

## A FLORISTIC STUDY OF FIVE SITES ALONG AN ELEVATIONAL TRANSECT IN THE SIERRA DE BAORUCO, PROV. PEDERNALES, DOMINICAN REPUBLIC

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Fisher-Meerow, Linda L. & Walter S. Judd (Department of Botany, 220 Bartram Hall, University of Florida, Gainesville, Florida 32611) A floristic study of five sites along an elevational transect in the Sierra de Baoruco, Prov. Pedernales, Dominican Republic. *Moscosa* 5: 159-185. 1989. The vascular plant flora is enumerated in five study sites ranging from sea level to 1500 m elevation in the Sierra de Baoruco, Prov. Pedernales, Dominican Republic. The sites encompass the vegetational zones of thorn woodland, dry forest, moist forest, lower montane moist to wet forest (pine savanna), and wet (cloud) forest. A total of 325 species, 235 genera, and 85 families, comprising 31 ferns, 2 conifers, and 292 flowering plants, was collected. Thirty five species were recorded from site 1, 45 from site 2, 72 from site 3, 82 from site 4, and 132 from site 5. The greatest floristic similarity is between the first two sites, which share 25% of their species, followed by the third and fifth sites (6.2%), and second and third sites (5.4%). All others have less than 2% of their species in common. The major ecological factors, including rainfall, temperature, soil type, and history of disturbance, are discussed in relation to the vegetation of the zones. Endemism varies significantly between sites, ranging from ca. 9% in the dry forest to ca. 48% in the pine savanna.

Un estudio florístico de cinco sitios en el trayecto elevacional en la Sierra de Bahoruco, Provincia Pedernales, República Dominicana. Se reporta sobre la flora vascular de los sitios ubicados entre el nivel del mar y 1500 m en la Sierra de Bahoruco occidental. La vegetación incluye el bosque espinoso, el bosque árido, el bosque húmedo, el bosque húmedo a muy húmedo montano (sabana del pino), y el bosque muy húmedo (o nublado) montano. Se recolectaron 325 especies de 235 géneros y de 85 familias. Los factores ecológicos principales, incluyendo la precipitación, la temperatura, el suelo, y la historia de alteración, se tratan en relación a la vegetación en cada zona estudiada. El endemismo varía mucho entre los sitios: de muy bajo nivel de 9% del bosque árido hasta 48% de la sabana del pino arriba en la sierra.

The flora of Hispaniola is the least known of any in the Antilles. It provides both an excellent example of the rapidly disappearing tropical forest and an opportunity to examine altitudinal zonation of vegetation. For these reasons, a floristic study in the Dominican Republic was undertaken. A study area in the Province of Pedernales on the southern slope of the Sierra de Baoruco was chosen for several reasons. Reports of the area's high endemism and unusual edaphic conditions suggested an interesting flora. Also, the region has been historically one of the least accessible and least populated regions of the Dominican Republic, and Alcoa Aluminum, which leased (until 1984) the land upon which the study sites were located, prohibited settlement on the property, so relatively low levels of disturbance were anticipated and found. Not the least important was the ease with which a

transect of the mountains could be observed due to their relative steepness, and thus short distances involved, and the excellent sea level to 1400 m paved road built by Alcoa. Ecological information was recorded in the study sites and gathered from the literature, and the species present in the various elevational zones (as represented by the study plots) were enumerated. These species lists were used to provide quantitative estimates of endemism and elevational distribution within the study area.

A brief summary of the botanical exploration of Hispaniola may be found in Moscoso (1943) and Jiménez (1985).

### **General Description of Study Area and Collection Methods**

The study area was located in the southwestern portion of the Dominican Republic, Prov. Pedernales, on the southern slope of the Sierra de Baoruco and the adjacent peninsular coastal plain. The mountains intercept the prevailing north-easterly trade winds and cause wide variation in precipitation. The entire southern peninsula is sparsely populated and is maintained as open range throughout. The study sites were located on land leased by Alcoa Aluminum. Alcoa had controlled the property since the 1940's when it was inaccessible and nearly unpopulated. The company prohibited public access to the road leading from Cabo Rojo to their main mine operations at an elevation of about 1500 m, some 45 km to the north. Thus, except for the strip mines and presence of occasional grazing animals, the area was relatively undisturbed. However, fires are frequent in the pine forests. The undisturbed nature of the region's vegetation and the easy access to a wide variety of habitats made the region ideal for a floristic study. Five sites were chosen to best represent the range of variation in vegetation types along the altitudinal gradient upon arrival in the area in early July of 1982 (Figures 1 and 2). At the first two sites central stations were established and the vegetation sampled in all directions from these stations, covering an area slightly greater than one hectare. The same technique was followed for site 4, except that a larger area was covered (ca. 5 hectares) due to its greater diversity. For sites 3 and 5 the vegetation was sampled in the forest adjacent to the road and footpath, respectively, for ca. 2 km. Three to six days of intensive collecting were spent on each site. Preliminary identifications were made at the University of Florida using published floras and checklists (see introduction to checklist) and confirmed by comparison with specimens at the New York Botanical Garden. Several identifications were provided by Dr. Thomas A. Zanoni, based on material at the herbarium of the Jardín Botánico Nacional, Santo Domingo. Voucher specimens are located at the herbarium of

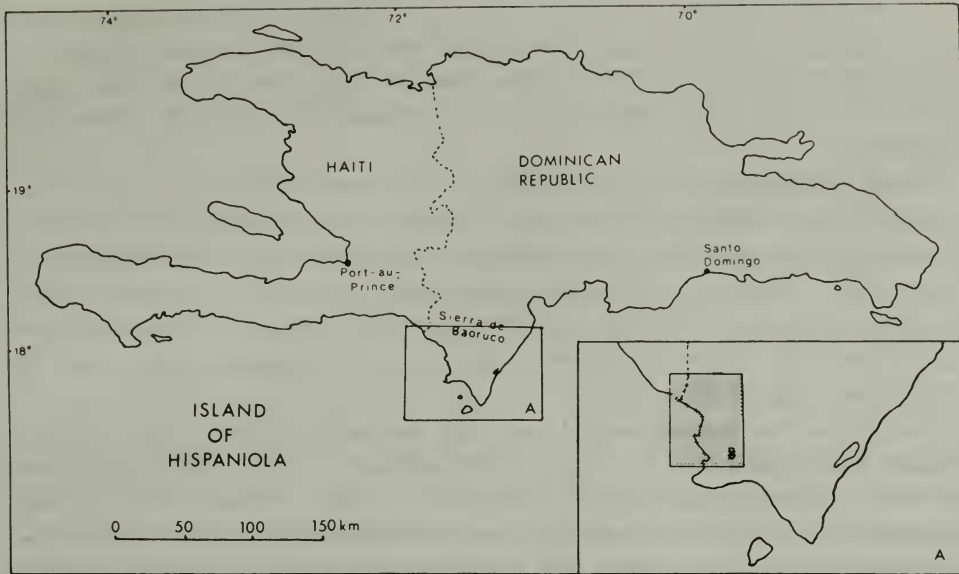


Fig. 1. The island of Hispaniola. Shaded area of inset contains the study sites and is enlarged in Figure 2.

the University of Florida, Gainesville, FL (FLAS) and the herbarium of the Jardín Botánico Nacional, Santo Domingo (JBSD).

### Description of Vegetation and Ecology of Study Sites

The study sites are described in order from low to high elevation. The Holdridge system of vegetation classification (Holdridge, 1964) was used because it has been applied successfully in the most recent ecological discussion of the Dominican Republic (Union Panamericana, 1967) and, since its units are determined empirically, it is believed to most objectively allow comparisons between different vegetation zones. Reference will also be made to Beard's (1955) system, since it has been used most frequently in describing Antillean vegetation. Other useful vegetation classifications are found in Howard (1973) and Ciferri (1936). An annotated bibliography of the vegetation and flora of Hispaniola is available in Zanoni et al. (1985).

*Site 1: Subtropical Thorn Woodland.* The main study site, i.e., site 1a in Figure 2, was located at 60 m in elevation about 0.5 km east of the road to Las Mercedes and about 7 km from Pedernales. Additional collections were also made adjacent to the Alcoa Exploration Company residential buildings

at Cabo Rojo, near the coast, i.e., site 1b in Figure 2. In the first area mangrove vegetation (which was not sampled) extends some distance inland, so a site was chosen about 2 km from the coast, while, in the second, a limestone cliff with cacti and thornwoodland vegetation rises directly above the shoreline.

Mean temperatures in Azua (also on the south coast near sea level), area 28.5°C in August and 25.0°C in January (Union Panamericana, 1967). Biotemperature, as used in the Holdridge scheme, disregards all temperatures above 30°C. Thus, the biotemperature at site 1 would be somewhat lower than the figures given above, and the region falls into the subtropical zone just above the tropical/subtropical division in Holdridge's diagram of life zones (Holdridge, 1964).

Rainfall in the area of site 1 has been estimated to be below 750 mm (Union Panamericana, 1967) and below 500 mm (Ciferri, 1936). As is true in most areas of the subtropics, the rainfall is highly seasonal. There are two rain maxima, in May-June and again in September-October. The interim two summer months are not very dry, but the period from December to March is exceedingly so. It is likely that in no month does rainfall exceed potential evapotranspiration.

