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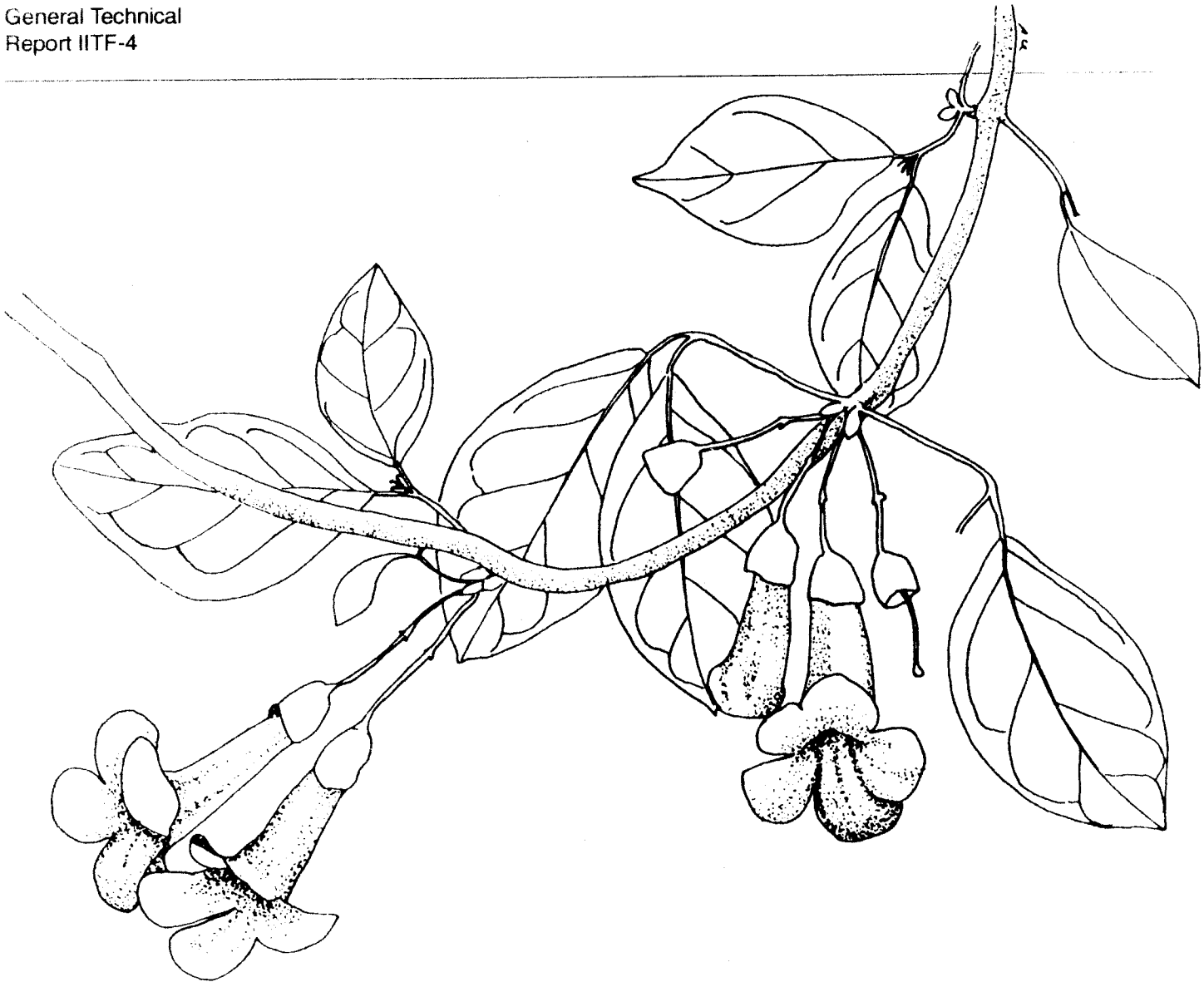
The Flora of Cañón de San Cristóbal, Puerto Rico

John K. Francis, Salvador Alemañy, Henri A. Liogier, and George R. Proctor



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Abstract

Although it is one of the most spectacular geologic features in Puerto Rico, the vegetation of Cañón de San Cristóbal was seriously disturbed over the last century and a half by subsistence farming, grazing, and wood cutting. Now that agricultural activity has nearly ceased and the canyon is partially protected, the vegetation is rapidly recovering. At the request of the Conservation Trust of Puerto Rico, which owns about two-thirds of the canyon, personnel of the U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, conducted a vegetation survey of the entire canyon. A total of 678 species were identified in the 1000-ha area, including one new recording for Puerto Rico. Of the total species, 549 were native and 129 were exotic. Several of the species are considered rare and endangered. The species are listed, together with their lifeforms, whether they are native or not, their commonness, and the area within the canyon where they are found. In addition, a map of the various vegetation types in the canyon is presented.

Keywords: Biodiversity, endangered species, native species, natural area, secondary forest.

Introduction

Cañón de San Cristóbal is one of the most spectacular geologic features in Puerto Rico. Located between the municipalities of Barranquitas and Aibonito (fig. 1), the canyon begins abruptly and within 2 km plunges to a depth of 200 m. For about 1.5 km near its head, the canyon has nearly vertical walls and widths of only 200 m; it then gradually widens after about 4 km to become a steep-sided river valley (fig. 2). In its course down the canyon, the Río Usabón is joined by Río Barranquitas and Quebrada Alicia along with several smaller creeks.

The hills surrounding the canyon are covered by eroded clayey soils over fractured sedimentary siltstone. Underlying this is a thick (150 m) bed of soft and unstable tuffaceous breccia of the Robles formation. Defining the

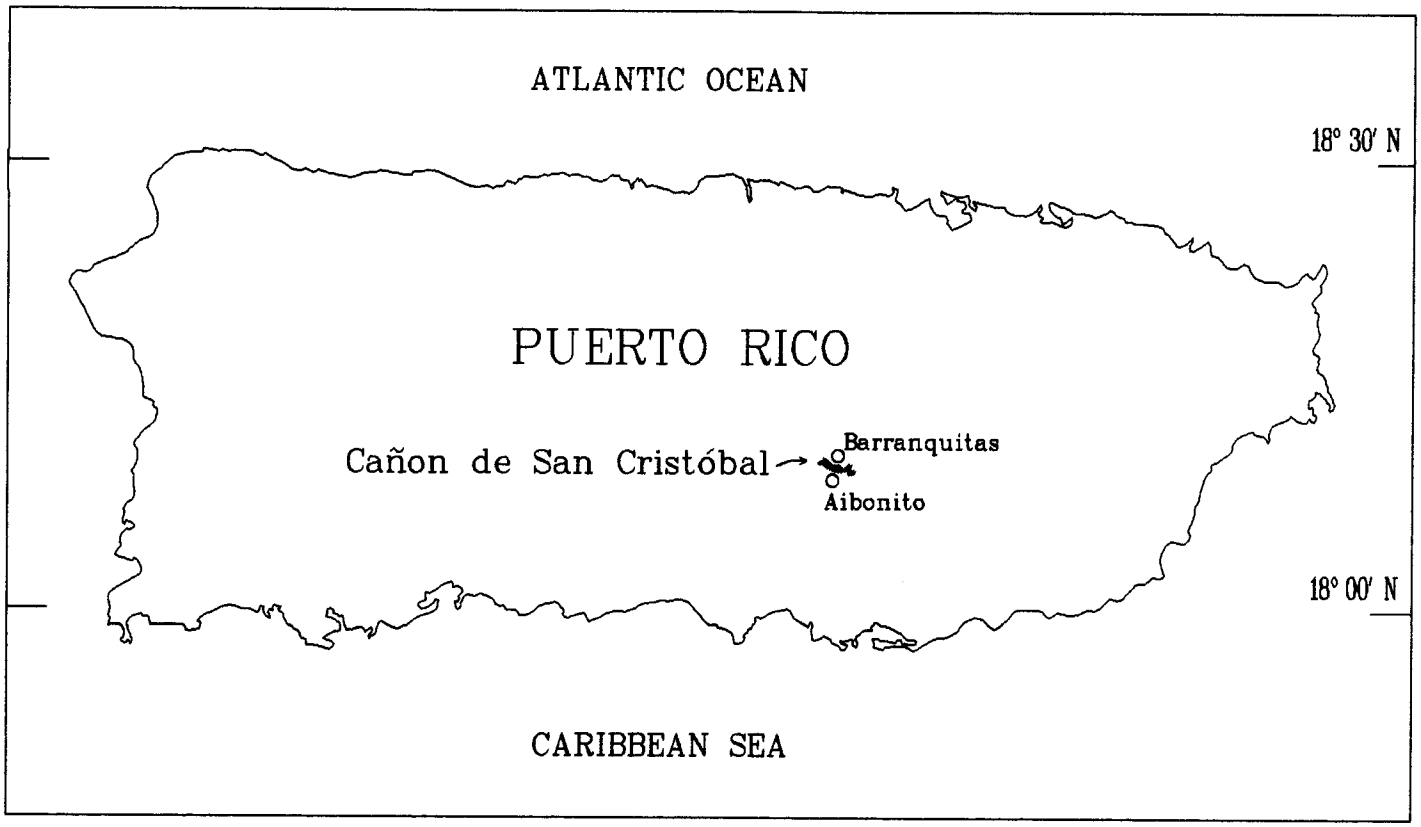

Figure 1—Map showing the location of Cañón de San Cristóbal in Puerto Rico near the municipalities of Barranquitas and Aibonito.

