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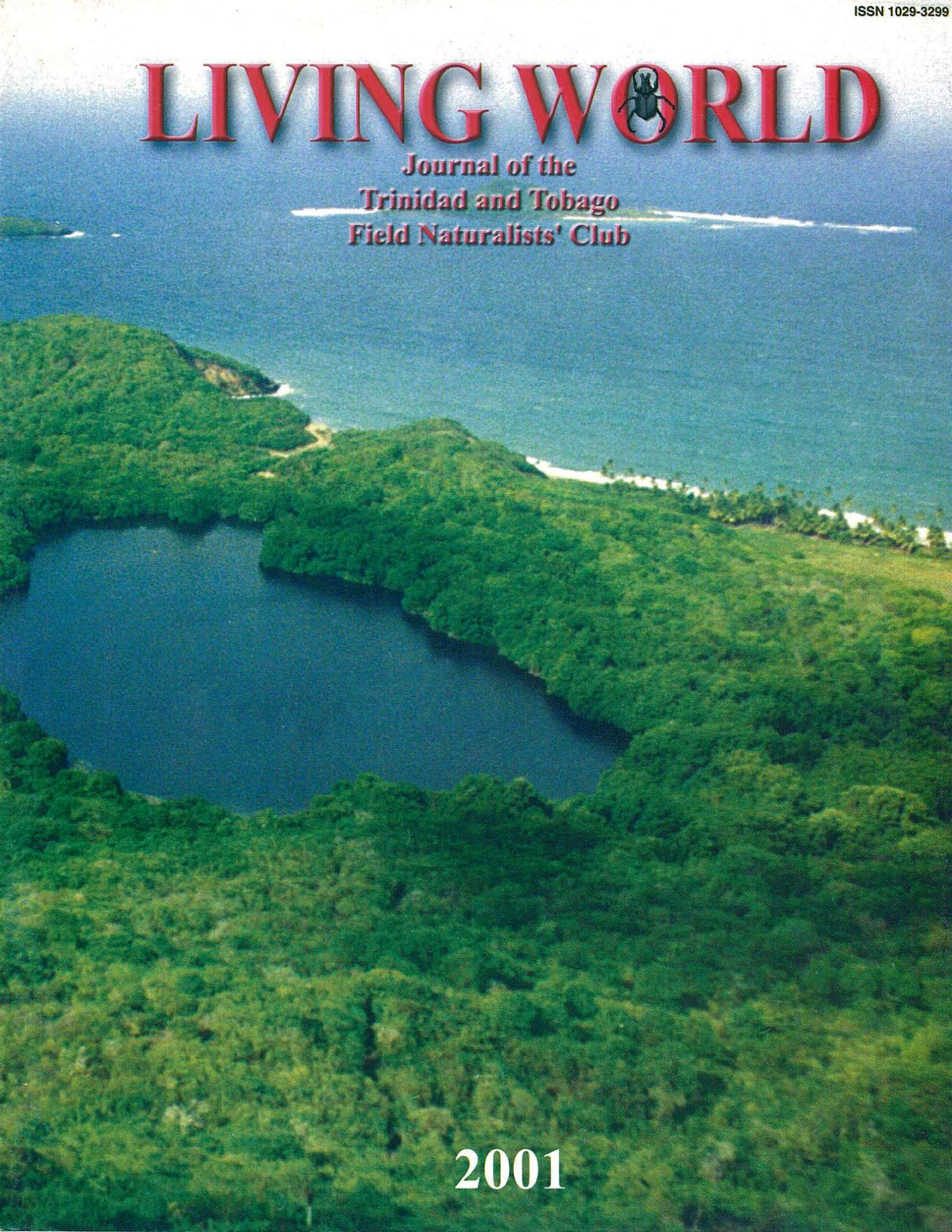

2001

LIVING WORLD

Journal of The Trinidad and Tobago Field Naturalists' Club 2001

Natura Maxime Miranda in Minimis

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EDITORIAL

In 1937, John Stanley Beard, a young British Forest Officer, came to Trinidad and studied the vegetation of Trinidad and Tobago as well as the vegetation in the Windward and Leeward Islands. He produced many papers and monographs which are still in use today. His monograph on "The Natural Vegetation of Trinidad" although now somewhat out of date is still regularly quoted in the scientific literature. Doreen Jodhan and Michael Oatham discovered that Dr. and Mrs. Beard and their eldest daughter were living in Perth, Australia and were able to interview them. We are pleased to carry a summary of that interview.

Two of the studies reported in this issue of the Journal have come from observations made in countries other than in Trinidad and Tobago. One in Grenada by Paul and Yasmin Comeau describes the vegetation around Lake Antoine, Levera Pond and Grand Étang. The other article by Mathew Cock reports on his observation on butterflies in Nevis. We welcome articles from other areas in the Caribbean.

Jason Teixeira and Michael Oatham record their observations on the effect of bamboo on surrounding vegetation, while Quesnel *et al.* discuss the potential use of hemiepiphytes in the revegetation of barren sites.

The annual Christmas bird counts for the period 1991-1996 are recorded in this issue and hopefully the authors will begin an analysis of the data collected. Hans Boos provides some interesting notes on the local names of two species of crabs.

This issue of the Journal carries reviews on six books. However, all but one of the books, were published after the 1999-2000 edition of the Journal was issued and as we wanted to keep our book reviews current, all are included in this issue.

A lengthy review paper on some aspect of our flora/fauna/environment promised in our last issue did not materialize, but we hope it can still occur in future issues of the Journal. Starting with this issue, the Journal will be published annually.

E.S.T.

THE TRINIDAD AND TOBAGO FIELD NATURALISTS' CLUB

The Trinidad and Tobago Field Naturalists' Club was founded on 10th July 1891. Its name was incorporated by an Act of Parliament (Act No.17 of 1991). The objects of the Club are to bring together persons interested in the study of natural history, the diffusion of knowledge thereof and the conservation of nature.

Monthly lecture meetings are held at St. Mary's College, on the second Thursday of every month, while field excursions are held on the last Sunday of every month except December.

Membership is open to all persons of at least fifteen years of age, who subscribe to the objects of the Club.

All enquiries concerning the Club or its Journal should be addressed to the Honorary Secretary, P.O. Box 642, Port of Spain, Republic of Trinidad and Tobago

e-mail: *ttfnc@wow.net*

Cover:
View of north-east Grenada from the top of Levera Hill
(Photo: Paul Comeau)

ACKNOWLEDGEMENTS

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The Vegetation of Lake Antoine, Levera Pond and Grand Étang, Grenada, W.I.

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ABSTRACT

Two former volcanic explosion craters now containing shallow fresh water lakes, and one former embayment now containing a shallow brackish water pond were surveyed over a four year period from 1992 to 1996 with attention being focused on their surrounding vegetation cover. The three sites, which are situated in central and north-east Grenada, display a harmonious balance between natural and cultivated land-use. Comparisons are made based on land ownership, the vegetation, climate, soil, ecology, and human disturbance.

INTRODUCTION

Grenada is unique amongst the islands of the Lesser Antillean archipelago in possessing a number of volcanic explosion craters (Arculus 1976) that are located near a north-east/south-west trending fault line (Mann *et al.* 1990). Some of these craters and a former embayment (Fig. 1) are now filled with water and sediment, and surrounded by natural, semi-natural and cultivated vegetation. Only one of these sites, Grand Étang, has received attention regarding its natural history, with several studies being published or written on the geology and flora and fauna; notably Beard (1949) on the forest communities, Groome (1970) on the natural history, and Ramcharan and McAndrews (1992) on the palynology. The attention given to this area is attributable to the crater being the centre piece of the Grand Étang Forest Reserve which was established in 1897. The volcanic explosion crater of St. George's Harbour, which is surrounded by the urban development of Grenada's capital, fell outside the scope of this survey. The other prominent explosion crater, Lake Antoine, and the former embayment at Levera Pond (Sharman 1994; McAndrews 1996), have received little attention regarding their natural history; which is reflected in a dearth of studies on these sites. The present study aims to correct this imbalance.

The authors had the opportunity to do some vegetational sampling at Lake Antoine, Levera Pond, and Grand Étang, in conjunction with palynological studies being undertaken by the Royal Ontario Museum from 1992-1996. Based on this extended survey, a number of interesting observations emerged regarding the vegetation dynamics of these three sites

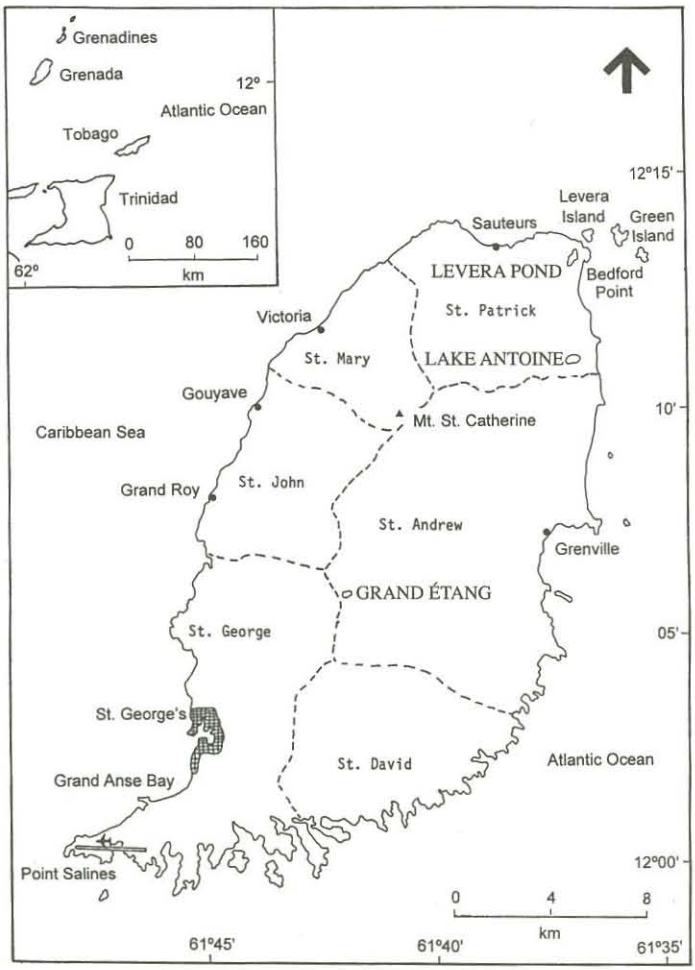

Fig. 1. The island of Grenada showing the location of the study sites.

Plate 1a. View of Lake Antoine looking southward.

where a stable balance exists between natural and human-made ecosystems that occur within the ambience of an aquatic environment. An understanding of this balance and diversity of vegetation types could provide the basis for land management plans and interpretive themes, especially for a national landmark at Lake Antoine and the recently established national park at Levera Pond.

BACKGROUND

Lake Antoine, at an altitude of eight metres above sea-level, is situated, at 61^0 37' W and 12^0 11' N, near the east coast of Grenada approximately 500 m from the sea (Plate 1a). It is surrounded by low volcanic hills of tuffaceous material which on the west side of the catchment forms a rocky escarpment up to six metres in height. Large boulders, some well-rounded, are scattered around the lake. The lowest ridge elevations, up to 30 metres, surrounding Lake Antoine occur on the south-east side; while on the west side, at

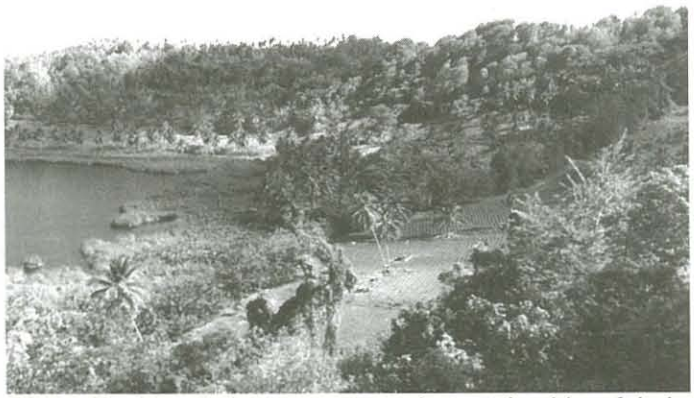

Plate 1b. Vegetation zones on the north side of Lake Antoine. Note the sedge (*Cladium jamaicense*) community forming part of the 'aquatic zone' along the lake's margin. On the landward side of this zone is the cultivated area (coconuts, pasture, bananas). Further inland on higher elevation there is a secondary forest community.

Plate 2. View of Levera Pond looking eastward from the summit of Levera Hill. The pond's margins are surrounded by red mangrove (*Rhizophora mangle*).

higher elevations up to 90 m, the vegetation shows signs of wind trim. The lake itself is almost circular, approximately 17 hectares in area and 8 metres deep. There are no inflow or outflow channels. The climate in the vicinity of the lake is dry-mesic, with approximately 1600 mm of rain per annum. The soils on the lower slopes near the lake are rich in nutrients and have been extensively cultivated and used as pasture. The steeper slopes at higher elevations are covered with second growth forest trees (Plate 1b). Due to the drier climatic conditions, fires frequently damage the natural vegetation on these slopes.

Levera Pond, situated at the north-east corner of Grenada (lat. 61^0 37' W, long. 12^0 13' N), is the remnant of a former bay that has been isolated from the sea (Plate 2). The pond, which is 3 metres deep (Sharman 1994) and approximately 11 hectares in area, is surrounded on three sides by elevated terrain. Bedford Point on the east and low-lying hills on the

Plate 3a. View of Grand Étang looking southward from near the summit of Mt. Qua Qua. Montane Thicket occurs in the foreground. The sedge (*Cladium jamaicense*) community is clearly visible around the lake's margin.

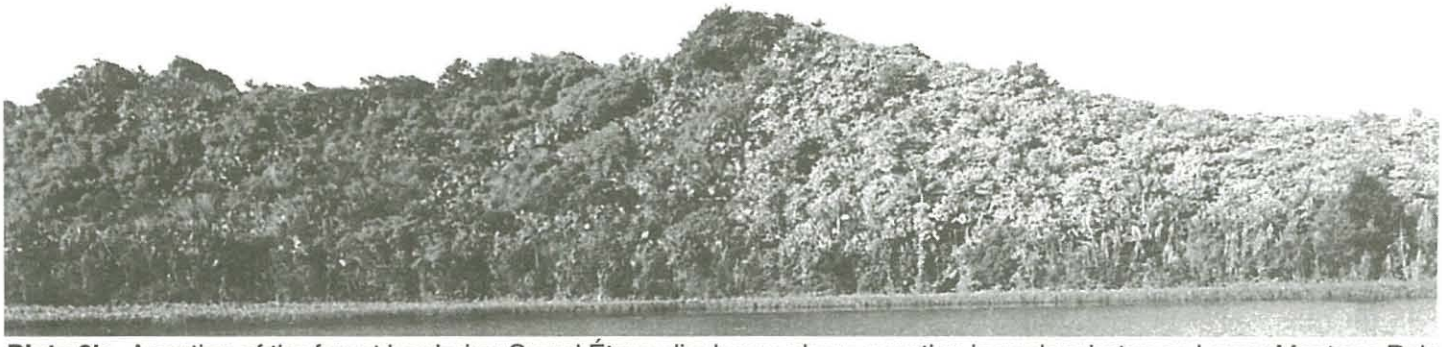

Plate 3b. A portion of the forest bordering Grand Étang displays a sharp zonation boundary between Lower Montane Rain Forest on the left and the Blue Mahoe (*Hibiscus pernambucensis*) Plantation Forest on the right. The blue mahoe was planted following forest devastation caused by Hurricane Janet in 1955.

south have elevations of 45 m while Levera Hill on the west reaches an elevation of 254 metres. On the north side, between the pond and the sea, is a mangrove-filled depression with a sandy beach along the shore. Organic muck and clay, the latter having eroded from the surrounding hills (McAndrews 1996), form thick deposits in the low-lying areas around the pond while large igneous boulders are a common feature on Levera Hill. Marine limestone overlies reworked volcanics at Bedford Point. The local climate is dry with approximately 1200 mm of rain per annum. The natural vegetation on the hills is strongly xerophytic reflecting the drier conditions. Around the pond patches of cultivated land intersperse with the natural vegetation.

Grand Étang (Plate 3a) occurs inside a forest reserve of the same name and has national park status. It is located at 61^0 42' W and 12^0 06' N in the southern massif of Grenada, which includes the summits of Qua Qua (elev. 724 m) and Feldon's Camp (elev. 754 m) both of which are north of the lake. The shallow lake, depth 4.5 m and approximately 8 hectares in area, is surrounded by mountain ridges and occurs at an elevation of 510 metres. At these elevations, the climate is cool, mean temp. 22^0 C, and wet with approximately 3880 mm of rain per annum (Caribbean Conservation Association 1991). The presence of ferns around the lake margin is a reflection of the wetter climate, these plants being absent at Lake Antoine and Levera Pond. Grand Étang has two large and two small inflow channels, and one large outflow brook where a concrete spillway has been constructed 150 m downstream from the lake. Most of the vegetation in the vicinity of the lake is natural except for some pockets of plantation forestry (Plate 3b).

METHODS

Vegetation surveys, covering approximately 80 percent of the terrain at each of the three study sites, were made by walking around each area. These surveys were conducted in November 1992 and June 1993 around Levera Pond and Grand Étang, and in June 1993 at Lake Antoine. All the sites were revisited in April 1995 and February 1996. Vegetation zonations were noted and species lists were compiled for each zone at each site. For most plant species information was recorded on habitat, abundance, distribution, habit, economic value and disturbance factors. Species not identified in the field were collected and keyed out using the *Flora of the Lesser Antilles* (Howard 1974-1989).

RECENT ENVIRONMENTAL CHANGES

The shoreline of northern Grenada indicates recent uplift. The offshore island of Sugar Loaf (Levera Island) influences wave and sand deposition on Levera Beach. On the south side of Sugar Loaf Island there is a remnant of an elevated beach just to the west of a beach house. A sand-bar extends offshore indicating a possible connection with the mainland in recent times, circa the 1970's. At the last glacial maximum sea-levels were 120 m lower

(Williams *et al.* 1993). Based on a topographic map survey, the washed-out bridge and road at the mouth of the Levera outflow channel indicate approximately 10 m of shoreline retreat over the past 30 years. A sea-level rise of one centimetre corresponds to a shoreline retreat of one metre (J. McAndrews personal communication). Along the south-east side of Levera Pond there is evidence of a former shoreline where shells and rounded beach rocks were found. Elevated markings, i.e. painted tree trunks, along the trails around Levera Pond indicate periodic flooding which occurs whenever the sea breaches the beach or heavy rainfall causes increased runoff from the landward side.

VEGETATION ZONATIONS

The vegetation at Lake Antoine, Levera Pond, and Grand Étang shows clear zonation patterns that are based on environmental gradients, topography and land-use. The zonations at all three sites start at the water's edge, i.e. the fresh water basin at Lake Antoine and Grand Étang, and the brackish water pond and salt water beach at Levera.

Lake Antoine

Surrounding the margin of Lake Antoine is an 'aquatic zone' of natural vegetation where, because of moisture extremes, a few plant species form almost pure stands. *Cladium jamaicense*, a tall sedge over two metres, grows in an almost continuous belt around the lake margin (Plate 1b) usually away from the shore where it propagates vegetatively via thick horizontal rhizomes producing a floating vegetation mat. Closer to the shore, the aroid *Montrichardia arborescens* also forms an almost continuous belt where it is grazed by cattle. Both these plants also feature prominently at Grand Étang, where the sedge surrounds the lake (Plate 3a), but the aroid is mainly confined to the north-east side. Neither species occurs around the more brackish Levera Pond.

Other plants in the aquatic zone around Lake Antoine that form sporadic colonies include: the water lily *Nymphaea ampla*, which also occurs at Levera Pond; *Acrostichum danaeifolium*, a large aquatic fern; the sedges *Eleocharis flavescens*, small and caespitose at the lake edge, and *E. mutata*, tall in standing water; *Bacopa monnieri* (Scrophulariaceae) which forms mats at the water's edge; and

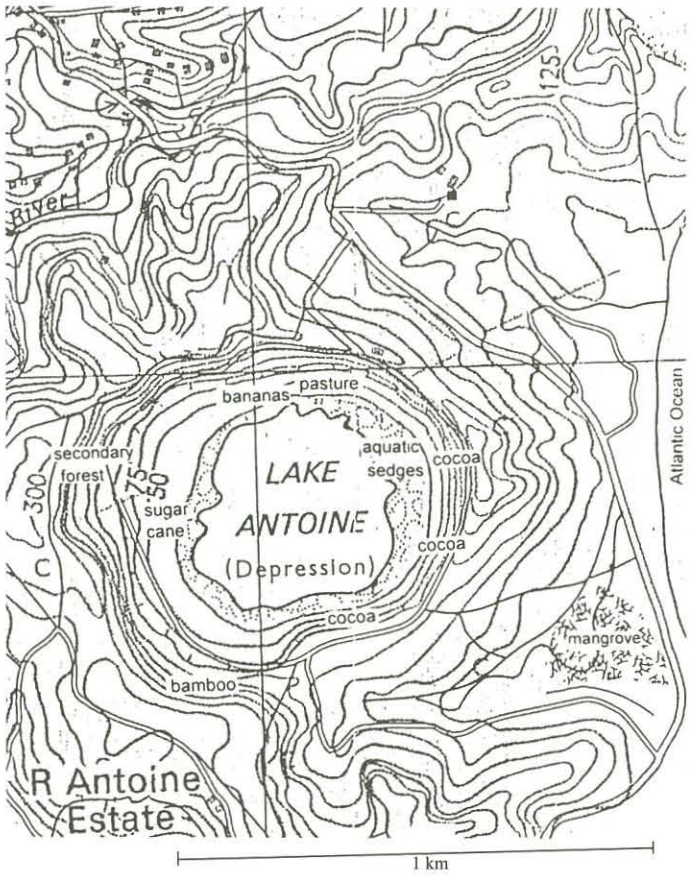

Fig. 2. Some of the vegetation zones around Lake Antoine. (contours in feet)

Sarcostemma clausum (Asclepiadaceae), a climbing epiphyte on *Montrichardia*.

Between the natural vegetation of the aquatic zone and the second growth forest on the upper slopes at Lake Antoine there occurs the 'cultivated zone', a broad continuous belt of pasture, plantation and arable land (Plate 1b). Grand Étang, which is the least disturbed site, has nothing corresponding to this zone while Levera Pond has small isolated patches of pasture and plantation. The vegetation of this zone at Lake Antoine reflects the agricultural history of the site. The native species that occur here are those that take advantage of the disturbance and compete successfully with the cultivated plants. These include aggressive herbaceous weeds, such as *Paspalum conjugatum*, *Vernonia cinerea* and *Ruellia tuberosa* that invade pastureland, and woody species, like *Sida acuta*, *Cordia collococca*, *Croton balsamifera* and *Rauvolfia viridis* that are common throughout this zone.

Cultivated species at Lake Antoine (Fig. 2)

include the legumes, *Leucaena leucocephala*, a fast-growing shrub that is a source of high-protein foliage-forage for cattle and goats, provided it is coppiced, and *Gliricidia sepium*, planted along roadsides on the east side of the lake. *Bambusa vulgaris,* bamboo, is spreading from its use as a slope stabilizer. The most common plantation species are *Theobroma cacao*, concentrated on the south-east side of the lake, *Cocos nucifera,* coconut, *Saccharum officinarum,* sugar-cane, occurring on the north-west side of the lake and *Musa sp.*, banana. Scattered amongst the cacao trees is *Artocarpus altilis,* breadfruit, with *Solanum hazenii* in the under-storey, while *Psidium guajava,* guava, *Tamarindus indica,* tamarind, and *Mangifera indica,* mango, are scattered throughout the cultivated zone. Two other plantation species, *Myristica fragrans,* nut-meg, and *Manilkara zapota,* sapodilla, are found only occasionally. *Swietenia mahagoni*, West Indian mahogany, is the only tree planted for its timber value, a small immature stand occurring on the north side high above the lake.

On the upper slopes around Lake Antoine occurs the 'second-growth Forest zone' where very large trees predominate. *Albizia niopoides*, *Spondias mombin* and *Tabebuia heterophylla* are common to abundant throughout this zone, with the former two also being scattered in the cultivated zone, while *Bursera simaruba* is concentrated on the upper east slopes. Smaller trees and shrubs common in this zone include, *Pisonia fragrans*, *Randia aculeata*, *Cordia curassavica*, *Melochia nodiflora* and *Croton sp.* In the under-storey and along roadsides, *Cereus margaritensis,* a cactus, *Wedelia calycina,* a composite, *Hymenocallis caribaea,* an amaryllis, and *Solanum hazenii* can be found.

Levera Pond

Levera Pond is approximately 600 m inland from Levera Beach where a 'littoral zone' separates the mangrove from the sea. The upper beach sand is covered in places by dense vegetation mats composed of prostrate vines, like the legume *Canavalia rosea* and two species belonging to the Aizoaceae, *Sesuvium portulacastrum,* seaside purslane, and *Trianthema portulacastrum*. Grasses in this zone include *Eleusine indica*, a weedy species, *Sporobolus virginicus* and *Brachiaria distachya*. Other herbs found growing on the upper beach are *Chamaesyce serpens* (Euphorbiaceae) and *Spigelia anthelmia* (Loganiaceae), a medicinal plant that is very toxic (Howard 1974-1989). Shrubs present in this zone include *Capparis odoratissima* (Capparaceae), *Jacquinia armillaris* (Theophrastaceae), which

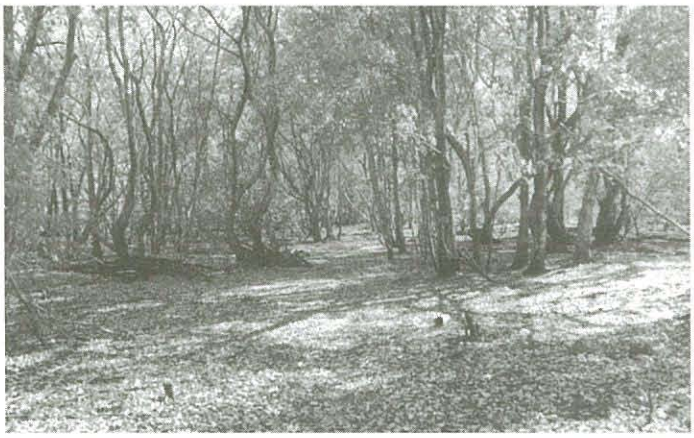

Plate 4. Manchineel (*Hippomane mancinella*) woodland north-west of Levera Pond. Lack of under-storey vegetation is owing to periodic flooding.

