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Vegetation Structure and Composition Across Select Ecological Succession Stages and Land Uses in Puerto Rico

Johann D. Crespo-Zapata, Steve Maldonado-Silvestrini, William A. Gould



Cover photos: Front cover, clockwise, starting at the top left corner: seedlings of *Annona glabra*, tree fern canopy/frond undersides of *Cyathea arborea*, inflorescence of *Desmodium incanum*, and trunk of *Spathodea campanulata*. **Back cover, left:** stem of *Dioscorea chondrocarpa*; **right, top to bottom:** pinnae of *Odontosoria aculeata*, stipels/leaflets of *Andira inermis*, and young leaves of *Stigmaphyllon puberum*. Forest Service photos by Johann D. Crespo-Zapata.

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Johann D. Crespo-Zapata, Steve Maldonado-Silvestrini, William A. Gould

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Contributions

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W.A. Gould initiated the project and led to its development; served as the project advisor; provided guidance on field data collection and analyses; wrote the Preface section; and reviewed this report.

Abstract

From 2021 to 2023, researchers conducted inventories to assess, survey, and describe vegetation on 99 sites in Puerto Rico. Inventory sites comprise several ecological succession stages (or vegetation community phases) and land uses across the island, encompassing mature forests, restored forests, secondary forests, shrublands, pioneers, abandoned tillage crops, managed grasslands, abandoned grasslands, and abandoned horticulture grounds. These were located among the municipalities of Cabo Rojo, Caguas, Canóvanas, Fajardo, Jayuya, Lajas, Loíza, Luquillo, Manatí, Río Grande, Santa Isabel, and Utuado. Some 689 plant species were recorded during this period and are included in this report, accounting for approximately 20 percent of the total suggested flora of Puerto Rico. A total of 80 plant samples were collected and processed, and the corresponding imaged herbarium specimen vouchers are also included. This report presents an overview of the floristic makeup and dynamics, based on the areas and sites assessed, and provides inventory data summaries, as well as descriptive analyses and other general results. The information is intended to serve as a multipurpose planning tool and to support conservation, land-use management, and other practices to mitigate the effects of climate change and extreme weather events.

Keywords: plants, flora, species, Puerto Rico, island, ecological succession stages, land uses

Preface

This report presents new information on the composition and structure of vegetation on what are sometimes “overlooked” components of the landscape in terms of taxonomic description. These are the abundant abandoned fields and secondary forests that make up a major component of the landscape in Puerto Rico. The publication stems from a collaboration and long-time shared interest between the U.S. Department of Agriculture’s Natural Resources Conservation Service (NRCS) and Forest Service to develop information on vegetation succession stages, closely tied to soil descriptions and terrain features, that can serve as a decision-support tool for public and private land managers. Vegetation cover is a dynamic property governed by historical conditions, biogeography of species, natural and anthropogenic disturbances, and decisions on whether and how to manage the land. The land management cycle often starts with identifying objectives and is followed by planning how to get from “here to there” and achieve desired outcomes. The kinds of forests and other vegetation associated with specific soils, topography, and climates provide important templates for planning. These data provide site-specific information that represents potential future conditions based on vegetation succession and response to disturbance and helps inform management for future conditions in concert with ecological principles.

The information in this report is based on careful site selection so that inventories represent vegetation found on sites nested within Major Land Resource Areas defined across the United States and its territories by NRCS. The inventories and associated site information serve as standard Ecological Site Descriptions developed by NRCS to allow for evaluating land suitability for different uses, assessing response to different management activities or disturbances, and supporting a site’s ability to sustain productivity over the long term. The detailed inventory and assessment of a wide range of landscape units adds significantly to the long history of botanical description and ecological research in Puerto Rico.

I hope this work will benefit readers by offering accessible information on plants and their dynamics in relation to a variety of community phases and land uses. It is intended to pave the way for further research, general interest, exploration, and, ultimately, a deeper appreciation of the island’s natural heritage.

William A. Gould

Contents

Authors	ii
Contributions	ii
Abstract	iii
Preface	iv
List of Figures	vi
List of Tables	xii
Acknowledgments	xiii
Acronyms and Abbreviations	xiv
Introduction	1
Background	1
Objectives	3
Methodology	4
Inventory Locations and Sites	4
Vegetation Community Phases and Land Uses	4
Vegetation Data	4
Ancillary Data and Photographic Documentation	5
Plant Identification, Collection of Samples, Taxonomic Approach, and Species References	6
Data Processing and Analyses	6
Vegetation Data	6
Ecological Life Zones (or Holdridge Life Zones)	7
General Limitations and Potential Biases	8
Inventory Locations, Sites, Vegetation Community Phases, and Land Uses	8
Vegetation Data Collection, Processing, and Analyses	8
Results and Discussion	10
General Results	10
Vegetation Community Phases and Land Uses	13
Mature Forest	13
Restored Forest	17
Secondary Forest	20
Shrubland	32
Pioneers	40
Abandoned Tillage Crop	47
Managed Grassland	51
Abandoned Grassland	56
Abandoned Horticulture	62
Glossary	65
Literature Cited	67
Appendix A: Inventory Sites	69
Appendix B: Species List	169
Appendix C: Unidentified Taxa	187
Appendix D: Herbarium Vouchers	189

List of Figures

Figure 1 —Select landscapes of Puerto Rico: central mountainous region (A), eastern valleys (B), northern coast (C), and western coastal plain (D)	1
Figure 2 —The archipelago of Puerto Rico (main island and satellite islands), located in the Caribbean between the North Atlantic Ocean and the Caribbean Sea	2
Figure 3 —Puerto Rico’s mean annual precipitation (mm) (Daly et al. 2003)	2
Figure 4 —Vegetation inventory sites, located across 12 municipalities in Puerto Rico.....	4
Figure 5 —Vegetation inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973)	7
Figure 6 —Top 10 most common plant families and respective number of recorded species.....	11
Figure 7 —Top 10 most frequently recorded species <4 cm DBH, by site occurrence	11
Figure 8 —Top 10 most frequently recorded species ≥4 cm DBH, by site occurrence	12
Figure 9 —Top 10 most recorded species ≥4 cm DBH, by number of stems	12
Figure 10 —Mature forest inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973)	13
Figure 11 —Landscape view of the area where two mature forest sites are located (Bo. Saliente, municipality of Jayuya). According to the landowner, a few centuries ago this area was once a small town dedicated almost exclusively to coffee production, but some forest patches in the mountain peaks remained undisturbed.....	15
Figure 12 —Restored forest inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973)	17
Figure 13 —General views of two restored forest inventory sites (Bo. Tierras Nuevas Poniente, municipality of Manatí), dominated by <i>Pterocarpus officinalis</i> trees (A) and trees/shrubs of <i>Annona glabra</i> (B)	20
Figure 14 —Secondary forest inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973)	20
Figure 15 —General view of a secondary forest inventory site (Bo. Las Palmas, municipality of Utuado)	22
Figure 16 —General views of two secondary forest inventory sites (Bo. Hato Candal and Bo. Juan Martín, municipalities of Río Grande and Luquillo, respectively), dominated by <i>Spathodea campanulata</i> (A) and <i>Andira inermis</i> and <i>Terminalia catappa</i> (B).....	28
Figure 17 —Shrubland inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973)	32
Figure 18 —General view of a shrubland inventory site (Bo. Quebrada Fajardo, municipality of Fajardo), dominated by a variety of shrub species	37
Figure 19 —Pioneer inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973).....	40
Figure 20 —General view of a pioneer vegetation inventory site (Bo. Sabana Yeguas, municipality of Lajas), dominated by subshrubs and herbaceous vegetation	42
Figure 21 —General views of two pioneer vegetation inventory sites (Bo. Quebrada Fajardo [A] and Bo. Pitahaya [B], municipalities of Fajardo and Luquillo, respectively).44	
Figure 22 —Abandoned tillage crop inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973).....	47
Figure 23 —General views of two abandoned tillage crop inventory sites (Bo. Boca Velázquez [A] and Bo. Descalabrado [B], municipality of Santa Isabel)	48
Figure 24 —General views of two abandoned tillage crop inventory sites (Bo. Canóvanas, municipality of Loíza): an abandoned pumpkin/squash crop (A), and a neglected or unmanaged plantain crop (B)	49
Figure 25 —Managed grassland inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973)	51
Figure 26 —Landscape view of the mountain where two managed grassland sites are located (Bo. Saliente, municipality of Jayuya). According to the landowner, this mountain has been managed and disturbed over the years with recurring fires	53

Figure 27 —A hay production field, one of three managed grassland inventory sites located in the municipality of Lajas (Bo. Sabana Yeguas)	54	Figure A-9 —(A) General view of the site and (B) pinnae of <i>Lygodium japonicum</i> , a climbing fern observed within the site	78
Figure 28 —Abandoned grassland inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973).....	56	Figure A-10 —(A) General view of the site and (B) <i>Syngonium podophyllum</i> vines, commonly seen throughout the understory.....	79
Figure 29 —Abandoned grassland inventory sites located in the municipality of Lajas (Bo. Sabana Yeguas)	58	Figure A-11 —(A) General view of the site and (B) a view of the understory showing mostly <i>Blechnum occidentale</i> ferns	80
Figure 30 —General views of two abandoned or unmanaged grassland inventory sites (Bo. Quebrada Fajardo and Bo. Pitahaya, municipalities of Fajardo and Luquillo, respectively), dominated by <i>Paspalum virgatum</i> (A) and <i>Paspalum fasciculatum</i> (B).....	60	Figure A-12 —(A) General view of the site and (B) one of a few <i>Miconia impetiolearis</i> shrubs observed in the understory.....	81
Figure 31 —Abandoned horticulture inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973).....	62	Figure A-13 —(A) General view of the site and (B) a view of the understory showing ferns, shrubs, herbs, vines, and lianas	82
Figure 32 —General views of two abandoned horticulture inventory sites (Bo. Las Palmas, municipality of Utuado). Neglected <i>Musa × paradisiaca</i> plantation (A), and an abandoned small-scale plantation of primarily <i>Manihot esculenta</i> , <i>Theobroma cacao</i> , and <i>Coffea arabica</i> (B).....	63	Figure A-14 —(A) General view of the site and (B) saplings of <i>Prestoea acuminata</i> var. <i>montana</i> observed in the understory	83
Figure A-1 —(A) General view of the site and (B) flowers of <i>Fareamea occidentalis</i> , a common shrub species within the site	70	Figure A-15 —(A) General view of the site and (B) details of a <i>Swietenia macrophylla</i> trunk, the dominant tree within the site	84
Figure A-2 —(A) General view of the site and (B) flowers of <i>Pharus lappulaceus</i> , a grass observed throughout the understory.....	71	Figure A-16 —(A) General view of the site and (B) details of a <i>Bursera simaruba</i> trunk, a tree species observed within the site	85
Figure A-3 —(A) General view of the site and (B) <i>Dennstaedtia bipinnata</i> blades, a fern observed throughout the understory.....	72	Figure A-17 —(A) General view of the site and (B) inflorescence of <i>Bromelia pinguin</i> , a bromeliad observed within the site.....	86
Figure A-4 —(A) General view of the site and (B) branch/leaves of <i>Stahlia monosperma</i> , a planted species within the site	73	Figure A-18 —(A) General view of the site and (B) branch/leaves of <i>Miconia laevigata</i> , a shrub observed in the understory	87
Figure A-5 —(A) General view of the site and (B) trunk/roots of <i>Pterocarpus officinalis</i> , a planted species within the site	74	Figure A-19 —(A) General view of the site and (B) trunk of <i>Spathodea campanulata</i> , the dominant tree species within the site	88
Figure A-6 —(A) General view of the site and (B) branch/leaves of <i>Amphitecna latifolia</i> , a planted species within the site	75	Figure A-20 —(A) General view of the site and (B) stipels/leaflets of <i>Andira inermis</i> , a dominant tree species within the site	89
Figure A-7 —(A) General view of the site and (B) fruit/seedpod of <i>Pterocarpus officinalis</i> , a planted species within the site	76	Figure A-21 —(A) General view of the site and (B) sapling of <i>Calophyllum antillanum</i> , a tree species observed within the site	90
Figure A-8 —(A) General view of the site and (B) sapling of <i>Licaria triandra</i> , a tree species observed within the site...77	77	Figure A-22 —(A) General view of the site and (B) fruits/leaves of <i>Terminalia catappa</i> , the dominant species within the site	91
		Figure A-23 —(A) General view of the site and (B) leaf of <i>Peltophorum pterocarpum</i> , the dominant species within the site	92

Figure A-24 —(A) General view of the site and (B) sapling of <i>Pterocarpus officinalis</i> , the dominant species within the site	93	Figure A-39 —(A) General view of the site and (B) fruits/leaves of <i>Paullinia pinnata</i> , a species of vine observed within the site	108
Figure A-25 —(A) General view of the site and (B) fruit/seedpod of <i>Oeceoclades maculata</i> , an orchid observed within the site	94	Figure A-40 —(A) General view of the site and (B) leaves of <i>Tournefortia hirsutissima</i> , a vine/liana observed within the site	109
Figure A-26 —(A) General view of the site and (B) young leaves of <i>Stigmaphyllon puberum</i> , a vine/liana observed in the site	95	Figure A-41 —(A) General view of the site and (B) <i>Piper aduncum</i> with inflorescences, a common pepper species in the site	110
Figure A-27 —(A) General view of the site and (B) flower/leaves of <i>Dissotis rotundifolia</i> , a creeping herb observed in the site	96	Figure A-42 —(A) General view of the site and (B) flower of <i>Asystasia gangetica</i> , a common herb observed within the site	111
Figure A-28 —(A) General view of the site and (B) pinnae of <i>Nephrolepis multiflora</i> , a common fern within the site	97	Figure A-43 —(A) General view of the site and (B) <i>Euphorbia heterophylla</i> , a common spurge species observed within the site	112
Figure A-29 —(A) General view of the site and (B) details of <i>Clidemia hirta</i> leaves, a subshrub species observed within the site	98	Figure A-44 —(A) General view of the site and (B) flower of <i>Bastardia viscosa</i> , a subshrub species observed within the site	113
Figure A-30 —(A) General view of the site and (B) a young <i>Cyathea arborea</i> frond, a common tree fern within the site	99	Figure A-45 —(A) General view of the site and (B) flowers of <i>Jasminum fluminense</i> , the dominant species within the site	114
Figure A-31 —(A) General view of the site and (B) stem details of <i>Pilosocereus royerii</i> , a common cactus within the site	100	Figure A-46 —(A) General view of the site and (B) flowers of <i>Antigonon leptopus</i> , a dominant vine species within the site	115
Figure A-32 —(A) General view of the site and (B) fruit/flowers of <i>Jatropha gossypifolia</i> , a subshrub observed within the site	101	Figure A-47 —(A) General view of the site and (B) fruit/flowers of <i>Jatropha gossypifolia</i> , a subshrub observed within the site	116
Figure A-33 —(A) General view of the site and (B) flower of <i>Boussieria succulenta</i> , a common species within the site	102	Figure A-48 —(A) General view of the site and (B) flower of <i>Sphagneticola trilobata</i> , a creeping herb observed within the site	117
Figure A-34 —(A) General view of the site and (B) flowers/leaves of <i>Lantana horrida</i> , a shrub species observed within the site	103	Figure A-49 —(A) General view of the site and (B) flower of <i>Vigna adenantha</i> , a species of vine observed within the site	118
Figure A-35 —(A) General view of the site and (B) inflorescence/leaf of <i>Vachellia tortuosa</i> , a dominant shrub within the site	104	Figure A-50 —(A) General view of the site and (B) flower of <i>Ipomoea tiliacea</i> , a species of vine observed within the site	119
Figure A-36 —(A) General view of the site and (B) flower of <i>Centrosema pubescens</i> , a species of vine observed within the site	105	Figure A-51 —(A) General view of the site and (B) flower of <i>Ludwigia leptocarpa</i> , a subshrub species observed within the site	120
Figure A-37 —(A) General view of the site and (B) fruit/leaves of <i>Annona glabra</i> , a dominant species within the site	106	Figure A-52 —(A) General view of the site and (B) <i>Nymphoides humboldtiana</i> , an aquatic herb observed within the site	121
Figure A-38 —(A) General view of the site and (B) inflorescences of <i>Mimosa pigra</i> , the dominant shrub species within the site	107	Figure A-53 —(A) General view of the site and (B) flower of <i>Vigna luteola</i> , a species of vine observed within the site	122

Figure A-54 —(A) General view of the site and (B) inflorescence of <i>Neptunia plena</i> , an aquatic herb observed within the site	123	Figure A-69 —(A) General view of the site and (B) flowers/buds of <i>Gomphocarpus physocarpus</i> , a shrub observed in the site	138
Figure A-55 —(A) General view of the site and (B) sori of <i>Nephrolepis multiflora</i> , a dominant fern species within the site	124	Figure A-70 —(A) General view of the site and (B) fruits of <i>Rhynchosia minima</i> , a species of vine observed within the site	139
Figure A-56 —(A) General view of the site and (B) flowers of <i>Boerhavia erecta</i> , an herb species observed within the site	125	Figure A-71 —(A) General view of the site and (B) inflorescences of <i>Cynodon dactylon</i> , a dominant grass within the site	140
Figure A-57 —(A) General view of the site and (B) flowers of <i>Parthenium hysterophorus</i> , an aster species observed in the site	126	Figure A-72 —(A) General view of the site and (B) spikelets of <i>Urochloa dictyoneura</i> , the dominant grass within the site	141
Figure A-58 —(A) General view of the site and (B) leaves/bud of <i>Amaranthus spinosus</i> , a dominant species within the site	127	Figure A-73 —(A) General view of the site and (B) leaf blades of <i>Zoysia matrella</i> , the dominant grass within the site	142
Figure A-59 —(A) General view of the site and (B) flower of <i>Helianthus annuus</i> , a persistent species observed within the site	128	Figure A-74 —(A) General view of the site and (B) flower of <i>Macroptilium lathyroides</i> , a vine species observed within the site	143
Figure A-60 —(A) General view of the site and (B) <i>Physalis angulata</i> , a species of groundcherry observed within the site	129	Figure A-75 —(A) General view of the site and (B) infructescences of <i>Cynodon dactylon</i> , the dominant grass within the site	144
Figure A-61 —(A) General view of the site and (B) flower of <i>Solanum torvum</i> , a shrub species observed within the site	130	Figure A-76 —(A) General view of the site and (B) stolon details of <i>Zoysia matrella</i> , the dominant grass within the site	145
Figure A-62 —(A) General view of the site and (B) leaves of <i>Manihot esculenta</i> , one of three crop species within the site	131	Figure A-77 —(A) General view of the site and (B) inflorescence of <i>Kyllinga nemoralis</i> , a sedge species observed within the site	146
Figure A-63 —(A) General view of the site and (B) a decaying fruit of <i>Cucurbita moschata</i> , a secondary crop species in the site	132	Figure A-78 —(A) General view of the site and (B) leaf blades of <i>Axonopus compressus</i> , the dominant grass within the site	147
Figure A-64 —(A) General view of the site and (B) decaying fruits of <i>Musa × paradisiaca</i> , a crop species within the site	133	Figure A-79 —(A) General view of the site and (B) <i>Dissotis rotundifolia</i> , a creeping herb observed within the site	148
Figure A-65 —(A) General view of the site and (B) inflorescence of <i>Cyperus polystachyos</i> , a sedge species observed in the site	134	Figure A-80 —(A) General view of the site mostly showing <i>Urochloa maxima</i> grass and (B) details of its flowers and seeds	149
Figure A-66 —(A) General view of the site and (B) leaf blades of <i>Melinis minutiflora</i> , the dominant grass within the site	135	Figure A-81 —(A) General view of the site and (B) <i>Cissus verticillata</i> with flower buds, a vine species observed within the site	150
Figure A-67 —(A) General view of the site and (B) inflorescences of <i>Andropogon bicornis</i> , a dominant grass within the site	136	Figure A-82 —(A) General view of the site and (B) pinnae of <i>Odontosoria aculeata</i> , a spiny fern observed within the site	151
Figure A-68 —(A) General view of the site and (B) spikelets of <i>Urochloa mutica</i> , the dominant grass within the site	137	Figure A-83 —(A) General view of the site and (B) inflorescence/buds of <i>Leucaena leucocephala</i> , a common species in the site	152