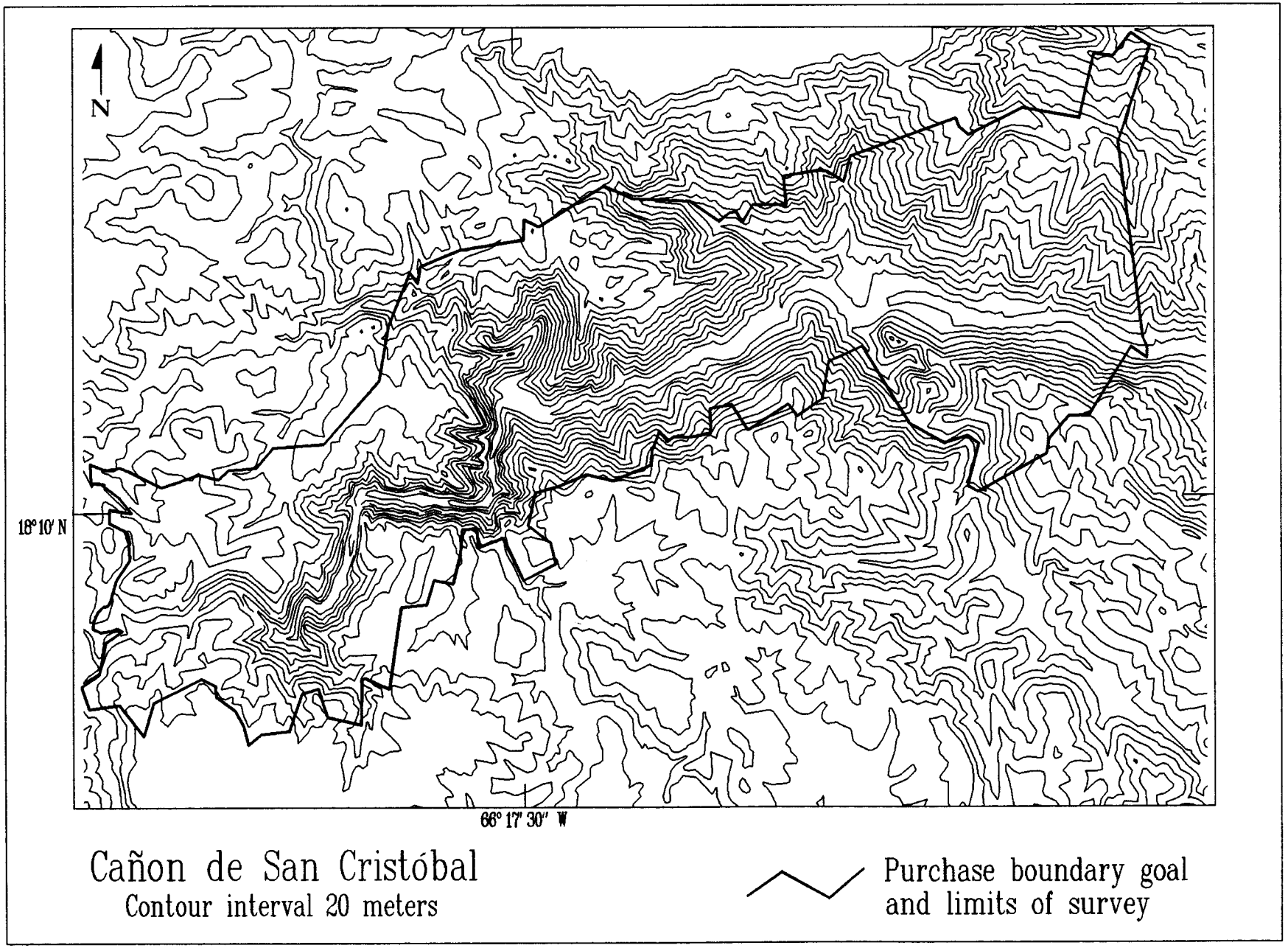

Figure 2—Topographic map of Cañón de San Cristóbal, Puerto Rico, with the Conservation Trust purchase goal and limit of the vegetation survey drawn as a bold line.

bottom of the canyon are massive beds of hard lava of the pre-Robles formation. The canyon owes its origin to erosion from flash floods that at times raised the water level of the river 4 m above the normal flow. Headward erosion of waterfalls and the scouring action of rapids along at least one geologic fault have carved the canyon in a relatively short period of geologic time. There has been almost no wear into the hard lava at the riverbed. Constant slides, creep, and erosion of the breccia beds have smoothed the canyon sides. The slopes of the canyon walls gradually decrease from nearly 90° in its upper part to around 35° at the lower end.

The annual rainfall of the area is about 1500 mm. Although it rains each month during the year, the wettest season occurs in the fall and the driest in the spring. Mean annual temperature is about 22 °C (Calvesbert 1970). The forests of the area correspond to the subtropical moist forest life zone (Holdridge 1967).

During the latter part of the 19th century and the first four decades of the 20th century, the forests of the canyon were cleared or cut over. Except for a few tiny patches and a small area of very steep (>60°) slopes, the former stands were either completely cleared for pastures and fields, particularly for the cultivation of tobacco or partially cleared for shade-grown coffee. Several house sites within the canyon are known, and the remnants of coffee and other plantings are still evident. The sprouted stumps of three large *Manilkara valenzuelana* (A. Rich.) Penn. on 50°-slopes attest to how desperately the former residents sought and harvested wood. Two old charcoal pits in the area show further evidence of the pressure on the former forest stands. Until it was halted recently, garbage was dumped by the truckload from the canyon rim.

The reduction of land-use pressure in the canyon began gradually through the progressive abandonment of agriculture, beginning with the steepest tracts. The process began in the late 1940's and still continues. An era of environmental protection began in 1972 when the Conservation Trust of Puerto Rico purchased their first tract of land within the canyon. Today, about 60 percent of the canyon is under their protection. About 25 percent of the canyon in private and Conservation Trust land is still grazed, a small amount of it is improved pasture, and 20–30 ha of land above the canyon rim is still being cultivated.

The nonagriculture vegetation today consists of brushy pastures in the process of reforestation, small areas of forest plantations (for reforestation), early secondary forests, advanced secondary forests, brushy areas on unstable slopes, and riparian plant communities at the canyon bottom. The last two units of pioneer vegetation are maintained in relative stability by the periodic violent flooding of the river and the weathering and movement of rock on the canyon sides. There are minor variations in stands due to aspect and position. The history of anthropogenic disturbance is the biggest single determinant of the current species mix of stands. In many cases species were completely eliminated from certain tracts and, due to lack of local seed sources and possibly other factors, have not been able to become reestablished.

Procedure

The canyon vegetation was characterized through a systematic survey of the entire canyon. First, one hundred 0.001-ha temporary plots were established on an approximate 200-m spacing throughout the forested portion of the canyon and associated uplands. Because of the extreme ruggedness of the terrain and a self-imposed prohibition against cutting survey lines, it was impossible to place the plots in a completely random or rigid systematic fashion. Complete plant lists (excluding mosses and lichens) were compiled for each plot, and collections were made of each new species encountered. Notes were also taken on soil, slope, aspect, and tree-canopy height. From these data, approximate mean species densities and frequencies were calculated for the canyon-side portion of the area (88 plots). Samples from the riparian zone, a small and very heterogeneous area, and the hills above the canyon rim were not sampled sufficiently to be representative.

All of the species encountered during the sampling were assembled into an overall list. This basic list was augmented with species encountered in about 50 days of collecting in all parts of the canyon. Samples of unknown or unfamiliar species were collected and carried to specialists for positive identification. In addition to the University of Puerto Rico and the Department of Natural Resources herbariums, a number of published references were also used in identifying plants and as authorities for the scientific names (Acevedo Rodríguez and Woodbury 1985; Del Castillo Mayda and Ackerman 1992; González Mas 1964; Howard 1979; Howard 1988; Howard 1989a, 1989b; Liogier 1985, 1988; Liogier and Martorell 1982; Little and Wadsworth1964; Little and others 1974; Proctor 1989).

Finally, a map showing the vegetation types in the area was hand-drawn on a digitized printing of the topographic map (fig. 3). Five vegetation types were designated. Cultivated fields and improved pastures (1) consisted of cultivated vegetable crops and associated weeds; native and exotic

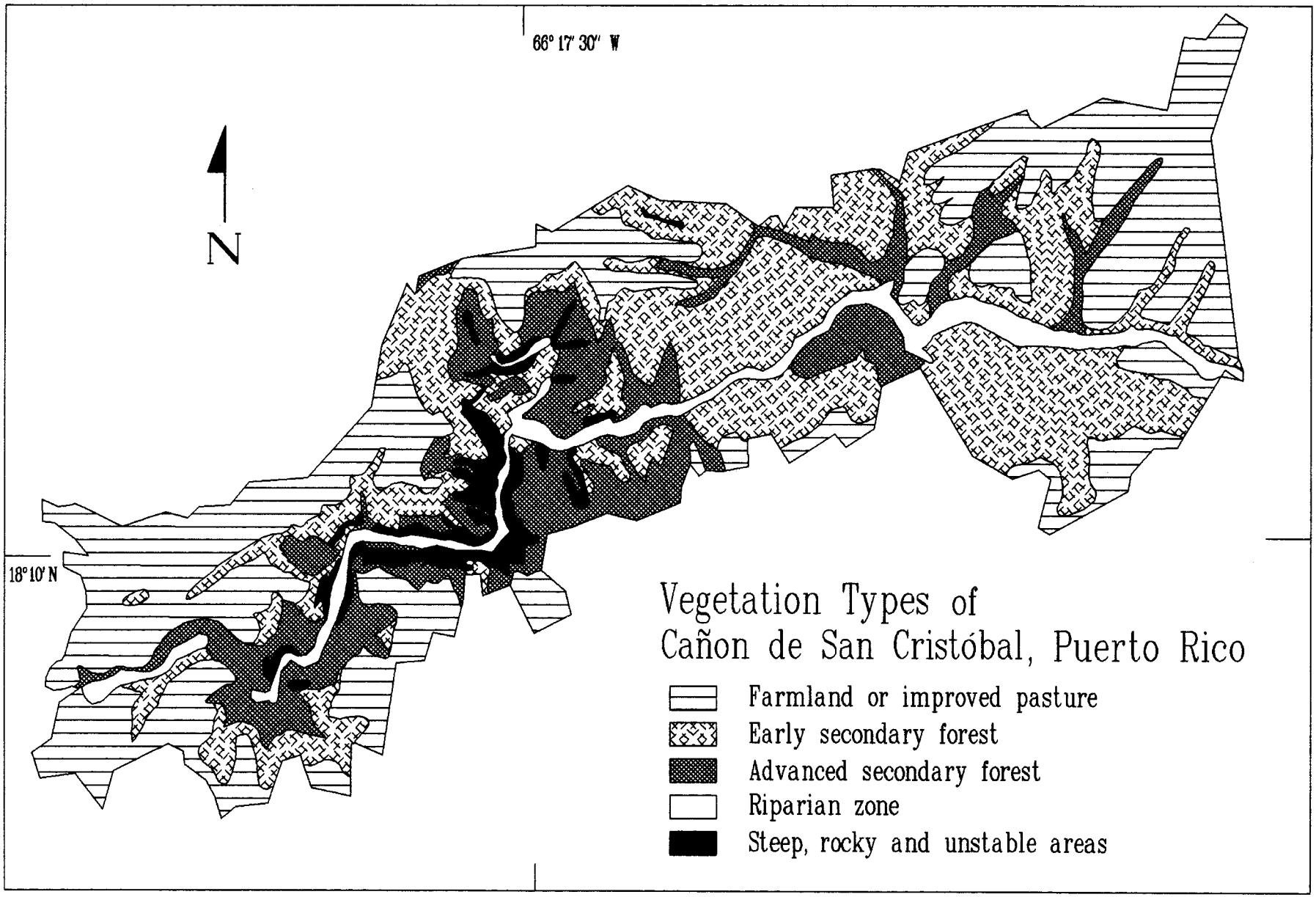

Figure 3—The vegetation types of Cañón de San Cristóbal, Puerto Rico, found in the 1994 survey.

pasture grasses; and invading herbs, shrubs, and trees. Early secondary forest (2) was a brushy, low forest usually less than 20 years old. Advanced secondary forest (3) consisted of closed-canopy stands of relatively tall, usually midsuccessional trees. The riparian zone (4) consisted of the occasionally flooded zone along rivers and perennial or intermittent streams. It contained trees, shrubs, vines, herbs, and grasses. The unstable areas (5) included cliffs and rock outcrops on the canyon side with a broken cover of mostly low vegetation that can survive the droughty conditions and cling to this difficult substrate.