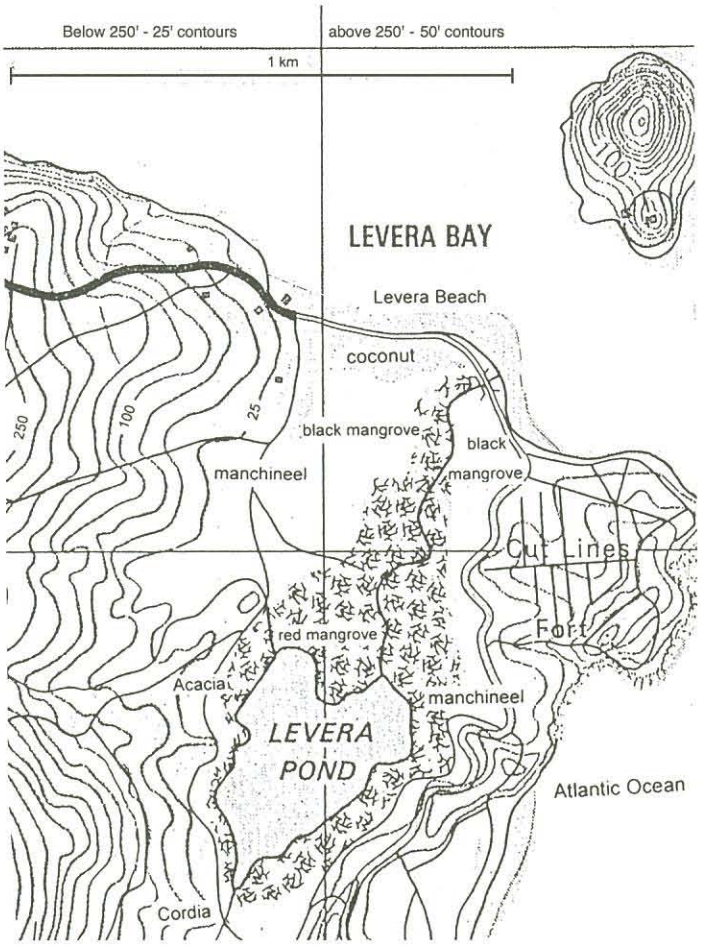

Fig. 3. Some of the vegetation zones around Levera Pond (contours in feet).

prefers drier habitats, and *Clerodendrum aculeatum* (Verbenaceae). Common tree species are *Hippomane mancinella* (Euphorbiaceae), all parts of which are caustic, and *Coccoloba uvifera* (Polygonaceae), the sea grape, while *Conocarpus erectus* (Combretaceae), buttonwood, is scattered.

In the 'aquatic zone' around Levera Pond, *Rhizophora mangle*, red mangrove, forms a dense continuous belt of trees (Plate 2) with its tangled mass of stilt and aerial roots. Floating in the water near the mangrove are sporadic colonies of *Nymphaea ampla,* water lily, while rooted in the muck at or near the edge of the pond are the tall guinea grass, *Panicum maximum*, the sedge, *Fimbristylis spadicea,* and the vines *Evolvulus convolvuloides* (Convolvulaceae) and *Rhabdadenia biflora* (Apocynaceae).

Moving away from the pond but still forming part of the low-lying depression, several distinct natural vegetation zones can be recognized (Fig. 3). The 'Black Mangrove zone' occupies a large area between the pond and the littoral zone. Black mangrove trees, *Avicennia germinans,* form young, immature stands on the north-west side of Levera Pond where they are being cut continuously for charcoal. Beneath these stands, numerous pneumatophores extrude from the muck. Very large mature black mangrove trees, with dark fissured bark, are not found in this area but are concentrated on the north-east side of the pond where their population density is smaller in comparison with the trees in the immature stands. Scattered amongst the black mangrove are manchineel, *Hippomane mancinella*, which in places occur in almost pure stands (Plate 4), coconut, *Cocos nucifera*, and hog plum trees, *Spondias mombin*, plus one other mangrove species, *Laguncularia racemosa,* white, and *Conocarpus erectus,* buttonwood.

Under-storey species in the Black Mangrove zone include: the weedy grass *Cynodon dactylon*,; two sedges, *Fimbristylis cymosa* and *Abildgaardia ovata*, the latter growing in sandy-organic soil; several vine-like species; *Blutaparon vermiculare*, a prostrate herb, and *Alternanthera flavescens*, a weedy scandent herb, both belonging to the family Amaranthaceae plus *Jacquemontia pentantha* (Convolvulaceae); the shrubs, *Malachra fasciata* and *M. alceifolia* (Malvaceae); and the legumes *Senna obtusifolia*, a weedy species and *Acacia nilotica*, a naturalized small tree, which also is found on the adjacent hillside in pure stands or mixed with other acacias. Also growing in the Black Mangrove zone are the herb *Capraria biflora* (Scrophulariaceae) and the shrub *Jacquinia armillaris* which occurs in the littoral zone as well.

At the south or landward end of Levera Pond, the 'Cordia zone' is found (Fig. 3), dominated by the small tree *Cordia obliqua,* sticky cherry, belonging to the family Boraginaceae. Two other members of this family also occur here, the shrub *Bourreria succulenta* and the scrambling shrub *Tournefortia caribaea.* Other species in the under-storey include the shrubs, *Psychotria microdon* (Rubiaceae), *Erythroxylum havanense* (Erythroxylaceae), and the herb *Fimbristylis ferruginea* (Cyperaceae). Large trees in or near this zone include *Bursera simaruba* (Burseraceae), *Crateva tapia* (Capparaceae), *Diospyros inconstans* (Ebenaceae), *Albizia niopoides* and *Samanea saman* (Leguminosae), while smaller trees found here are the calabash, *Crescentia cujete*, having large oblong or almost spherical fruit, belonging to the family Bignoniaceae, and buttonwood which is scattered in this zone.

On the eastern side of Levera Pond, along the forest edge and mangrove, the following trees are found: *Genipa americana* (Rubiaceae), *Pisonia fragrans* (Nyctaginaceae), *Coccoloba sp.* (Polygonaceae), and *Casearia sylvestris* (Flacourtiaceae) while vines growing here include *Phryganocydia corymbosa* (Bigoniaceae) and *Paullinia pinnata* (Sapindaceae). On the western side of the pond, near the red mangrove, there is a small stand of the legume tree *Acacia macracantha,* which also occurs on the adjacent slopes.

All the zones described so far for Levera Pond are composed mainly of natural vegetation. The cultivated areas around the pond are not as extensive as those found at Lake Antoine. Coconut plantation covers the western portion of Levera Beach (Fig. 3) and extends inland a short distance in the north-west section of the low-lying depression. In addition to *Cocos nucifera*, a few guava trees, *Psidium guajava*, belonging to the Myrtaceae family are found here. Under the coconuts are the legumes *Desmodium triflorum*, *Crotalaria retusa* and *C. falcata* plus the grass *Paspalum vaginatum.* Pastureland is found on the east-

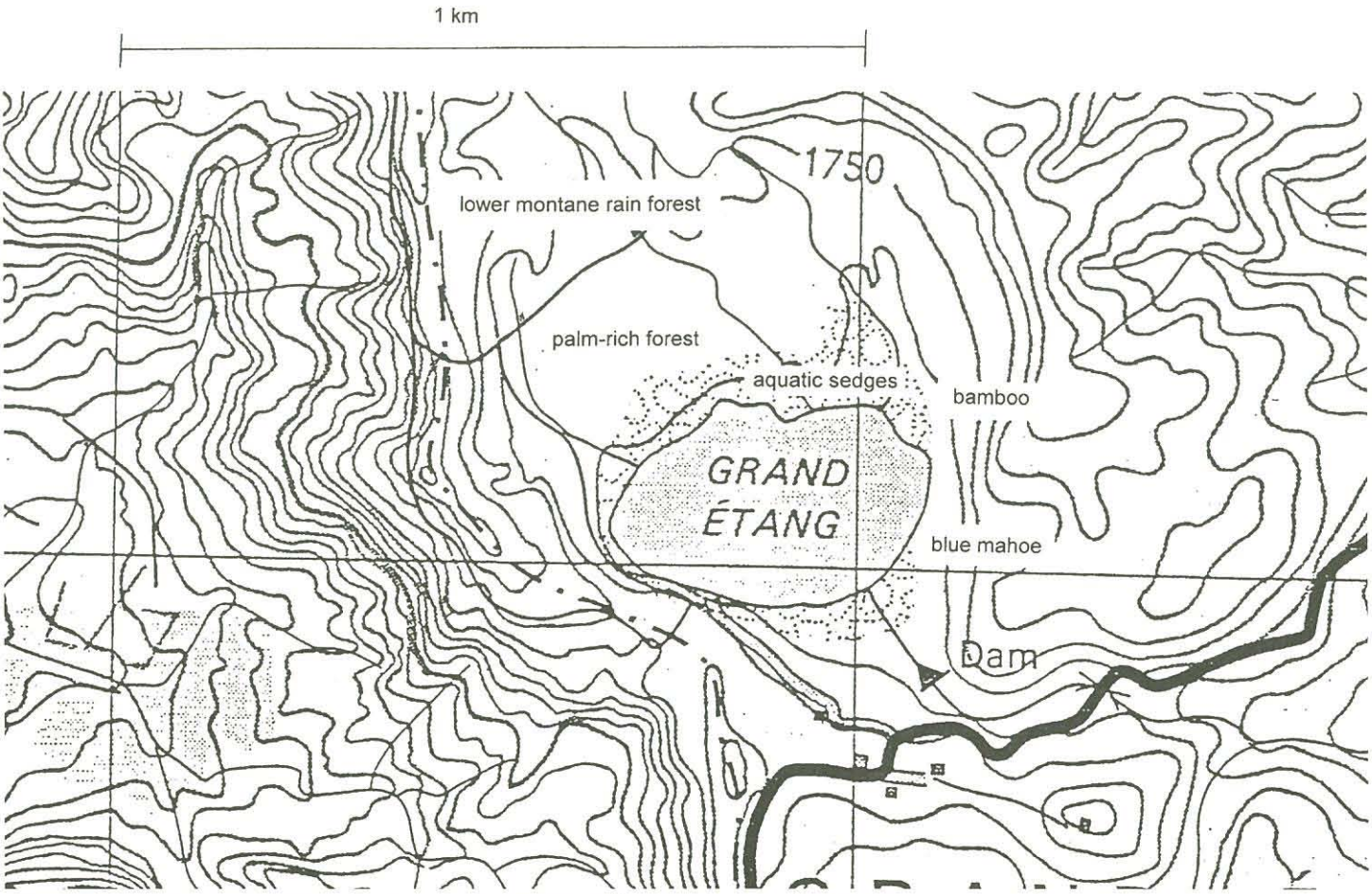

Fig. 4. Some of the vegetation zones around Grand Étang. (contours in feet)

ern side of the pond and in the south-east corner of the depression. Forage herbs and grasses are the dominant vegetation cover in these areas. Large patches of *Sesuvium portulacastrum*, a species of the littoral zone, are growing in pastureland on the eastern side of the pond near the edge of the mangrove. Also found here are the legumes *Desmanthus virgatus* and *Coursetia caribaea*, a forage shrub, plus the composite *Vernonia cinerea*. In the pasture at the south-east corner of the depression, several scattered fruit trees are present: sapodilla, *Manilkara zapota*, coconut, guava and mango, *Mangifera indica*.

On elevated embankments near Levera Pond the spiny shrub *Randia aculeata* (Rubiaceae) occurs while at even higher elevations near Bedford Point on exposed headlands species belonging to the Cactaceae family are a prominent aspect of the under-storey vegetation. Cacti include *Opuntia dillenii*, forming prostrate clumps, and the erect *Pilosocereus royeni* and *Acanthocereus tetragonus*. Other plants in the under-storey are the shrubs *Justicia sphaerosperma* (Acanthaceae) and *Guettarda odorata* (Rubiaceae). A prominent tree in elevated areas on the eastern side of the pond and near exposed headlands is *Bursera simaruba*. Most of the vegetation in the elevated zones around the pond is xerophytic reflecting low rainfall and the drying onshore winds. On the south-west side of the pond on the lower slopes of Levera Hill, an occasional cultivated tree, such as tamarind, *Tamarindus indica*, is found in the natural forest cover.

Grand Étang

Like the other sites, the vegetation zonations at Grand Étang (Fig. 4) start at the water's edge with an 'aquatic zone' up to 50 m wide. The dominant species here, is the sedge *Cladium jamaicense,* which grows in an almost continuous belt around the margin. Other sedges growing in standing water and found around the lake are *Fuirena umbellata* and *Eleocharis interstincta,* together with the grass *Paspalum conjugatum*. Also growing around the lake margin are ferns belonging to the genus *Thelypteris* (for example *T. reticulata*).

Montrichardia arborescens (Araceae) is concentrated mainly on the north-east side of the lake while a colony of *Hydrilla verticillata*, a submerged aquatic, is found at the boat launch site on the south side of Grand Étang. Overlapping the margin between the aquatic zone and the adjacent landward zone are *Cyclanthus bipartitus* (Cyclanthaceae) and *Ischnosiphon arouma* (Marantaceae).

Moving inland from the lake edge, on slightly elevated but level terrain that is periodically flooded, there occurs the 'lake margin forest zone'. Trees observed in this zone include the palms *Prestoea acuminata* and *Euterpe broadwayi* that proliferate in poorly drained areas on the north-west side of the lake. On slightly higher ground in this region large *Sloanea caribaea* trees (Elaeocarpaceae) are common. Other trees growing in this zone include *Dacryodes excelsa* (Burseraceae), *Ficus guianensis* (Moraceae) and *Micropholis guyanensis* (Sapotaceae), which is common. Under-storey trees found here are *Miconia tetrandra* (Melastomataceae) and *Palicourea crocea* (Rubiaceae). Epiphytes include *Anthurium hookeri* (Araceae), *Alloplectus cristatus, Columnea scandens* (Gesneriaceae), *Asplundia rigida* (Cyclanthaceae) which also grows on the ground, and the orchids *Epidendrum secundum* and *E. lechleri.*

Small sections of plantation forest have been established near Grand Étang. Bamboo occurs along the north side of the lake, while blue mahoe, *Hibiscus pernambucensis*, is common on the north-east side, having been planted to rehabilitate sections of the forest damaged by Hurricane Janet in 1955.

Beyond the lake margin forest zone, the terrain rises steeply on all sides covered with Lower Montane Rain Forest, which grades at higher elevations into Montane Thicket, then Palm Brake and Elfin woodland at the highest summits (Beard 1949).

ECOLOGICAL ASSESSMENT

Lake Antoine

This is the most disturbed site with respect to human activities and probably has had a long history of agricultural development through cultivation and grazing. This is reflected in the type of vegetation cover now surrounding the lake. There is little historical documentation of the natural plant communities around Lake Antoine. Beard (1949) does not even mention the lake in his paper on "Natural Vegetation of the Windward and Leeward Islands". Based on the native trees present, he would have included the area in his Dry Scrub Woodlands "near the sea-coast". Groome (1970), in discussing the geology of the island, only mentions the lake briefly as an example of an extinct explosion crater. In addition to the plants found in the aquatic zone, probably the least disturbed area, some of the natural trees surrounding the lake that reflect the original vegetation include: *Tabebuia heterophylla, Bursera simaruba, Spondias mombin, Albizia niopoides* and *Pisonia fragrans,* which are now more abundant on the upper slopes.

The cultivation history of the area seems to have undergone many changes, with the dominant crop reflecting the economic climate of the time. It would seem from existing evidence that sugar cane and coconuts were more widely planted in the past. The same might be said of the cacao plantations, while bananas represent a crop currently in demand. Recent plantings of *Leucaena leucocephala,* as a forage crop, plus the planting of a samaan tree for shade indicate the extensive use of the land around the lake as pasture. Short-term vegetable crops are presently being planted in tilled areas

Levera Pond

The natural vegetation around the pond has not been disturbed to the same extent as the native plants around Lake Antoine. The former site is situated in a low-lying, flat depression that is frequently inundated with brackish water thus preventing extensive use of the area for agricultural crops, although some grazing takes place. The only plantation crop is a stand of coconut palms along the beach west of the outflow channel. At the back of the pond on slightly elevated terrain there occurs open pastureland surrounded by scattered plantation species such as: *Manilkara zapota, Cocos nucifera, Psidium guajava* and *Mangifera indica.*

Beard (1949) and Groome (1970) only make brief references to Levera Pond, the former classifying it as swamp and listing the various mangrove species present, while the latter describes the pond as "a Hydrophytic community associated with mangrove swamps." The various mangrove species, especially *Rhizophora* and *Avicennia*, tend to form pure stands

with their distribution controlled by their salt tolerance. *Rhizophora mangle* forms a continuous belt around the pond while young *Avicennia* occurs in almost pure stands north of the pond.

Grand Étang

Grand Étang is the most natural of the three sites but still shows signs of human disturbance around parts of the lake margin, where some bamboo, *Bambusa vulgaris*, and blue mahoe, *Hibiscus pernambucensis*, have been established. The former as a soil stabilizer and the latter as a replacement tree for hurricane-damaged forest. Because the area has been set aside as a forest reserve much of the native vegetation remains intact and has been well documented by Beard (1949) in his "Natural Vegetation of the Windward and Leeward Islands". He recognizes the following forest types in the Grand Étang area: Lower Montane Rain Forest around the lake margin and the lower slopes of the surrounding hills; Montane Thicket at higher elevations; Palm Brake on steep windward slopes near the summits; and Elfin Woodland at the summits. Groome (1970) uses Beard's vegetation types in describing high elevation areas such as Grand Étang.

COMPARING SITES

An examination of the plant species found at the three sites reveals very little overlap in the flora. None of the species were present at all three sites, six were present at both Levera Pond and Lake Antoine, three at both Lake Antoine and Grand Étang, while none were common to Grand Étang and Levera Pond. This lack of similarity in the flora between the sites is to be expected in light of the contrasts regarding elevation above sea level, degree of salinity, moisture levels, prevailing wind, and amount of cultivation. The two sites near sea level, Levera Pond and Lake Antoine, have the most overlap but this has more to do with elevation, low rainfall and/or cultivation than salinity. The absence of overlap at two sites, Grand Étang and Levera Pond, is owing to large contrasts between elevation, amount of rainfall and salinity.

There is much stronger affinity between the 122 plant species recorded in the survey area and the species that are found on Trinidad and Tobago. Seventy-six or 62% of the species in the survey are found on the three islands, with 93 species (76%) being shared with Trinidad and 81 (66%) with Tobago. This is a reflection of similar habitats found on these islands.

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REFERENCES

Arculus, R.J. 1976. Geology and geochemistry of the alkali-andesite association of Grenada, Lesser Antilles island arc. *Bull. Geol. Soc. Amer.*, 87: 612-624.

Beard, J.S. 1949. Natural vegetation of the Windward and Leeward Islands. *Oxford Forestry Memoirs*, 21: 1-192.

Caribbean Conservation Association. 1991. Grenada environmental profile. St. Michael, Barbados.

Groome, J.R. 1970. A natural history of the island of Grenada, West Indies. Caribbean Printers Ltd., Trinidad.

Howard, R.A. 1974-1989. Flora of the Lesser Antilles. Arnold Arboretum, Harvard University, Cambridge, Mass. (6 volumes).

Mann, P., Schubert, C. and **K. Burke.** 1990. Review of Caribbean neotectonics. *In* Dengo, G. and Case, J.E. (eds) *Geology of North America: the Caribbean Region.* Geological Society, Boulder, Colo. pp. 307-338.

McAndrews, J.H. 1996. Habitat history at Levera National Park, Grenada. *Rotunda*, 42: 2-3.

Ramcharan, E.K. and **J. H.** McAndrews. 1992. Late Quaternary Pollen Analysis from Grand Étang, Grenada, West Indies. *Department of Botany, ROM.* C:\EKR\GRENADA.TX2

Sharman, M.Y. 1994. Vegetation and sea-level history of a mangrove swamp at Levera Pond, Grenada. *M.Sc. Thesis, University of Toronto.*

Williams, M.A.J., Dunkerley, D.L., De Deckker, P., Kershaw, A.P. and **T. Stokes.** 1993. Quaternary Environments. Edward Arnold, London.

An Investigation into the Effect of Bamboo on the Surrounding Vegetation in the Arena Forest Reserve

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ABSTRACT

Bambusa vulgaris (Bamboo) is widespread in Trinidad. It occurs at all elevations and in all counties of the island. A study was conducted in the Arena Forest Reserve to determine whether or not *B. vulgaris* had an effect on the vegetation surrounding it, and whether or not it was an invasive species in a closed canopy forest in Trinidad. Species composition, diversity and density of all trees and seedlings within the immediate area of effect of four bamboo clumps in the Reserve were recorded and the parameters compared with an area of natural forest of the same size in the immediate vicinity. The abiotic conditions of dead organic matter (DOM) depth, and canopy closure were also compared between bamboo and natural forest plots. It was found that *B. vulgaris* does not appear to be invasive in the closed canopy areas of the Arena Forest Reserve in Trinidad, but where it exists it modifies its environment to the detriment of some tree species and the apparent benefit of others.

INTRODUCTION

The Present Situation

Bambusa vulgaris Schrad. ex J.C. Wendl (Bamboo) is a widespread introduced plant in Trinidad and Tobago. It is seen mainly in disturbed areas, being an integral part of the early stages of succession of vegetation primarily in agricultural areas. As a result of its growth habit it may deflect or suppress the later successional stage vegetation. It may also be an aggressive invasive species of the natural forests of Trinidad and Tobago with a detrimental effect on the surrounding vegetation and a tendency to form monodominant stands. This study into the effects of bamboo on its surrounding vegetation in a closed canopy rainforest could bring some insight into the situation and useful information will be gleaned to enhance the management strategies concerning this plant.

Invasive Species

B. vulgaris may be considered an invasive species in Trinidad and Tobago. An invasive species is defined by Cronk and Fuller (1995) as "an alien plant spreading naturally (without the direct assistance of people) in natural or semi-natural habitats, to produce a significant change in terms of composition, structure or ecosystem processes"

Invasive species may affect their new environment in a number of ways. These include: -

Category

1. A replacement of diverse ecosystems with single species stands of aliens
2. Invasion that poses a direct threat to native fauna
3. Alteration of soil chemistry
4. Alteration of geomorphological processes
5. Invasion leading to plant extinction
6. Alteration of the fire regime
7. Alteration of hydrology

It is suspected that of these, *Bambusa vulgaris* may to some extent threaten natural forest ecosystems in Trinidad and Tobago at least with a Category 1 effect and possibly with effects in other categories.

The Species

The plant that will be considered in this investigation is of the family Gramineae. Farrelly (1984) has described *Bambusa vulgaris* as the most common bamboo in the world. It is an adaptable plant and very

hardy. It has been found at sea level and up to 1219.2 m. It is capable of surviving at most temperatures above 0°C.

B. vulgaris is suspected to have originated in the Madagascar, Java, and Sri-Lanka area by some authors, (Farrelly 1984) and in the East Indies, China, Japan and India by others (Lawson 1968). All authors agree, however, that it originated somewhere in the Far East. By this token it is not native to Trinidad. It is not clear when it was introduced to Trinidad nor the original reasons for its introduction. Uses of *B. vulgaris* in Trinidad today are as a construction material (scaffolding, frames for buildings etc...) and soil stabilisation on slopes and along watercourses.

The ecology of *B. vulgaris* can be inferred from the habitats where it is generally found. It fits the profile of a pioneer or early successional stage plant, the habitats in which it is found are generally disturbed by humans; broken canopies with copious amounts of direct sunlight, adequate moisture and nutrients. Its distribution thus appears to be strongly influenced by humans in Trinidad. It flowers and seeds very infrequently (once every 50 years or so) and so, therefore, spreads over longer distances vegetatively with the aid of humans. However, once established in an area, it is capable of surviving and probably expanding its range slowly without any further assistance. Thus *B. vulgaris* appears to be naturalised because it appears to be surviving in many parts of Trinidad and Tobago without human assistance.

Culms or stalks of *B. vulgaris* can grow up to 20 m tall with an average width of 12 cm. Growth rates have been estimated at 15 - 18 cm per day. Other estimates are a 10 – 30% increase of its height annually. Tree species have a growth rate of a 2 – 5% increase in height per year (Farrelly 1984). The fast growth rate exhibited may result in the overtopping of seedlings and saplings of other species in the vicinity, suppressing their growth by blocking out the sunlight.

Another aspect of the growth habit of *B. vulgaris* is its toppling stalks. The culms grow straight up and when they reach their maximum height topple over either from wind-throw, old age, predation, or rotting at the base. This may have the effect of battering down developing saplings in the immediate area. Healthy culms usually sprout at the nodes when lying on the ground causing the clump to increase in size.

B. vulgaris also has copious leaf production and leaf fall. This may have the effect of building up a thick layer of Dead Organic Matter (DOM) which may stifle the seedlings growing in the immediate area of effect of the bamboo clump.

These phenomena were all observed at clumps of *B. vulgaris* in the Arena Forest Reserve, so a quantitative investigation of its effect on the surrounding vegetation was initiated. The study was undertaken to determine if *B. vulgaris* was acting as an invasive plant and caused a Category 1 effect in closed canopy forest in the Arena Forest Reserve.