Figure A-84 —(A) General view of the site and (B) flowers of <i>Melochia pyramidata</i> , an herb species observed within the site	153
Figure A-85 —(A) General view of the site and (B) flowers of <i>Euphorbia hypericifolia</i> , a spurge species observed in the site	154
Figure A-86 —(A) General view of the site and (B) spikelets of <i>Paspalum millegrana</i> , a grass observed within the site	155
Figure A-87 —(A) General view of the site and (B) flowers of <i>Crotalaria retusa</i> , an herb species observed within the site	156
Figure A-88 —(A) General view of the site and (B) spikelets of <i>Paspalum virgatum</i> , the dominant grass within the site	157
Figure A-89 —(A) General view of the site and (B) spikelets of <i>Urochloa mutica</i> , the dominant grass within the site	158
Figure A-90 —(A) General view of the site and (B) sheath details of <i>Paspalum fasciculatum</i> , the dominant grass within the site	159
Figure A-91 —(A) General view of the site and (B) inflorescence/nutlets of <i>Scleria eggersiana</i> , a nutrush observed in the site	160
Figure A-92 —(A) General view of the site and (B) spikelets of <i>Paspalum pleostachyum</i> , the dominant grass within the site	161
Figure A-93 —(A) General view of the site and (B) inflorescence of <i>Mikania cordifolia</i> , a vine species observed within the site	162
Figure A-94 —(A) General view of the site and (B) spikelets of <i>Urochloa arrecta</i> , the dominant grass within the site	163
Figure A-95 —(A) General view of the site and (B) opening flower of <i>Passiflora foetida</i> , a vine species observed within the site	164
Figure A-96 —(A) General view of the site and (B) flower of <i>Passiflora rubra</i> , a species of vine observed within the site	165
Figure A-97 —(A) General view of the site and (B) flowers of <i>Dissotis rotundifolia</i> , a creeping herb observed within the site	166
Figure A-98 —(A) General view of the site and (B) flowers of <i>Miconia prasina</i> , a species of shrub observed within the site	167

Figure A-99 —(A) General view of the site and (B) flowers of <i>Theobroma cacao</i> , a dominant species within the site	168
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Figure D-1 —(A) <i>Vitis tiliifolia</i> Humb. & Bonpl. ex Schult.; (B) <i>Urochloa dictyoneura</i> (Fig. & De Not.) Veldkamp; (C) <i>Oeceoclades maculata</i> (Lindl.) Lindl.; (D) <i>Heliotropium lamarckii</i> Feuillet; (E) <i>Crescentia linearifolia</i> Miers; (F) <i>Diplazium unilobum</i> Hieron.; (G) <i>Oeceoclades maculata</i> (Lindl.) Lindl.; and (H) <i>Microchilus hirtellus</i> (Sw.) D.Dietr.	192
--	-----

Figure D-2 —(A) <i>Cyclopogon elatus</i> (Sw.) Schltr.; (B) <i>Blechnum fragile</i> (Liebm.) C.V.Morton & Lellinger; (C) <i>Goniopteris tetragona</i> (Sw.) C. Presl ssp. <i>tetragona</i> ; (D) <i>Goniopteris tetragona</i> (Sw.) C. Presl ssp. <i>tetragona</i> ; (E) <i>Rhynchosia minima</i> (L.) DC.; (F) <i>Asystasia gangetica</i> (L.) T.Anderson ssp. <i>micrantha</i> (Nees) Ensermu; (G) <i>Digitaria eriantha</i> Steud.; and (H) <i>Digitaria eriantha</i> Steud.	193
---	-----

Figure D-3 —(A) <i>Urochloa distachya</i> (L.) T.Q.Nguyen; (B) <i>Casearia aculeata</i> Jacq.; (C) <i>Meniscium reticulatum</i> (L.) Sw.; (D) <i>Pterocarpus officinalis</i> Jacq.; (E) <i>Struchium sparganophorum</i> (L.) Kuntze; (F) <i>Pterocarpus officinalis</i> Jacq.; (G) <i>Callisia repens</i> (Jacq.) L.; and (H) <i>Zoysia matrella</i> (L.) Merr.	194
---	-----

Figure D-4 —(A) <i>Eriochloa punctata</i> (L.) Ham.; (B) <i>Scleria eggersiana</i> Boeckeler; (C) <i>Cyperus brevifolius</i> (Rottb.) Hassk.; (D) <i>Urochloa distachya</i> (L.) T.Q.Nguyen; (E) <i>Condea verticillata</i> (Jacq.) Harley & J.F.B.Pastore; (F) <i>Capsicum chinense</i> Jacq.; (G) <i>Digitaria horizontalis</i> Willd.; and (H) <i>Pluchea odorata</i> (L.) Cass.	195
---	-----

Figure D-5 —(A) <i>Paspalum pleostachyum</i> Döll; (B) <i>Paspalum vaginatum</i> Sw.; (C) <i>Echinochloa crus-pavonis</i> (Kunth) Schult.; (D) <i>Enydra sessilis</i> DC.; (E) <i>Saccharum officinarum</i> L.; (F) <i>Salix humboldtiana</i> Willd.; (G) <i>Persicaria punctata</i> (Elliott) Small; and (H) <i>Struchium sparganophorum</i> (L.) Kuntze.	196
--	-----

Figure D-6 —(A) <i>Eleocharis interstincta</i> (Vahl) Roem. & Schult.; (B) <i>Eleocharis interstincta</i> (Vahl) Roem. & Schult.; (C) <i>Eleocharis flavescens</i> (Poir.) Urb.; (D) <i>Ludwigia peploides</i> (Kunth) P.H.Raven; (E) <i>Panicum laxum</i> (Sw.) Zuloaga; (F) <i>Enydra sessilis</i> DC.; (G) <i>Fuirena umbellata</i> Rottb.; and (H) <i>Rhynchospora corymbosa</i> (L.) Britton.	197
--	-----

Figure D-7 —(A) <i>Leersia hexandra</i> Sw.; (B) <i>Nymphoides humboldtiana</i> (Kunth) Kuntze; (C) <i>Ceratopteris thalictroides</i> (L.) Brongn.; (D) <i>Eleocharis flavescens</i> (Poir.) Urb.; (E) <i>Annona glabra</i> L.; (F) <i>Cyperus haspan</i> L.; (G) <i>Urochloa arrecta</i> (Hack.) Morrone & Zuloaga; and (H) <i>Paspalum setaceum</i> Michx.	198
--	-----

Figure D-8—(A) *Digitaria eriantha* Steud.; (B) *Sorghum halepense* (L.) Pers.; (C) *Dichanthium annulatum* (Forssk.) Stapf; (D) *Psilotum nudum* (L.) P.Beauv.; (E) *Licaria triandra* (Sw.) Kosterm.; (F) *Paspalum fasciculatum* Willd. ex Flüggé; (G) *Spermacoce prostrata* Aubl.; and (H) *Phyllanthus debilis* J.G.Klein ex Willd.199

Figure D-9—(A) *Hirtella triandra* Sw.; (B) *Mickelia nicotianifolia* (Sw.) R.C.Moran, Labiak & Sundue; (C) *Hernandia sonora* L.; (D) *Eucharis amazonica* Linden ex Planch.; (E) *Alpinia purpurata* (Vieill.) K.Schum.; (F) *Dracaena fragrans* (L.) Ker Gawl.; (G) *Pachystachys spicata* (Ruiz & Pav.) Wassh.; and (H) *Selaginella plana* (Desv.) Hieron.200

Figure D-10—(A) *Dypsis lutescens* (H. Wendl.) Beentje & J.Dransf.; (B) *Caryota mitis* Lour.; (C) *Strobilanthes reptans* (G.Forst.) Moylan ex Y.F.Deng & J.R.I. Wood; (D) *Lithachne pauciflora* (Sw.) P.Beauv.; (E) *Ptychosperma macarthurii* (H. Wendl. ex H.J. Veitch) H.endl. ex Hook.f.; (F) *Stigmaphyllon puberum* (Rich.) A.Juss.; (G) *Costus scaber* Ruiz & Pav.; and (H) *Senna nitida* (Rich.) H.S.Irwin & Barneby.201

List of Tables

Table 1 —Vegetation community phases and land uses by number of sites assessed	10
Table 2 —Mature forest species, site frequency, site density, relative frequency, relative density, relative dominance, and importance value of canopy trees and shrubs ≥ 4 cm DBH and ≥ 2 m height, recorded within the three fixed-area square plots	14
Table 3 —Restored forest species, site frequency, site density, relative frequency, relative density, relative dominance, and importance value of canopy trees and shrubs ≥ 4 cm DBH and ≥ 1.8 m height, recorded within six fixed-area square plots	18
Table 4 —Secondary forest species (sites 1–5), site frequency, site density, relative frequency, relative density, relative dominance, and importance value of canopy trees and shrubs ≥ 4 cm DBH and ≥ 2 m height, recorded within five fixed-area square plots	21
Table 5 —Secondary forest species (sites 6–8), site frequency, site density, relative frequency, relative density, relative dominance, and importance value of canopy trees and shrubs ≥ 4 cm DBH and ≥ 2 m height, recorded within three fixed-area square plots.....	24
Table 6 —Secondary forest species (sites 9–15), site frequency, site density, relative frequency, relative density, relative dominance, and importance value of canopy trees and shrubs ≥ 4 cm DBH and ≥ 1.5 m height, recorded within seven fixed-area square plots.....	27
Table 7 —Secondary forest species (sites 16–18), site frequency, site density, relative frequency, relative density, relative dominance, and importance value of canopy trees and shrubs ≥ 4 cm DBH and ≥ 2.6 m height, recorded within three fixed-area square plots.....	30
Table 8 —Shrubland species (sites 1–3), site frequency, site density, relative frequency, relative density, relative dominance, and importance value of shrubs and small trees ≥ 4 cm DBH and ≥ 1.8 m height, recorded within three fixed-area square plots	33
Table 9 —Shrubland species (sites 4–6), site frequency, site density, relative frequency, relative density, relative dominance, and importance value of shrubs and small trees ≥ 4 cm DBH and ≥ 2 m height, recorded within three fixed-area square plots	35
Table 10 —Shrubland species (sites 7, 8, and 10), site frequency, site density, relative frequency, relative density, relative dominance, and importance value of shrubs and small trees ≥ 4 cm DBH and ≥ 2 m height, recorded within three of six fixed-area square plots	37
Table 11 —Abandoned horticulture species (sites 2 and 3), site frequency, site density, relative frequency, relative density, relative dominance, and importance value of shrubs ≥ 4 cm DBH and ≥ 2 m height, recorded within two fixed-area square plots	62
Table B-1 —Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species.....	169
Table C-1 —Genus, family, origin, growth habit, and relation to sampling plots for taxa not identified to the rank of species.....	188
Table D-1 —Scientific name and authority, collection date, locality, and voucher number of herbarium specimens.....	189

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Acronyms and Abbreviations

BAF—basal area factor

Bo.—barrio

DBH—diameter at breast height

IUCN—International Union for the Conservation of Nature

NRCS—Natural Resources Conservation Service (U.S. Department of Agriculture)

PRDNER—Puerto Rico Department of Natural and Environmental Resources

USDA—U.S. Department of Agriculture

Introduction

Background

Puerto Rico, with its blend of mountains, valleys, coastal plains, and beaches, harbors a diverse landscape and rich biodiversity (fig. 1). The main island occupies 8937 km² and includes several satellite islands, islets, and cays (fig. 2) with mean annual precipitation ranging from 701 to 4598 mm (fig. 3) and mean annual temperatures of 19.4 to 29.7 °C (Daly et al. 2003). With the only tropical rainforest in the U.S. Department of Agriculture (USDA), Forest Service's National Forest System—El Yunque National Forest—the island has been a favored location for research in tropical ecology over the last decades. The intricate relationships between a tropical climate

and diverse topography and soils, as well as historical and contemporary land-use patterns, have played crucial roles in defining the island's current vegetation cover and plant communities. Such conditions have fostered mixed conditions for plant life to thrive in a wide array of ecosystems. Also, recurring natural disturbances such as droughts, wildfires, storms, and hurricanes contribute to both short- and long-term changes on the island's vegetation patterns and structure. Overall, the floristic composition varies considerably across different areas, elevations, and land uses (Dessalines 2023, Gould et al. 2006, Weaver and Gould 2013).



Figure 1—Select landscapes of Puerto Rico: central mountainous region (A), eastern valleys (B), northern coast (C), and western coastal plain (D). Forest Service photos by Johann D. Crespo-Zapata and Steve Maldonado-Silvestrini.

Introduction

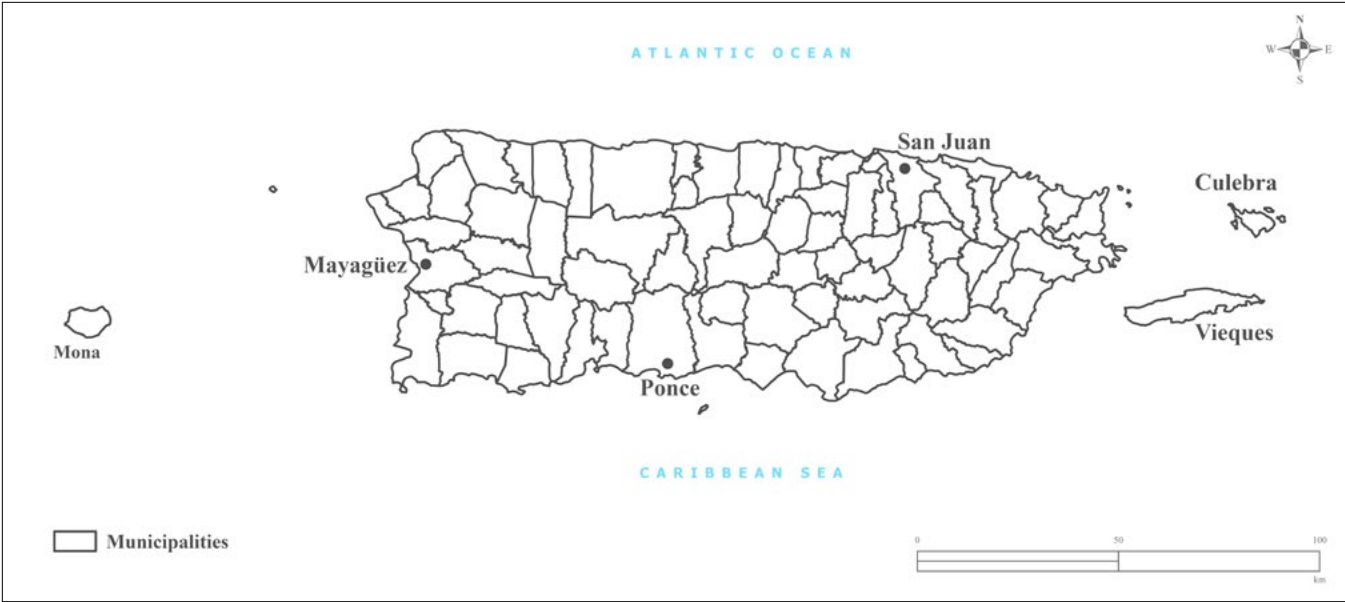


Figure 2—The archipelago of Puerto Rico (main island and satellite islands), located in the Caribbean between the North Atlantic Ocean and the Caribbean Sea.

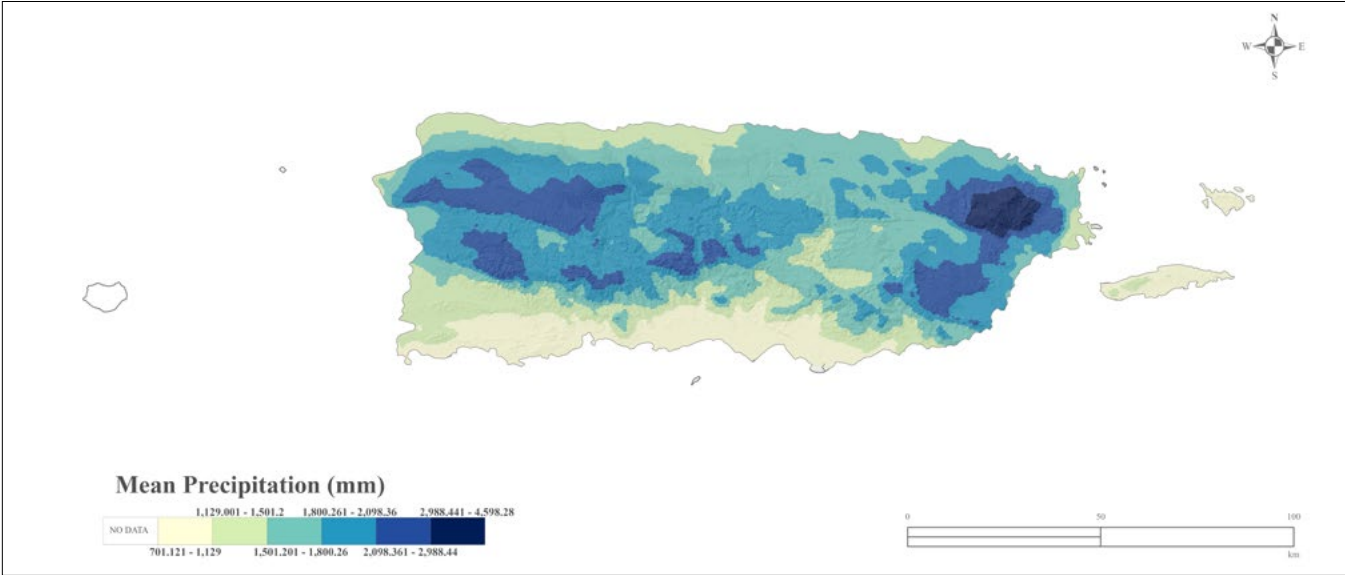


Figure 3—Puerto Rico’s mean annual precipitation (mm) (Daly et al. 2003).

Puerto Rico has undergone abrupt land-use changes that have shifted throughout the years as a reflection of its sociocultural and economic transformations (Gould et al. 2017, Miller and Lugo 2009)—first, with the arrival of early humans and indigenous communities, and subsequently with its colonization in the 16th century. The island’s primary vegetation cover was severely reduced because of emerging agricultural practices during and after the Spanish colonial period, notably

by monocultures of tobacco, sugarcane, and coffee, as well as timber harvest and pasturage. The conversion of forests and other natural areas into cultivated lands had long-lasting impacts on the island’s ecosystems, causing a significant loss of biomass and profound habitat alteration. However, the abandonment of agricultural lands during the industrialization period, in combination with ensuing conservation efforts and reforestation, have promoted forest regeneration and overall vegetation

cover in contemporary times. Since the mid-20th century, the island's forest cover has increased substantially, representing a vital resource in providing habitat for many species of wildlife and supplying numerous benefits for the human population. The island's landscape is now appreciably covered by multiple forest types of different ecological succession stages and comprises a variety of plant communities among natural and restored areas.

Preserving and restoring forests is essential not only for maintaining ecosystem processes and ecological balance but also for mitigating the effects of climate change. Forested areas act as carbon sinks by absorbing and storing greenhouse gases, helping prevent further global warming. Anthropogenic activities, including urban development, remain as one of the leading causes of natural landscape alteration and disruption. The expansion of urbanization often leads to the fragmentation of natural areas, potentially impacting species' distributions and composition. Furthermore, agriculture lands continue covering a sizable portion of the terrain with active croplands of banana, plantain, coffee, pineapple, tubers, and grains, among others. Despite all the land-use changes, disturbance events, and

ongoing ecological stressors, Puerto Rico possesses a remarkably diverse flora encompassing a broad range of ecosystems. The island boasts around 3,500 plant species, many of which have a prominent ecological and heritage value. Conservation practices can help safeguard the island's biota and diminish the potential consequences of human-induced disturbance and land-use changes.

