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Contribution to the knowledge of the plant communities of the Caribbean-Cibensean Sector in the Dominican Republic

Contribution a la connaissance des communautés végétales du Secteur des Caraïbes-Cibensean dans la République dominicaine

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Abstract: The Caribbean-Cibensean Sector (Eastern Coastal Plain) is situated in the east of Santo Domingo (Dominican Republic). Despite intense tourist activity and farming, two types of forest can still be found in this area. This survey analyses the phytosociological profile of these forests. As a result of the heavy water losses in the underlying coral limestones, both the primary and the secondary forest undergo water stress and, consequently, there is no doubt that they are edaphoxerophilous. However, growing on deeper soils, the *Chrysophyllo oliviformi-Sideroxyletum salicifolii* primary forest undergoes less intense water stress than the *Zamio debilis-Metopietum toxiferi* secondary forest, which is a development of the former and appears as a result of the outcropping of coral limestones. Both forest formations are located in a pluviseasonal tropical, subhumid, infratropical macrobioclimate, but as a result of the xericity induced by the porous coral substrate and high potential evapotranspiration, these forests occasionally behave ambivalently, that is, either as climatophilous or edaphoxerophilous. The great number of endemic species and the high endangered level of some, such as *Goetzea ekmanii* O. E. Schulz, *Peresquia quisqueyana* Alain and *Cubanola domingensis* Aiello, lead us to propose that these two forest types be regarded as habitats worthy of preservation.

Keywords: conservation; endemic species; habitats; phytosociology; vegetation

Résumé: Le secteur Caribeo-Cibense (la Plaine la Dosse Orientale) s'étend à l'est de Saint-Domingue (République Dominicaine), malgré la pression touristique et l'agriculture se maintiennent deux types de bois, dont l'étude phytosociologique présentons à ce travail. Les deux types de bois, le primaire et le secondaire présentent un stress hídrido par les fortes pertes de l'eau que les corallines calcaires expérimentent sur celles qui s'assoient, par ce que nous admettons son caractère edafoxerófilo. Cependant après avoir été trouvé sur des sols plus profonds, le bois primaire de *Chrysophyllo oliviformi-Sideroxyletum salicifolii* a un moindre stress hídrido que le bois secondaire de *Zamio debilis-Metopietum toxiferi*, obtenu à partir de l'antérieur après avoir vanné les corallines calcaires. Les deux formations boisées sont trouvées dans le macrobioclima pluviestacional tropical, sous-humide et infratropical, mais le xericidad qui confère le substrat corallin poreux et la haute évapotranspiration potentielle, il fait que dans des situations déterminées ces bois présentent un comportement ambivalent, en pouvant être climatófilos ou edafoxerófilos. La quantité élevée d'espèces endémiques et le haut degré de la menace que certains présentent, comme: *Goetzea ekmanii* O. Schulz, *Peresquia quisqueyana* Alain, *Cubanola domingensis* Aiello etc., permet de proposer ces deux types de bois comme d'habitats d'intérêt pour sa conservation.

Mots clés: conservation; espèces endémiques; habitats; phytosociologie; végétation

Introduction

Our study was conducted on the Eastern Coastal Plain in the eastern part of the Dominican Republic. Substrates are limestones (coral limestones), the ombroclimate is dry-subhumid and the thermotype, is infratropical. Ombrothermic index values are: 3.4 in La Romana; 3.8 in San Rafael del Yuma and 4.8 in Hato Mayor. The Thermicity index/compensated Thermicity index values are 716/656. The territories belong to the Caribbean-Cibensean Sector, where basic substrates, limestones, marls and serpentines are dominant (García et al. 2002; Jiménez and Rodríguez 2008; Cano et al. 2009a; Cano et al. 2011) (Figure 1).

The Eastern Coastal Plain has a coral origin so the substrate is extremely porous and, although rainfall records are over 800 mm per m^2, the territory is very dry.

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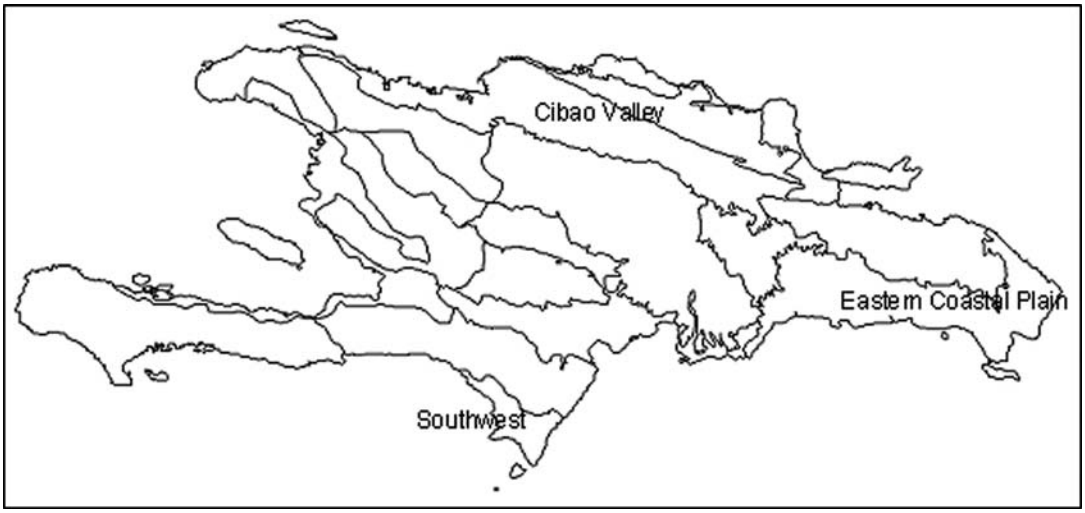

Figure 1. Location of the study.
Figure 1. Localité de l'étude.

The flora is very similar to that of the Cibao Valley, southwest zones and, to a lesser extent, to that of Yamasá. However, there are some floristic differences, as far as habitats and use of land are concerned, compared with the dry zones of the southwest. The territories of the Eastern Coastal Plain, for example, are used for sugar cane and, to a much lesser extent, coconut production. As for vegetation, there are some peculiar plant communities highly dependent on the substrate profile. Dry forests can be found when the soil is thin and porous. However, when the soil is deep, these dry phytocoenoses give way to transitional semi-deciduous forests between dry forests and evergreen forests. In one of our previous papers Cano et al. (2009a), we included this kind of vegetation in the subhumid areas of the Dominican Republic that present a pluviseasonal, tropical macrobioclimate and an infratropical thermotype (Cano et al. 2009b, 2010b). In these territories the period of drought extends from December to April. Important enclaves are Isla Saona and the National Park of the East (in this natural park more than 50 endemic species have been recorded). The richness in deciduous and endemic taxa makes these plant communities extremely valuable (Table 1).

