Scientific Reports in Life Sciences 6 (1): 17-48

DOI: https://doi.org/10.5281/zenodo.14947452

Scientific reports in life sciences
http://www.scientific-reports.com

Main structural and functional features of vegetation in the Lesser Antilles: The example of low altitude vegetation of Martinique

Philippe Joseph*, **Yelji Abati, Jean-Philippe Claude**
Institute of Biodiversity and Ecology, University of the French West Indies, Martinique
**Email: joseph.phil@wanadoo.fr*

Received: 13 October 2024 / Revised: 01 December 2024/ Accepted: 06 December 2024 / Published online: 02 March 2025.
How to cite: Joseph, P., Abati, y. Claude, J. P. (2025). Main structural and functional features of vegetation in the Lesser Antilles: The example of low altitude vegetation of Martinique, Scientific Reports in Life Sciences 6(1), 17-48. **DOI:** https://doi.org/10.5281/zenodo.14947452

Abstract

The Lesser Antilles are very diverse regarding species and plant units. The latter constitute a dense mosaic presenting surface differences. The contrasting geomorphology, which modifies the structure and dynamics of the climate in covariance with human activities, are the main elements that constitute determining ecological factors. This results in a bioclimatic gradient of which rainfall is the most discriminating parameter initiating vegetation layering from the coast to the mountain peaks. For the study of phytocenotic organization, the anthropized lower level of Martinique is a good example. From transects, it was possible to collect data, making it possible to decipher the main structural and phytocenotic aspects of this bioclimatic stage and to single out stages of temporal evolution.

Keywords: Lesser Antilles, Martinique, bioclimate, low altitude vegetation, species, phytocenoses, physiognomies, dynamics

Introduction

Like most of the mountainous islands of the Lesser Antilles, Martinique is the result of intra-oceanic subduction (Feuillet et al., 2011; Stein et al., 1982). Which results in a contrasting geomorphology (Boudon & Balcone-Boissard, 2021). Indeed, topographic facies modify the spatiotemporal structure of climatic factors (Weil-Accardo et al., 2016). This results in diverse biotopes. Within different habitats, among these climatic factors, rainfall is the one that most influences the establishment and development of populations of plant species (Jury, 2017). Thus, the gradient of precipitation from the lower areas to the highest peaks delimits the dry subhumid, humid subhumid, humid, and hyper-humid bioclimates, which influence the development of evergreen seasonal vegetation (lower horizon and upper horizon) and ombrophilous vegetation (sub-montane and montane). Naturally, within each bioclimatic stage, the ecological parameters operate spatiotemporal variations that condition differentiated biotopes welcoming combinations of species, equally differentiated (Kiptoo et al., 2023; Kassa & Nigussie, 2022; Eckardt et al., 2022). A bioclimate could be compared to a network of biotopes or habitats whose differences are insufficient to belong to another bioclimate (Liu et al., 2022). Biotopes result from the distribution of topographical facets that modify the structure of physical factors: windy or not windy ridges, slopes exposed to the wind or protected from the wind, valleys of variable dimensions, flat areas, plateaus, and rocky ledges. The floristic mosaic observed constitutes a phytocenotic response (Gratani, 2014; Gelles et al., 2022). Human activities, which have varied in intensity and frequency from the takeover of the island by the French until today, have accentuated the diversity of biotopes (Baillard, 2016; Fitzpatrick and Keegan, 2007). Whatever the spatial scale, we can therefore consider anthropization as an important factor in plant diversity both at the structural and dynamic level (de Araújo et al., 2021; Martin et al., 2021). These are, in large part, the elements indicated above which make Martinique belong to a global biodiversity hot spot: that of the Caribbean (Helmer et al., 2002; Maunder et al., 2011; Francisco-Ortega et al., 2007). In this context, Martinique's lower plant floor, which is very humanized, is a real laboratory of plant dynamics. What are the different phases of temporal evolution of the lower plant floor? What species are associated with it? What is the nature of interspecies relationships? In this article, globally, we will attempt to decipher the main structural and dynamic features of the species of the lower plant floor of the island of Martinique.

Martial and methods

Location of study sites

The very contrasted geomorphology of Martinique modifies the structure of the general climate factors which influence the establishment and development of phytocenoses (Germa et al., 2010; Dibacto et al., 2020; Joseph, 2013). Overall, the bioclimatic altitudinal gradient from low areas to the summits of mountain ranges corresponds to a tiering of vegetation types. Concerning other factors with small spatiotemporal differences, precipitation ranging between 1250 mm (or even less in certain places) and more than 4000 mm constitutes the determining factor in the installation and development of plant communities. Moreover, this is at all stages of biocenotic evolution. Generally speaking, the ecosystem potential of Martinique, like that of the other Lesser Antilles, is sylvatic, at least up to an average altitude of 800-900 m. In other words, apart from the windy ridges and the steeply sloping slopes as well as the rocky ledges, all the surfaces removed from anthropization achieve, after a specific time and through biological self-organization, the implementation establishment of forestry groups. Thus, from the sylvas of the Amerindian era, a large number of which had remained primitive, the activities of Martinican societies, varying in intensity and frequency, have conditioned the current floristic and physiognomic mosaic of the lower plant floor. The different physiognomic types correspond to stages of plant succession. (İrem Tüfekcioğlu & Tavşanoğlu, 2022). There are 73 study stations to which added a reference from the island of Saint-Vincent (Table 1, Fig. 1). In terms of structures and functional units, these stations are as multiple as they are diverse. Their great heterogeneity testifies to the complexity of the underlying factorial determinisms, in particular, the topographic facies and the rainfall gradient (Table 1). In order of importance, they are (these stations) composed of tree formations, shrub formations, and mixed formations corresponding to soils of varying depths. These three physiognomic types are references for the study however all possible intermediaries exist in the inventoried spaces. It will be essential to prioritize these stations along the time scale subdivided into phases and to define the place and function of the species or groups of species associated with them. The minimum survey areas vary depending on the stations. The multiplicity of topographic features and the more or less selective activity of man in the environment lead to spatial variation and overlapping of dynamic stages, which introduce a bias.

Table 1. General characteristics of the Survey stations

Stations	Communes	Exposures	Soil types/ Depths (m)	Precipitation (mm/year)	Slopes (°)
Aca1	Rivière-Pilote	West slope	Ferrisol / 1,5	1600	14
Aca2	Rivière-Pilote	West slope	Ferrisol / > 1,5	1600	0
Aca3	Rivière-Pilote	West slope	Ferrisol /1,5	1600	10
Aca4	Rivière-Pilote	West slope	Ferrisol / 1,5	1600	20
Aca5	Rivière-Pilote	West slope	Ferrisol / <1	1600	20
Aca6	Rivière-Pilote	West slope	Ferrisol / <0,8	1600	15
Aca7	Rivière-Pilote	West slope	Ferrisol / <0,8	1600	22
Aca8	Rivière-Pilote	West slope	Ferrisol / <0,8	1600	0
Aca9	Rivière-Pilote	West slope	Ferrisol / <0,8	1600	20
Aca10	Rivière-Pilote	West slope	Ferrisol / <0,8	1600	20
Aca11	Rivière-Pilote	West slope	Ferrisol / <0,8	1600	20
Aca12	Rivière-Pilote	West slope	Ferrisol / <0,8	1600	20
Aca13	Rivière-Pilote	West slope	Vertisol / <0,6	1400	21
Aca14	Rivière-Pilote	West slope	Vertisol / <0,6	1400	20
Aca15	Rivière-Pilote	West slope	Vertisol / <0,6	1400	20
Aca16	Rivière-Pilote	West slope	Vertisol / <0,3	1400	30
Aca17	Marin	West slope	Vertisol / <0,8	1400	0
Aca18	Marin	West slope	Vertisol / <0,6	1400	20
Aca19	Marin	West slope	Vertisol / <0,8	1400	5
Aca20	Marin	West slope	Vertisol / <0,6	1400	20
Aca21	Marin	East side	Vertisol / <0,6	1400	20
Aca22	Marin	East side	Vertisol / <0,5	1250	30
Aca23	Marin	East side	Vertisol / <0,8	1250	15
Aca24	Marin	East side	Vertisol / <0,8	1250	20
Aca25	Marin	East side	Vertisol / <0,8	1500	30
Pointe Banane (ba)	Robert	Flat area	Vertisol / <1	1500	0
Pointe Brumel (br)	Trinité	Flat area	Ferrisol / 0,3	1250/1500	20
Morne Amérique (am)	Sainte-Anne	East side	Vertisol / <0,6	1300/1500	20
Morne Caritan 1 (ct1)	Sainte-Anne	West slope	Vertisol / <0,6	1300/1500	30
Morne Caritan 2 (ct2)	Sainte-Anne	Crete	Vertisol / <0,8	1300/1500	0
Morne Caritan 3 (ct3)	Sainte-Anne	East slope	Vertisol / <0,8	1300/1500	30
Piton Crève Cœur 1 (cc1)	Sainte-Anne	West slope	Vertisol / <0,6	1250/1500	25
Piton Crève Cœur 2 (cc2)	Sainte-Anne	East side	Vertisol / <0,6	1250/1500	20
Morne Gardier 1 (g1)	Diamant	West slope	Inconnu / <0,8	1500/2000	35
Morne Gardier 2 (g2)	Diamant	Flat area	Inconnu / >1	1500/2000	0
Morne Gardier 3 (g3)	Diamant	East side	Inconnu / <0,8	1500/2000	30
Morne Gentyl (ge)	Anses d'Arlets	West slope	Vertisol / <0,6	1300/1500	30
Pointe Jean Claude 1 (j1)	Trinité	West slope	Ferrisol / <1	1500/1600	15
Pointe Jean Claude 2 (j2)	Trinité	West slope	Ferrisol / <0,8	1500/1600	35
Pointe Jean Claude 3 (j3)	Trinité	South slope	Ferrisol / >1	1500/1600	7
Morne Joli Cœur 1 (jo1)	Sainte-Anne	East side	Vertisol / <0,8	1300/1500	25
Morne Joli Cœur 2 (jo2)	Sainte-Anne	East side	Vertisol / <0,8	1300/1500	30
Morne Manioc 1 (mn1)	Sainte-Anne	South slope	Vertisol / <0,8	1300/1500	0
Morne Manioc 2 (mn2)	Sainte-Anne	East side	Vertisol / <0,8	1300/1500	20
Morne Manioc 3 (mn3)	Sainte-Anne	West slope	Vertisol / <0,8	1300/1500	25
Morne marguerite 1 (mg1)	Sainte-Anne	Flat area	Vertisol / <0,8	1300/1500	0
Morne marguerite 2 (mg2)	Sainte-Anne	West slope	Vertisol / <0,8	1300/1500	25
Morne marguerite 3 (mg3)	Sainte-Anne	West slope	Vertisol / <0,8	1300/1500	32
Morne Berry 1 (mr1)	Marin	East side	Vertisol / <0,8	1300/1500	32
Morne Berry 2 (mr2)	Marin	East side	Vertisol / <1	1300/1500	40
Morne Berry 3 (mr3)	Marin	Crete	Vertisol / <0,6	1300/1500	10
Morne Larcher 1 (la1)	Diamant	Plateau	Vertisol / <0,6	1250/1500	0
Morne Larcher 2 (la2)	Diamant	East side	Vertisol / <0,3	1250/1500	35
Morne Valentin (va1)	François	West slope	Vertisol / 0,7	1500/2000	35
Montagne du Vauclin (mv)	Vauclin	Interior slope	Ferrisol / <0,8	1500/1600	20
Pointe la Rose 1 (lr1)	François	Interior slope	Vertisol / 1,5	1250/1500	20
Pointe la Rose 2 (lr2)	François	Flat area	Vertisol / 0,8	1250/1500	0
Bois Pothau (po)	Robert	East side	Ferrisol / >1	1500/2000	25
Morne Préfontaine 1 (pr1)	Sainte-Luce	Plateau	Vertisol / >1	1500/2000	0
Morne Préfontaine 2 (pr2)	Sainte-Luce	Interior slope	Vertisol / 0,8	1500/2000	25
Rocher Leclerc 1 (lc1)	François	Summit	Vertisol / <0,6	1250/1500	22
Rocher Leclerc 2 (lc2)	François	Flat area at the base of the rock	Vertisol / <1,5	1250/1500	0
Ravine Saint-Pierre 1 (rs1)	Sainte-Luce	Flat area	Vertisol / >1	1300/1500	0
Ravine Saint-Pierre 2 (rs2)	Sainte-Luce	Interior slope	Vertisol / <0,8	1300/1500	15
Ravine Saint-Pierre 3 (rs3)	Sainte-Luce	Interior slope	Vertisol / <0,8	1300/1500	15
Ravine Saint-Pierre 4 (rs4)	Sainte-Luce	Interior slope	Vertisol / >0,6	1300/1500	25
Caravelle 1 (cv1)	Trinité	Interior slope	Ferrisol / 0,9	1250/1500	20
Caravelle 2 (cv2)	Trinité	Interior slope	Ferrisol / >1,5	1250/1500	0

