to the Evergreen Seasonal Forest of the *Licania biglandulosa* faciation (Beard 1946). However, this grades into Lower Montane Forest at the higher elevations. Beard (1946) found the commonest species in the *Licania biglandulosa* faciation were:

Emergents:	<i>Aniba pamurensis</i>	Laurier Canelle	V. Abundant
	and <i>A. trinitensis</i>		
	<i>Pachira insignis</i>	Wild Chataigne	Abundant
	<i>Sterculia caribaea</i>		
	(- <i>S. pruriens</i> )	Mahoe	Abundant
Canopy Layer:	<i>Carapa guianensis</i>	Crappo	Abundant
	<i>Chimarrhis cymosa</i>	Bois Riviere	l. Abundant
	<i>Licania biglandulosa</i>	Wild Debasse	V. Abundant

Lower Story:	<i>Diospyros ierensis</i>	Bois Charbon	Abundant
	<i>Tabebuia stenocalyx</i>	Wild Calabash	Abundant
	<i>Brownea latifolia</i>	Copperhoop	V. Abundant
	<i>Miconia</i> sp.	Sardine	Abundant
	<i>Clathrotropis brachypetala</i>	Blackheart	Frequent
	<i>Cassipourea latifolia</i>	Pois l'ail	Frequent

The forest on the estate itself was cleared for plantation crops, primarily cocoa. The main species that have been found on cacao estates in Trinidad are cacao (*Theobroma cacao*), coffee (*Coffea arabica*), mango (*Mangifera indica*) and various shade trees such as mountain immortelle (*Erythrina poeppigiana*) and rubber (*Hevea brasiliense*) (Anon. 1980). Once cacao estates are abandoned, certain species of native trees tend to invade quickly and persist in high densities for several decades. Species that invade large areas of open ground are the strong light demanders and are typified by bois canon (*Cecropia peltata*), bois flot (*Ochroma pyramidale*), kiskideewood (*Vismia guianense*) and wild tobacco (*Acnistus arborescens*) (Beard 1946). These species will only persist in large numbers if there is ongoing disturbance on the abandoned estate. Other light demanders that are longer lived and so persist for longer periods of time are species such as cypre (*Cordia alliodora*), hogplum (*Spondias mombin*), pois doux (*Inga* sp.), chaconia (*Warszewiczia coccinea*), l'épinet (*Zanthoxylum* sp.), olier (*Terminalia amazonia*), matchwood (*Schefflera morototoni*) and wild cashima (*Rollinia mucosa*) (Beard 1946; Marshall 1939). Beard (1946)

reports the palm cocorite (*Attalea maripa*) as being occasional in the *Licania biglandulosa* faciation. However, he goes on to state that cocorite increases in numbers as a result of disturbance due to fires in natural forest. See Appendix for a more comprehensive list of species often found on abandoned and active estates, extracted from the last national forest inventory (Anon. 1980).

The estate has not been used for cultivation for a number of years (at least 10 or 20 years). As a result it appears that the population of species characteristic of a cacao estate has declined, species characteristic of disturbance have invaded, and some of the natural forest species have already become established on the estate.

Eco-tourism requires activities such as bird and animal watching, and rain forest ecology interpretation. These depend on restoring as natural a forest tree composition as possible on the estate, starting with those species that will attract wildlife for eco-tourists to view. In order to do this, it is necessary to understand the present state of the succession of the forest on the aban-

doned cacao estate, and in order to speed up the process of succession to natural forest and to select tree species from the forest that could be collected as seed and planted on the estate. To understand this, a survey was carried out in both the cacao estate and the adjacent forest.

## SITE DESCRIPTION

The study was carried out on the Paria Springs Estate south of the village of Brasso Seco-Paria in the Northern Range of Trinidad W.I. (Fig. 1). An area of 14.6 hectares was surveyed on the estate and also in the adjacent forest reserve which is on the estate's southern boundary.

The relief of the area is steep to precipitous. The area is on the northern flank of the east-west running Morne Bleu ridge which rises to approximately 850m. The soils appear to be very thin over the whole area and excessively well drained. Three steep gullies traverse the area with at least one containing a stream with perennial flow.

The climate of the area is moist tropical with 2800 to 3000mm average annual rainfall (Water Resources Agency 1985a). The dry season (January to May) rainfall is 600 to 650mm (Water Resources Agency 1985b) indicating there is enough rainfall throughout the year to maintain an evergreen forest formation.