Material and methods

Our study deals with the vegetation of the Eastern Coastal Plain, located to the east of Santo Domingo (Dominican Republic). The territory is a fairly uniform plain that does not rise to more than 70 m above sea level. The plain is made up of Quaternary marine deposits, such as coral and perforated limestones, which allow good water drainage. Samples were taken in the area under study following phytosociological methods (Braun-Blanquet 1979). Our bioclimatic and biogeographical analyses are based on the contributions of Rivas-Martínez (2004), Cano et al. (2009a, b) (Figure 2), and our floristic study has followed the suggestions of Liogier (1996–2000, 2000). To define the groups for statistical purposes, we first generated a matrix of 185 rows (species) by 14 columns (relevés), transforming the phytosociological indexes of Braun-Blanquet, +, 1, 2, 3, 4, 5 into those of Van der Maa-

Table 1.
Tableau 1.

Site	No. st.	Av. h.	At	Tmi	T	Pt	P	PTE	Oi	Ci
S. R. Yuma	0193	3	28.4	24.9	27.0	3240	1241	1610	3.8	3.5
L. Romana	0199	23	27.8	24.4	26.3	3156	1080	1617	3.4	3.4
H. Mayor	0255	102	28.3	24.5	26.7	3204	1548	1458	4.8	3.8
Airport	0485	14	27.2	24.2	25.9	3108	1075	1387	3.4	3.0
Sto. Dgo.	0486	14	27.1	23.9	25.7	3084	1394	1329	4.5	3.2
El Seybo	3001	100	26.6	23.5	25.0	3000	1226	1511	4.0	3.1
SYamasa	3460	69	26.6	24.5	25.7	3084	1992	1241	6.4	3.1

Av.h., average height; At, average temperature of warmest month; Tmi, average temperature of coldest month; T, annual average temperature; Pt, positive temperature; P, annual average precipitation; PTE, potential evapotranspiration; Oi, ombrothermic index; Ci, Continentality index.
Av.h., hauteur moyenne; A, la température moyenne de mois le plus chaud; Tmi, la température moyenne de mois le plus froid; T, la température moyenne annuelle; Pt, de température positif, P, les précipitations annuelles en moyenne; PTE, l'évapotranspiration potentielle; Oi, l'indice de ombrothermic; Ci, l'indice de continentalité.

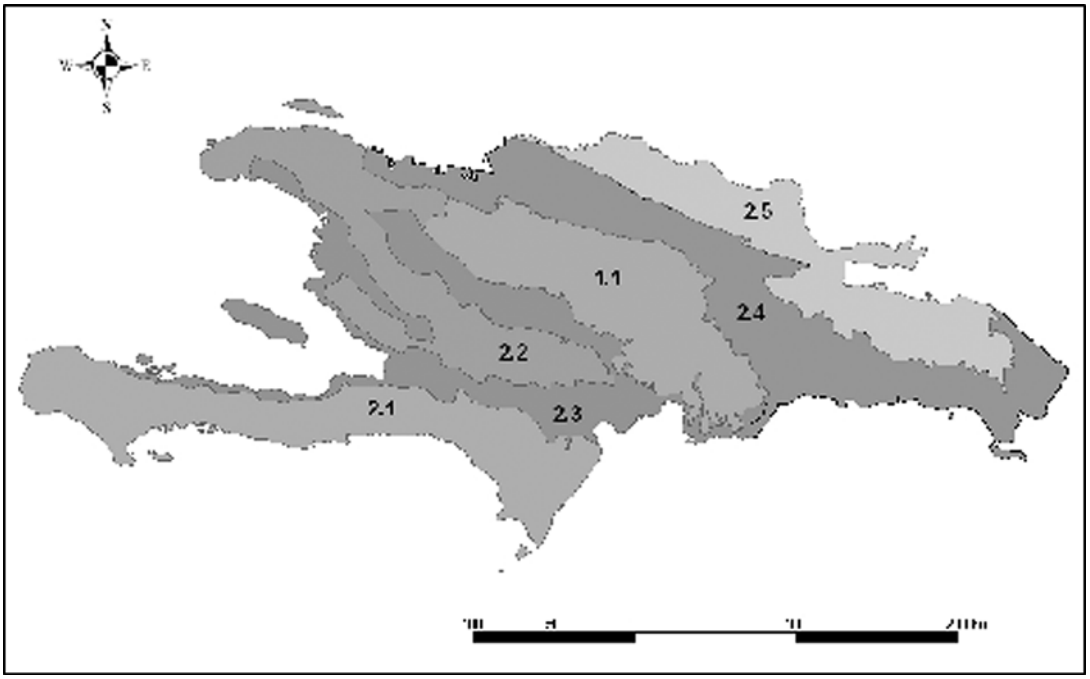

Figure 2. Map of biogeographical sectors of Hispaniola. 1.1. Central. 2.1. Bahoruco-Hottensean, 2.2. Neiba-Matheux-Northwest, 2.3. Azua-San Juán-Hoya Enriquillo-Port-au-Prince-Artiobonite-Gonaivës, 2.4. Caribbean-Cibensean, 2.5. North (Cano et al. 2010a).
Figure 2. Carte des secteurs biogéographiques d'Hispaniola. 1.1. Central. 2.1. Bahoruco-Hottensean, 2.2. Neiba-Matheux-Northwest, 2.3. Azua- San Juán-Hoya Enriquillo-Port-au-Prince-Artiobonite-Gonaivës, 2.4. Caribbean-Cibensean, 2.5. North (Cano et al. 2010a).

rel 2, 3, 4, 5, 6, 7. To avoid distorted results, we omitted species with + abundance to obtain a cleaned-up 72 × 14 matrix. With this matrix and the software package COMMUNITY ANALYSIS PACKAGE 3.0, we performed a Euclidean Distance Clustering and a Principal Component Analysis. To avoid any loss of information relevant to a correct phytosociological analysis, all sampled species were taken into account with the groups defined in our statistical analysis as the reference basis. We followed Rivas-Martínez (2005) to establish the dynamic-catenal phytosociology.

Results and discussion

Statistical analysis

Our statistical analysis, performed on a cleaned-up matrix of 72 rows by 14 columns, yielded a clustering with two clearly distinct groups. Group GI (3–13) comprises five forest samples dominated by species belonging to the *Sideroxylon* genus. However, relevé 10 remains a little apart from the other samples on account of the high abundance of *Bucida buceras* L. and *Celtis trinervia* Lam. Group GII (1–14) represents the secondary copses dominated by *Metopium toxiferum* (L.) Krug. and Urb., which to a certain extent are edaphoxerophilous, because they grow on perforated coral limestones that arise after heavy soil losses when the forest of *Sideroxylon foetidissimum* Jacq. and *Sideroxylon salicifolium* (L.) Sw. disappears (Figure 3). The principal components analysis confirms the separation between relevé groups GI and GII (Figure 4).