The topography of the peninsular lowlands is distinctive. A series of broad, flat plains, which continue unbroken for many miles, is punctuated by a series of rocky steps. Sites 1a and 1b are located on the plains rather than on the sparsely vegetated cliffs.

The soils, if a soil cover exists, are primarily skeletal lithic torriothents (Comprehensive Resource Inventory and Evaluation Systems (CRIES), 1977). Depth to the bedrock, which is hard coral limestone, is mostly less than 50 cm. The soils are extremely stony, have a clay texture, are excessively drained, and have very low available water capacity. They have a pH range of 7.7 to 8.9 and an average of 8.4 (Santiago, 1982). At alkaline conditions such as these, the solubility of nearly all micronutrients is reduced, and phosphate, which averages 20 p.p.m. (Santiago, 1982), is unavailable (Donahue et al., 1977). Very little organic matter is present, and there is essentially no surface litter. In many areas the coral limestone bedrock is exposed. This limestone has a rough irregular upper boundary with abundant solution holes and fractures, which has earned it the name dogtooth limestone elsewhere in the Caribbean (Howard & Briggs, 1953). Site 1a consists entirely of soil, but in the coastal site (1b), exposed dogtooth limestone predominates. Several taxa appear to be limited essentially to the exposed limestone areas, such as *Capparis cynophallophora*, *Capraria biflora*, *Cordia ignea*, *Echites umbellata*, *Plumeria obtusa*, *Harrisia nashii*, *Leptochloopsis*



*virgata*, and *Urechites lutea*.

Sites 1a and 1b are not very diverse floristically and contain only 35 species of tracheophytes (of which ca. 18% are endemic to Hispaniola). Members of the Cactaceae, Fabaceae and Euphorbiaceae are common. At site 1a a single species, *Acacia macracantha*, makes up over 50% of the cover. Other common to very common trees are *Capparis ferruginea*, *Guaiacum officinale*, *Haitiella ekmanii*, *Metopium brownei*, *Opuntia moniliformis*, and *Phyllostylon brasiliense*; common shrubs include *Croton origanifolius*, *C. discolor*, and *Lippia alba*. The succulents, *Agave brevipetala*, *Cephalocereus polygonus*, *Harrisia nashii*, *Melocactus communis*, *Opuntia caribaeae*, and *Opuntia dillenii*, are also conspicuous. In the coastal site no one species dominates, but *Metopium brownei*, *Plumiera obtusa*, and *Capparis cynophallophora*, as well as many of the species from the main site are common. The small trees and shrubs are widely spaced, without forming a closed canopy, and mostly limited to three to five meters in height. The most diagnostic feature of this community, and the main basis for separating sites 1 and 2, is the abundance of cacti. Six species were identified in the study plots, and *Mammalaria prolifera* (Mill.) Haw. was seen nearby. Xeric adaptations such as small, thick leaves or dense pubescence are frequent; spinyness is also very obvious.

Holdridge (1964) classified this vegetation as subtropical thorn woodland, but noted that this may be due to edaphic factors since the estimated quantity of rainfall would qualify this area for dry forest. Thus, in this case, the classification is based on observations of the vegetation itself and not on a known rainfall value. Rainfall may be slightly lower than in site 2 due to coastal effects, but no rainfall measurements have been made in the peninsula south of Pedernales. Observations of the authors suggest that desiccating daily afternoon winds, which are very strong near the coast, would compound the effective dryness caused by soil with poor water-holding ability and result in a habitat substantially dryer than rainfall alone would suggest. In Beard's (1955) system of classification the vegetation falls between typical thorn woodland and cactus scrub formations in the seasonal formation series. In most general descriptions of this vegetation type, e. g., Howard (1973), it is known as thorn scrub. This title would also be applied to site 2, and thus may not be sufficiently discriminating. Although the 25% coefficient of community similarity between sites 1 and 2 is significantly higher than that of any other two sites, it is small enough that they probably should be considered distinct floristically. However, the same species of *Acacia* is dominant in both, and they are quite similar ecologically.

*Site 2: Subtropical Dry Forest.* The second study site also contains two subsites as indicated in Figure 2. The main site, upon which specimens of

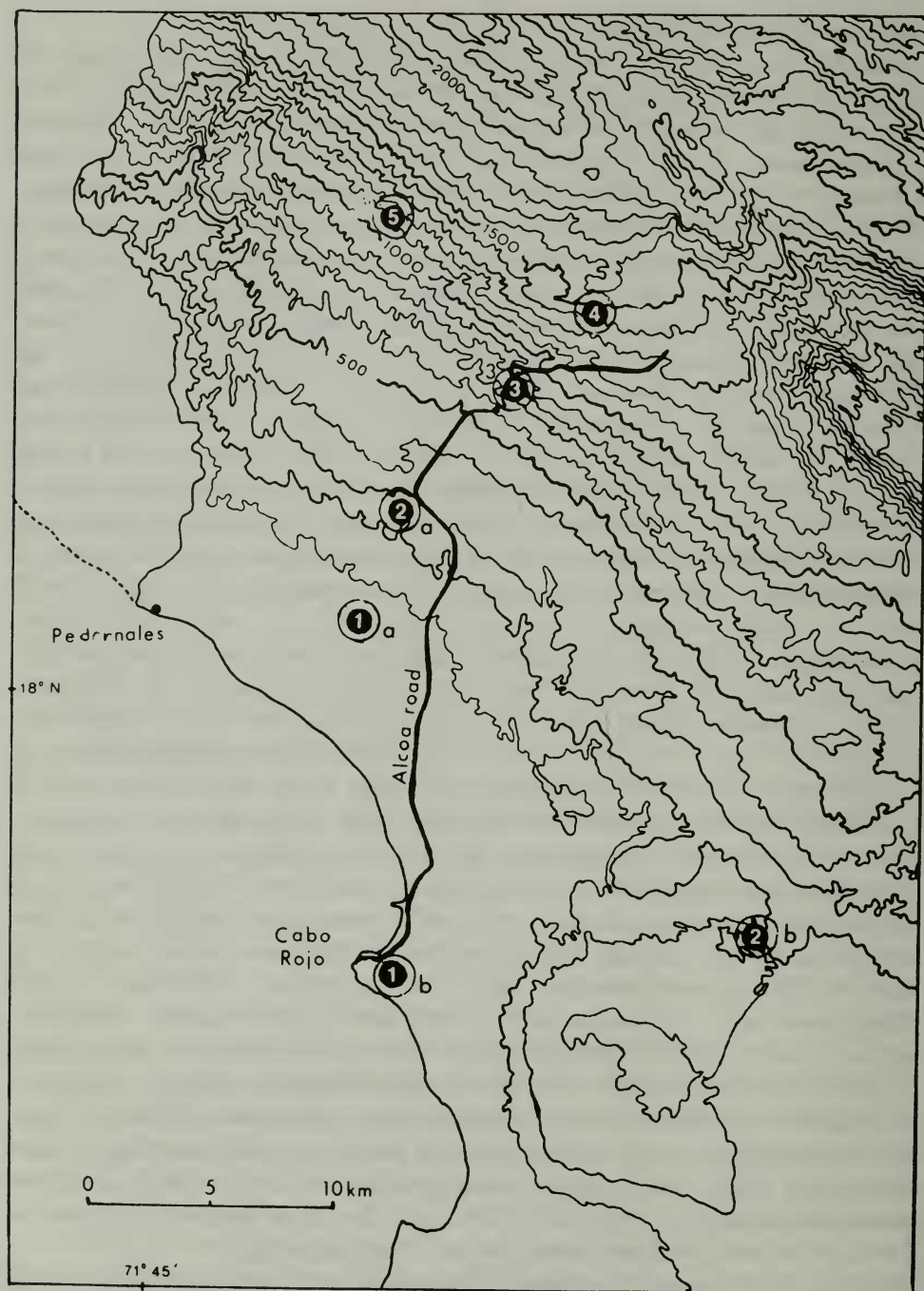


Fig. 2. Location and elevation of the study sites.

nearly all species present were collected, was located at 245 m elevation on the road to Las Mercedes, about 1 km south of the village (2a in Figure 2). Collections were also made of those species unique to a second site (2b in Figure 2) at 215 m elevation along the main road linking Barahona and Pedernales, about 25 km east of the latter (vicinity of Loma El Guano).

Temperature at this elevation is not significantly different from that of the first site. However, rainfall is greater, primarily due to the distance from the coast, and has been estimated to be between 750 and 1000 mm per year (Union Panamericana, 1967). Its annual distribution is undoubtedly very similar to that of site 1. Two other factors in addition to the higher annual rainfall combine to produce an effectively wetter habitat. The first is the vegetation itself; especially in the main site, the canopy is essentially closed and provides a substantial degree of shade. Several herbaceous species appear to be limited to these shaded areas. The second factor is wind velocity; the extremely high afternoon winds were not observed here, especially under the canopy.

The topography in site 2 consists of gently sloping terrain with occasional steep cliffs. As in site 1, the main site (2a) was on soil, whereas the subsite (2b) consists of bare, eroded dogtooth limestone. The soil appears very similar to that of site 1, and the available soil maps (CRIES, 1977; Union Panamericana, 1967) do not differentiate the soils of sites 1 and 2.