Over the years, scientific research has produced valuable contributions to the understanding of the dynamic relationship between Puerto Rico's land uses and vegetation. Field studies, along with innovative techniques including digital mapping, remote sensing, and ecological modeling, provide comprehensive assessments on land-use patterns and changes in vegetation cover over time. This report aims to complement prior research by providing a representative overview of the current floristic makeup of several of the island's ecological succession stages and land uses. The material herein is intended to serve as an easy-access guide for a broad audience including government agencies, academic institutions, researchers, teachers, students, and the general public.

Objectives

The four main objectives of this report are to:

- ▶ Summarize vegetation inventory data gathered across 21 localities or areas in Puerto Rico's main island between 2021 and 2023.
- ▶ Present an overview of the island's current floristic makeup and dynamics, based on 99 surveyed inventory sites over select ecological succession stages (or vegetation community phases) and land uses.
- ▶ Provide descriptive analyses of the vegetation and other general results to serve as reference for future research and/or comparative studies.
- ▶ Contribute information to serve as a multipurpose planning tool and to support conservation, land-use management, and other practices to mitigate the effects of climate change and extreme weather events.

Methodology

Inventory Locations and Sites

From 2021 to 2023, vegetation inventories were conducted in 21 localities and areas in Puerto Rico, comprising the municipalities of Cabo Rojo, Caguas, Canóvanas, Fajardo, Jayuya, Lajas, Loíza, Luquillo, Manatí, Río Grande, Santa Isabel, and Utuado. This report refers to smaller farms or small-scale locales as “localities” and to broader land extensions as “areas,” which may include several towns. Inventory locations include private properties, agricultural and/or livestock farms, as well as protected nature reserves. Inventory sites were initially explored and considered via satellite imagery using ESRI shapefile polygons of targeted areas developed and provided by the USDA Natural Resources Conservation Service (NRCS) Caribbean Area staff and consisting of distinct Ecological Sites and soil components within different Major Land Resource Areas as part of Ecological Site Descriptions. This was an interagency and interdisciplinary effort. Once a potential inventory area or precise location was identified, selected, and authorized for visiting, a general area reconnaissance was conducted at the physical location to detect and assess potential patches or stretches of the targeted vegetation community phases and/or land uses. After a site was determined to meet all criteria for inventorying, data collection proceeded. During this period, inventories were conducted in a total of 99 sites (fig. 4). See appendix A for summarized descriptions,

disturbance history, vegetation, and additional information on the inventory sites.

Vegetation Community Phases and Land Uses

Vegetation was assessed, surveyed, and described in the following community phases and land uses: **mature forest, restored forest, secondary forest, shrubland, pioneers, abandoned tillage crop, managed grassland, abandoned grassland, and abandoned horticulture.**

These concepts were identified and selected for vegetation inventories conforming to their unique set of ecological and qualitative features, as well as specific structural characteristics that distinguish each of these succession stages and land uses. All terms or concepts in boldface are defined in the glossary of this report.

Vegetation Data

A 10- x 10-m (0.01 ha) **fixed-square plot** was established at each inventory site. The arrangement and positioning of the plots in the landscape were determined with particular focus on capturing the core concept and specific features of each respective ecological succession stage or land use. For instance, if the core concept of

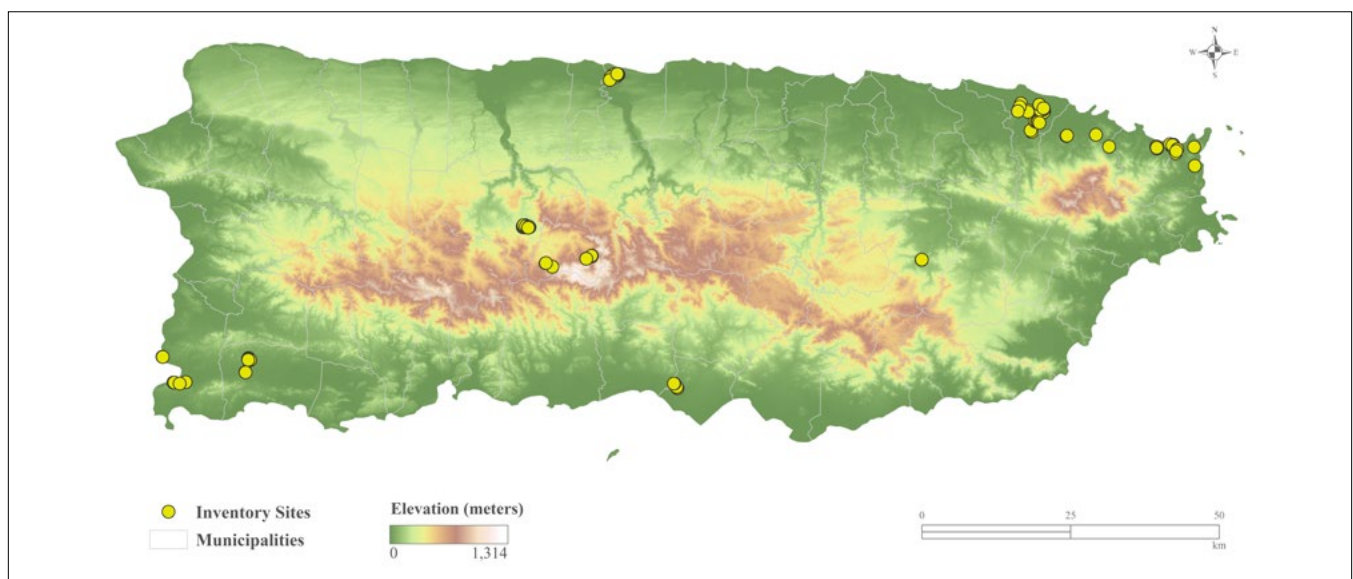


Figure 4—Vegetation inventory sites, located across 12 municipalities in Puerto Rico.

a site was grassland, it had to be dominated by grasses. Likewise, if the concept was forest, the site would have to be dominated by **trees** and possess a canopy and an understory, among other ecological features that are unique to forested areas. At mature, restored, and secondary forest inventory sites, the larger trees and some **shrubs** ≥ 4 cm **diameter at breast height (DBH)** were inventoried on a **variable-radius plot** using a 10 **basal area factor (BAF)** ft²/ac (or 2.29 m²/ha) rectangular clear cruising wedge prism. The center points of the square plots served as the cruiser locations or plot centers for all variable-radius plots. Species, DBH, and heights were recorded for all trees ≥ 4 cm DBH tallied as “in” variable-radius plots. In many forest sites, some of the larger trees were situated outside the square plot boundaries and recorded accordingly. In other forest sites, some large trees appeared to have a single trunk from the square plot center position, and were tallied initially as such, but upon closer inspection they presented multiple stems at breast height. In such cases, each stem’s diameter was measured separately, and the overall tallest height was applied to the entire tree to specify that all stems corresponded to the same individual. This approach was also used for **gemel trees** encountered, all of which corresponded to different individuals of the same species. Logger tapes were used for measuring DBH (cm) and setting the square plots (m). A base plate compass was also used for aligning the corners of all the square plots. Heights (m) were measured using a laser hypsometer.

Species, DBH, and heights were recorded for all other trees and shrubs ≥ 4 cm DBH that occurred within the fixed-square plots but were not captured by the cruising wedge prism to be inventoried in a variable-radius plot. Data of all trees and shrubs ≥ 4 cm DBH that were present in non-forest inventory sites (e.g., shrublands, grasslands, among others) was collected as well. Special cases or exceptions for height and DBH measurements involved mainly palm trees, tree ferns, and columnar cacti. The heights of palm trees were measured from the base of the trunk to the top of the crown shaft where the petioles appear, while tree ferns were measured from the base to the top of the trunk where the fronds emerge. Heights of columnar cacti ≥ 1.5 m were recorded, and instead of measuring DBH, the number of each individual’s branches or stems was counted and registered. The heights of all ordinary trees and shrubs ≥ 4 cm DBH were measured from the base of the trunk or stem to the top of the crown, when possible, or to the highest visible branch. On occasion, the diameters of some trees were measured above breast height, either due to inosculation (i.e., gemel trees) or a split in the trunk at breast height (i.e., codominant stems). The diameters of trees occurring on slopes or above average ground level were measured

from the uphill side. Leaning, snapped, or damaged shrubs and trees, as well as snags or standing dead trees were often encountered. The measurements of DBH and height were recorded for those as well, when possible.

Species and their respective percent cover were recorded for all other vegetation that occurred within the fixed-square plots. This encompassed multiple plant groups with varying **growth habits** and different **biological stages**, which were classified as **mosses**, **ferns**, **graminoids**, **herbs**, **vines**, **lianas**, **subshrubs**, **shrubs**, **cacti**, and **epiphytes**, as well as **seeds**, **seedlings**, and **saplings**. Furthermore, **lichens** were occasionally observed and recorded. Many plants exhibit consistent or unique growth habits, while some others may be variable. Growth habits of taxa were classified based on the plant material encountered *in situ* and after consulting sources mentioned below (see Plant Identification, Collection of Samples, Taxonomic Approach, and Species References). The following categories or ranges were applied to visually estimate percent cover of all plant species other than trees and shrubs ≥ 4 cm DBH: <1 percent cover; 1–5 percent cover; 5–25 percent cover; 25–50 percent cover; 50–75 percent cover; and 75–100 percent cover. This was recorded as a visual estimation of the shade that each separate species would cast if the sun were positioned directly overhead. Consequently, the total estimated cover of some square plots may have exceeded 100 percent, especially in cases where species footprints overlapped.

Other plants that did not occur within sampling plots but were either associated with the overall vegetation community or observed nearby were also recorded. All associated plant species were adjacent to each respective sampling plot. Species recorded within sampling plots (i.e., fixed-area square plots and/or variable-radius plots) are mentioned throughout this report as “inventory species,” while additional recorded plants are referred to as “associated species.” All inventoried and associated species are listed in appendix B.

Ancillary Data and Photographic Documentation

Elevation (m above sea level) and landscape position (e.g., toeslope, footslope, backslope, mountain shoulder) were recorded at each inventory site, as well as other ancillary data, when possible (i.e., ongoing land managements, historical land uses, and other disturbance histories). Interview sessions were conducted with landowners or farm personnel for insights on previous land uses and disturbances at several locations. Also, digital photographs were captured at all sites, with emphasis on illustrating key features such as dominant vegetation,

Methodology

representative species, landscape, and canopy cover when applicable. Canopy photos were taken at 1 m height in three randomized points within the square plots.

Plant Identification, Collection of Samples, Taxonomic Approach, and Species References

Several plants inventoried and assessed could not be identified to the taxonomic rank of species. This was mostly due to being observed in early life stages, lacking crucial morphological details and reproductive material. Cases involving mosses and lichens required specialized microscopy and other expertise for proper species identification. All taxa not identified to the rank of species are listed in appendix C.

Plant samples of inventory and associated species were collected for diverse reasons: identification, site representation, and/or notable findings (i.e., unreported species, new naturalization reports, or new distribution records for the island). Collected plant samples were dried, processed, mounted, and vouchered as herbarium specimens. All specimens are housed at the University of Puerto Rico, Río Piedras Herbarium (UPRRP). The herbarium vouchers of plant specimens that resulted from this work are listed in appendix D.

Most plant species mentioned in this report have been listed following the naming conventions of the USDA Plants Database (USDA NRCS 2024), which includes most of the scientific names and taxonomic authorities applied throughout this period. Nevertheless, various species, subspecies, and varieties are absent from that database. In some of these cases, taxa may be absent or not included, as taxonomic updates or corrections are pending and required. Deviations were applied for certain taxonomic synonyms and misapplied taxa following a taxonomic review. For instance, if a widely accepted taxon was found to be listed in the USDA Plants Database (USDA NRCS 2024) as a synonym of an outdated taxon, the most widely accepted scientific name and author(s) were applied instead of the one(s) accepted as current by this database. These deviations extended to misapplied taxa and erroneous synonyms, and for these cases, the correct scientific names were applied accordingly. On the other hand, several species were found to be listed in the database but did not include Puerto Rico within their distribution range, while the origin status (i.e., native, introduced) and taxonomic families of some others were found to be erroneous. For these cases, except for pteridophytes (i.e., seedless vascular plants), Acevedo-Rodríguez and Strong (2012) were followed as the main reference. However, some other species are absent from

both the USDA Plants Database (USDA NRCS 2024) and Acevedo-Rodríguez and Strong (2012); for such taxa, references were the Plants of the World Online Database by Kew Science (POWO 2017–2024) and the species checklists portal of the Global Biodiversity Information Facility (GBIF 2024). Other references used to verify taxonomy, distribution, biological habits, or to acquire any other species-related details are Axelrod (2011) and the Plants of the Island of Puerto Rico online database by The Institute for Regional Conservation (Gann et al. 2015–2023).

Data Processing and Analyses

VEGETATION DATA

All vegetation and ancillary data from each inventory site were entered into Microsoft Excel®, edited, and categorized to ensure uniformity and consistency. Formulas and equations were entered and adjusted accordingly, and the respective calculations were performed for all corresponding analyses (see next paragraphs). Pivot tables were created to extract and visualize processed data for individual tree and shrub species ≥ 4 cm DBH, as well as the different groups of plants < 4 cm DBH. All data, supplementary information, and additional analyses are available in the Forest Service Research Data Archive (Crespo-Zapata et al. 2026).

The respective **site frequency** and **site density** of tree and shrub species ≥ 4 cm DBH, recorded within fixed-area square plots, are included in the Results and Discussion section. Also, their **relative frequency**, **relative density**, **relative dominance**, and **importance value** were calculated and are provided as well. Recorded snags or standing dead trees were considered in these analyses and are listed among the species. Total sums of **basal area (BA)** of recorded and measured stems were also included. This analysis framework excludes all stems ≥ 4 cm DBH recorded in variable-radius plots that occurred concurrently outside the respective square plot boundaries. It also excludes stems of columnar cacti > 1.5 m in height recorded within square plots.

The percent cover data of all other vegetation (< 4 cm DBH) was analyzed by assigning numeric values (1–6) to the categories or ranges that were applied for visual estimations in the field, for each separate species: < 1 percent cover = 1; 1–5 percent cover = 2; 6–25 percent cover = 3; 26–50 percent cover = 4; 51–75 percent cover = 5; and 76–100 percent cover = 6.

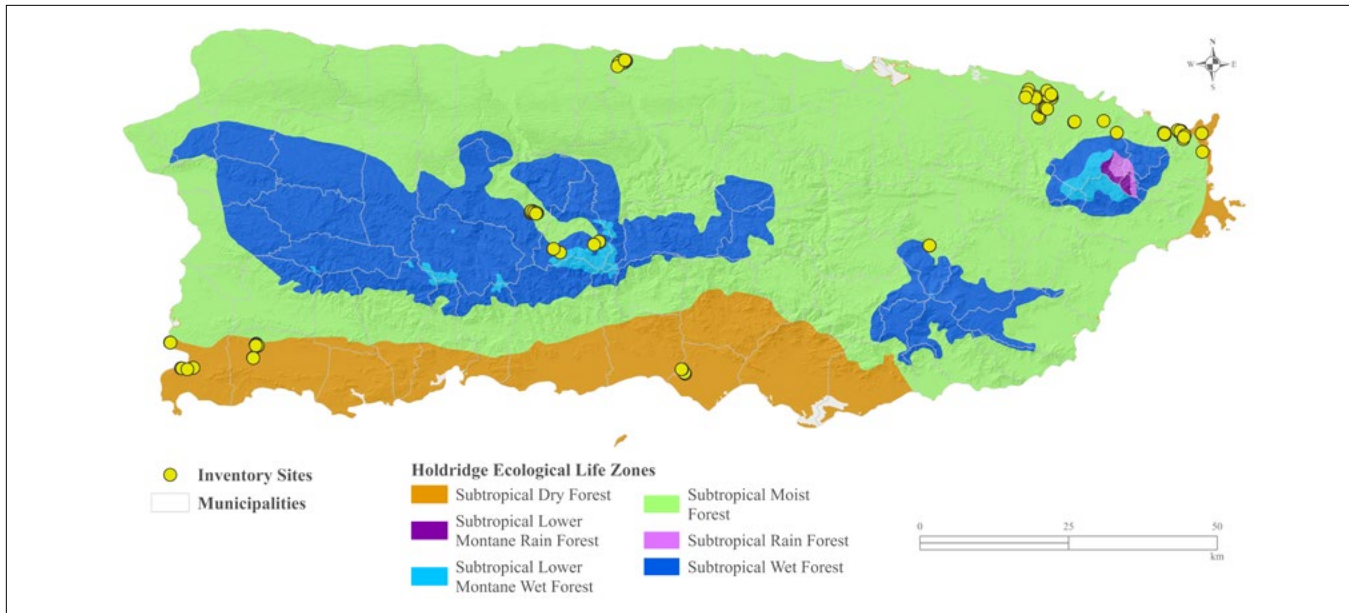


Figure 5—Vegetation inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973).

ECOLOGICAL LIFE ZONES (OR HOLDRIDGE LIFE ZONES)

The occurrence of inventory sites among the ecological life zones of Puerto Rico was assessed and identified for each respective community phase and land use (see fig. 5, Results and Discussion, and app. A). Such life zones include the subtropical moist forest, subtropical dry forest, subtropical wet forest, and subtropical lower montane wet forest (Ewel and Whitmore 1973). This classification system provides a general representation of ecological zoning and vegetation using multiple variables such as temperature, precipitation, potential evapotranspiration, latitude, and altitude. All corresponding maps were produced using the ArcGIS Pro software version 3.1.4.

Slope and Canopy Cover Estimations

The slope (percent) of each inventory site was estimated following the equation below:

$$\text{Slope} = \frac{\text{Elevation difference}}{\text{Diagonal distance}} \times 100\%$$

To calculate elevation difference, the corresponding elevation (m above sea level) of all square plot corners was first obtained via satellite imagery (utilizing the Google Earth Pro software version 7.3.6.9796; Google Inc.). Then, the difference was determined for each square plot by subtracting the highest elevation value from the lowest.

The diagonal distance (d) of square plots (14.14 m) was used as a fixed value for the previous equation, with each equal side (a) measuring 10 m:

$$d = \sqrt{2} \times a = \sqrt{2} \times 10 = 14.14$$

Refer to FAO (2006) for standardized slope gradient classes and descriptions.

Canopy photos were processed and analyzed utilizing the ImageJ software version 1.50i (Schneider et al. 2012). Canopy cover estimates were calculated by quantifying an image's number of canopy pixels, which was then divided by the image's total pixel number and multiplied by 100 percent (see Dharmawan et al. 2020). Three nonhemispherical canopy photos per inventory site were analyzed via this method (taken in three randomized points within the square plot boundaries, where applicable). The canopy cover estimates of inventory sites are based on the average canopy cover percentages of the three photos. However, due to the nature of some community phases and land uses, the canopy concept was not applicable for all sites, with several consisting of open spaces throughout (i.e., most pioneers, managed grasslands, and abandoned grasslands). Furthermore, canopy photos were not taken within all square plots having a canopy, hence canopy cover estimations were not carried out for an additional three inventory sites (see app. A).

General Limitations and Potential Biases

INVENTORY LOCATIONS, SITES, VEGETATION COMMUNITY PHASES, AND LAND USES

All inventory locations and sites, as well as the corresponding ecological succession stages and land uses, were selected in accordance with ESRI shapefile polygons of targeted areas developed and provided by NRCS, which included predetermined sets of Ecological Sites and soil components within different Major Land Resource Areas. Thus, the field data collection process was limited to certain select areas within the given map unit footprints meeting each particular Ecological Site and Major Land Resource Area standards. In addition, the overall framework, sampling design, and most logistics regarding the collection of vegetation data were primarily developed and adapted following the methods and standards for rangeland and forest land outlined in the National Ecological Site Handbook (USDA NRCS 2017). The specific ecological features and other distinct qualities pertaining to the surveyed community phases and land-use concepts were pre-targeted and objectively established in advance.