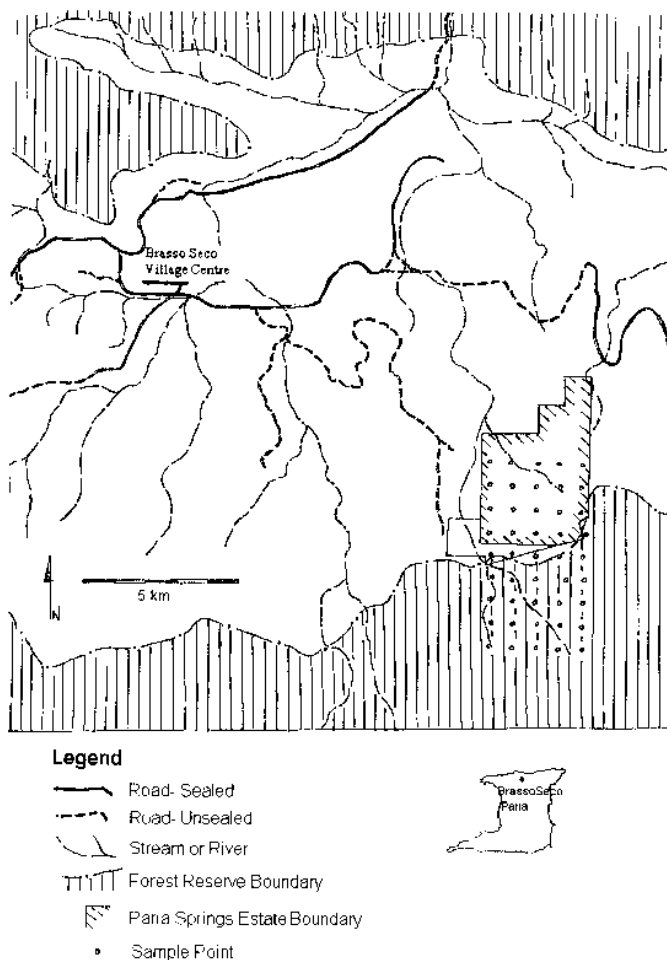
## METHODS

### Fieldwork

The estate and an equivalent area of adjacent forest were sampled systematically at points arranged on a 75m grid (Fig 1). Based on the amount of time for this survey, the spacing and thus number of sample points was restricted to 45. At each point, up to four trees  $\geq 10$ cm diameter at breast height (DBH) were measured. Two sticks were placed in a cross at each point, forming four quadrants. In each quadrant the distance to the nearest suitable tree was measured. A local tree guide identified each tree using their common names, and the height for each tree was estimated. Each point was permanently marked using a length of PVC pipe painted orange.

### Analysis

Summary tables were compiled to indicate and contrast the species composition of trees in the abandoned cacao estate and in the adjacent forest. The patterns of occurrence of the different species at the different points in the area were also examined in a general manner.



**Figure 1.** Map of sample site and location map.

Interpretations were made of disturbance on the basis of the successional position of the species.

## RESULTS

A total of 32 species was found in the 45 points (149 trees) measured in the estate and in the adjacent forest (Table 1). Of these species 16 were found in the abandoned cacao estate and 26 in the adjacent forest. The most common tree in the abandoned cacao estate and the adjacent forest was bois canon (Table 1.). Several species characteristic of plantations were found in the adjacent forest. These species were cacao, mountain immortelle and rubber. Rubber is found at one of the points in the forest furthest from the estate-adjacent

forest boundary, while bois canon is found throughout the survey area in the abandoned estate and in the adjacent forest.

## DISCUSSION

This tree survey although very brief and of an exploratory nature, gives a good indication of the state of the abandoned cacao estate and the adjacent forest.

It is clear that the abandoned cacao estate is beginning to be colonized by natural forest "light demanders" such as bois canon and wild tobacco. More important, the trees of the next stage of succession: pois doux, chaconia, and mayaro poui, are also making an appearance. This indicates natural succession is well under-

**Table 1.** Species found in the abandoned cacao estate and in the adjacent forest. The data are ordered by the frequency of the species in the adjacent forest.