Floristic and phytosociological study

The Eastern Coastal Plain has a subhumid ombroclimate with rainfall rates ranging from 1080 mm (La Romana) to 1992 mm (Yamasá). Ombrothermic index records for these two sites are 3.4 and 6.4, respectively. The thermotype is infratropical with Thermicity index/compensated Thermicity index values of 756/691 in Punta Cana (Cano et al. 2009b). Substrates are made up of very perforated and well-drained coral limestones. Not surprisingly, the corresponding vegetation comprises forests and copses rich in semi-deciduous taxa as a result of water stress. Examples are *Bursera simaruba* (L.) Sarg., *Swietenia mahagoni* (L.) Jacq. and columnar Cactaceae, *Pilosocereus polygonus* (Lam.) B. and R., *Leptocereus weingartianus* (Hartn.) B. and R., *Consolea picardae* (Urb.) Areces. Despite the intense tourist and farming activity in the territory, some patches of vegetation are still well preserved. Besides the magnificent mangrove swamps of Isla Saona, Bahía Catalina, Cumayaza etc., there are two kinds of forests that we propose as new associations belonging to the class *Coccothrinaceto-Plumerietea* Knapp (1964) (Borhidi 1991). The class comprises partly deciduous forests and scrublands growing in the West Indies, rich in climbing plants and evergreen sclerophyllous elements. These are plant communities usually depicted as dry forest. This dry forest develops on the eroded limestones of the coastline and beaches, terraces and calcareous mountains of Central and West Cuba, and is conditioned by a bixeric, seasonal climate, with seven to nine dry months and 600–1200 mm annual rainfall. The order *Eugenio-Metopietalia toxiferi* Knapp (1964)

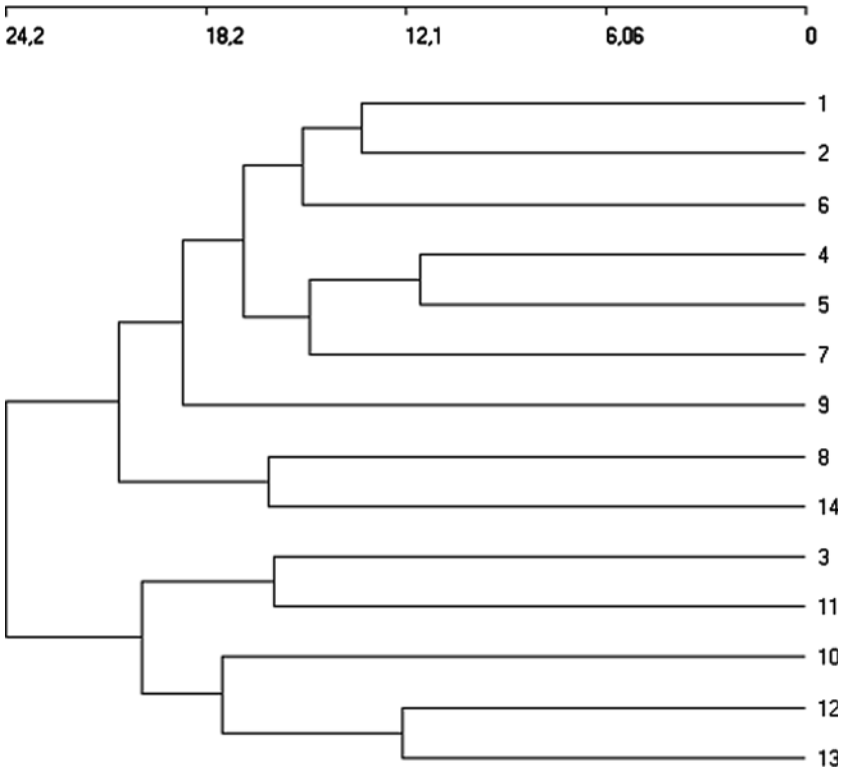

Figure 3. Euclidean distance clustering.
Figure 3. Clustering distance euclidienne.

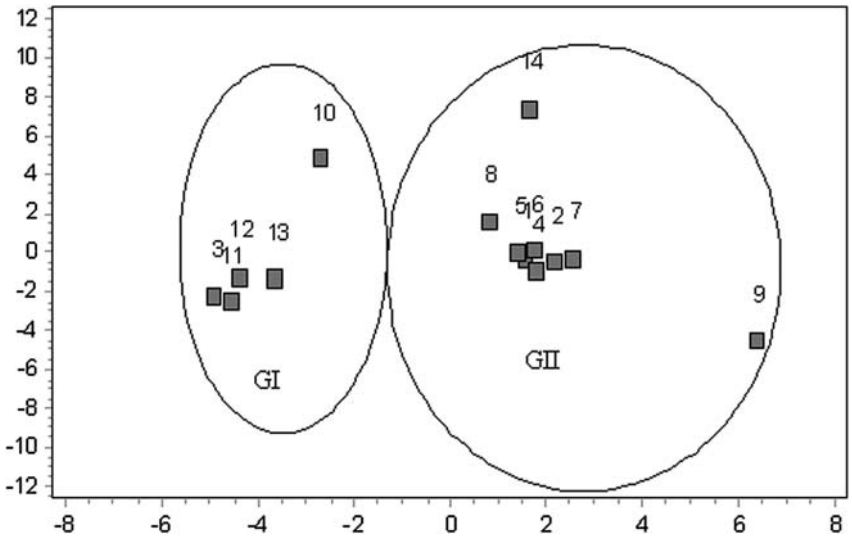

Figure 4. Principal component analysis (PCA).
Figure 4. Analyse en composantes principales.

Borhidi 1991 was included in this class. In the order we included the two new associations proposed for the alliance *Eugenio-Capparidion* Borhidi in Borhidi et al. 1979, which comprises the dry forests and copses growing on the coral limestones and low-level terraces of the coastal rims of the Greater Antilles. The alliance is characterized by the presence of deciduous and evergreen sclerophyllous trees, thorny bushes, tree-like, columnar cacti and other succulent species. In Cuba, the alliance is characterized by *Capparis fexuosa* (L.) L., *C. cynophalophora* L, *Colubrina elliptica* (Sw.) Briz. and Stern, *Hippomane mancinella* L., *Krugiodendron ferreum* (Vahl) Urb., *Eugenia maleolens* Pers. and *Opuntia dillenii* (Ker-Gaw) Haw (Borhidi 1991).

On the Eastern Coastal Plain, with a more fertile soil, there is a semi-deciduous, well-structured forest,

Table 2. *Chrysophyllo oliviformi-Sideroxyletum salicifolii ass. nova.*
Tableau 2. *Chrysophyllo oliviformi-Sideroxyletum salicifolii ass. nova.*