The specific objectives of this study were the following:

1. To compare species diversity, composition and density of woody vegetation of a relatively undisturbed, closed canopy forest with the woody vegetation in the immediate area of effect of a clump of *Bambusa vulgaris* growing in the same forest;

2. To compare the depth of the DOM and the canopy closure of the two microenvironments.

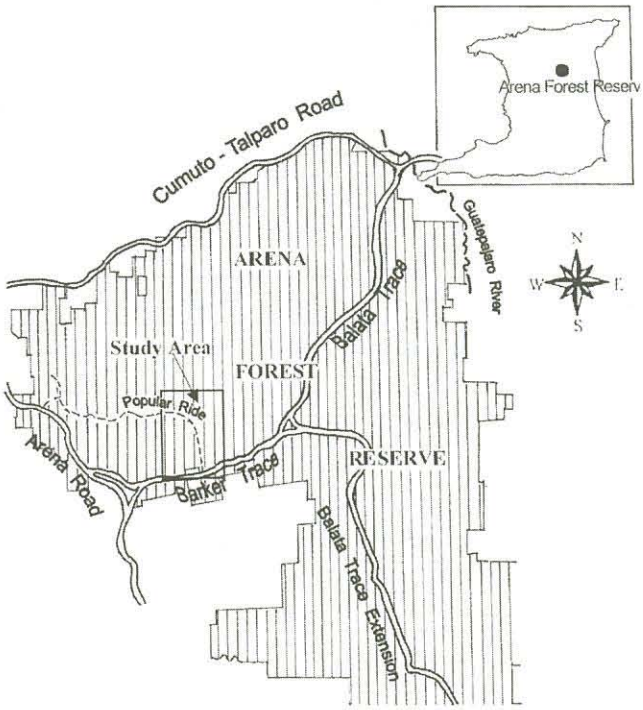

Fig. 1. Location of study area in Arena Forest Reserve

The Study Site

The Arena Forest Reserve lies in the San Raphael forestry range of the Northwest Conservancy, and occupies an area of 1536.6 ha. (Fig. 1)(Bell 1969).

The ground is gently undulating throughout with occasional short steep slopes. Minimum elevations of 22.8 m above sea level are found at the northern boundary of the reserve. Approximately 12.1 ha exceed an elevation of 76.2 m and a maximum elevation of 87.4m above sea level occurs at the southern extreme of the reserve (Bell 1969).

Sands and clays derived from rocks laid down in the lower Pliocene to upper Eocene epochs of the tertiary period constitute the bulk of the Arena Forest Reserve's soil, while in the northwest of the Reserve, sands derived from the deposits of the Pleistocene epoch of the quaternary period are present (Bell 1969). Soils of the Reserve range from the Arena Sand with excessive internal drainage, to clay soils with impeded internal drainage. Soil at the study sites was of two types, the Arena Sand and the Las Lomas Sand and Loam. Both soils drain freely (Bell 1969).

The vegetation of the reserve consists of altered lowland seasonal evergreen forest (Bell 1969). The original composition of the forest was reported in Beard (1946) and was found to be a tall closed forest dominated by commercially important timber trees such as *Carapa guianensis* Aubl. (Crappo) and *Eshwielera subglandulosa* Miers (Guatacare). Over the course of the century the forest was modified by and for timber production but still retained its character as a tall closed forest (Bell 1969). Timber production in Arena Forest Reserve was halted in the late 1980's as it was felt the Reserve no longer contained adequate timber supplies (Vernon Ragbir *pers. comm.*). The practice of harvesting trees for charcoal production was an integral part of the timber production systems in Arena Forest Reserve. However, with the advent of cheap kerosene supplies it became economically marginalised by the middle of the last century (Bell 1969). Charcoal production continued until the 1970's but on a much smaller scale.

B. vulgaris was introduced into the Arena Forest ecosystem by the charcoal producers as posts to brace the sides of the pits in which a tree was burnt for charcoal (Vernon Ragbir *pers. comm.*). After the charcoal was removed the pit was abandoned and the bamboo sprouted from nodes taking advantage of the gap created when the tree was felled for burning and the nutrients in the soil from un-recovered charcoal. The result is clumps of *B. vulgaris* scattered throughout the Reserve today, dating from the abandonment of charcoal burning pits (Vernon Ragbir *pers. comm.*).

METHODS

Site Selection

The Arena Forest reserve was chosen as the preferred site for this investigation, based on its close proximity to the campus of the University of the West Indies in St. Augustine and a known history of human intervention and establishment of *B. vulgaris* clumps. The bamboo clumps investigated at the reserve were established by humans some 30 – 60 years ago (Vernon Ragbir *pers. comm.*).

Four clumps of *B. vulgaris* were chosen within the reserve. One lay obliquely opposite to the eastern end

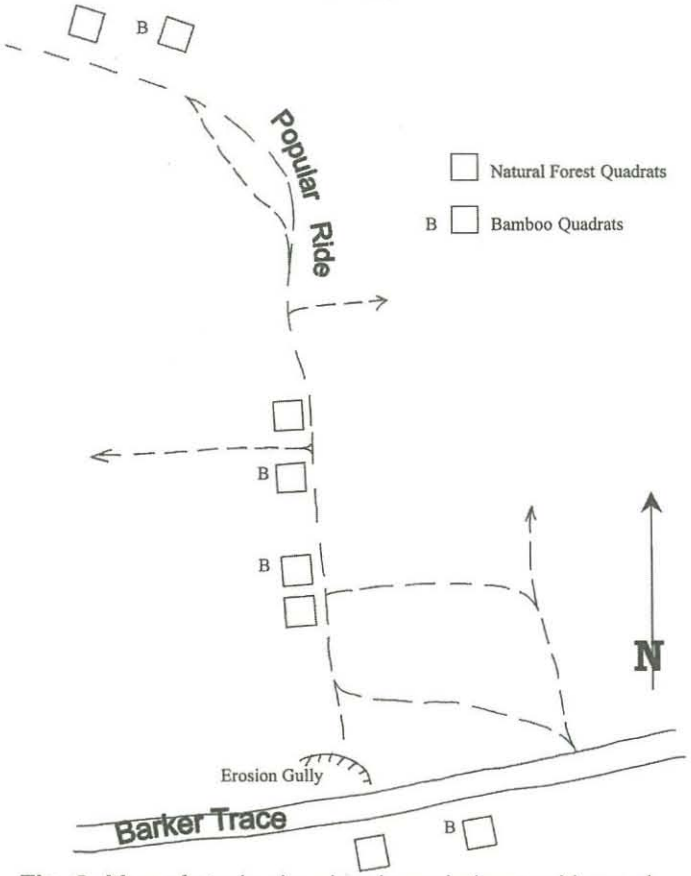

Fig. 2. Map of study site showing relative positions of Bamboo and Natural Forest Quadrats

of Popular Ride; two others were situated along Popular Ride; and one other was off Popular Ride surrounded by forest (Fig. 2). These clumps were chosen because of their close proximity to each other, so that they were easily accessible, while being far enough apart so as not to have an effect on each other.

At each site, woody vegetation was sampled in two main size classes; tree flora (woody vegetation > 1cm Diameter at Breast Height (DBH)) and ground flora (vegetation < 1cm DBH).

Tree Flora

Single 15 m x 15 m quadrats were used to sample trees > 1cm DBH. The size of these quadrats was determined by the qualitative observations of the spread of bamboo leaf litter, and the length of the fallen bamboo stems. With a measuring tape these quadrats were constructed around each bamboo clump, adequately sampling the area of effect. These quadrats were known as the bamboo quadrats.

The process of constructing the quadrats and taking their inventory and the DBH of the plants within them was repeated for an area close by each bamboo clump with similar abiotic conditions, but out of the area of effect of the bamboo clump. The positions of these quadrats were determined by a qualitative difference in leaf litter composition and the longest fallen bamboo stalk seen. These quadrats were known as the natural forest quadrats.

Within the 15 m x 15 m quadrats, every tree's DBH was measured with a measuring tape and samples were taken to the National Herbarium of Trinidad and Tobago (TRIN) for identification by herbarium staff when the specific name was not known. Species names followed those in current usage at the time at the National Herbarium (See Appendix 1 for species list). The number of individuals, number of species, Shannon diversity index, average basal area (m^2) and projected percentage cover were calculated and recorded for each 15 m x 15 m quadrat.

The Shannon diversity index is a combined measure of the species richness and the evenness of the distribution of numbers of individuals in the different species according to the formula:

$$H' = [\Sigma p_i(\log_{10} p_i)] \times (-1)$$

Where p_i = the proportion of all individuals in the i^{th} species

The Shannon diversity index increases with increasing species richness and decreasing dominance of any one or few species.

Ground Flora

Within the 15 m x 15 m quadrats, in both bamboo and natural forest quadrats, smaller 2 .m x 2 m quadrats were constructed. This size was determined by the use of a species area curve done in the reserve prior to the investigation. Four of these quadrats were arbitrarily placed within the larger 15 m x 15 m quadrats. Within the 2 m x 2 m quadrats, an inventory of all seedlings (defined here as any plant <1cm DBH) was taken. The number of individuals, number of species, and the Shannon diversity index were recorded for each quadrat and averaged for each site.

Abiotic Data Measurement

In each of the 15 m x 15 m quadrats, the DOM depth was taken at four points with a ruler. Canopy closure measurements were taken with the use of a spherical densiometer (Forest Densiometers, Oklahoma), also within each of the 2 m x 2 m quadrats. Averages of these measurements were taken as representative for their respective quadrats. The averages of abiotic readings for the 2 m x 2 m quadrat were themselves averaged to give a value for the 15 m x 15 m quadrat.

Statistical Analysis

A paired t-test was performed to compare the number of individuals, number of species, average basal area (m^2) and canopy closure between bamboo quadrats and natural forest quadrats (Hayes 1999). An alternative method was used to determine a t statistic for the Shannon Diversity index (H′) (Zar 1984).

Table 1. Descriptive statistics obtained in the investigation and the probablities that the values obtained for the two microenvironments are the same according a paired t-test (p)

Descriptive Statistic	Microenvironments		p
	Bamboo	Natural Forest	
15m x 15m Quadrats			
Avg. No. of Individuals	46.25	82.00	0.038*
Avg. No. of Species	9.50	8.25	0.120
Shannon Diversity (H')	2.27	2.52	<0.05*
Avg. Basal Area (cm^2)	48.31	39.34	0.368
Canopy Closure (%)	87.00	82.71	0.019*
DOM Depth	4.44	3.94	0.325
2m x 2m Quadrats			
Avg. No. of Individuals	47.50	54.00	0.363
Avg. No. of Species	7.25	8.75	0.248
Shannon Diversity	2.27	2.70	<0.05*

* denotes significant difference

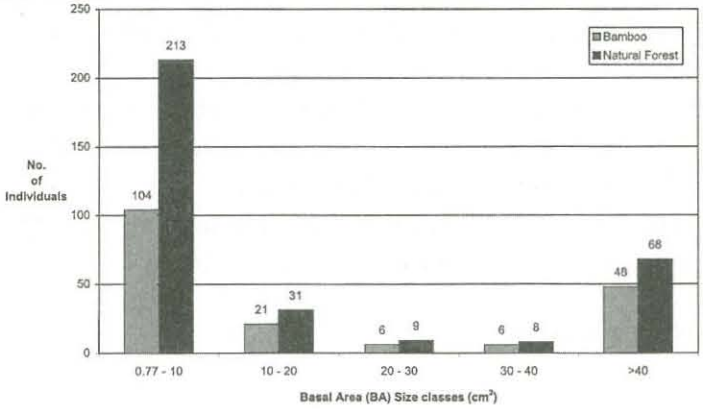

Fig. 3. Histogram of basal area size class vs. no. of individuals for the two microenvironments

RESULTS

Descriptive Statistics

In the 15 m x 15 m quadrats there was a significant difference in the average number of individuals >1 cm DBH (paired t-test, $p = 0.038$), H′ of individuals >1 cm DBH (paired t-test, $p > 0.05$), and percentage cover between the bamboo and the natural forest plots (paired t-test, $p = 0.019$) (Table 1). There were fewer trees in the bamboo quadrats (46.25) compared to the natural quadrats (82.00). This appeared to be accounted for mainly by saplings (Fig. 3). The Shannon Diversity Index was lower around bamboo clumps ($H' = 2.27$) than in the natural forest ($H' = 2.52$) however the average number of species was not significantly different (paired t-test, $p = 0.120$). Finally, in the 15 m x 15 m quadrats, the canopy closure was lower in the natural forest (82.71%) compared to the bamboo quadrats (87.00%).

In the 2 m x 2 m quadrats, the seedlings showed a significantly different Shannon diversity index between the two microenvironments (paired t-test, $p < 0.05$).

Tree Flora

Fourteen species of trees > 1 cm DBH were found at least 5 times in either the natural forest or bamboo quadrats, and were therefore assumed to occur frequently enough for any patterns in their distribution to be of potential significance (Fig. 4). Of the fourteen, four occurred exclusively in the bamboo quadrats, 2 occurred exclusively in the natural forest quadrats and 8 occurred in both quadrats. The species found exclusively in the natural forest plots were *Lacisterma aggregatum* and *Pinzonia coriacea*. In addition *Ryania speciosa* and *Terminalia amazonia* were dras-

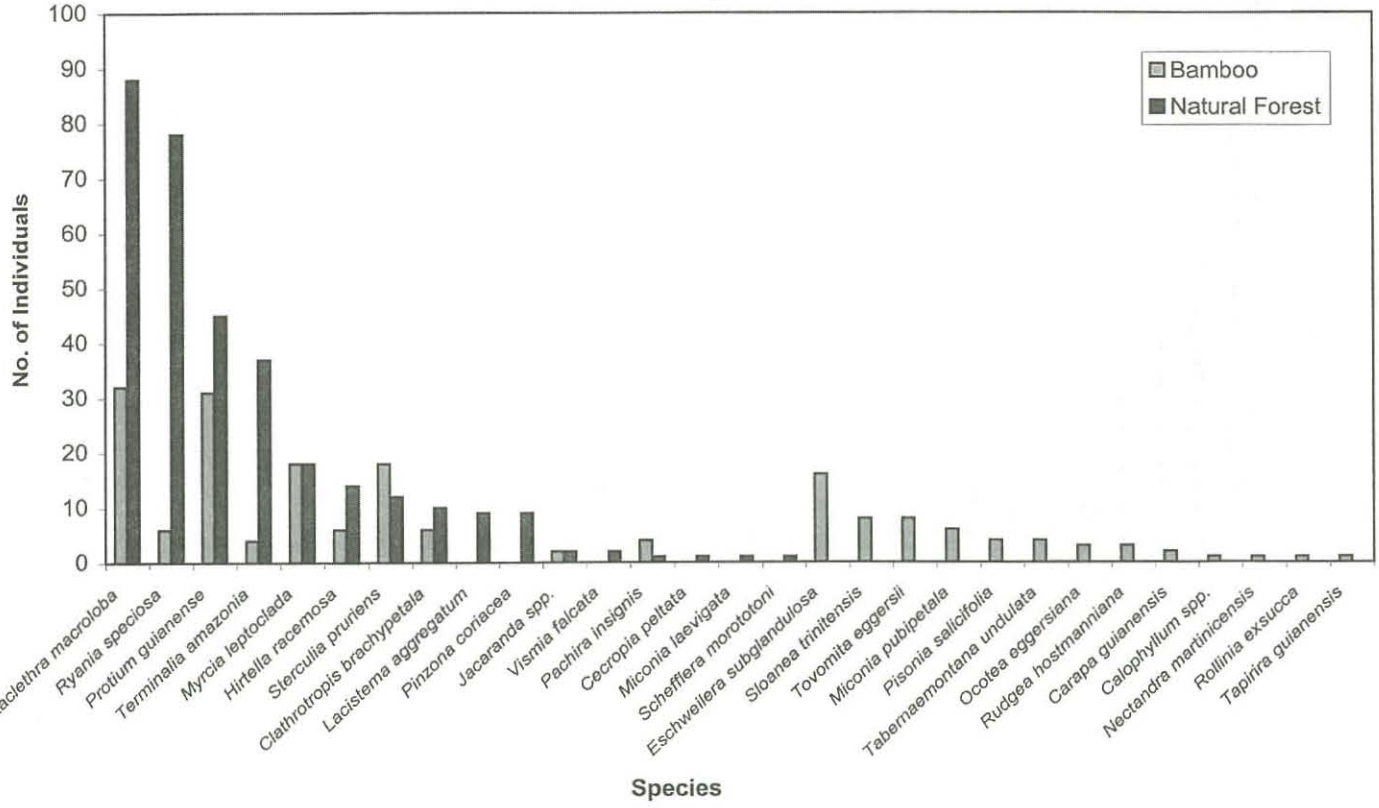

Fig. 4. Species of trees vs. no. of individuals for two microenvironments

tically reduced in numbers in the bamboo plot. The four species found exclusively in the bamboo plots were *Eschweilera subglandulosa*, *Sloanea trinitensis*, *Tovomita eggersi* and *Miconia pubipetala*.

In terms of size class distribution, there were more individuals in the natural forest quadrats in all size classes than there were in the bamboo quadrats (Fig. 3). There were more trees in the larger size class categories in the natural forest quadrats than in the bamboo quadrats. But, generally, greater sapling numbers accounted for the higher numbers of individuals in the natural forest environment.

Ground Flora

Similar trends were observed in ground flora as with the mature trees. There were, however, a few additions and contradictions. *R. speciosa,* and *T. amazonia* seedlings had the same preference for natural forest as did stems > 1cm DBH (Fig. 5). The family of vines, Bignoniaceae also appeared to have a preference for a natural forest environment. *E. subglandulosa* seedlings had the same preference for the microenvironment created by bamboo as did the trees > 1cm DBH. *Heliconia psittacorum* was another "seedling" (so classified because it had a DBH < 1cm) to prefer the environment created by bamboo. It should also be noted here that the numbers of individuals of the species associated with the bamboo microenvironment were lower than the species associated with the natural forest environment but not significantly so (paired t-test, p = 0.363,Table 1).

DISCUSSION

Tree Flora

Bambusa vulgaris clearly had an effect on the surrounding vegetation. The most obvious effect was the significantly lower number of trees around the bamboo clump compared to the natural forest. The majority of individuals in both environments were in the sapling size class; however, there were more than double the number of saplings in the natural forest environment than in the bamboo quadrats. This may be as a result of toppling bamboo stems battering down saplings, a phenomenon that was observed in the bamboo quadrats. There was no difference in the average basal area of trees for the two microenvironments. However, it was shown that there were more individuals in all size classes in the natural forest environment. This indicated that the woody vegetation left in the bamboo quadrats was dominated by a few large trees that presumably had grown tall enough to overtop the bamboo and not be harmed by its toppling culms. Another pos-

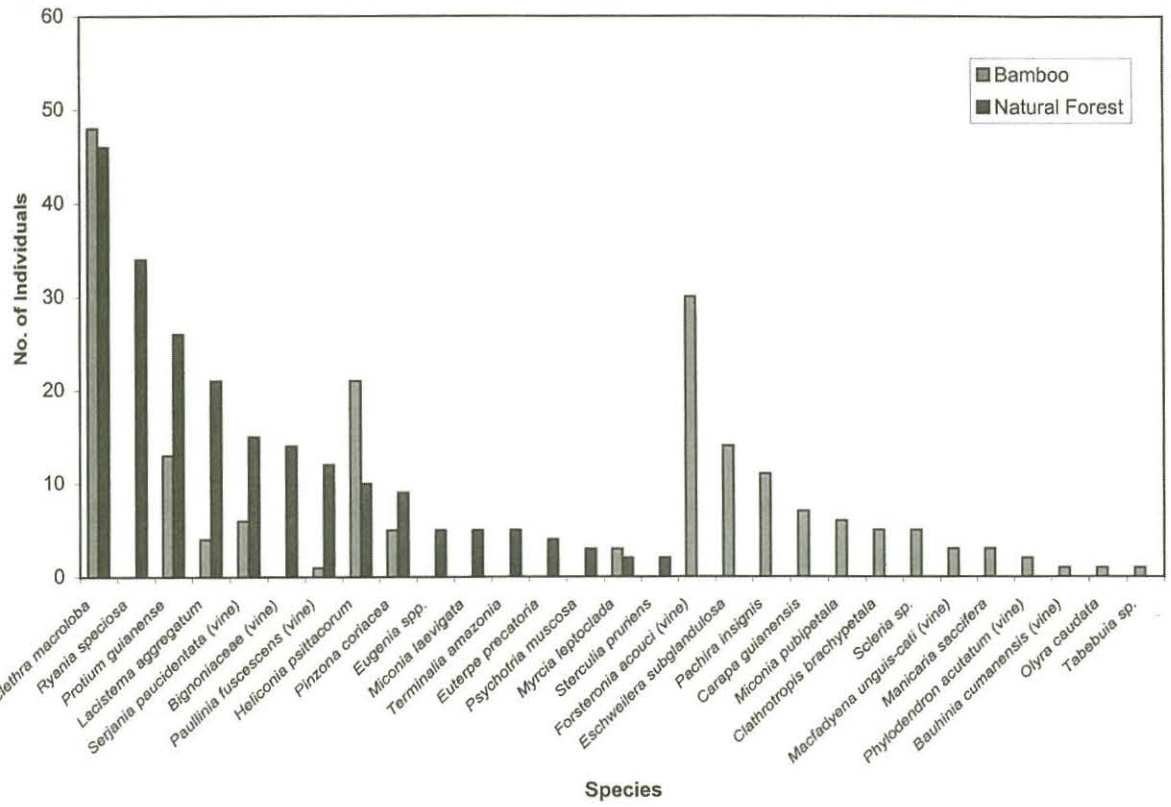

Fig. 5. Species of seedlings vs. no. of individuals for two microenvironments

sible reason for the lower numbers of saplings in the bamboo quadrats could also have been the higher canopy closure cover found in the bamboo quadrats. This indicated that bamboo shaded the plants beneath it more than the trees in the natural forest do, probably resulting in poorer vegetative growth around the bamboo clumps. The higher canopy closure in the bamboo plots is a result of the high density of culms creating a more closed canopy than the adjacent natural forest. Below, ground root competition may have also had a part to play in the lower numbers of saplings in the bamboo plots but this was not investigated in this study.

There was no difference in the number of species of trees in the two microenvironments. There was however, a difference in the Shannon diversity index (H′). This indicated that although the species count was similar for both microenvironments, the evenness of representation of the species was greater in the natural forest environment than in the immediate vicinity of the bamboo clumps. This indicated that some species are able to survive the bamboo microenvironment better than others and dominate the tree species community. The species that favoured the bamboo quadrats (*Eschweilera subglandulosa*, *Sloanea trinitensis*, *Tovomita eggersi* and *Miconia pubipetala*) were better able to survive and grow in the altered microenvironment under the bamboo. These species may have favoured the bamboo quadrats, however, they probably occur in the natural forest as well, albeit probably at a lower density. The reasons and mechanisms for their higher density in the bamboo plots were not determined in this project and need further study.

Of the common species that occurred in numbers having >20 individuals in at least one of the microenvironments, the main difference between the natural forest and bamboo quadrats was the large reduction in the numbers of *Ryania speciosa* and *Terminalia amazonia* in the bamboo. In particular, the reduction in *Ryania speciosa* would emphasize the dominance of *Pentaclethra macroloba* and *Protium guianense* in the bamboo quadrats. This appears likely to be the cause of the difference in H′ between the two microenvironments. The reasons for the reduction in numbers of *R. speciosa* and *T. amazonia* are not clear and need further work.

Ground Flora

In the ground flora quadrats there appeared to be no difference in either the average number of individuals or average number of species in the natural forest and bamboo quadrats (Table 1). There was, however, a significant difference in H′ between the two microenvironments. This indicated that the ground flora in the bamboo quadrats tended to be dominated by particular species that had disproportionally high numbers compared to the natural forest plots (for example *Pentaclethra macroloba*, *Forsteronia accoui* and *Heliconia psittacorum*). Like the 15 m x 15 m tree quadrats, the dominance of the above species is emphasized by the absence of species common in the natural forest (for example *Ryania speciosa*, *Protium guianense* and *Lacistema aggregatum*). The difference in the species composition may have been due to such factors as nearby seed trees affecting the frequency of seedlings in any plot, or differences in soil nutrient status in the plots.

For the most part, the seedlings of the trees (Fig. 5) that were found in the natural forest environment had the same preference as the mature trees (Fig. 4). An exception was *Clathrotropis brachypetala* which showed higher numbers of mature trees in the natural forest and higher number of seedlings in the bamboo quadrats. The reverse of this situation is seen in the distribution of *Sterculia pruriens*, where the trees appeared to have a greater preference for the bamboo environment and the seedlings showed a greater preference for the natural forest environment. These distributions may be a result of transient seedling populations resulting from a recent germination. Further work needs to be done to find the reasons for these distributions.

From the results obtained, the microenvironments and woody vegetation immediately surrounding *Bambusa vulgaris* were different from the surrounding forest. Of the characteristics of invasive species previously described, *B. vulgaris* had a tendency to form monodominant stands and modify the ecosystem. Bamboo, however, is not seen as a major problem in the Arena Reserve and is reported to be overtopped and outcompeted by native trees eventually (Vernon Ragbir *pers. comm.*). However, the results of this study seem to indicate that the vegetation communities in the forest were influenced by bamboo; the process of succes-

sion was likely to be slowed after the disturbance from charcoal burning; and there was a reduction of numbers of individuals of regenerating woody vegetation. In addition, the different responses of species of woody vegetation to the bamboo microenvironment indicated succession was probably deflected from the expected course in natural forest in areas close to bamboo stands.

The results also indicated the possibility of more severely disturbed forests where *B. vulgaris* forms much larger monodominant stands, and in more open deciduous forests, such as exist in Tobago, which may be more severely affected by the presence of *B. vulgaris*. This study is by no means complete and future research needs to be done to examine the relationships of single species with *Bambusa vulgaris*.