Results

A total of 382 species were observed in the one hundred 0.001-ha plots, an average of 36 species per plot. The number of species per plot ranged from 18 to 52. An accounting of the species frequencies within the 88 canyon-side plots is given in Appendix table 1. The most frequently encountered species (highest degree of constancy) were *Eugenia monticola* (Sw.) DC. (75 percent), *Erythroxylum brevipes* DC. (68 percent), *Macfadyena unguis-cati* (L.) A. Gentry (67 percent), *Picramnia pentandra* Sw. (66 percent), *Eugenia biflora* (L.) DC. (64 percent), *Adianthum pyramidale* (L.) Willd. (61 percent), *Andira inermis* (Wright) Kunth ex DC. (61 percent), and *Bryophyllum pinnatum* (Lam.) Oken (61 percent). The species that had the highest frequency also tended to have a high number of individuals per plot.

The complete list of plants observed in Cañón de San Cristóbal may be found in Appendix table 2. Also given are the life form (tree, shrub, vine, herb, grasslike, or fern), the origin (native, naturalized exotic, or residual from cultivation), the commonness (common and widespread, locally common, or uncommon to rare), and the areas of the canyon where each grew (above the rim, side slope, or riparian zone). A total of 677 species were observed; 548 were native to Puerto Rico and 129 were exotic.

Lists of the most important species found in each of the defined vegetation types may be found in Appendix table 3. Twenty-two of the species observed in the survey are listed as threatened or endangered according to the Department of Natural Resources of Puerto Rico,[1] three species are rare and endangered according to Julio C. Figueroa Colón and Roy O. Woodbury,[2] and four species are endangered according to a list compiled by Henri A. Liogier.[3] The cited species are listed in Appendix table 4. One species found during the survey, *Samolus parviflorus* Raf., had not been previously reported in Puerto Rico, although it was known from Cuba and Hispañola.

Discussion

The results of this survey raise at least two interesting questions. First, why is there such a large number of species in a relatively small (about 1000 ha) area? Apparently, most of the original native species have survived, augmented by a considerable number of exotics. The large number of distinct habitats in the area facilitates a high degree of species diversity. These habitats include (1) upland slopes and hills, (2) swales and draws within the uplands, (3) rocky cliffs with many variations in microhabitat, (4) sideslopes with southfacing aspects and northfacing aspects, and (5) a riparian zone with many variations in microhabitat. Within the above habitats, there are many degrees of progression on the successional scale. These include cultivated fields, improved pastures, savanna pasture, early through midsecondary forest, disturbed remnants of primary forest, active talus slides, and overflow areas along the river.

Second, if the entire canyon was so thoroughly disturbed, how did so many species survive? We believe that a large flora remains today because a number of microrefugia were spared where the less aggressive species could survive, and because the cultivation practices of that time period allowed a great number of native species to coexist with agriculture. One area (about 2 ha) is known to contain the disturbed remnants of the primary forest. It has sustained some tree felling and probably some grazing but retains some rare species and trees that, because of size, appear to predate colonization. The cliff faces, high benches, and very steep

[1] Departamento de Recursos Naturales de Puerto Rico. [n.d.]. Lista de plantas críticas. Programa Pro-Patrimonio Natural de Puerto Rico. 136 p. Unpublished memo on file at the International Institute of Tropical Forestry, Río Piedras, PR 00928-2500.

[2] Figueroa Colón, Julio C.; Woodbury, Roy O. 1991. Annotated list of rare and endangered plant species of Puerto Rico & U.S. Virgin Islands. 25 p. Unpublished memo on file at the International Institute of Tropical Forestry, Río Piedras, PR 00928-2500.

[3] Liogier, Henri Alain. [n.d.]. Endangered plants in Puerto Rico and adjacent islands. 4 p. Unpublished memo updating list published as: Center For Plant Conservation. 1992. Report on the rare plants of Puerto Rico. St. Louis, MO: Center for Plant Conservation, Missouri Botanical Garden. [n.p.]. On file at the International Institute of Tropical Forestry, Río Piedras, PR 00928-2500.

slopes (>65°) have remained largely undisturbed. Coffee was cultivated in some areas of the canyon using native trees for shade, where a great many species must have found favorable habitat. Finally, fence rows, brushy pastures, and small patches of trees and brush along drains and around rock outcrops provided some additional habitat.

It is worthwhile to speculate on what the primary forests were like before settlement, what species the canyon may have lost, and what the forests may look like in the future after decades to centuries of protection. Because of their size, longevity, and tolerance, the trees *Guarea guidonia* (L.) Sleumer, *Manilkara valenzuelana* (A. Rich.) Penn, *Prunus occidentalis* Sw., *Sideroxylon portoricense* Urban, and *Tetragastris balsamifera* (Sw.) Kunt. probably dominated the better sites on the canyon sides and above the canyon rim. *Clusia rosea* Jacq. probably dominated the cliffs and rocky ridges, as it does today, and *G. guidonia*, probably dominated the riparian zone, as it also does today in company with exotics.

The stress of conversion of the canyon to agriculture almost certainly eliminated a few species; but, without fossil evidence, they are impossible to identify. Tree species that should have been adapted to the area and that occur not too distantly elsewhere include *Cedrela odorata* L., *Coccoloba pubescens* L., *Dacryodes excelsa* Vahl, and *Zanthoxylum flavum* Vahl. The current secondary forests on the side slopes and above are progressing toward stands dominated by *Andira inermis* (W. Wright) H.B.K., *G. guidonia*, *T. balsamifera*, and *Z. martinicense* (Lam.) DC. Over the next 50 to 100 years, *Z. martinicense* will begin to drop out of those advanced stands, while the *Ocotea* species will become more important. It will take hundreds of years before *M. valenzuelana*, *P. occidentalis*, and *S. portoricense* assume their former importance. The riparian zone will continue to be dominated by *G. guidonia*, *Erythyna poeppigiana* Urban, and *Syzygium jambos* (L.) Alst.

Recommendations

Much work remains to be done to completely protect Cañón de San Cristóbal. Purchase of the remaining one-third of the canyon by the Conservation Trust is strongly recommended followed by the complete elimination of grazing and cultivation on the reserved property. The major trails leading down into the canyon should be paved to stop ongoing erosion. Control of camping and picnicking by permit or by a ranger employed fulltime would greatly reduce the accumulation of litter. Major water pollution problems still exist in the streams of the canyon. Silt loads have their origin in farming and construction upstream and may be difficult to control. The worst polluters are the poultry producers, who sometimes wash large quantities of manure into drains exiting their properties. Such point sources should be relatively easy to trace and control. Finally, although natural reforestation is proceeding on unused pasture lands, the planting of trees is encouraged, not so much to speed up the process, but, to reintroduce species that have disappeared or become rare. We particularly recommend *Cedrela odorata*, *Coccoloba pubescens*, *M. valenzuelana*, *O. krugii* (Mez) Howard, *O. floribunda* (Sw.) Mez, *Pisonia borinquena* Proctor ind., *Prunus occidentalis*, *Sideroxylon portoricense*, and *Z. flavum*.

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Appendix

Appendix Table 1—Species noted in eighty-eight 0.001-ha plots on the canyon sides and the percentage of plots (frequency) in which each was noted

Species (by life form)	Frequency	Species (by life form)	Frequency
	Percent		*Percent*
Trees			
Eugenia monticola (Sw.) DC.	75	*Guettarda scabra* (L.) Vent.	6
Picramnia pentandra Sw.	66	*Citrus sinensis* (L.) Osbeck	5
Eugenia biflora (L.) DC.	64	*Eugenia ligustrina* (Sw.) Willd.	5
Andira inermis (Wright) Kunth ex DC.	61	*Homalium racemosum* Jacq.	5
Casearia guianensis (Aubl.) Urban	59	*Coccoloba swartzii* Meissn. in DC.	3
Thouinia striata Radlk. var. *striata*	51	*Cupania americana* L.	3
Trichilia pallida Sw.	45	*Ocotea leucoxylon* (Sw.) De Laness	3
Guarea guidonia (L.) Sleumer	44	*Ocotea patens* (Sw.) Nees	3
Ocotea coriacea (Sw.) Britton	43	*Persea americana* Miller	3
Casearia sylvestris Sw.	41	*Tabebuia heterophylla* (DC.) Brit.	3
Ardisia obovata Hamilt.	39	*Turpinia occidentalis* (Sw.) G. Don	3
Coccoloba venosa L.	38	*Vitex divaricata* Sw.	3
Eugenia pseudopsidium Jacq.	35	*Bourreria succulenta* Jacq.	2
Capparis baducca L.	34	*Chrysophyllum pauciflorum* Lam.	2
Eugenia confusa DC.	34	*Coccoloba diversifolia* Jacq.	2
Daphnopsis americana (Mill.) J.R. Johnst. ssp. *caribaea* (Griseb.) Nevl.	33	*Ficus citrifolia* Miller	2
Syzygium jambos (L.) Alst.	33	*Guazuma ulmifolia* Lam.	2
Guapira fragrans (Dum.-Cours.) Little	30	*Guettarda ovalifolia* Urban	2
Faramea occidentalis (L.) A. Rich.	25	*Hymenaea courbaril* L.	2
Inga laurina (Sw.) Willd.	23	*Inga vera* Willd.	2
Cordia alliodora (Ruíz & Pavón) Oken	22	*Lonchocarpus pentaphyllus* (Poiret) DC.	2
Zanthoxylum martinicense (Lam.) DC.	19	*Mangifera indica* L.	2
Citharexylum fruticosum L.	18	*Myrcia deflexa* (Poir.) DC.	2
Quararibea turbinata (Sw.) Poir.	16	*Myrciaria floribunda* (West ex Willd.) Berg.	2
Coccoloba sintenisii Urban	15	*Spondias mombin* L.	2
Roystonea borinquena O.F. Cook	14	*Annona muricata* L.	1
Erythrina poeppigiana (Walp.) Cook	13	*Chionanthus compactus* Sw.	1
Erythroxylum rufum Cav.	13	*Citrus aurantium* L.	1
Clusia rosea Jacq.	12	*Citrus x paradisi* Macfad.	1
Trichilia hirta L.	12	*Cordia sulcata* DC.	1
Pouteria dictyoneura (Griseb.) Radlk. ssp. *fuertesii* (Urban) Cron.	11	*Cupania triquetra* A. Rich. in Sagra	1
Tetragastris balsamifera (Sw.) Oken	10	*Drypetes alba* Poit.	1
Dendropanax arboreus (L.) Decne. & Planch.	9	*Drypetes lateriflora* (Sw.) Krug & Urban	1
Eugenia stewardsonii Britton	9	*Guarea glabra* Vahl	1
Chionanthus domingensis Lam.	8	*Hirtella triandra* Sw.	1
Chrysophyllum argenteum Jacq.	8	*Ilex guianensis* (Aubl.) Kuntze	1
Margaritaria nobilis L. f.	8	*Jatropha curcas* L.	1
Myrcia splendens (Sw.) DC.	8	*Licaria parvifolia* (Lam.) Kosterm.	1
Ocotea sintenisii (Mez) Alain	8	*Licaria triandra* (Sw.) Kosterm.	1
Pouteria multiflora (A. DC.) Eyma	8	*Mammea americana* L.	1
Spathodea campanulata Beauv.	8	*Ormosia krugii* Urban	1
Capparis cynophallophora L.	6	*Prunus occidentalis* Sw.	1
		Schefflera morototoni (Aubl.) Maguire	1
		Senna spectabilis (DC.) Irwin & Barneby	1
		Tamarindus indica L.	1
		Ximenia americana L.	1