VEGETATION DATA COLLECTION, PROCESSING, AND ANALYSES

Species composition, richness, and overall representation may have been limited or biased in some areas due to inaccessibility or land tenure restrictions. Some potential sites were located on remote or unreachable areas with very unstable and steep terrain, which made them impossible to hike through or reach by foot. Other potential sites were located on private properties or lands, and either communication with landowners to obtain access was not possible or access was denied. On the other hand, some inventory sites along several succession stages and land uses were selected by targeting certain species assemblages. Therefore, the overall surveying and inventorying are partly biased due to the selection of some sites not being random in terms of species composition (see fig. 8 in General Results).

Although the collection of vegetation data was systematized following National Ecological Site Handbook standards (USDA NRCS 2017), visual estimations had to be conducted in the field for a quick and practical assessment of species' percent cover. Even though visual estimations for this purpose are among the most common methods performed in plant ecology, it is a highly subjective and variable measurement that is susceptible to error. It is worth emphasizing that DBH and heights were recorded only for trees and shrubs ≥ 4 cm DBH, and all other plants within the square plots were sampled via this method (e.g., woody species < 4 cm DBH, as well as herbs, graminoids, ferns, lianas, etc.). On the other hand, the consideration of **borderline trees** in variable-radius plots was somewhat unconventional; if two or more of these trees occurred in a site, typically every other one was tallied and recorded, subject to ground or terrain level.

As with the general analyses, an unequal number of surveyed inventory sites per community phase or land use overall limits an appropriate data comparison between equivalent plots (see table 1 in General Results). In terms of stem data, all trees ≥ 4 cm DBH recorded in variable-radius plots and occurring outside the square plot boundaries were not considered for most corresponding analyses and results (see tables 2–11). To ensure an adequate representation of biomass and other comparative measures in sampled areas, only stems recorded within the dimensions of each square plot (10 x 10 m; 0.01 ha) were considered. On the other hand, this analysis framework includes measured stems of individuals both planted and growing naturally (see fig. 9 in General Results). The latter also applies to other sampled vegetation < 4 cm DBH (e.g., graminoids, herbs, vines, subshrubs, etc.) among managed and abandoned land-use sites.



Flowers of *Antigonon leptopus*, an exotic or nonnative vine that can be found in different habitats and elevations across the island. Forest Service photo by Johann D. Crespo-Zapata.

Results and Discussion

General Results

Ninety-nine inventory sites encompass nine ecological succession stages (or vegetation community phases) and land uses (see Vegetation Community Phases and Land Uses in the Methodology section, as well as app. A and table 1). A total of 689 species were inventoried or documented across all sites, comprising 497 native and 192 introduced plants within 118 taxonomic families (see

app. B), and representing approximately 20 percent of the total suggested flora of Puerto Rico. The top 10 most common or frequently recorded plant families and species are summarized and illustrated below (figs. 6, 7, 8, and 9). Some additional plants and lichens were inventoried or recorded at multiple sites but could not be identified to species level (see app. C).

Table 1—Vegetation community phases and land uses by number of sites assessed

Vegetation Community Phases and Land Uses	Number of Inventory Sites
Mature forest	3
Restored forest	6
Secondary forest	18
Shrubland	13
Pioneers	15
Abandoned tillage crop	10
Managed grassland	13
Abandoned grassland	17
Abandoned horticulture	4

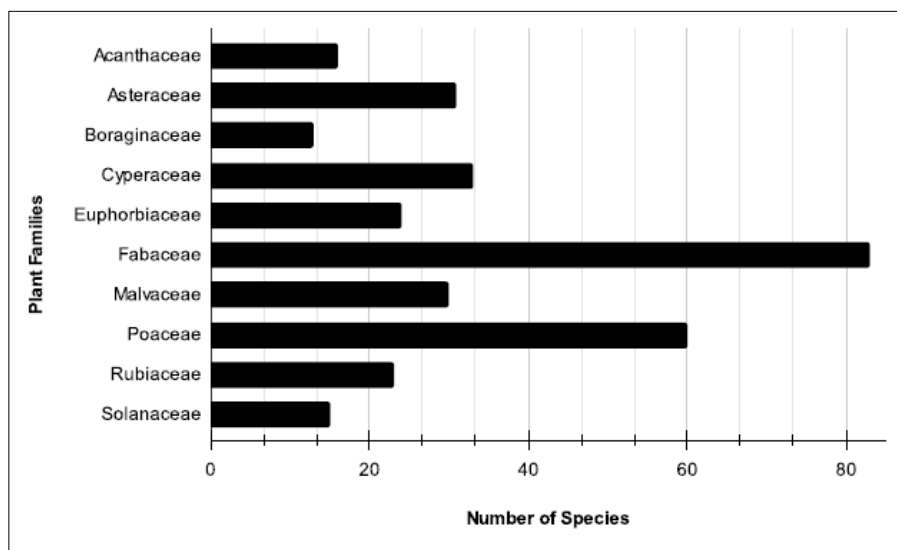


Figure 6—Top 10 most common plant families and respective number of recorded species.

Fabaceae tops the list with 83 recorded species, followed by Poaceae (60), Cyperaceae (33), Asteraceae (31), Malvaceae (30), Euphorbiaceae (24), Rubiaceae (23), Acanthaceae (16), Solanaceae (15), and Boraginaceae (13). It is worth noting that Fabaceae is one of the largest flowering plant families in the world (Christenhusz

et al. 2017, Clark 2020) and is often among the most representative taxonomic groups in tropical plant communities. Also, Fabaceae, Poaceae, and Asteraceae are the three families with the highest number of introduced species in Puerto Rico and the Virgin Islands (Rojas-Sandoval and Acevedo-Rodríguez 2015).

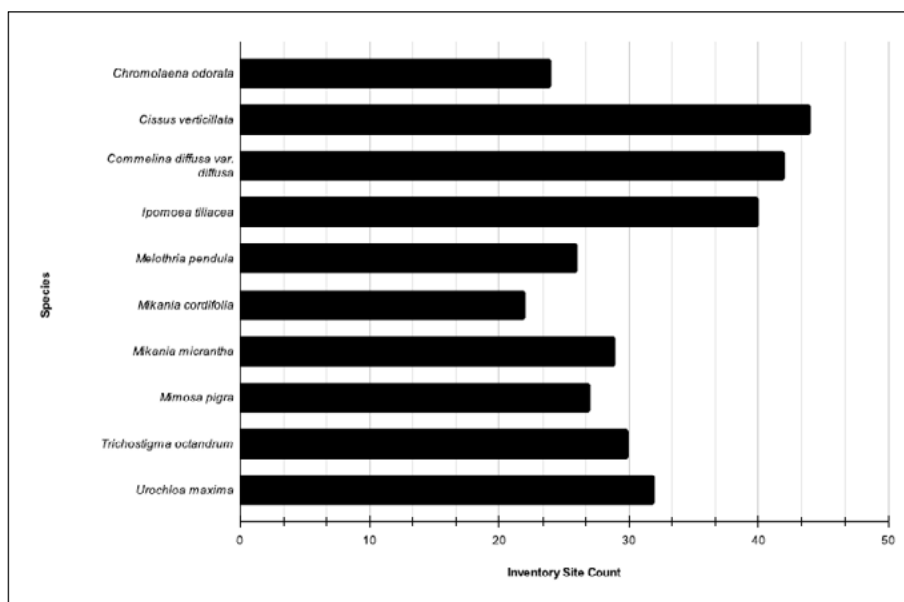


Figure 7—Top 10 most frequently recorded species <4 cm DBH, by site occurrence.

The species illustrated in figure 7 correspond to plants <4 cm DBH inventoried within fixed-area square plots. *Cissus verticillata*, a native species of vine in the Vitaceae family, was overall the most common and frequently recorded,

occurring in a total of 44 inventory sites through all 9 community phases and land uses assessed. On the other hand, *Mimosa pigra*, an introduced shrub, was the most frequently recorded Fabaceae, while the introduced grass

Results and Discussion

Urochloa maxima ranks as the most frequently recorded Poaceae. However, the Asteraceae family is the most represented among these species, and all are

native—*Chromolaena odorata*, *Mikania cordifolia*, and *Mikania micrantha*.

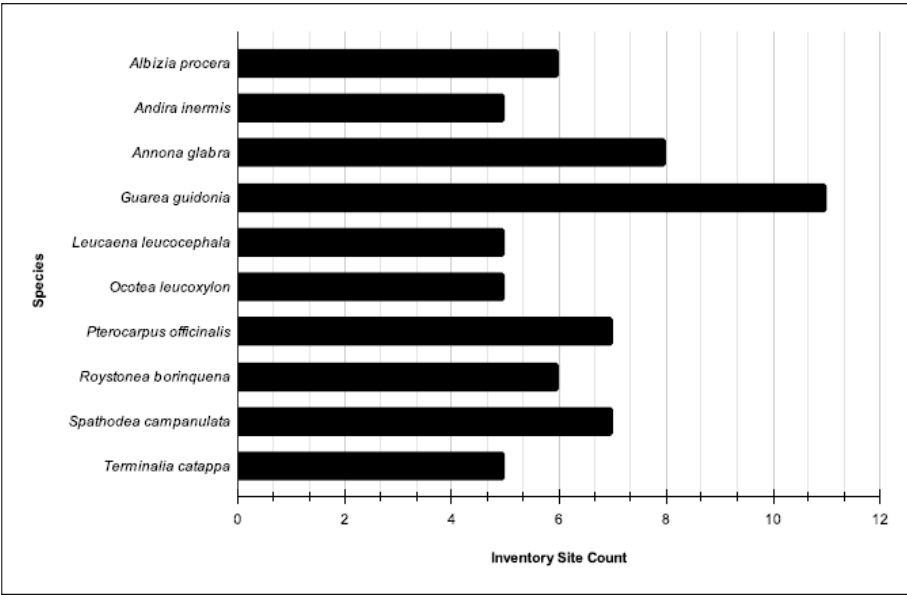


Figure 8—Top 10 most frequently recorded species ≥4 cm DBH, by site occurrence.

The species illustrated in figure 8 correspond to trees and shrubs ≥4 cm DBH inventoried in all fixed-area square plots and variable-radius plots. *Guarea guidonia*, a native species of tree, was overall the most common and frequently recorded, occurring in a total of 11 inventory sites and most notably in forested areas, followed by the natives *Annona glabra* (8 sites) and *Pterocarpus officinalis* (7 sites), as well as the introduced *Spathodea*

campanulata (7 sites). *A. glabra* and *P. officinalis* occurred in different community phases and land uses that were specifically targeted on wetland areas. Thus, their frequency of occurrence in this representation is biased due to the corresponding site selection not being random and, instead, determined by the presence of one or both species.

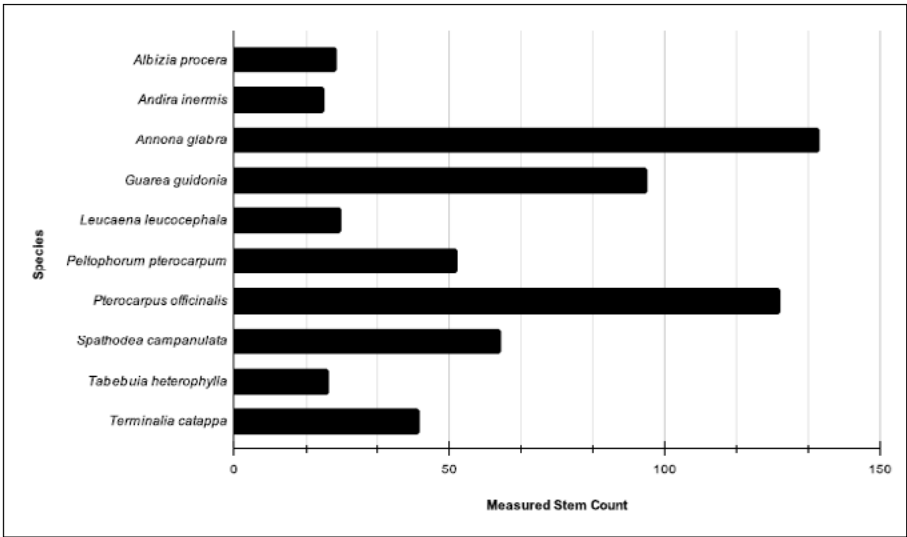


Figure 9—Top 10 most recorded species ≥4 cm DBH, by number of stems.

The species illustrated in figure 9 correspond to trees and shrubs ≥ 4 cm DBH inventoried in both fixed-area square plots and variable-radius plots. Stems recorded in variable-radius plots and occurring outside the respective square plot boundaries are included here. Stems of *Annona glabra* and *Pterocarpus officinalis* were the most recorded and measured—with 136 and 127, respectively—followed by *Guarea guidonia* (96 stems). It should be noted that most stems of *A. glabra* and *P. officinalis* correspond to planted individuals from restored forest

sites and that both species were occasionally among the most dominant or representative in other targeted vegetation community phases and land uses on wetland areas. Consequently, this representation considers measured stems of individuals both planted and growing naturally. On the other hand, although not included here, a total of 52 stems from snags or standing dead trees was also recorded, measured at multiple sites among several succession stages and land uses.

Vegetation Community Phases and Land Uses

MATURE FOREST

All three mature forest inventory sites are located in the municipality of Jayuya (Bo. Saliente and Bo. Zamas), within the subtropical wet forest and subtropical lower montane wet forest ecological life zones (Ewel and Whitmore 1973; figs. 10 and 11), and range from approximately 785 to 845 m above sea level. Some inventory species may be repeated among different categories if they have been observed in more than

one biological stage (i.e., seedling, sapling, shrub, and/or tree) or displaying multiple growth habits (e.g., *Lasiacis sorghoidea*, a graminoid species, was observed exhibiting climbing habits in an inventory site, and thus could also be classified as a vine). Refer to appendix A for summarized descriptions, vegetation, and additional information on each inventory site.

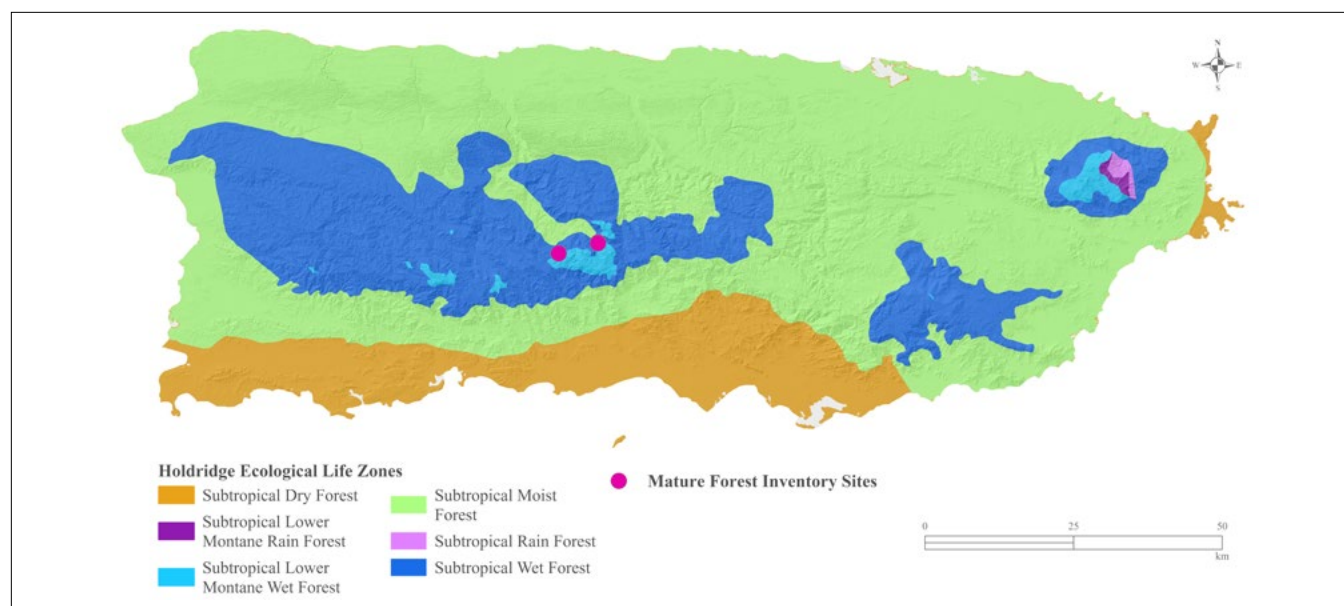


Figure 10—Mature forest inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973).

Results and Discussion

INVENTORY SPECIES:

Canopy trees and shrubs (≥ 4 cm DBH and ≥ 2 m height recorded within three fixed-area square plots and/or variable-radius plots): *Casearia sylvestris*, *Cedrela odorata*, *Chionanthus domingensis*, *Cinnamomum elongatum*, *Cordia alliodora*, *Cordia sulcata*, *Famea occidentalis*, *Guarea guidonia*, *Ilex nitida*, *Inga vera*, *Ocotea floribunda*, *Ocotea leucoxylon*, *Prestoea acuminata* var. *montana*, *Prunus occidentalis*, *Spathodea campanulata*, *Tabebuia heterophylla*, *Trichilia pallida*, and *Zanthoxylum martinicense*

Table 2—Mature forest species, site frequency, site density, relative frequency, relative density, relative dominance, and importance value of canopy trees and shrubs ≥ 4 cm DBH and ≥ 2 m height, recorded within the three fixed-area square plots

Species	Site Frequency	Site Density	Relative Frequency	Relative Density	Relative Dominance	Importance Value
<i>Casearia sylvestris</i>	1	9	4.16	11.68	2.81	6.22
<i>Chionanthus domingensis</i>	1	1	4.16	1.29	0.14	1.87
<i>Cinnamomum elongatum</i>	1	1	4.16	1.29	0.11	1.85
<i>Cordia alliodora</i>	2	11	8.33	14.28	21.54	14.72
<i>Cordia sulcata</i>	2	5	8.33	6.49	28.74	14.52
Dead species	2	4	8.33	5.19	1.99	5.17
<i>Famea occidentalis</i>	1	5	4.16	6.49	0.85	3.83
<i>Guarea guidonia</i>	2	9	8.33	11.68	5.64	8.55
<i>Ilex nitida</i>	1	1	4.16	1.29	7.35	4.27
<i>Inga vera</i>	2	4	8.33	5.19	7.18	6.90
<i>Ocotea floribunda</i>	1	1	4.16	1.29	0.39	1.95
<i>Ocotea leucoxylon</i>	2	6	8.33	7.79	1.11	5.74
<i>Prestoea acuminata</i> var. <i>montana</i>	2	7	8.33	9.09	14.85	10.75
<i>Spathodea campanulata</i>	1	1	4.16	1.29	0.18	1.88
<i>Tabebuia heterophylla</i>	1	4	4.16	5.19	0.49	3.28
<i>Trichilia pallida</i>	1	2	4.16	2.59	0.51	2.42
<i>Zanthoxylum martinicense</i>	1	6	4.16	7.79	6.02	5.99

Totals: 3 inventory sites (sampled area = 0.03 ha); 16 species; 77 stems (sum of basal area = 1.26 m²). Results exclude species and corresponding stems recorded within variable-radius plots but occurring outside the square plot boundaries. Recorded snags or standing dead trees are included and listed as dead species.