Figure 1a. Martinique within the Caribbean

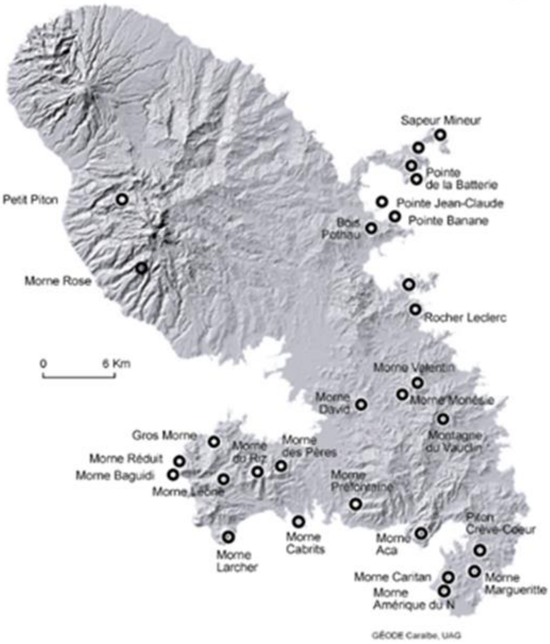

Figure 1b. The survey areas (Martinique)

Data analysis

The objective is to decipher the structural and functional dimensions of vegetation. Using transects (stations) subdivided into quadrats and depending on the minimum survey area, we generated data which are all ecological and floristic descriptors: species, numbers of individuals of populations of plant species (of regenerations to mature specimens:

biodemographic aspects), diameter classes, total height classes. These elements made it possible:

- to appreciate the distribution of sections of individuals, the architecture of the formations by the distribution of heights, the characteristics of the canopies,
-to evaluate the phytomasses or biovolumes using the Basal Surface Area (St) which corresponds to the sum of the surfaces of the circles that constitute the sections measured at 1.33 meters from the ground by international standards.
- to know the distribution of species between the stations using the Distribution Index which corresponds to the following formula: Id= fr ×d (fr being the relative frequency about the study stations and d (nb/ Sr) the density corresponding to the number of individuals of the species (nb) divided by the survey surface (Sr)
-to appreciate the minimum floristic inventory area which perfectly transcribes all the properties of a phytocenosis considered homogeneous from an ecological point of view. The minimum areas depend on the formation's degree of organization and evolution. Thus, the position of floristic entities on the dynamic gradient is essential data. Too large differences in development levels between the eco-units of a station can cause erroneous estimates of the minimum surface area.
- to know the relative dominance of epigeal woody plant species about each other using the Dominance Index (ID). ID= Id ×St (Basal surface area).
-to indicate the richness of the stations by the Shannon index [H', (Kumar et al., 2010; Tadeo-Noble et al., 2019)] and by the Piélou equitability index (J), or equidistribution index (E), its formula corresponds to the ratio between H' and Hmax: E =H'/Hmax.

Results

Minimum areas, basal areas, plant physiognomies of stations, and openings of plant cover

To reduce the possibility of errors in estimating minimum areas, tests were carried out on around twenty stations corresponding to shrub formations and tree formations. The latter, easily perceptible during plant succession, indicates notable dynamic changes. These preliminary tests made it possible to specify the minimum area of the different physiognomic types of the study stations (Table 2). For shrub communities, it is between 150 and 200 m², while for tree units, it seems to be effective from 500 or even 600 m². Consequently, the choice of minimum areas between 500 and 800 m² for shrub and sylvatic formations confers a certain relevance to the sampling. Each station's basal area or basal area shows quite tangible differences (Table 2). These differences appear to be associated with specific degrees of openness of plant units: low (+), medium (++), and high (+++) openness (Table 2). The biological spectra reflect the degree of organization and, therefore, the dynamic level of the stations. But also allows us to understand the diversity of floristic combinations. Microphanerophytes, by their importance, confirm the previous conclusions. Namely, the preponderance of small-diameter classes is the direct translation of the youth of plant groups. Mesophanerophytes are more poorly represented: between 0% and 33%. Theoretically, the increase in Mesophanerophytes would indicate a more structured sylvatic phase. It is necessary, however, to consider the types of Mesophanerophytes and their place in forest architecture related to their ecology. Although they are quantitatively superior to Mesophanerophytes, Microphanerophytes have variable populations from one station to another (Fig. 2 a, b & c). The King's Hill (sv) station on the Island of Saint Vincent generally presents a similar profile.

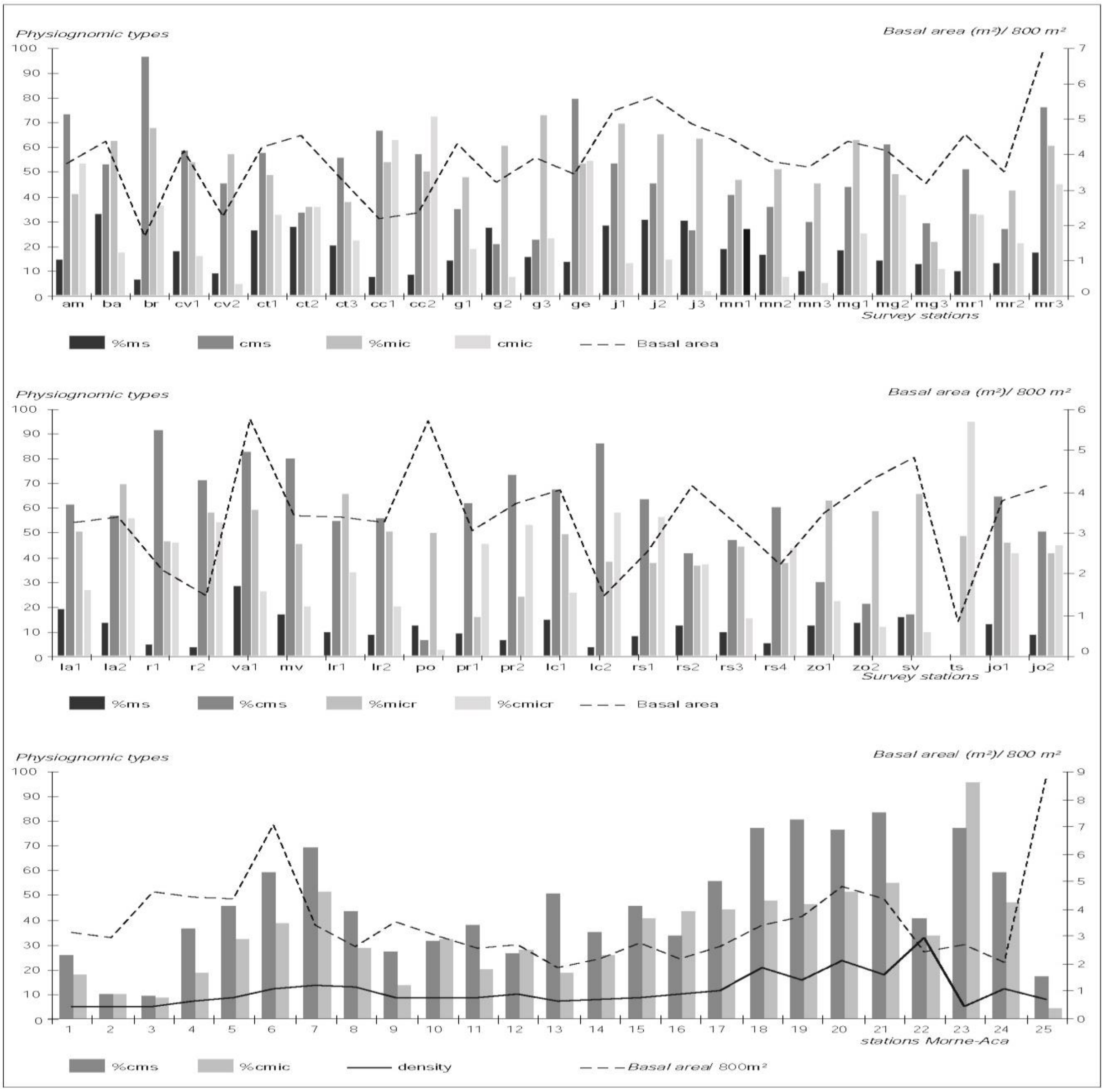

Figure 2 a, b & c. Physiognomic types, basal areas, and associated densities of individuals (see Table 1)/ MS: Mesophanerophytes /CMS: Deciduous Mesophanerophytes /MICR: Microphanerophytes /CMIRCR: Deciduous Microphanerophytes

Table 2. Physiognomic affiliation of the stations (ST: Basal Surface or Basal Area, see Table 1)

Increasing xericity	Stations	S.T.(m^2) / 800m^2
Small opening	Structured forests	Basal area
+	Morne-Gardier1	4,3
+	Morne-Gardier2	3,22
+	Morne-Gardier3	3,9
+	Pointe-Jean-claude1	5,23
+	Pointe-Jean-claude2	5,65
+	Pointe-Jean-claude3	4,89
+	Morne-manioc1	4,45
+	Morne-manioc2	3,81
+	Morne-manioc3	3,65
+	Bois-Pothau	5,72
+	Saint-Vincent1	4,85
+	Saint-Vincent2	5,21
+	Rocher-Zombi2	4,3
+	Ravine-Saint-Pierre3	3,23
+	Aca2(Morne-Aca)	2,94
+	Aca3(Morne-Aca)	4,65
+	Aca25(Morne-Aca)	8,81
+	Aca9(Morne-Aca)	3,55
+	Aca4(Morne-Aca)	4,43
+	Aca11(Morne-Aca)	2,56
+	Aca13(Morne-Aca)	1,85
+	Aca1(Morne-Aca)	3,15
Medium opening	Stations Sylvatic Young	S.T(m^2)/800m^2
++	Marin2(Morne-Berry)	3,5
++	Morne-Marguerite3	3,2
++	Morne-Caritan1	4,22
++	Morne-Caritan3	3,36
++	Pointe-Banane	4,37
++	Caravelle1	4,1
++	Caravelle2	2,24
++	Morne-Larcher1	3,25
++	Morne-Valentin	5,77
++	Montagne du Vauclin	3,44
++	Pointe-La-Rose1	3,4
++	Pointe-La-Rose2	3,27
++	Rocher-Leclerc1	4,07
++	Morne-Préfontaine1	3,07
++	Morne-Préfontaine2	3,72
++	Aca5(Morne-Aca)	4,38
++	Aca6(Morne-Aca)	7,1
++	Aca8(Morne-Aca)	2,64
++	Aca12(Morne-Aca)	2,67
++	Aca14(Morne-Aca)	2,2
High opening	Stations: Presilvatic/ Shrub	S.T(m^2)/800m^2
+++	Morne-Gentyl	3,46
+++	Marin3(Morne-Berry)	6,95
+++	Marin1(Morne-Berry)	4,57
+++	Morne-Marguerite1	4,38
+++	Morne-Marguerite2	4,12
+++	Piton-Crève-coeur1	2,19
+++	Piton-Crève-coeur2	2,37
+++	Morne-Caritan2	4,54
+++	Pointe-Brunel	1,7
+++	Morne-Amérique	3,76
+++	Morne-Joli-Coeur1	3,8
+++	Morne-Joli-Coeur2	4,15
++++	Rocher-leclerc2	1,48
++++	Ravine-Saint-Pierre1	2,56
++++	Ravine-Saint-Pierre2	4,14
++++	Ravine-Saint-Pierre4	2,25
++++	Morne larcher2	3,4
++++	Morne-Réduit1	2,12
++++	Morne-Réduit2	1,49
++++	Tête-De-Singe	8,5
++++	Aca7(Morne-Aca)	3,41
++++	Aca10(Morne-Aca)	3
++++	Aca15(Morne-Aca)	2,78
++++	Aca16(Morne-Aca)	2,17
++++	Aca17(Morne-Aca)	2,66
++++	Aca18(Morne-Aca)	3,4
++++	Aca19(Morne-Aca)	3,7
++++	Aca20(Morne-Aca)	4,8
++++	Aca21(Morne-Aca)	4,34
++++	Aca22(Morne-Aca)	2,42
++++	Aca23(Morne-Aca)	2,72
++++	Aca24(Morne-Aca)	2,08
++++	Rocher-Zombi1	3,5

Population aspects

The number of individuals counted, all diameters and all taxa combined, is 57,721 for a total survey area of 55,050 m^2. However, the density varies from one station to another. Tables 3 a, b, and c allow us to observe this variation. Most of the population is made up of woody tree and shrub species. The distribution of sections shows a rapid decrease in the population sizes of the 2.5 cm class to 1.33 m in height (international standard) towards those which coincide with increasingly higher diameters. Of the entire count, 63% of the stems (number of individuals: 54,800) correspond to the 2.5 and 5 cm diameter classes. Medium and large diameters are very little represented. For the “Morne Aca” stations (Table 3a), the predominant diameter classes are in order of importance: 0.5 cm, 1.5 cm, 2.5 cm, and 5 cm. In comparison, for the other stations the most represented sections are in order of importance 2.5 cm, 5 cm and 10 cm (Tables 3 b & c). 20 cm in diameter and beyond, the number of individuals decreases very significantly.