Appendix Table 1—Species noted in eighty-eight 0.001-ha plots on the canyon sides and the percentage of plots (frequency) in which each was noted (continued)

Species (by life form)	Frequency	Species (by life form)	Frequency
	Percent		*Percent*
Shrubs		*Securidaca virgata* Sw.	56
Erythroxylum brevipes DC.	68	*Chiococca alba* (L.) Hitchc.	52
Randia aculeata L.	48	*Serjania polyphylla* (L.) Radlk.	41
Pavonia spinifex (L.) Cav.	41	*Tragia volubilis* L.	41
Psychotria nervosa Sw.	39	*Paullinia pinnata* L.	40
Piper amalago L.	38	*Cissus verticillata* (L.) Nicolson & Jarvis	34
Gesneria pedunculosa (DC.) Fritsch	34	*Acacia retusa* (Jacq.) Howard	31
Palicourea croceoides W. Hamilt.	15	*Pristimera caribaea* (Urban) A.C. Smith	30
Coffea arabica L.	14	*Ipomoea tiliacea* (Wild.) Choisy	27
Eupatorium portoricense Urban	14	*Passiflora suberosa* L.	22
Miconia laevigata (L.) DC.	14	*Gouania lupuloides* (L.) Urban	20
Urera baccifera (L.) Gaud.	12	*Hippocratea volubilis* L.	20
Acalypha portoricensis Muell. Arg.	11	*Rhynchosia reticulata* (Sw.) DC.	20
Gonzalagunia hirsuta (Jacq.) Schum.	9	*Passiflora edulis* Sims	18
Proustia vanillosma Wr. & Sauv.	7	*Stigmaphyllon emarginatum* (Cav.) Adr. Juss.	16
Eupatorium odoratum L.	6	*Metastelma grisebachianum* Schltr.	15
Malpighia coccigera L.	6	*Philodendron angustatum* Schott	12
Miconia impetiolaris (Sw.) D. Don	6	*Centrosema virginianum* (L.) Benth.	9
Triumfetta semitriloba Jacq.	5	*Clusia minor* L.	9
Amyris elemifera L.	3	*Dioscorea polygonoides* Humb. & Bonpl. ex Willd.	9
Clidemia hirta (L.) D. Don	3	*Ipomoea indica* (Burm.f.) Merrill var. *acuminata* (Vahl) Fosb.	9
Cordia polycephala (Lam.) I.M. Johnst.	3	*Rhynchosia minima* (L.) DC.	9
Rondeletia inermis (Spreng.) Krug & Urban	3	*Distictis lactiflora* (Vahl) DC.	8
Schaefferia frutescens Jacq.	3	*Jacquemontia pentantha* (Jacq.) Don	8
Sida acuta Burm.f.	3	*Melothria pendula* L.	8
Eupatorium polyodon Urban	2	*Vanilla dilloniana* Corell	8
Lantana camara L. var. *aculeata* (L.) Mold.	2	*Bidens reptans* (L.) G. Don	7
Melochia nodiflora Sw.	2	*Cissampelos pareira* L.	7
Miconia prasina (Sw.) DC.	2	*Desmodium incanum* DC.	7
Psidium guajava L.	2	*Heterópterys purpurea* (L.) Kunth	7
Piper aduncum L.	2	*Vitis tiliifolia* Humb. & Bonpl. ex Willd.	7
Poitea florida (Vahl) Lavin	2	*Abrus precatorius* L.	6
Agave missionum Trel.	1	*Dioscorea alata* L.	6
Caesalpinia decapetala (Roth) Alst.	1	*Galactia dubia* DC.	6
Cestrum diurnum L.	1	*Hylocereus trigonus* (Haw.) Saff.	6
Comocladia glabra (Schultes) Spreng.	1	*Passiflora rubra* L.	6
Justicia sphaerosperma M. Vahl	1	*Stigmaphyllon floribundum* (DC.) Anders.	6
Odontonema strictum (Nees) Kuntze	1	*Syngonium podophyllum* Schott	6
Pluchea carolinensis (Jacq.) G. Don	1	*Cayaponia racemosa* (Miller) Cogn.	5
Sagraea umbrosa (Sw.) DC.	1	*Clematis dioica* L.	5
Savia sessiliflora (Sw.) Willd.	1	*Mimosa pudica* L.	5
Stachytarpheta cayennensis (L.C. Rich.) Vahl	1	*Peperomia rotundifolia* (L.) HBK.	5
Trema lamarckiana (R. & S.) Blume	1	*Rhipsalis baccifera* (J.S. Mill.) Strn.	5
Vines			
Macfadyena unguis-cati (L.) A. Gentry	67		

Appendix Table 1—Species noted in eighty-eight 0.001-ha plots on the canyon sides and the percentage of plots (frequency) in which each was noted (continued)

Species (by life form)	Frequency	Species (by life form)	Frequency
	Percent		*Percent*
Heterópterys laurifolia (L.) A. Juss.	3	*Commelina diffusa* Burm.	23
Heterópterys wydleriana A. Juss.	3	*Wedelia reticulata* DC.	23
Ipomoea repanda Jacq. var. *repanda*	3	*Tillandsia polystachya* (L.) L.	15
Ipomoea setifera Poir.	3	*Dieffenbachia seguine* (Jacq.) Schott	13
Merremia umbellata (L.) H. Hall.	3	*Priva lappulacea* (L.) Pers.	11
Mimosa ceratonia L.	3	*Erythrodes plantaginea* (L.) Fawc. & Rend.	7
Pereskia aculeata Mill.	3	*Impatiens wallerana* Hook. f.	7
Pisonia aculeata L.	3	*Peperomia pellucida* (L.) HBK.	7
Rourea surinamensis Miq.	3	*Peperomia sintenisii* C. DC.	7
Senna nitida (Rich.) Irwin & Barneby	3	*Tillandsia utriculata* L.	7
Teramnus uncinatus (L.) Sw.	3	*Vernonia sericea* L.C. Rich.	7
Trichostigma octandrum (L.) H. Walt.	3	*Cyathula prostrata* (L.) Blume	6
Vigna vexillata (L.) A. Rich.	3	*Desmodium wydlerianum* Urban	6
Cayaponia americana (Lam.) Cogn.	2	*Encyclia cochleata* (L.) Dress.	6
Convolvulus nodiflorus Desr.	2	*Pilea microphylla* (L.) Liebm.	6
Fevillea cordifolia L.	2	*Tillandsia usneoides* (L.) L.	6
Gouania polygama (Jacq.) Urban	2	*Dorstenia contrajerva* L.	5
Jacquemontia cayensis Brit.	2	*Elephantopus mollis* HBK.	5
Jacquemontia havanensis (Jacq.) Urban	2	*Pitcairnia angustifolia* Aiton	5
Rajania cordata L.	2	*Oeceoclades maculata* (Lind.) Lind.	4
Smilax havanensis Jacq.	2	*Aploleia monandra* (Sw.) Moore	3
Calopogonium caeruleum (Benth.) Hemsley	1	*Callisia repens* (Jacq.) L.	3
Cissus erosa L.C. Rich.	1	*Commelinopsis persicariifolia* (DC.) M. Pichon	3
Cissus obovata Vahl	1	*Guzmania berteroniana* (R. & S.) Mez	3
Desmodium axillare (Sw.) DC. var. *axillare*	1	*Heliconia caribaea* Lam.	3
Dioscorea altissima Lam.	1	*Tillandsia fasciculata* Sw.	3
Dioscorea pilosiuscula Bertero ex Spreng.	1	*Tradescantia zanonia* (L.) Sw.	3
Galactia striata (Jacq.) Urban	1	*Anthurium scandens* (Aubl.) Engl.	2
Jacquemontia solanifolia (L.) H. Hall.	1	*Bromelia pinguin* L.	2
Metastelma lineare Bello	1	*Cestrum macrophyllum* Vent.	2
Mikania cordifolia (L.f.) Willd.	1	*Epidendrum difforme* Jacq.	2
Mikania odoratissima Urban	1	*Oncidium altissimum* (Jacq.) Sw.	2
Mikania stevensiana Brit.	1	*Peperomia robustior* (Dahlst.) Urban	2
Momordica charantia L.	1	*Tillandsia festucoides* Brongn.	2
Mucuna urens (L.) DC.	1	*Tillandsia recurvata* (L.) L.	2
Neorudolphia volubilis (Willd.) Brit.	1	*Zebrina pendula* Schnizl.	2
Prestonia agglutinata (Jacq.) Woods.	1	*Achyranthes aspera* L.	1
Tetrapterys citrifolia (Sw.) Pers.	1	*Anthurium dominicense* Schott	1
Turbina corymbosa (L.) Raf.	1	*Asystasia gangetica* (L.) T. Anders.	1
		Bidens alba (L.) DC. var. *radiata* (Sch.-Bip.) Ballard	1
Herbs			
Bryophyllum pinnatum (Lam.) Oken	61	*Boehmeria repens* (Griseb.) Wedd.	1
Anthurium crenatum (L.) Kunth	58	*Eupatorium microstemon* Cass.	1
Tolumnia variegata (Sw.) Braem	57	*Euphorbia heterophylla* L.	1
Tillandsia setacea Sw.	40	*Gibasis geniculata* (Jacq.) Rohw.	1
Tillandsia valenzuelana A. Rich.	39	*Hippeastrum puniceum* (Lam.) Ktze.	1
Pilea semidentata (Juss.) Wedd.	33	*Hohenbergia antillana* Mez in DC.	1
Pilea nummulariifolia (Sw.) Wedd.	32	*Hyptis lantanifolia* Poit.	1