		Avg. DBH (cm)	Avg. Height (m)	% Freq.	Avg. DBH (cm)	Avg. Height (m)	% Freq.
<i>Cecropia peltata</i>	Bois Canon	33.0	20.3	89	34.2	19.2	58
<i>Warszewiczia coccinea</i>	Chaconia	16.6	21.0	11	22.0	16.7	38
<i>Erythrina poeppigiana</i> *	Mountain Immortelle*	100.9	46.2	32	59.7	29.0	27
<i>Steculia pruriens</i> <sup>^</sup>	Mahoe <sup>^</sup>				33.3	21.7	27
<i>Hevea brasiliensis</i> *	Rubber*	22.4	17.9	84	18.7	22.0	19
<i>Theobroma cacao</i> *	Cacao*	21.8	10.4	47	20.8	11.1	19
<i>Chrysophyllum sp.</i>	Wild Kaimit				110.6	35.3	12
<i>Inga sp.</i>	Pois doux	53.1	25.0	21	28.6	23.0	12
<i>Nectandra kaburiensis</i>	Laurier Mattack				29.3	19.0	12
<i>Protium insigne</i>	Gommier				23.0	23.0	12
<i>Rollinia mucosa</i>	Wild Cashima				31.8	60.3	12
	Guevay?				70.0	18.0	8
<i>Acnistus arborescens</i>	Wild Tobacco	26.3	11.5	11	15.6	12.0	8
<i>Persea americana</i> *	Avocado*	36.0	30.0	5	42.5	8.0	8
<i>Vitex capitata</i>	Fiddlewood	35.0	45.0	5	60.6	21.5	8
	Bloodwood?	45.0	30.0	4			
<i>Attalea maripa</i>	Cocorite				36.6	18.0	4
<i>Ficus sp.</i>	Figuier				22.9	32.0	4
<i>Licania biglandulosa</i> <sup>^</sup>	Wild Cocoa <sup>^</sup>				60.5	28.0	4
<i>Pithecellobium jupunba</i>	Puni				54.0	33.0	4
<i>Schefflera morototoni</i>	Matchwood				74.6	20.0	4
<i>Spondias mombin</i>	Hogplum	13.0	25.0	5	76.4	28.0	4
<i>Terminalia amazonia</i>	Olivier				49.0	29.0	4
<i>Virola surinamensis</i>	Cajuca				48.0	21.0	4
<i>Vismia guianense</i>	Kiskideewood				25.5	13.0	4
<i>Zanthoxylum sp.</i>	L'epinet				22.3	30.0	4
<i>Cedrela odorata</i>	Cedar	38.3	30.0	5			
<i>Clathrotropis brachypetala</i> <sup>^</sup>	Mayaro Poui <sup>^</sup>	23.0	39.0	5			
<i>Coffea arabica</i> *	Coffee*	9.0	5.0	5			
<i>Copaifera officinalis</i>	Balsam	62.0	50.0	5			
<i>Cordia alliodora</i>	Cypre	43.3	26.5	11			
<i>Myristicia fragrans</i> *	Nutmeg*	59.0	30.0	5			

\* Species typical of cacao estates

<sup>^</sup> Species typical of Lower Montane Forest

way on the abandoned cacao estate. On the other hand, the adjacent forest, which was expected to be relatively pristine, has estate trees (marked with an asterisk on Table 1), indicating that cultivation continued into the adjacent forest in the past. This adjacent forest therefore, should probably not be considered natural, but instead a degraded forest eco-system recovering after disturbance. However, the adjacent forest has greater species richness and more natural forest trees than the cacao estate so either it was not completely cleared or was abandoned earlier and has successional advanced further. Another possibility is that the adjacent forest was not cultivated at all, but rather, was degraded by logging and fires, and subsequently colonized by estate trees by natural means. Whatever the case, it is unlikely that any of the estate trees represent a threat in terms of an aggressive invader in the adjacent forest, as they have not appeared to fill that role, in the absence of human induced disturbance, in other parts of Trinidad.

It is also evident that many of the species that were reported by Beard (1946) for the *Licania biglandulosa* faciation are not present in the adjacent forest. This is probably due to a combination of disturbance due to proximity to the estate, and the small sample size of this exploratory study. Some of the dominant species that were reported by Beard as being abundant in the faciation and that were not found in the survey are: laurier canelle (*Aniba panurensis* and *A. trinitensis*), wild chataigne (*Pachira insignis*), crappo (*Carapa guianensis*), bois charbon (*Diospyros ierensis*), wild calabash (*Tabebuia stenocalyx*) and copperhoop (*Brownea latifolia*). The under representation of laurier canelle, crappo, and wild chataigne may be because in the study area, the *Licania biglandulosa* faciation of the Seasonal Evergreen Forest is giving way to the Lower Montane Forest in which they are not abundant (Beard 1946).