Floristically site 2 is slightly more diverse than site 1 (45 vs. 35 species; ca. 9% of these endemic to Hispaniola) and contains a greater diversity of life forms. Malvaceae, Euphorbiaceae, and Fabaceae are the most abundant families both in number of species and number of individuals. In disturbed areas, the leguminous species *Acacia macracantha*, *Prosopis juliflora*, and *Cassia atomaria* from a fairly open canopy three or four meters in height. In presumably less disturbed areas two other trees, *Capparis ferruginea* and *Zizyphus rignoni*, are also common, and the canopy is generally taller and less even. The tallest species in the study plots, *Zizyphus rignoni*, reaches ca. ten meters and occasional emergent individuals of *Bursera simaruba* were seen outside the study plots. Other common trees include *Cameraria angustifolia*, *Cordia buchii* and *Plumeria obtusa*, the first two essentially limited to limestone outcrops. Common shrubs include: *Abutilon abutiloides*, *Comocladia dodonaea*, *Croton ciliato-glanduliferus*, *Cryptorhiza hatiensis*, *Guaiaecum sanctum*, *Hybanthus havanensis*, *Lantana camara*, and *Turnera diffusa*. Vines are common, as is the herb, *Callisia repens*. Plants with spines are nearly absent from the less disturbed areas of the main site.

This area would be classified as subtropical dry forest in the Holdridge scheme (1964). The vegetation is slightly less developed than that typical

of this life zone due to the poor soils and history of disturbance, and approaches thorn woodland vegetation in the most disturbed areas and in localities with exposed limestone substrate. The vegetation in the less disturbed main site would probably be classified in Beard's (1955) system as deciduous seasonal forest or dry evergreen woodland.

The thorn woodland of sites 1 and 2 is the most common lowland formation in the Antilles (Howard, 1973). Despite being so widespread, ecological questions remain concerning its status as a natural climax community (see Johannessen, 1963; Asprey & Robbins, 1953; Seifriz, 1943; Howard & Briggs, 1953). The percentage of endemics in these sites is not high, and most of these endemic species appear to be limited to the dogtooth limestone outcrops. The flora on the dogtooth limestone of sites 1b and 2b is likely a stable climax community, but the *Acacia* dominated main study sites probably represent a secondary reduction from more diverse dry forest similar to the denser forested areas of site 2.

*Site 3: Subtropical Moist Forest.* At the third site collections were made in the forest adjacent to the Alcoa road from 620 to 900 m in elevation. Collecting was concentrated in the middle of this range, which was from 700 to 800 m at kilometer 22 and 23 on the Alcoa road.

Assuming a lapse rate of 6°C per km, mean temperatures at 750 m elevation are about 24°C in August and 21.5°C in January. Annual precipitation averages 1100 to 1250 mm per year (Union Panamericana, 1967). It is likely that for six to seven months precipitation exceeds evapotranspiration, and the area is effectively wet.

It is in this region of the mountains that elevation changes most abruptly; the topography is steep and rocky throughout. Average slopes range from 15 to 30% and higher (CRIES, 1977). Exposed Eocene limestone bedrock outcrops are more abundant than soil covered areas, and the limestone is eroded into numerous deep pits, many of which are filled with leaf litter. The soils are typic and paralithic Ustropepts. These soils are somewhat excessively drained, rocky, and have a clay loam texture nearly uniform with depth (CRIES, 1977). They have an average pH of 7.4 and an average organic matter content of 3.5%.

The study site supports a well-developed diverse forest of 72 species. No single canopy tree is dominant although *Prunus myrtifolia* and *Ficus citrifolia* are locally very abundant. Other common trees include: *Catalpa longissima*, *Cecropia peltata*, *Cupania americana*, *Guarea guidonia*, *Gyrotaenia myriocarpa*, and *Wallenia apiculata*. Common shrubs or small trees are *Hamelia patens*, *Heterotrichum angustifolium*, *Piper aduncum*, *P. amalago*, *Psychotria nervosa*, *P. pubescens*, *Rytidophyllum leucomallon*, and



*R. auriculatum*. The canopy is typically about 20 m high with much variation due to steep slopes and emergents. Woody species predominate and vines are common. Only three epiphytic species were seen, and all are rare. Although no one family is dominant, the following have three to five species in the flora at this site: Bignoniaceae, Rubiaceae, Polypodiaceae, Fabaceae, Urticaceae, Orchidaceae, Poaceae, and Piperaceae. Endemism is not particularly high (ca. 15% ) and several introduced species are common, especially *Senna spectabilis*, which dominates the forest margin. Spiny and/or succulent species are rare, and leaves tend to be larger than in the previous two sites.

The area is classified as subtropical/premontane moist forest by holdridge (Union Panamericana, 1967). In Beard's (1955) system it would probably be considered semi-evergreen seasonal forest.

*Site 4: Subtropical Lower Montane Moist to Wet Forest (Pine Savanna).* The fourth study site was located in the pine savanna at 1400 to 1500 m elevation, about 3 km west of the end of Alcoa's paved road (north of Aceitillar).

Temperature here is much lower than at the previous sites. Mean January temperatures of 4.4° to 8.3°C with occasional frosts have been recorded at 1675 m in Haiti (Pedersen, 1953). In winter, extratropical circulation systems often reach into the Caribbean (Lauer, 1973), and lend an unpredictability to winter weather in the mountains. Mean annual temperature is probably about 15°C, which places the area in the lower montane zone of Holdridge's scheme (1964).

Rainfall averages about 1700 mm per year (Union Panamericana, 1967). This is nearly twice as great as the annual potential evapotranspiration. In addition, afternoon clouds descend to ground level much of the year, some of which condense on the vegetation and ground, thus increasing total moisture. However, due to exposure the pine savanna lacks the moister subcanopy microhabitat of broadleaved forests.

The red soil of the pine savanna is extremely high in aluminum and iron oxides (Goldrich and Berquist, 1947). The soils have been classified as paralithic and typic Eutropepts, are well drained, have very low available water capacity, and a clay loam texture nearly uniform with depth (CRIES, 1977). They have an average pH of 6.7 and an average of 4% organic matter. Although soil fills the valleys and flat areas to considerable depths, ridges and slopes have exposed limestone. These are often covered with pine litter, but bare rock is common. The terrain on which the pine savanna occurs is mostly gently rolling hills with occasional steeper slopes and ravines.

As the name implies, the zone is an open windswept community dominat-

ed by a single tree species, *Pinus occidentalis*, with a continuous grass, herb, and shrub layer beneath. Eighty two species were collected on the study site. The pines are widely spaced (ave. ca. 10 m between trees), allowing much light to reach the ground layer, and are mostly less than 40 cm in diameter and 15 m in height. Regeneration seems to be common, even on unreclaimed mine sites. The only other common tree in the open savanna is the palm *Coccothrinax scoparia*, but several small trees, including *Weinmannia pinnata*, *Clusia clusioides*, and *Garrya fadyenii* occur in ravines. *Agave antillana* is common, especially in rocky areas. Herbs are abundant (ca. 80% of species); the grasses *Andropogon glomeratus*, *A. urbanianus*, *Schizachyrium gracile*, *Triodia eragrostoides*, *Tripsacum dactyloides*, and *Panicum aciculare* and a sedge, *Bulbostylis subaphylla* dominate the landscape, although patches of *Pteridium aquilinum* and many other herbs are also common (especially *Borreria verticillata*, *Chamaesyce thymifolia*, *Gnaphalium eggersii*, *Hieracium gronovii*, and *Polygala crucianelloides*). Among the shrubs two types appear more or less equally abundant, those upright to a height of ca. 0.5–1.5 m, e.g., *Cestrum brevifolium*, *Chamaescrista glandulosa* var. *picardae*, *Coreopsis buchii*, *Eupatorium illitum*, *Hypericum hypericoides*, *Lyonia truncata*, *L. microcarpa*, *Myrica picardae*, *Senecio picardae*, and *Sophora albopetiolulata*, and decumbent or very diminutive shrubs usually less than ca. 0.3 m in height, e. g., *Bumelia repens*, *Ilex tuerckheimii*, *Forestiera selleana*, *Gesneria pulverulenta*, *Lippia domingensis*, *Vernonia fruticosa*, and *Rondeletia* sp. The orchids, two of which are very common (*Tetramicra ekmanii* and *Spiranthes torta*), are all terrestrial. Members of the Asteraceae and Poaceae are especially diverse in this community. About 48% of the species collected on the study site are endemic to Hispaniola; this is nearly three times as great as that of the preceding three sites and slightly greater than that of the fifth site. This high endemism may be explained by the fact that the high elevation forests of Hispaniola are basically a series of biological islands, and thus promote isolation and speciation. Edaphic factors also may contribute to the region's high endemism since the soil is highly lateritic and high in aluminum and iron.

The study site is classified as lower montane moist forest in Holdridge's (1964) system. At higher elevations (above 2000 m) similar pine savanna occurs in the montane wet forest life zone. According to Beard (1955), montane pine forest should be considered a fire-climax derived from montane hardwood forest. He believed that the high elevation pinelands of Hispaniola are not true savannas because the grasses are not dominant ecologically, but that true pine savanna does occur at lower elevations. This distinction is probably not meaningful since grasses are certainly abundant

and the pines are quite open at many high elevation localities. Howard (1973) considered the pinelands of Hispaniola as a variation of montane sclerophyll vegetation.