Understory shrubs and subshrubs (<4 cm DBH and <2 m height): *Casearia decandra*, *Casearia sylvestris*, *Cecropia schreberiana* ssp. *schreberiana*, *Cestrum macrophyllum*, *Chrysophyllum argenteum*, *Cinnamomum elongatum*, *Clusia gundlachii*, *Coffea arabica*, *Coffea liberica* var. *liberica*, *Colubrina glandulosa* var. *antillana*, *Dendropanax arboreus*, *Famea occidentalis*, *Gonzalagunia hirsuta*, *Guarea guidonia*, *Inga vera*, *Inga nobilis* ssp. *quaternata*, *Lobelia robusta*, *Mecranium latifolium*, *Miconia racemosa*, *Myrcia splendens*, *Ocotea floribunda*, *Ocotea leucoxylon*, *Piper amalago*, *Piper glabrescens*, *Piper hispidum*, *Piper umbellatum*, *Solanum rugosum*, *Tabebuia heterophylla*, *Tetragastris balsamifera*, *Trichilia pallida*, *Turpinia occidentalis*, and *Urera baccifera*

Seedlings and saplings: *Alchornea latifolia*, *Byrsonima spicata*, *Casearia sylvestris*, *Cecropia schreberiana* ssp. *schreberiana*, *Cedrela odorata*, *Cestrum macrophyllum*, *Chionanthus domingensis*, *Chrysophyllum argenteum*, *Cinnamomum elongatum*, *Citharexylum spinosum*, *Colubrina glandulosa* var. *antillana*, *Cordia alliodora*, *Cordia sulcata*, *Dendropanax arboreus*, *Guarea guidonia*, *Guarea glabra*, *Inga vera*, *Inga nobilis* ssp. *quaternata*, *Myrsine coriacea*, *Ocotea floribunda*, *Ocotea leucoxylon*, *Palicourea crocea*, *Piper umbellatum*, *Prestoea acuminata* var. *montana*, *Prunus occidentalis*, *Schefflera morototoni*, *Tabebuia heterophylla*, *Tetragastris balsamifera*, and *Zanthoxylum martinicense*

Lianas and vines: *Bidens reptans*, *Cissampelos pareira*, *Cissus verticillata*, *Cydista aequinoctialis*, *Desmodium axillare* var. *axillare*, *Dioscorea alata*, *Gonolobus stephanotrichus*, *Gouania lupuloides*, *Ipomoea tiliacea*, *Lasiacis sorghoidea*, *Lycianthes virgata*, *Macfadyena unguis-cati*, *Melothria pendula*, *Mikania cordifolia*, *Mikania micrantha*, *Mimosa ceratonia*, *Passiflora edulis*, *Passiflora sexflora*, undetermined *Ranunculaceae* sp., *Rhynchosia phaseoloides*, *Securidaca virgata*, *Senegalia westiana*, *Smilax domingensis*, *Stigmaphyllon floribundum*, *Tournefortia hirsutissima*, *Trichostigma octandrum*, and *Vitis tiliifolia*

Ferns: *Adiantum pyramidale*, *Arachniodes chaerophylloides*, *Blechnum occidentale*, *Dennstaedtia bipinnata*, *Diplazium unilobum*, and *Lastreopsis effusa*

Herbs: *Cyclopogon elatus*, *Desmodium axillare* var. *axillare*, *Erythroxylon hirtella*, *Gibasis geniculata*, *Heliconia caribaea*, *Lobelia robusta*, *Oeceoclades maculata*, *Pilea inaequalis*, *Pilea nummulariifolia*, *Pilea parietaria*, and *Ruellia coccinea*

Graminoids: *Ichnananthus pallens* var. *pallens*, *Lasiacis sorghoidea*, and *Pharus lappulaceus*

Mosses: *Neckeropsis* sp. and undetermined moss



Figure 11—Landscape view of the area where two mature forest sites are located (Bo. Saliente, municipality of Jayuya). According to the landowner, a few centuries ago this area was once a small town dedicated almost exclusively to coffee production, but some forest patches in the mountain peaks remained undisturbed. Forest Service photo by Johann D. Crespo-Zapata.

Results and Discussion

Associated Species

Three inventory sites yielded a total of 94 species inventoried. Another 27 species were observed near the inventory sites: *Alsophila portoricensis*, *Andira inermis*, *Anthurium crenatum*, *Ardisia obovata*, *Blechnum fragile*, *Bocconia frutescens*, *Callisia monandra*, *Calophyllum antillanum*, *Campyloneurum* sp., *Cnemidaria horrida*, *Cordia polycephala*, *Ficus trigonata*, *Henriettea fascicularis*, *Hypolepis repens*, *Iresine diffusa*, *Microgramma piloselloides*, *Musa acuminata*, *Niphidium crassifolium*, *Oxalis debilis* var. *corymbosa*, *Pecluma* sp., *Piper marginatum*, *Pisonia roqueae*, *Psychotria berteriana*, *Rajania cordata*, *Tradescantia zanonía*, *Trema micrantha*, and *Vernonia sericea*.

Site Features

All mature forest inventory sites are located within areas known for being former coffee farms or plantations that at some point ceased production and were abandoned. The presence of two coffee species in these sites (i.e., *Coffea arabica* and *C. liberica* var. *liberica*) suggests that both may have been planted for consumption and are currently persisting to naturalizing further in the assessed areas. The larger *Inga vera* trees observed at some of the sites are likely to have been planted many years ago for coffee shade, as this was the preferred species for this purpose within the Utuado and Jayuya region (Oliver 1965, as cited in Marcano-Vega et al. 2002). Nevertheless, this is a native species that also occurs naturally in the wild at various elevations in the central mountain range (Axelrod 2011, Gann and Trejo-Torres 2015–2023). Other inventoried or observed native tree species previously used for providing shade in coffee plantations on the island include *Andira inermis*, *Cordia alliodora*, *Dendropanax arboreus*, *Guarea guidonia*, and *Ocotea* spp. (Birdsey and Weaver 1982, Marcano-Vega et al. 2002, Marrero 1954). Additional inventoried or associated species that are widely known for being cultivated for production or consumption are *Dioscorea alata* and *Musa acuminata*.

Notable Species

Uncommon and remarkable species encountered within or near mature forest inventory sites are *Cedrela odorata*, *Prunus occidentalis*, *Tradescantia zanonía* (Gann and Trejo-Torres 2015–2023), and *Pisonia roqueae* (Caraballo-Ortiz and Trejo-Torres 2017, Gann and Trejo-Torres 2015–2023). *C. odorata*, *P. occidentalis*, and *T. zanonía* have been listed as Critical Elements by the Natural Heritage Program of the Puerto Rico Department of Natural and Environmental Resources (PRDNER 2007). Other regional and/or notable mature forest species inventoried or observed near inventory sites include *Colubrina glandulosa* var. *antillana*, *Guarea glabra*, *Lasiacis sorghoidea*, *Passiflora sexflora*, *Prestoea acuminata* var. *montana*, and *Rhynchosia phaseoloides*.



Inflorescence of *Heliconia caribaea*, a native herb recorded in a mature forest inventory site. Forest Service photo by Johann D. Crespo-Zapata.

RESTORED FOREST

The six restored forest inventory sites are located in the municipalities of Luquillo (Bo. Pitahaya), Canóvanas (Bo. Canóvanas), and Manatí (Bo. Tierras Nuevas Poniente), within the subtropical moist forest ecological life zone (Ewel and Whitmore 1973; figs. 12 and 13), and range from approximately 5 to 12 m above sea level. Some inventory species may be repeated among different categories if they have been observed in more than one

biological stage (i.e., seedling, sapling, shrub, and/or tree) or displaying multiple growth habits (e.g., *Lygodium japonicum* is a fern with climbing habits, and thus was also classified as a vine). In addition, planted species are indicated accordingly. Refer to appendix A for summarized descriptions, vegetation, and additional information on each inventory site.

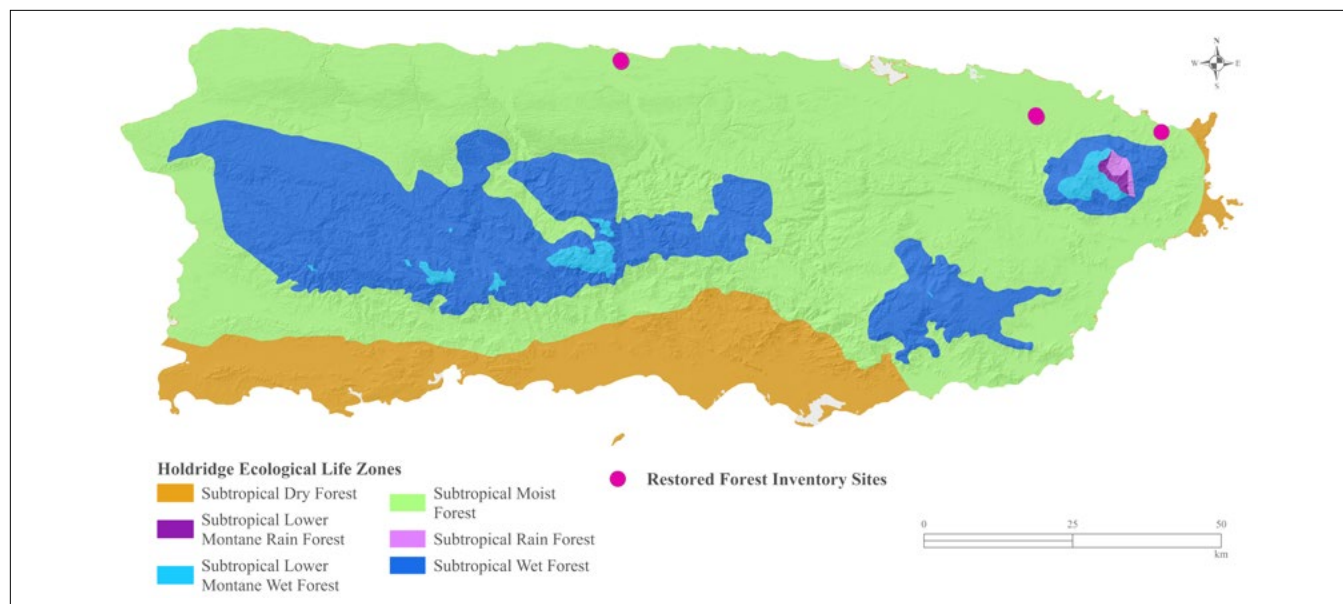


Figure 12—Restored forest inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973).

Results and Discussion

INVENTORY SPECIES:

Canopy trees and shrubs (≥ 4 cm DBH and ≥ 1.8 m height recorded within three fixed-area square plots and/or variable-radius plots): *Amphitecna latifolia* (planted), *Annona glabra* (planted), *Erythrina fusca* (planted), *Guarea guidonia*, *Hura crepitans* (planted), *Manilkara bidentata* ssp. *surinamensis* (planted), *Nectandra coriacea*, *Pterocarpus officinalis* (planted), *Roystonea borinquena* (planted), *Spondias mombin* (planted), and *Thespesia populnea* (planted)

Table 3—Restored forest species, site frequency, site density, relative frequency, relative density, relative dominance, and importance value of canopy trees and shrubs ≥ 4 cm DBH and ≥ 1.8 m height, recorded within six fixed-area square plots

Species	Site Frequency	Site Density	Relative Frequency	Relative Density	Relative Dominance	Importance Value
<i>Amphitecna latifolia</i>	3	16	11.53	7.17	2.05	6.92
<i>Annona glabra</i>	6	130	23.07	58.29	15.61	32.32
Dead species	2	3	7.69	1.34	0.26	3.10
<i>Guarea guidonia</i>	1	1	3.84	0.44	0.10	1.46
<i>Hura crepitans</i>	1	6	3.84	2.69	1.49	2.67
<i>Manilkara bidentata</i> ssp. <i>surinamensis</i>	1	1	3.84	0.44	0.04	1.44
<i>Nectandra coriacea</i>	1	1	3.84	0.44	0.23	1.50
<i>Pterocarpus officinalis</i>	6	54	23.07	24.21	60.43	35.90
<i>Roystonea borinquena</i>	3	7	11.53	3.13	19.42	11.36
<i>Thespesia populnea</i>	2	4	7.69	1.79	0.33	3.27

Totals: 6 inventory sites (sampled area = 0.06 ha); 9 species; 223 stems (sum of basal area = 2.89 m²). Results exclude species and corresponding stems recorded within variable-radius plots but occurring outside the square plot boundaries. Recorded snags or standing dead trees are included and listed as dead species.

Understory shrubs and subshrubs (<4 cm DBH and <2 m height): *Amphitecna latifolia* (planted and recruited from planted individuals), *Annona glabra* (recruited from planted individuals), *Casearia aculeata*, *Casearia guianensis*, *Casearia sylvestris*, *Cupania americana*, *Guapira fragrans*, *Guarea guidonia*, *Hibiscus tiliaceus* var. *pernambucensis* (planted), *Hura crepitans* (recruited from planted individuals), *Mimosa pigra*, *Pavonia spinifex*, *Pterocarpus officinalis* (recruited from planted individuals), *Spathodea campanulata*, *Stahlia monosperma* (planted), *Thespesia grandiflora*, *Thespesia populnea* (planted), and *Zanthoxylum caribaeum*

Seedlings and saplings: *Amphitecna latifolia*, *Andira inermis*, *Annona glabra*, *Bursera simaruba*, *Calophyllum antillanum*, *Casearia guianensis*, *Casearia sylvestris*, *Centrosema pubescens*, *Cestrum diurnum*, *Cissus verticillata*, *Citharexylum spinosum*, *Coccoloba diversifolia*, *Coccoloba uvifera*, *Coccoloba venosa*, *Cordia laevigata*, *Cupania americana*, undetermined Cyperaceae sp., *Erythrina fusca*, *Erythroxylum brevipes*, *Eugenia biflora*,

Exothea paniculata, *Guapira fragrans*, *Guarea guidonia*, *Hura crepitans*, *Ipomoea tiliacea*, *Licaria triandra*, *Macfadyena unguis-cati*, *Manilkara bidentata* ssp. *surinamensis*, *Melothria pendula*, *Mikania cordifolia*, *Mimosa pigra*, *Nectandra coriacea*, *Picramnia pentandra*, *Pithecellobium dulce*, *Pterocarpus officinalis*, *Randia aculeata*, *Roystonea borinquena*, *Spathodea campanulata*, *Stahlia monosperma*, *Terminalia catappa*, *Thespesia grandiflora*, *Thespesia populnea*, *Trichilia pallida*, *Vigna luteola*, and *Zanthoxylum caribaeum*

Lianas and vines: *Callisia repens*, *Centrosema pubescens*, *Cissus verticillata*, *Commelina diffusa* var. *diffusa*, *Desmodium* sp., *Diodia sarmentosa*, *Ipomoea tiliacea*, *Jasminum fluminense*, *Lygodium japonicum*, *Macfadyena unguis-cati*, *Melothria pendula*, *Mikania cordifolia*, *Mikania micrantha*, *Mucuna urens*, *Paullinia pinnata*, *Pavonia spinifex*, *Pueraria phaseoloides*, *Syngonium podophyllum*, *Tournefortia hirsutissima*, *Trichostigma octandrum*, *Vigna hosei*, *Vigna luteola*, and *Vigna vexillata*

Ferns: *Acrostichum danaeifolium*, *Adiantum latifolium*, *Lygodium japonicum*, *Nephrolepis multiflora*, *Phymatosorus grossus*, *Psilotum nudum*, *Tectaria incisa*, *Thelypteris dentata*, *Thelypteris reticulata*, and *Thelypteris tetragona*

Herbs: *Canna glauca* (recruited from planted individuals), *Callisia repens*, *Colocasia esculenta*, *Commelina diffusa* var. *diffusa*, *Desmodium* sp., *Justicia comata*, *Oeceoclades maculata*, *Phyllanthus urinaria*, and *Scleria eggersiana*

Graminoids: *Cyperus* sp., *Panicum laxum*, *Saccharum spontaneum*, *Scleria eggersiana*, undetermined Cyperaceae sp., and undetermined Poaceae sp.

Epiphytes: *Nephrolepis multiflora* and *Phymatosorus grossus*

Mosses and lichens: *Neckeropsis* sp., *Parmotrema* sp., *Plagiochila* sp., and undetermined lichen

Associated Species

Six inventory sites yielded a total of 87 species inventoried. Another 53 species were observed near the inventory sites: *Achyranthes aspera* var. *aspera*, *Ammannia latifolia*, *Calophyllum inophyllum*, *Calopogonium caeruleum*, *Caperonia palustris*, *Casearia decandra*, *Cecropia schreberiana* ssp. *schreberiana*, *Ceiba pentandra*, *Ceratopteris thalictroides*, *Chromolaena odorata*, *Chrysophyllum argenteum*, *Clidemia hirta*, *Coccoloba rugosa*, *Conocarpus erectus*, *Cordia collococca*, *Cuphea strigulosa*, *Cynodon dactylon*, *Cyperus ochraceus*, *Cyperus odoratus*, *Dissotis rotundifolia*, *Eclipta prostrata*, *Euphorbia heterophylla*, *Famea occidentalis*, *Ficus citrifolia*, *Hernandia sonora*, *Heteranthera reniformis*, *Hyptis capitata*, *Inga laurina*, *Ludwigia* sp., *Ludwigia octovalvis*, *Machaerium lunatum*, *Mimosa pudica* var. *unijuga*, *Ocotea leucoxylon*, *Oldenlandia lancifolia*, *Paspalum fasciculatum*, *Passiflora suberosa*, *Piper aduncum*, *Pityrogramma calomelanos*, *Ruellia blechum*, *Ruellia simplex*, *Sacciolepis indica*, *Sagittaria lancifolia*, *Securidaca virgata*, *Senna alata*, *Sida rhombifolia*, *Sideroxylon foetidissimum*, *Solanum torvum*, *Struchium sparganophorum*, *Tabebuia heterophylla*, *Tabebuia rosea*, *Typha domingensis*, *Urena lobata*, and *Urochloa mutica*.

Site Features

All restored forest inventory sites correspond to human-made forest patches or plantations from different restoration or environmental mitigation projects. All sites aim to replicate the dominant species composition of a mature forest but had secondary forest age and ecological features at the time the vegetation inventories were conducted. Furthermore, all the sites are situated in former grasslands, including a sugarcane field that was later converted into a seasonally flooded wetland. Consequently, classic ecological succession concepts would not necessarily apply to these sites because most of the earlier ecological phases and vegetation communities were skipped and went straight to a mature forest species composition.

Notable Species

Uncommon nonplanted species encountered within or near the restored forest inventory sites are: *Casearia aculeata*, *Ceratopteris thalictroides*, *Licaria triandra*, *Mucuna urens*, *Sagittaria lancifolia*, *Scleria eggersiana*, *Struchium sparganophorum*, and *Thespesia grandiflora* (Gann and Trejo-Torres 2015–2023). *C. thalictroides*, *L. triandra*, and *M. urens* have been listed as Critical Elements by the Natural Heritage Program of the PRDNER (2007). Uncommon and/or regional planted species inventoried or observed near inventory sites include *Amphitecna latifolia*, *Canna glauca*, *Ceiba pentandra*, *Coccoloba rugosa*, *Pterocarpus officinalis*, and *Stahlia monosperma* (Gann and Trejo-Torres 2015–2023). *A. latifolia*, *C. pentandra*, and *C. rugosa* have also been listed as Critical Elements by the PRDNER (2007). Last but foremost, *S. monosperma* has been listed as Threatened by the U.S. Department of the Interior, Fish and Wildlife Service (USFWS 1990), Endangered by the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species (World Conservation Monitoring Centre 1998b), and Vulnerable by the PRDNER (2007). *C. rugosa* is also cataloged as Endangered by the IUCN (World Conservation Monitoring Centre 1998a).

Results and Discussion



Figure 13—General views of two restored forest inventory sites (Bo. Tierras Nuevas Poniente, municipality of Manatí), dominated by *Pterocarpus officinalis* trees (A) and trees/shrubs of *Annona glabra* (B). Forest Service photos by Johann D. Crespo-Zapata.

SECONDARY FOREST

The 18 secondary forest inventory sites are located in the municipalities of Utuado (Bo. Las Palmas and Bo. Caonillas Arriba), Jayuya (Bo. Saliente), Lajas (Bo. Sabana Yeguas), Cabo Rojo (Bo. Boquerón), Fajardo (Bo. Quebrada Fajardo and Bo. Quebrada Vueltas), Río Grande (Bo. Hato Candal, Bo. Guzmán Abajo, and Bo. Mameyes II), Luquillo (Bo. Juan Martín), Manatí (Bo. Tierras Nuevas Poniente), and Caguas (Bo. Río Turabo), within the subtropical moist forest, subtropical wet forest, and subtropical dry forest ecological life zones (Ewel and Whitmore 1973; figs. 14, 15, and 16), and range from approximately sea level to 785 m above sea level. Some inventory species may be repeated among different categories if they have been observed in more than one biological stage (i.e., seedling,

sapling, shrub, and/or tree) or displaying multiple growth habits (e.g., *Campyloneurum phyllitidis* is a fern with epiphytic habits). Since inventory sites assessed in this succession stage occur in different ecological life zones, across considerably distant areas, and/or have distinctive vegetation assemblages, the results below are grouped by locality: five inventory sites from the municipalities of Utuado and Jayuya; three from the municipalities of Lajas and Cabo Rojo; seven from the municipalities of Fajardo, Río Grande, Luquillo, and Manatí; and three from the municipalities of Río Grande and Caguas. Refer to appendix A for summarized descriptions, vegetation, and additional information on each inventory site.