Appendix Table 1—Species noted in eighty-eight 0.001-ha plots on the canyon sides and the percentage of plots (frequency) in which each was noted (continued)

Species (by life form)	Frequency	Species (by life form)	Frequency
	Percent		*Percent*
Ionopsis satyrioides (Sw.) Rchb.f.	1	*Rhynchospora nervosa* (Vahl) Boeck.	
Justicia mirabiloides Lam.	1	ssp. *ciliata* (Vahl) Koyama	1
Leonurus sibiricus L.	1	*Stenotaphrum secundatum* (Walt.) Kuntz	1
Liparis nervosa (Thunb.) Lindl.	1		
Ludwigia leptocarpa (Nutt.) H. Hara	1	Ferns	
Macroptilium lathyroides (L.) Urban	1	*Adiantum pyramidale* (L.) Willd.	61
Malvastrum coromandelianum (L.) Garcke	1	*Polypodium phyllitidis* L.	58
Peperomia cogniauxii Urban	1	*Blechnum occidentale* L.	41
Pleurothallis wilsonii Lindl.	1	*Polypodium pectinatum* L.	17
Rhytidophyllum auriculatum Hook.	1	*Doryopteris pedata* (L.) Fée	16
Rorippa heterophylla (Blume) R.O Williams	1	*Asplenium cristatum* Lam.	11
Ruellia coccinea (L.) Vahl	1	*Tectaria trifoliata* (L.) Cav.	9
Ruellia tuberosa L.	1	*Adiantum fragile* Sw.	6
Senna hirsuta (L.) Irwin & Barneby	1	*Thelypteris reticulata* (L.) Proct.	6
Spermacoce verticillata L.	1	*Nephrolepis exaltata* (L.) Schott	5
Teliostachya alopecuroidea (Vahl) Nees	1	*Polypodium astrolepis* Lieb.	5
Thunbergia fragrans Roxb.	1	*Thelypteris poiteana* (Bory) Proct.	5
		Oleandra articulata (Swartz) K. Presl.	3
Grasses and grass-like		*Polypodium aureum* L.	3
Lithachne pauciflora (Sw.) Beauv.	40	*Polypodium dispersum* Evans	3
Brachiaria adspersa (Trin.) Parodi	38	*Elaphoglossum rigidum* (Aubl.) Urban	2
Lasiacis divaricata (L.) Hitchc.	35	*Polystichum rhizophyllum* (Sw.) K. Presl.	2
Pharus glaber HBK.	28	*Arachniodes chaerophylloides* (Poir.) Proct.	1
Panicum maximum Jacq.	16	*Cheilanthes trichomanoides* (L.) Mett.	1
Arthrostylidium capillifolium Griseb.	10	*Cyclopeltis semicordata* (Sw.) J. Smith	1
Lisiacis sorghoidea (Desv.) Hitchc. & Chase	6	*Polypodium heterophyllum* L.	1
Andropogon glomeratus (Walt.) B.S.P.	5	*Psilotum nudum* (L.) Griseb.	1
Setaria geniculata (Lam.) Beauv.	5	*Pteris longifolia* L.	1
Ichnanthus nemorosus (Sw.) Doell	3	*Tectaria heracleifolia* (Willd.) Underw.	1
Cyperus alternifolius L.	2	*Tectaria incisa* Cav.	1
Cyperus urbanii Brit. & Brit.	2	*Thelypteris balbisii* (Spreng.) Ching	1
Pennisetum purpureum Schumach.	2	*Thelypteris sclerophylla* (Poep.	
Chusquea abietifolia Griseb.	1	ex Spreng.) Mort.	1
Olyra latifolia L.	1		

Appendix Table 2—Species of plants observed in Cañón San Cristóbal listed by family with descriptive information on life form, origin, commonness, and area of occurrence in the canyon

Family and species	Descriptive information			
	Life form[a]	Origin[b]	Commonness[c]	Area[d]
Acanthaceae				
Asystasia gangetica (L.) T. Anders.	H	X	+	2
Justicia comata (L.) Lam.	H	N	+	3
Justicia martinsoniana R.A. Howard	H	N	+	3
Justicia mirabiloides Lam.	H	N	+	2
Justicia pectoralis Jacq.	H	N	+	2,3
Justicia sphaerosperma M. Vahl	S	N	+	2,3
Odontonema strictum (Nees) Kuntze	S	X	++	3
Ruellia brittoniana Leonard emend. Fernald	H	X	++	3
Ruellia coccinea (L.) Vahl	H	N	+	3
Ruellia tuberosa L.	H	N	+	3
Stenandrium tuberosum (L.) Urban	H	N	+	2
Teliostachya alopecuroidea (Vahl) Nees	H	N	++	2
Thunbergia alata Bojer	V	X	+	1,3
Thunbergia fragrans Roxb.	V	X	++	2,3
Thunburgia grandiflora (Roxb. ex Rottl.) Lodd.	V	X	+	3
Agavaceae				
Agave missionum Trel.	S	N	++	1,2
Furcraea tuberosa (Miller) Ait.f.	S	N	++	1,2
Amaranthaceae				
Achyranthes aspera L.	H	X	+	1
Alternanthera philoxeroides (Mart.) Griseb.	H	X	+	3
Amaranthus dubius Mart.	H	X	++	1,3
Amaranthus spinosus L.	H	X	+	3
Cyathula prostrata (L.) Blume	H	X	++	2
Gomphrena cerrata L.	H	N	+	3
Iresine diffusa Humb. & Bonpl. ex Willd.	H	N	+	2,3
Pfaffia grandiflora (Hook.) Fries	V	N	+	2
Amaryllidaceae				
Crinum latifolium L. var. *zeylanicum* (L.) Hook.f. in Trimen	H	X	+	3
Hymenocallis caribaea (L. emend. Gawl.) Herb.	H	N	+	2
Hippeastrum puniceum (Lam.) Ktze.	H	N	+	2
Anacardiaceae				
Comocladia glabra (Schultes) Spreng.	S	N	+	1,2
Mangifera indica L.	T	C	++	1,2,3
Spondias mombin L.	T	N	++	1,2
Annonaceae				
Annona montana Macf.	T	N	+	3
Annona muricata L.	T	C	+	1,2
Annona reticulata L.	T	C	+	1,2

Appendix Table 2—Species of plants observed in Cañón San Cristóbal listed by family with descriptive information on life form, origin, commonness, and area of occurrence in the canyon (continued)

Family and species	Descriptive information			
	Life form[a]	Origin[b]	Commonness[c]	Area[d]
Apocynaceae				
Nerium oleander L.	S	C	+	1
Prestonia agglutinata (Jacq.) Woods.	V	N	+	2,3
Rauvolfia nitida Jacq.	T	N	+	1
Aquifoliaceae				
Ilex guianensis (Aubl.) Kuntze	T	N	+	1
Araceae				
Alocasia macrorrhiza Schott	H	X	+	3
Anthurium crenatum (L.) Kunth	H	N	+++	1,2,3
Anthurium dominicense Schott	H	N	+	2
Anthurium scandens (Aubl.) Engl.	H	N	++	2
Dieffenbachia seguine (Jacq.) Schott	H	N	+++	2,3
Epipremnum aureum (Lindl. & André) Bunt.	V	X	+	3
Philodendron angustatum Schott	V	N	++	1,2,3
Syngonium podophyllum Schott	V	X	++	2,3
Xanthosoma atrovirens C. Koch & Bouché	H	X	+	3
Xanthosoma sagittifolium (L.) Schott	H	C	++	2,3
Xanthosoma undipes (C. Koch) C. Koch	H	C	+	2,3
Xanthsoma violaceum Schott	H	X	++	3
Araliaceae				
Dendropanax arboreus (L.) Decne. & Planch.	T	N	++	1,2
Schefflera morototoni (Aubl.) Maguire	T	N	++	1
Asclepiadaceae				
Asclepias curassavica L.	H	N	++	1
Metastelma grisebachianum Schltr.	V	N	++	2
Metastelma lineare Bello	V	N	+	1,2
Balsaminaceae				
Impatiens walleriana Hook.f.	H	X	++	3
Begoniaceae				
Begonia sp.	H	X	++	2
Bignoniaceae				
Crescentia cujete L.	T	N	+	1
Distictis lactiflora (Vahl) DC.	V	N	++	1,2
Macfadyena unguis-cati (L.) A. Gentry	V	N	+++	1,2,3
Spathodea campanulata Beauv.	T	X	++	1,2,3
Tabebuia heterophylla (DC.) Brit.	T	N	++	1
Bixaceae				
Bixa orellana L.	S	X	++	1,2,3

Appendix Table 2—Species of plants observed in Cañón San Cristóbal listed by family with descriptive information on life form, origin, commonness, and area of occurrence in the canyon (continued)