The problem is caused by the fact that savannas are not a true climatic climax since similar climates can and do support hardwood forests. Considerable controversy exists over the factors that control the presence of savannas, Koeppen (1931) stressed the importance of climatic factors, i.e., high but unevenly distributed rainfall along with an impermeable hardpan layer in the soil. Although the rainfall statistics fit the study area, a hardpan is not present and the soils are well drained with little water holding ability. Beard (1953) observed that most savannas in northern tropical America occur on mature, oligotrophic soils. Although it is true that the pine savanna soils are oligotrophic neither Beard's nor Koeppen's factors are sufficient, since Holdridge (1942) observed that if the pinelands were prevented from burning, hardwood forest would eventually succeed the pines. Further controversy exists over the role of humans, especially aboriginal peoples, in setting fires and thus inducing savannas. Denevan (1961) considered the upland pines of Nicaragua to be primarily human induced, however, as pointed out by Chardon (1941), the pinelands of Hispaniola are ancient geologically (as suggested by the present level of endemism) and occupy vast areas of high uninhabited mountains. Sarmiento and Monasterio (1975), in their review of the environmental conditions associated with savannas in tropical America, concluded that a holocenotic interpretation was required. First, savannas will not occur if rainfall is either too little, too great, or too evenly distributed. Second, although oligotrophic soils tend to support savannas, the presence of a savanna contributes to oligotrophy since litter is not incorporated into the soil, but instead is consumed by fire. Third, fire is a critical factor in eliminating hardwoods and encouraging pine regeneration. They argue that many to most savannas are not human-induced ecosystems and that those that are may be recognized readily by the prevalence of weedy, introduced species. If this is true, then the study site is a natural savanna since only ca. 2% of the species are non-native, and, as mentioned above, the area supports a large number of endemics.

*Site 5: Premontane Wet Forest.* The last site, which is known locally as Las Abejas, is located about 10 km west of the end of Alcoa's paved road at 1100 to 1200 m elevation. Unquestionably the most dramatic of the sites, it consists of a deep ravine, which descends abruptly from the pines. The area is occupied by an epiphyte-rich, diverse hardwood forest.

Mean temperatures of ca. 18°C in January and 21.5°C in July would be expected based on a 6°C lapse rate. In the humid, heavily shaded microhabi-

tat under the dense canopy temperatures are moderated, and frost is not known to occur. Union Panamericana's (1967) rainfall map shows that the area receives an amount (1700 mm) equivalent to site 4. In addition, sub-surface and surface flow contribute to the total rainfall. Since dense clouds descend into the ravine almost every afternoon, at least in summer, condensation also makes a sizeable contribution to total moisture. In fact, the vegetation exhibits abundant epiphytes and festooning bryophytes typical of cloud or mist forest.

Edaphic conditions vary greatly. Nearly vertical limestone cliffs occur on the sides of the ravine, whereas the floor of the ravine shows thick accumulations of organic matter over a base of red lateritic soil like that of the pinelands.

As is typical in wetter tropical forests, the vegetation is very diverse. In the relatively small area contained in the Las Abejas study site, 132 species of vascular plants were collected; ca. 31% of these are endemic to Hispaniola. Common trees and shrubs include: *Alsophila woodwardioides*, *Ardisia angustata*, *Bernardia tenuifolia*, *Brunellia comocladifolia*, *Cestrum coelophlebium*, *Cupania americana*, *Dendropanax arboreus*, *Gomedesia lindeniana*, *Guarea guidonia*, *Hamelia patens*, *Mecranium amygdalinum*, *Meriania involucrata*, *Miconia ferruginea*, *M. laevigata*, *M. lanceolata*, *Myrcia splendens*, *Myrsine coriacea*, *Nectandra patens*, *Ossaea barahonensis*, *Piper arboreum*, *P. confusum*, *Prestoea montana*, *Psychotria berteriana*, *P. liogieri*, *P. pubescens*, *Rhamnus sphaerosperma*, and *Trema micranthum*. Lianas are very abundant. Although ferns make up the greatest percentage of terrestrial herbaceous species (see checklist), several angiosperms are also abundant. These include *Pilea leptogramma*, *Peperomia pellucida*, *Campelia zanonii*, and *Ichanthus axillaris*. The most distinctive feature of this site is the abundance of epiphytes. These include orchids, ferns, bromeliads, species of *Peperomia*, and *Rhopsalis baccifera* (see checklist). In addition to tracheophytes, mosses and liverworts are both diverse and very abundant. The most diverse family is the Polypodiaceae, followed by Piperaceae, Orchidaceae, Solanaceae, Melastomataceae, Rubiaceae, Asteraceae, Urticaceae, and Myrtaceae.

The area likely falls within the premontane wet forest type, although the Las Abejas ravine, because of its small size, is not distinguished from the surrounding pine savanna on the Holdridge map (Union Panamericana, 1967). It may be further classified as a cloud forest type of atmospheric association due to frequent fog and mist. Beard (1943) characterized similar zones as montane lower montane rain forest, moist forest, or cloud forest. Howard (1973) considered such forests under the broad category of montane



sclerophyll. Edaphic factors are probably very important in controlling distinctions between montane wet forest types (see Grubb and Tanner, 1976; Tanner, 1977). The ravine (unlike the surrounding uplands) is protected from wind and fire, and has somewhat more moisture due to runoff; thus it is dominated by broadleaf trees instead of pines.

### Results and Conclusions

A total of 325 species, 235 genera and 85 families (including 31 ferns, 2 conifers, and 292 angiosperms) was collected (or in a few cases, recorded) in the various study sites. Families with ten or more species included: Polypodiaceae (29 spp.), Orchidaceae (19), Asteraceae (19), Rubiaceae (16), Piperaceae (15), Poaceae (14), Fabaceae (13), Urticaceae (11), Solanaceae (11), and Apocynaceae (10). Thirty five species were recorded from site 1, 45 from site 2, 72 from site 3, 82 from site 4, and 132 from site 5. Species diversity increases with elevation, i. e., from site 1 to 5. Las Abejas (site 5) derives mucho of its diversity from epiphytic and terrestrial herbaceous species; the high diversity of the pine savanna is surprising, especially since it consists almost entirely of herbs and shrubs. As shown in Table 1 the sites are distinct floristically. Greatest similarity is seen between sites 1 and 2, followed by sites 3 and 5, and sites 2 and 3.

Changes in the relative abundance of plant families are also correlated with site. Cactaceae, Fabaceae, Euphorbiaceae, and Malvaceae dominate the first two sites, whereas Rubiaceae, Bignoniaceae, and Urticaceae are common in the mid-elevation moist forest. Asteraceae, Poaceae, Fabaceae, and Rubiaceae are well represented in site 4, while Polypodiaceae, Orchidaceae, Solanaceae, Rubiaceae, and Melastomataceae dominate site 5. Canopy height increases in the order of site 1, 2, 4, 3, 5. Succulents are abundant and herbaceous species nearly non-existent in site 1. Herbs are still rare in site 2, but site 3 contains plants with a diversity of habits. A diverse range of habits also characterizes site 5, and epiphytes are especially abundant. Small-leaved species predominate in sites 4, 1, and 2, while larger leaved plants characterize sites 3 and 5.

The zonation observed in the Sierra de Baoruco has as its first order cause the major gradients in soil characters, temperature, and rainfall. The soils are somewhat unfavorable to plant growth in all zones, but especially in sites 1, 2, and 4. Soil pH changes fairly regularly with elevation, decreasing from ca. 8 to 6.5 as elevation increases. In addition, fire in site 4 reduces soil organic matter, and the cool, humid atmosphere and dense vegetation of site 5 results in the accumulation of a peat-like soil in places. The complete

lack of soil in the subsites of sites 1 and 2 is probably the major reason for the occurrence of several distinctive species in these plots. Temperature decreases regularly as elevation increases except at the highest elevations which are affected by extra-tropical frontal systems. The direct results of temperature may only be limiting factors in the pine savanna (site 4), where frosts occur, thereby eliminating many tropical species from competition with the pines. Indirectly, however, temperature exerts an influence since potential evapotranspiration is a direct function of temperature.

The moisture gradient is more complex. Although rainfall increases regularly as elevation increases, complicating factors are soil water-holding ability (which is least in sites 1, 2, and 4), lateral flow (which augments rainfall in site 5), potential evapotranspiration differences, the frequent occurrence of fog and mist at higher elevations (as in site 5), and wind velocity (which increases the evaporative power of the air, especially in site 1, but also in site 4). The nature of the vegetation also effects the moisture gradient in that a more humid microhabitat exists under the closed canopies of sites 3 and 5, and to a lesser degree of site 2. In addition, the history of disturbance in sites 1 and 2 has resulted in changes in their vegetation, the magnitude of which is unknown. Fire in site 4 results in a syndrome of vegetational adaptations and severely limits the spread of hardwood species into the pine savanna.