Table 3a. Number of species by diameter class [Morne Aca stations (1 to 25)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
0.5	0	1	0	109	8	11	157	46	38	60	66	83	86	82	85	16	80	151	206	135	59	170	204	522	117
1.5	6	27	20	106	68	71	351	166	92	173	127	174	236	162	173	58	293	574	550	389	233	566	152	487	207
2.5	95	105	71	149	109	57	420	343	165	265	275	341	181	221	256	173	345	554	409	346	274	486	84	414	210
5	231	132	142	141	268	282	102	114	49	72	95	113	46	68	80	87	99	140	63	43	52	70	45	125	37
10	81	49	40	59	54	85	70	65	27	59	46	62	34	62	39	36	65	81	50	40	64	55	48	64	46
15	49	22	19	28	39	26	29	30	20	21	30	26	10	18	35	9	21	24	17	11	13	6	17	23	19
20	16	12	15	18	15	13	12	10	8	12	13	11	5	12	11	5	11	13	20	7	11	2	6	9	9
25	6	7	6	2	6	4	9	2	7	14	8	4	9	4	5	1	5	7	8	1	0	1	6	4	9
30	9	4	6	8	7	4	0	3	5	5	3	2	3	5	2	1	0	5	2	0	0	0	5	0	5
35	2	2	5	3	8	0	0	1	3	0	0	3	2	3	2	0	1	1	2	2	0	0	0	0	7
40	4	2	3	4	2	0	1	0	1	0	1	1	1	0	2	0	1	0	1	0	0	0	1	0	5
45	0	1	2	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	3
50	0	0	2	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
55	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3b. Number of species by diameter class
Stations (1 : Morne America, 2: Pointe Banane, 3: Pointe Brumel, 4: Caravelle Alluvial Basin, 5: Caravelle Sapeur Mineur, 6: Morne Caritan 1, 7: Morne Caritan 2, 8: Morne Caritan 3, 9: Crève -heart 1, 10: Heartbreak 2, 11: Morne Gardier 1, 12: Morne Gardier 2, 13: Morne Gardier 3, 14: Morne Gentyl, 15: Pointe Jean-Claude1, 16: Pointe Jean-Claude2, 17: Pointe Jean-Claude3, 18: Morne Joli-Cœur1, 19: Morne Joli-Cœur2, 20: Morne Manioc1, 21: Morne Manioc2, 22: Morne Manioc3, 2 3: Morne Marguerite1)

Sections (cm)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
0.5	1	4	6	12	39	5	13	0	0	1	5	8	33	2	2	0	0	5	0	2	4	4	0
1.5	1	4	5	9	13	32	60	1	5	0	0	13	22	6	0	2	2	2	1	0	1	2	1
2.5	462	173	356	354	269	127	171	127	196	386	294	300	256	349	176	189	188	335	316	337	257	423	199
5	68	79	27	91	46	82	86	65	59	107	47	134	127	72	108	126	141	70	32	52	56	64	119
10	51	54	24	54	34	54	109	65	49	53	41	89	55	54	75	122	107	42	24	63	36	27	71
15	12	26	11	33	9	36	61	28	13	23	20	11	21	20	15	45	32	14	16	23	23	7	29
20	10	6	7	18	5	20	24	17	7	5	8	8	16	10	12	19	15	9	11	13	13	9	14
25	15	3	0	5	6	15	10	11	4	3	5	7	7	3	3	13	17	9	3	8	9	6	4
30	15	3	0	2	4	9	4	5	0	0	2	6	5	0	4	10	7	12	5	8	7	3	6
35	3	3	0	1	2	3	2	3	0	0	0	4	1	0	2	2	5	4	0	4	5	4	5
40	3	2	0	0	0	3	2	1	0	0	0	1	5	3	1	3	1	0	2	2	5	2	2
45	0	0	0	1	0	0	0	1	0	0	1	0	2	0	3	0	0	1	2	1	2	1	0
50	0	0	0	0	1	0	1	0	0	0	1	1	1	0	1	1	2	1	2	1	1	1	1
55	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	1	1	1	0	0	1	1
60	0	1	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	2	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3c. Number of species by diameter class
Stations (1: Morne Marguerite2, 2: Morne Marguerite3, 3: Morne Berry1, 4: Morne Berry2, 5: Morne Berry3, 6: Morne Larcher1, 7: Morne Larcher2, 8: Morne Réduit1, 9: Morne Réduit2, 10: Morne Valentin, 11: Montagne du Vauclin, 12: Pointe Larose1, 13: Pointe Larose2, 14: Bois Pothau, 15: Morne Préfontaine1, 16: Morne Préfontaine2, 17: Rocher Leclerc1, 18: Rocher Leclerc2, 19: Ravine Saint-Pierre1, 20: Ravine Saint-Pierre2, 21: Ravine Saint-Pierre3, 22: Ravine Saint-Pierre4, 23: Rocher Zombi1, 24: Rocher Zombi2, 25: Tête de Singe)

Sections(cm)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
0.5	0	1	177	47	24	6	0	29	1	64	116	0	3	1	162	3	1	5	92	37	22	112	0	0	3
1.5	0	1	34	24	3	4	6	24	3	13	2	0	0	3	249	1	3	3	27	36	44	116	0	0	18
2.5	218	285	603	462	268	301	181	350	134	262	282	427	423	186	174	576	375	370	446	677	331	683	242	224	370
5	52	57	117	96	200	131	76	34	50	130	88	153	90	78	52	76	124	41	123	106	53	135	108	100	28
10	41	20	60	46	144	94	37	13	22	143	72	84	33	33	27	48	89	32	93	93	37	93	69	61	5
15	11	18	16	11	19	31	23	3	3	69	37	24	21	20	30	34	38	7	40	53	11	19	17	30	0
20	7	9	14	15	14	13	8	10	1	29	21	13	8	12	14	18	30	2	4	23	6	3	10	13	0
25	7	9	7	9	16	2	3	1	0	12	9	1	6	9	5	9	9	0	3	4	5	3	8	9	0
30	2	3	2	6	3	0	2	2	1	6	7	3	2	9	5	7	2	0	0	6	1	1	3	5	0
35	5	2	7	2	6	0	1	1	0	5	4	1	2	4	3	2	2	0	0	1	1	0	1	4	0
40	5	4	3	3	3	0	0	0	0	2	2	2	1	3	1	1	2	0	0	1	1	2	2	1	0
45	3	1	1	0	0	0	0	0	0	0	0	1	2	4	0	0	0	0	0	0	2	0	0	1	0
50	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
55	1	1	1	2	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	1	0	0	0	0	0
60	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0
65	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0

Specific diversity of stations

Comparison of stations using the Shannon-Wiener index (H') between 2.6 and 7.34 reveals quite notable differences in floristic collection (Table 4). Indeed, stations with higher Shannon-Wiener index values are richer in plant species. With values between 5.09 and 7.34, the stations of “Morne Aca” as well as the stations of “Morne Gardier3, réduit2, rsp1, and zombi1 (Table 4) are the richest from a floristic point of view. These plant units corresponding to these stations can be composed of rare or singular species and belong to a fairly large diversity of stages of plant succession because of modes of anthropization that are as varied as they are. In table 4 the variability of the equidistribution index (Piélou's equitability index) indicates the level of population balance. When the equidistribution index is between 0.7 and 0.9, the phytocenoses of the different stations have almost identical species populations. Below 0.9 (between 0.6 and 0.4), stationary imbalances with regard to species populations are increasingly marked.

Table 4. Diversity (H') and Equity (E) index

Stations	H' (Diversity)	H'Max	Equitability (E)	Stations	H' (Diversity)	H'Max	Equitability (E)
Morne Amérique	3,55	7,86	0,452	aca1	6,26	7,86	0,797
Caravelle 1	4,7	7,86	0,598	aca2	6,2	7,86	0,789
Caravelle 2	3,75	7,86	0,477	aca3	6,3	7,86	0,802
Tête de singe	3,41	7,86	0,434	aca4	6,26	7,86	0,797
Pointe Brumel	2,67	7,86	0,34	aca5	6,29	7,86	0,8
Pointe banane	5	7,86	0,636	aca6	5,06	7,86	0,644
Morne Caritan1	4,21	7,86	0,536	aca7	6,13	7,86	0,78
Morne Caritan2	4,5	7,86	0,573	aca8	5,9	7,86	0,751
Morne Caritan3	3,2	7,86	0,407	aca9	4,98	7,86	0,634
Piton Crève-cœur 1	5,34	7,86	0,68	aca10	6,94	7,86	0,883
Piton Crève-cœur 2	5,5	7,86	0,7	aca11	5,72	7,86	0,728
Morne Gardier1	4,98	7,86	0,634	aca12	6,33	7,86	0,806
Morne Gardier2	4,12	7,86	0,524	aca13	5,66	7,86	0,72
Morne Gardier3	5,26	7,86	0,669	aca14	7,23	7,86	0,92
Morne Gentyl	4,34	7,86	0,552	aca15	6,42	7,86	0,817
Pointe Jean-Claude1	3,5	7,86	0,445	aca16	4,46	7,86	0,568
Pointe Jean-Claude2	3,37	7,86	0,429	aca17	6,13	7,86	0,78
Pointe Jean-Claude3	3,04	7,86	0,387	aca18	5,36	7,86	0,682
Morne Joli-Cœur 1	3,5	7,86	0,445	aca19	5,13	7,86	0,653
Morne Joli-Cœur 2	4,7	7,86	0,598	aca20	5,17	7,86	0,658
Morne Manioc 1	4,5	7,86	0,573	aca21	6,75	7,86	0,859
Morne Manioc 2	2,68	7,86	0,341	aca22	5,23	7,86	0,666
Morne Manioc 3	2,68	7,86	0,341	aca23	7,34	7,86	0,934
Morne Marguerite 1	4,98	7,86	0,634	aca24	6,47	7,86	0,823
Morne Marguerite 2	4,43	7,86	0,564	aca25	5,62	7,86	0,715
Morne Marguerite 3	4,05	7,86	0,515	s/vincent1	3,78	7,86	0,481
Morne Berry 1	4,39	7,86	0,559	pothiau	3,99	7,86	0,508
Morne Berry 2	4,2	7,86	0,534	préfont1	5,92	7,86	0,753
Morne Berry 3	4,31	7,86	0,548	préfont2	4,24	7,86	0,54
Morne Larcher 1	3,88	7,86	0,494	leclerc1	4,82	7,86	0,613
Morne Larcher 2	4,67	7,86	0,594	leclerc2	2,6	7,86	0,331
réduit1	4,33	7,86	0,551	rsp1	5,98	7,86	0,761
réduit2	5,6	7,86	0,713	rsp2	4,45	7,86	0,566
valentin	3,58	7,86	0,456	rsp3	5,07	7,86	0,645
vauclin	4,18	7,86	0,532	rsp4	5,37	7,86	0,683
larose1	4,52	7,86	0,575	zombi1	6,26	7,86	0,797
larose2	4,47	7,86	0,569	zombi2	5,37	7,86	0,683