Family and species	Descriptive information			
	Life form[a]	Origin[b]	Commonness[c]	Area[d]
Bombacaceae				
Ceiba pentandra (L.) Gaertn.	T	N	+	1,2,3
Ochroma lagopus Sw.	T	N	+	3
Quararibea turbinata (Sw.) Poir.	T	N	+++	1,2,3
Boraginaceae				
Bourreria succulenta Jacq.	T	N	++	2
Cordia alliodora (Ruíz & Pav.) Oken	T	N	+++	1,2
Cordia laevigata Lam.	T	N	+	2
Cordia polycephala (Lam.) I.M. Johnst.	S	N	++	1,2
Cordia sulcata DC.	T	N	++	1,2
Heliotropium angiospermum Murray	H	N	+	3
Tournefortia hirsutissima L.	V	N	+	1
Bromeliaceae				
Aechmea nudicaulis (L.) Griseb.	H	N	+	2
Bromelia pinguin L.	H	X	++	1,2
Catopsis floribunda L.B. Smith	H	N	+	2
Guzmania monostachia (L.) Rusby	H	N	++	2
Hohenbergia antillana Mez in DC.	H	N	+	1,2
Pitcairnia angustifolia Aiton	H	N	++	2
Tillandsia fasciculata Sw.	H	N	++	1,2
Tillandsia festucoides Brongn.	H	N	++	1,2
Tillandsia polystachya (L.) L.	H	N	+++	1,2
Tillandsia recurvata (L.) L.	H	N	++	1,2
Tillandsia setacea Sw.	H	N	+++	1,2
Tillandsia usneoides (L.) L.	H	N	++	2
Tillandsia utriculata L.	H	N	++	1,2
Tillandsia valenzuelana A. Rich.	H	N	+++	1,2
Burseraceae				
Tetagrastris balsamifera (Sw.) Oken	T	N	++	1,2
Cactaceae				
Hylocereus trigonus (Haw.) Saff.	V	N	++	1,2
Pereskia aculeata Mill.	V	N	++	1,2
Rhipsalis baccifera (J.S. Mill.) Strn.	V	N	++	1,2
Cannaceae				
Canna indica L.	H	X	++	3
Capparaceae				
Capparis amplissima Lam.	T	N	+	2
Capparis baducca L.	T	N	+++	1,2
Capparis cynophallophora L.	T	N	++	2
Cleome speciosa Raf.	H	N	++	3

Appendix Table 2—Species of plants observed in Cañón San Cristóbal listed by family with descriptive information on life form, origin, commonness, and area of occurrence in the canyon (continued)

Family and species	Descriptive information			
	Life form[a]	Origin[b]	Commonness[c]	Area[d]
Caricaceae				
Carica papaya L.	H	X	+	3
Caryophyllaceae				
Drymaria cordata (L.) Willd.	H	N	++	1
Stellaria antillana Urban	H	N	+	3
Celastraceae				
Schaefferia frutescens Jacq.	S	N	++	1,2
Chenopodiaceae				
Chenopodium ambrosioides L.	H	X	+	3
Chrysobalanaceae				
Hirtella triandra Sw.	T	N	+	2
Combretaceae				
Buchenavia tetraphylla (Aublet) R. Howard	T	N	++	1
Bucida buceras L.	T	N	+	1
Terminalia catappa L.	T	X	+	2
Commelinaceae				
Aploleia monandra (Sw.) Moore	H	N	++	2
Callisia repens (Jacq.) L.	H	N	++	2
Commelina diffusa Burm.	H	N	+++	1,2,3
Commelinopsis persicariifolia (DC.) M. Pichon	H	N	++	2
Gibasis geniculata (Jacq.) Rohw.	H	N	+	2,3
Tradescantia pallida (Rose) Hunt	H	X	+	3
Tradescantia zanonia (L.) Sw.	H	N	++	2,3
Zebrina pendula Schnizl.	H	N	++	3
Compositae				
Ageratum conyzoides L.	H	N	+	3
Bidens alba (L.) DC. var. *radiata* (Sch.-Bip.) Ballard	H	N	+	2,3
Bidens pilosa L.	H	N	+	2
Bidens reptans (L.) G. Don	V	N	++	1,2
Centratherum punctatum Cass.	H	X	+	1,2,3
Chaptalia nutans (L.) Polak.	H	N	++	2
Conyza apurensis HBK.	H	N	++	1
Conyza bonariensis (L.) Cron.	H	N	+	1
Crassocephalum crepidioides (Benth.) S. Moore	H	X	++	1,2,3
Eclipta prostrata (L.) L.	H	N	+	3
Elephantopus mollis HBK.	H	N	++	2,3
Emilia fosbergii Nicols.	H	X	+	2
Erechtites valerianifolia (Spreng.) DC.	H	N	+	2
Erigeron bellioides DC.	H	N	++	3

Appendix Table 2—Species of plants observed in Cañón San Cristóbal listed by family with descriptive information on life form, origin, commonness, and area of occurrence in the canyon (continued)

Family and species	Descriptive information			
	Life form[a]	Origin[b]	Commonness[c]	Area[d]
Compositae (continued)				
Eupatorium geraniifolium Urban	H	N	+	3
Eupatorium microstemon Cass.	H	N	+	2
Eupatorium odoratum L.	S	N	++	1,2
Eupatorium polyodon Urban	S	N	++	1
Eupatorium portoricense Urban	S	N	++	2
Galinsoga parviflora Cav.	H	X	+	1
Helianthus annuus L.	H	X	+	1
Melanthera aspera (Jacq.) Small	S	N	+	2
Mikania cordifolia (L.f.) Willd.	V	N	++	3
Mikania micrantha HBK. var. *congesta* (DC.) Robins.	V	N	+	2,3
Mikania odoratissima Urban	V	N	+	3
Mikania stevensiana Brit.	V	N	+	2
Neurolaena lobata (L.) Cass.	H	N	++	3
Pluchea symphytifolia (Mill.) Gillis	S	N	+	1
Proustia vanillosma Wr. & Sauv.	S	N	++	2
Pseudelephantopus spicatus (Aubl.) Baker	H	N	+	3
Rolandra fruticosa (L.) Kuntze	H	N	+	
Sonchus oleraceus L.	H	X	+	1,3
Synedrella nodiflora (L.) Gaertn.	H	N	++	2
Tithonia diversifolia (Hemsl.) A. Gray	H	X	+	3
Tridax procumbens L.	H	N	++	3
Vernonia cinerea (L.) Less.	H	N	+	2
Vernonia sericea L.C. Rich.	H	N	++	1,2,3
Wedelia reticulata DC.	H	N	+++	2
Wedelia trilobata (L.) Hitchc.	H	N	+	1,3
Youngia japonica (L.) DC.	H	X	+	3
Connaraceae				
Rourea surinamensis Miq.	V	N	++	3
Convolvulaceae				
Convolvulus nodiflorus Desr.	V	N	++	1
Dichondra repens J.R. & G. Forst.	V	X	+	3
Ipomoea indica (Burm.f.) Merrill var. *acuminata* (Vahl) Fosb.	V	N	+++	1,2,3
Ipomoea macrantha Roem. & Schult.	V	N	+	
Ipomoea repanda Jacq. var. *repanda*	V	N	++	
Ipomoea setifera Poir.	V	N	++	1,2,3
Ipomoea tiliacea (Wild.) Choisy	V	N	+++	2
Jacquemontia cayensis Brit.	V	N	++	
Jacquemontia havanensis (Jacq.) Urban	V	N	++	2
Jacquemontia pentantha (Jacq.) Don	V	N	++	2,3
Jacquemontia solanifolia (L.) H. Hall.	V	N	+	1
Merremia dissecta (Jacq.) H. Hall.	V	N	+	1
Merremia quinquefolia (L.) H. Hall.	V	N	+	2

Appendix Table 2—Species of plants observed in Cañón San Cristóbal listed by family with descriptive information on life form, origin, commonness, and area of occurrence in the canyon (continued)

Family and species	Descriptive information			
	Life form[a]	Origin[b]	Commonness[c]	Area[d]
Convolvulaceae (continued)				
Merremia umbellata (L.) H. Hall.	V	N	++	2
Turbina corymbosa (L.) Raf.	V	N	+	1
Crassulaceae				
Bryophyllum pinnatum (Lam.) Oken	H	N	+++	1,2,3
Cruciferae				
Brassica juncea (L.) Czermajew	H	X	++	3
Coronopus didymus (L.) Smith	H	X	++	1,3
Lepidium virginicum L.	H	N	++	3
Rorippa heterophylla (Blume) R.O Williams	H	X	++	3
Rorippa indica (L.) Hiern	H	X	++	3
Rorippa islandica (Oeder) Borbás var. *hispida* (Desv.) Butt. & Abbe	H	X	++	2
Cucurbitaceae				
Cayaponia americana (Lam.) Cogn.	V	N	++	3
Cayaponia racemosa (Miller) Cogn.	V	N	++	3
Cucurbita moschata (Lam.) Poir.	V	X	+	3
Fevillea cordifolia L.	V	N	++	2,3
Melothria pendula L.	V	N	++	2
Momordica charantia L.	V	X	++	1,2
Psiguria pedata (L.) R.A. Howard	V	X	+	1,2
Psiguria trilobata (L.) R.A. Howard	V	N	+	2
Sechium edule (Jacq.) Sw.	V	N	+	3
Cyatheaceae				
Cyathea portoricensis Sprengel ex Kuhn	T	N	+	1
Cyperaceae				
Cyperus alternifolius L.	G	X	++	3
Cyperus brevifolius (Rottb.) Endl. & Hassk.	G	N	++	1,2,3
Cyperus distans L. f.	G	N	+	3
Cyperus imbricatus Retz.	G	N	+	3
Cyperus mutisii (HBK.) Griseb	G	N	++	3
Cyperus obtusatus (Presl.) Maltf. & Kük	G	N	+	3
Cyperus rotundus L.	G	N	+	1
Cyperus sphacelatus Rottb.	G	N	+	1
Cyperus surinamensis Rottb.	G	N	++	3
Cyperus urbanii Brit. & Brit.	G	N	++	2,3
Eleocharis geniculata (L.) R. & S.	G	N	+	3
Fimbristylis dichotoma (L.) Vahl	G	N	++	3
Rhynchospora nervosa (Vahl) Boeck. ssp. *ciliata* (Vahl) Koyama	G	N	++	1

Appendix Table 2—Species of plants observed in Cañón San Cristóbal listed by family with descriptive information on life form, origin, commonness, and area of occurrence in the canyon (continued)