Altitude in m	8	42	8	14	12	L	S	F
Area in m^2 1=10	100	200	200	200	200	I	T	A
Cover rate in %	90	95	100	100	100	F	A	M
Average veg. height in m	12	15	18	18	20	E	T	I
No. of field relevé	49	48	50	52	53		U	L
No. of clusters	3	10	11	12	13		S	y
No. of orders	1	2	3	4	5			
Characteristics of the association and upper units								
Sideroxylon foetidissimum Jacq.	4	5	2	3	4	A	N	*Sapotaceae*
Sideroxylon salicifolium (L.) Sw.	+	3	3	5	3	A	N	*Sapotaceae*
Krugiodendron ferreum (Vahl) Urb.	+	+	2	+	+	A	N	*Rhamnaceae*
Acacia macracantha H. and B. Ex Willd.	+	.	+	2	+	A	N	*Leguminosae*
Bucida buceras L.	+	4	4	.	+	A	N	*Combretaceae*
Celtis trinervia Lam.	.	4	+	2	+	A	N	*Ulmaceae*
Bursera simaruba (L.) Sarg.	+	+	+	+	+	A	N	*Burseraceae*
Coccoloba diversifolia Jacq.	+	.	+	.	+	A	N	*Polygonaceae*
Chrysophyllum oliviforme L.	+	.	+	+	+	A	N	*Sapotaceae*
Guaiacum sanctum L	+	.	+	+	+	A	N	*Zygophyllaceae*
Guapira fragans (Dun-Cours) Little	.	.	+	+	+	A	N	*Nyctaginaceae*
Guazuma ulmifolia Lam.	+	.	+	.	+	A	N	*Sterculiaceae*
Cissus verticillata (L.) Nichols and Jarvis	+	.	2	+	.	Tr	N	*Vitaceae*
Serjania polyphylla (L.) Radlk.	2	.	2	2	2	Tr	N	*Sapindaceae*
Cissus oblongo-lanceolata Krug and Urb.	.	+	.	+	.	Tr	E	*Vitaceae*
Eugenia axillaris (Sw.) Willd.	+	.	2	.	.	A	N	*Myrtaceae*
Melicoccus jimenezii (Alain) Acev. Rodr.	+	+	+	.	.	A	E	*Sapindaceae*
Ottoschulzia rhodoxylon (Urb.) Urban	.	.	.	2	+	A	N	*Icacinaceae*
Pouteria dictyoneura (Griseb.) Radk.	.	.	.	+	+	A	N	*Sapotaceae*
Ficus velutina H. and B. Ex Willd.	.	.	.	2	2	A	N	*Moraceae*
Clusia rosea Jacq.	.	+	+	.	.	A	N	*Clusiaceae*
Amyris elemifera L.	.	+	2	.	.	A	N	*Rutaceae*
Capparis cynophallophora L.	.	+	+	.	.	A	N	*Capparaceae*
Rauvolfia nitida Jacq.	.	.	.	+	+	A	N	*Apocynaceae*
Ocotea coriacea (Sw.) Griseb.	+	.	+	2	.	A	N	*Lauraceae*
Acacia skleroxyla Tuss.	+	.	.	.	.	A	E	*Leguminosae*
Bourreria ovata Miers	.	.	.	+	.	A	N	*Boraginaceae*
Cecropia schreberiana Miq.	.	.	.	.	+	A	N	*Moraceae*
Ceiba pentandra (L.) Gaert.	.	.	+	.	.	A	N	*Bombacaceae*
Citharexylum fruticosum L.	.	.	+	.	.	A	N	*Verbenaceae*
Colubrina arborescens (Mill.) Sarg.	.	+	.	.	.	A	N	*Rhamnaceae*
Cupania americana L.	.	.	.	+	.	A	N	*Sapindaceae*
Exothea paniculata (Juss.) Radk.	.	.	.	.	+	A	N	*Sapindaceae*
Ficus citrifolia Mill.	.	+	.	.	.	A	N	*Moraceae*
Guaiacum officinale L.	.	2	.	.	.	A	N	*Zygophyllaceae*
Guettarda dictyophylla Urban	.	+	.	.	.	A	E	*Rubiaceae*
Tabebuia obovata Urban	.	+	.	.	.	A	E	*Bignoniaceae*
Thouinia trifoliata Poit.	.	+	.	.	.	A	N	*Sapindaceae*
Trema micrantha (L.) Blume	.	.	.	+	+	A	N	*Ulmaceae*
Trichilia hirta L.	.	.	.	+	.	A	N	*Meliaceae*
Ziziphus rignonii Delp.	.	+	.	.	.	A	N	*Rhamnaceae*
Ziziphus rhodoxylum Urb.	.	.	.	.	+	A	N	*Rhamnaceae*
Zanthoxylum elephantiasis Maca	+	.	.	.	.	A	N	*Rutaceae*
Trichilia pallida Sw.	.	.	.	+	+	A	N	*Meliaceae*
Companions								
Adelia ricinella L.	2	+	.	+	2	Ar	N	*Euphorbiaceae*
Gouania lupuloides (L.) Urb.	2	.	2	3	2	Tr	N	*Rhamnaceae*
Chioccoca alba (L.) Hitchcok	2	.	2	+	+	Ar	N	*Rubiaceae*
Drypetes alba Poit	.	.	+	2	2	Ar	N	*Euphorbiaceae*
Rivina humilis L.	2	.	2	+	+	H	N	*Phytolacaceae*
Trichostigma octandrum (L.) H. Walt.	2	.	2	+	2	Tr	N	*Phytolacaceae*
Pilosocereus polygonus (Lam.) B. and R.	+	2	+	.	.	Sar	N	*Cactaceae*
Pisonia aculeata L.	2	.	.	+	+	Ar	N	*Nyctaginaceae*
Gyminda latifolia (Sw.) Urb.	3	+	2	.	.	Ar	N	*Celastraceae*
Zamia debilis L	2	+	2	2	.	Es	N	*Zamiaceae*
Eugenia monticola (Sw.) D.C.	+	.	+	.	+	Ar	N	*Myrtaceae*

(*Continued*)

Table 2. (*Continued*).