Dominance of species by physiognomic types

Using the dominance index (ID) calculated for the different stations, it was possible to extract from the floristic potential of species associations having very significant ecological importance within the shrub formations (group A, Table 5), mixed shrub/tree formations, pre-sylvatic formations (Group B, Table 5) and structured tree formations (sylvatic state, group C, Table 5). These three groups correspond to three phases of phytocenotic evolution over time with species belonging to different levels of vertical stratification. For stations made up of structured tree formations (group C), it is appropriate to divide them into two categories, considering species of proven ecological importance. The latter, depending on their morphogenetic profiles, structure the vertical organization of forest groups into three distinct strata. Firstly the species that structure the upper and middle strata S3 and S2 respectively (Table 5: *Pisonia fragrans, Bursera simaruba, Lonchocarpus violaceus, Pimenta racemosa,* *Tabebuia heterophylla, Coccoloba swatzii, Sideroxylon foetidissimum, Byrsonima spicata, Maytenus laevigata, Chionanthus compacta, Krugiodendron ferreum , Coccoloba pubescens, Inga laurina, Amyris elemifera, Eugenia confusea, Myrcia fallax, Chrysophyllum argenteum, Tabernaemontana citrifolia, Guettarda scabra, Eugenia pseudopsidium* . Secondly, those of the lower strata (S1, Table 5): *Bourreria succulenta, Ocotea coriacea, Eugenia monticola, Myrcia citrifolia, Erythroxylum havanense*. For the other plant communities (groups A and B, Tables 6 & 7) the species of the middle stratum and sometimes those of the lower stratum of group C previously indicated can act as structuring or building elements of first magnitude. We, therefore, distinguish taxa that preferentially belong either to intra-sylvatic cycles and which are in morphogenetic development or to extra-sylvatic cycles. Generally speaking, species from extra-sylvatic successional cycles are frequently present in large windthrows in structured forest units, in unstructured sylvatic units, and shrubby and pre-sylvatic communities due to natural climatic and telluric hazards and human activities.

The main species of the intrasylvatic succession are strongly represented by group C (Table 5): *Maytenus laevigata, Pimenta racemosa, Sideroxylon foetidissimum, Inga laurina, Myrcia fallax, Tabernaemontana citrifolia, Ocotea coriacea, Eugenia pseudopsidium, Chrysophyllum argenteum*

Table 5. Importance of species in the sylvatic type (group C)

Species	Morphological types and SA at maturity stage	Dominance index (D.I.)	Species	Morphological types and SA at maturity stage	Dominance index (D.
Pimenta racemosa	A/S3	28,4	*Lonchocarpus vioalaceus*	A/S3	0,517
Ocotea coriacea	A/S1	27,99	*Croton corylifolius*	A/S1	0,429
Maytenus laevigata	A/S2	27,2	*Capparis baduca*	A/S1	0,425
Sideroxylon foetidissimum	A/S3	17,97	*Byrsonima spicata*	A/S3	0,4
Myrcia fallax	A/S3	13,77	*Ormosia monosperma*	A/S3	0,377
Inga laurina	A/S3	11,1	*Bourreria succulenta*	A/S2	0,372
Pisonia fragrans	A/S3	10,2	*Hymenaea courbaril*	A/S3	0,347
Bursera simaruba	A/S2	6,916	*Coccoloba pubescens*	A/S2	0,308
Chrysophyllum argenteum	A/S2	5,47	*Ficus nymphaeifolia*	A/S3	0,305
Manilkara bidentata	A/S3	4,925	*Eugenia axilaris*	A/S2	0,304
Eugenia pseudopsidium	A/S2	4,372	*Buchenavia tetraphylla*	A/S3	0,222
Pilocarpus racemosus	A/S1	4,29	*Tabebuia heterophylla*	A/S3	0,205
Coccoloba swartzii	A/S2	3,5	*Daphnopsis americana*	A/S2	0,186
Mangifera indica	A/S2	3,12	*Exothea paniculata*	A/S2	0,184
Ocotea eggersiana	A/S2	2,96	*Pouteria semecarpifolia*	A/S3	0,171
Chionanthus compacta	A/S2	2,89	*Eugenia oerstedeana*	A/S2	0,161
Guarea glabra	A/S2	2,74	*Simaruba amara*	A/S3	0,157
Pouteria multifolia	A/S3	2,514	*Capparis indica*	A/S2	0,154
Ocotea patens	A/S2	2,22	*Ocotea cernua*	A/S2	0,145
Faramea occidentalis	A/S1	2,18	*Haematoxylon campechianum*	A/S2	0,1
Plinia pinnata	A/S2	2,086	*Ilex nitida*	A/S3	0,095
Spondias monbin	A/S3	1,892	*Antirhea coriacea*	A/S2	0,094
Cassipourea guianenis	A/S2	1,8	*Ficus citrifolia*	A/S3	0,093
Eugenia monticola	A/S2	1,46	*Brosimum alicastrum*	A/S2	0,069
Guarea macrophylla	A/S3	1,32	*Guazuma ulmifolia*	A/S3	0,067
Eugenia ligustrina	A/S2	1,23	*Casearia decandra*	A/S2	0,057
Eugenia confusa	A/S2	1,161	*Persea americana*	A/S2	0,042
Quararibaea turbinata	A/S2	0,996	*Sideroxylon obovatum*	A/S2	0,041
Rhyticocos amara	A/S3	0,757	*Exostema sanctae-luciae*	A/S2	0,04
Guettarda scabra	A/S2	0,684	*Sterculia caribaea*	A/S3	0,015
Tabernaemontan citrifolia	A/S2	0,64	*Andira inermis*	A/S3	0,009
Licaria sericea	A/S2	0,556	*Artocarpus altilis*	A/S2	0,001
Myrciaria floribunda	A/S2	0,545	*Zanthoxylum flavum*	A/S3	0,001
Eugenia tapacumensis	A/S2	0,533			

SA: Stratum of Belonging - A: Tree - S3: Upper Stratum – S2: Middle Stratum – S1: Lower Stratum

The main species of extra-sylvatic succession:

Group B (Table 6): *Pisonia fragrans, Bursera simaruba, Lonchocarpus violaceus, Bourreria succulenta, Coccoloba swartzii, Chionanthus compacta, Krugiodendron ferreum, Sideroxylon foetidissimum, Guettarda scabra, Coccoloba pubescens, Byrsonima spicata, Amyris elemifera.*

Table 6. Importance of species in the pre-sylvatic type (group B)

Species	Morphological types and SA at maturity stage	Dominance index (D.I.)	Species	Morphological types and SA at maturity stage	Dominan index (D.
Lonchocarpus violaceus	A/S2	72,24	*Rochefortia spinosa*		1,214
Maytenus laevigata	A/S1	57,92	*Eugenia ligustrina*	A/S1	0,855
Pisonia fragrans	A/S2	49,64	*capparis indica*	A/S1	0,795
Sideroxylon foetidissimum	A/S3	41,39	*pithecellobium inguis-cati*	A/S1	0,675
Bursera simaruba	A/S2	37,73	*Chrysophyllum argenteum*	A/S2	0,509
Ocotea coriacea	A/S1	36,25	*Crateva tapia*	A/S2	0,434
Krugiodendron ferreum	A/S2	32,94	*Forestiera rhamifolia*	A/S2	0,418
Coccoloba swartzii	A/S2	18,84	*Daphnopsis americana*	A/S1	0,416
Pimenta racemosa	A/S3	17,73	*Zanthoxylum punctatum*	A/S1	0,383
Hymenaea courbaril	A/S3	15,7	*Myrciaria floribunda*	A/S1	0,35
Tabernaemontana citrifolia	A/S2	13,97	*Capparis hastata*	A/S1	0,336
Chionanthus compacthus	A/S2	11,77	*Zanthoxylum caribaeum*	A/S2	0,292
Bourreria succulenta	A/S2	11,39	*Annona reticulata*	A/S1	0,279
Haematoxylon campechianum	A/S2	10,5	*Zanthoxylum spinifex*	A/S1	0,214
Guettarda scabra	A/S2	7,96	*Guaiacum officinale*	A/S2	0,207
Eugenia confusa	A/S1	7,43	*Picramnia pentandra*	A/S1	0,156
Amyris elemifera	A/S1	7,367	*Ouratea guildinguii*	A/S1	0,154
Coccoloba pubescens	A/S2	7,29	*Pisonia suborbiculata*	A/S1	0,148
Manilkara bidentata	A/S3	7,24	*Conostegia calyptrata*	A/S1	0,146
Tabebuia heterophylla	A/S3	7,151	*coccothrinax barbadensis*	A/S2	0,122
Pilocarpus racemosus	A/S1	7,07	*Ficus citrifolia*	A/S2	0,118
Cassine xylocarpa	A/S2	6,985	*Zanthoxylum flavum*	A/S3	0,1
Gyminda latifolia	A/S2	5,65	*Zanthoxylum monophyllum*	A/S1	0,093
Ardisia obovata	A/S1	5,065	*Inga laurina*	A/S3	0,091
Eugenia monticola	A/S1	4,77	*Cedrela odorata*	A/S3	0,087
Byrsonima spicata	A/S3	4,27	*Buchenavia tetraphylla*	A/S3	0,086
Myrcia citrifolia	A/S1	3,4	*Citharexylum spinosum*	A/S2	0,078
Myrcia fallax	A/S2	3,367	*Garcinia humilis*	A/S2	0,076
Erythroxylon havanense	A/S1	2,95	*Croton corylifolius*	A/S1	0,074
Cordia alliodora	A/S3	2,7	*Cordia collococca*	A/S2	0,06
Eugenia tapacumensis	A/S1	2,64	*Randia aculeata*	A/S1	0,027
Calliandra tergemina	A/S1	2,54	*Guazuma ulmifolia*	A/S3	0,025
Morisonia americana	A/S1	2,25	*Ocotea eggersiana*	A/S3	0,021
Bunchosia glandulosa	A/S1	2	*Ceiba pentandra*	A/S3	0,008
Sideroxylon obovatum	A/S2	1,944	*Lonchocarpus cericeus*	A/S2	0,007
Schaefferia frutescens	A/S1	1,881	*Simaruba amara*	A/S3	0,005
Eugenia pseudopsidium	A/S2	1,42	*Maclura tinctoria*	A/S2	0,002
Swietenia macrophylla	A/S3	1,236			

SA: Stratum of Belonging - A: Tree S3: Upper stratum – S2: Middle stratum – S1: Lower stratum

Group A (Table 7): *Tabebuia heterophylla, Eugenia monticola, Eugenia confusa, Myrcia citrifolia, Erythroxylon havanense, Guetttarda scabra, Calliandra tergemina, Coccoloba pubescesns, Amyris elemifera.*

Table 7. Importance of species in the shrub type (group A)