Family and species	Descriptive information			
	Life form[a]	Origin[b]	Commonness[c]	Area[d]
Cyperaceae (continued)				
Scleria sp.	G	N	+	1
Dioscoreaceae				
Dioscorea alata L.	V	X	++	2
Dioscorea altissima Lam.	V	X	++	2,3
Dioscorea pilosiuscula Bertero ex Spreng.	V	N	++	1,2
Dioscorea polygonoides Humb. & Bonpl. ex Willd.	V	N	++	1,2
Rajania cordata L.	V	N	++	2
Ebenaceae				
Diospyros sintenisii (Krug & Urban) Standley	T	N	+	1
Erythroxylaceae				
Erythroxylum aerolatum L.	T	N	+	2
Erythroxylum brevipes DC.	S	N	+++	1,2
Erythroxylum rufum Cav.	T	N	++	1,2,3
Euphorbiaceae				
Acalpha bisetosa Bert.	S	N	+	2
Acalypha chamaedrifolia (Lam.) Muell.-Arg.	H	N	+	3
Acalypha portoricensis Muell. Arg.	S	N	++	1,2
Alchornea latifolia Sw.	T	N	++	1,2
Chamaesyce hirta (L.) Millsp.	H	N	++	1
Chamaesyce hyssopifolia (L.) Small	H	N	++	3
Drypetes alba Poit.	T	N	+	2
Drypetes lateriflora (Sw.) Krug & Urban	T	N	+	2
Euphorbia heterophylla L.	H	N	++	3
Jatropha curcas L.	T	C	+	1,2
Jatropha gossypiifolia L.	S	N	++	1,2
Margaritaria nobilis L.	T	N	++	2
Phyllanthus niruri L.	H	N	+	2
Phyllanthus urinaria L.	H	X	+	1
Ricinus communis L.	S	X	++	3
Savia sessiliflora (Sw.) Willd.	S	N	++	2,3
Tragia volubilis L.	V	X	+++	1,2
Flacourtiaceae				
Casearia arborea (Rich.) Urban	T	N	++	1
Casearia decandra Jacq.	S	N	+	3
Casearia guianensis (Aubl.) Urban	T	N	+++	1,2,3
Casearia sylvestris Sw.	T	N	+++	1,2
Homalium racemosum Jacq.	T	N	++	1,2

Appendix Table 2—Species of plants observed in Cañón San Cristóbal listed by family with descriptive information on life form, origin, commonness, and area of occurrence in the canyon (continued)

Family and species	Descriptive information			
	Life form[a]	Origin[b]	Commonness[c]	Area[d]
Gesneriaceae				
Gesneria pedunculosa (DC.) Fritsch	S	N	+++	1,2,3
Rhytidophyllum auriculatum Hook.	H	N	++	3
Gramineae				
Andropogon bicornis L.	G	N	++	1
Andropogon glomeratus (Walt.) B.S.P.	G	N	++	1,2,3
Arthrostylidium capillifolium Griseb.	G	N	++	2
Arundinella confinis (Schultes) H. & C.	G	N	++	1
Axonopus compressus (Sw.) Beauv.	T	N	+	3
Bambusa vulgaris Schrad. ex Wendl.	T	C	++	2,3
Brachiaria adspersa (Trin.) Parodi	G	N	+++	1,2,3
Brachiaria reptans (L.) Gardn. & C.E. Hubb.	G	N	++	1
Cenchrus echinatus L.	G	N	++	1,3
Chloris inflata Link	G	N	++	1
Chloris radiata (L.) Sw.	G	N	+++	1
Chloris sagraeana A. Rich.	G	N	+	1
Chusquea abietifolia Griseb.	G	N	++	3
Coix lacryma-jobi L.	G	X	++	3
Cynodon dactylon (L.) Pers.	G	N	++	3
Cynodon nlemfuensis Vanderhyst	G	X	++	1
Dichanthium annulatum (Forssk.) Stapf	G	X	++	1
Echinochloa colona (L.) Link	G	X	+	1
Eleusine indica (L.) Gaertn.	G	X	++	1
Ichnanthus nemorosus (Sw.) Doell	G	N	++	2
Lasiacis divaricata (L.) Hitchc.	G	N	+++	2
Lasiacis maculata (Aubl.) Urban	G	N	++	1,2
Lithachne pauciflora (Sw.) Beauv.	G	N	+++	2
Melinis minutiflora Beauv.	G	X	++	1
Olyra latifolia L.	G	N	++	2
Panicum laxum Sw.	G	N	++	1
Panicum maximum Jacq.	G	X	+++	1,2,3
Panicum trichoides Sw.	G	N	+	3
Paspalum bakeri Hook.	G	N	+	3
Paspalum conjugatum Berg.	G	N	++	1
Paspalum notatum Flügge	G	N	++	1
Paspalum paniculatum L.	G	N	++	1,3
Paspalum pleostachyum Doell	G	N	+	3
Pennisetum purpureum Schumach.	G	X	++	3
Pharus glaber HBK.	G	N	+++	1,2
Poa annua L.	G	X	+	3
Rhynchelytrum repens (Willd.) C.E. Hubb.	G	X	++	1
Setaria geniculata (Lam.) Beauv.	G	N	++	1
Setaria setosa (Sw.) Scribn.	G	N	+	3
Sporobolus indicus (L.) R. Br.	G	N	++	1
Sporobolus jacquemontii Kunth	G	N	++	2

Appendix Table 2—Species of plants observed in Cañón San Cristóbal listed by family with descriptive information on life form, origin, commonness, and area of occurrence in the canyon (continued)

Family and species	Descriptive information			
	Life form[a]	Origin[b]	Commonness[c]	Area[d]
Gramineae (continued)				
Stenotaphrum secundatum (Walt.) Kuntze	G	N	++	1,3
Guttiferae				
Calophyllum calaba L.	T	N	+	3
Clusia minor L.	V	N	++	2
Clusia rosea Jacq.	T	N	+++	1,2,3
Mammea americana L.	T	C	++	1,2
Hippocrateaceae				
Hippocratea volubilis L.	V	N	+++	1,2,3
Pristimera caribaea (Urban) A.C. Smith	V	N	+++	1,2,3
Hypericaceae				
Hypericum diosmoides Griseb.	H	N	++	1,2,3
Hypoxidaceae				
Hypoxis decumbens L.	H	N	+	3
Hypoxis wrightii (Baker) Brackett	H	N	+	3
Labiatae				
Coleus scutellarioides (L.) Benth.	H	X	++	3
Hyptis capitata Jacq.	H	N	++	1,3
Hyptis lantanifolia Poit.	H	N	++	1,3
Hyptis pectinata (L.) Poit.	S	N	+	1
Hyptis suaveolens (L.) Poit.	H	N	+	2
Hyptis verticillata Jacq.	H	N	+	3
Leonotis nepetifolia (L.) Ait.f.	H	X	+	3
Leonurus sibiricus L.	H	N	++	3
Salvia occidentalis Sw.	H	N	+	3
Scutellaria havanensis Jacq.	H	N	++	3
Lauraceae				
Cinnamomum montanum (Sw.) Bercht. & Presl.	T	N	+	1
Licaria parvifolia (Lam.) Kosterm.	T	N	++	2
Licaria triandra (Sw.) Kosterm.	T	N	+	2
Ocotea coriacea (Sw.) Britton	T	N	+++	1,2,3
Ocotea floribunda (Sw.) Mez	T	N	+	2
Ocotea krugii (Mez) Howard	T	N	+	1,2
Ocotea leucoxylon (Sw.) De Laness	T	N	++	1,2
Ocotea membranacea (Sw.) Howard	T	N	+	2
Ocotea patens (Sw.) Nees	T	N	++	2
Ocotea sintenisii (Mez) Alain	T	N	++	2
Persea americana Miller	T	X	++	2

Appendix Table 2—Species of plants observed in Cañón San Cristóbal listed by family with descriptive information on life form, origin, commonness, and area of occurrence in the canyon (continued)

Family and species	Descriptive information			
	Life form[a]	Origin[b]	Commonness[c]	Area[d]
Leguminosae (Mimosoideae)				
Acacia retusa (Jacq.) Howard	V	N	+++	1,2
Albizia procera (Roxb.) Benth.	T	X	+	2
Calliandra portoricensis (Jacq.) Benth.	S	N	+	2
Inga laurina (Sw.) Willd.	T	N	++	1,2,3
Inga quaternata Poepp. & Endl.	T	X	+	3
Inga vera Willd.	T	N	++	1,2,3
Leucaena leucocephala (Lam.) DeWit	T	X	++	3
Mimosa ceratonia L.	V	N	++	1,2
Mimosa pellita Willd.	S	X	+	1,3
Mimosa pudica L.	V	N	++	1,2,3
Pithecellobium arboreum (L.) Urban	T	N	++	2
Samanea saman (Jacq.) Merr.	T	X	+	1
Leguminosae (Caesalpinioideae)				
Bauhinia monandra Kurz	T	C	+	1
Caesalpinia decapetala (Roth) Alst.	S	X	+	2
Chamaecrista nictitans (L.) Moench	S	N	++	1,2,3
Delonix regia (Bojer ex Hook.) Raf.	T	X	++	1
Hymenaea courbaril L.	T	N	++	2
Senna hirsuta (L.) Irwin & Barneby	H	X	++	2
Senna nitida (Rich.) Irwin & Barneby	V	N	++	1,2
Senna siamea (Lam.) Irwin & Barnaby	T	X	++	1,3
Senna spectabilis (DC.) Irwin & Barneby	T	X	++	1,2,3
Stahlia monosperma (Tul.) Urban	T	C	+	1
Tamarindus indica L.	T	X	++	1,2,3
Leguminosae (Papilionoideae)				
Abrus precatorius L.	V	N	++	3
Aeschynomene americana L.	S	N	++	1
Andira inermis (Wright) Kunth ex DC.	T	N	+++	1,2,3
Calopogonium caeruleum (Benth.) Hemsley	V	X	++	2
Centrosema virginianum (L.) Benth.	V	N	+++	1,2,3
Clitoria falcata Vahl ex DC.	V	N	+	1
Clitoria ternatea L.	V	X	+	1
Crotalaria pallida Ait.	H	N	++	1,2
Crotalaria retusa L.	H	X	++	1,2
Desmodium axillare (Sw.) DC. var. *axillare*	H	N	+	1
Desmodium incanum DC.	V	N	++	1,2
Desmodium wydlerianum Urban	H	N	++	2,3
Erythrina berteroana Urban	T	C	+	2
Erythrina poeppigiana (Walp.) Cook	T	X	+++	2,3
Galactia dubia DC.	V	N	++	2
Galactia striata (Jacq.) Urban	V	N	+	2
Gliricidia sepium (Jacq.) Kunth ex Walp.	T	C	++	1,2

Appendix Table 2—Species of plants observed in Cañón San Cristóbal listed by family with descriptive information on life form, origin, commonness, and area of occurrence in the canyon (continued)