Appendix 1. List of species found during study

Species	Family	Lifeform
Bauhinia cumanensis Kunth	Leguminosae	Vine
Calophyllum sp.	Guttiferae	Tree
Carapa guianensis Aubl.	Meliaceae	Tree
Cecropia peltata L.	Moraceae	Tree
Clathrotropis brachypetala (Tul.) Kleinh	Leguminosae	Tree
Eschweilera subglandulosa (Steud ex Berg) Miers.	Lecythidaceae	Tree
Eugenia sp.	Myrtaceae	Tree
Euterpe precatoria Mart.	Palmae	Palm
Forsteronia acouci (Aubl.) A. DC.	Apocyanaceae	Vine
Heliconia psittacorum L.f.	Musaceae	Herb
Hirtella racemosa Lam.	Chrysobalanaceae	Tree
Jacaranda sp.	Bignoniaceae	Tree
Lacistema aggregatum (Berg.) Rusby	Flacourtiaceae	Tree
Macfadyena unguis-cati (L.) A.H. Gentry	Bignoniaceae	Vine
Manicaria saccifera Gaertn.	Palmae	Palm
Miconia laevigata (L.) D. Don	Melastomaceae	Shrub
Miconia pubipetala Miq.	Melastomaceae	Tree
Myrcia leptoclada DC.	Myrtaceae	Tree
Nectandra martinicensis (Jacq.) Mez.	Lauraceae	Tree
Ocotea eggersiana Mez.	Lauraceae	Tree
Olyra caudata Trin.	Gramineae	Herb
Pachira insignis Sw.	Bombaceae	Tree
Paullinia fuscescens Kunth	Sapindaceae	Vine
Pentaclethra macroloba (Willd) Kuntze	Leguminosae	Tree
Philodendron acutatum Schott.	Araceae	Vine
Pinzona coriacea Mart. & Zucc	Dilleniaceae	Vine
Protium guianense (Aubl.) March	Burseraceae	Tree
Psychotria muscosa (Jacq.) Steyerm	Rubiaceae	Shrub
Rollinia exsucca (Dun.) A. DC.	Annonaceae	Tree
Rudgea hostmanniana Benth.	Rubiaceae	Tree
Ryania speciosa Vahl	Flacourtiaceae	Tree
Schefflera morototoni (Aubl.) Maguire, Steyerm & Frodin	Araliaceae	Tree
Scleria sp.	Cyperaceae	Herb
Serjania paucidentata DC.	Sapindaceae	Vine
Sloanea trinitensis (Sandwith)	Eleocarpaceae	Tree
Sterculia pruriens (Aubl.) Schum	Sterculiaceae	Tree
Tabebuia sp.	Bignoniaceae	Tree
Tabernaemontana undulata Vahl	Apocyanaceae	Tree
Tapirira guianensis Aubl.	Annonaceae	Tree
Terminalia amazonia (J.F.Gmel.)Excell	Combretaceae	Tree
Tovomita eggersii Vesque	Guttiferae	Tree
Vismia falcata Rusby	Guttiferae	Tree

REFERENCES

Beard J.S. 1946. The Natural Vegetation of Trinidad. Clarendon Press. Oxford

Bell, T.I.W. 1969. Arena Forest Working Plan. Unpublished

Cronk, Q.C.B. and J.L. Fuller 1995. Plant Invaders: The Threat to Natural Ecosystems. Chapman & Hall. London.

Farrelly, D. 1984. The Book of Bamboo. Sierra Club Books. San Francisco.

Hayes, F. 1999. BL11G. General Ecology and Biometry. Lecture Notes. Unpublished.

Lawson, A.H. 1968. Bamboos : A Gardener's Guide to their Cultivation in Temperate Climates. Faber & Faber Ltd. London

Zar, J.H. 1984. Biostatistical Analysis. 3rd ed. Prentice Hall. Upper Saddle River, N.J.

Can Hemiepiphytes be Useful in the Revegetation of Barren Sites?

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ABSTRACT

Hemiepiphytes, when they grow as epiphytes, must start life with minimal nutrition, and presumably, their physiology has evolved to cope with this situation. They should therefore be good candidates for revegetating barren areas. We tested this hypothesis with *Clusia minor*, *Ficus amazonica* and *Ficus trigonata*. Seedlings of each were grown in plastic bags and later planted out on two sites in the sand pit at the Arena Forest where their behaviour and survival were followed from 1993 to 2000. Of the three species, *Clusia minor* was much more promising than either of the other two. The reasons seem to lie in the evergreen habit of *Clusia* and its freedom from attack by leaf-cutting ants.

INTRODUCTION

Hemiepiphytes are plants that will grow free-standing as well as epiphytically. Among tree species, *Ficus* (Moraceae) and *Clusia* (Guttiferae) are the most important of the locally occuring genera. As epiphytes, they must be able to endure long periods of minimal water supply and mineral nutrition. It occurred to one of us (VCQ) that these very properties might make them useful in the revegetation of barren areas. In addition, the plants in both of these genera have fruit that birds or bats feed on, and the dispersal of seeds by these animals, once the plants begin to fruit, would be an additional benefit. We decided to lay down a small trial to test these ideas.

METHODS

Study area

The site we chose was an abandoned sand pit in the Arena Forest from which sand had been obtained for the construction of the Arena Dam in 1977-1982. The Forestry Division had attempted to revegetate the area after the dam had been built. They tried many species and had only a little success. With their permission we had put in a small trial of *Vismia falcata* and *Pentaclethra macroloba*, but we had abandoned that after a couple of years. In 1993 when we began this new trial much of the area was still treeless though growing a cover of weeds and grass.

We decided to give our plants the most severe test they could possibly be given by planting them at two sites on the slopes of the pit where almost nothing had grown since the pit had been abandoned. Fig. 1 shows the location of the two sites relative to the entrance road, and Figs. 2 & 3 show the appearance of each on 11 October 1998. The sites were not only mostly bare but also subject to rapid erosion and leaching out of nutrients. They had both been terraced many years ago. At site 2 where the soil holds together a bit better than it does at site 1 the terraces are still visible. At site 1 where the soil is extremely loose the terraces have been effaced by gullies, in spite of efforts to shore them up with wooden supports.

Planting and recording procedures

Plants were grown from seed in plastic bags and planted out when they were big enough, mostly over 20cm for the two *Ficus* species and 13-17cm for *Clusia minor*. At planting out they were watered once but no fertilizer or compost was used and the plants during subsequent growth received no fertilizer. Each was labelled with a yellow plastic tag bearing the plant's name, the date of planting, the letters TTFNC and a number. Maps were prepared giving the location of each plant. The dates of planting were as follows: Nos. 1-7 10/VI/1993, Nos 8-9 11/VII/1993; No. 10 10/X1993, Nos 11-12 14/XI/1993; Nos 13-23 12/VI/94. To begin with, heights were measured with a steel tape every month but when we saw how slowly growth was taking place they were measured less frequently after 1994. For the correspondence between numbers and species see Table 1.

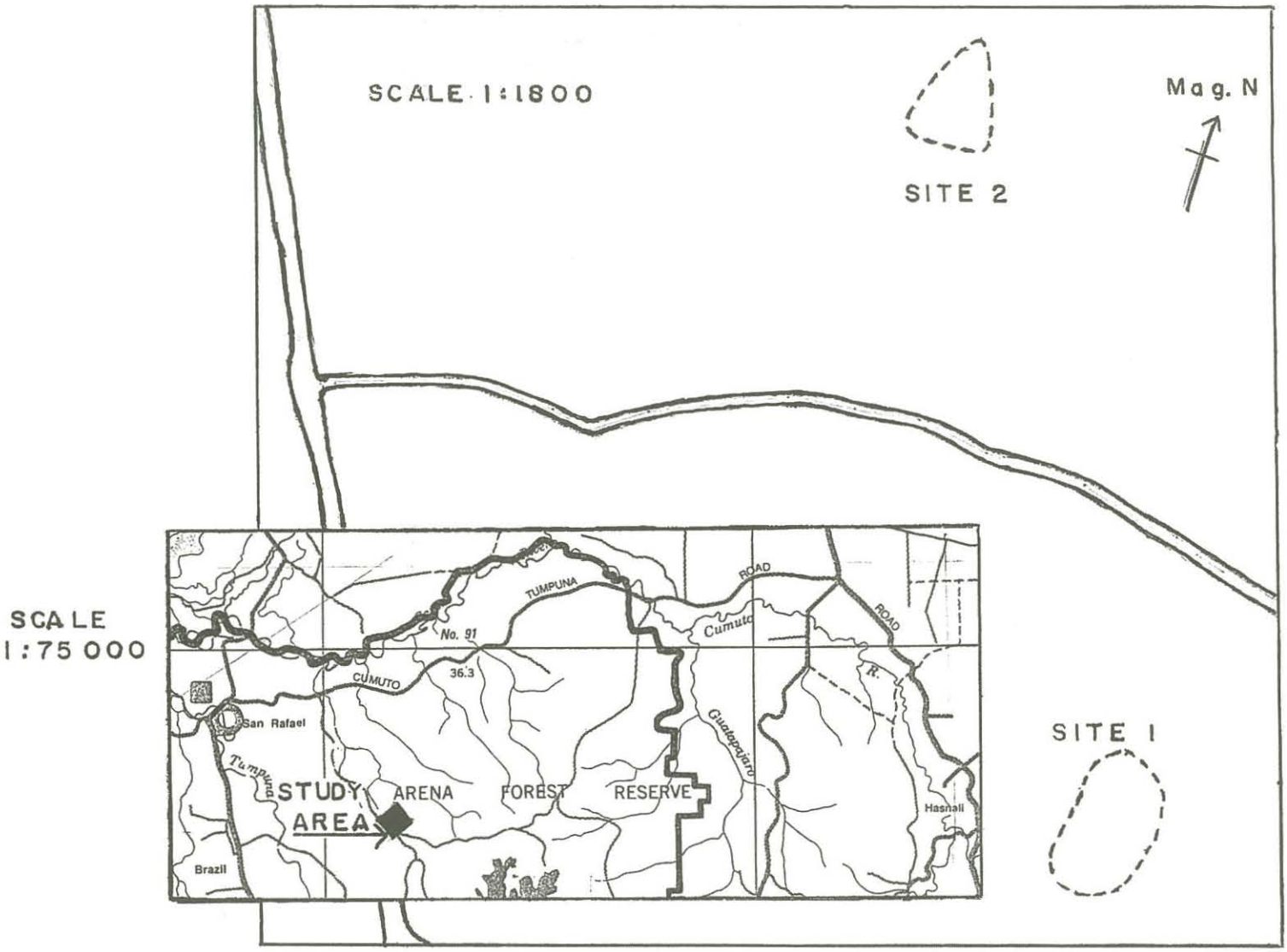

Fig. 1. Study Area

Fig. 2. Site 1 as it was on 11 Oct 1998.

Fig. 3. Site 2 as it was on 11Oct 1998.

TABLE 1.Growth of the plants over the seven years from 1993 to 2000. Measurements are in cm. A = alive D = dead ND=nearly dead NF = not found NR = not recorded

			1993		1994		1995	1996	1997		1998		2000	
Sp	No.	Site	11/7	12/12	21/8	27/11	9/3	11/2	8/1	31/12	20/1	11/10	4/1	28/9
F.am	1	2	40	40	37.5	37.5	-	NF	NF	NF	-	NF	NF	NF
F.am	2	2	36	43	43	42.5	-	40.5	A	NF	-	NF	NF	NF
F.am	3	2	27	35	39.5	40	-	D	-	-	-	-	-	-
F.am	4	1	41	38	38	-	A	NF	A	NF	NF	NF	NF	35.5
F.am	5	1	36	31	31	38	A	NF	A	NF	NF	NF	NF	28
F.am	6	1	40	52.5	64.5	89	-	76	A	A	A	D	-	-
F.am	7	1	23	24	27	-	-	NR	A	A	A	NF	A	61
F.am	8	2	16	34	36	33	-	18	A	NF	-	NF	NF	NF
F.am	9	2	23	49	52.5	51	-	52	A	NF	-	NF	NF	NF
F.am	10	1	-	41	40.5	41	-	44	NF	NF	A	NF	NF	NF
F.trig	11	2	-	23	28	26	-	ND	ND	D	-	-	-	-
F.trig	12	1	-	20	-	20.5	ND	D	-	-	-	-	-	-
F.trig	13	2	-	-	51	52	-	55.5	A	NF	-	NF	NF	NF
F.trig	14	2	-	-	55	59.5	-	60.5	ND	NF	-	NF	NF	NF
C.min	15	2	-	-	17	20	-	24	A	24	-	NF	A	20
C.min	16	2	-	-	13	15.5	-	23	A	43	-	59	A	58
C.min	17	2	-	-	-	17	-	21	A	21	-	NF	NF	NF
F.trig	18	1	-	-	47	49.5	-	49	A	A	A	NF	A	50
F.trig	19	1	-	-	44.5	49.5	-	61	A	A	A	76	A	66
C.min	20	1	-	-	14	16	-	D	-	-	-	-	-	-
C.min	21	1	-	-	14	16	A	20	A	A	26	28	A	30
C.min	22	1	-	-	17	18	-	21.5	A	A	40	43	A	45
F.trig	23	1	-	-	-	37	-	NF	A	A	A	56	A	54

Fig. 4. *Clusia minor* No. 22 as it was 11 Oct 1998.

RESULTS

Table 1 gives a representative sampling of the measurements we made, omitting most of those made during 1993 and 1994, and indicates the presence or absence of plants when we did not measure them. The omitted measurements were those of the dry season months and the middle of the wet season so that the measurements in Table 1 are near the beginning and end of the growing season. Overall, 10 of the 23 plants survived to 28/IX/00 for a percentage survivorship of 43.5. By species, survivorship was 3 out of 10 (30%) for *Ficus amazonica*, 3 out of 7 (42.9%) for *F . trigonata* and 4 out of 6 (66.7%) for *Clusia minor.*

Of the three surviving *F. amazonica* Nos 4 & 5 were shorter on 28/IX/00 than at planting because, in the gullies where they were planted, sand washed from above had accumulated around them and because leaf-cutting ants had cut the stems below the

growing point. No 7 had grown; the original stem had decayed, but two branches had grown, the taller of which at 61 cm was more than double the height at planting out. All had relatively few leaves, No 4 four, No 5 five and No. 7 eleven, seven on the taller branch and four on the shorter one.

Two of the surviving *F. trigonata* (Nos 19 and 23) were about 50% taller than they were at planting out but had just two leaves each. The third (No 18) was virtually a short side shoot with two leaves on a leafless, seemingly dead but not dried, main shoot. It seemed unlikely to survive much longer.

Of the four surviving *Clusia minor*, one (No 15) was seemingly shorter than it was three years before, but this is probably due to the accumulation of sand at the base. The other three (Nos 16, 21, 22) were flourishing with at least four branches each in addition to the main stem, which itself was substantially taller than at planting. No 16 is in a small gully where sand has accumulated and where it gets more water than Nos. 21 and 22, which are exposed on a terrace. Fig. 4 shows No 22 as it was on 11/X/98. It is clear that as a group, the *Clusia minor* plants have grown much better than the *Ficus* species, and seem likely to keep on growing.

DISCUSSION

There were various problems. Labels faded and became hard to read, sometimes even difficult to find as they were covered by sand. At some locations, sand was deposited and at others washed away so measurements from the existing substrate at these locations gave false impressions about the growth of the plant. Height was measured to the terminal bud but all measurements must be regarded as approximations only, and in any case, height is a poor representation of the vigour of the plant since it may be growing side shoots which are not acknowledged. All six plants of *Clusia minor* (nos 15-17 and 20-22) were so bent over at planting that the measure from substrate to terminal bud was significantly shorter than the length of the main stem. Also, there was evidence on at least three occasions that leaf-cutting ants (*Atta cephalotes?)* had cut not only the leaves of some plants but the stems too, so reducing the height. However, none of these difficulties prevented us from collecting the data we needed. They are mentioned here as guidance to others who may want to repeat or extend our work.

It is clear that of the three species in the trial, *Clusia minor* is the only one that can be considered as promising for revegetating barren areas. It is a fairly slow-growing plant even under good conditions, so the fact that the largest of the four plants was only 58 cm tall at six years of age cannot be considered a disadvantage. Slow growth may well be one of the characteristics that makes it suitable for this kind of project. When consideration is given to the fact that nothing has grown naturally on the actual spots where the plants were put in, a height of 58 cm in six years must be considered a feat.

Both *Ficus* species are deciduous and, as far as we can determine, shed their leaves twice a year, as do other *Ficus* species. The cost in energy to replace these leaves must be a significant factor in their failure to grow well. In addition, however, they face defoliation by leaf-cutting ants. Normally, latex is a deterrent to leaf-cutting ants (Stradling 1978) and *Ficus* should be immune from attack. However, it is known that leaf-cutting ants will cut wilting leaves even if they contain latex (Stradling 1978). We never saw the ants in the act of cutting the leaves, but surmise that in the difficult conditions in which these plants were growing their leaves could not remain turgid at all times and were attacked when flaccid.

Clusia, because it is evergreen, needs to replace leaves only occasionally, and is presumably free from attack by ants since it has never been seen to be cut even around VCQ's home (unpub. obs.) where it is abundant. Presumably, these are the features that make it grow better than *Ficus* spp in the conditions obtaining at the chosen site. A larger trial with different *Clusia* species would seem to be the next logical step.

We have also noticed that *Xylopia cubensis* (Annonaceae) and several shrubs in the Melastomataceae seem to be colonizing the area around our study sites. A detailed inventory of these colonizers might reveal potentially useful species that could be incorporated into the proposed *Clusia* trial.

REFERENCE

Stradling, D.J. 1978. The influence of size on foraging in the ant, *Atta cephalotes*, and the effect of some plant defence mechanisms. *J. Anim. Ecol.*, 47: 173-188.

Species and Individuals Recorded on Christmas Bird Counts 1991 - 1996

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Christmas bird counts started in Trinidad in 1969 and have continued annually (ffrench, 1986; Lambie and Debie, 1998 and Lambie and Debie, 2000). In continuation of this series, we now present data for the period 1991-1996. Methods for these counts have remained the same as described by ffrench (1986).

	SPECIES / YEAR	1991	1992	1993	1994	1995	1996
1	Little Tinamou	6	7	14	20	19	13
2	Least Grebe	36	56	33	25	11	12
3	Pied-Billed Grebe	1	12	2	1		
4	Olivaceous Cormorant		3	1			
5	Anhinga		6	1	2	1	
6	Magnificent Frigatebird	CW	3			1	5
7	Stripe-Backed Bittern						
8	White-Necked Heron						
9	Great Egret	1	3	18		7	146
10	Snowy Egret	63	17	264	34	46	607
11	Green-Backed Heron	6	5	4		7	
12	Great Blue Heron		2			1	
13	Little Blue Heron	8	44	21	135	60	107
14	Tricoloured Heron	39	17	450	52	301	370
15	Striated Heron				2		2
16	Cattle Egret	126	277	323	68	330	351
17	Black-Crowned Night-Heron		3	7			7
18	Yellow-Crowned Night-Heron	10	6	1		6	33
19	Boat-Billed Heron	1					8
20	Least Bittern						
21	Pinnated Bittern			CW			
22	Scarlet Ibis	7000	8137	7000	3506	8000	3780
23	Fulvous Whistling-Duck						1
24	Snow Goose						
25	American Pigeon						
26	Blue-Winged Teal	17	4	50	1		
27	King Vulture						
28	Black Vulture	542	638	232	265	129	323
29	Turkey Vulture	36	42	50	71	120	95
30	Gray-Headed Kite	2	6	8		8	12
31	Hook-Billed Kite			1			
32	Pearl Kite		2	1	2	2	2
33	White-Tailed Kite			CW			
34	Double-Toothed Kite	1	3	1			3
35	Short-Tailed Hawk			1		2	1
36	Zone-Tailed hawk			4	4	10	1
37	Gray Hawk	2	3	3	1	3	4
38	White Hawk	1	1	5	3	7	1
39	Savanna Hawk	6	7	5	2	7	6
40	Broad -Winged Hawk	4	3	3	1	5	1
41	Common Black Hawk	11	5	9	3	4	8
42	Great Black Hawk						
43	Ornate Hawk-Eagle	CW	1	1		3	2
44	Long-Winged Harrier		3			1	1
45	Osprey	3	9	6	4	3	10
46	Crested Caracara	1					
47	Yellow-Headed Caracara			1	1	2	1
48	Peregrine Falcon	5	3	1		1	3
49	Bat Falcon	3	4		2	3	1
50	Merlin	3		2	5	5	
51	Gray-Breasted Crake						
52	Clapper Rail					1	
53	Gray-Necked Rail						
54	Sora						
55	Common Moorhen	2	5	3	1	6	2
56	Purple Gallinule		7	CW	1	14	7
57	Azure Gallinule			CW			
58	Limpkin			3			
59	Wattled Jacana	111	115	28	50	53	29
60	Southern Lapwing	40	30	17	35	25	15

	SPECIES / YEAR	1991	1992	1993	1994	1995	1996
61	Semipalmated Plover		2	20			
62	Black-Bellied Plover		180	30		12	
63	Collared Plover		1				
64	Solitary Sandpiper	1	5	2	3	7	7
65	Lesser Yellowlegs		9	23	15	12	
66	Greater Yellowlegs		7	2	2		31
67	Spotted Sandpiper	10	15	15	26		4
68	Willet	7	4	4	22	12	15
69	Black-Necked Stilt						1
70	Wimbrel	8	4	3	8	2	8
71	Sanderling		10				
72	Western sandpiper		1				
73	Least Sandpiper		2	2	2	2	6
74	Pectoral Sandpiper		7	15			
75	Ruddy Turnstone	6		2	15		
76	Semipalmated Sandpiper				2		
77	Common Snipe					2	
78	Short-Billed Dowitcher	10	3	4		10	
79	Yellow-billed tern			2			
80	Rock Dove	139	155	88	88	21	52
81	Scaled Pigeon	27	27	10	13	21	7
82	Pale-Vented Pigeon						1
83	Eared Dove	7	62	2	3	1	40
84	Common Ground-Dove	2	23			2	
85	Plain Breasted Ground Dove						
86	Ruddy Ground-dove	163	87	70	48	57	42
87	White-Tipped Dove		4	2	2	2	1
88	Gray-Fronted Dove	2	5	3	9	12	8
89	Red-Bellied Macaw				104		
90	Brown-Throated Parakeet			16			
91	Green-Rumped Parrotlet	22	6	1	40	29	8
92	Lilac-Tailed Parrotlet	46	234	40	52	121	49
93	Blue-Headed Parrot	2	19	12	2	50	6
94	Yellow-Crowned Parrot		4			7	
95	Orange-Winged Parrot	30	82	128	175	157	113
96	Mangrove Cuckoo						
97	Squirrel Cuckoo	2	3	6	2	6	3
98	Little Cuckoo						
99	Greater Ani					3	
100	Smooth-Billed Ani	77	139	96	58	112	59
101	Striped Cuckoo	2	3	2	3	7	7
102	Barn Owl		4	1		1	1
103	Tropical Screech owl	1	1	2		2	3
104	Spectacled Owl	4	3	1	1	3	2
105	Ferruginous Pygmy-Owl	5	13	12	11	12	8
106	Mottled Owl	1			1		
107	Oilbirds	120	133	132	138	99	118
108	Common Potoo	4	2	1	1	1	3
109	Semicollared Nighthawk						
110	Pauraque			1			2
111	White-Tailed Nightjar				2	2	
112	White-Collared Swift		1	2	52		
113	Chestnut-Collared Swift			5			9
114	Gray-Rumped Swift	5	21	18	6	23	6
115	Band-Rumped Swift	2		17	35	15	14
116	*Chaetura spp.*						
117	Short-Tailed Swift	12	47	22	8	2	2
118	Lesser Swallow-Tailed Swift		1				1
119	Forked-Tailed Palm Swift		2	21	6	30	5
120	Rufous-Breasted Hermit	6	7	21	10	7	9