Capparis flexuosa (L.) L.	+	+	+	.	.	Tr	N	*Capparaceae*
Exostema caribaeum (Jacq.) R. and S.	+	+	+	.	.	Ar	N	*Rubiaceae*
Psychotria nervosa Sw.	+	.	.	+	2	Ar	N	*Rubiaceae*
Randia aculeata L.	+	+	+	.	.	Ar	N	*Rubiaceae*
Furcraea tuberosa Ait.	.	+	.	.	.	Sar	N	*Agavaceae*
Hamelia patens Jacq.	.	.	+	.	+	Ar	N	*Rubiaceae*
Hippocratea volubilis L.	.	.	.	2	2	Tr	N	*Hippocrateaceae*
Hylocereus undatus (Haw.) Britt. and Rose	.	+	.	.	.	Sar	N	*Cactaceae*
Hyperbaena brevipes Urban	.	2	.	.	.	Ar	E	*Menispermiaceae*
Ipomoea indica (Burm.) Cerril	.	.	.	.	2	Tr	N	*Convolvulaceae*
Lantana exarata Urb. and Ekm.	.	+	.	.	.	Ar	N	*Verbenaceae*
Leptocereus weingartianus (Hartn.) Britt. and Rose	.	+	.	.	.	Sar	E	*Cactaceae*
Leucanea leucocephala (Lam.) De Wit	+	.	.	.	.	Ar	N	*Mimosaceae*
Macfadyena unguis-cati (L.) a. Gentry	.	+	.	+	.	Tr	N	*Bignoniaceae*
Mikania cordifolia (L.f.) Willd.	.	.	.	+	.	Tr	N	*Asteraceae*
Oplonia spinosa (Jacq.) Raf.	.	+	.	.	.	Ar	N	*Acanthaceae*
Passiflora suberosa L.	+	.	.	.	.	Tr	N	*Passifloraceae*
Pereskia quisqueyana Alain	.	+	.	.	.	Ar	E	*Cactaceae*
Picramnia pentandra Sw.	.	.	2	.	.	Ar	N	*Picrammiaceae*
Pithecellobium unguis-cati (L.) Mart.	+	.	.	.	.	Ar	N	*Mimosaceae*
Plumeria obtusa L.	.	+	.	.	.	Ar	N	*Apocynaceae*
Poitaea paucifolia (DC.) Lavin	.	.	+	.	.	Ar	N	*Leguminosae*
Portulaca oleracea L.	+	.	.	.	.	H	N	*Portulacaceae*
Psiguria triphylla (Miq.) C. Jeffrey	.	.	.	+	.	Tr	N	*Cucurbitaceae*
Samyda dodecandra Jacq.	.	+	.	.	+	Ar	N	*Flacourtiaceae*
Savia sessiliflora (Sw.) Willd.	.	.	+	.	.	H	N	*Euphorbiaceae*
Smilax domingensis Willd.	.	.	.	+	.	Tr	N	*Smilacaceae*
Smilax populnea Kunth	.	.	.	.	+	Tr	N	*Smilacaceae*
Solanum erianthum D. Don	2	.	.	+	.	Ar	N	*Solanaceae*
Sophora tomentosa L.	+	.	.	.	.	Ar	N	*Leguminosae*
Talinum paniculatum (Jacq.) W.	.	2	.	.	.	H	N	*Portulacaceae*
Tillandsia bulbosa Hook	.	+	2	.	.	Ep	N	*Bromeliaceae*
Tillandsia schiedeana Steud.	.	+	.	.	.	Ep	N	*Bromeliaceae*
Tillandsia usneoides (L.) L.	.	2	.	.	+	Ep	N	*Bromeliaceae*
Vanilla claviculata (W.W.R.) Sw.	.	+	.	.	.	Tr	N	*Orchidaceae*
Zanthoxylum fagara (L.) Sarg.	3	.	2	.	.	Ar	N	*Rutaceae*
Bromelia pinguin L.	.	.	+	.	.	H	N	*Bromeliaceae*
Eupatorium odoratum L.	.	.	.	+	.	Ar	N	*Asteraceae*
Bromelia plumieri Lam.	.	+	.	.	.	H	N	*Bromeliaceae*
Casearia aculeata Jacq.	.	.	.	.	+	Ar	N	*Flacourtiaceae*
Celtis iguanaea (Jacq.) Sarg.	.	.	+	+	.	Tr	N	*Ulmaceae*
Centrosema virginianum (L.) Bentham	.	+	.	+	.	Tr	N	*Leguminosae*
Comocladia cuneata Britton	.	.	.	.	+	Ar	N	*Anacardiaceae*
Consolea moniliformis (L.) hawoth in Stend.	.	+	.	.	.	Sar	N	*Cactaceae*
Convolvulus nodiflorus Ders.	.	2	.	.	.	Tr	N	*Convolvulaceae*
Cordia polycephala (Lam.) Johnst.	+	.	.	.	.	Ar	N	*Boraginaceae*
Cordia curassavica (Jacq.) R. and S.	.	+	.	.	.	H	N	*Boraginaceae*
Cordia fitchii Urban	.	+	.	.	.	Ar	E	*Boraginaceae*
Echites umbellata Jacq.	.	+	.	.	.	Tr	N	*Apocynaceae*
Eugenia ligustrina (Sw.) Willd.	.	+	.	.	+	Ar	N	*Myrtaceae*
Eugenia maleolens Pers.	.	+	.	.	.	Ar-A	N	*Myrtaceae*
Forsteronia corymbosa (Jacq.) G. Meyer	.	.	.	.	+	Tr	N	*Apocynaceae*
Brougtonia domingensis (Lindl.) Rolf.	.	+	+	.	.	Ep	N	*Orchidaceae*
Callisia repens L.	+	.	.	.	.	H	N	*Commelinaceae*

Order no. of sites: 1. Crossroads Hotel Dominicus and Bayahibe (19Q 0517849/2031060). 2. Path 4 km from Pueblo de Beyahibe. 3. Crossroads Hotel Dominicus-Beyahibe. 4. Caccana. Punta Cana (R. Dominicana) (19Q 0565493/205055). 5. Near entrance to Caccana. Punta Cana (19Q 0564945/2051672).
A, tree; Ar, shrub; Tr, climber; H, herbaceous; Ep, epiphyte; Sar, succulents; N, native; E, endemic; Es, estipite (trunk).

with a 100% cover rate and dominant species with an average height of 12–20 m. More than 50% of this flora is made up of tree-like species, lianas and column-shaped elements. The dominant species, namely, *Sideroxylon salicifolium* (L.) Sw, *Sideroxylon foetidissimum* Jacq., *Guaiacum sanctum* L., *Celtis trinervia* Lam., *Bucida buceras* L. and *Chrysophyllum oliviforme* L., with the endemic trees *Melicoccous jimenezii* (Alain) Acev. Rodr., *Acacia skleroxyla* Tuss., *Tabebuia obovata* Urban, *Leptocereus weingartianus*

Table 3. *Zamio debilis-Metopietum toxiferi ass. nova*.
Tableau 3. *Zamio debilis-Metopietum toxiferi ass. nova.*