The physical and human induced changes mentioned above are correlated with vegetational changes. For convenience, these vegetational changes are often categorized as a series of zones. The zones actually consist of hundreds of different individual species' ranges that are correlated only where a sharp discontinuity in the physical environment exists. For the study area, this is found only between the pine savanna and the moist hardwood forest of the Las Abejas ravine. Here the transition area is very narrow, whereas elsewhere broad overlaps between designated types are present. By selecting a series of five widely separated study sites (Figure 2), the inherent problems in determining the boundaries of vegetational zones were avoided in this study.

One of the most useful aspects of the Holdridge (1974) system of vegetation classification is that it actually uses the two most important aspects of the physical environment, rainfall and temperature, and thus avoids the problems caused by non-correlated species ranges. The system works especially well for sites 2 and 3. However, the pine savanna of site 4 includes three different life zones (lower montane moist forest, lower montane wet forest, and montane wet forest). Despite this fact it appears relatively homogeneous because the edaphic factors of fire and soil conditions probably are most

TABLE 1. Floristic comparison of the five study sites (values = percent similarity).

	site 1	site 2	site 3	site 4	site 5
site 1	*				
site 2	25.0	*			
site 3	1.9	5.4	*		
site 4	0	0.8	1.3	*	
site 5	0	0.6	6.2	1.9	*

important in determining vegetation at this site. For sites 1 and 5, either rainfall data are not adequate or other factors influence the vegetation to a degree, making classification difficult. Also disturbance (as in sites 1 and 2) commonly results in a vegetation type more typical of the adjacent drier life zone.

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### Checklist

The following is a list of all vascular plant species collected by the authors in the study sites described in the preceding chapter. The sequence, rank, and delimitation of taxa in the Filicepsida follows that used by Proctor (1977). For the Angiospermopsida, the classification scheme of Thorne (1983) was followed with some slight modifications (R. Thorne, pers. comm.). For each species the following information is given: name, site number(s), Fisher-Meerow collection numbers (unless stated as *Judd*), frequency, and habit. (Species are assumed to be terrestrial unless stated otherwise.) Voucher specimens have been deposited at the herbarium of the University of Florida, Gainesville (FLAS) and the herbarium of the Jardín Botánico Nacional, Santo Domingo (JBSD).

In addition to relevant monographs and revisions, the following references were consulted for identification and distribution: Barker & Dardeau (1930), Moscoso (1943), Jiménez (1966), Liogier (1978, 1981, 1982, 1983, 1985), Adams (1972), León (1946), León & Alain (1951), Alain (1953–1957, 1963), Correll & Correll (1982), Britton & Millspaugh (1920), Britton & Wilson (1923–1926), Howard (1974–1979), Long & Lakela (1976), Urban (1898–1928), and Hitchcock & Chase (1936). Since relatively few families are covered in Liogier's flora of Hispaniola (1981, 1983, 1985) and Moscoso's flora (1943) lacks keys and descriptions, the identity of endemic and difficult species was determined by comparison with specimens at the New York Botanical Garden.

#### FILICOPSIDA

##### Schizaeaceae

*Anemia adiantifolia* (L.) Sw. Site 4: *Judd 1492*; occasional herb.

##### Cyatheaceae

*Alsophila woodwardioides* (Kaulf.) Conant. Site 5: *912*; common tree.

##### Polypodiaceae

*Anopteris hexagonia* (L.) C. Chr. Site 5: *815*; occasional herb.

*Asplenium auritum* Sw. Site 5: *604*; common epiphytic herb.

*Asplenium cristatum* Lam. Site 5: *864*; occasional herb.

- Asplenium myriophyllum* (Sw.) Presl. Site 5: 846, 866a; common herb.  
*Asplenium radicans* L. Site 5: 915; occasional herb.  
*Asplenium serra* Langed. & Fish. Site 5: 863; rare herb.  
*Asplenium trichomanes-dentatum* L. Site 5: 866b; occasional herb.  
*Dennstaedtia globulifera* (Poir.) Hieron. Site 5: 914; occasional herb.  
*Didymochlaena truncatula* (Sw.) J. Smith. Site 5: 867; very common herb.  
*Diplazium hians* Kunze ex Klotzsch. Site 5: 844; common herb.  
*Diplazium pectinatum* (Fée) C. Chr. Site 5: 854; uncommon herb.  
*Diplazium unilobum* (Poir.) Hieron. Site 5: 842; very common herb.  
*Elaphoglossum eggersii* (Baker) C. Chr. Site 5: 605; occasional epiphytic herb.  
*Lastreopsis effusa* (Sw.) Tindale var. *effusa*. Site 5: 865; rare herb.  
*Nephrolepis multiflora* (Roxb.) Jarrett ex Morton. Site 3: 770; occasional herb.  
*Odontosoria aculeata* (L.) J. Smith. Site 5: 904; common vine.  
*Polypodium consimile* Mett. Site 5: 843; occasional herb.  
*Polypodium crassifolium* L. Site 5: 848; common, primarily epiphytic herb.  
*Polypodium dispersum* A.M. Evans. Site 3: 738; common herb.  
*Polypodium heterophyllum* L. Site 3: 723; common vine.  
*Polypodium loriceum* L. Site 5: 600, 603; common epiphytic herb.  
*Polypodium phyllitidis* L. Site 3: 752; common herb.  
*Polypodium vulpinum* Lindman. Site 5: 602; occasional herb.  
*Pteridium aquilinum* (L.) Kuhn. Site 4: 652; very common herb.  
*Pteris longifolia* L. Site 3: 771; occasional herb.  
*Tectaria incisa* Cav. Site 5: 847; rare herb.  
*Thelypteris imitata* C. Chr. Site 4: 708, 661; occasional herb.  
*Thelypteris patens* (Sw.) Small. Site 5: 905; common herb.  
*Vittaria graminifolia* Kaulf. Site 5: 839; rare epiphytic herb.

#### CONIFEROPSIDA

##### Pinaceae

*Pinus occidentalis* Sw. Site 4: 687; very abundant tree.

##### Podocarpaceae

*Podocarpus aristulatus* Parl. Site 5: reported by T. Zanoni; occasional tree.

#### ANGIOSPERMOPSIDA

##### DICOTYLEDONEAE (ANNONIEAE)

##### ANNONIFLORAE

##### Lauraceae

*Licaria triandra* (Sw) Kostermans. Site 3: 616; occasional tree.

*Nectandra patens* (Sw.) Nees. Site 5: 615; occasional tree. Det. T. Zanoni.

##### Piperaceae

*Peperomia* cf. *alata* Ruiz & Pav. Site 5: 837, 853; common epiphytic herb.

*Peperomia glabella* (Sw.) A. Dietr. Site 5: 879, 939; common herb.

*Peperomia maculosa* (L.) Hook. Site 5: 860; rare herb.

*Peperomia magnoliifolia* (Jacq.) A. Dietr. Site 5: 878; common herb on limestone cliffs.

*Peperomia obtusifolia* (L.) A. Dietr. Site 3: 780; common herb on limestone cliffs

*Peperomia pellucida* (L.) Kunth. Site 5: 852; very common herb.

*Peperomia penicillata* DC. Site 5: 857; occasional epiphytic herb.

*Peperomia quadrifolia* (L.) Kunth. Site 5: 838, 937; common epiphytic or terrestrial herb.

*Peperomia rhombea* Ruiz & Pav. Site 5: 856; occasional epiphytic herb.

*Piper aduncum* L. Site 3: 765; very common, in openings and along roadside; site 5: 816; common roadside shrub.

*Piper amalago* L. Site 3: 734; common shrub.

*Piper arboreum* Aubl. Site 5: 870; common tree.

*Piper confusum* DC. Site 5: 612, 820; common shrub to small tree.

*Piper jacquemontianum* (Kunth) DC. Site 5: 855; occasional small tree.

*Lepianthes umbellatum* (L.) Raf. Site 5: 800; common shrub, along roadside and in openings.

##### Menispermaceae

*Cissampelos pareira* L. Site 2: 532; occasional; site 3: 730, 758; common; site 5: 801; common vine.

## Ranunculaceae

*Clematis barahonensis* Urb. Site 4: 897; occasional vine in ravine.

## Papaveraceae

*Bocconia frutescens* L. Site 4: 685; occasional; site 5: 797; common shrub, especially in disturbed openings.

## THEIFLORAE

## Theaceae

*Ternstroemia* sp. Site 5: reported by T. Zanoni; shrub.

## Aquifoliaceae

*Ilex tuerckheimii* Loes. Site 4: 601, 640; common shrub.

## Marcgraviaceae

*Marcgravia oligandra* C. Wr. ex Griseb. Site 5: 840; occasional vine.

*Marcgravia rectiflora* Triana & Planch. Site 3: 759; common vine.

## Clusiaceae

*Clusia clusioides* (Griseb.) D'Arcy. Site 4: 900; occasional, in ravine; site 5: 871; rare to occasional small tree.

*Clusia rosa* Jacq. Site 3: 745; occasional shrub.

*Hypericum hypericoides* (L.) Crantz. Site 4: 633; common shrub.

*Rheedia* sp. Site 5: reported by T. Zanoni; shrub.

## Ericaceae

*Lyonia microcarpa* Urb. & Ekm. Site 4: Judd 3012; occasional shrub.

*Lyonia truncata* Urb. var. *truncata*. Site 4: 650; occasional shrub.

## Sapotaceae

*Bumelia repens* (Urb. & Ekm.) Stream. Site 4: 649, 694; occasional shrub.