	SPECIES / YEAR	1991	1992	1993	1994	1995	1996
121	Green Hermit	4	11	8	8	9	11
122	Little Hermit	8	7	7	7	7	9
123	White-Necked Jacobin	3	6	9	3	4	7
124	Brown Violetear					1	1
125	Green-Throated Mango				1		1
126	Black-Throated Mango	6	21	6	4	6	18
127	Ruby Topaz	3	5			5	2
128	Tufted Coquette	4	5	5	3	5	4
129	Blue-Chinned Sapphire	11	12	9	14	5	13
130	White-Tailed Goldernthroat			CW		1	
131	White-Chested Emerald	8	19	18	10	18	15
132	Copper Rumped Hummingbird	12	15	19	19	38	27
133	Long-Billed Starthroat	2	2	2	2	1	4
134	White-Tailed Trogon	4	4	10	14	6	10
135	Collared Trogon	3	3	3	4	3	4
136	Violaceous Trogon	2	3	4	9	15	7
137	Ringed Kingfisher		1		1	1	
138	Green Kingfisher	1	3	1	1	1	1
139	Belted Kingfisher						
140	Pygmy Kingfisher			1	2		
141	Blue-Crowned Motmot	6	2	7	12	12	5
142	Rufous-Tailed Jacamar		2	13	2	6	
143	Channel-Billed Toucan	24	10	16	23	52	20
144	Goldern-Olive Woodpecker	5	5	3	9	11	10
145	Red-Rumped Woodpecker	2	1	3		1	1
146	Chestnut Woodpecker	3	1	3	5	5	2
147	Lineated Woodpecker	6	12	13	16	20	5
148	Crimpson-Crested Woodpecker	1	1	1			
149	Plain-Brown Woodcreeper	1	4	3	7	9	12
150	Straight-Billed Woodcreeper			1	1		
151	Buff-Throated Woodcreeper	5	2	10	13	8	4
152	Streak Headed Woodcreeper						
153	Pale-Breasted Spinetail		3	4	2	6	6
154	Stripe-Breasted Spinetail	2		2		5	5
155	Yellow-Chinned Spinetail	4	4	7	2	5	5
156	Gray-Throated Leaftosser	CW		1	1		2
157	Streaked Xenops	1	1	5	3	2	
158	Great Antshrike	8	7	4	11	9	10
159	Black-Crested Antshrike	2		3	3	2	
160	Barred Antshrike	8	15	17	20	23	22
161	Plain Antvireo	1					
162	White-Flanked Antwren	4	2	4	4	12	5
163	White-Bellied Antbird	1	1	5	4	7	4
164	Black-Faced Antthrush	11	8	9	14	9	11
165	Bright-Rumped Attila	1				1	1
166	Black-Tailed Tityra	2	10	6	5	13	3
167	Bearded Bellbird	5	7	9	10	13	8
168	Golden-Headed Manakin	14	15	46	40	47	25
169	White-Bearded Manakin	11	19	49	46	44	14
170	Fork-Tailed Flycatcher						
171	Pied-Water Tyrant	5	21	6	5	12	4
172	White-Headed Marsh-Tyrant	12	14	8	5	8	20
173	Tropical Kingbird	36	51	43	72	28	60
174	Gray Kingbird		2	4		2	
175	White-Winged Becard	1		1			
176	SulphuryFlycatcher			1	3	1	
177	Piratic Flycatcher	3			1		
178	Boat-Billed Flycatcher	4	13	18	13	28	10
179	Streaked Flycatcher	2	8	4	7	7	3
180	Varigated Flycatcher			1			
181	Great Kiskadee	28	77	55	49	53	45
182	Dusky-Capped Flycatcher	3	1		4		
183	Olive-Sided Flycatcher	1	2	2			1
184	Tropical Pewee	7	4	6	3	5	6
185	Euler's Flycatcher	5	3	1	4	5	
186	Fuscous Flycatcher			1			
187	Bran-Colored Flycatcher		1	2		1	1
188	Yellow-Olive Flycatcher		1				3
189	White-Throated Spadebill	2					1
190	Yellow-Breasted Flycatcher	1	4	16	7	17	4
191	Yellow-Bellied Elaenia	4	11	32	15	24	15
192	Small-Billed Elaenia						
193	Forest Elaenia	3	7	8	7	7	4
194	Short-Tailed Pygmy Tyrant				7	1	
195	Scrub Flycatcher				1		
196	Southern Beardless Tyrannulet	6	7	10	5	8	8
197	Slaty-Capped Flycatcher	4	2	1		7	4
198	Ochre-Bellied Flycatcher	7	13	6	8	13	6
199	White-Winged Swallow	7	33	18	17	18	88

	SPECIES / YEAR	1991	1992	1993	1994	1995	1996
200	White Wagtail						
201	Gray-Breasted Martin		12	27	7	3	30
202	S.Rough-Winged Swallow	10	27	29	7	14	7
203	Barn Swallow	5	4		32		32
204	Rufous-breasted Wren	19	19	33	43	53	44
205	House Wren	12	13	22	24	27	47
206	Long-Billed Gnatwren	9	11	13	18	27	11
207	Tropical Mockingbird	19	46	33	47	32	29
208	Yellow-Legged Thrush	1	1	CW	4	1	1
209	Cocoa Thrush	7	21	26	27	25	28
210	Bare-Eyed Thrush	1	21	17	28	19	33
211	White-Necked Thrush	5	4	13	3	7	9
212	Rufous-Browed Peppershrike	9	15	33	24	22	28
213	Red-Eyed Vireo	1		1			
214	Golden-Fronted Greenlet	11	25	28	26	55	39
215	Black-And-White Warbler						
216	Prothonotory Warbler						
217	Tropical Parula	3	9	7	7	8	12
218	Yellow Warbler	3	3	17	21	13	7
219	Blackpoll Warbler			CW	1		
220	Canada Warbler			CW			
221	Northern Waterthrush	5	15	14	21	15	22
222	Masked Yellowthroat		1	1		2	
223	American Redstart	2	3	3	1	3	3
224	Bay-Breasted Warbler						
225	Golden-Crowned Warbler	5	3	2	7	6	11
226	Blackburnian Warbler			CW			
227	Bicolored Conebill	3	15		12	8	2
228	Bananaquit	39	82	100	145	153	195
229	Purple Honeycreeper	4	25	11	37	70	40
230	Red-Legged Honeycreeper		4			7	5
231	Green Honeycreeper	12	23	38	33	41	45
232	Blue Dacnis	15	15	21	13	23	12
233	Trinidad Euphonia	2	2	13	19	17	6
234	Violaceous Euphonia	37	32	29	38	50	38
235	Speckled Tanager	8	6	10	4	11	9
236	Turquoise Tanager	16	41	38	40	92	35
237	Bay-Headed Tanager	35	20	46	36	40	40
238	Blue-Gray Tanager	24	55	66	59	64	68
239	Blue-Capped Tanager						CW
240	Palm Tanager	47	96	94	104	92	66
241	Silver-Beaked Tanager	11	56	53	49	88	51
242	Hepatic Tanager		1		3	2	1
243	Summer Tanager	1	1				1
244	Red-Crowned Ant-Tanager	5	7	5		9	7
245	White-Lined Tanager	8	28	34	43	75	68
246	Swallow Tanager						2
247	White-Shouldered Tanager	11	2	18	26	13	CW
248	Grayish Saltator	CW	15	16	12	17	12
249	Streaked saltator		1				
250	Red-Capped Cardinal			1		1	
251	Dickcissel						
252	Blue-Black Grassquit	6	45	93	59	53	88
253	Sooty Grassquit		5	10	7	10	2
254	Yellow-Bellied Seedeater						
255	Ruddy-Breasted Seedeater				1	5	2
256	Grey Seedeater						1
257	Shiny Cowbird	3	8	8		5	21
258	Giant Cowbird	43	16	11	1	18	3
259	Crested Oropendola	101	106	68	133	105	118
260	Yellow-Rumped Cacique	24	37	35	14	16	25
261	Carib Grackle	58	63	71	21	64	99
262	Yellow-Hooded Blackbird	155	89	19	31	20	160
263	Moriche Oriole				1		
264	Yellow Oriole	7	23	20	8	11	16
265	Red-Breasted Blackbird	11	33	11	11	27	2

Year	1991	1992	1993	1994	1995	1996
Total Number	**9963**	**12556**	**11278**	**7158**	**12300**	**8851**
Total Species	**161**	**184**	**185**	**168**	**181**	**177**

Number of different species for years 1969 to 1996 = 265
CW = Count Week

REFERENCES

ffrench, R. 1986. Christmas counts of birds in Trinidad, 1969-1975 and 1981-1983. Living World, J. Trinidad and Tobago Field Naturalists' Club, 1985-1986: 12-18.

Lambie, I. and **Vishnu Debie.** 1998. Living World, J. Trinidad and Tobago Field Naturalists' Club,1997-1998: 20-22.

Lambie, I. and **Vishnu Debie.** 2000. Living World, J. Trinidad and Tobago Field Naturalists' Club,1999-2000: 36-38.

Notes on Butterflies Seen or Collected on a Short Visit to Nevis, W.I., including the Life History of *Epargyreus zestos* Geyer (Hesperiidae)

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ABSTRACT

Since nothing has been hitherto recorded about the butterflies of the Caribbean island of Nevis, these observations are of interest. Food plants, descriptions and illustrations are given of the early stages of the hesperiids *Epargyreus zestos* Geyer, *Urbanus proteus domingo* Scudder, *Pyrgus oileus* Linnaeus, *Calpodes ethlius* Stoll, *Panoquina sylvicola woodruffi* F.E. Watson and *Nyctelius nyctelius* Fabricius. *Epargyreus zestos* is compared with the closely related *E. clarus* Cramer, and the other species are compared with the Trinidad fauna and published descriptions. Records of a further 17 butterfly species are listed.

INTRODUCTION

During a visit to Nevis, 7-11 November 1995, on a mission to look at pests of coconut, I was able to make some limited observations on the butterflies of the island, with particular interest to the Hesperiidae. I stayed at the Golden Rock Hotel (c. 260 m or 850 ft. on the southeast side of the island), an old sugar estate, with secondary forest extending upwards on the slopes of the main peak of the island. Most observations were made on the nature trail at the hotel, either early in the morning (before 07.45h) or late afternoon (after 17.00h). Observations at other locations were on a casual basis in the course of my work. Eight species of Hesperiidae and 15 other butterflies were recorded, making a modest total of 23 records. In contrast, 10 days collecting in neighbouring St. Kitts in December 1935 by A. Hall produced 36 species (Hall 1936). Life history information was recorded for six Hesperiidae, two of which were not reared and are identified from the larva.

Nothing seems to have been recorded specifically about the butterflies of Nevis (Smith *et al.* 1994; Lamas *et al.* 1995) although the fauna of neighbouring St Kitts is quite well known (Hall 1936; Riley 1975; Smith *et al.* 1994). There is no reason to expect that any of the species recorded from St. Kitts will not be found in Nevis since they are only separated by three kilometres of sea, and all of the species I record here from Nevis are already known from St. Kitts. Very few Nevis specimens were noted in the collection of the Natural History Museum, London (NHM) during a somewhat cursory inspection, and representative material from my visit will be deposited there. In view of this surprising dearth of information, my limited observations should be of interest. The plates all show material that I reared from Nevis, except as indicated.

LIFE HISTORY OBSERVATIONS

Epargyreus zestos Geyer

Smith *et al.* (1994) note that "no detailed account of the life history has been published [of *E. zestos*], although the larvae of this species use several woody legumes, including *Galactia spiciformis* (Scott 1986) as foodplants," and that "full details of the life history and food plant preferences of this species would be

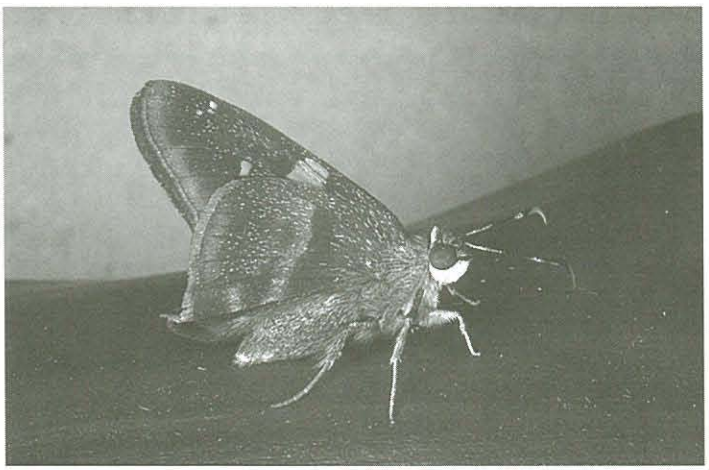

Plate 1. Adult female *Epargyreus zestos.*

of value in assessing its relationship with its close congener, *E. clarus*" Cramer. Accordingly, I present here my observations based on several larvae that I found at Golden Rock Hotel, one of which was reared through to adult (Plate 1).

Food plants. No adults were seen, but larvae were quite common on the legume vines, *Galactia longiflora* and *Centrosema virginianum*, in open patches and along a pathway in secondary forest.

Pupa 19mm. Smoothly contoured, no projections; head across the eyes almost as wide as the thorax, which is only slightly narrower than the widest part at A2-3. Ground colour light brown with dark brown dots and speckles; the only distinct markings a brown, shiny stripe down middle of the eye. Head with indistinct markings anteriorly between eyes: spot adjacent to anterior margin of eye, another more ventral and separated from eye, and an indistinct spot centrally between these four; surface of head and thorax irregularly striated with slightly darker brown; appendages more or less striated transversely; wings with striations mostly at right angles to nearest margin; abdomen with dark speckling more intense towards posterior margin of segments; laterally on A4-8 a diffuse, double line; ventrally on A4-5 a transverse, rounded bar with parallel arcs at each end; ventrally a small dark rectangle anterior to cremaster. Spiracle T1 dark brown, conspicuous; other spiracles dark, but inconspicuous. No trace of white waxy powder on pupa or shelter (Plate 2).

Larval shelters. Shelter I a small triangle cut from within the area of feeding and folded over dorsally; about 5 mm on longest axis. Shelter II similar but with a notch cut from one edge and the shelter keeled along notch; 11 mm on longest axis. Shelter III a large triangular fold from lamina edge, held with silk threads around margin; longest axis 19mm. The final larval shelter is between two leaves. The mature larva would not settle to form a pupal chamber until I provided it with some soil surface leaf litter, in which it formed a flimsy cocoon and pupated; I conclude that pupation is normally in or on the soil.

L5 27mm. Head oval, indent at vertex; rugose, shiny; reddish brown with large orange eye-spot in front of stemmata. T1 brown, yellow-orange ventrally. Body greenish white with yellow tint; indistinct, transverse, greenish micro-markings, especially on posterior margin of segments. Spiracles pale yellow, inconspicuous. Legs pale orange; prolegs yellowish. (Plate 3) (Plate 4).

L4 12mm (newly moulted). Head rounded; indent at vertex; smooth and shiny; deep chestnut brown; large yellow eye-spot anterior to stemmata. T1 black, brown ventrally. Body blue green; more opaque than

Plate 2. Pupa of *Epargyreus zestos*, lateral view, 19 mm.

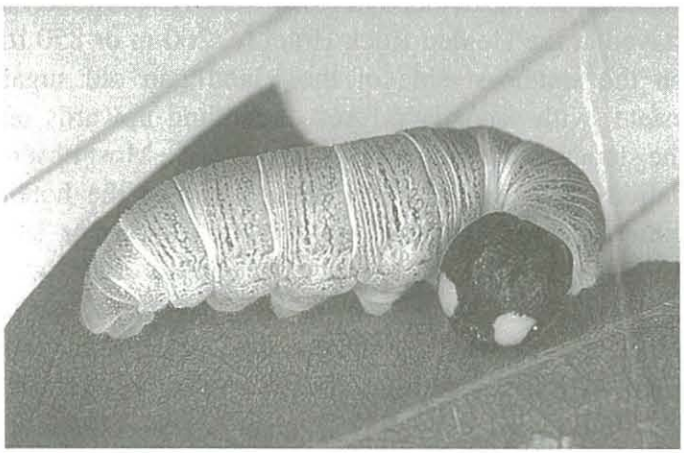

Plate 3. Fifth instar larva of *Epargyreus zestos*, 27 mm.

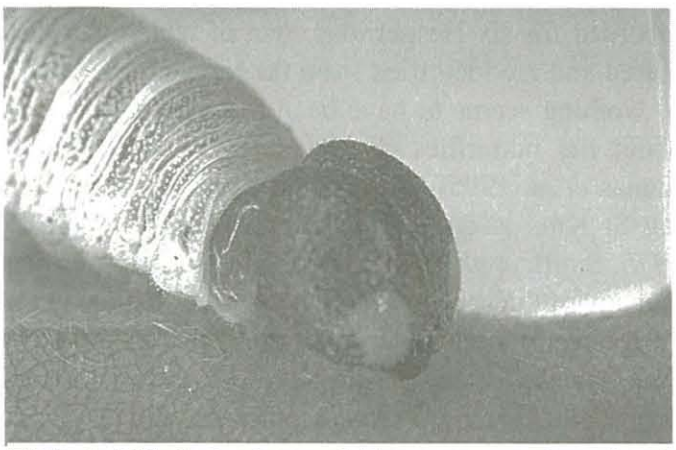

Plate 4. Fifth instar larva of *Epargyreus zestos*, showing detail of head and T1.

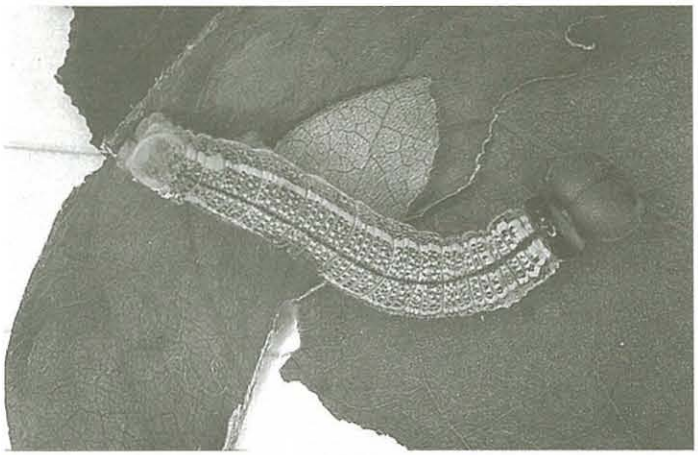

Plate 5. Fifth instar larva of *Urbanus proteus domingo*, 22 mm.

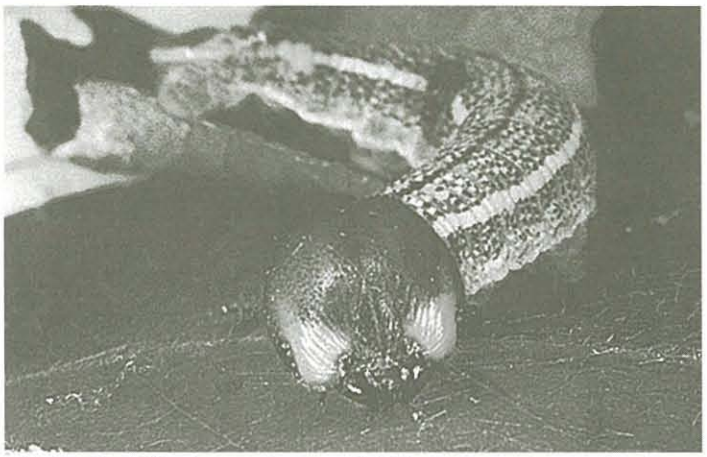

Plate 6. Fifth instar larva of *Urbanus proteus domingo*, showing detail of head.

translucent; interrupted darker dorsal line; indistinct transverse lines of darker green - a broader one anteriorly and 3-4 very narrow ones on each segment; tracheal line visible. Spiracles pale, inconspicuous. T1 legs pale brown; T2-3 legs pale; prolegs conspicuously paler than body.

L3 9mm. Similar to L4, but head black with small brown eye-spots.

L2 7mm. Similar to L3, but head matt black with no eye-spots; body dark translucent green.

Ova laid on leaf under surface in the middle of the lamina.

Comments. The brief description of the larva of *E. clarus* given by Smith *et al.* (1994) is of a green larva with yellow-green stripes, clearly different from the fifth instar larva described and illustrated here, with the body nearly white. This species does not occur in Trinidad, and the one putative Tobago specimen is most probably mis-labelled (Cock 1986).

Urbanus proteus domingo Scudder

Field Observations. One male and two females taken at rest or at lantana flowers at Golden Rock Hotel. The male UPF spotting is very reduced.

Food plants. Larvae of this species were found in the garden of the Golden Rock Hotel on the ornamental legume, *Clitoria ternatea*, but not reared through.

Larval shelters. Shelter I is a triangular flap cut from the edge of the feeding area, about 5 mm on longest axis. Shelter II is a larger triangle, cut from the edge of the leaf lamina; longest edge (12 mm) is the lamina edge; 8 mm wide; keeled on shorter side.

L5 22mm. Head rounded, indent at vertex; slightly rugose, shiny; ground colour brown; black shiny spot over stemmata; black triangle on epicranium, one side parallel to, but separate from clypeal suture; mouthparts dark; area between the dark spots and the mouthparts red. T1 with broad, shiny, dark dorsal plate; ventrally salmon red. Body green with black and yellow speckles in irregular transverse rows; dorsal line clear of speckles and hence dark green; orange dorso-lateral line, which is yellow on T2, and thicker and brighter on A8-10 becoming more salmon in colour; ventro-lateral flange pale; gonads yellow-brown, indistinct. Spiracles brown. Legs black; prolegs salmon-orange (Plates 5&6).

L4 14-18mm. Similar to L5, except as follows. T1 grey-brown ventrally; spiracle brown with a black dot above and an orange spot below. Body green with yellow speckles only; dorso-lateral line is orange-yellow and orange on A8-9; yellow speckles paler laterally. Spiracles inconspicuous. T1-2 legs black; T3 legs dark distally; prolegs orange-brown.

L3 7mm (newly moulted). Head rounded, oval; strongly indent at vertex; matt brown; diffuse dark band across lower face interrupted by orange-brown eye-spot anterior to stemmata; posterior margin dark. T1 shiny black. Body opaque, dark green, covered with yellow speckles to give a yellow-green appearance; dorsal line darker; a narrow, yellow dorso-lateral line, which on A8-9 is wider and orange. T1 legs brown; T2-3 legs pale brown; prolegs concolorous. Spiracles inconspicuous.

L2 6mm. As L3 but head entirely black.

Ova laid on leaf under surface in mid-lamina. Transparent, with 12 moderately strong ribs.

Comments. Subspecies *domingo* is found in Bahamas and the Antilles, while, the nominate subspecies occurs widely on the mainland and in Trinidad. I have reared ssp. *proteus* in Trinidad (Cock unpublished) and the mature larva does not differ significantly from that described here. Riley (1975) states that the larval colouring of ssp. *domingo* varies from place to place. My own observations of subspecies *domingo* in New Providence Island, Bahamas (Cock 1998), support this; fifth instar larvae on *Desmodium tortuosum* (Leguminosae) were distinctly blue-green in body colour compared to the yellow-green described above, the lateral stripe was red rather than yellow or orange, and the eye spot on the head was less vividly coloured.

Smith *et al.* (1994) state that the pupa is covered anteriorly in a whitish, waxy powder, but in the material I have reared from Trinidad and the Bahamas the pupa is completely covered with white, waxy powder (Cock, unpublished).

***Pyrgus oileus* Linnaeus**

Field Observations. Four males were collected at Golden Rock Hotel roosting at dusk on the tips of grass inflorescences in a grassy patch that caught the last of the sun. Males were caught at Clark's Estate and at the Department of Agriculture above Charlestown, and two females at St Thomas Anglican Church (on *Tridax* flowers) (Plate 7).

Food plants. Larvae on *Sida rhombifolia* (Malvaceae) at Golden Rock Hotel.

Pupa 14mm. Rounded, smooth, short; cremaster elongate; covered with long, semi-erect, pale setae except on appendages and stripe down centre of eye; proboscis extends to end of wings only. Colour khaki-green on thorax, head, appendages; pale yellow-green on abdomen; brown tinge to front of head. Sub-dorsal black dots on A2-A5; irregular black marking on abdomen along dorsum of wing; dorsal line on abdomen slightly darker; cremaster brown. Spiracle T1 slightly protuberant, light brown with outer margin dark brown; abdomen spiracles black and quite conspicuous (Plate 8).

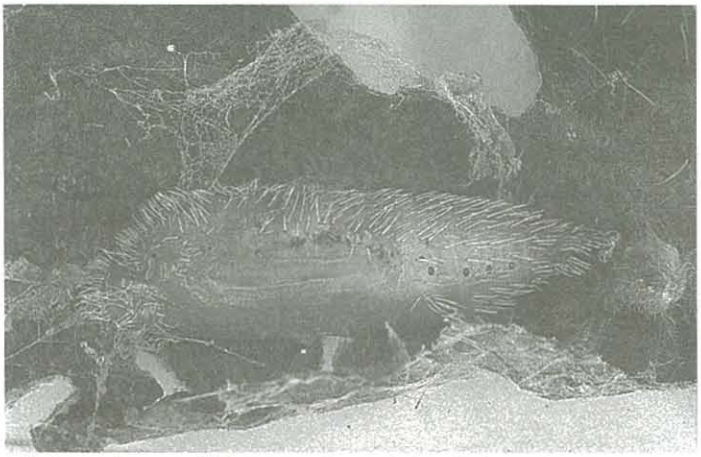

Plate 8. Pupa of *Pyrgus oileus*, lateral view, 14 mm.

Larval shelters in folded leaves.

L5 14mm. Head rounded, flattened dorsally; broadly indent at vertex; rugose matt black; covered with short, pale, erect setae. T1 brown; posterior margin dark; dorsal line white; paler laterally; pale spiracle; band of long, pale, erect setae around middle of segment. Body opaque yellow-green; covered with scattered pale spots with long and short, pale, erect setae; dorsal line slightly darker. Spiracles pale, inconspicuous. Gonads yellow-orange, faintly visible. T1 legs dark; T2-3 legs pale brown, darker distally; prolegs concolorous.

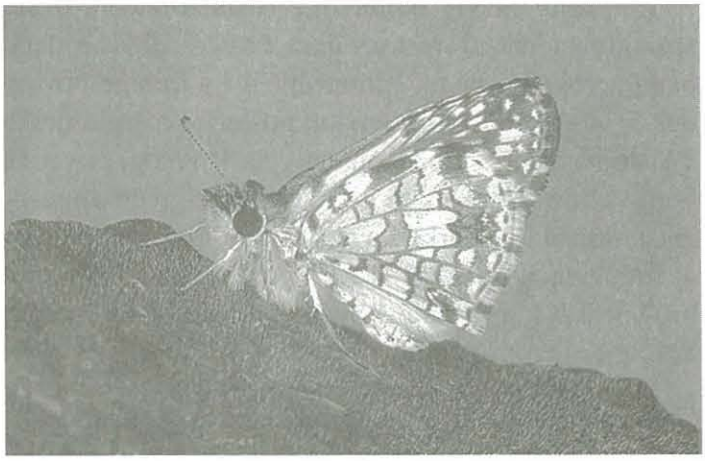

Plate 7. Adult male *Pyrgus oileus.*

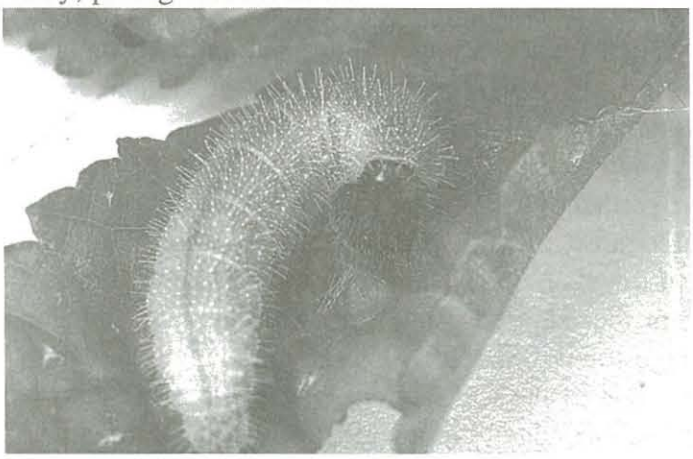

Plate 9. Fifth instar larva of *Pyrgus oileus* 14 mm.