Altitude in m	39	36	15	8	24	4	29	6	69	L	S	F
Area in m^2 1=10	100	100	200	200	200	100	50	100	1000	I	T	A
Cover rate in%	100	100	95	90	100	100	60	100	100	F	A	M
Average veg. height in m	6	5	5.5	5	6	4.5	6	8	8	E	T	I
No. of field relevé	46	47	7	8	9	11	12	45	10		U	L
No. of clusters	1	2	4	5	6	7	8	9	14		S	Y
No. of orders	1	2	3	4	5	6	7	8	9			
Characteristics of the association and upper units												
Metopium toxiferum (L.) Krug. and Urb.	4	4	4	5	4	4	5	3	5	Ar	N	*Anacardiaceae*
Zamia debilis L	2	2	2	2	2	+	3	3	2	Es	N	*Zamiaceae*
Exostema caribaeum (Jacq.) R. and S.	5	4	+	4	5	+	+	2	1	Ar	N	*Rubiaceae*
Eugenia rhombea (Berg) Krug and Urb.	2	.	2	2	.	2	.	2	.	Ar	N	*Myrtaceae*
Serjania polyphylla (L.) Radlk.	+	2	2	2	2	.	2	2	.	Tr	N	*Sapindaceae*
Chioccoca alba (L.) Hitchcok	+	+	.	+	+	+	.	+	+	Ar	N	*Rubiaceae*
Krugiodendron ferreum (Vahl) Urb.	+	+	+	+	+	.	+	3	2	Ar	N	*Rhamnaceae*
Adelia ricinella L.	+	+	.	2	+	.	3	+	2	Ar	N	*Euphorbiaceae*
Macfadyena unguis-cati (L.) a. Gentry	+	2	+	+	+	.	.	+	.	Tr	N	*Bignoniaceae*
Capparis flexuosa (L.) L.	.	.	+	+	.	.	+	+	+	Tr	N	*Capparaceae*
Comocladia dodonaea (L.) Urb.	.	4	.	.	.	.	2	2	.	Ar	N	*Anacardiaceae*
Arislolochia bilobata L.	+	2	+	.	.	.	.	+	.	Tr	E	*Aristolochiaceae*
Centrosema virginianum (L.) Bentham	.	+	.	.	.	.	+	+	+	Tr	N	*Leguminosae*
Randia aculeata L.	.	.	.	+	.	+	+	.	.	Ar	N	*Rubiaceae*
Rhynchosia reticulata (Sw.) DC	+	.	.	.	+	.	.	+	.	Tr	N	*Leguminosae*
Samyda dodecandra Jacq.	+	.	+	.	.	.	.	.	+	Ar	N	*Flacourtiaceae*
Coccotrinax barbadensis (Lodd ex Mart.) Becc.	+	+	.	.	+	.	.	2	.	Es	N	*Arecaceae*
Coeloneurum ferrugineum (Spreng.) Urb.	2	+	.	.	+	.	.	.	.	Ar	E	*Solanaceae*
Pithecellobium unguis-cati (L.) Mart.	.	.	+	+	.	+	.	.	.	Ar	N	*Mimosaceae*
Comocladia domingensis Britton	.	.	.	.	+	.	+	.	+	Ar	E	*Anacardiaceae*
Consolea picardae (Urb.) Areces	.	.	.	.	.	.	+	.	+	Sar	E	*Cactaceae*
Cordia polycephala (Lam.) Johnst.	.	.	.	+	.	+	.	.	.	Ar	N	*Boraginaceae*
Erythroxylum brevipes D.C.	.	+	+	.	2	+	+	+	+	Ar	N	*Erythroxylaceae*
Eugenia ligustrina (Sw.) Willd.	.	.	+	.	.	+	.	.	+	Ar	N	*Myrtaceae*
Goetzea ekmanii O.E. Schulz	+	.	.	+	+	.	.	+	.	Ar	E	*Solanaceae*
Gouania lupuloides (L.) Urb.	+	+	.	+	+	+	+	+	.	Tr	N	*Rhamnaceae*
Pisonia aculeata L.	+	+	.	.	.	.	+	.	+	Ar	N	*Nyctaginaceae*
Passiflora suberosa L.	+	.	.	+	+	.	.	+	.	Tr	N	*Passifloraceae*
Guettarda scabra (L.) Vent.	+	.	.	.	+	.	.	+	.	Ar	N	*Rubiaceae*
Lonchocarpus neurophyllus Urb.	+	+	2	+	.	.	.	.	.	Ar	E	*Leguminosae*
Gyminda latifolia (Sw.) Urb.	.	.	.	+	+	+	+	.	.	Ar	N	*Celastraceae*
Lantana camara L.	.	+	.	.	+	.	.	+	.	Ar	N	*Verbenaceae*
Lantana exarata Urb. and Ekm.	+	.	.	.	2	.	.	+	.	Ar	N	*Verbenaceae*
Picramnia pentandra Sw.	.	.	.	.	+	.	+	.	2	Ar	N	*Picrammiaceae*
Hyperbaena brevipes Urban	.	.	.	.	.	.	+	.	+	Ar	E	*Menispermiaceae*
Ipomoea tiliacea (Willd.) Choisy	.	.	.	.	.	.	.	.	+	Tr	N	*Convolvulaceae*
Isidorea pungens (Lam.) B. L. Rob.	.	.	2	.	.	+	.	.	.	Ar	E	*Rubiaceae*
Jacquemontia havanensis (Jacq.) Urb.	.	.	.	+	.	.	.	.	.	Tr	N	*Convolvulaceae*
Jasminum fluminense	.	.	.	+	.	.	.	.	.	Ar	Na	*Oleaceae*
Lantana involucrata L.	.	.	2	3	.	.	.	.	.	Ar	N	*Verbenaceae*
Leptocereus weingartianus (Hartn.) Britt. and Rose	.	.	+	.	.	.	+	.	+	Sar	E	*Cactaceae*
Malpighia setosa Sprengel	.	.	+	.	.	+	.	.	.	Ar	E	*Malpighiaceae*
Melochia tomentosa L.	.	.	.	+	.	.	.	.	.	Ar	N	*Sterculiaceae*
Merremia quinquefolia (L.) Hall.	.	.	.	.	+	.	.	.	.	Tr	N	*Convolvulaceae*
Merrenia dissecta (Jacq.) Hall.f.	2	.	.	.	.	.	.	.	.	Tr	N	*Convolvulaceae*
Oncidium variegatum (Sw.) Sw.	.	.	.	.	.	+	+	.	.	Ep	N	*Orchidaceae*
Oplonia microphylla (Lam.) Stearn	.	.	.	.	.	+	.	.	.	Ar	N	*Acanthaceae*
Oplonia spinosa (Jacq.) Raf.	.	.	.	.	.	.	.	+	.	Ar	N	*Acanthaceae*
Passiflora multiflora L.	.	.	.	.	.	.	+	.	.	Tr	N	*Passifloraceae*
Pavonia spinifex (L.) Cav.	.	.	.	.	.	.	.	.	+	Ar	N	*Malvaceae*
Pedilanthus tithymaloides (L.) Poit.	.	.	.	.	+	.	.	.	.	Ar	N	*Euphorbiaceae*
Pereskia quisqueyana Alain	.	.	.	.	.	.	2	.	.	Ar	E	*Cactaceae*
Pictetia sulcata (P. Beauv) Beyra and Lavin	.	.	.	.	.	+	.	.	.	Ar	N	*Leguminosae*
Pilosocereus polygonus (Lam.) B. and R.	.	.	.	.	.	.	2	.	2	Sar	N	*Cactaceae*
*Poitaea dubia (*Poiret) Lavin	.	.	.	.	.	+	.	.	.	Ar	E	*Leguminosae*

(*Continued*)

Table 3. (*Continued*).