*Chrysophyllum oliviforme* L. Site 3: 755; occasional tree.

## Myrsinaceae

*Ardisia angustata* Urb. Site 5: 599; common tree or shrub.

*Myrsine coriacea* (Sw.) R. Br. ex Roem. & Schult. Site 5: 902; common tree.

*Wallenia apiculata* Urb. Site 3: 728; common tree.

## CHENOPODIIFLORAE

## Phytolaccaceae

*Phytolacca icosandra* L. Site 5: 819; occasional herb, along trail.

*Rivina humilis* L. Site 3: 715; occasional herb.

## Amaranthaceae

*Achyranthes aspera* L. Site 2: 540; occasional herb.

## Cactaceae

*Cephalocereus polygonus* (Lam.) Britt. & Rose. Site 1: 579; common shrub.

*Harrisia nashii* Britt. Site 1: 793b; locally common shrub.

*Hylocereus triangularis* (L.) Britt. & Rose. Site 3: 749; occasional scrambling vine.

*Melocactus communis* Link & Otto. Site 1: 948; locally abundant shrub.

*Opuntia caribaeae* Britt. & Rose. Site 1: 576; abundant shrub.

*Opuntia dillenii* (Ker-Gawl.) Haw. Site 1: 578; common shrub; site 2: not collected; rare, juveniles only.

*Opuntia moniliformis* (L.) Haw. Site 1: 577, 792; abundant shrub or small tree.

*Rhipsalis baccifera* (J. S. Mill.) Stearn. Site 5: 841; occasional epiphytic shrub.

## GERANIIFLORAE

## Zygophyllaceae

*Gualacum officinale* L. Site 1: 557; common; site 2: 515; occasional small tree.

*Guaiaacum sanctum* L. Site 1: 574a; occasional; site 2: 519; abundant shrub.

## Malphiaceae

*Stigmaphyllon angulosum* (L.) A. Juss. Site 3: 725, 768; site 5: 814; occasional vine.

*Stigmaphyllon emarginatum* (Cav.) A. Juss. Site 2: 574b; occasional; site 4: 888; rare vine.

## Polygalaceae

*Polygala crucianelloides* DC. Site 4: 635; common herb.

*Securidaca virgata* Sw. Site 3: 731, 762; occasional to common vine.



## CELASTRIFLORAE

## Celastraceae

*Maytenus reynosioides* Urb. & Ekm. Site 1: 556; occasional small tree.

*Schaefferia frutescens* Jacq. Site 2: 516; occasional tree.

## SANTALIFLORAE

## Loranthaceae

*Dendropemon haitiense* Urb. & Ekm. Site 2: 523; occasional epiphytic and parasitic shrub.

## Viscaceae

*Arceuthobium bicarinatum* Urb. Site 4: 625; occasional epiphytic and parasitic subshrub..

*Phoradendron mucronatum* (DC.) Krug & Urb. Site 1: 570; common epiphytic and parasitic shrub.

*Phoradendron trinervum* (Lam.) Griseb. Site 3: 739; occasional epiphytic and parasitic shrub.

## Balanophoraceae

*Scybalium jamaicense* (Sw.) Schott. & Endl. Site 5: 945; rare root-parasitic herb.

## VIOLIFLORAE

## Flacourtiaceae

*Samyda dodecandra* Jacq. Site 2: 547; occasional shrub. Det. T. Zanoni.

## MALVIFLORAE

## Sterculiaceae

*Melochia tomentosa* L. Site 1: 567; site 2: 546; occasional shrub.

*Waltheria indica* L. Site 4: 671, 892; uncommon herb or subshrub.

## Malvaceae

*Abutilon abutiloides* (Jacq.) Gareke. Site 2: 531; very common shrub, especially disturbed areas.

*Abutilon hirtum* (Lam.) Sweet. Site 2: 535; occasional herb.

*Bastardia bivalvis* (Cav.) Kunth. Site 2: 534; occasional herb.

*Hibiscus brasiliensis* L. Site 2: 575; occasional shrub.

*Sida acuta* Burm. Site 2: 536; abundant herb in open areas.

## Violaceae

*Hybanthus havanensis* Jacq. Site 2: 521; common; site 3: 753; occasional shrub.

## Passifloraceae

*Passiflora orbiculata* Cav. Site 5: 875; occasional vine.

*Passiflora rubra* L. Site 3: 757; occasional; site 5: 809, 834, 883; common vine.

## Turneraceae

*Turnera diffusa* Willd. Site 2: 545; common shrub.

## Cucurbitaceae

*Cayaponia americana* (Lam.) Cogn. Site 5: 798, 806, 941; common vine.

*Psiguria pedata* (L.) Howard. Site 3: 620; site 5: 935; occasional vine.

## Begoniaceae

*Begonia domingensis* DC. Site 5: 614; occasional herb.

## Capparaceae

*Capparis cynophallophora* L. Site 1: 710; site 2: 522, occasional shrub or small tree.

*Capparis ferruginea* L. Site 1: 560, 571; common; site 2: 513; very common shrub or small tree.

## Brassicaceae

*Cardamine africana* L. Site 5: 921; occasional herb.

## Ulmaceae

*Phyllostylon brasiliense* Capanema. Site 1: 573; common shrub.

*Trema micranthum* (L.) Blume. Site 5: 827; common tree.

## Urticaceae (incl. Moraceae, Cecropiaceae)

*Cecropia peltata* L. Site 3: 748; very abundant; site 5: 832; occasional tree, open areas.

*Ficus citrifolia* P. Mill. Site 3: 763; common tree.

*Ficus perforata* L. Site 3: 781; occasional tree on limestone cliff.

*Ficus trigonata* L. Site 3: 727; occasional tree.

*Gyrotaenia myriocarpa* Griseb. Site 3: 764, 733; occasional small tree.

*Phenax microcarpus* Urb. Site 5: 877, 906; common subshrub.

*Pilea inequalis* (Juss. ex Poir.) Wedd. Site 5: 919; common herb.

*Pilea lanceolata* (Lam.) Wedd. Site 4: 696; in ravine; site 5: 910; occasional herb

*Pilea leptogramma* Urb. Site 5: 611, 920; very common herb.

*Pilea microphylla* (L.) Liebm. Site 4: 693; occasional to common herb.

*Urera baccifera* (L.) Wedd. Site 3: 784; occasional shrub.

#### Rhamnaceae

*Colubrina arborescens* (Mill.) Sarg. Site 5: 924; common tree.

*Rhamnus sphaerosperma* Sw. Site 5: 903; common shrub or small tree.

*Zizyphus rignoni* Delp. Site 2: 520; common tree.

#### Euphorbiaceae

*Acalypha chamaedrifolia* (Lam.) Mull. Arg. Site 4: 697; occasional herb.

*Bernardia tenuifolia* Urb. Site 5: 934; common small tree.

*Chamaesyce thymifolia* (L.) Millsp. Site 4: 636, 638; common herb.

*Croton discolor* Willd. Site 1: 561a; site 2: 526; common shrub. Det. T. Zanoni (561a)

*Croton ciliato-glanduliferus* Ort. Site 2: 517; very common shrub. Det. T. Zanoni.

*Croton organifolius* Lam. Site 1: 561b; very common shrub.

*Dalechampia scandens* L. Site 3: 767; occasional vine.

*Drypetes lateriflora* (Sw.) Krug & Urb. Site 3: 719; occasional shrub to small tree.

*Jatropha gossypifolia* L. Site 1: 559; rare; site 2: 533; occasional shrub.

*Phyllanthus caroliniensis* subsp. *saxicola* (Small) Webster. Site 4: 637; occasional herb

#### RUTIFLORAE

##### Rutaceae

*Citrus aurantifolia* (Christm.) Swingle. Site 3: 714; occasional tree along roadside.

*Citrus aurantium* L. Site 5: 922; rare tree, near path.

*Zanthoxylum martinicense* (Lam.) DC. Site 3: 756; occasional to common tree.

##### Simaroubaceae

*Picramnia pentandra* Sw. Site 3: 621, 732, 736; occasional shrub to small tree.

##### Meliaceae

*Guarea guidonia* L. Site 3: 623; site 5: 862, 929; common tree.

*Trichilia pallida* Sw. Site 3: 619, 718; occasional shrub to small tree.

##### Burseraceae

*Bursera simaruba* (L.) Sarg. Site 2: not collected; rare shrub, emergent trees observed outside study site.

##### Anacardiaceae

*Comocladia cuneata* Britt. Site 3: 743; occasional tree.

*Comocladia dodonaea* (L.) Urb. Site 2: not collected; occasional shrub.

*Metopium brownii* (Jacq.) Urb. Site 1: not collected; common shrub to tree.

##### Sapindaceae

*Allophylus rigidus* Sw. Site 5: 826; occasional shrub.

*Cupania americana* L. Site 3: 760; common; site 5: 859; occasional tree.

*Dodonaea angustifolia* L. f. Site 4: 680; uncommon shrub.

*Serjania* sp. Site 2: 525; occasional vine.

##### Sabiaceae

*Meliosma* cf. *herbertii* Rolfe. Site 5: 872; occasional shrub or small tree.

##### Myricaceae

*Myrica picardae* Krug & Urb. Site 4: 704; common shrub.