Plate 10. Adult female *Pyrgus orcus*, collected as a larva, 11.x.1993, Trinidad, Rio Claro - Guayaguayare Road, _ mile north of Saunders Trace, on *Sida rhombifolia*, M.J.W. Cock (Ref. 93/10).

L4 10mm. Similar to L5 but T1 all dark; body more blue-green (Plate 9).

Comments. In Cock (2000), I incorrectly stated that *P. oileus* can be distinguished from the otherwise very similar *P. orcus* by a brown spot in space 8 of the UNH of *P. orcus* which is absent in *P. oileus*; in fact it is the other way round, the spot is present in *P. oileus*, and absent in *P. orcus* as stated by Evans (1953). This can be seen clearly by comparing the plates of *P. oileus* reared in Nevis and *P. orcus* reared in Trinidad (Plate 10).

The larva and pupa described here from Nevis agree with the detailed descriptions of the same species from Jamaica by Panton (1897) as *P. montivagus* Reakirt, a synonym (the description is repeated in Brown & Heineman 1972). The larva of *P. oileus* is indistinguishable from that which I described and illustrated for *P. orcus* (Cock 2000). There appear to be differences in pupal colouring between *P. oileus* and my colour description of *P. orcus*, but based on Panton's description of pupal colour changes during development of *P. oileus*, I now suspect that the colour description which I gave for *P. orcus* was of a young pupa which subsequently would have turned dark like that described and illustrated here of *P. oileus*.

Plate 11. Adult male *Calpodes ethlius.*

Calpodes ethlius Stoll

Field Observations. One seen at *Asystasia* flowers at Golden Rock Hotel (Plate 11).

Food plant. Larvae of all sizes on ornamental canna (*Canna* sp., Cannaceae) at Golden Rock Hotel, and larval shelters seen on canna at several other places on the island.

Pupa 37mm. Elongate, smooth; frontal spike 2mm, upturned at tip, brown; proboscis sheath, which is brownish distally, extends beyond cremaster tip by 4 mm. Colour whitish green, at least partially due to a light layer of white waxy powder, which is heavier on the inside of the pupal shelter. A row of four dots across the front margin of the collar, the outer ones just dorsal and posterior to the eye, the inner ones evenly spaced. A row of black, dorso-lateral dots, single on T2 and T3, double on A1-6, single on A7; those on T2 and T3 in middle of segment; those on A1-A6 equally spaced, the anterior one displaced dorsally; those on A7 near posterior margin (Plate 12).

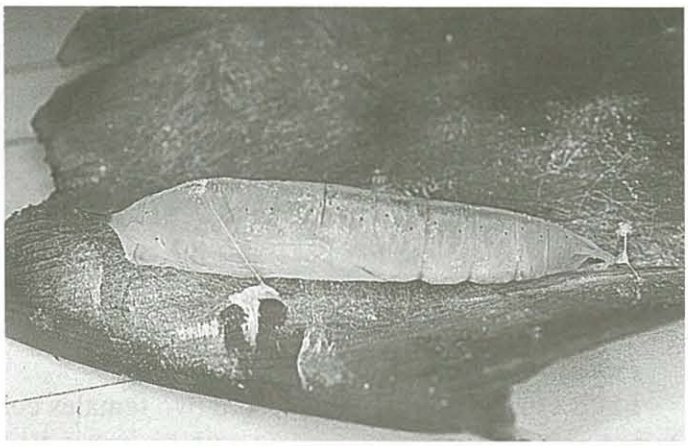

Plate 12. Pupa of *Calpodes ethlius*, lateral view, 37 mm.

Larval shelters a fold from the edge of the leaf, often with feeding at one end. Pupation in the final larval shelter. Smaller shelters are usually made with a notch cut from the leaf margin at each end.

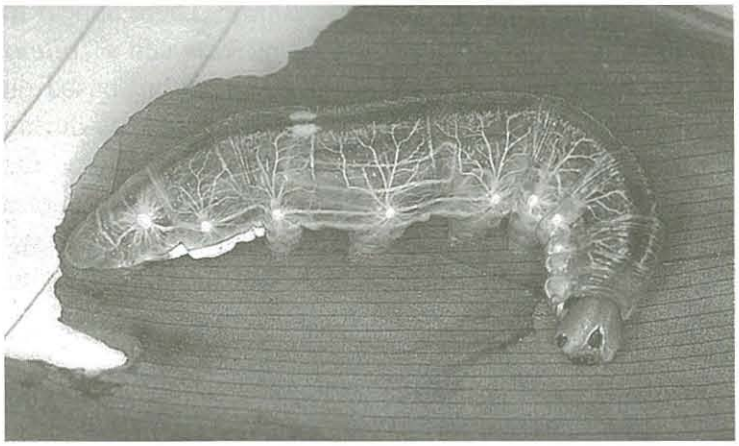

Plate 13. Fifth instar larva of *Calpodes ethlius*, 40 mm.

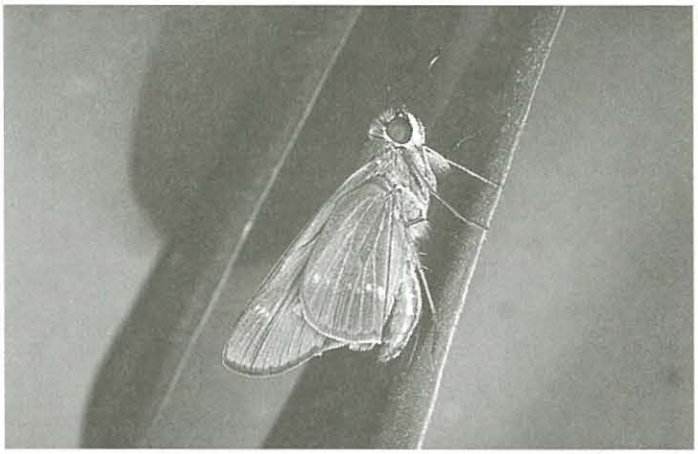

Plate 14. Adult male *Panoquina sylvicola woodruffi.*

L5 40mm. Head triangular, rounded; indented at vertex; very slightly rugose, rather shiny; light brown with narrow, oval, black mark over stemmata and over upper half of clypeus. T1 with broad, dorsal plate, black at lateral extremities. Body dull, translucent green with transparent cuticle; diffuse, pale, sub-dorsal line defines unmarked dorsal line; trachea very evident, including tracheal line; malpighian tubules visible; gonads pale yellow; ventrally paler and more opaque. Wax glands develop ventro-laterally from posterior margin A7 to anterior margin A9. T1 legs brown; T2-3 legs and prolegs concolorous.

L4 24mm. Similar to L5 but head chestnut brown with similar markings; T1 dorsal plate all black (Plate 13).

Comments. Although I have reared this species in Trinidad, I only prepared very brief notes at the time. Those notes however agree with the descriptions given here. Judging from the literature (e.g. Brown & Heineman 1972; Smith *et al.* 1994) the colour of the larval head may vary in tone.

***Panoquina sylvicola woodruffi* Watson**

Field Observations. A male and two females collected at Golden Rock Hotel at rest on vegetation. (Plate 14).

Food plants. Larvae and pupae found on the grass, *Panicum maximum* (Poaceae) at Golden Rock Hotel.

Pupa formed on UNS of slightly flexed leaf with no shelter as such; held by cremaster and a single strand of silk over thorax. Length 31mm; elongate, smooth, fairly slender; frontal spike straight, 2.5mm. Green; narrow, faint, pale sub-dorsal and dorso-lateral lines extend from thorax along abdomen. Spiracles inconspicuous (Plate 15).

Larval shelters are leaf rolls.

L5 34mm. Head rounded triangular, flattened on top, slightly indent at vertex; matt surface; light green, no markings; stemmata brown. T1 concolorous with body. Body mat opaque whitish green, strong yellow tint on T2, T3 and posterior sections of A1, A2; scattered darker speckles; dorsal line slightly darker green; faint, but sharply defined, broad, pale sub-dorsal stripe. Spiracles pale, inconspicuous, weakly linked by pale lateral line. Ventro-lateral flange present, white. All legs concolorous with body. Anal plate narrow, the clasper protruding at base on each side; narrow, pale sub-dorsal line. Male gonads pale, indistinct. Wax glands developed ventro-laterally on anterior portion of A7 and A8 (Plate 16).

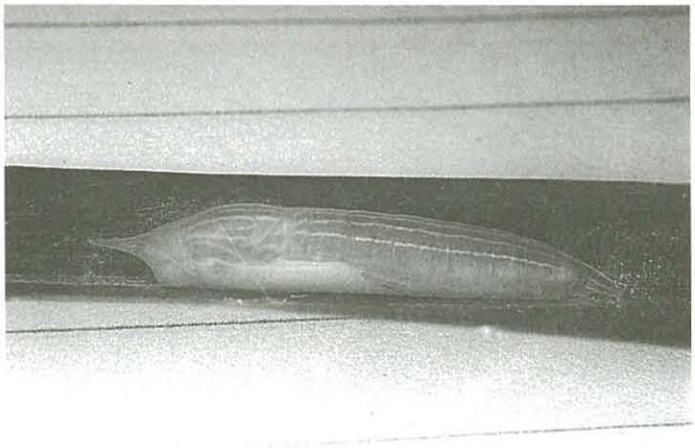

Plate 15. Pupa of *Panoquina sylvicola woodruffi*, dorso-lateral view, 31 mm.

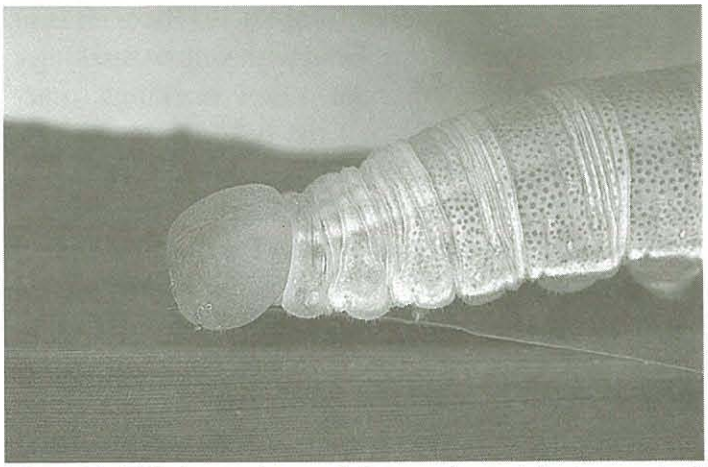

Plate 16. Fifth instar larva of *Panoquina sylvicola woodruffi*, detail of head and T1.

L4 25mm. Similar to L5, but head has an indistinct, narrow dark line forming a bell-shaped curve with its peak between the frons and the vertex, expanding laterally to stemmata; sub-dorsal line more contrasting and more yellow (Plate 17).

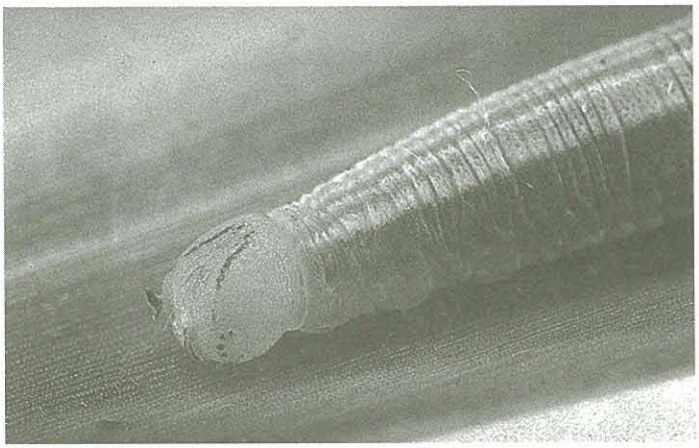

Plate 17. Fourth instar larva of *Panoquina sylvicola woodruffi*, detail of head and T1.

L3 17mm. Similar to L4 except bell-shaped line very dark and sharply defined; additional black line on head from vertex, laterally down the side of the head (Plate 18).

L2 6mm. Similar to L3, but lines on head not so strong and sharp, and line more of an inverted-V than a bell-shaped curve (Plate 19).

Comments. Brown and Heineman (1972) present a description of the early stages based on the notes of T.H. Jones on this subspecies from Puerto Rico. The L1 has a black head, and the L2 has two narrow dark lines down each side of the head, but in subsequent instars these lines disappear. In contrast, the dark

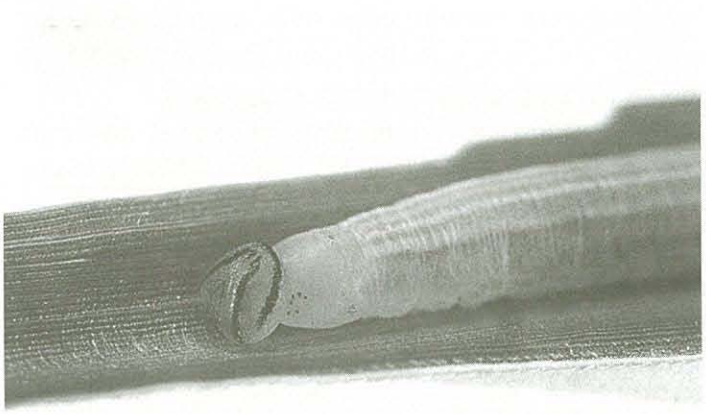

Plate 18. Third instar larva of *Panoquina sylvicola woodruffi*, detail of head and T1. This larva is about to moult to the fourth instar and the developing head capsule of the fourth instar, and the stemmata on it, is visible through the larval skin behind the head.

lines on the head of Nevis material persisted into the third instar, one dark line is still found in the fourth instar, and only in the fifth instar is the head plain green. Apart from this the two descriptions are comparable. This species also occurs in Trinidad where I have reared it from maize (Cock unpublished) but did not record details of the life history.

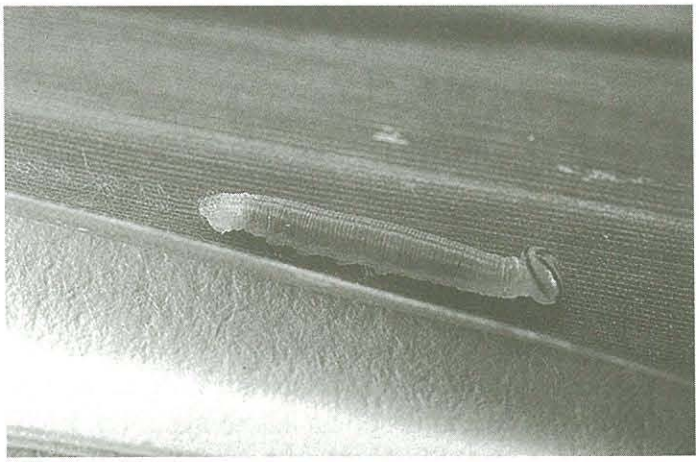

Plate 19. Second instar larva of *Panoquina sylvicola woodruffi*, 6 mm.

Nyctelius nyctelius Latreille

A single larva collected on *Panicum maximum* was not successfully reared through. My identification is based upon the description and illustrations in Jones & Walcott (1922) as *Prenes ares* Felder, a synonym of *N. nyctelius*, and comparison with material, which I reared in Trinidad. Without adult material, I cannot

say which form or subspecies of *N. nyctelius* this represents (see Cock, this issue), but from the locality it should have been the nominate subspecies.

L5 22 mm (newly moulted). Head oval, wider at base, slightly indent at vertex; light yellow brown; yellow stripe each side of epicranial suture; yellow stripe along exterior margin of clypeus, divided from the former by a narrow brown line; brown stripe down epicranial suture; upper half of frons brown; a broad, brown stripe lateral to the yellow stripes; a black oval covering the stemmata is surrounded by an orange halo, which is conspicuous anteriorly. T1 with black dorsal plate. Body greenish white; T2-A7 corrugated except for the anterior portion; smooth except for pale setae on anal plate. Legs dark; prolegs concolorous with body. Spiracles pale, inconspicuous (Plate 20).

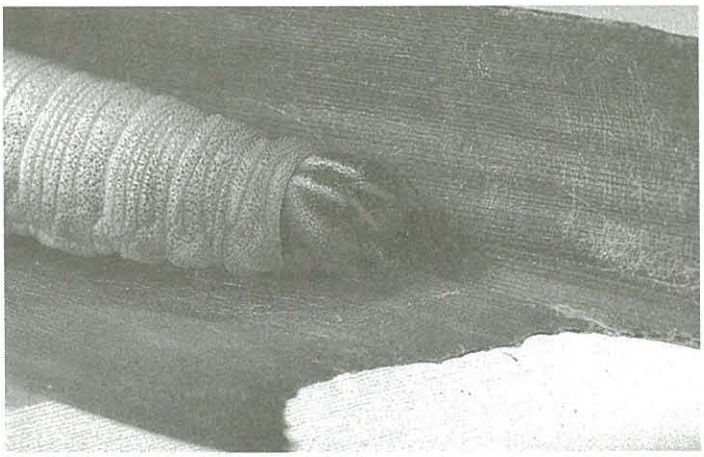

Plate 20. Fifth instar larva of *Nyctelius nyctelius*, detail of head and T1.

L4 20mm. As L5.

L3. Head dark, with brown stripes down each side of epicranial suture and clypeal margin, across clypeus, and indications down lateral margin of head. T1 a short, broad, black, shiny transverse plate, and two black lateral dots (one presumably T1 spiracle). Body greenish white with very short, dark, erect setae. T1 legs dark; T2-3 legs brown; prolegs concolorous with body. Spiracles inconspicuous; faint tracheal line.

L2 9mm. Head oval, black, shiny. T1 with black bar. Body opaque, pale blue-green. Larval shelter the rolled apex of a leaf.

Comments. The description in Jones & Walcott (1922) (which is repeated in Brown & Heineman 1972) is based on material from Puerto Rico. It is of a larva with a dark brown head with yellow markings, although it is noted that the yellow markings sometimes cover more than half the head, as is the case with my Nevis specimen. Jones & Walcott (1922) describe the body colour as bluish grey-green, whereas I describe it as greenish white. Trinidad material of this species which I also reared from *P. maximum* had the head almost entirely dark brown, with only minimal yellow lines each side of the epicranial suture and clypeus, however the body colour matches my Nevis material. Apart from the extent of the yellow markings of the head, the Nevis specimen, the Trinidad material and the Puerto Rico description all agree quite closely (Plate 21).

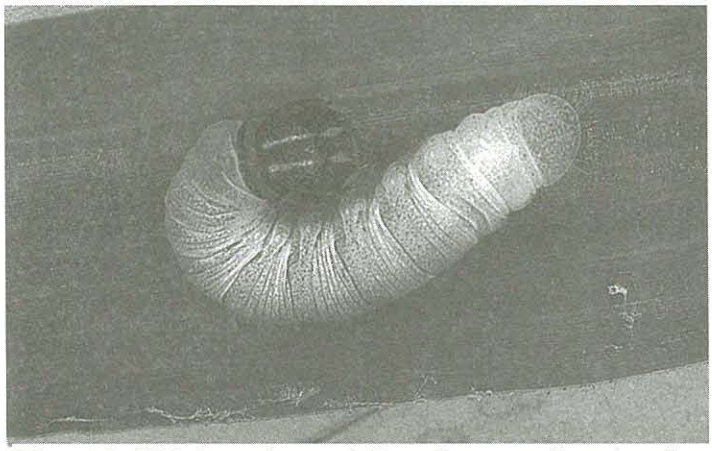

Plate 21. Fifth instar larva of *Nyctelius nyctelius nyctelius*, collected 11.x.1993, Trinidad, St. Benedict's, on *Panicum maximum*, M.J.W. Cock (Ref. 93/7), 18 mm.

FIELD OBSERVATIONS: Hesperiidae

I did not record *Wallengrenia ophites* Mabille during my visit but there is a specimen in the NHM from Nevis (Evans 1955).

***Polygonus leo leo* Gmelin.** Two females collected at Golden Rock Hotel, one sunbathing at 06.45h, the other at lantana flowers at 07.30h.

***Urbanus obscurus* Hewitson.** Two females collected, and others seen, at Golden Rock Hotel. Neither has spots present in cell or space 2; one has no spot in space 3, only apical spots.

***Hylephila phyleus phyleus* Drury.** Evans (1955) lists a male from Nevis in the NHM. Two males and two females collected at Golden Rock Hotel (one

male collected roosting on low bush at height of about 35 cm at dusk); others seen. Abundant at St Thomas Anglican church (male and three females collected on *Tridax* flowers). Several seen at Four Seasons, Nisbet hotel (Beachlands Estate), Potworks Estate, Barnes Ghaut etc., flying low and rapidly over short vegetation, but not collected.

Nymphalidae

I follow current practice and treat this family in the broad sense to include the former families Danaidae and Heliconiidae, amongst others.

***Agraulis vanillae insularis* Maynard.** Single specimens seen near Zetlands Hotel and at Golden Rock Hotel; none collected. This subspecies occurs throughout the northern West Indies (Smith *et al.* 1994), including St. Kitts (Hall 1936).

***Anartia jatrophae jatrophae* Linnaeus.** One was seen at Four Seasons Resort at *Tridax* flowers; not collected. Riley (1975) and Smith *et al.* (1994) list this species from the Lesser Antilles as far north as St Kitts (Hall 1936) and Barbuda.

***Biblis hyperia* Cramer.** Three were seen at Golden Rock Hotel; none were collected. Recorded as abundant in St. Kitts (Hall 1936, as *Didonis biblis*).

***Danaus plexippus megalippe* Hübner.** Single specimens seen at Golden Rock Hotel, Clark's Estate, Barnes Ghaut, and Nisbet Hotel; none were collected. Riley (1975) and Smith *et al.* (1994) list this species as from the Lesser Antilles without mentioning specific islands, although it is recorded from St. Kitts (Hall 1936).

***Heliconius charitonia charitonia* Linnaeus.** Three specimens were collected at Golden Rock Hotel, and several others seen. Two show the FW spot of ssp. "*punctata* Hall", described from St. Kitts (Hall 1936), but probably just a clinal variant (Smith *et al.* 1994).

***Junonia genoveva* Cramer**. Turner & Parnell (1985) recently separated this species from *J. evarete* Stoll. *Junonia genoveva* is the very common and widespread species often referred to as *Precis evarete* in the literature (e.g. Barcant 1970), whereas the true *J. evarete* is a much more localised species, associated with its food plant, black mangrove (*Avicennia germinans*, Verbenaceae). Its known range includes the east Coast of Central America, Florida, and the Caribbean islands as far to the southeast as Barbuda (Smith *et al.* 1994).

Two *J. genoveva* were collected at Golden Rock Hotel, and others noted at Clark's Estate, St Thomas Anglican Church and Barnes Ghaut (common). I observed it frequently in all areas when driving around the island. Smith *et al.* (1994) list this species as from the Lesser Antilles without mentioning specific islands, although Hall (1936) notes it is very common on St. Kitts.

***Siproeta stelenes stelenes* Linnaeus.** One was seen near Zetlands Hotel, but not collected. Hall (1936) did not record this species from St. Kitts, although Smith *et al.* (1994) do so.

Lycaenidae

The following four species are all recorded from St. Kitts by either Hall (1936) and/or Smith *et al.* (1994).

***Strymon bubastus ponce* W.P.Comstock & Huntington.** Five (four males, one female) were collected at St Thomas Anglican Church at *Tridax* flowers. One was collected and others seen at Four Seasons Hotel again on *Tridax* flowers, and one seen at the Department of Agriculture above Charlestown.

***Leptotes cassius catilina* Fabricius.** Two males were collected at Golden Rock Hotel in the garden; one female at Barnes Ghaut. The male has the UPS uniformly blue.

***Hemiargus hanno watsoni* W.P. Comstock & Huntington.** One male was collected at Clark's Estate, two males at St Thomas Anglican Church and two females at Potworks Estate.

***Cyclargus thomasi woodruffi* W.P. Comstock & Huntingdon.** Two males were collected at Golden Rock Hotel in a scrub clearing. This would seem to be the southern limit of this subspecies and species.

Pieridae

Hall (1936) reported the following four species as common in St. Kitts.

***Ascia monuste eubotea* Godart.** This species was abundant everywhere. It was noted feeding at *Asystasia* flowers at Golden Rock. Roosting is low down (usually less than one metre) on vegetation, often in small groups of up to six; butterflies do not return to the same location on successive nights.

***Eurema elathea* Cramer.** Three males caught and several more seen at St Thomas Anglican Church; one male at Golden Rock Hotel roosting on top of a grass inflorescence at dusk.

***Eurema lisa euterpe* Ménétriés.** Common at Clark's Estate (four males and three females collected); also at St Thomas Anglican Church (one female collected) and observed at the Department of Agriculture, above Charlestown.

***Phoebis sennae* Linnaeus.** Common everywhere; noted feeding at *Asystasia* flowers at Golden Rock Hotel.

ACKNOWLEDGEMENTS

Living material was imported into the UK and reared through for identification under MAFF License. I thank Yasmin Comeau and Winston Johnston of the Trinidad and Tobago National Herbarium who identified the food plants, *Centrosema virginianum*, *Clitoria ternatea* and *Galactia longiflora*. I thank Phillip Ackery for facilitating my visits to the NHM, on one of which I checked the identification of some of my Nevis material.

REFERENCES

Barcant, M.B. 1970. Butterflies of Trinidad and Tobago. Collins, London, UK. 314 pp.

Cock, M.J.W. 1986. The skipper butterflies (Hesperiidae) of Trinidad Part 4 Pyrginae (second section). *Living World. J. of the Trinidad and Tobago Field Naturalists' Club,* 1985-1986: 33-47.

Cock, M.J.W. 1998. Two species of Hesperiidae recently established on New Providence. *Bahamas J. of Science*, 5: 12-15.