Poitaea paucifolia (DC.) Lavin	.	.	.	.	.	.	.	+	.	Ar	N	*Leguminosae*
Pothuya nudicaulis (L.) Regel	.	.	.	.	.	2	.	2	.	Ep	N	*Bromeliaceae*
Pseudophoenix sargentei Wendl *subsp. saoanae* (O.F.Cook.) Real	.	.	.	.	.	2	.	.	.	Es	E	*Arecaceae*
Psychotria nervosa Sw.	.	.	.	.	+	.	.	2	+	Ar	N	*Rubiaceae*
Psychotria nutans Sw.	.	.	.	.	.	.	+	.	+	Ar	N	*Rubiaceae*
Schaefferia frutescens Jacq.	.	.	.	.	+	.	.	2	.	Ar	N	*Celastraceae*
Securidaca virgata Sw.	.	.	.	.	.	.	.	+	.	Tr	N	*Polygalaceae*
Serjania sinuata (Poir.) Schum.	.	.	.	.	.	2	.	.	.	Ar	E	*Sapindaceae*
Smilax domingensis Willd.	.	.	.	.	.	.	.	+	.	Tr	N	*Smilacaceae*
Tournefortia volubilis L.	.	.	+	.	.	.	.	.	.	Tr	N	*Boraginaceae*
Trichostigma octandrum (L.) H. Walt.	.	.	.	.	.	.	+	.	+	Tr	N	*Phytolacaceae*
Vanilla claviculata (W.W.R.) Sw.	.	.	.	.	.	+	+	.	2	Tr	N	*Orchidaceae*
Zanthoxylum fagara (L.) Sarg.	.	.	+	.	.	.	.	.	.	Ar	N	*Rutaceae*
Hylocereus undatus (Haw.) Britt. and Rose	.	.	.	.	.	.	.	.	2	Sar	N	*Cactaceae*
Bourreria divaricata (DC.) G. Don	.	.	.	.	+	.	.	.	.	Ar	N	*Boraginaceae*
Brougtonia domingensis (Lindl.) Rolf.	.	.	.	.	.	+	.	.	2	Ep	N	*Orchidaceae*
Brunelia obovata (Lam.) A. DC.	.	.	+	.	.	.	.	.	.	Ar	N	*Sapotaceae*
Buxus glomerata (Griseb.) Muell. Arg.	.	.	.	.	.	+	.	+	.	Ar	N	*Buxaceae*
Caesalpinia bonduc (L.) Roxb.	.	.	+	.	.	.	.	.	.	Ar	N	*Caesalpinaceae*
Eugenia monticola (Sw.) D.C.	.	.	.	.	.	.	.	.	+	Ar	N	*Myrtaceae*
Exostema acuminatum Urban	.	.	.	+	.	.	.	.	.	Ar	E	*Rubiaceae*
Exostema ellipticum Griseb.	.	.	+	.	.	.	.	.	.	Ar	N	*Rubiaceae*
Dalechampia scandens L.	.	+	.	.	.	.	.	.	.	Tr	N	*Euphorbiaceae*
Diospyros domingensis (Urb.) Alain	.	.	.	+	.	.	.	.	.	Ar	E	*Ebenaceae*
Echites umbellata Jacq.	.	.	.	+	.	.	.	.	.	Tr	N	*Apocynaceae*
Furcraea tuberosa Ait.	.	.	.	.	.	+	.	.	.	Sar	N	*Agavaceae*
Galactia dictyophylla Urb.	+	.	.	.	.	.	.	.	.	Tr	E	*Leguminosae*
Galactia striata (Jacq.) Urb.	.	.	+	.	.	.	.	.	.	Tr	N	*Leguminosae*
Cissus oblongo-lanceolata Krug and Urb.	.	.	.	.	.	.	+	.	.	Tr	E	*Vitaceae*
Cissus verticillata (L.) Nichols and Jarvis	.	+	.	.	.	.	.	.	.	Tr	N	*Vitaceae*
Guapira brevipetiolata (Heimerl) Alain	.	.	.	.	+	.	.	.	.	Ar	E	*Nyctaginaceae*
Guapira discolor (Spreng.) Little	.	+	.	.	.	.	.	.	.	Ar	N	*Nyctaginaceae*
Guettarda elliptica Sw.	+	.	.	.	.	.	.	+	.	Ar	N	*Rubiaceae*
Capparis frondosa Jacq.	.	.	.	.	.	.	.	.	+	Ar	N	*Capparaceae*
Capsicum frutescens L.	.	.	.	.	.	.	.	.	+	Ar	N	*Solanaceae*
Comocladia cuneata Britton	.	.	.	.	+	.	.	.	.	Ar	N	*Anacardiaceae*
Cubanola domingensis Aiello	.	.	.	.	.	.	.	.	+	Ar	E	*Rubiaceae*
Chaefferia frutescens Jacq.	.	.	.	.	+	.	.	.	.	Ar	N	*Celastraceae*
Casearia aculeata Jacq.	.	.	.	.	.	.	+	.	+	Ar	N	*Flacourtiaceae*
Celtis iguanaea (Jacq.) Sarg.	.	.	.	.	.	.	+	.	+	Tr	N	*Ulmaceae*
Companions												
Guaiacum sanctum L	+	2	2	2	2	2	+	2	3	A	N	*Zygophyllaceae*
Eugenia maleolens Pers.	2	2	+	.	.	2	+	2	+	A	N	*Myrtaceae*
Gynnanthes lucida Sw.	.	.	2	.	.	2	.	2	.	A	N	*Euphorbiaceae*
Amyris elemifera L.	+	+	2	+	+	+	+	2	+	A	N	*Rutaceae*
Argythamnia candicans Sw.	+	2	+	+	+	+	.	2	2	H	N	*Euphorbiaceae*
Bursera simaruba (L.) Sarg.	+	.	+	2	+	+	+	+	+	A	N	*Burseraceae*
Acacia macracantha H. and B. Ex Willd.	+	+	.	+	+	.	+	+	.	A	N	*Mimosaceae*
Bucida buceras L.	.	.	.	.	+	+	.	+	+	A	N	*Combretaceae*
Eugenia axillaris (Sw.) Willd.	.	+	.	+	3	+	.	+	.	A	N	*Myrtaceae*
Bunchosia glandulosa (Cav.) D. C.	.	+	.	+	.	.	.	2	+	A	N	*Malpighiaceae*
Coccoloba diversifolia Jacq.	+	+	+	+	2	+	.	2	.	A	N	*Polygonaceae*
Sideroxylon foetidissimum Jacq.	+	.	.	+	+	.	+	+	+	A	N	*Sapotaceae*
Sideroxylon salicifolium (L.) Sw.	2	2	.	+	.	.	.	3	.	A	N	*Sapotaceae*
Stigmaphyllon emarginatum (Cav.) Adr.	+	.	+	.	+	.	.	+	.	Tr	N	*Malpighiaceae*
Chrysophyllum oliviforme L.	.	.	.	+	+	.	2	+	.	A	N	*Sapotaceae*
Thouinia trifoliate Poit.	.	.	+	.	.	.	2	2	+	A	N	*Sapindaceae*
Oeceoclades maculata (Lindl.) Lindl.	.	.	.	+	2	+	+	.	2	H	N	*Orchidaceae*
Citharexylum fruticosum L.	+	+	+	+	2	+	.	.	.	A	N	*Verbenaceae*
Celtis trinervia Lam.	.	.	.	.	.	.	+	+	+	A	N	*Ulmaceae*
Acacia skleroxyla Tuss.	.	.	+	.	.	.	+	+	.	A	E	*Leguminosae*
Zanthoxylum elephantiasis Maca	.	.	.	+	+	.	.	+	.	A	N	*Rutaceae*
Guaiacum officinale L.	.	.	.	.	.	.	2	+	2	A	N	*Zygophyllaceae*

(*Continued*)

Table 3. (*Continued*).