##### Fabaceae

*Acacia macracantha* Humb. & Bonpl. ex Willd. Site 1: 563; abundant tree; site 2: 512; abundant tree; site 3: 742; occasional tree.

*Acacia skleroxyla* Tuss. Site 3: 724; occasional tree.

*Ateleia gummifera* (Bert.) D. Dietr. Site 4: 891; occasional shrub.

*Cassia atomaria* (L.) Irw. & Barn. Site 1: 569; occasional; site 2: 514, 554; very common shrub or small tree. Det. T. Zanoni.

*Centrosema virginianum* (L.) Benth. Site 4: 662; common vine.

*Chamaescrista glandulosa* var. *picardae* (Urb.) Irw. & Barn. Site 4: 630; common shrub. Det T Zanoni.

*Cracca caribaea* (Jacq.) Benth. Site 5: 858; uncommon vine.

- Desmodium ascendens* (Sw.) DC. Site 4: 586; occasional herb.  
*Pithecellobium circinale* (L.) Benth. Site 1: 562, 791; uncommon shrub.  
*Poitea galeoides* Vent. Site 4: 580; uncommon shrub.  
*Prosopis juliflora* (Willd.) DC. Site 1: 564; uncommon; site 2: 537; very common small tree.  
*Senna spectabilis* (DC.) Irw. & Barn. Site 2: 528; occasional shrub to small tree; site 3: 711; abundant tree, especially along road.  
*Sophora albo-petiulata* Leonard. Site 4: 632; occasional shrub.

## ROSIFLORAE

## Rosaceae

- Prunus myrtifolia* (L.) Urb. Site 3: 618, 735; abundant tree.

## Cunoniaceae

- Weinmannia pinnata* L. Site 4: 658; common tree in ravines.

## Brunelliaceae

- Brunellia comocladifolia* subsp. *domingensis* Cuatr. Site 5: 911; common tree.

## MYRTIFLORAE

## Melastomataceae

- Heterotrichum angustifolium* DC. Site 3: 582; common shrub.  
*Mecranium amygdalinum* (Desr.) C. Wr. Site 5: Judd 3018; common tree.  
*Meriania involucrata* (Desv.) Naud. Site 5: 609, 794, 916; common shrub.  
*Miconia ferruginea* (Desv.) DC. Site 5: 908; occasional shrub to tree.  
*Miconia laevigata* (L.) DC. Site 5: 917; occasional shrub to tree.  
*Miconia lanceolata* (Desv.) DC. Site 5: 909; occasional tree.  
*Ossaea barahonensis* Urb. & Ekm. Site 5: 610, 851; occasional shrub to tree.

## Myrtaceae

- Calyptranthes nummularia* Berg. Site 5: 869; occasional shrub to tree.  
*Cryptorhiza haitiensis* Urb. Site 2: Zannoni & Pimentel 26407 (FTG, JBSD); common shrub.  
*Eugenia maleolens* Pers. Site 3: 733; occasional shrub.  
*Eugenia picardae* Krug & Urb. Site 5: 830; occasional shrub.  
*Gomidesia lindeniana* Berg. Site 5: 887; occasional tree.  
*Myrcia splendens* (Sw) DC. Site 5: 829, 928; common tree.  
 Onagraceae  
*Fuchsia triphyllum* (L.) Site 5: 592, 944; common shrub.

## GENTIANIFLORAE

## Oleaceae

- Forestiera selleana* Urb. & Ekm. Site 4: 895; occasional shrub.

## Rubiaceae

- Borreria laevis* (Lam.) Griseb. Site 2: 524, 530; occasional herb.  
*Borreria verticillata* (L.) G.F.W. Meyer. Site 4: 585, 672; common herb.  
*Chiococca alba* (L.) Hitchc. Site 3: 779; occasional liana or scrambling shrub.  
*Diodia apiculata* (Willd.) K. Schum. Site 4: 644, 692, 679; common herb. This taxon may be only varietally distinct from *Diodia teres* Walt.  
*Galium domingense* Iltis. Site 4: 657, 699, 706; occasional vine, especially in ravines and on limestone outcrops.  
*Hamelia patens* Jacq. Site 3: 712, 778; site 5: 818; very common shrub.  
*Mitracarpus brachystigma* Urb. Site 4: 643; occasional herb.  
*Mitracarpus decumbens* Urb. Site 4: 624, 664; occasional herb.  
*Psychotria berteriana* DC. Site 5: 796; occasional shrub or small tree.  
*Psychotria liogieri* Steyermark. Site 5: 606, 875, 933; common shrub.  
*Psychotria nervosa* Sw. Site 3: 713; abundant shrub.  
*Psychotria pubescens* Sw. Site 3: 622, 716; common shrub or small tree.  
*Psychotria uliginosa* Sw. Site 5: 608, 913; occasional semiberbaceous scrambling shrub.  
*Relbunium hypocarpium* (L.) Hemsl. Site 5: 660, 698; occasional herb.  
*Rondeletia* sp. 1. Site 3: 717, 722; occasional shrub or small tree.  
*Rondeletia* sp. 2. Site 4: 899; occasional shrub near ravine.

## Apocynaceae (incl. Asclepiadaceae)

- Angadenia berterii* (DC.) Miers. Site 4: 890; occasional vine.  
*Asclepias nivea* L. Site 4: 631; occasional; site 5: 828; rare herb, limited to trail margin.  
*Cameraria angustifolia* L. Site 2: 548; common tree on dogtooth limestone.  
*Cynanchum aemulans* (Schltr.) Jiménez. Site 4: 628, 710a; occasional vine.  
*Cynanchum leptocladon* (Dene.) Jiménez. Site 3: 740; site 5: 824; occasional vine.  
*Echites umbellata* Jacq. Site 1: 787; common; site 2: 543, 551; occasional vine.  
*Forsteronia corymbosa* (Jacq.) G.F.W. Meyer. Site 3: 617; occasional vine.  
*Mesechites angustifolia* (Poir.) Miers. Site 3: 769; occasional vine.  
*Plumeria obtusa* L. (s. lat.) Site 1: not collected; site 2: 552; common shrub to small tree.  
*Urechites lutea* (L.) Britton. Site 1: 785; occasional vine. Bignoniaceae

## Bignoniaceae

- Catalpa longissima* (Jacq.) Dum.—Cours. Site 3: 581; common tree.  
*Distictis lactiflora* (Vahl) DC. Site 3: 777; occasional vine.  
*Doxantha unguis-cati* (L.) Miers. Site 2: 518; site 3: 754; common vine.  
*Jacaranda poitaei* Urb. Site 3: 775; occasional tree. This specimen appeared intermediate in vegetative characters between this species and *J. ekmanii* Alain.  
*Tecoma stans* (L.) Kunth. Site 3: 737; site 4: 624; occasional shrub to tree.

## Scrophulariaceae

- Buchnera floridana* Gandog. Site 4: 595; occasional herb.  
*Capraria biflora* L. Site 1: 788; occasional shrub.

## Gesneriaceae

- Gesneria pulverulenta* Alain. Site 4: 656; occasional shrub.  
*Rytidophyllum leucomallon* Hanst. Site 3: 750; common shrub.  
*Rytidophyllum auriculatum* Hook. Site 3: 583; common shrub; site 4: 702; occasional shrub in ravine.  
*Trichantha domingensis* (Urb.) Wiehler. Site 5: 613; occasional epiphytic herb. Species is placed in the genus *Columnea* by some botanists.

## Verbenaceae

- Citrarexylum caudatum* L. Site 3: 776; occasional shrub.  
*Citharexylum schulzii* Urb. & Ekm. Site 4: 596; occasional shrub.  
*Lantana camara* L. (s. lat.) Site 2: 527; common shrub in disturbed areas.  
*Lippia alba* (Mill.) N.E. Br. Site 1: 566; common shrub.  
*Lippia domingensis* Moldenke. Site 4: 669, 707; occasional shrub. Det. T. Zanoni.  
*Petitia domingensis* Jacq. Site 3: 761, 772, 782; occasional tree.  
*Verbena domingensis* Urb. Site 4: 676, 677; rare herb.

## Lamiaceae

- Salvia selleana* Urb. Site 4: 639; occasional shrub.

## SOLANIFLORAE

## Boraginaceae

- Cordia alliodora* (Ruiz & Pav.) Oken. Site 1: 568; site 2: 529; occasional shrub or small tree. Det. T. Zanoni.

- Cordia buchii* Urb. Site 2: 549; common small tree on dogtooth limestone.

- Cordia ignea* Urb. & Ekm. Site 1: 786; occasional small tree

- Tournefortia glabra* L. Site 5: 598, 907; occasional small tree.

- Tournefortia minuta* Bert. ex Spreng. Site 2: 542; occasional shrub.

## Solanaceae

- Cestrum brevifolium* Urb. Site 4: 626, 682; occasional shrub.

- Cestrum coelophlebium* O. E. Schulz. Site 5: 938; occasional shrub to small tree. Det. T. Zanoni.

- Cestrum picardae* Alain. Site 5: 849; rare shrub.

- Jaltomata antillana* (Krug & Urb.) D'Arcy. Site 5: 850; common herb, in clearings.

- Lycianthes virgata* (Lam.) Bitter. Site 5: 815; occasional shrub.