Species	Morphological types and SA at maturity stage	Dominance index (D.I.)	Species	Morphological types and SA at maturity stage	Dominance index (D.I.)
Eugenia confusa	**Ap**	**75,25**	***Acacia tamarindifolia***	**Ab**	**0,963**
Calliandra tergemina	**Ab**	**74,51**	***Myrcia fallax***	**A**	**0,893**
Acacia muricata	**A**	**46,25**	***Morisonia americana***	**Ap**	**0,65**
Tabebuia heterophylla	**A**	**40,55**	***Guettarda odorata***	**Ap**	**0,614**
Pilocarpus racemosus	**Ab**	**22,51**	***Cassine xylocarpa***	**A**	**0,5**
Lonchocarpus violaceus	**A**	**18,36**	***Cordia marticensis***	**Ap**	**0,492**
Pisonia fragrans	**A**	**16,96**	***Citharexylum spinosum***	**Am**	**0,472**
Erythroxylon havanense	**Ap**	**15,37**	***Picramnia pentandra***	**Ap**	**0,469**
Myrcia citrifolia	**Ap**	**14,89**	***Acacia sp***	**Am**	**0,379**
Bourreria succulenta	**Ap**	**13,32**	***Chrysophyllum argenteum***	**A**	**0,365**
Pithecellobium inguis-cati	**Ab**	**13,3**	***Conostegia calyptrata***	**Ab**	**0,36**
Eugenia monticola	**Ap**	**12,77**	***Cordia alliodora***	**A**	**0,346**
Maytenus laevigata	**A**	**11,92**	***Manilkara bidentata***	**A**	**0,343**
Krugiodendron fereum	**A**	**11,54**	***Bunchosia glandulosa***	**Ab**	**0,279**
Croton bixoides	**Ab**	**11,25**	***Croton flavens***	**Ab**	**0,235**
Bursera simaruba	**A**	**10,14**	***Eugenia ligustrina***	**Ab**	**0,22**
Erithalis fruticosa	**Ap**	**9,756**	***Swietenia macrophylla***	**A**	**0,218**
Haematoxylon campechianum	**Am**	**9,3**	***Buchenavia tetraphylla***	**A**	**0,178**
Eugenia cordata	**Ap**	**9,22**	***Zanthoxylum monophyllum***	**Am**	**0,16**
Coccoloba pubescens	**A**	**8,5**	***Capparis cynophallophora***	**Ab**	**0,154**
Amyris elemifera	**Ap**	**8,235**	***Cornutia pyramidata***	**Am**	**0,113**
Coccoloba swartzii	**A**	**8**	***Capparis hastata***	**Ab**	**0,106**
Guettarda scabra	**Am**	**7,7**	***Exothea paniculata***	**A**	**0,051**
Pisonia suborbiculata	**Ap**	**5,661**	***Ilex nitida***	**A**	**0,045**
Eugenia pseudopsidium	**A**	**5,2**	***Ocotea eggersiana***	**A**	**0,044**
Ocotea coriacea	**Am**	**5,082**	***Inga laurina***	**A**	**0,039**
Canella winterana	**Am**	**4,96**	***Randia aculeata***	**Ab**	**0,02**
Capparis indica	**Ab**	**2,74**	***Ocotea patens***	**Am**	**0,018**
Croton corylifolius	**Ab**	**2,43**	***Ficus citrifolia***	**A**	**0,015**
Mangifera indica	**A**	**1,86**	***Sideroxylon foetidissimum***	**A**	**0,015**
Daphnopsis americana	**Am**	**1,688**	***Ceiba pentandra***	**A**	**0,009**
Forestiera rhamnifolia	**Am**	**1,679**	***Zanthoxylum caribaeum***	**A**	**0,008**
Chionanthus compacta	**Am**	**1,579**	***Cordia collococca***	**A**	**0,003**
Byrsonima spicata	**A**	**1,43**	***Guazuma ulmifolia***	**A**	**0,003**
Schaefferia frutescens	**Ab**	**1,33**	***Simaruba amara***	**A**	**0,002**
Casearia decandra	**Am**	**1,2**			

A: Tree/Ab: Shrub/Ap: Small tree/Am: Tree medium height

Distribution and dominance of species for all stations

From the twenty-six species of great ecological importance (Table 8) for all stations and their predominant associations and using the distribution index (Id) and the dominance index (ID), the main synecological and auto-ecological characteristics were decrypted. It is now possible to propose the main characteristics of plant succession. From physiognomic group C to group

A, via group B, the taxa are found in an increasingly open, more and more regressive, more and more xeric environment and belong to increasingly heliophilic families. Group A cannot be assimilated to the first chrono-sequence of plant dynamics, because the methodology used does not make it possible to obtain reliable information on the physiognomic components which precede the shrub stage: this stage corresponds to the beginning of expansion of the shrub morphotypes. All species of group A (regressive processes) do not appear at the same time in the internal dynamics of this stage of succession. Therefore, although it seems simplified and schematic, it is necessary to identify several phases of evolution to understand the dynamic process of plants. Generally speaking, the small successive internal cycles at a dynamic stage considered take place on an extremely small-time scale. We then propose three phases of evolution to reach the shrub stage (group A):

1) Initiation of shrub structure
2) development of shrub structure
3) the shrub structure has reached its maximum degree of organization. It is dotted with a small number of trees which are the precursors of the pre-sylvatic plant entity.

Most species of this group pass through the physiognomic types of small shrubs and shrubs during their morphogenetic development.

For this phase 1, we distinguish the following taxa:

Eugenia confusea/ Calliandra tergemina/Acacia muricata/ Pilocarpus racemosus/ Erythroxylon havnense/ Myrcia citrifolia/ Bourreria succulenta/ Pithecellobium unguis-cati/ Eugenia monticola/ Croton bixoids/ Erithalis fruticosa/ Haemotoxylon campechianum/ Eugenia cordata/ Pisonia suborbiculata/Bursera simaruba/ tamarindifolia/ Guettarda odorata/ Cordia martinicensis/ Croton flavens/ Eugenia ligustrina/ Acacia sp/ Randia aculeata/.

In phase 2 the shrubby physiognomic type is still dominant, however the same species from the previous phase are frequently found, but they have reached a higher level of architectural expansion:

Eugenia confusea/ Calliandra tergemina/ Acacia muricata/ Tabebuia heterophylla/ Lonchocarpus violaceus/ Pisonia fragrans/ Maytenus laevigata/ Krugiodendron ferreum/ Bursera simaruba/ Erithalis fruticosa/ Haematoxylon campechianum/ Coccoloba pubescens/ Amyris elemifera/ Coccoloba swartzii/ Guettarda scabra/ sonia suborbiculata /Eugenia pseudopsidium / Ocotea coriacea/ Canella winterana/ Croton corylifolius/ Daphnopsis americana/ Forestieria rhamnifolia/ Chionanthus compacta/ Byrsonima spicata/ Schaefferia frutescens/ Casearia decandra/ Acacia tamarindifolia/ Morisonia americana/ Guettarda *odorata/ Cassine xylocarpa/ Citharexylum spinosum/ Conostegia calyptrata/ Bunchosia glandulosa/ Swietenia mahagony/ Zanthoxylum monophyllum/ Cornutia pyramidata/ Capparis hastata/ Ceiba pentandra*

Finally, phase 3 characterized by a mature shrub structure marks the end of this internal successional cycle and brings together the conditions for initiating tree morphotypes. Correlative to the progression of the latter, the regression of the shrubby physiognomic type gradually takes place. The formations that belong to this organization give the plant landscape a discontinuous architecture compared to the crowns of trees, which are not contiguous. At this level of structuring, the probability of establishing shrub species decreases sharply in favor of tree species. Often under the cover formed by shrub groups, we observe the regeneration of trees, which will later form the pre-sylvatic unit. The shrub species of this phase are little different from those of the previous one, only they reach their maximum morphological expansion and enter a process of senescence. We find, among the trees and regenerations which become abundant in the shrubby plant cover:

Eugenia confusea/ Acacia muricata/ Tabebuia heterophylla/ Lonchocarpus violaceus/ Pisonia fragrans/ Maytenus laevigata/ krugiodendron ferreum/ Bursera simaruba/ Cocoloba pubescens/ Coccoloba swartzii/ Canella winterana/ Eugenia pseudopsidium/ Dapnopsis americana/ Chionanthus compacta/ Byrsonima spicata/ Cassine xylocarpa / Picramnia pentandra / Chrysophyllum argenteum/ Cordia alliodora/ Bunchosia glandulosa/ Swietenia macrophylla/ Buchenavia tetraphylla/ Zanthoxylum monophyllum/ Capparis cynophallophora/ Cornutia pyramidata/ Capparis hastata/ Ceiba pentandra/ Cordia collococca/.

Group B is made up of all pre-forest formations (mixed: shrubs-trees) in which the tree component is quantitatively significant and begins to significantly influence the intra-vegetation microclimate. The roof of the plant units is still discontinuous and their internal environment is still punctuated by the macroclimate. However, compared to the previous group, the spatial distribution of light has changed significantly, resulting in a lower degree of xericity. The influence of light energy is reduced correlatively with the closure of the canopy of the pre-forest entity. The leaf area index of tree species increases in parallel with their morphological development and conversely there is a regression of shrub species. The pre-sylvatic stage is a transitional phase which corresponds to the transition from extra-sylvatic successional cycles to intra-sylvatic successional cycles which announce the era of the quasi-dominance of the tree physiognomic type.

Ultimately, the forest pioneer stage can be broken down into three chrono-sequences. First of all, the “pre-sylvatic thicket” sequence during which the shrubby formation dominates and contains within it, in a scattered manner, the beginnings of first-rank sylvatic species.[1] *: Lonchocarpus violaceus/ Pisonia fragrans/ Bursera simaruba/ Ocotea coraicea/ Coccoloba swartzii/ Chionanthus compacta/ Bourreria succulenta/ Haematoxylon campechianum/ Guettarda scabra/ Eugenia confusea/ Amyris elemifera/ Coccoloba pubescens/ Tabebuia heterophylla/ Pilocarpus racemosus/ Ardisia obovata/ Eugenia mon ticola/ Byrsonima spicata/ Myrcia citrifolia/Erythroxylon havanense/ Calliandra tergemina/ Morisonia americana/Bunchosia glandulosa/ Schaefferia frutescens/ Sweitenia mahagoni/ Sweitenia macrophylla/ Eugenia ligustrina/ Capparis indica/ Pithecellobium unguis-cati/ Forestieria rhamnifolia/ Daphnopsis americana/ Zanthoxylum punct atum/ Myrciaria floribunda/ Capparis hastata/ Zanthoxylum spinifex/ Ouratea guidingui/ Pisonia suborbiculata/ Zanthoxylum monophyllum/ Citharexylum spinosum/ Croton corylifolius/ Randia aculeata/ Ceiaba pentandra* .

This phytocenosis is mainly made up of mature shrubs resulting from extra-sylvatic cycles and often in the early stages of senescence. These shrubs are associated with trees presenting transitional shrub morphotypes which will form young forest formations at the end of the succession stage: these are the first elements of intra-sylvatic cycles. The “mature pre-sylvatic thicket” sequence is then the result of the expansion of trees installed in the mature shrub structure. When these trees reach their level of morphological inversion, they will create favorable conditions for the installation of other sylvatic taxa. The level of morphological inversion corresponds to the phase where the tree develops its ramifications. In the young pre-sylvatic thicket, a certain number of trees form the structural ensemble of the present and are dominant in the phytomass. We then distinguish : *Lonchocarpus violaceus/ Maytenus laevigata/ Pisonia fragrans/ Bursera simaruba/ Ocotea coriacea/ Krugiodendron ferreum/ Coccoloba swartzii/ Pimenta racemosa/ Hymenaea courbaril/ Chionanthus compacta/ Eugenia confusea/ Amyris elemifera/ Coccoloba pubescens/ Tabebuia heterophylla/ Gyminda latifolia/ Byrsonima s picata/ Cordia collococca/ Eugenia tapacumensis/ Morisonia americana/ Bunchosia glandulosa/ Sweitenia macrophylla/ Forestieria rhamifolia/ Daphnopsis americana/ Myrciaria floribunda/ Capparis hastata/ Zanthoxylum caribaeum/ Zanthoxylum spinifex/ Ouratea guildinguii/ Pisonia suborbiculata/*

---

[1] The first sylvan heliophiles.

Coccothinax barbadensis/ Ficus citrifolia/ Cordia colloco cca/ Ceiba pentandra/ Crateva tappia/ Zanthoxylum monophyllum/ Citharexylum spinosum/ Croton corylifolius.

Finally, in the last sequence of this dynamic stage, the tree plant cover definitively supplants the shrubby entity resulting from the previous system. The sylvatic state is represented by a young sylva of first-rank trees (pioneer species). The leaf area index increases as they develop and under the still discontinuous plant cover that they form, species of more advanced dynamic stages settle in small numbers, such as: *Sideroxylon foetidissimum/ Manilkara bidentata / Cassina xylocarpa/ Myrcia fallax/ Cordia alliodora/ Sideroxylon obovatum/ Eugenia speudosidium/ Chrysophyllum argenteum/ Guaiacum officinale/ Picramnia pentandra/ Zanthoxylum flavum/ Inga laurina/ Cedrela odorata/ Buchenavia tetraphylla/ Garcinia humilis/ Guazuma ulmifolia/ Ocotea eggersiana/ Simaruba amara/ Maclura tinctoria.*

Group C includes stations whose formations are dominated by associations of trees of varying maturity. In these, the vertical organization appears polystratified, but is truly made up of structural groups. Usually, the plant units belonging to this group are more evolved from the point of view of their structure. The interactional fabric is much more complex and offers very specialized ecological niches compared to those generated by the ecological conditions of the plant communities of previous dynamic groups. The plant species in the regeneration phase in the terminal sequence of group B, a large number of which do not have representatives in the dominant floristic procession of this group C, take on an important development here. Progressively, they will constitute the forest framework and although they are part of the most specialized associations of our reference stations, they are however not the most specialized of the dynamic gradient of this bioclimatic level (lower plant level).