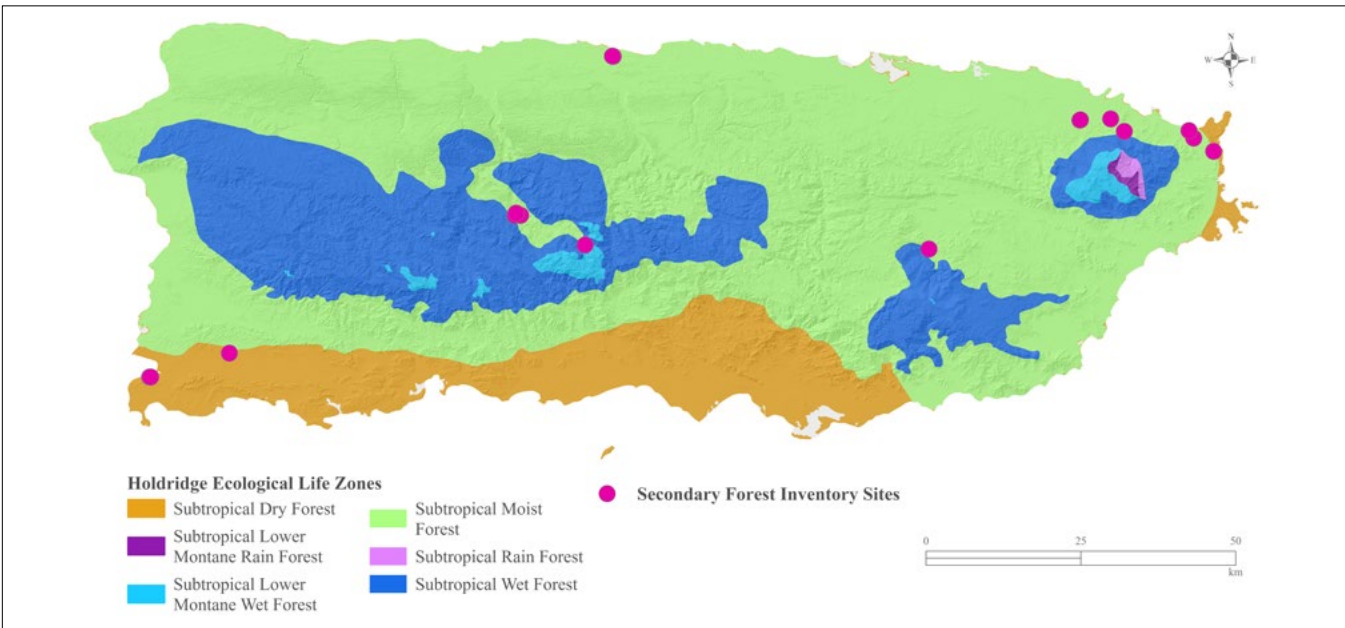


Figure 14—Secondary forest inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973).

SECONDARY FOREST SITES 1–5

Municipalities of Utuado (Bo. Las Palmas and Bo. Caonillas Arriba) and Jayuya (Bo. Saliente)

INVENTORY SPECIES:

Canopy trees and shrubs (≥ 4 cm DBH and ≥ 2 m height recorded within three fixed-area square plots and/or variable-radius plots): *Casearia sylvestris*, *Cecropia schreberiana* ssp. *schreberiana*, *Chrysophyllum argenteum*, *Cordia alliodora*, *Cupania americana*, *Faramea occidentalis*, *Guapira fragrans*, *Guarea guidonia*, *Inga nobilis* ssp. *quaternata*, *Mangifera indica*, *Ocotea leucoxylon*, *Prunus occidentalis*, *Psidium guajava*, and *Zanthoxylum martinicense*

Table 4—Secondary forest species (sites 1–5), site frequency, site density, relative frequency, relative density, relative dominance, and importance value of canopy trees and shrubs ≥ 4 cm DBH and ≥ 2 m height, recorded within five fixed-area square plots

Species	Site Frequency	Site Density	Relative Frequency	Relative Density	Relative Dominance	Importance Value
<i>Casearia sylvestris</i>	1	7	5.88	10.29	0.95	5.71
<i>Cecropia schreberiana</i> ssp. <i>schreberiana</i>	1	1	5.88	1.47	8.30	5.21
<i>Chrysophyllum argenteum</i>	1	1	5.88	1.47	0.10	2.48
<i>Cupania americana</i>	1	2	5.88	2.94	3.55	4.12
Dead species	3	3	17.64	4.41	15.21	12.42
<i>Faramea occidentalis</i>	1	2	5.88	2.94	0.46	3.09
<i>Guapira fragrans</i>	1	1	5.88	1.47	0.65	2.66
<i>Guarea guidonia</i>	4	36	23.52	52.94	52.00	42.82
<i>Inga nobilis</i> ssp. <i>quaternata</i>	1	7	5.88	10.29	6.88	7.68
<i>Ocotea leucoxylon</i>	2	5	11.76	7.35	11.38	10.16
<i>Psidium guajava</i>	1	3	5.88	4.41	0.45	3.58

Totals: 5 inventory sites (sampled area = 0.05 ha); 10 species; 68 stems (sum of basal area = 1.39 m²). Results exclude species and corresponding stems recorded within variable-radius plots but occurring outside the square plot boundaries. Recorded snags or standing dead trees are included and listed as dead species.

Results and Discussion

Understory shrubs and subshrubs (<4 cm DBH and <2 m height): *Annona muricata*, *Bixa orellana*, *Byrsonima spicata*, *Casearia decandra*, *Casearia guianensis*, *Casearia sylvestris*, *Cestrum macrophyllum*, *Chionanthus domingensis*, *Chromolaena odorata*, *Clerodendrum chinense*, *Clidemia hirta*, *Coffea arabica*, *Coffea liberica* var. *liberica*, *Cordia polycephala*, *Faramea occidentalis*, *Gonzalagunia hirsuta*, *Guarea guidonia*, *Inga laurina*, *Inga nobilis* ssp. *quaternata*, *Lepianthes peltata*, *Miconia impetolaris*, *Miconia laevigata*, *Ocotea floribunda*, *Ocotea leucoxylon*, *Phytolacca rivinoides*, *Piper amalago*, *Piper glabrescens*, *Piper hispidum*, *Prunus occidentalis*, *Psidium guajava*, *Schefflera morototoni*, *Solanum rugosum*, *Spathodea campanulata*, *Tabebuia heterophylla*, *Trema micrantha*, and *Urena lobata*

Seedlings and saplings: *Andira inermis*, *Annona muricata*, *Bixa orellana*, *Byrsonima spicata*, *Casearia guianensis*, *Cecropia schreberiana* ssp. *schreberiana*, *Chionanthus domingensis*, *Chrysophyllum argenteum*, *Clerodendrum chinense*, *Coffea liberica* var. *liberica*, *Cordia alliodora*, *Cordia sulcata*, *Cupania americana*, *Guarea guidonia*, *Inga nobilis* ssp. *quaternata*, *Inga vera*, *Miconia laevigata*, *Myrcia splendens*, *Nectandra patens*, *Ocotea floribunda*, *Ocotea leucoxylon*, *Prestoea acuminata* var. *montana*, *Prunus occidentalis*, *Roystonea borinquena*, *Schefflera morototoni*, *Spathodea campanulata*, *Syzygium jambos*, *Syzygium malaccense*, and *Zanthoxylum martinicense*

Lianas and vines: *Centrosema virginianum*, *Chromolaena odorata*, *Cissampelos pareira*, *Cissus verticillata*, *Commelina diffusa* var. *diffusa*, *Cydista aequinoctialis*, *Desmodium axillare* var. *axillare*, *Dissotis rotundifolia*,

Gonolobus stephanotrichus, *Gouania polygama*, *Hippocratea volubilis*, *Ichnanthus pallens* var. *pallens*, *Ipomoea tiliacea*, *Iresine diffusa*, *Lasiacis sorghoidea*, *Lycianthes virgata*, *Macfadyena unguis-cati*, *Melothria pendula*, *Mikania cordifolia*, *Mikania micrantha*, *Mimosa ceratonia*, *Momordica charantia*, *Passiflora edulis*, *Passiflora rubra*, *Paullinia pinnata*, *Pueraria phaseoloides*, *Rhynchosia phaseoloides*, *Rubus rosifolius*, *Securidaca virgata*, *Smilax domingensis*, *Stigmaphyllon floribundum*, *Syngonium podophyllum*, *Thunbergia alata*, *Thunbergia fragrans*, *Tournefortia hirsutissima*, *Trichostigma octandrum*, and *Vigna vexillata*

Ferns: *Adiantum latifolium*, *Adiantum pyramidale*, *Arachniodes chaerophylloides*, *Blechnum occidentale*, *Campyloneurum phyllitidis*, *Dennstaedtia bipinnata*, *Lastreopsis effusa*, *Nephrolepis multiflora*, *Tectaria incisa*, *Thelypteris dentata*, and *Thelypteris poiteana*

Herbs: *Commelina diffusa* var. *diffusa*, *Desmodium axillare* var. *axillare*, *Dieffenbachia seguine*, *Dissotis rotundifolia*, *Elephantopus mollis*, *Erythroxylon hirtella*, *Iresine diffusa*, *Oeceoclades maculata*, *Oxalis debilis* var. *corymbosa*, *Ruellia coccinea*, *Xanthosoma acevedoi*, and *Xanthosoma violaceum*

Graminoids: *Ichnanthus pallens* var. *pallens*, *Lasiacis sorghoidea*, *Pharus lappulaceus*, and *Urochloa maxima*

Epiphytes: *Campyloneurum phyllitidis* and *Tillandsia fasciculata*

Mosses and lichens: *Parmotrema* sp. and *Plagiochila* sp.



Figure 15—General view of a secondary forest inventory site (Bo. Las Palmas, municipality of Utuado). Forest Service photo by Johann D. Crespo-Zapata.

Associated Species

Five inventory sites yielded a total of 112 species inventoried. Another 18 species were observed near the inventory sites: *Alsophila portoricensis*, *Artocarpus altilis*, *Buchenavia tetraphylla*, *Calophyllum antillanum*, *Canna indica*, *Citrus × aurantium*, *Clusia rosea*, *Costus guanaiensis* var. *macrostrobilus*, *Dendropanax arboreus*, *Dioscorea bulbifera*, *Ficus citrifolia*, *Ficus trigonata*, *Hymenaea courbaril*, *Miconia prasina*, *Mucuna pruriens*, *Piper aduncum*, *Piper jacquemontianum*, and *Pisonia roqueae*.

Site Features

The inventory sites vary from young to late secondary forests in two distinct locations at elevations ranging from approximately 288 to 785 m above sea level. The array of species inventoried and observed consists of a wide variety of trees, shrubs, lianas, vines, herbs, and ferns. In addition, one inventory site is a late secondary forest located near mature forests. Thus, a few species that would typically be considered mature forest species were present within and near that site, especially in the understory.

Inventoried or associated species that are generally known for being cultivated for production and consumption include: *Annona muricata*, *Artocarpus altilis*, *Bixa orellana*, *Citrus × aurantium*, *Inga nobilis* ssp. *quaternata*, *Mangifera indica*, *Passiflora edulis*, *Psidium guajava*, *Syzygium jambos*, *Syzygium malaccense*, and *Xanthosoma violaceum*.

Notable Species

Uncommon remarkable species encountered within or near these inventory sites are *Prunus occidentalis* (Gann and Trejo-Torres 2015–2023) and *Pisonia roqueae* (Caraballo-Ortiz and Trejo-Torres 2017, Gann and Trejo-Torres 2015–2023). Both species correspond to the late secondary forest site that is close to a mature forest area and mountain range, so species composition seems to be highly influenced by that proximity. Other regional and/or notable species inventoried or observed near inventory sites include *Buchenavia tetraphylla*, *Lasiacis sorghoidea*, *Prestoea acuminata* var. *montana*, *Rhynchosia phaseoloides*, and *Thelypteris poiteana*.



Shrub of *Ocotea floribunda*, a native tree species regularly encountered at the Utuado and Jayuya secondary forest sites. Forest Service photo by Johann D. Crespo-Zapata.

Results and Discussion

SECONDARY FOREST SITES 6–8

Municipalities of Lajas (Bo. Sabana Yeguas) and Cabo Rojo (Bo. Boquerón)

INVENTORY SPECIES:

Canopy trees and shrubs (≥ 4 cm DBH and ≥ 2 m height recorded within three fixed-area square plots and/or variable-radius plots): *Amyris elemifera*, *Andira inermis*, *Bourreria succulenta*, *Bursera simaruba*, *Capparis hastata*, *Cordia laevigata*, *Crescentia linearifolia*, *Eugenia foetida*, *Eugenia* sp., *Guapira fragrans*, *Jacquinia arborea*, *Melicoccus bijugatus*, *Pictetia aculeata*, *Pithecellobium unguis-cati*, *Sideroxylon salicifolium*, *Swietenia macrophylla* (planted), *Tabebuia heterophylla*, *Tamarindus indica*, *Thouinia striata* var. *striata*, and *Zanthoxylum monophyllum*

Table 5—Secondary forest species (sites 6–8), site frequency, site density, relative frequency, relative density, relative dominance, and importance value of canopy trees and shrubs ≥ 4 cm DBH and ≥ 2 m height, recorded within three fixed-area square plots

Species	Site Frequency	Site Density	Relative Frequency	Relative Density	Relative Dominance	Importance Value
<i>Amyris elemifera</i>	1	8	4.34	11.59	1.98	5.97
<i>Andira inermis</i>	1	2	4.34	2.89	2.71	3.32
<i>Bourreria succulenta</i>	1	1	4.34	1.44	0.71	2.16
<i>Bursera simaruba</i>	1	1	4.34	1.44	10.52	5.44
<i>Capparis hastata</i>	1	1	4.34	1.44	0.67	2.15
<i>Cordia laevigata</i>	1	1	4.34	1.44	2.84	2.88
<i>Crescentia linearifolia</i>	1	6	4.34	8.69	3.33	5.45
Dead species	2	6	8.69	8.69	2.82	6.73
<i>Eugenia foetida</i>	1	1	4.34	1.44	0.45	2.08
<i>Eugenia</i> sp.	1	1	4.34	1.44	0.21	2.00
<i>Guapira fragrans</i>	1	3	4.34	4.34	0.78	3.15
<i>Jacquinia arborea</i>	1	1	4.34	1.44	0.27	2.02
<i>Melicoccus bijugatus</i>	1	3	4.34	4.34	3.79	4.16
<i>Pictetia aculeata</i>	1	1	4.34	1.44	0.24	2.01
<i>Pithecellobium unguis-cati</i>	1	1	4.34	1.44	0.19	1.99
<i>Sideroxylon salicifolium</i>	1	2	4.34	2.89	0.49	2.57
<i>Swietenia macrophylla</i>	1	3	4.34	4.34	39.01	15.90
<i>Tabebuia heterophylla</i>	1	14	4.34	20.28	15.00	13.21
<i>Tamarindus indica</i>	1	3	4.34	4.34	11.32	6.67

Table 5 (cont.)—Secondary forest species (sites 6–8), site frequency, site density, relative frequency, relative density, relative dominance, and importance value of canopy trees and shrubs ≥ 4 cm DBH and ≥ 2 m height, recorded within three fixed-area square plots

Species	Site Frequency	Site Density	Relative Frequency	Relative Density	Relative Dominance	Importance Value
<i>Thouinia striata</i> var. <i>striata</i>	1	8	4.34	11.59	2.06	6.00
<i>Zanthoxylum monophyllum</i>	2	2	8.69	2.89	0.53	4.04

Totals: 3 inventory sites (sampled area = 0.03 ha); 20 species; 69 stems (sum of basal area = 0.68 m²). Results exclude species and corresponding stems recorded within variable-radius plots but occurring outside the square plot boundaries. Recorded snags or standing dead trees are included and listed as dead species.

Understory shrubs and subshrubs (<4 cm DBH and <2 m height): *Adelia ricinella*, *Amyris elemifera*, *Argythamnia candicans*, *Argythamnia fasciculata*, *Bourreria succulenta*, *Capparis hastata*, *Capparis indica*, *Comocladia dodonaea*, *Cordia laevigata*, *Crescentia linearifolia*, *Crossopetalum rhacoma*, *Croton betulinus*, *Croton flavens*, *Croton glabellus* ssp. *polytrichus*, *Cynophalla flexuosa*, *Erythroxylum areolatum*, *Erythroxylum brevipes*, *Eugenia rhombea*, *Eugenia* sp., *Exostema caribaeum*, *Guaiaicum officinale*, *Guapira fragrans*, *Guettarda odorata*, *Jacquinia arborea*, *Krugiodendron ferreum*, *Lantana involucrata*, *Pithecellobium unguis-cati*, *Randia aculeata*, *Rochefortia acanthophora*, *Schaefferia frutescens*, *Sideroxylon obovatum*, *Solanum bahamense*, *Tephrosia senna*, *Thespesia grandiflora*, *Thouinia striata* var. *striata*, *Trichilia hirta*, *Triumfetta lappula*, *Wedelia calycina*, and *Zanthoxylum monophyllum*

Seedlings and saplings: *Amyris elemifera*, *Bourreria succulenta*, *Capparis hastata*, *Chrysophyllum oliviforme*, *Citharexylum spinosum*, *Colubrina arborescens*, *Cordia laevigata*, *Crescentia linearifolia*, *Cupania americana*, *Cynophalla flexuosa*, *Guaiaicum officinale*, *Guapira fragrans*, *Leucaena leucocephala*, *Melicoccus bijugatus*, *Pictetia aculeata*, *Pithecellobium dulce*, *Roystonea borinquena*, *Samanea saman*, *Solanum bahamense*, *Swietenia macrophylla* (recruited from planted

individuals), *Tabebuia heterophylla*, *Tamarindus indica*, and *Thouinia striata* var. *striata*

Seeds: *Mangifera indica*

Lianas and vines: *Chiococca alba*, *Cissus verticillata*, *Commelina diffusa* var. *diffusa*, *Cydista aequinoctialis*, *Distictis lactiflora*, *Galactia striata*, *Gouania lupuloides*, *Heteropterys purpurea*, *Jacquemontia cumanensis*, *Jasminum fluminense*, *Macfadyena unguis-cati*, *Melothria pendula*, *Passiflora suberosa*, *Senegalia westiana*, *Serjania polyphylla*, *Stigmaphyllon emarginatum*, *Thunbergia fragrans*, *Tournefortia scabra*, and *Tragia volubilis*

Herbs: *Achyranthes aspera* var. *aspera*, *Argythamnia candicans*, *Bromelia pinguin*, *Commelina diffusa* var. *diffusa*, *Oeceoclades maculata*, *Petiveria alliacea*, *Rivina humilis*, *Siphonoglossa sessilis*, and *Tillandsia recurvata*

Graminoids: *Cynodon nlemfuensis* and *Urochloa maxima*

Epiphytes: *Tillandsia recurvata*

Cacti and succulents: *Opuntia repens*

Mosses and lichens: *Leucomium* sp. and *Parmotrema* sp.

Results and Discussion

Associated Species

Three inventory sites yielded a total of 88 species inventoried. Another 26 species were observed near the inventory sites: *Asystasia gangetica* ssp. *micrantha*, *Casearia aculeata*, *Cestrum diurnum*, *Corchorus siliquosus*, *Cordia collococca*, *Cordia rickseckeri*, *Desmanthus virgatus*, *Desmodium incanum*, *Desmodium scorpiurus*, *Hylocereus trigonus*, *Inga laurina*, *Jatropha gossypifolia*, *Malvastrum corchorifolium*, *Mimosa pudica* var. *unijuga*, *Myriopus volubilis*, *Phyllanthus urinaria*, *Pilosocereus royenii*, *Piscidia carthagenensis*, *Prosopis juliflora*, *Ruellia tuberosa*, *Samyda dodecandra*, *Senna siamea*, *Sida rhombifolia*, *Sterculia apetala*, *Trichostigma octandrum*, and *Zanthoxylum flavum*.