Cock, M.J.W. 2000. The skipper butterflies (Hesperiidae) of Trinidad. Part 10, Pyrginae completed, Genera groups F and G. *Living World, J. of the Trinidad and Tobago Field Naturalists' Club,* 1999-2000, 49-71.

Evans, W.H. 1953. A catalogue of the American Hesperiidae indicating the classification and nomenclature adopted in the British Museum (Natural History). Part III (Groups E, F, G) Pyrginae. Section 2. London; British Museum (Natural History), 246pp, plates 26-53.

Evans, W.H. 1955. A catalogue of the American Hesperiidae in the British Museum (Natural History). Part IV Hesperiinae. British Museum (Natural History) Publication, London, UK. 499 pp., plates 54-88.

Hall, A. 1936. The butterflies of St. Kitts. *Entomologist,* 69: 274-278.

Jones, T.H. and **G.N. Walcott** 1922. The caterpillars which eat the leaves of sugar cane in Porto Rico. *J. of the Dept. of Agriculture and Labor of Porto Rico*, 6:38-50.

Lamas, G., Robbins, R.G. and **W.D. Field** 1995. Bibliography of butterflies. An annotated bibliography of the Neotropical butterflies and skippers (Lepidoptera: Papilionoidea and Hesperioidea). *Atlas of Neotropical Lepidoptera* Volume 124. Association for Tropical Lepidoptera & Scientific Publishers, Gainesville, Florida. 463 pp.

Riley, N.D. 1975. A field guide to the butterflies of the West Indies. Collins, London. 224 pp.

Scott, J.A. 1986. The butterflies of North America. A natural history and field guide. Stanford University Press, Stanford, California, USA. 583 pp.

Smith, D.S., Miller, L.D. and **J.Y. Miller** 1994. The butterflies of the West Indies and South Florida. Oxford University Press, Oxford, UK. 264 pp.

Turner, T.W. and **J.R. Parnell** 1985. The identification of two species of Junonia Hübner (Lepidoptera: Nymphalidae): *J. evarete* and *J. genoveva* in Jamaica. *J. of Research on the Lepidoptera*, 24: 142-153.

Cirique and Zagaya: Notes on the Local Names for the Crabs *Callinectes* and *Grapsus*.

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The name "Cirique", for a crab, is noted by Taylor (1938) in his work on the Caribs on the island of Dominica. However, the "cirique" is described as a crab "disliking the sea" (p.111). Taylor quotes the Carib word for crabs from Father Raymond Breton's "Carib Dictionary" (1665) and notes that there are current Creole, patois, names of native origin for these crabs. Some of these names are as follows:

ba'khu (ba'khri)	is the cirique land crab.
yele'u	is the "soft shell" cirique.
agaya	a species of sea crab.

Breton, in fact, lists "araya" and not "agaya", though the description is apt-Cancre de Mer-Sea crab.

The Creole word "cirique" and the Carib word "agaya" (pluralized in the French Patois as "zagaya"), were mostly likely brought to Trinidad from the Lesser Antilles in the nineteenth century by French-speaking planters and their slaves following the Cedula of Population in Trinidad. In Trinidad today, "cirique" no longer refers to a land-dwelling crab, but specifically to the species of *Callinectes*.

Nine species of *Callinectes* are recorded from the Western Central Atlantic (FAO 1978), and of these six are found in the waters around Trinidad and Tobago, all distinguished from one another by various details of carapace, claw and thoracic shape. The six species are *C. sapidus*, *C. ornatus, C. danae, C. exasperatus, C. bourcourti* and *C. marginatus*. Stonley (1971), however, in her monograph on the crabs of Trinidad excluded *C. marginatus*. The largest of all the *Callinectes* is *C. sapidus* with a maximum width of 21 cm, which includes the lateral spines on the shell or carapace.

"Zagaya" is retained for the mottled, marine, rock-dwelling crabs that are commonly seen on the sea coasts and off-shore islands and rocks where the sea - surge washes. These "zagaya" are *Grapsus grapsus*.

By way of interest, there is a strange retention of the name "zagaya" in Trinidad, it being applied to a mountain peak in the northeastern portion of the Northern Range, inland from the town of Sans Souci. This peak rises to a height of approximately 360 m. The Zagaya River is an upland tributary of the Grande Riviere, which flows out of the North Coast at a town of the same name, Grande Riviere.

Stonley (1971) reports only one species of the genus *Grapsus* for Trinidad, *Grapsus grapsus*, and notes it has been collected in the same habitats as another species of grapsid crab, *Plagusia depressa*, which is probably also referred to as a "zagaya".

The survival and use in Trinidad of "cirique" for the swimming crab has been by word-of-mouth for more than a century and a half. The earliest reference in print, which points to the fact that it was a well known name, even then, is in the work by Vincent (1910), on "The Sea Fish of Trinidad." He reported that on a menu for a meal of boiled grouper served on an estate in the Cocal, Manzanilla by the manager, one L.E.B. (Bovell?), Cirique sauce-the crab being identified as "The Blue Rock Crab"-was considered a suitable garnish for the fish.

A search through a considerable number of natural history and scientific books and papers turned up four references to the name "cirique". Two were in Innes (1986) and Innes and Taylor (1987). In the first it is given as the local name for the Swimming Crab, *Callinectes sapidus*. In the second, it is noted that the swimming crab or "cirique" is sometimes sold as food in Trinidad. Bacon *et al.* (1979) also referred to the swimming crab or "cirique", identified as *Callinectes*

spp. and *C. bourcourti*. They also list *C. danae, C. exasperatus* and *C. sapidus* from the mouth of the Nariva River. The same species, with the addition of *C. arcuratus* are listed as ciriques from the Caroni and Oropouche Swamps by Alkins-Koo and Soomai (1991).

REFERENCES

Alkins-Koo, M. and **S. Soomai.** 1991. Status report on key animal species, Trinidad and Tobago. *Interim Report. Committee on Biological Diversity and Genetic Resources, Dept.of Zoology,* U.W.I., St. Augustine, Trinidad.

Bacon, P. R., J. S. Kenny, M. E. Alkins, S. M. Mootoosingh, E. K. Ramdeen and **G. S. B. Seeberan.** 1979. Nariva Swamp Development Project Studies on the Biological Resources of Nariva Swamp, Trinidad. *Occ. Paper No. 4.* Dept. of Zoology, U.W.I., St. Augustine, Trinidad.

Breton, R. P. R. 1665. Dictionaire Caraibe-Francais. Auxairre: Gilles Bouquet. (Facsimile reprint 1892 by Jules Platzman. Leipzig: B. G. Tuebner.)

F. A. O. 1978. *Species identification sheets for fishery purposes for the Western Central Atlantic. Fishing Area 31. Vol. 6.*

Innes, A. 1986. Identification parade, edible crabs of Trinidad and Tobago. *Naturalist*, 6 (6):16-17.

Innes, A. and **E. W. Taylor.** 1987. Capture and marketing strategies for amphibious land crabs and fishes. *Naturalist*, 6 (12): 16-17.

Stonley, J. M. 1971. A monograph of the crabs of Trinidad. M. Sc. Diss., U.W.I., St. Augustine, Trinidad.

Taylor, D. 1938. The Caribs of Dominica. *Smithsonian Institution, Bureau of American Ethnology, Anthropological Papers No. 3. 119:109-159.*

Vincent, H. 1910. The Sea Fish of Trinidad. N.Y., J.J. Little and Ives Co.

Dr. John Stanley Beard – The Very Same

"...I am an explorer, you know. I want to know what's there over the next hill..."

Our excitement and eager curiosity were temporarily replaced by anxious uncertainty as we walked around trying to discover which of the houses belonged to Dr. Beard. Mike had been there before and was struggling with his memory. We both stopped and focused on a house we thought the most likely. A flight of stairs led steeply down from the pavement to a dim porch. A discerning eye had chosen a beautiful and interesting collection of plants that flanked both sides of the stairs and was eventually scattered arbitrarily along the porch. You could imagine this house being cool and enjoyable even in the middle of a hot Australian summer when temperatures can get up to 40°C. We were on Fraser Street in Applecross, which is a leafy suburb of Perth. The house we stood in front of was one of the comfortable residences overlooking the Swan River estuary that runs through the city of Perth in Western Australia. We hurried down the steps to the dim porch, rang the bell and waited, our brains conjuring up and replacing images of what J. S. Beard could turn out to be.

Mike had actually met Beard before. As an undergraduate Mike was familiar with vegetation maps for Western Australia that were produced by a J. S. Beard. While working as a geologist after graduation, he found that they did not have the vegetation map for the area being worked on. After unsuccessful attempts at obtaining the map he was given a contact and told to "buy it from the guy who had done the maps". And so he called, got an address, went and bought the map from Beard and that was that. He had no way of knowing then that his career would bring him to Trinidad, the very country where Beard had begun his career fifty-three years earlier. Yet this is exactly what happened.

In 1996, Mike was appointed as the Plant Ecologist at the University of the West Indies here in Trinidad. He knew very little about Trinidad, only that it was in the West Indies and that West Indies meant cricket. It was not long though, before he came in contact with "The Natural Vegetation of Trinidad" by J. S. Beard. The same J. S. Beard? He realised that it was the very same man. When this eventually came up in conversations the inevitable response from all of us in excited disbelief was "*The* J. S. Beard? Is he still alive?" for we obviously had no idea how young he was when he had come to Trinidad and accomplished all that he had. It is not surprising that when in August 2000, the opportunity arose for us to visit Western Australia, one of the things Mike and I were most looking forward to, was a meeting with Beard. Once we contacted him, and plans were made, it became clear that many others wanted to in some way share in this experience and what was supposed to be a mere meeting escalated to an interview.

I recognised the gentleman who opened the door as Dr. Beard himself since I had seen a picture in one of his books – a distinguished gentleman with a crop of silvery hair, a kind but humorous smile and bushy eyebrows. His welcome was warm and sincere and I got the distinct impression that he was as excited and enthusiastic as we were about this meeting. We were led through the door into a living area that extended to the veranda through large French windows, blurring the boundary between indoors and outdoors. The effect is an immediate and striking view of the river as you step into the house. I had noticed a lovely array of orchids on the porch and the suspicion that these plants were favoured was confirmed by the specimens in the living area – well tended with long beautiful sprigs of flowers. We were introduced to his wife Pamela and his daughter Rowena who was actually born in Trinidad in 1943.

Pamela is a dynamic woman who has some interesting stories of her own to tell. She has an amazing memory for the people who touched their lives, their names and what they did and this greatly added to our information on social aspects of the Beards' lives in

Trinidad. We were in the midst of people who were very open and willing to share information of their lives and events in Trinidad so we decided to let the conversation take its own course with only minor inputs to direct it.

We spoke for over four hours in which Beard proceeded to charm and fascinate us with his engaging personality and witty anecdotes. Old photo albums were pulled out as he covered the places he had been to and work he had done. He was eager to show his old calypso records. Indeed, it was a pleasure to hear him switch to his 'pseudo-trini dialect' as he gave his rendition of 'The Graf Zeppelin' by Attila the Hun, remembering all the words of a whole verse without falter. Dr. Beard is a product of that era that scientists today wistfully read and dream about. He has travelled far and wide, lived in very different countries and studied subjects "inside-out" in those countries. He has sampled many different cultures – when you hear him tell his stories – and a great raconteur he is – you hear the fondness, acceptance of what he has experienced and understood of those people and their land. He has the confidence of someone who knows he has seen and done more than most and by that token, has a contribution to make.

Imagine 1937, you're a young British Forest Officer, just twenty-one years old. Your 'first tour of duty" is to be in Trinidad. Ten years later, apart from numerous papers written and a Land-Use map compiled, you have produced vegetation studies for Trinidad, Tobago and the Windward and Leeward Islands – work which will continue to be important over sixty years later. The next fourteen years are spent in South Africa and then finally to Australia in 1961, all the time continuing groundbreaking works. Fourteen books, eight contributed chapters to books, twenty-nine vegetation maps and explanatory booklets and many scientific papers later, you see in the new century.

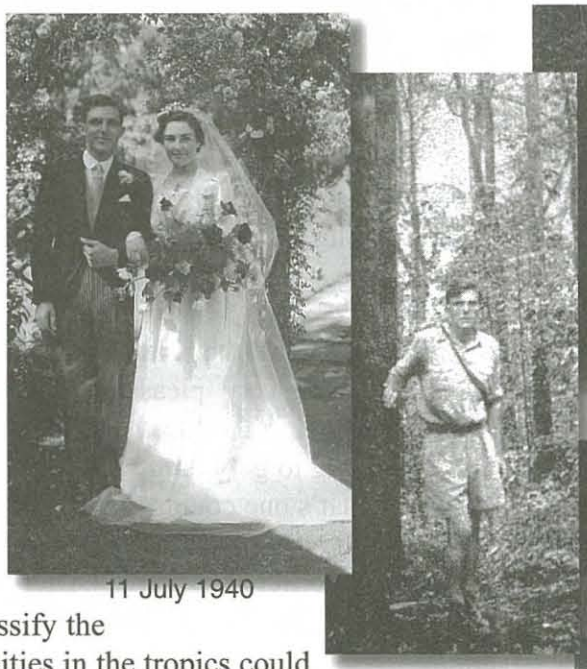
Beard spent just ten years in our region at the very beginning of his professional career and he went on to accomplish much grander projects. It is amazing though, and he would not have imagined then and cannot believe it even now, how significant his work was and continues to be to this region.

John Stanley Beard was born on February 15, 1916 at Gerrards Cross, Buckinghamshire in England. At the age of fifteen he attended Marlborough College for three years, all this time not giving much thought to what career he would pursue. Fate and how our paths are chosen is a tantalising and elusive subject that many like dwelling on. However, this thought does come to mind when Beard explains that he himself does not know how he came to study Forestry. It was not something he had always wanted to do. His father being an architect, it was hoped that young John would follow along similar lines. For this reason, once he finished Marlborough College he went to University College, London, and studied for a term at the School of Architecture. It did not take him long to realise that he would not be able to "stand" that life. He was also beginning to realise that, for him, England meant a ghastly climate and it was "disgracefully overcrowded". This short dabble in architecture and his newly acknowledged feelings for England made him look elsewhere for his future.

"...wide open spaces are what I'm really after. So...what about taking up forestry?" In 1934, against the advice of the Professor at the Imperial Forestry Institute, Beard entered Pembroke College, Oxford to study Forestry. He was advised that jobs were difficult to come by, so he decided that he could solve this problem by graduating at the head of the class. This he duly accomplished and it did secure him a post in the British Colonial Forest Service where he would be employed from 1937 to 1947. That first ten years of his career was dedicated to work in the Caribbean and the Tropical America region. Back then it was a practice that, on joining the Forest Service, young forestry officers would be sent on a 'first tour of duty' to one of the colonies. This initial period spent at the colonies varied in length depending on where the officer was placed, "it was very short in West Africa, but it was quite long in some other parts that were more healthy". On return from the colonies they would study for a year at the Forestry School at Oxford. For Beard, his first tour of duty 1937-1939 was to be Trinidad. The journey took a couple of weeks by sea on a Dutch boat. He was to assume the post of Divisional Officer as a replacement for John Cater, so he was sent directly to San Fernando headquarters. Beard had no idea what to expect from Trinidad but was pleasantly surprised. Compared to other parts of the Empire in those days, Trinidad was "civilised and

comfortable". In fact when he got back to Oxford after his year of service, the other officers' response to his experiences was "What, you lived in a *town*?"

Classification of vegetation in the tropics was in its infancy. Accepted systems of nomenclature and classification were mainly based on temperate vegetation communities and proved unsuitable for the tropics. Workers in this field had to build their own systems to suit their local conditions. There was a movement at the time to encourage Colonial Forest Officers, led by P. W. Richards (author of The Tropical Rainforest 1952, 1996), to make studies of the local vegetation in their respective colonies. Richard's work had delved deeper into techniques that used physiognomic descriptions like the structure of the vegetation in the communities, and profile diagrams to classify tropical woody vegetation types. It was felt that using purely floristics, that is,the species present, to classify the plant communities in the tropics could not work. Beard became one of these young officers who took up this challenge.


11 July 1940

The return to the Imperial Forestry Institute at Oxford for a year was customary before the war. This period lasted a year in which there were no set courses but they were allowed to read and develop their scientific interests. While Beard was spending his time at Oxford in 1940, Dr Burtt-Davy talked him into doing one of these vegetation studies and it was suggested that Beard should gather data to prepare a doctoral thesis. His involvement in the physiognomic approach to vegetation was entirely due to this background.

In 1940 the Colonial Forest Service employed Beard, and although the Second World War was on, he was still sent, new wife in tow, to Trinidad. He was made the Forest Department's Research Officer and his priority was to compile Land- Use maps using 'new-fangled' aerial photography supplied to them by the oil company at Pointe-a-Pierre. This map only showed lands alienated for agriculture so he suggested that they ought to make a vegetation map to show the original, pre-Columbian plant communities on the unalienated crown land. The Department had been taking stock of the timber in those years as a Survey of Resources and this data was utilised as the basis for his doctoral ambitions to which he dedicated two days per week. He filled in areas not covered in the survey like Nariva Swamp and the Northern Range and he went over to Tobago, which no one had looked at before. He was surprised at its difference from Trinidad and as he found later, from the Windward Islands. The physiognomic approach to vegetation studies was also used in much of his later research including his paper "Climax Vegetation In Tropical America" (Ecology 25: 127-58, 1944) which was well received in the USA. According to Beard, "It is ideal for large-scale studies of the vegetation of a large area, especially if the area is previously poorly known. Later, more detailed work can fill in data on floristic communities".


Middle life. c. 1958


The ancient sage and the dynamic woman
11 July 2000

When Beard returned to Trinidad in 1940 with his wife Pamela he was based at the Forest Department at Port of Spain headquarters and they lived on Mt. Hololo Road in Cascade. They spent eighteen months there before they were suspected of being spies and

Beard was transferred to San Fernando. John and Pamela tried to convince us that this was untrue with some suspect explanation about a generator and its noise?! This move however, was more than a bit disappointing, especially for Pamela since it meant her having to leave her job. Apart from this they both liked living at Cascade. Beard was applying his bit of experience from one term of studying architecture and whatever was in his genes while they built a house on their own up at Mount Hololo.

Pamela had lots of activities to occupy her while living in Cascade. Her knowledge of French and particularly German got her an intriguing job in the Censorship Office, which was opened in 1940 and was part of the Ministry of Economic Warfare. Since World War II was on, it was not censorship but more like "Intelligence", according to Beard. All mail that passed between Europe and South America came through Trinidad. Imagine being paid to read other peoples' mail – but mail that was scary and exciting. Mail that made it obvious that Japan was going to declare war on the USA – and they did, and despite all, surprised the USA when they attacked Pearl Harbour.

A cook and a yard-boy to look after domestics, left Dr. Beard and Pamela's evenings relatively open for socialising. One of their favourite past-times was dancing at the 'Country Club' in Maraval. Dances were held three times for the week and the Beards enjoyed this tremendously, especially when their-favourite band, Roy Rollock was playing. Visiting friends and drinking rum was also something to look forward to after working all day. According to Pamela, " I could go out and drink rum, which I liked very much... not with Coca-Cola which I thought ruined it, but with ginger-ale". One could get 'good' rum like Fernandes for 3s 6d per bottle (less than a Trinidad and Tobago dollar in the 1940's) or alternatively, you could take your chances with cheap rum. "Cheap rum" was colourless rum, put into ordinary beer bottles and just labelled 'strong rum'.

Rowena, their first child, was born in 1943 at the oil company's Staff Hospital in Pointe-à-Pierre. Just four months after, Beard was seconded as adviser on forestry in the Windward and Leeward Islands. Apart from maybe passing some laws to protect the forests, in many of these islands there were no actual policies to control exploitation or regeneration. This job took Beard up and down the Windward and Leeward Islands. "It was terrific. I loved it". The three of them ventured as far as Grenada. "All of us were in the first commercial flight of our British West Indian Airways from Trinidad to Grenada in about October 1943." Pamela was forced to be a bit more sedentary; her ability to work with her husband on these trips coming to a temporary halt since Rowena was still so young.

The war had been over for about two years, Rowena was now three years old, and with thoughts on the family, education for children became an issue. They felt that if they stayed in Colonial territories it would mean being separated from their children, since they would have to send them to England. Beard looked for a job where this problem could be overcome. He applied for one he had seen, got it, and soon they were on their way to South Africa where they would spend the next fourteen years of their lives. Natal Tanning Extract Co. Ltd. employed him as an Estates Research Officer from 1947 to 1961 to largely work on crop improvement in the wattle industry. The Beards liked their life in South Africa; they thought it was very pleasant. Dr. Beard himself although enjoying the life there, after fourteen years, was beginning to get bored with the work.

"Now that's one country I would never want to go to," was Beard's first assessment of Australia after attending a conference there. After living in South Africa, Australia was a stark contrast. Back then, things were still very rural, with Sydney having just two modern, high-rise buildings. The biggest problem though was that Beard had felt that "they (Australians) were still in a state of resenting the immigrants". However, in his quest for wide open spaces it is not surprising that, contrary to his first impression of Australia, this is the part of earth he would choose to settle in. It took Pamela and the children – now three girls, a few years to adjust. Pamela had tried to discourage the move to Australia; "I hated it at first. Hated it! My life in South Africa was so happy." In 1961, on applying for the post, he was appointed Director of King's Park, Perth. One of his major tasks was "to plan and establish a botanic garden and display Western Australian native plants." This meant the collection of propagating material and

studying the ecology of the native species in their habitats to investigate their ecological requirements. Beard's research and career were more or less concentrated in Western Australia except for a two-year break from 1970 to 1972 when he took the post as Director at the Royal Botanic Gardens in Sydney. After retirement he finished the vegetation survey and still writes scientific papers on various subjects.

During the course of this work and his personal research, an extensive amount of fieldwork was undertaken and this afforded Beard the opportunity to study the vegetation of Western Australia in some detail. In the course of botanical surveys over a period of twenty years, he covered all accessible parts of the state, travelling over 200,000 kilometres and mapped the whole area, two million square kilometres. His research in Trinidad possibly was the foundation of his studies in Western Australia – "it was a natural progress to approach the Australian vegetation using an adapted physiognomic classification." This research produced a series of vegetation maps, explanatory booklets and scientific papers culminating in 'Plant Life of Western Australia' – a beautiful book published in 1990, which includes over 550 coloured plates and brings the Western Australian landscapes to life.

They have now been in Australia for forty years. Sitting in their lovely home, listening to John and Pamela Beard eagerly tell their stories, with Rowena helping us to keep things on track and clarify details was a pleasure. A few hours in one day would never be enough to know very much of anyone's life. But looking at Beard interacting with his wife and daughter, one could not help thinking that in his enviable career he must have achieved some balance. One of the determining steps in achieving this balance in life is choosing the right spouse. We feel Pamela and John made truly appropriate and successful choices. Beard, in correspondence and during the interview, mentioned more than a couple of times that they were celebrating their sixtieth anniversary that year. You could hear the pride in his voice. Another striking insight into their regard for each other was his reply when we asked *him* for an interview about his work in Trinidad. His reply was "My wife and I will be happy to meet you and share our experiences in Trinidad." They do see themselves as partners in every way. They have seen many places together, worked hard, played hard, borne and brought up three girls and are now retired comfortably.

This article, we hope, gives a brief overview ot the life, past and present, of a man who has made great contributions to vegetation studies in Trinidad and around the world. It also shows how a new concept, like the physiognomic approach, to which a few might be loyal, was born and evolved to an accepted scientific approach. An approach which Beard still applauds. Once, when he was asked to referee a paper, the author of the paper had suggested that much more could be got out of the paper if descriptions of physiognomy were included. And Beard's response to the editor was: "A blinding glimpse of the obvious!"

(This article is largely based on an interview of John and Pamela Beard. The authors carried out the interview on 6 September 2000 at the interviewees' home in Perth, Western Australia)

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The authors would like to congratulate The Forestry Division in Trinidad, in this year 2001, on the celebration of their 100th anniversary.

The following are some publications by **J.S. Beard** that are relevant to our region:

1940. Forestry and land-planning in the tropics. *Empire Forestry J.*, 19: 69-73.
1940. The woodlands of Bermuda. *Empire Forestry J.*, 19: 258-263.
1941-. Soil erosion on the island of Chacachacare, B.W.I. *Caribbean Forester*, 2: 136- 137.
1941. Land utilisation survey of Trinidad. *Caribbean Forester*, 2: 182-187.
1942. Montane vegetation of the Antilles. *Caribbean Forester*, 3: 61-74.
1942. Summary of silvicultural experience with Cedar (*Cedrela mexicana* Roem.) in Trinidad. *Caribbean Forester*, 3: 91-102.
1942. The use of the term "deciduous" as applied to forest types in Trinidad, B.W.I. *Empire Forestry J.*, 21: 12-17.