Family and species	Descriptive information			
	Life form[a]	Origin[b]	Commonness[c]	Area[d]
Leguminosae (Papilionoideae) (continued)				
Indigofera suffruticosa Mill.	S	N	+	1
Lonchocarpus latifolius (Willd.) DC.	T	N	++	3
Macroptilium lathyroides (L.) Urban	H	N	+	3
Mucuna urens (L.) DC.	V	N	+	2
Neorudolphia volubilis (Willd.) Brit.	V	N	++	2
Ormosia krugii Urban	T	N	++	1,2
Phaseolus lunatus L.	V	X	+	3
Poitea florida (Vahl) Lavin	S	N	++	2,3
Pterocarpus macrocarpus Kurz	T	C	+	1
Rhynchosia minima (L.) DC.	V	N	++	2
Rhynchosia reticulata (Sw.) DC.	V	N	+++	1,2,3
Teramnus uncinatus (L.) Sw.	V	N	++	1
Vigna adenantha (G. Meyer) Maréchal et al.	V	N	+	1
Vigna luteola (Jacq.) Benth.	V	N	+	1,2
Vigna vexillata (L.) A. Rich.	V	N	++	1,2
Lemnaceae				
Spirodela polyrhiza (L.) Schleiden	H	N	++	3
Liliaceae				
Sansevieria hyacinthoides (L.) Druce	H	X	+	3
Lobeliaceae				
Hippobroma longiflora (L.) G. Don	H	N	+	1,2
Lobelia assurgens L.				
var. *portoricensis* (A. DC.) Urban	H	N	++	3
Lobelia cliffortiana L.	H	X	+	3
Lythraceae				
Cuphea hyssopifolia Kunth in Humb.	S	X	+	2
Cuphea strigulosa Kunth in Humb.	S	N	++	3
Ginoria rohrii (Vahl) Koehne	S	N	+	2
Malpigheaceae				
Bunchosia glandulosa (Cav.) L.C. Rich	T	N	+	2
Byrsonima spicata (Cav.) HBK.	T	N	++	1
Heterópteris laurifolia (L.) A. Juss.	V	N	++	2
Heterópteris purpurea (L.) Kunth	V	N	++	2
Heterópteris wydleriana A. Juss.	V	N	++	1,2
Malpighia coccigera L.	S	N	++	2
Malpighia fucata Ker-Gawl.	T	N	+	3
Stigmaphyllon emarginatum (Cav.) A. Juss.	V	N	+	2
Stigmaphyllon floribundum (DC.) Anders.	V	N	++	2
Stigmaphyllon puberum (L.C. Rich) A. Juss.	V	N	+	2,3
Tetrapterys inaequalis Cav.	V	N	+	2

Appendix Table 2—Species of plants observed in Cañón San Cristóbal listed by family with descriptive information on life form, origin, commonness, and area of occurrence in the canyon (continued)

Family and species	Descriptive information			
	Life form[a]	Origin[b]	Commonness[c]	Area[d]
Malvaceae				
Hibiscus pernambucensis Arruda	T	C	+	2
Hibiscus rosa-sinensis L.	T	C	+	1
Malachra alceifolia Jacq.	H	N	+	3
Malva neglecta Wall.	S	X	+	1
Malvastrum coromandelianum (L.) Garcke	H	N	++	1
Malvaviscus arboreus Cav.	S	X	++	2,3
Pavonia fruticosa (Miller) Fawc. & Rendle	S	N	+	3
Pavonia spinifex (L.) Cav.	S	N	+++	1,2
Sida acuta Burm.f.	S	N	++	1,3
Sida repens Dombey ex Cav.	H	X	+	1
Sida rhombifolia L.	S	N	++	1
Sida salviifolia C. Presl	H	N	+	2
Sida urens L.	S	N	++	1
Thespesia grandiflora DC.	T	N	+	3
Urena lobata L.	H	N	++	1
Marattiaceae				
Danaea nodosa (L.) J.E. Smith	F	N	+	1
Marcgraviaceae				
Marcgravia rectiflora Triana & Planch.	V	N	+	2
Melastomataceae				
Clidemia cymosa (Wendl.) Alain	S	N	+	1
Clidemia hirta (L.) D. Don	S	N	++	1
Miconia impetiolaris (Sw.) D. Don	S	N	++	1,2
Miconia laevigata (L.) DC.	S	N	+++	1,2
Miconia mirabilis (Aubl.) L.O. Williams	S	N	++	1
Miconia prasina (Sw.) DC.	S	N	++	1,2
Miconia racemosa (Aubl.) DC.	S	N	++	1
Miconia splendens (Sw.) Griseb.	T	N	+	1,2
Miconia thomasiana DC.	S	N	+	1
Nepsera aquatica (Aubl.) Naud.	H	N	+	3
Meliaceae				
Guarea glabra Vahl	T	N	++	1,2
Guarea guidonia (L.) Sleumer	T	N	+++	1,2,3
Trichilia hirta L.	T	N	++	1,2
Trichilia pallida Sw.	T	N	+++	1,2,3
Menispermaceae				
Cissampelos pareira L.	V	N	++	1,2

Appendix Table 2—Species of plants observed in Cañón San Cristóbal listed by family with descriptive information on life form, origin, commonness, and area of occurrence in the canyon (continued)

Family and species	Descriptive information			
	Life form[a]	Origin[b]	Commonness[c]	Area[d]
Moraceae				
Artocarpus altilis (Park.) Fosb.	T	C	+	1
Cecropia schreberiana Miq.	T	N	++	2
Dorstenia contrajerva L.	H	N	++	2,3
Ficus americana Aubl.	T	N	+	2,3
Ficus citrifolia Miller	T	N	++	1,2,3
Ficus elastica Roxb. ex Horm.	T	C	++	1
Ficus trigonata L.	T	N	++	1,2,3
Musaceae				
Heliconia caribaea Lam.	H	N	++	2
Musa spp.	H	C	+	3
Myrsinaceae				
Ardisia obovata Hamilt.	T	N	+++	1,2
Myrsine coriacea (Sw.) R. Br.	T	N	++	1
Parathesis crenulata (Vent.) Hook.f.	T	N	+	1
Myrtaceae				
Eucalyptus robusta J.E. Smith	T	C	++	1
Eugenia biflora (L.) DC.	T	N	+++	1,2
Eugenia confusa DC.	T	N	+++	1,2
Eugenia laevis Berg.	S	N	+	1
Eugenia ligustrina (Sw.) Willd.	S	N	++	1,2
Eugenia monticola (Sw.) DC.	T	N	+++	1,2
Eugenia pseudopsidium Jacq.	T	N	+++	1,2
Eugenia stewardsonii Brit.	T	N	++	1,2
Myrcia citrifolia (Aubl.) Urban	S	N	+	1,2
Myrcia deflexa (Poir.) DC.	T	N	++	1,2
Myrcia splendens (Sw.) DC.	T	N	++	1,2
Myrciaria floribunda (West ex Willd.) Berg.	T	N	++	2
Pimenta racemosa (Miller) J. Moore var. *racemosa*	T	C	+	2
Psidium guajava L.	S	N	++	1,2,3
Syzygium jambos (L.) Alst.	T	X	+++	1,2,3
Nyctaginaceae				
Bougainvillea glabra Choisy	S	C	+	1
Guapira fragrans (Dum.-Cours.) Little	T	N	+++	1,2
Mirabilis jalapa L.	H	X	++	1
Pisonia aculeata L.	V	N	++	1,2,3
Pisonia borinquena Proctor ind.	T	N	+	2
Olacaceae				
Ximenia americana L.	T	N	++	2

Appendix Table 2—Species of plants observed in Cañón San Cristóbal listed by family with descriptive information on life form, origin, commonness, and area of occurrence in the canyon (continued)

Family and species	Descriptive information			
	Life form[a]	Origin[b]	Commonness[c]	Area[d]
Oleaceae (continued)				
Chionanthus compactus Sw.	T	N	+	2
Chionanthus domingensis Lam.	T	N	++	2
Jasminum fluminense Vell.	V	X	+	1
Onagraceae				
Ludwigia leptocarpa (Nutt.) H. Hara	H	N	++	1
Ludwigia octovalis (Jacq.) Raven	H	N	+	1,3
Ludwigia peploides (HBK.) Raven	H	N	+	3
Orchidaceae				
Campylocentrum micranthum (Lindl.) Rolfe	H	N	+	2
Comparettia falcata Poepp. & Endl.	H	N	+	3
Encyclia cochleata (L.) Dress.	H	N	++	2,3
Encyclia pygmaea (Hook.) Dress.	H	N	+	2
Epidendrum difforme Jacq.	H	N	++	2
Epidendrum nocturnum Jacq.	H	N	+	2
Epidendrum secundum Jacq.	H	N	+	2,3
Erythrodes plantaginea (L.) Fawc. & Rend.	H	N	++	2
Ionopsis satyrioides (Sw.) Rchb.f.	H	N	+	2
Ionopsis utricularioides (Sw.) Lind.	H	N	+	2
Liparis nervosa (Thunb.) Lindl.	H	N	+	2
Oeceoclades maculata (Lind.) Lind.	H	X	++	2
Oncidium altissimum (Jacq.) Sw.	H	N	++	1,2
Pleurothallis pruinosa Lindl.	H	N	+	2
Pleurothallis wilsonii Lindl.	H	N	+	2
Polystachya concreta (Jacq.) Garay & Sweet	H	N	+	2
Prescottia stachyodes (Sw.) Lindl.	H	N	+	2
Stenorrhynchos speciosus (Jacq.) Lindl.	H	N	+	
Tolumnia variegata (Sw.) Braem	H	N	+++	1,2
Vanilla dilloniana Corell	V	N	++	2
Oxalidaceae				
Oxalis barrelieri L.	H	N	+	3
Oxalis corniculata L.	H	N	+	3
Oxalis debilis Kunth var. *corymbosa* (DC.) Lourteig	H	N	+	3
Palmaceae				
Roystonea borinquena O.F. Cook	T	N	++	1,2
Papaveraceae				
Argemone mexicana L.	H	N	+	1
Bocconia frutescens L.	S	N	+	3

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Although it is one of the most spectacular geologic features in Puerto Rico, the vegetation of Cañón de San Cristóbal was seriously disturbed over the last century and a half by subsistence farming, grazing, and wood cutting. Now that agricultural activity has nearly ceased and the canyon is partially protected, the vegetation is rapidly recovering. At the request of the Conservation Trust of Puerto Rico which owns about two-thirds of the canyon, personnel of the U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, conducted a vegetation survey of the entire canyon. A total of 678 species were identified in the 1000-ha area, including one new recording for Puerto Rico. Of the total species, 549 were native and 129 were exotic. Several of the species are considered rare and endangered. The species are listed, together with their lifeforms, whether they are native or not, their commonness, and the area within the canyon where they are found. In addition, a map of the various vegetation types in the canyon is presented.

Keywords: Biodiversity, endangered species, native species, natural area, secondary forest.

The Forest Service, United States Department of Agriculture (USDA), is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives—as directed by Congress—to provide increasingly greater service to a growing Nation.