Site Features

Inventory sites are in distinct locations at low elevations in the island's southwest. Two are natural secondary forests and one is an abandoned mahogany plantation.

Notable Species

The most uncommon species inventoried is *Tournefortia scabra* (Gann and Trejo-Torres 2015–2023, Monsegur-Rivera 2009). Other rare and/or regional species inventoried or observed near the inventory sites are: *Casearia aculeata*, *Cordia rickseckeri*, *Crescentia linearifolia*, *Guaiacum officinale*, *Jacquinia arborea*, *Rochefortia acanthophora*, *Siphonoglossa sessilis*, *Thespesia grandiflora*, and *Zanthoxylum flavum* (Gann and Trejo-Torres 2015–2023). *Asystasia gangetica* ssp. *micrantha*, observed near an inventory site, became a new record of this subspecies, as it was not previously recorded for Puerto Rico (see Maldonado-Silvestrini et al. 2022). Last but foremost, an inventoried and undetermined *Eugenia* sp. could potentially represent an undescribed species for Puerto Rico and the Virgin Islands.¹

¹Gibney, E. 2021. Personal communication. Native plant consultant, Friends of Virgin Islands National Park. P.O. Box 811, St. John, VI 00831.



Air plants, such as *Tillandsia recurvata*, regularly occupy the epiphyte ecological niche in forested areas within the subtropical dry forest ecological life zone. Forest Service photo by Johann D. Crespo-Zapata.

SECONDARY FOREST SITES 9–15

Municipalities of Fajardo (Bo. Quebrada Fajardo and Bo. Quebrada Vueltas), Río Grande (Bo. Hato Candal and Bo. Guzmán Abajo), Luquillo (Bo. Juan Martín), and Manatí (Bo. Tierras Nuevas Poniente)

INVENTORY SPECIES:

Canopy trees and shrubs (≥ 4 cm DBH and ≥ 1.5 m height recorded within three fixed-area square plots and/or variable-radius plots): *Albizia procera*, *Andira inermis*, *Calophyllum antillanum*, *Casearia guianensis*, *Casearia sylvestris*, *Cupania americana*, *Mangifera indica*, *Nectandra coriacea*, *Ocotea leucoxylon*, *Peltophorum pterocarpum*, *Pterocarpus officinalis*, *Roystonea borinquena*, *Spathodea campanulata*, *Terminalia catappa*, and *Zanthoxylum martinicense*

Table 6—Secondary forest species (sites 9–15), site frequency, site density, relative frequency, relative density, relative dominance, and importance value of canopy trees and shrubs ≥ 4 cm DBH and ≥ 1.5 m height, recorded within seven fixed-area square plots

Species	Site Frequency	Site Density	Relative Frequency	Relative Density	Relative Dominance	Importance Value
<i>Albizia procera</i>	2	4	6.66	2.32	1.99	3.66
<i>Andira inermis</i>	3	16	10	9.30	5.15	8.15
<i>Calophyllum antillanum</i>	2	3	6.66	1.74	1.25	3.22
<i>Casearia guianensis</i>	1	6	3.33	3.48	0.40	2.40
<i>Casearia sylvestris</i>	1	1	3.33	0.58	0.06	1.32
<i>Cupania americana</i>	2	3	6.66	1.74	0.57	2.99
Dead species	6	16	20	9.30	24.13	17.81
<i>Mangifera indica</i>	1	2	3.33	1.16	0.28	1.59
<i>Nectandra coriacea</i>	1	1	3.33	0.58	0.09	1.33
<i>Ocotea leucoxylon</i>	1	1	3.33	0.58	0.17	1.36
<i>Peltophorum pterocarpum</i>	2	43	6.66	25	14.49	15.38
<i>Pterocarpus officinalis</i>	1	19	3.33	11.04	24.29	12.89
<i>Spathodea campanulata</i>	2	23	6.66	13.37	12.31	10.78
<i>Terminalia catappa</i>	5	34	16.66	19.76	14.74	17.05

Totals: 7 inventory sites (sampled area = 0.07 ha); 13 species; 172 stems (sum of basal area = 4.08 m²). Results exclude species and corresponding stems recorded within variable-radius plots but occurring outside the square plot boundaries. Recorded snags or standing dead trees are included and listed as dead species.

Results and Discussion

Understory shrubs (<4 cm DBH and <2 m height):

Albizia procera, *Andira inermis*, *Calophyllum antillanum*, *Calophyllum inophyllum*, *Casearia decandra*, *Casearia guianensis*, *Casearia sylvestris*, *Cestrum laurifolium*, *Cinnamomum elongatum*, *Citharexylum spinosum*, *Cordia dichotoma*, *Cordia laevigata*, *Cupania americana*, *Eugenia biflora*, *Gonzalagunia hirsuta*, *Guapira fragrans*, *Guarea guidonia*, *Inga laurina*, *Licaria triandra*, *Mammea americana*, *Melicoccus bijugatus*, *Miconia laevigata*, *Miconia prasina*, *Mimosa pigra*, *Peltophorum pterocarpum*, *Piper aduncum*, *Pterocarpus officinalis*, *Randia aculeata*, *Spathodea campanulata*, *Terminalia catappa*, and *Thespesia grandiflora*

Seedlings and saplings: *Andira inermis*, *Annona glabra*, *Annona montana*, *Bursera simaruba*, *Calophyllum antillanum*, *Calophyllum inophyllum*, *Casearia decandra*, *Casearia guianensis*, *Casearia sylvestris*, *Cissus verticillata*, *Cordia collococca*, *Cordia dichotoma*, *Cordia laevigata*, *Cupania americana*, *Erythroxylum brevipes*, *Eugenia biflora*, *Gonzalagunia hirsuta*, *Guapira fragrans*, *Guarea guidonia*, *Licaria parvifolia*, *Licaria triandra*, *Mammea americana*, *Melicoccus bijugatus*, *Mimosa pigra*, *Myrcia splendens*, *Nectandra coriacea*, *Ouratea litoralis*, *Paullinia pinnata*, *Peltophorum pterocarpum*, *Picramnia pentandra*, *Pithecellobium dulce*, *Pterocarpus officinalis*, *Randia aculeata*, *Roystonea borinquena*, *Serjania polyphylla*, *Spathodea campanulata*, *Terminalia catappa*, *Thespesia grandiflora*, *Trichostigma octandrum*, and undetermined Lauraceae sp.

Lianas and vines: *Centrosema pubescens*, *Centrosema virginianum*, *Chiococca alba*, *Cissus verticillata*, *Commelina diffusa* var. *diffusa*, *Desmodium incanum*, *Dioscorea chondrocarpa*, *Epipremnum aureum*, *Epipremnum pinnatum*, *Gouania lupuloides*, *Heteropterys laurifolia*, *Hippocratea volubilis*, *Jasminum fluminense*, *Lasiacis divaricata*, *Lygodium japonicum*, *Mimosa ceratonia*, *Paullinia pinnata*, *Serjania polyphylla*, *Syngonium podophyllum*, *Trichostigma octandrum*, and *Vigna vexillata*

Ferns: *Acrostichum danaeifolium*, *Adiantum latifolium*, *Campyloneurum phyllitidis*, *Lygodium japonicum*, *Microgramma lycopodioides*, *Nephrolepis multiflora*, *Phymatosorus grossus*, *Thelypteris dentata*, *Thelypteris reticulata*, and *Thelypteris tetragona*

Herbs: *Commelina diffusa* var. *diffusa*, *Costus pictus*, *Desmodium incanum*, *Dieffenbachia seguine*, *Oeceoclades maculata*, *Petiveria alliacea*, *Teliostachya alopecuroidea*, and *Xanthosoma acevedoi*

Graminoids: *Cynodon dactylon*, *Ichnanthus pallens* var. *pallens*, *Lasiacis divaricata*, *Lithachne pauciflora*, and *Urochloa maxima*

Epiphytes: *Campyloneurum phyllitidis*, *Microgramma lycopodioides*, *Nephrolepis multiflora*, and *Phymatosorus grossus*

Mosses and lichens: *Neckeropsis* sp., undetermined moss, and undetermined lichen



Figure 16—General views of two secondary forest inventory sites (Bo. Hato Candal and Bo. Juan Martín, municipalities of Río Grande and Luquillo, respectively), dominated by *Spathodea campanulata* (A) and *Andira inermis* and *Terminalia catappa* (B). Forest Service photos by Johann D. Crespo-Zapata.

Associated Species

Seven inventory sites yielded a total of 90 species inventoried. Another 69 species were observed near the inventory sites: *Achyranthes aspera* var. *aspera*, *Acrocomia media*, *Acrostichum aureum*, *Amphitecna latifolia*, *Ardisia elliptica*, *Bourreria succulenta*, *Canna glauca*, *Cecropia schreberiana* ssp. *schreberiana*, *Chromolaena odorata*, *Chrysophyllum argenteum*, *Chrysophyllum oliviforme*, *Cissampelos pareira*, *Coccoloba diversifolia*, *Coccoloba venosa*, *Cocos nucifera*, *Colocasia esculenta*, *Cynophalla flexuosa*, *Cyperus alternifolius* ssp. *flabelliformis*, *Cyperus giganteus*, *Desmodium adscendens*, *Dissotis rotundifolia*, *Eichhornia crassipes*, *Elephantopus mollis*, *Ficus trigonata*, *Genipa americana*, *Guettarda scabra*, *Hernandia sonora*, *Hygrophila costata*, *Ipomoea setifera*, *Ipomoea tiliacea*, *Ixora coccinea*, *Leucaena leucocephala*, *Machaerium lunatum*, *Melochia nodiflora*, *Miconia impatiolaris*, *Miconia racemosa*, *Mikania micrantha*, *Momordica charantia*, *Muntingia calabura*, *Oplismenus hirtellus* ssp. *setarius*, *Oxycaryum cubense*, *Paspalum fasciculatum*, *Passiflora edulis*, *Passiflora suberosa*, *Piper amalago*, *Polygonum acuminatum*, *Pueraria phaseoloides*, *Ricinus communis*, *Ruellia simplex*, *Saccharum spontaneum*, *Salvinia minima*, *Samanea saman*, *Sansevieria hyacinthoides*, *Scleria microcarpa*, *Senna bicapsularis*, *Senna spectabilis*, *Spermacoce remota*, *Sphagneticola trilobata*, *Syzygium jambos*, *Tabebuia heterophylla*, *Tectaria incisa*, *Thalia geniculata*, *Thelypteris poiteana*, *Thunbergia fragrans*, *Tournefortia hirsutissima*, *Trichilia hirta*, *Tripogandra serrulata*, *Typha domingensis*, and *Urochloa mutica*.

Site Features

The inventory sites are located at low elevations along the island's north and northeastern regions, often in areas prone to flooding, and some within protected nature reserves. Inventoried or associated species that are generally known for having ethnobotanical uses (i.e., food and traditional medicine) include: *Annona glabra*, *Annona montana*, *Colocasia esculenta*, *Costus pictus*, *Genipa americana*, *Mammea americana*, *Mangifera indica*, *Melicoccus bijugatus*, *Passiflora edulis*, *Syzygium jambos*, and *Terminalia catappa*.

Exotic or nonnative species such as *Calophyllum inophyllum* and *Peltophorum pterocarpum* have been used throughout the years in Puerto Rico for ornamental and decorative purposes (Schubert 1979) and have consequently become naturalized in their respective ecological niches close to urban areas. This is also the case of other recorded or observed species such as *Epipremnum aureum*, *Epipremnum pinnatum*, *Ixora coccinea*, *Phymatosorus grossus*, and *Syngonium podophyllum*, which have been used for the same purpose in both urban and rural areas across the island. As a result, they have also become naturalized in several habitats. On the other hand, native species such as *Citharexylum spinosum*, *Eugenia biflora*, *Guapira fragrans*, and *Ouratea litoralis* have been propagated for reforestation and related conservation efforts (Santiago-Valentín et al. 2019) along with others, such as *Amphitecna latifolia*, *Andira inermis*, *Calophyllum antillanum*, *Canna glauca*, *Pterocarpus officinalis*, and *Roystonea borinquena*. Of these, *A. inermis*, *C. antillanum*, and *R. borinquena* are commonly planted in urban areas.

Notable Species

Rare, regional, and/or other notable species encountered within or near the inventory sites are: *Acrocomia media*, *Amphitecna latifolia*, *Canna glauca*, *Dioscorea chondrocarpa*, *Hernandia sonora*, *Licaria triandra*, *Ouratea litoralis*, *Polygonum acuminatum*, *Pterocarpus officinalis*, *Thalia geniculata*, and *Thespesia grandiflora* (Gann and Trejo-Torres 2015–2023). *A. media*, *A. latifolia*, *H. sonora*, and *L. triandra* have been listed as Critical Elements by the Natural Heritage Program of the PRDNER (2007).

Results and Discussion

SECONDARY FOREST SITES 16–18

Municipalities of Río Grande (Bo. Guzmán Abajo and Bo. Mameyes II) and Caguas (Bo. Río Turabo)

INVENTORY SPECIES:

Canopy trees and shrubs (≥ 4 cm DBH and ≥ 2.6 m height recorded within three fixed-area square plots and/or variable-radius plots): *Albizia procera*, *Andira inermis*, *Casearia guianensis*, *Cordia sulcata*, *Guapira fragrans*, *Guarea guidonia*, *Peltophorum pterocarpum*, *Pterocarpus indicus*, *Spathodea campanulata*, and *Urera baccifera*

Table 7—Secondary forest species (sites 16–18), site frequency, site density, relative frequency, relative density, relative dominance, and importance value of canopy trees and shrubs ≥ 4 cm DBH and ≥ 2.6 m height, recorded within three fixed-area square plots

Species	Site Frequency	Site Density	Relative Frequency	Relative Density	Relative Dominance	Importance Value
<i>Albizia procera</i>	2	9	12.5	10.22	13.18	11.97
<i>Andira inermis</i>	1	1	6.25	1.13	0.13	2.50
<i>Casearia guianensis</i>	2	9	12.5	10.22	2.32	8.35
<i>Cordia sulcata</i>	1	4	6.25	4.54	3.09	4.62
Dead species	3	8	18.75	9.09	15.09	14.31
<i>Guapira fragrans</i>	1	1	6.25	1.13	0.22	2.53
<i>Guarea guidonia</i>	3	30	18.75	34.09	43.41	32.08
<i>Pterocarpus indicus</i>	1	1	6.25	1.13	1.03	2.80
<i>Spathodea campanulata</i>	1	22	6.25	25	21.01	17.42
<i>Urera baccifera</i>	1	3	6.25	3.40	0.46	3.37

Totals: 3 inventory sites (sampled area = 0.03 ha); 9 species; 88 stems (sum of basal area = 0.91 m²). Results exclude species and corresponding stems recorded within variable-radius plots but occurring outside the square plot boundaries. Recorded snags or standing dead trees are included and listed as dead species.

Understory shrubs and subshrubs (<4 cm DBH and <2 m height): *Casearia decandra*, *Casearia guianensis*, *Casearia sylvestris*, *Cecropia schreberiana* ssp. *schreberiana*, *Clidemia hirta*, *Cordia sulcata*, *Cupania americana*, *Guapira fragrans*, *Guarea guidonia*, *Nectandra turbacensis*, *Ocotea leucoxylon*, *Pterocarpus indicus*, *Senna nitida*, *Spathodea campanulata*, and *Urera baccifera*

Seedlings and saplings: *Bucida buceras*, *Calophyllum antillanum*, *Casearia decandra*, *Casearia guianensis*, *Casearia sylvestris*, *Citharexylum spinosum*, *Cocos nucifera*, *Cordia sulcata*, *Cupania americana*, *Guapira fragrans*, *Guarea guidonia*, *Miconia laevigata*, *Miconia prasina*, *Myrcia splendens*, *Nectandra turbacensis*, *Ptychosperma macarthurii*, *Roystonea borinquena*, *Spathodea campanulata*, and *Urera baccifera*

Seeds: *Adonidia merrillii*, *Cocos nucifera*, and *Terminalia catappa*

Lianas and vines: *Cissampelos pareira*, *Cissus verticillata*,

Dioscorea bulbifera, *Dissotis rotundifolia*, *Epipremnum aureum*, *Heteropterys laurifolia*, *Hippocratea volubilis*, *Ipomoea tiliacea*, *Jasminum fluminense*, *Macfadyena unguis-cati*, *Microgramma lycopodioides*, *Passiflora suberosa*, *Paullinia pinnata*, *Pisonia aculeata*, *Senna nitida*, *Stigmaphyllon puberum*, *Syngonium podophyllum*, *Trichostigma octandrum*, undetermined Fabaceae sp., and *Vigna hosei*

Ferns: *Adiantum latifolium*, *Microgramma lycopodioides*, *Nephrolepis multiflora*, and *Psilotum nudum*

Herbs: *Alocasia macrorrhizos*, *Alpinia purpurata*, *Costus pictus*, *Costus scaber*, *Dieffenbachia seguine*, *Dissotis rotundifolia*, *Odontonema cuspidatum*, *Oeceoclades maculata*, *Petiveria alliacea*, and *Xiphidium caeruleum*

Graminoids: *Ichnananthus pallens* var. *pallens*, *Lithachne pauciflora*, and *Scleria pterota*

Mosses and lichens: *Neckeropsis* sp. and undetermined lichen

Associated Species

Three inventory sites yielded a total of 65 species inventoried. Another 57 species were observed near the inventory sites: *Adiantum pyramidale*, *Adiantum tetraphyllum*, *Bambusa vulgaris*, *Blechnum occidentale*, *Bolbitis nicotianifolia*, *Calathea lutea*, *Campyloneurum phyllitidis*, *Caryota mitis*, *Chrysophyllum argenteum*, *Cinnamomum elongatum*, *Colocasia esculenta*, *Commelina diffusa* var. *diffusa*, *Cordyline fruticosa*, *Cyathea arborea*, *Cyperus alternifolius* ssp. *flabelliformis*, *Dendropanax arboreus*, *Dracaena fragrans*, *Dypsis lutescens*, *Eucharis amazonica*, *Eugenia biflora*, *Gonzalagunia hirsuta*, *Hemigraphis reptans*, *Hernandia sonora*, *Hirtella triandra*, *Inga laurina*, *Inga vera*, *Lagerstroemia speciosa*, *Miconia impetolaris*, *Microgramma piloselloides*, *Mikania micrantha*, *Morinda citrifolia*, *Musa acuminata*, *Olyra latifolia*, *Oxalis barrelieri*, *Pachystachys spicata*, *Pennisetum purpureum*, *Pharus latifolius*, *Pimenta racemosa*, *Piper aduncum*, *Piper hispidum*, *Polyscias guilfoylei*, *Psychotria grandis*, *Pueraria phaseoloides*, *Ruellia simplex*, *Schefflera morototoni*, *Selaginella plana*, *Sphagneticola trilobata*, *Syzygium jambos*, *Syzygium malaccense*, *Tectaria incisa*, *Thelypteris dentata*, *Thelypteris poiteana*, *Thelypteris reticulata*, *Tournefortia hirsutissima*, *Turpinia occidentalis*, *Urochloa maxima*, and *Xanthosoma sagittifolium*.

Site Features

These inventory sites are located on the island's northeast and Caguas Valley at the eastern range of the central mountainous region.

Notable Species

One inventory site resulted in the documentation of multiple introduced species that are notably used for ornamental or decorative purposes across the island, all of which were observed in a naturalized state. These include *Adonidia merrillii*, *Alpinia purpurata*, *Caryota mitis*, *Cordyline fruticosa*, *Dracaena fragrans*, *Dypsis lutescens*, *Eucharis amazonica*, *Pachystachys spicata*, *Polyscias guilfoylei*, *Pterocarpus indicus*, *Ptychosperma macarthurii*, and *Xiphidium caeruleum*, of which *A. purpurata*, *C. mitis*, and *D. lutescens* comprise new naturalization records in Puerto Rico (see Maldonado-Silvestrini et al. 2023).