1943. The importance of race in Teak (*Tectona grandis* L.). *Caribbean Forester*, 4: 135-139.
1944. Provisional list of trees and shrubs of the Lesser Antillies. *Caribbean Forester*, 5: 48-66.
1944. The natural vegetation of Tobago B.W.I. *Ecol. Monog.*, 14: 135-163.
1944. Climax vegetation in tropical America. *Ecology,* 25:127-158.
1944. A silvicultural technique in Trinidad for the rehabilitation of degraded forest. *Caribbean Forester,* 6:1-18.
1944. Forestry and timber in the Windward and Leeward Islands. Guardian Press, Trinidad.
1944. The vegetation of Trinidad and Tobago. *In* Verdoorn F. (ed) Plants and plant science in Latin America. Chronica Botanica Co., Waltham Mass.
1945. Some ecological work in the Caribbean. *Empire Forestry J.,* 24: 40-46.
1945. Plant succession on the Soufriere of St. Vincent. *Journal of Ecology,* 33: 1-9.
1946. The Mora forests of Trinidad. *Journal of Ecology*, 33: 173-192.
1946. Notes on the vegetation of the Paria Peninsula, Venezuela. *Caribbean Forester* 7: 37-46.
1946. The Natural Vegetation of Trinidad. Oxford Forestry Memoir no. 20. Clarendon Press, Oxford.
1946. (In Collaboration with A.C. Smith). The genus *Eschweilera* in Trinidad and Tobago. *J. Arnold Arboretum,* 27: 305-313.
1946. Los Climax Vegetacion en la America tropical (Spanish Version of *Ecology,* 25: 127-158). *Rev. Fac. Nal. de Agron., Medellin* 6: 225-293.
1949. Brazilian campo cerrado: Fire climax or edaphic climax. *Geog. Review,* 39: 664-666.
1949. The natural vegetation of the Windward and Leeward Islands. Oxford Forestry Memoir No. 21, Clarendon Press, Oxford.
1949. (In collaboration with Hardy F.) Soil formation in the British Caribbean Volcanic Islands. *Proceedings of the Caribbean Soil Conference*, Puerto Rico.
1949. Ecological Studies upon a Physiognomic basis. *Actas del. 2. Congr. S. Am. de Bot., Lilloa xx*, 45-53.
1953. The savanna vegetation of Northern tropical America. *Ecol. Monog.,* 23: 149-215.
1955. The classification of tropical American vegetation-types. *Ecology,* 36: 89-100.
1955. A note on gallery forests. *Ecology,* 36: 339-40
1971. The seasonal forests of Trinidad. *In* Eyre S. R. (ed.) World Vegetation Types. MacMillan Press Ltd. pp. 56-69 (Reprinted from The Natural Vegetation of Trinidad (1946)).
1974. Chapt. 22. Vegetational Changes on Ageing Landforms in the Tropics and Subtropics. *In* Knapp R. (ed.). Handbook of Vegetation Science, Part VIII. Vegetation Dynamics. D.V. Junk, The Hague, Netherlands.
1976. The progress of plant succession on the Soufriere of St. Vincent: Observations in 1972. *Vegetation,* 31: 69-77.
1980. Progress of plant succession on Soufriere volcano, St. Vincent Island, West Indies 1972. *Nat. Geog. Soc. Research Reports*, 12: 39-46.

Book Reviews

Views from the Bridge: A Memoir on the Freshwater Fishes of Trinidad

Dr Julian S Kenny
98 pages, including Index
Published by Julian S. Kenny, 1995.
Available from
REAL (Rapid Environmental Assessments Ltd.) 41 Ana Street, Woodbrook, Trinidad.

Dr Julian S Kenny confuses amateur naturalists and natural scientists alike by choosing almost identical titles for his books on the Natural History of Trinidad and Tobago.

He says he gave this memoir the title "Views from the Bridge" because it described so well the times he spent on bridges while taking his students on field trips and directing their search for fish, amphibians and other fauna in the streams of Trinidad. When he was asked for a title for his "coffee table" full colour, hardback book which gave an overview of the flora and fauna of Trinidad, he pictured himself surveying the island from the Ridges of the Northern, Central and Southern Ranges of Trinidad - hence the title "Views from the Ridge".

This memoir (from the bridge) was the first book and was published in 1995. It is a book written as a series of seven essays, mainly intended for the professional natural scientist and the serious amateur.

In the Preface, Dr Kenny mentions his first encounter with freshwater fishes as a boy playing in the St Ann's River (where Lechmere Guppy discovered the fish that now bears his name - and today is known the world over). One would be lucky indeed to find any guppies in that river today.

In the first essay, "Faces and Places," Dr Kenny mourns the degradation of the environment through quarrying, bush fires and squatting. Even so, below bridge 1/71 on the Southern Main Road, Bonasse, there is abundant life, despite the fact that local residents find the river a convenient place to dispose of household garbage.

In contrast, in the upper reaches of the rivers of the Northern Range where the water is clear, there is much less life to be found.

The author gives an overview of the freshwater fish, not excluding the pools of the Pitch Lake in La Brea, ending the essay with some amusing anecdotes on the hardships endured by students, visiting scientists and naturalists while doing research on freshwater fish.

Essay Two tells the sad story of fish-farming, aquaculture, in Trinidad; of the rainbow trout; the carp; the North American catfish imported at the whim of senior bureaucrats in the Ministry, or travelling politicians impressed by fish-farms in places where aquaculture is a tradition dating back centuries. Most of those exotics provided a good meal for local predatory fauna, only tilapia has adapted to take its place in Trinidad ponds and reservoirs.

Essay Three considers Bridges and Barriers; currents from the Orinoco in flood bringing new species to Trinidad rivers; the land bridge in past geological ages; and the dangers of pontificating when, having pronounced that a certain species is never found in this location, a student/research assistant holds up the seine to show the exact species trapped in the net.

Essay Four describes the difficulties of producing an accurate, up-to-date list of freshwater fishes. It is a problem bedevilling all natural scientists to a greater or lesser degree due, in part, to the taxonomists' habits of changing scientific names with, so it appears, every new discovery. The problems seem to be compounded here by some persons' cavalier attitude to scientific data.

Essay Five, Homes and Ranges, is well illustrated with 48 maps to explain the text describing each species. Feeding and Breeding is the heading for the short Essay Number Six since comparatively little is known of these subjects.

Views from the Bridge, the last essay in this memoir, poses questions for the reader to ponder - perhaps to inspire the reader to take up Dr Kenny's challenge for further research.

Throughout this book Dr Kenny acknowledges the work and the help of colleagues and associates while, (as is only proper) omitting to mention the names of

stumbling blocks in the path of scientific research. A brief postscript, bibliography, black-and-white photographs of three dozen freshwater fish and an index complete this memoir.

Anyone with a serious interest in freshwater fish will find this memoir invaluable, while those who read to broaden their knowledge of the natural world cannot fail to be amused by Dr Kenny's wry asides and fund of funny, fishy stories.

Anne Hilton

Views from the Ridge: Exploring the Natural History of Trinidad and Tobago

Julian Kenny
Prospect Press, 6 Prospect Avenue, Maraval,
Trinidad and Tobago, 2000

This excellent, highly professional publication is not to be confused with the same author's memoir "Views from the Bridge" (also reviewed in this issue of Living World). It is, first and foremost, a full colour, photographic record of the surprisingly diverse biota of Trinidad and Tobago, with text to put the photographs in perspective, where and in which of the differing ecosystems of the islands a plant or animal is to be found. It is also Dr. Julian Kenny's personal record of a lifetime spent studying and photographing the flora and fauna of this twin-island Republic. Dr Kenny begins this book with the groundwork - the geology that is the foundation of the islands' ecology (and the basis of the economy), the ocean currents that are continually eroding and depositing, eating away at the land here, building it up elsewhere, and the geographic position - so close as to be in sight of the South American mainland. Having set the scene, the view from on high, as it were, Dr Kenny takes his readers into the wonderland that is the flora, of Trinidad and Tobago. At a casual glance it seems there are plenty of full colour, close-up photographs of flowers and plants but, as we learn from the text, these are but the tip of the iceberg of approximately 2,500 species in the 175 families of plants to be found here.

Orchids have been one of Dr Kenny's special studies. It should be no surprise to see many close-up photographs of flowers of these intricate, highly developed plants in this book.

The bright green iguana on the cover of the book is but one of the animals (including grasshoppers, mantids and other insects, a coral snake, the lovely golden tree frog) featured in the chapter headed "Animals". Sea creatures are given a place in this chapter: the brightly coloured sponges on the rocks around Nelson Island, the flower-like tentacles of stony corals photographed at night, the sea anemones, crabs and fish. Having whetted the reader's appetite with a dazzling variety of photographs, the author gives some brief descriptions of where to find what in the Chapter headed "Distribution of Species". Dr Kenny describes the main ecosystems, from the elfin woodland at the very tip of the highest peaks, to the savannas and swamps on the lowlands, the rocky shore and the sea, the waterfalls and the rivers.

From the natural he then turns his attention to the man-made environment of Trinidad and Tobago: the cocoa, coffee, citrus and coconut plantations, sugar estates and rice fields.

Nature can be red in tooth and claw: Dr Kenny does not shirk descriptions of natural hazards, the poisonous snakes, scorpions,"shinnys," vicious biting ants, fire worms and fire corals.

The last, and perhaps the most important chapter, "The Outlook for Conservation" presents a scenario that, though gloomy, may not be quite as bleak as some fear.

Dr Kenny does not "write down" to his readers; he assumes one has at least a nodding acquaintance with natural science. He does, however, include a comprehensive glossary of technical terms at the end of the book. This "coffee table" sized book is one to treasure for the range of excellently reproduced photographs (in some cases, lovingly and carefully restored). "Views from the Ridge" by Dr Julian Kenny is an important, entirely local publication - only the the author's camera and the film had to be imported.

Trinidad and Tobago has been waiting a long time for such a book to show a wider audience at home and those overseas the beautiful, bewildering variety of nature in two small Caribbean islands off the coast of South America.

Anne Hilton

Views from the Ridge: Exploring the Natural History of Trinidad and Tobago

Julian Kenny
Prospect Press, 6 Prospect Avenue, Maraval,
Trinidad and Tobago, 2000

"This book is a compromise". That is how the author begins his preface, and it had to be that way because the scope is so wide he has had to be selective in his treatment. According to him, it began life as an account of his research projects, became for a time a general report on the state of the environment and later still a commentary on a selection of his favourite photographs. Put that way one might imagine that the result would be rather scrappy and without any discernable theme. However, this is in fact far from the truth. The text is well organized in ten fairly short chapters that proceed in a logical succession from "The origin of the islands", through samplings of the plants and animals and their distribution and ecology, to the man-made environment and "The outlook for conservation". The fact is, too, that the photographs complement the text and, at the same time, display the beauty and variety of the plants and animals that inhabit our treasured isles.

The early chapters present much numerical information such as the number of species, their division into families, the number of useful timber species etc., and similar information about the animals. If to some this information may seem somewhat "dry", persevere; the text brightens and becomes more interesting as the story unfolds. The final chapter, the longest of all, is a history of the conservation movement in Trinidad and Tobago, the development of the legislation that tries to regulate the impact of the human population on its environment and goals for the future. It is a thoughtful and optimistic essay.

So, now to the photographs. Good as they are, I suspect that the originals are even better, and that a few have lost much of their sparkle in the printing, eg. the picture of *Heliconia psitticorum* (p 23), and *Otostylis brachystalix* (p 32), which is prettily grey-blue in the picture but is white in real life. However, some photos are simply superb, such as the dramatic shot of "Mangrove Lagoon at Mayaro" and the panoramic one of "Guanapo Valley". Those of the mountain forests are equally evocative and well convey the atmosphere of silence and dampness of these remote forests.

I have done some counts and find that of 135 photos there are 34 scenic ones depicting habitat, 29 of marine animals including 12 corals, 21 of orchids and 8 of reptiles. These add up to 92, leaving just 43 for the rest of the plant and animal kingdoms. There is no doubt where the author's interest lies, and this observation should not be taken as a complaint but simply as a guide to the potential reader.

In addition to the photos and the text, there are three charts, six maps, a glossary of technical terms, a select bibliography and a more than just-adequate index. The last of the maps on pg. 100 shows the present distribution of the different kinds of forest. From this, one can estimate the extent of forest cover as about 33% of the land area. The author discusses the problem of getting a reliable estimate, mentions optimistic estimates of 40% and 50%, and concludes that "Current unpublished research studies suggest that by 2000 the forest cover had shrunk to about a quarter of its original size, and was severely fragmented. The percentage of undisturbed forest is probably even lower than that." In this assessment I concur completely. One of the most distressing features of the Trinidadian countryside at present is the prevalence of abandoned, derelict or under-utilized land in what was once forest or productive farm land, and Tobago may be equally afflicted.

Proof-reading is such a devilishly difficult job that errors are hard to eliminate completely. I noticed only one: *shrevel* for *shrevei* in the caption to the map on pg. 10. Both the author and the proof-readers missed a more subtle "misstep" in the sentence, "There are two species of venomous coral snakes and two venomous species of pit vipers found in Trinidad and Tobago." for it suggests that there are venomous reptiles on Tobago when the reality is that Tobago is free from venomous snakes.

The book is lavishly produced; one photograph extends over all of two pages. This same picture in monotone grey makes stylish inside covers. The binding is good, the covers solid, and very attractive too in dark green with gold lettering. For this you expect to pay some money, and the corollary is that

many people who would love to own a copy will not be able to afford one.

Nevertheless, this is a worthy addition to the books on local natural history, and its author, who up to now has been well-known as a professor of zoology and a photographer, has proved himself a fair botanist as well.

Victor C. Quesnel

The Fern Gazette

(Ed: J.M. Camus & J.A. Crabbe).
Vol.16, Parts 1 & 2, 2000
The British Pteridological Society,
London, 124 pp.

This issue is of interest to us here in Trinidad and Tobago because it commemorates the 80th birthday of C. Dennis Adams and contains a checklist of the pteridophytes of Trinidad and Tobago.

We are not told the actual date of Adams's birthday, but that does not matter much. What matters is that his contributions to botany are being recognised. Dennis saw service in World War II, later studied at King's College, London, where he obtained a Ph.D. in botany, and then went off to Africa as lecturer in botany at the University of the Gold Coast (as it was then). In 1959 he came to the West Indies, and remained here until retirement in September 1980, first at The University of the West Indies in Mona and then at St. Augustine from 1976 to 1980. After retirement he was accommodated at The Natural History Museum, London, where he left off lecturing for a whole new life of research and writing. All of this is documented in four short articles by three current members of the museum and one by our own E. Julian Duncan.

These articles can be read with pleasure by anyone with the slightest interest in botany. Not so the remainder of the issue, the checklist of pteridophytes (ferns and their allies) of Trinidad and Tobago by Yasmin Baksh-Comeau. The introduction is straightforward enough - a history of collecting - with maps of the islands showing the most important sites. As to the rest of the checklist I can best give an idea of its "flavour" by quoting the first entry verbatim.

PSILOTACEAE

Psilotum nudum (L.) P. Beauv., Prodr. Aetheogam. 106. 112. 1805. *Bernhardia antillarum* K. Muller, Bot. Zeit. 14: 234. 1856. Syntypes: Jamaica, Martinique, Trinidad.
Lycopodium nudum L., Sp. Pl. 1100. 1753. Lectotype (designated by Proctor, 1977): 'in Indiis', *Anon.* (LINN 1257.1).

Habitat: Occasional: epiphyte and on stumps and logs, and in crevices of old masonry, cliffs or plant pots (-30-m).

Material examined: TRINIDAD. without locality, *Hombersley s.n.* in 1924 (TRIN 34308), *Hombersley 310* (BM); Salibea-Matura Trace,
Baksh 747 (TRIN 28151)

Distribution: tropics and subtropics generally.

There are over three hundred entries like this one taking up 103 pages. There are no descriptions, no keys, no illustrations. If you do not know what the abbreviations stand for, if you do not know what is a lectotype or a syntype (neither of which I could find in my new Chambers Dictionary, though I did find holotype) then this publication is not for you. Except in special circumstances, it will not help you to identify a fern you have found, though it does give answers to certain questions, which we will get back to later.

If, on the other hand, you do know what all the abbreviations stand for, and you do know what is a lectotype and a syntype, then you are either a professional botanist or a very enthusiastic amateur with some knowledge of plant taxonomy, and this publication is for you. You should welcome it; it is the result of a detailed, scholarly examination of all the collections in our National Herbarium and those of the Natural History Museum, London, Kew Gardens, and major museums in North America. It provides, for the first time, a list that is as reliable as anyone can make it, and is a firm foundation for further studies of

pteridophytes in our islands. It is sure to enhance the reputation of its author.

So, now to the "special circumstances" and the kind of questions the list can answer. As is clear from the entry quoted above, information is given on habitat and distribution for each species. Sometimes this can be put to good use. For instance, if you are a pteridologist of sufficient experience to recognise a *Pecluma* when you see one, and turn to this publication for help in determining the species, you are in luck. There are only two species and one grows at elevations of 10-20 metres and the other at 180-600 metres. If you try the same method with an *Acrostichum* you are unlucky; there are only two species but they both grow in the same type of habitat.

How many species of *Selaginella* do we have? When I was a student at St. Mary's College in the early 1940s, Fr. Graf, who taught us botany opined that there may be as many as twenty. Now I can say with confidence that thirteen species are known from Trinidad and four from Tobago. Three of the thirteen were introduced and have become naturalised. Suppose I find *Lindsaea lancea* in the Aripo Savannas and I ask " Does it grow elsewhere?" The checklist answers,"Yes," and gives other localities. "Do other *Lindsaea* species grow in the Aripo Savannas?" " Yes, two more." "Do any ferns grow in the dry habitat of Chacachacare?" I know one does because I found a *Lygodium* there,many years ago. I look up the checklist and find that *Lygodium venustum* is listed for Chacachacare. "Are there other species besides this one?' The answer is there in the checklist, but you will have to find it for yourself. "Are there any endemic species?" I make a quick search and find *Asplenium oroupouchense* listed as "Endemic to Trinidad." I also find just below this entry *Asplenium papyraceum* which strange terminology designates a hybrid, which in this case the checklist tells us is a "sterile triploid hybrid with 123 chromosomes and irregular meiosis." More searching turns up more endemics and more hybrids.

You will not find this publication in bookshops. To get a copy you will have to contact the publisher, The British Pteridological Society, Department of Botany, The Natural History Museum, London SW7 5BD, U.K

Victor C. Quesnel

The Hunt for Caribbean Viruses: A History of the Trinidad Regional Virus Laboratory

Elisha S. Tikasingh (PAHO/WHO)
Caribbean Epidemiology Centre, Port of Spain, Trinidad and Tobago, 2000

This is a book that every member of the Trinidad & Tobago Field Naturalists' Club should read. A book that they should want to own and keep on their library shelf. It is a book that will be welcomed by all persons interested in the natural history of Trinidad or in the history of scientific investigations.

Dr. Tikasingh's book is a very readable and fascinating account of the establishment and growth of the Trinidad Regional Virus Laboratory (TRVL) during the period 1952 to 1974; and its subsequent re-organization as the Caribbean Epidemiology Centre (CAREC). It begins by describing how a small group of researchers set up a field laboratory for the Rockefeller Foundation in a small wooden building on the Port of Spain waterfront and started to train a team of technicians for the study of viruses. A detailed account is given of the expansion of the work to several areas of the country, with the establishment of field centres and camps, and of the many hiccups and frustrations experienced for many years. After only a few years, in 1955, the virus laboratory began to expand its activities regionally. Surveys were conducted and serum samples collected in Tobago, St. Lucia, St. Vincent, Antigua, Jamaica, Guyana and Venezuela. Meanwhile, the laboratory was involved locally with studies of yellow fever and encephalitis, and had discovered several new viruses. In the next few years, influenza and Newcastle Disease (in chickens) were added to the areas of research, together with non-viral disease agents, such as *Leptospira*, *Toxoplasma* and *Trypanosoma*. In 1961, there was a move to greatly expanded facilities at Federation Park and an association of the laboratory with the University of the West Indies. By this time a major scientific programme was underway on Bush Bush Island, in Nariva Swamp, which included ecological investigations of a wide range of invertebrates and vertebrates. In addition to isolation of viruses, the TRVL amassed considerable information on environ-

mental conditions and on the biodiversity of Bush Bush, as they studied potential virus hosts and agents of virus transmission. Such studies were expanded to Soldado Rock in 1962, the Arena Forest in 1965, the Turure Forest and Cedros in 1966. After this the TRVL became involved with polio and rabies investigations and control. The various roles played by the Government, Ministry of Health, other agencies and the University are included in Dr. Tikasingh's thorough documentation.

The reader is taken through the technical features of this rapidly developing research programme easily, as Dr. Tikasingh has been able to describe the methods used in virology simply and without confusing detail. The book is profusely illustrated, to show the study sites and some of the practical methodologies. The non-specialist will learn a great deal about this fascinating field of endeavour. There are maps showing the locations of field and overseas study sites. The several appendices contain financial statements and annual reports from the TRVL, which will be of great interest to historians and directors of research programmes.

In his careful account, Dr. Tikasingh provides the names of all the people involved, the visiting scientists, local experts and local support staff. Most of these players are shown in the numerous text illustrations and he tells us who they all were, where they came from and how they each contributed to the field and laboratory work. Throughout the book, one is constantly reminded that the work of the TRVL was a team effort and that the success of their programme was due in no small measure to the efforts of nationals. Local readers are going to feel very proud of the work done by TRVL in Trinidad and of its well - deserved international status.

Another feature of this book that will be of particular interest to field naturalists and other biologists is the extensive list of publications resulting from the work of scientists at the TRVL. This shows that a wealth of knowledge has been accumulated about biodiversity in Trinidad and other neighbouring countries and is contained in these publications and in the TRVL reference collections. This includes taxonomic and ecological data on such groups as the mosquitoes, sandflies, horseflies, ticks, scorpions, reptiles, small mammals and birds. The natural history data collected from Bush Bush has formed the basis of all later studies on the management of Nariva Swamp, as has that for Turure, and that from Soldado Rock is some of the only data from that site.

I enjoyed reading Dr. Tikasingh's book and learnt a great deal from it. It is a truly valuable contribution to the history and scientific culture of Trinidad and Tobago. The book is published by CAREC, in association with PAHO and WHO and is available from the Caribbean Epidemiology Centre in Federation Park.

Peter R. Bacon

Native Trees of Trinidad and Tobago

Victor C. Quesnel and T. Francis Farrell Published by The Trinidad and Tobago Field Naturalists' Club
155 pp.

Before "Native Trees of Trinidad and Tobago" appeared, there had only been a handful of books published about the flora of Trinidad and Tobago. They were usually written for professional foresters and botanists, and if they were illustrated, it was either by drawings or black and white photographs. It was difficult for the average field naturalist to appreciate these books.

Now, a book that can be appreciated by all nature lovers has come along. Written by Dr. Victor C. Quesnel and T. Francis Farrell, two of the country's foremost field naturalists, "Native Trees" contains a wealth of information. The text is very interesting and easy to read, and the excellent color photographs by Dr. Paul L. Comeau make the trees easily recognizable.

As many as 386 trees are native to Trinidad and Tobago, so it was quite a task for the authors to decide which should be included in the book. Those selected all stand out in some way, either by their unusual flowers, fruit foliage or sheer abundance, which make them likely to be spotted in the forests.

Maps showing the locations of various types of forests are used along with a color code to indicate where these trees can be found. The botanical, as well as local, name is given for each tree, which is introduced with an interesting anecdote followed by

a comprehensive description of its botanical features, ecology and uses.

The accuracy of the information provided by the authors cannot be doubted, as it is obvious that they have done a great deal of research and are very familiar with the trees that they describe.

"Native Trees of Trinidad and Tobago" is one book that no local tree lover or field naturalist should be without.

Johnny Lee

An Illustrated Guide to The Freshwater Fish of Trinidad and Tobago

Dawn Phillip and Indar Ramnarine, 2001
Available from
The Department of Life Sciences,
The University of The West Indies,
St Augustine Trinidad and Tobago, 85 pp, price $60.

This is a very useful companion to Professor Kenny's "Views from the Bridge", (see page 45).

I bought Professor Kenny's book because I wanted to be able to identify the freshwater fish of Trinidad and Tobago. As far as that is concerned, his book is a disappointment. There is no description of the fish, and the black and white photographs at the end of his book are inadequate, especially as they lack a scale. However, his erudite and entertaining text more than compensates for this.

Phillip and Ramnarine's book is, as its title indicates, an illustrated guide that covers all of the freshwater fish of Trinidad and Tobago. It contains forty colour photographs, and an adequate description of each fish. Moreover, it also contains one key to identify the families and a second to identify the genera and species of the fish. I have not yet had the opportunity to test these keys, but they appear to be simple and straightforward to use.

I now feel that I can confidently combat such questions as "What's this one, Daddy?", with the response "We can identify it from Phillip and Ramnarine's book". As a child in England, my interest in natural history was encouraged by the availability of inexpensive books on birds, birds eggs, moths, butterflies, insects, flowers, trees, etc. Such books are sorely lacking in Trinidad and Tobago, and this book from Phillip and Ramnarine is a valuable contribution.

Let's hope that others follow.

Nigel Gains

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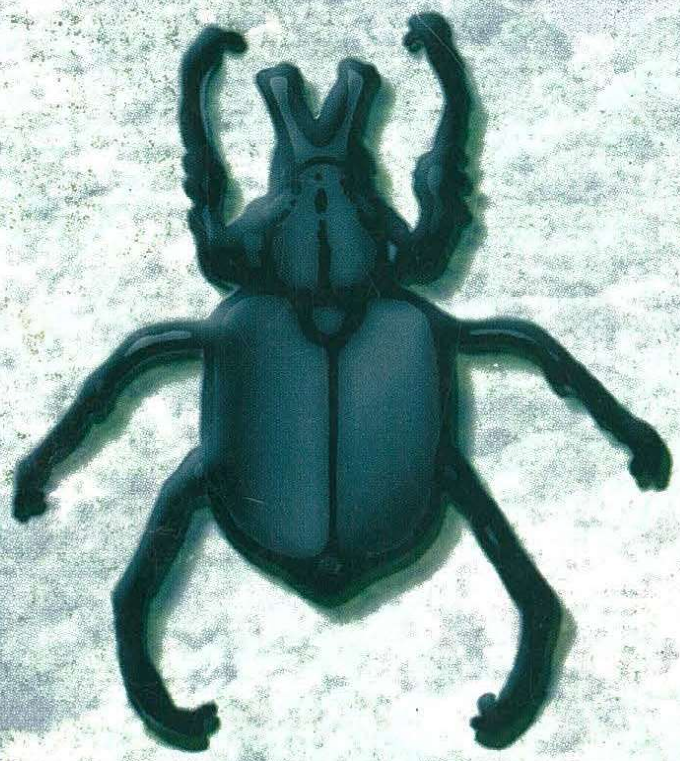

Mission Statement

To foster education and knowledge on natural history and to encourage and promote activites that would lead to an appreciation, preservation and conservation of our natural heritage.

Natura Maxime Miranda in Minimis