In Group C, some stations are home to taxa that are relicts of former climax formations. These have reached their maximum complexity and they reiterated the most specialized species of the floristic potential: the so-called terminal species, in the plant matrix or in small chablis (small gaps in the vegetation): *Pimenta racemosa/ Maytenus laevigata/ Sideroxylon foetidissimum/ Manilkara bidentata/ Guarea glabra/ Pouteria multiflora/ Guarea macrophylla/ Myrciaria floribunda/ Eugenia tapacumensis/ Licaria sericea/ Ormosia monosperma/ Hymenaea courbaril/ Bunchosia tetraphylla/ Exothea paniculata/ Pouteria semecar pifolia/ Eugenia oerstedeana/ Sterculia caribaea/ Brosimum alicastrum/ Sideroxylon obovatum/ Andira inermis/ Zanthoxylum flavum/ Antirhea coriacea.*

At other stations in this group, the remaining taxa form predominant associations corresponding to the dynamic secondary structured and advanced secondary sylvatic stages.

Within these associations, environmental conditions initiate the final stages of plant succession.: *Ocotea coriacea/ Myrcia fallax/ Inga laurina/ Pisonia fragrans/ Eugenia pseudopsidium/ Coccoloba swartzii/ Ocotea eggersiana/ Chionanthus compacta/ Ocotea patens/ Cassipourea guianensis/ Eugenia axilaris/ Byrsonima spicata/ Rhyticocos amara.*

These results are global and do not claim to interpret all the particularities of the study stations due to topography, exposure and soil. Table 8 shows large ecological differences between stations in terms of biomass, biodemography, individual densities and distributions. The variations in the Distribution Index (Id) and the Dominance Index (ID) of the species constitute significant witnesses. These species have specific membership probabilities with regard to the stages of plant succession (Table 9). The notion of temperament with regard to solar energy is relative, however the species mentioned above and adapted to relatively open environments can be compared to "heliophiles" or "hemi-heliophiles". Their suitability for light depends on the bioclimatic region and the potential characteristics of the plant formations that develop there. The discriminating element is their photosynthetic behavior. Namely, their capacity to use the different levels of photic energy which are expressed in the vertical organization of vegetation (Table 10). Consequently, for an identical dynamic stage, a species considered as heliophile in one forest type can act as a hemi-heliophile or sciaphile in another. Certain heliophilous species settling in gaps in the tropical seasonal evergreen sylva (middle floor), act as hemi-heliophiles, hemisciaphiles or simply sciaophiles in the matrices of the more xeric sylva of the lower floor. In relation to light all temperaments exist. This results in a plasticity of floristic potential which offers a wide range of combination possibilities. The latter are related to the processes of succession, guided by the conditions of the environment and the modalities of disturbances (Tables 9 and 10).

Table 8. Ecological dominance of the main species of the lower level (Martinique)

Species	**nb**	**fa**	**Fr (%)**	**density**	**Id**	**Basal area**	**ID**
Pisonia fragrans	2578	75	100	0.04683015	4.68301544	17.362218	81.307535
Bursera simaruba	816	68	90.6666667	0.01482289	1.34394187	30.186213	40.5685156
Lonchocarpus violaceus	1250	60	80	0.02270663	1.81653043	16.470831	29.9197657
Maytenus laevigata	2558	56	74.6666667	0.04646685	3.46952468	6.9462584	24.1002149
Bourreria succulenta	2666	68	90.6666667	0.0484287	4.39086891	4.7602596	20.9016759
Ocotea coriacea	3082	60	80	0.05598547	4.47883742	3.9315548	17.6087948
Pimenta racemosa	2173	37	49.3333333	0.03947321	1.94734484	8.6791759	16.9013484
Tabebuia heterophylla	513	42	56	0.0093188	0.52185286	19.738256	10.3004654
Coccoloba swartzii	1006	48	64	0.0182743	1.16955495	8.4171233	9.84428822
Chionanthus compacta	1092	58	77.3333333	0.01983651	1.53402362	4.4138391	6.77093341
Eugenia monticola	2311	46	61.3333333	0.04198002	2.57477445	2.3457174	6.03969322
Sideroxylon foetidissimum	735	23	30.6666667	0.0133515	0.40944596	10.527929	4.31061798
Eugenia cordata	1360	29	38.6666667	0.02470481	0.9552528	4.49177	4.29077587
Myrcia citrifolia	2313	46	61.3333333	0.04201635	2.57700273	1.5360684	3.95845245

Krugiodendron ferreum	982	37	49.3333333	0.01783833	0.88002422	3.9985153	3.51879031
Erythroxylum havanense	946	57	76	0.01718438	1.30601272	2.2336979	2.91723786
Guettarda scabra	801	39	52	0.01455041	0.75662125	3.5595433	2.69322611
Calliandra tergemina	2024	23	30.6666667	0.03676658	1.12750833	1.96	2.20991632
Eugenia pseudopsidium	1080	36	48	0.01961853	0.94168937	2.3365329	2.2002882
Inga laurina	390	38	50.6666667	0.00708447	0.35894641	5.8409888	2.09660197
Byrsonima spicata	360	35	46.6666667	0.00653951	0.30517711	6.8034969	2.07627153
Coccoloba publescens	599	32	42.6666667	0.01088102	0.46425674	3.933321	1.82607077
Myrcia fallax	1215	27	36	0.02207085	0.79455041	1.9984334	1.58785608
Chrysophyllum argenteum	870	44	58.6666667	0.01580382	0.92715713	1.4942083	1.38536588
Tabernaemontana cirifolia	636	43	57.3333333	0.01155313	0.66237966	1.903468	1.26081848
Amyris elemifera	673	31	41.3333333	0.01222525	0.50531032	1.99	1.00556755

Nb: number of individuals/ fa: absolute frequency / fr =fa/75 stations (relative frequency) / Id= fr x density (Distribution Index)/ ID= Basal Area x Id (Dominance Index)/total surface area inventory: 55,050 m².

Table 9. Importance of dominant species in the different stages of plant dynamics of the lower level (Martinique)

Species	**FAB**	**FABM**	**FPS**	**FSJS**	**FSS**	**FSST**	**FSPC**	**FSC**
Pisonia fragrans	+	++	+++	+++	++++	++		
Bursera simaruba	++	+++	+++++	+++	++			
Lonchocarpus violaceus	+	++	+++	++++	+++++	++		
Maytenus laevigata		+	+	++	++	+++	++++	++++
Bourreria succulenta	+++	++++	+	+				
Ocotea coriacea				+	++++	+++		
Pimenta racemosa		+	++	+++	++++	+++	++	++
Tabebuia heterophylla	+++	+++	++++	+++	++			
Coccoloba swartzii		+	++	+++	+++++	+++	+	
Chionanthus compacta	+	++	+++	++++	+++++	++		
Eugenia monticola	+++	+++	+++++	+++	++	+		
Sideroxylon foetidissimum				+	++	++++	+++	++
Eugenia cordata	++++	+++++	+					
Myrcia citrifolia	++++	+++++	++	+				
Krugiodendron ferreum		+	+	++	+++	++++	+++	++
Erythroxylum havanense	++++	+++++						
Guettarda scabra	+	++++	+++++	++	+			
Calliandra tergemina	++++	+++++						
Eugenia pseudopsidium			+	+++	++++	++	+	
Inga laurina			+	++	++++	+++	+	
Byrsonima spicata			+	++	+++++	++	+	
Coccoloba publescens	++	++	++++	+++	++			
Myrcia fallax				+++	+++++	++		
Chrysophyllum argenteum			+	++	+++	++	+	
Tabernaemontana cirifolia			+	++	++++	+		
Amyris elemifera		+	++	+++	+++	+	+**?**	

(+): Importance of the descriptor/ (FAB): Shrub formation/ (FABM): Mature shrub formation/ (FPS): Pre-sylvatic formation/ (FSJS): Young sylvatic formation structured / (FSS): Secondary sylvatic formation / (FSST): Late secondary sylvatic formation / (FSPC): Preclimacic sylvatic formation / (FSC): Climacic sylvatic formation /

Table 10. Temperaments about light and modes of dispersal of dominant species (Lower-level Martinique)

Species	**HP**	**HS**	**HTS**	**HéSc**	**S**	**HémSc**	**VDP**	**PSEM**	**VS**	**D**	**OF**
Pisonia fragrans		+++	++			+	ORNI	S1	NC	G	G
Bursera simaruba	+++	+	+				ORNI	S2	T	M	G
Lonchocarpus violaceus	+	+++					ANEMO	S1	T	M	M
Maytenus laevigata					+++		ORNI	S1	NC	G	M
Bourreria succulenta	+++	+					ORNI	S3	T	G	M
Ocotea coriacea		+	+++				ORNI	S2	NC	G	M
Pimenta racemosa		+	+	+++			ORNI	S1	NC	M	M
Tabebuia heterophylla	+++	++	++				ANEMO	S1	T	F	M
Coccoloba swartzii		+++	+				ORNI	S1	P	M	F
Chionanthus compacta		+++	+				ORNI	S2	NC	M	F
Eugenia monticola	+	+++	+				ORNI	S2	NC	G	F
Sideroxylon foetidissimum			+	+++			ORNI	S1	P	F	F
Eugenia cordata	+++	+					ZOOCH	S3	NC	EF	EF
Myrcia citrifolia	+	+++					ORNI	S3	NC	G	F
Krugiodendron ferreum		+	+	+++			ORNI	S2	NC	F	F
Erythroxylum havanense	+++	+					ORNI	S3	T	M	F
Guettarda scabra	++	+++	+				ORNI?	S2	T	F	F
Calliandra tergemina	+++	+					BARO	S3	T	M	F
Eugenia pseudopsidium		+	+++				ORNI	S2	NC	F	F
Inga laurina			+++				ZOOCH	S1	NC	F	F
Byrsonima spicata	+	+	+++				ZOOCH	S1	P	TF	F
Coccoloba publescens	+++	++					ZOOCH	S2	P	TF	F
Myrcia fallax		+++	++				ZOOCH	S2	NC	F	F
Chrysophyllum argenteum			+++			++	ZOOCH	S3	NC	F	F
Tabernaemontana cirifolia		++				++	ZOOCH	S3	NC	F	F
Amyris elemifera	+	++	+++				ZOOCH	S2	NC	F	F

HP: Primary Heliophile / HS: Secondary Heliophile / HTS: Sylvatic Gap Heliophile / HéSc: HelioSciaphile / S: Sciaphile / HémSc: HemiSciaphile / (+): importance of the descriptor/ VDP: Potential Dissemination Vector (BARO: Barochory, ORNI: Ornithochoria, ZOOCH: Zoochoria, ANEMO: Anemochoria)/ PSEM: Stratigraphic Position in Maximum Expansion (S1: Upper Stratum, S2: Middle Stratum, S3: Lower Stratum)/ C: deciduousness (T: Total, NC: Not Deciduous, P: partial) / D: Distribution / DE: Ecological Dominance / G: Large, M: Medium, F: Low, TF: Very Low /