- Physalis peruviana* L. Site 5: 799; common herb, in clearings.

- Solanum americanum* Mill. Site 5: 813; common herb, in clearings.

- Solanum antillarum* O. E. Schulz. Site 5: 821; occasional shrub, in clearings and along trail.

- Solanum pyrifolium* Lam. Site 5: 804; common vine, in clearings.



*Solanum umbellatum* Mill. Site 5: 802; common shrub.

cf. *Solanum* sp. Site 5: 923; occasional vine.

Convolvulaceae

*Evolvulus arbuscula* Poir. Site 2: 550; occasional herb.

*Ipomoea furcyensis* Urb. Site 3: 751; site 5: 659; occasional vine. Det. T. Zanoni.

*Turbina rudolphii* (R. & S.) O'Donell. Site 3: 729; occasional vine. Det. T. Zanoni.

Polemoniaceae

*Gilia incisa* Benth. Site 4: 627; occasional herb in ravine.

Campanulaceae

*Lobelia robusta* Graham. Site 5: 593; common subshrub, especially in disturbed areas along road and trail.

CORNIFLORAE

Vitaceae

*Cissus acida* L. Site 1: 565, 789; common vine.

*Cissus intermedia* A. Rich. Site 2: 553; occasional vine on dogtooth limestone

Garryaceae

*Garrya fadyenii* Hook. Site 4: 655; occasional shrub; site 5: not collected; uncommon tree.

Araliaceae (incl. Apiaceae)

*Dendropanax arboreus* (L.) Decne. & Planch. Site 3: 746; occasional; site 5: 811, 825, 868, 873; abundant tree.

Valerianaceae

*Valeriana scandens* L. Site 5: 812; occasional vine.

ASTERIFLORAE

Asteraceae

*Ambrosia peruviana* Willd. Site 4: 670; common herb.

*Bidens alba* (L.) DC. Site 4: 705; common herb.

*Conyza canadensis* var. *pusilla* (Nutt.) Cronq. Site 4: 690; occasional herb.

*Coreopsis buchii* Blake. Site 4: 641; common shrub.

*Erigeron cuneifolius* DC. Site 4: 674; rare herb.

*Eupatorium* cf. *barahonense* Urb. Site 5: 822; occasional shrub.

*Eupatorium illitum* Urb. Site 4: 584, 651; occasional shrub.

*Eupatorium sinuatum* var. *viscegerum* Urb. & Ekm. Site 4: 889, 894; occasional shrub.

*Eupatorium sophiaefolium* L. Site 4: 654, 675; occasional herb.

*Gnaphalium eggersii* Urb. Site 4: 663; common herb.

*Hieracium gronovii* L. Site 4: 634; common herb.

*Liabum umbellatum* (L.) Sch. Bip. Site 4: 898; occasional herb.

*Mikania cordifolia* (L. f.) Willd. Site: 805; occasional vine.

*Mikania micrantha* HBK. Site 5: 807; occasional vine.

*Neurolaena lobata* (L.) Cass. Site 5: 817; occasional subshrub.

*Piqueria trinerva* Cav. Site 4: 681; occasional herb.

*Senecio picardae* Krug & Urb. Site 4: 628; common shrub.

*Vernonia fruticosa* (L.) Sw. Site 4: 666, 673, 683; occasional shrub.

*Asteraceae* sp. 1. Site 5: 808; rare herb, disturbed roadside.

MONOCOTYLEDONEAE (LILIIDAE)

LILIIFLORAE

Dioscoreaceae

*Rajania cordata* L. Site 4: 701; occasional vine in ravine.

*Rajania ovata* Sw. Site 5: 823; common vine.

Smilacaceae

*Smilax havanensis* Jacq. Site 4: 709; occasional vine in ravine.

*Smilax populnea* Kunth. Site 5: 861; uncommon vine; this may only be a spineless form of the variable *S. havanensis*.

*Smilax smallii* Morong. Site 3: 726; occasional vine.

Alstroemeriaceae

*Bomarea edulis* (Tuss.) Herb. Site 5: 597, 833; occasional vine.

## Agavaceae

*Agave antillana* Descourt. Site 4: 896; common shrub, especially in rocky areas.

*Agave brevipetala* Trel. Site 1: 793a; common shrub, especially in rocky areas.

## Orchidaceae

*Beadlea* sp. (sterile). Site 5: 943; occasional herb. Det. D. Dod.

*Eltroplectris calcarata* (Sw.) Garay & Sweet (plant sterile, possibly *Pelexia adnata* (Sw.) Spreng) Site 3: 774; occasional herb. Det. D. Dod.

*Bletia patula* Hook. Site 3: 901; common herb.

*Encyclia vespa* Vell. Site 5: 926; occasional epiphytic herb. Det. D. Dod.

*Epidendrum* cf. *anceps* Jacq. Site 5: 835; occasional epiphytic herb. Det. D. Dod.

*Epidendrum cochleatum* L. Site 5: reported by T. Zanoni; epiphytic herb.

*Isochilus linearis* (Jacq.) R. Br. Site 5: 876; occasional epiphytic herb.

*Lycaste barringtoniae* (Smith) Lindl. Site 5: 927; occasional epiphytic herb.

*Oncidium variegatum* Sw. Site 4: 588; rare herb on limestone outcrop. Det. D. Dod.

*Oncidium velutinum* Lindl. Site 3: 946; occasional epiphytic herb.

*Pleurothallis gelida* Lindl. Site 5: 950; occasional epiphytic herb.

*Pleurothallis* cf. *parvula* Ames & Schweinf. Site 5: 884; occasional epiphytic herb. Det. D. Dod.

*Pleurothallis oblongifolia* Lindl. Site 5: 942; occasional epiphytic herb.

*Polyrrhiza sallei* (Richb. f.) Cogn. Site 3: 947; rare epiphytic herb.

*Prescottia stachyodes* Lindl. Site 5: 875b; occasional herb. Det. D. Dod.

*Spiranthes torta* (Thunb.) Garay & Sweet. Site 4: 590; common herb. Det. D. Dod.

*Tetramicra bulbosa* Mansf. Site 4: 587; rare herb.

*Tetramicra ekmanii* Mansf. Site 4: 591, 668; common herb. Det. D. Dod.

*Trichopilia fragrans* (Lindb.) Rehb. Site 5: 925; uncommon epiphytic herb.

## ARIFLORAE

## Araceae

*Anthurium scandens* (Aubl.) Engl. Site 5: 936; uncommon vine.

## ARECIFLORAE

## Arecaceae

*Coccothrinax scoparia* Becc. Site 4: 589; common small tree.

*Haitiella ekmanii* (Burret) Bailey. Site 1: 949; abundant small tree.

*Prestoea montana* (Grah.) Nichols. Site 5: 885; occasional tree.

## COMMELINIFLORAE

## Bromeliaceae

*Pitcairnia elizabethae* L. B. Smith. Site 4: 689; common herb, especially on rocky slopes.

*Tillandsia recurvata* (L.) L. Site 1: 558; site 2: 539; site 3: 747; uncommon epiphytic herb.

*Tillandsia selleana* Harms. Site 5: 594, 881; common epiphytic herb.

*Tillandsia variabilis* Schlecht. Site 5: 940; occasional epiphytic herb.

## Cyperaceae

*Bulbostylis subaphylla* Clarke. Site 4: 647, 691; common herb.

## Commelinaceae

*Callisia repens* (Jacq.) L. Site 2: 538; abundant herb.

*Campelia zanonii* (L.) Kunth. Site 5: 918; common herb.

## Poaceae

*Andropogon glomeratus* var. *pumilus* Dewey. Site 4: 653, 678; common herb.

*Andropogon urbanianus* Hitchc. Site 4: Judd 1464; common herb.

*Eragrostis pilosa* (L.) Beauv. Site 1: 572; abundant; site 2: 541; occasional herb.

*Ichnanthus axillaris* (Nees) Hitchc. & Chase. Site 5: 607, 930, 931, 932; common herb. Det. D. Hall.

*Lasiacis divaricata* (L.) Hitchc. Site 3: 721; occasional large herb, arching over shrubs.

*Lasiacis sorghoidea* var. *patentiflora* (Hitchc. & Chase) Davidse. Site 3: 744; common scrambling climbing herb. Since this specimen is nearly, but not completely, glabrous, it exhibits characteristics somewhat intermediate between variety *patentiflora* and variety *sorghoidea*. According to Davidse (1972) the two varieties are most distinct in Trinidad, becoming less so north and south of this region.

*Leptochloa monticola* Chase. Site 4: Judd 1491; uncommon herb.

*Panicum aciculare* Desv. ex Poir. Site 4: 644, 645; occasional herb.

*Rhynchelytrum repens* (Willd.) C. E. Hubbard. Site 3: 741; common herb, especially along road.

*Schizachyrium gracile* (Spreng.) Nash. Site 4: 646; very common herb.

*Setaria glauca* (L.) Beauv. Site 4: 667; 893; occasional herb.

*Triodia eragrostoides* Vasey & Scribn. Site 5: 648; 695; occasional herb.

*Tripsacum dactyloides* (L.) L. Site 4: 686; occasional herb. Det. T. Zanoni.

*Leptochloopsis virgata* (Poir.) Yates. Site 1: 790; occasional herb near coast.