Exothea paniculata (Juss.) Radk.	.	.	.	.	.	.	.	2	.	A	N	*Sapindaceae*
Ficus citrifolia Mill.	+	.	.	+	.	.	.	.	.	A	N	*Moraceae*
Ocotea coriacea (Sw.) Griseb.	.	.	.	+	.	.	.	.	+	A	N	*Lauraceae*
Colubrina arborescens (Mill.) Sarg.	.	+	.	.	+	.	.	.	.	A	N	*Rhamnaceae*
Ficus velutina H. and B. Ex Willd.	.	.	.	+	.	.	+	.	.	A	N	*Moraceae*
Bourreria ovata Miers	2	+	.	.	.	.	.	.	.	A	N	*Boraginaceae*
Maclura tinctoria (L.) D. Don	.	.	.	.	.	.	.	+	.	A	N	*Moraceae*
Drypetes glauca Vahl	.	.	.	.	.	.	.	.	+	A	N	*Euphorbiaceae*
Capparis cynophallophora L.	.	.	+	.	.	.	.	.	+	A	N	*Capparaceae*
Ziziphus rignonii Delp.	.	.	+	.	.	.	.	.	.	A	N	*Rhamnaceae*
Calyptranthes myrcioides Urb. and Ekm.	.	.	.	.	.	.	.	.	2	A	E	*Myrtaceae*
Canella winterana (L.) Gaertn.	.	.	.	.	.	.	.	+	.	A	N	*Canellaceae*
Trichilia hirta L.	.	.	.	.	.	.	.	.	+	A	N	*Meliaceae*
Trema micrantha (L.) Blume	.	.	.	.	.	.	+	.	.	A	N	*Ulmaceae*
Scleria secans (L.) Urb.	.	.	.	.	+	.	.	.	.	H	N	*Cyperaceae*
Spermacoce assurgens Ruiz and Pavon	.	.	.	.	.	.	.	.	+	H	N	*Rubiaceae*
Tillandsia balbisiana Shultes	.	.	.	.	.	+	.	.	.	Ep	N	*Bromeliaceae*
Tillandsia juncea (Ruiz and Pavon) Poir	.	.	.	.	.	.	.	.	+	Ep	N	*Bromeliaceae*
Tillandsia usneoides (L.) L.	.	.	.	.	.	.	.	.	2	Ep	N	*Bromeliaceae*
Polypodium phyllitidis L.	.	.	.	.	.	.	.	.	+	H	N	*Polypodiaceae*
Morinda citrifolia L.	.	.	.	+	.	.	.	.	.	A	Na	*Rubiaceae*
Myrcianthes montana (Sw.) C. Nelson	.	.	.	.	.	+	.	.	.	A	N	*Myrtaceae*
Melicoccus jimenezii (Alain) Acev. Rodr.	.	.	.	.	.	.	.	.	+	A	E	*Sapindaceae*
Rauvolfia nitida Jacq.	.	.	.	.	+	.	.	.	.	A	N	*Apocynaceae*
Leucanea leucocephala (Lam.) De Wit	+	.	.	.	.	.	.	.	.	A	N	*Mimosaceae*
Catalpa longissima (Jacq.) Dum.-Cours.	.	.	+	.	.	.	.	.	.	A	N	*Bignoniaceae*
Crescentia cujete L.	.	.	.	.	.	+	.	.	.	A	N	*Bignoniaceae*
Clusia rosea Jacq.	.	.	.	.	.	.	.	.	+	A	N	*Clusiaceae*
Capparis ferruginea L.	.	.	+	.	.	.	.	.	.	A	N	*Capparaceae*
Guapira fragans (Dun-Cours) Little	+	.	.	.	.	.	.	.	.	A	N	*Nyctaginaceae*
Guazuma ulmifolia Lam.	.	.	.	+	.	.	.	.	.	A	N	*Sterculiaceae*
Bromelia plumieri Lam.	.	.	.	.	.	.	.	.	+	H	N	*Bromeliaceae*
Microgramma piloselloides (L.) Copel.	.	.	.	.	.	.	.	.	+	H	N	*Polypodiaceae*

Order no. of sites: 1. Near Poblado de Cumayaza (San Pedro) (19Q 0490159/2037558). 2. Near Río Cumayaza (San Pedro) (19Q 0490586/2038122). 3. Boca Cumayaza (19Q 0490285/2834062). 4. Cumayaza (19Q 0489200/2034829). 5. Cumayaza (19Q 04900488/2037546). 6. Near entrance to Parque Nacional del Este (19Q 0519492/2027853). 7. Road to Bayahibe (19Q 0517200/2000026). 8. Near Puente de Cumayaza (San Pedro de Macoris) (19Q4897906/2039255). 9. On the way to Beyahibe (19Q 0516924/2033776)
A, tree; Ar, shrub; Tr, climber; H, herbaceous; Ep, epiphyte; Sar, Plants succulent; N, native; E, endemic; Es, estipite (trunk).

(Hartn.) B. & R., and *Guettarda dictyophylla* Urban, which characterize this kind of forest, lead us to propose the association *Chrysophyllo oliviformi-Sideroxyletum salicifolii* nova (Table 2; rel. 1–5, typus rel. 2). The presence of endemic, bush-like elements with an average height of 3.5 m (v.g., *Goetzea ekmanii* O. E. Schulz, *Hyperbaena brevipes* Urban, *Cordia fitchii* Urban, *Peresquia quisqueyana* Alain) leads us to propose that these forests be considered as a habitat worthy of being preserved.

When the forest of *Chrysophyllo oliviformi-Sideroxyletum salicifolii* disappears, the soil becomes impoverished and drainage increases. Then the forest is replaced by a copse or high scrubland with a 60–100% cover rate and dominant species with an average height of 4.5–8.0 m. However, this secondary copse emerges not only as a result of the removal of the larger trees of *Chrysophyllo oliviformi-Sideroxyletum salicifolii*, but also when the coral substrate almost reaches the surface level. For that reason, we consider it an edaphoxerophilous copse. This secondary copse or high scrubland dominated by *Metopium toxiferum* (L.) Krug. and Urb., *Zamia debilis* L. and *Exostema caribaeum* (Jacq.) R. & S. presents a thorny, entangled aspect, with 23 endemic plants such as *Lonchocarpus neurophyllus* Urb., *Coeloneurum ferrugineum* (Sprengel) Urb. and *Consolea picardae* (Urb.) Areces. This profile leads us to propose the association *Zamio debilis-Metopietum toxiferi* nova (Table 3; rel. 1–9 typus rel. 3) and argue that the habitat should be preserved.

Conclusions

Our phytosociological study of the Eastern Coastal Plain of the Dominican Republic has revealed two types of forest formations. The primary forest develops on deep soils undergoing water stress as a result of water loss. For this reason, semi-deciduous elements and Cactaceae species can also be found in this well-structured forest with a high cover rate and a high rate of tree-like species. However, deforestation produces an entangled secondary copse of less height. Our phytosociological study has also revealed that the distribution area of the class, order and alliance described for Cuba (where we have

included the two new associations proposed here) also encompasses Hispaniola.

Syntaxonomical scheme

Cl. *Coccotrinacetho-Plumerietea* Knapp (1964) Borhidi 1991

O. *Eugenio-Metopietalia toxiferi* Knapp (1964) Borhidi 1991

Al. *Eugenio-Capparidion* Borhidi in Borhidi et al. 1979

As. *Chrysophyllo oliviformi-Sideroxyletum salicifolii ass nova hoc loco*

As. *Zamio debilis-Metopietum toxiferi ass nova hoc loco*

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