Discussion

Physiognomic types of stations

The variability of physiognomies is the direct consequence of the various degrees of evolution of the phytocenoses taken as a reference for this study. Floristic recruitment increases quantitatively and qualitatively during the progressive dynamic. Furthermore, stations belonging to the same successional stage do not necessarily have the same number of species: this must be related to the notion of ecological group (Wilson, 1999; Noreika et al., 2020). Area-species relationships reveal a whole set of structural intermediaries, from shrubby units to late or mature tree groups. In addition to estimating the minimum surface area, these area-species relationships specify the floristic richness. The latter depends both on the dynamic stage and the stationary ecological conditions. The multiplicity of topographical features, climatic hazards, and the more or less selective activity of man in the environment leads to a spatial variation of plant formations and an overlapping of successional cycles (extra-sylvatic and intra-sylvatic): which introduce a bias in the floristic analysis (Magalhães et al., 2015; Orta-Pineda et al., 2021; de Jesus et al., 2022). The biological spectrum through the distribution of biological types provides information on the stage of maturity of the phytocenoses of the survey stations (Naydenova et al., 2022; Chen et al., 2022). The quantitative differences between Megaphanerophytes, Mesophanerophytes, Microphanerophytes, and Nanophanerophytes attest to the importance of each of these biological types in the overall framework of vegetation (Tiendrébeogo et al., 2022; Luna-Florin et al., 2022). Indeed, all things being equal, in the plant ecosystem, the establishment and expansion of a species will depend on its ability to use the light energy available along the vertical gradient (Kengne et al., 2022; Tynsong et al., 2022). The stratification of a forest formation becomes more complex throughout its progressive evolution. There appears to be a phenomenon of inter-stratum biomass transfer linked to the possibility of occupation of installation and expansion sites. In other words, during the stages leading to maturity, the biomass of the lower strata decreases in favor of the upper strata's. The progressive closure of the plant cover is characterized by an increasingly high degree of light interception and therefore by the existence in the lower layers of increasingly weak photic energy (Kamiyama et al., 2010; Feng et al., 2022). Plants deciduous are adapted to dry bioclimatic conditions and are typical of open environments in which light energy is not a limiting factor. Logically, the percentage of deciduous species in the different plant strata acts as an indicator of openness and of degree of evolution (maturity, Figure 2 a, b & c). In our field of study, in addition to physiological adaptations, other marginal adaptive strategies result from singularities linked to the characteristics of the different stations: morphological and anatomical adaptations of certain species of very dry environments, Cacti and Myrtaceae, for example During the evolution of vegetation, the increase in the biomass of Mesophanerophytes has as a corollary a decrease in that of Microphanerophytes, therefore, as a corollary, a decrease in that of Microphanerophytes, therefore, a reduction in their possibility of installation and expansion. The induced effect is a drop in stem density. Nanophanerophytes were not considered strong indicators in this analysis. They are composed of regenerations of different ages, counting in their ranks a large number of individuals capable only of ensuring a brief phase of their biology: the plantular state. In other words, their germinative modalities allow them to find installation sites however they are incapable of carrying out their development and expansion processes. The Nanophanerophytes stratum is the site of great mortality, particularly among the regenerations of species not belonging to the predominant matrix, which are considered unbalanced.

Number of individuals and densities

The distribution mode of age classes and heights reveals the affirmed youth of the populations and mainly reflects an overall structural aspect (Barreto et al., 2022; Quigley & Platt, 2003). However, although they have similar profiles, the distribution of diameter classes is not identical in all stations. Everything depends on the phase of succession in which the different inventory plots are located (Table 3 a, b, and c). Given the current organization of the plant cover in the lower level, it is logical that individuals with small sections are in the majority. Representatives of the 2.5 and 5 cm classes are globally co-dominant. These results confirm the mainly regressive character of the inventory stations, some of which are in a reconstitution dynamic: the great abundance of small-diameter stems is a very significant indicator. About the "opening-closing" ecosystem duality, the extremes of which are distinctly signified by the herbaceous cover and the climax sylva, it is easy to see that the phytocenoses of this attitudinal level, for the most part, and to varying degrees, are closer of the "open" state. The degree of openness is signified by the extent of the interweaving of aboveground biomasses (crowns or crowns of trees, aerial parts of shrubs). This reality has as a corollary positive (progressive) or negative (regressive) plural successional processes presiding over a great functional, physiognomic, and landscape diversity (Costa et al., 2022; Bogale et al., 2022).

It is possible to put forward two complementary explanations:

-the characteristics of the photic, nutritional, and water resources are dependent on the stage of maturity of the plant formation,

-the different topographic facies and their exposure to wind and insolation partly influence the dynamics of water in the edaphic system.

Within the populations of species of the phytocenoses of the survey stations, the Microphanerophytes by their importance confirm the previous results. Namely, the preponderance of low-dimensional diametric classes associated with low heights (Sanou et al., 2021). In many shrub and presylvatic sites, micophanerohytes form often dense matrices from which mesophanerophytes emerge here and there. Mesophanerophytes are very poorly represented: between 0% and 33%. Theoretically, the increase in the number of Mesophanerophytes would indicate a transition to a sylvatic phase. It is necessary, however, to take into account the types of Mesophanerophytes and their place in forest architecture, which is related to their ecology. Indeed, like microphanerophytes and nanophanerophytes, depending on their height, mesophanerophytes are subdivided into higher or lower mesophanerophytes.

Specific wealth

Diversity and equitability indices express the structural maturity and the dynamic phase of plant units (Nangndi et al., 2021; Ndotar et al., 2022). Regression results in the opening, to varying degrees, of the plant cover, thus creating the conditions for the installation of new, increasingly generalist species. This phenomenon is responsible for the increase in the diversity index of degraded formations. Conversely, the greater complexity due to the multiple interactions of mature or climax forest communities allows the existence of particular installation sites occupied by specialized species. As we progress towards the climax, species become more and more specialized and antagonistic about ecological resources. The diversity within our inventory stations is conditioned by anthropization and the structural characteristics of the phytocenoses. Indeed, for most of the sylvatic formations in our study, anthropization results in a selective levy of species for domestic work needs. These small disturbances mean that the vertical distribution of their crowns creates an interior environment that only selects forest flora species. The sylvan groups of the survey stations are, therefore, not balanced in their dynamic stages. These are eco-units belonging to various phases of intrasylvatic evolution. They are opposed in age, spatial dimension, and floristic composition. This great spatiotemporal heterogeneity between stations leads to the existence of a multitude of installation sites and results in high indices of diversity and equitability.

In this category we find the following stations: Morne ACA2 / Morne ACA3 / Morne ACA 25 / Morne ACA 4 / Morne ACA1/ Morne ACA 11/ Morne ACA 13 / Morne GARDIER 3 / Morne ACA 9/ Morne GARDIER 1/ ROCHER-ZOMBI 1/ RAVINE-SAINT-PIERRE 3/ Morne GARDIER 2 / BOIS POTHAU/ SAINT-VINCENT 1. Other stations in this physiognomic group present lower diversity indices and correspond to among the most structured forest formations, which seem to be more stable in their dynamic stage: at any point in space, these plant communities are in almost identical or very close processes. Here, diversity reflects much more at the organizational level and, therefore, the degree of maturity. These relatively lower diversity indices of these sylvan communities are mainly due to their high complexity and reflect advanced dynamic stages: POINTE JEAN-CLAUDE 1/POINTE JEAN-CLAUDE 2/ MORNE MANIOC 2/ MORNE MANIOC 3.

The regressive mixed tree-shrub phytocenoses are found in intermediate positions. The mechanisms that generate the great floristic diversity of these open environments are difficult to understand. If we consider that the ecological differences between stations are insignificant, it is possible to explain the variations in observed diversity. Although having a notable tree population, some high-diversity stations are dominated by shrub taxa. In addition, they are subject to the regular effects of anthropogenic or zooanthropogenic factors. This results in an interweaving of multiple successional cycles that are extra-sylvatic. In this same group, whatever the qualitative and quantitative relationships of trees and shrubs, other sites are more homogeneous and seem less subject to the effect of anthropization. Their diversity can be assimilated to their capacity to accommodate plant species, testifying to stationary ecological conditions: in other words, their diversity of installation and expansion sites. Finally, the stations of the shrubby physiognomic type are composed of mainly shrubby plant associations (group A) reflecting a profound regression of the original vegetation. All the formations that comprise this group A are transitional representatives and belong to progressive or regressive extra-sylvatic successional cycles. The argument used previously to explain the differences in diversity and equitability between stations is applicable here. Ultimately, a whole set of heterogeneities of a topographical and edaphic or even microclimatic order is added to the structural heterogeneity of plant associations.

The difficulty in interpreting diversity and equitability indices is essentially due to the great complexity of plant ecosystems. This complexity is not only synonymous with evolution and, therefore, maturity; it expresses a strong heterogeneity of plant communities due to variability in biotic and abiotic factors. Unlike primitive vegetation or vegetation only slightly modified by natural disturbances, anthropized biosystems are not homogeneous. The scale of anthropogenic processes being extremely small compared to ecosystem restructuring, these biosystems are continually in a “progression-regression” mechanism. The constituent phytocenoses of the lower level of Martinique differ both from a floristic point of view and from the point of view of the density of individuals of the various diameter classes and their numerical importance in the height classes. The majority of stations fall within this summation of anthropogenic and, more rarely, natural events. Thus, the beginnings of restoration of the secondary plant cover are destroyed by new anthropogenic disturbances, which will be added to the previous ones. Under these conditions, vegetation regresses and deviates inexorably from its initial complexity. Currently, this mechanism leads to ecosystem collapse and explains the chaotic appearance of plant populations in low-lying areas. This complexity of biological self-organization corresponds to a large variation in diversity and equidistribution indices.

Dominance of species by physiognomic types

The classification of species about distribution indices (Id) and dominance (ID) allows us to glimpse all the dynamic processes of the taxa that are the most predominant today. As a result, these indices have an undeniable ecological value and reflect the overall ecological characteristics of the survey plots. The results obtained for all the stations allowed the positioning of plant species on the dynamic gradient. It was not possible to identify the station specificities if at all, they could provide a higher element of analysis. It is possible to affirm in light of these results that the lower floor species have an excellent affinity for degraded environments whatever their biological types. The plant cover is open and presents complex dynamics driven by human activities. In addition, its plant units, of variable spatial dimension and organization, are mainly engaged in extra-sylvatic cycles. All this leads to a highly heterogeneous spatio-temporal mesh that is almost impossible to approach. Classic concepts such as those of Oldeman relating to French Guiana's lightly anthropized forest formations are inapplicable (Oldeman, 1989). There is no longer any question here of a balanced, stable plant matrix in which the eco-units are very close on the dynamic scale and of a turnover occurring at the level of the quantitatively small openings of the forest roof (the gaps or Chablis). Here, it is clear that the plant mosaic is very dense and is made up of small cells that do not fall under the concept of eco-units in the sense of Oldeman (Oldeman, 1974). The variations are not micro-systemic but at lower scales. Thus, those notables are not observed for a given region between plots of average size but are detectable on the scale of the “soil-plant” system. Some stations, however, go beyond this general framework and are part of intra-sylvatic successional cycles. In this case, the dominant species belong to families with a heliophilous temperament, even if their establishment requires much more specialized ecological niches. Despite the great difficulty linked to exploring plant succession processes and analysing data, the results collected are sufficient to understand the ecological functioning of species and formations. These derive from the combinatorial capacities of taxa and acquire an increasingly significant self-organizing power during their evolution.

Distribution and dominance of species for all stations

Due to a lack of knowledge of the biology and ecology of specific taxa, this attempt to classify species or species associations has sometimes presented insurmountable difficulties. The preceding developments show a plurality of autoecological and synecological factorial determinisms. Therefore, under variable biocenotic conditions, a single descriptor can only partially reflect plant species' individual and community spatiotemporal dynamics. This is for example the case of the behavior of species about light which alone cannot explain their ecological functioning. However, if the success of a species or a group of species depends on the interaction of factors, they should be prioritized. Most of the plant species of our floristic potential have a reasonably wide distribution [Id (Distribution index), Table 8]. However, their demography and the biomasses of their variable age classes are modulated by stationary biophysical conditions. Within the transects, depending on the stage of development of the associated phytocenoses, factorial differences exist between the quadrats (soil depth, temperature, insolation, evapotranspiration, physical evaporation, humidity). This is reflected in Table 8 by dominance indices (ID) ranging by a factor of 80 between *Pisonia fragrans* and *Amyris elemifera*. Consequently, the diversity of floristic units of the lower level of Martinique results from the heterogeneous structure of ecological and anthropic factors.

Conclusion

The phytocenoses of the lower level of the present are regressive entities of the primitive tropical seasonal evergreen sylva of the lower horizon which was characterized by a weak physiognomic (chromatic) seasonality despite the undeniable conditions of seasonal climatic drought which can last from 3 to 5 months according to the site. The complexity of the vegetation of the lower level in its final stage probably made it possible to postpone the appearance of the wilting point corresponding to physiological drought (Tng et al., 2022; Oguz et al., 2022). To a lesser extent, plant units seem to derive from the regression of the tropical seasonal evergreen forest of the upper horizon and auxiliary semi-deciduous sylvan formations in the tropical dry season formerly little developed in areas of high xericity, notably the slopes of steep slope at the skeletal soils and islets which are located not far from the coast. Sometimes, ecological conditions do not allow the pre-forest and shrub stages to be exceeded. Parameters such as the density of stems, the distribution of diameter and height classes as well as distribution, dominance and richness indices all shed light on the structural, functional and evolutionary processes of the vegetation of the lower level of Martinique.