Trees characteristic of disturbance, notably bois canon, are present throughout the abandoned cacao estate and the adjacent forest. This is expected in the cacao estate but not in the adjacent forest if it is still in a pristine state. It indicates, subsequent to the abandonment of the cacao estate, an ongoing disturbance that is creating large gaps in the adjacent forest. The ongoing disturbance may be human-induced or it may be natural. Some of the human factors may be timber extraction, slash and burn agriculture, or fires escaping from the adjacent estates. Some of the natural causes could be wind toppling of older, taller trees in the thin soil, or

land slips. If the cause is natural then natural forest would be formed under the influence of these disturbances. However, if the causes are human-induced, then they need to be prevented if a natural forest is going to become established on the site. It is suggested that the reasons for the disturbed nature of the adjacent forest be investigated to eliminate any factors that may prevent a successful re-establishment of the natural forests.

### Recommendations for Re-establishing Natural Forest

It was observed that trees such as the wild kaimit (*Chrysophyllum* sp.) and the wild cashima (*Rollinia mucosa*) attract a lot of wildlife; tracks were seen around the base of the trees. In some cases, particularly with wild kaimit, seeds were very difficult to find, and there were no seedlings near the large trees. This may be because animals were removing the seeds as a source of food. It is recommended that trees that are attractive to the animals and also grow to considerable heights should be planted in the abandoned cacao estate. This will encourage the wildlife to move further into the estate, and the large fruiting trees will attract nesting birds.

It is recommended that the seeds and seedlings should be collected from the nearby forest because they are easy to find and are likely to be adapted to the local environmental conditions. Initially, it may be necessary to grow them in a greenhouse or in the forest before planting them in the estate. The trees should also be planted at the densities at which they were found in the natural forest.

Taking all the above factors into consideration the following trees are recommended for initial planting on the abandoned cacao estate.

1. Wild Kaimit (*Chrysophyllum* sp.)
2. Wild Cashima (*Rollinia mucosa*)
3. Laurier mattack (*Nectandra kaburiensis*)
4. Wild Debase (*Licania biglandulosa*)
5. Wild Coffee (*Licania heteromorpha*)
6. Chaconia (*Warszewiczia coccinea*)
7. Cooperhoop (*Brownea latifolia*)

### REFERENCES

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**Appendix.** Tree species list for non-forested land (Anon. 1980).

Family	Scientific Name	Common name
<b>Anacardiaceae</b>	<i>Mangifera indica</i>	Mango
	<i>Spondias mombin</i>	Hogplum
<b>Bombacaceae</b>	<i>Ceiba pentandra</i>	Silk Cotton
	<i>Ochroma pyramidale</i>	Bois Flot
	<i>Pachira insignis</i>	Wild Chataigne
<b>Boraginaceae</b>	<i>Cordia panamensis</i>	Hairy Bois Lay-Lay
<b>Burseraceae</b>	<i>Protium insigne</i>	Gommier
<b>Combretaceae</b>	<i>Terminalia spp</i>	White Olivier
<b>Euphorbiaceae</b>	<i>Sapium hippomane</i>	Milkwood
	<i>Pera galbrata</i>	Arena Sardine
<b>Guttiferae</b>	<i>Calophyllum lucidum</i>	Galba
<b>Hernandiaceae</b>	<i>Hernandia sonora</i>	Toporite
<b>Lauraceae</b>	<i>Lauraceae spp</i>	Laurier
<b>Leguminosae</b>	<i>Erythrina spp</i>	Immortelle
	<i>Inga spp</i>	Pois Doux
<b>Meliaceae</b>	<i>Cedrela odorata</i>	Cedar
	<i>Guarea guidonia</i>	Redwood
	<i>Trichilia plicata</i>	Acurel
<b>Moraceae</b>	<i>Cecropia peltata</i>	Bois canon
<b>Rutaceae</b>	<i>Zanthoxylum trinitense</i>	Bosoo
<b>Sapindaceae</b>	<i>Cupania americana</i>	Maraqul
	<i>Melicoccus bijugatus</i>	Chenet
<b>Sapotaceae</b>	<i>Manilkara bidentata</i>	Balata
<b>Sterculiaceae</b>	<i>Guazuma ulmifolia</i>	Bois d'Orme
	<i>Sterculia pruriens</i>	Mahoe
<b>Verbenaceae</b>	<i>Vitex capitata</i>	White Fiddlewood