References

Baillard, K. (2016). The effects of anthropization on the coastal island vegetation: The example of the mangrove forest of the Bay of Fort-de-France (Martinique). International Journal of Recent Research and Review, 9(2), 1–14.

Barreto, T. E., et al. (2022). Canopy openness and soil conditions explain community structure and diversity in a tropical seasonal forest in south-eastern Brazil. Acta Botanica Brasilica, 35, 638–652. https://doi.org/10.1590/0102-33062020abb0280

Bogale Worku, B., Birhane Hizkias, E., & Muhie Dawud, S. (2022). Diversity, structural, and regeneration analysis of woody species in the Afromontane dry forest of Harego, Northeastern Ethiopia. International Journal of Forestry Research, 1, 1–20. https://doi.org/10.1155/2022/7475999

Boudon, G., & Balcone-Boissard, H. (2021). Volcanological evolution of Montagne Pelée (Martinique): A textbook case of alternating Plinian and dome-forming eruptions. Earth-Science Reviews, 221, 103754. https://doi.org/10.1016/j.earscirev.2021.103754

Chen, C. F., et al. (2022). Secondary succession on landslides in submontane forests of central Taiwan: Environmental drivers and restoration strategies. Applied Vegetation Science, 25(1), e12635. https://doi.org/10.1111/avsc.12635

Costa, E. J. P., et al. (2022). Floristic and structure of woody vegetation in a Caatinga area between 2015 and 2019, in ASSÚ/RN. Floresta e Ambiente, 29, 1–11. https://doi.org/10.1590/2179-8087-FLORAM-2021-0001

de Araújo, W. S., Oliveira, B. M., & Gonçalves, P. S. (2021). Plant diversity drives responses of gall-inducing insects to anthropization in Neotropical savannas. Tropical Ecology, 62(2), 311–317. https://doi.org/10.1007/s42965-021-00148-3

de Jesus, J. B., de Oliveira, D. G., & Araújo, W. S. (2022). Influence of anthropization on the floristic composition and phytosociology of the Caatinga susceptible to desertification in the state of Sergipe, Brazil. Tropical Ecology, 63(3), 398–408. https://doi.org/10.1007/s42965-021-00201-1

Dibacto, S., et al. (2020). Growth and erosion rates of the East Carpathians volcanoes constrained by numerical models: Tectonic and climatic implications. Geomorphology, 368, 107352. https://doi.org/10.1016/j.geomorph.2020.107352

Eckardt, F. D., et al. (2022). A brief introduction to hot desert environments: Climate, geomorphology, habitats, and soils. In Microbiology of Hot Deserts (pp. 1–36). Springer International Publishing. https://doi.org/10.1007/978

Feuillet, N., Beauducel, F., & Tapponnier, P. (2011). Tectonic context of moderate to large historical earthquakes in the Lesser Antilles and mechanical coupling with volcanoes. Journal of Geophysical Research: Solid Earth, 116(B10), 1–26. https://doi.org/10.1029/2011JB008443

Fitzpatrick, S. M., & Keegan, W. F. (2007). Human impacts and adaptations in the Caribbean Islands: An historical ecology approach. Earth and Environmental Science Transactions of the Royal Society of Edinburgh, 98(1), 29–45. https://doi.org/10.1017/S1755691007000096

Francisco-Ortega, J., Santiago-Valentín, E., Acevedo-Rodríguez, P., et al. (2007). Seed plant genera endemic to the Caribbean Island biodiversity hotspot: A review and a molecular phylogenetic perspective. Botanical Review, 73, 183–234. https://doi.org/10.1663/0006-8101(2007)73[183:SPGETT]2.0.CO;2

Gelles, R. V., Davis, T. S., & Stevens-Rumann, C. S. (2022). Wildfire and forest thinning shift floral resources and nesting substrates to impact native bee biodiversity in ponderosa pine forests of the Colorado Front Range. Forest Ecology and Management, 510, 120087. https://doi.org/10.1016/j.foreco.2022.120087

Germa, A., et al. (2010). The eruptive history of Morne Jacob volcano (Martinique Island, French West Indies): Geochronology, geomorphology and geochemistry of the earliest volcanism in the recent Lesser Antilles arc. Journal of Volcanology and Geothermal Research, 198(3–4), 297–310. https://doi.org/10.1016/j.jvolgeores.2010.09.013

Gratani, L. (2014). Plant phenotypic plasticity in response to environmental factors. Advances in Botany, 2014, 1–17. http://dx.doi.org/10.1155/2014/208747

Helmer, E., et al. (2002). Mapping the forest type and land cover of Puerto Rico, a component of the Caribbean biodiversity hotspot. Caribbean Journal of Science, 38(3–4), 165–183.

Tüfekcioğlu, İ., & Tavşanoğlu, C. (2022). Diversity and regeneration strategies in woody plant communities of the Mediterranean Basin: Vegetation type matters. Plant Biosystems - An International Journal Dealing with All Aspects of Plant Biology, 156(5), 1247–1259. https://doi.org/10.1080/11263504.2022.2036845

Joseph, P. (2013). Mount Pelée, an ecoclimatic gradient generator. Acta Geographica Debrecina Landscape & Environment, 7(1), 27–41. https://ojs.lib.unideb.hu/landsenv/article/view/2299

Jury, M. R. (2017). Spatial gradients in climatic trends across the southeastern Antilles 1980–2014. International Journal of Climatology, 37(15), 5181–5191. https://doi.org/10.1002/joc.5156

Kamiyama, C., Oikawa, S., & Kubo, T. (2010). Light interception in species with different functional groups coexisting in moorland plant communities. Oecologia, 164, 591–599. https://doi.org/10.1007/s00442-010-1674-5

Kassa, A. W., & Nigussie, Z. A. (2022). Management and woody species diversity in boundary agroforestry of Banja District, Northwestern Ethiopia. Small-Scale Forestry, 21(3), 393–415. https://doi.org/10.1007/s11842-022-09503-1

Kengne, O. C., Feukeng, S. S. K., Ngansop, E. T., et al. (2022). Floristic composition, growth temperament, and conservation status of woody plant species in the Cameroonian tropical rainforests. Ecological Processes, 11(50), 1–17. https://doi.org/10.1186/s13717-022-00387-9

Kiptoo, T. K., et al. (2023). Environmental conditions and the growth patterns of Acacia melanoxylon in highland humid forests in North Tinderet Forest Block (Kenya). African Journal of Education, Science and Technology, 7(3), 13–30. https://doi.org/10.2022/ajest.v7i3.882

Kumar, J. N., et al. (2010). Tree species diversity and soil nutrient status in three sites of tropical dry deciduous forests of western India. Tropical Ecology, 51(2), 273–279.

Liu, Y., et al. (2022). Diversity and structure of vegetation rhizosphere bacterial community in various habitats of Liaohekou coastal wetlands. Sustainability, 14(24), 16396. https://doi.org/10.3390/su142416396

Luna-Florin, A. D., Nole-Nole, D. A., Rodríguez-Caballero, E., Molina-Pardo, J. L., & Giménez-Luque, E. (2022). Ecological characterization of the flora in Reserva Ecológica Arenillas, Ecuador. Applied Sciences, 12(17), 8656. https://doi.org/10.3390/app12178656

Magalhães, J. L. L., Lopes, M. A., & de Queiroz, H. L. (2015). Development of a Flooded Forest Anthropization Index (FFAI) applied to Amazonian areas under pressure from different human activities. Ecological Indicators, 48, 440–447. https://doi.org/10.1016/j.ecolind.2014.09.002

Martin, C. A., Proulx, R., Vellend, M., et al. (2021). How the relationship between vegetation cover and land-cover variance constrains biodiversity in a human-dominated world. Landscape Ecology, 36, 3097–3104. https://doi.org/10.1007/s10980-021-01312-9

Maunder, M., et al. (2011). The plants of the Caribbean islands: A review of the biogeography, diversity, and conservation of a storm-battered biodiversity hotspot. In The biology of island floras (pp. 154–178).

Nangndi, B. E. E., et al. (2021). Floristic and structural diversity of woody vegetation in the Sudano-Guinean zone of Larmanaye, Chad. Journal of Ecology and the Natural Environment, 13(3), 63–72. https://doi.org/10.5897/JENE2021.0900

Naydenova, G., Radkova, M., & Iantcheva, A. (2022). Legumes in natural post-fire successions of forest meadows and pastures in Northern Bulgaria. Thaiszia Journal of Botany, 32, 67–79. https://doi.org/10.33542/TJB2022-1-05

Ndotar, M., et al. (2022). Floristic diversity of recruits in plantations of Eucalyptus deglupta B., 1863, Pinus caribaea M., 1851, and Gmelina arborea R., 1814: Case of Cellucam plantations near Edea (Litoral, Republic of Cameroon). European Journal of Agriculture and Forestry Research, 10(2), 1–13. https://www.eajournals.org/

Noreika, N., Pärtel, M., & Öckinger, E. (2020). Community completeness as a measure of restoration success: Multiple-study comparisons across ecosystems and ecological groups. Biodiversity and Conservation, 29(13), 3807–3827. https://doi.org/10.1007/s10531-020-02050-1

Oguz, M. C., et al. (2022). Drought stress tolerance in plants: Interplay of molecular, biochemical, and physiological responses in important development stages. Physiologia, 2(4), 180–197. https://doi.org/10.3390/physiologia2040015

Oldeman, R. A. A. (1974). The tree ecotopes and vertical ecological gradients in the Gabonese forest. Ecology Review (Earth and Life), 28(4), 487–520.

Oldeman, R. A. A. (1989). Dynamics in tropical rain forests. In Tropical forests: Botanical dynamics, speciation, and diversity (pp. 3–21). Academic Press.

Orta-Pineda, G., et al. (2021). Effects of landscape anthropization on sylvatic mosquito assemblages in a rainforest in Chiapas, Mexico. Acta Tropica, 216, 105849. https://doi.org/10.1016/j.actatropica.2021.105849

Quigley, M. F., & Platt, W. J. (2003). Composition and structure of seasonally deciduous forests in the Americas. Ecological Monographs, 73(1), 87–106. https://doi.org/10.1890/0012-9615(2003)073[0087:CASOSD]2.0.CO;2

Sanou, L., et al. (2021). Composition, diversity, and structure of woody vegetation along a disturbance gradient in the forest corridor of the Boucle du Mouhoun, Burkina Faso. Plant Ecology & Diversity, 14(5–6), 305–317. https://doi.org/10.1080/17550874.2022.2039315

Stein, S., et al. (1982). Subduction seismicity and tectonics in the Lesser Antilles arc. Journal of Geophysical Research: Solid Earth, 87(B10), 8642–8664. https://doi.org/10.1029/JB087iB10p08642

Tadeo-Noble, A. E., Valdez-Hernández, J. I., Beltrán-Rodríguez, L., & García-Moya, E. (2019). Effect of logging on tree structure and diversity in tropical forests of Quintana Roo, Mexico. Revista Bosque, 40(2), 129–140. https://doi.org/10.4067/S0717-92002019000100129

Tiendrébeogo, N., Ouoba, P., Bastide, B., Ouoba, Y., Nacoulma, B., Somda, I., Nacro, B., & Boussim, I. (2022). Phytodiversity and vulnerability of protected areas in Burkina Faso: Case of Péni Classified Forest. Journal of Geoscience and Environment Protection, 10, 204–223. https://doi.org/10.4236/gep.2022.1012012

Tng, D. Y. P., et al. (2022). Drought reduces the growth and health of tropical rainforest understory plants. Forest Ecology and Management, 511, 120128. https://doi.org/10.1016/j.foreco.2022.120128

Tynsong, H., Dkhar, M., & Tiwari, B. K. (2022). Tree diversity and vegetation structure of the tropical evergreen forests of the southern slopes of Meghalaya, North East India. Asian Journal of Forestry, 6(1), 22–36. https://doi.org/10.13057/asianjfor/r060104

Weil-Accardo, J., et al. (2016). Two hundred and thirty years of relative sea level changes due to climate and megathrust tectonics recorded in coral microatolls of Martinique (French West Indies). Journal of Geophysical Research: Solid Earth, 121(4), 2873–2903. https://doi.org/10.1002/2015JB012406

Wilson, J. B. (1999). Guilds, functional types, and ecological groups. Oikos, 86(3), 507–522. https://doi.org/10.2307/3546655