The most uncommon species inventoried is *Stigmaphyllon puberum* (Acevedo-Rodríguez 2005, Gann and Trejo-Torres 2015–2023), which has also been listed as a Critical Element by the Natural Heritage Program of the PRDNER (2007).

Results and Discussion

SHRUBLAND

The 13 shrubland inventory sites are located in the municipalities of Utuado (Bo. Caonillas Arriba and Bo. Las Palmas), Cabo Rojo (Bo. Boquerón and Bo. Pedernales), Fajardo (Bo. Quebrada Fajardo), Luquillo (Bo. Pitahaya and Bo. Juan Martín), Canóvanas (Bo. San Isidro), Loíza (Bo. Torrecilla Alta), and Caguas (Bo. Río Turabo), within the subtropical moist forest and subtropical dry forest ecological life zones (Ewel and Whitmore 1973; figs. 17 and 18), and range from approximately sea level to 374 m above sea level. Some inventory species may be repeated among different categories if they have been observed in more than one biological stage (i.e., seedling, sapling,

shrub, and/or small tree) or displaying multiple growth habits (e.g., *Cyathea arborea* was classified as both a fern and a tree). Since inventory sites assessed in this succession stage occur in different ecological life zones, across considerably distant areas, and/or have distinctive vegetation assemblages, the results below are grouped by locality: three inventory sites from the municipality of Utuado; three from the municipality of Cabo Rojo; six from the municipalities of Fajardo, Luquillo, Canóvanas, and Loíza; and one from the municipality of Caguas. Refer to appendix A for summarized descriptions, vegetation, and additional information on each inventory site.

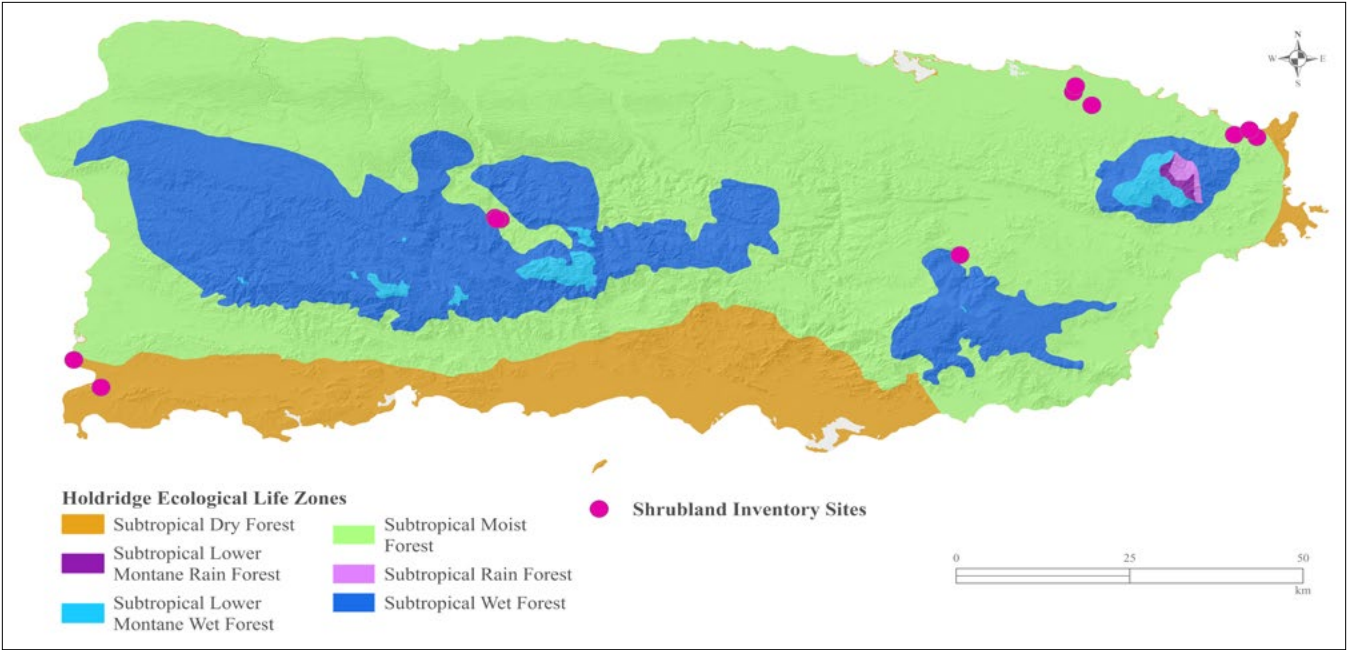


Figure 17—Shrubland inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973).

SHRUBLAND INVENTORY SITES 1–3

Municipality of Utuado (Bo. Caonillas Arriba and Bo. Las Palmas)

INVENTORY SPECIES:

Shrubs and small trees (≥ 4 cm DBH and ≥ 1.8 m height recorded within three fixed-area square plots): *Cupania americana*, *Cyathea arborea*, *Guarea guidonia*, *Miconia impetolaris*, *Myrsine coriacea*, and *Spathodea campanulata*

Table 8—Shrubland species (sites 1–3), site frequency, site density, relative frequency, relative density, relative dominance, and importance value of shrubs and small trees ≥ 4 cm DBH and ≥ 1.8 m height, recorded within three fixed-area square plots

Species	Site Frequency	Site Density	Relative Frequency	Relative Density	Relative Dominance	Importance Value
<i>Cupania americana</i>	1	2	16.66	14.28	4.81	11.92
<i>Cyathea arborea</i>	1	5	16.66	35.71	68.81	40.39
<i>Guarea guidonia</i>	1	3	16.66	21.42	8.65	15.58
<i>Miconia impetolaris</i>	1	2	16.66	14.28	6.67	12.54
<i>Myrsine coriacea</i>	1	1	16.66	7.14	8.41	10.74
<i>Spathodea campanulata</i>	1	1	16.66	7.14	2.62	8.81

Totals: 3 inventory sites (sampled area = 0.03 ha); 6 species; 14 stems (sum of basal area = 0.06 m²).

Shrubs and subshrubs (<4 cm DBH and <1.8 m height):

Casearia guianensis, *Casearia sylvestris*, *Chromolaena odorata*, *Clidemia hirta*, *Cordia polycephala*, *Cupania americana*, *Cyathea arborea*, *Guarea guidonia*, *Miconia impetolaris*, *Miconia laevigata*, *Myrsine coriacea*, *Piper aduncum*, *Psidium guajava*, and *Triumfetta semitriloba*

Lianas and vines: *Centrosema virginianum*, *Chromolaena*

odorata, *Cissampelos pareira*, *Cissus verticillata*, *Commelina diffusa* var. *diffusa*, *Desmodium incanum*, *Dissotis rotundifolia*, *Gouania polygama*, *Ipomoea setifera*, *Ipomoea tiliacea*, *Mikania micrantha*, *Mimosa pudica* var. *unijuga*, *Odontosoria aculeata*, *Passiflora rubra*, *Passiflora suberosa*, *Pueraria phaseoloides*, *Securidaca virgata*, *Sticherus bifidus*, *Stigmaphyllon floribundum*, *Syngonium podophyllum*, and *Thunbergia alata*

Ferns: *Cyathea arborea*, *Nephrolepis multiflora*, *Odontosoria aculeata*, and *Sticherus bifidus*

Herbs: *Commelina diffusa* var. *diffusa*, *Desmodium incanum*, *Dissotis rotundifolia*, *Elephantopus mollis*, *Melanthera nivea*, *Mimosa pudica* var. *unijuga*, *Oeceoclades maculata*, *Pseudelephantopus spicatus*, *Scleria pterota*, and *Spermacoce verticillata*

Graminoids: *Cynodon nlemfuensis*, *Pennisetum purpureum*, *Scleria pterota*, and *Urochloa maxima*

Lichens: *Parmotrema* sp.

Results and Discussion

Associated Species

Three inventory sites yielded a total of 46 species inventoried. Another 21 species were observed near the inventory sites: *Abrus precatorius*, *Andira inermis*, *Bambusa vulgaris*, *Cecropia schreberiana* ssp. *schreberiana*, *Cnemidaria horrida*, *Gonzalagunia hirsuta*, *Hippocratea volubilis*, *Ichnanthus pallens* var. *pallens*, *Iresine diffusa*, *Manihot esculenta*, *Miconia prasina*, *Mucuna pruriens*, *Piper amalago*, *Rhynchospora ciliata*, *Rubus rosifolius*, *Schefflera morototoni*, *Spondias dulcis*, *Trema micrantha*, *Urena lobata*, *Vitis tiliifolia*, and *Zanthoxylum martinicense*.

Site Features

The inventory sites are located in a farm. The farm's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain. The sites are generally dominated by shrubs and small trees. Inventoried or associated species that are generally known for being cultivated for production and/or consumption include *Manihot esculenta*, *Psidium guajava*, and *Spondias dulcis*.



Flower of *Thunbergia alata*, an exotic or nonnative vine recorded at the Utuado shrubland sites. Forest Service photo by Johann D. Crespo-Zapata.

SHRUBLAND INVENTORY SITES 4–6

Municipality of Cabo Rojo (Bo. Boquerón and Bo. Pedernales)

INVENTORY SPECIES:

Shrubs and small trees (≥ 4 cm DBH and ≥ 2 m height recorded within three fixed-area square plots): *Bourreria succulenta*, *Capparis indica*, *Crescentia linearifolia*, *Leucaena leucocephala*, *Parkinsonia aculeata*, *Pithecellobium unguis-cati*, *Prosopis juliflora*, *Rochefortia acanthophora*, *Schaefferia frutescens*, *Tamarindus indica*, and *Zanthoxylum monophyllum*

Table 9—Shrubland species (sites 4–6), site frequency, site density, relative frequency, relative density, relative dominance, and importance value of shrubs and small trees ≥ 4 cm DBH and ≥ 2 m height, recorded within three fixed-area square plots

Species	Site Frequency	Site Density	Relative Frequency	Relative Density	Relative Dominance	Importance Value
<i>Bourreria succulenta</i>	1	3	6.25	5.35	4.01	5.20
<i>Capparis indica</i>	1	1	6.25	1.78	0.60	2.87
<i>Crescentia linearifolia</i>	1	5	6.25	8.92	15.65	10.27
Dead species	2	3	12.5	5.35	2.02	6.62
<i>Leucaena leucocephala</i>	3	19	18.75	33.92	20.23	24.30
<i>Parkinsonia aculeata</i>	1	1	6.25	1.78	2.52	3.52
<i>Pithecellobium unguis-cati</i>	1	9	6.25	16.07	8.17	10.16
<i>Prosopis juliflora</i>	2	9	12.5	16.07	36.27	21.61
<i>Rochefortia acanthophora</i>	1	1	6.25	1.78	0.60	2.87
<i>Schaefferia frutescens</i>	1	1	6.25	1.78	0.82	2.95
<i>Tamarindus indica</i>	1	1	6.25	1.78	6.14	4.72
<i>Zanthoxylum monophyllum</i>	1	3	6.25	5.35	2.91	4.84

Totals: 3 inventory sites (sampled area = 0.03 ha); 11 species; 56 stems (sum of basal area = 0.21 m²). Recorded snags or standing dead trees are included as dead species.

Results and Discussion

Shrubs and subshrubs (<4 cm DBH and <2 m height): *Bastardia viscosa*, *Bourreria succulenta*, *Capparis indica*, *Citharexylum spinosum*, *Comocladia dodonaea*, *Cordia bullata* ssp. *humilis*, *Cryptostegia madagascariensis*, *Cynophalla flexuosa*, *Erythroxylum areolatum*, *Erythroxylum brevipes*, *Guaiacum officinale*, *Guapira fragrans*, *Jacquinia arborea*, *Jatropha gossypifolia*, *Lantana involucrata*, *Leucaena leucocephala*, *Melochia nodiflora*, *Pithecellobium unguis-cati*, *Prosopis juliflora*, *Randia aculeata*, *Rauvolfia viridis*, *Rocheffortia acanthophora*, *Samyda dodecandra*, *Schaefferia frutescens*, *Sida abutilifolia*, *Solanum bahamense*, *Tamonea boxiana*, *Tephrosia senna*, *Trichilia hirta*, *Wissadula periplocifolia*, and *Zanthoxylum monophyllum*

Seedlings and saplings: *Bourreria succulenta*, *Bursera simaruba*, *Capparis hastata*, *Capparis indica*, *Citharexylum spinosum*, *Cordia collococca*, *Erythroxylum areolatum*, *Erythroxylum brevipes*, *Guaiacum officinale*, *Krugiodendron ferreum*, *Leucaena leucocephala*, *Pithecellobium unguis-cati*, *Randia aculeata*, and *Zanthoxylum monophyllum*

Vines: *Cissus trifoliata*, *Clitoria ternatea*, *Cryptostegia madagascariensis*, *Cucumis dipsaceus*, *Cynophalla flexuosa*, *Dalechampia scandens*, *Desmodium incanum*, *Desmodium scorpiurus*, *Distictis lactiflora*, *Galactia dubia*, *Gouania lupuloides*, *Jacquemontia cumanensis*, *Jasminum fluminense*, *Macfadyena unguis-cati*, *Metastelma decipiens*, *Mikania cordifolia*, *Myriopus volubilis*, *Passiflora pallida*, *Rhynchosia reticulata*, *Serjania polyphylla*, *Stigmaphyllon emarginatum*, *Tragia volubilis*, and *Trichostigma octandrum*

Herbs: *Achyranthes aspera* var. *aspera*, *Argythamnia candicans*, *Bromelia pinguin*, *Commelina erecta*, *Desmodium scorpiurus*, *Euphorbia heterophylla*, *Ruellia tuberosa*, *Sida abutilifolia*, and *Tillandsia recurvata*

Graminoids: *Bothriochloa pertusa* and *Urochloa maxima*

Epiphytes: *Tillandsia recurvata*

Cacti and succulents: *Pilosocereus royerii*

Associated Species
Three inventory sites yielded a total of 69 species inventoried. Another six species were observed near the inventory sites: <i>Casearia guianensis</i> , <i>Desmanthus virgatus</i> , <i>Lasiacis divaricata</i> , <i>Melicoccus bijugatus</i> , <i>Oeceoclades maculata</i> , and <i>Waltheria indica</i> .
Site Features
The inventory sites are mostly dominated by shrubs and small trees. They are located within and near nature reserves and wildlife refuges at low elevations on the southwestern coast of the island. Inventoried or associated species that are known for being cultivated for production or consumption include <i>Melicoccus bijugatus</i> and <i>Tamarindus indica</i> .
Notable Species
Rare, regional, and/or other notable species inventoried are <i>Crescentia linearifolia</i> , <i>Guaiacum officinale</i> , <i>Jacquinia arborea</i> , <i>Rocheffortia acanthophora</i> , and <i>Tamonea boxiana</i> (Gann and Trejo-Torres 2015–2023). <i>G. officinale</i> and <i>R. acanthophora</i> have been listed as Critical Elements by the Natural Heritage Program of the PRDNER (2007).

SHRUBLAND INVENTORY SITES 7–12

Municipalities of Fajardo (Bo. Quebrada Fajardo), Luquillo (Bo. Pitahaya and Bo. Juan Martín), Canóvanas (Bo. San Isidro), and Loíza (Bo. Torrecilla Alta)

INVENTORY SPECIES:

Shrubs and small trees (≥ 4 cm DBH and ≥ 2 m height recorded within three fixed-area square plots): *Annona glabra*, *Eugenia biflora*, *Randia aculeata*, *Samanea saman*, *Schefflera morototoni*, and *Vachellia tortuosa*

Table 10—Shrubland species (sites 7, 8, and 10), site frequency, site density, relative frequency, relative density, relative dominance, and importance value of shrubs and small trees ≥ 4 cm DBH and ≥ 2 m height, recorded within three of six fixed-area square plots

Species	Site Frequency	Site Density	Relative Frequency	Relative Density	Relative Dominance	Importance Value
<i>Annona glabra</i>	1	4	12.5	33.33	21.07	22.30
Dead species	2	2	25	16.66	8.91	16.86
<i>Eugenia biflora</i>	1	1	12.5	8.33	7.21	9.34
<i>Randia aculeata</i>	1	1	12.5	8.33	4.61	8.48
<i>Samanea saman</i>	1	1	12.5	8.33	16.58	12.47
<i>Schefflera morototoni</i>	1	1	12.5	8.33	6.57	9.13
<i>Vachellia tortuosa</i>	1	2	12.5	16.66	35.01	21.39

Totals: 3 inventory sites (sampled area = 0.03 ha); 6 species; 12 stems (sum of basal area = 0.03 m²). Stems ≥ 4 cm DBH and ≥ 2 m height were recorded in three of six inventory sites, but the total sampled area (0.06 ha) was applied for all corresponding calculations (i.e., basal area, relative density, and relative dominance). Recorded snags or standing dead trees are included as dead species.



Figure 18—General view of a shrubland inventory site (Bo. Quebrada Fajardo, municipality of Fajardo), dominated by a variety of shrub species. Forest Service photo by Johann D. Crespo-Zapata.

Results and Discussion

Shrubs and subshrubs (<4 cm DBH and <2 m height):

Aeschynomene sensitiva, *Annona glabra*, *Casearia guianensis*, *Casearia sylvestris*, *Cestrum diurnum*, *Chromolaena odorata*, *Citharexylum spinosum*, *Clidemia hirta*, *Cordia polycephala*, *Cynophalla flexuosa*, *Desmanthus virgatus*, *Eugenia biflora*, *Guapira fragrans*, *Jatropha gossypifolia*, *Lantana horrida*, *Ludwigia octovalvis*, *Malachra capitata*, *Miconia prasina*, *Mimosa pigra*, *Neptunia plena*, *Psidium guajava*, *Randia aculeata*, *Samanea saman*, *Schefflera morototoni*, *Senna bicapsularis*, *Senna obtusifolia*, *Senna occidentalis*, *Sida glomerata*, *Sida rhombifolia*, *Sida urens*, *Solanum torvum*, *Triumfetta semitriloba*, *Urena lobata*, *Vachellia farnesiana* var. *farnesiana*, *Vachellia tortuosa*, *Waltheria indica*, and *Wissadula periplocifolia*

Seedlings and saplings: *Cestrum diurnum*, *Citharexylum spinosum*, *Cordia polycephala*, *Cupania americana*, *Cynophalla flexuosa*, *Eugenia biflora*, *Guapira fragrans*, *Randia aculeata*, *Samanea saman*, *Schefflera morototoni*, *Terminalia catappa*, *Vachellia farnesiana* var. *farnesiana*, and *Vachellia tortuosa*

Vines: *Aniseia martinicensis*, *Centrosema pubescens*, *Centrosema virginianum*, *Chromolaena odorata*, *Cissampelos pareira*, *Cissus verticillata*, *Commelina diffusa* var. *diffusa*, *Cordia polycephala*, *Cuscuta americana*, *Desmodium adscendens*, *Desmodium incanum*, *Desmodium scorpiurus*, *Galactia striata*, *Ipomoea setifera*, *Ipomoea tiliacea*, *Jasminum fluminense*, *Melothria pendula*, *Merremia umbellata*, *Mikania cordifolia*, *Mikania micrantha*, *Mimosa casta*, *Mimosa pudica* var. *unijuga*, *Momordica charantia*, *Passiflora foetida*, *Passiflora*

laurifolia, *Passiflora suberosa*, *Paullinia pinnata*, *Pueraria phaseoloides*, *Securidaca virgata*, *Vigna adenantha*, *Vigna hosei*, *Vigna luteola*, and *Vigna vexillata*

Ferns: *Adiantum latifolium*, *Ceratopteris thalictroides*, and *Salvinia minima*

Herbs: *Alternanthera philoxeroides*, *Commelina diffusa* var. *diffusa*, *Commelina erecta*, *Crotalaria retusa*, *Cuphea strigulosa*, *Cyanthillium cinereum*, *Desmodium adscendens*, *Desmodium incanum*, *Desmodium scorpiurus*, *Eclipta prostrata*, *Eleocharis flavescens*, *Eleocharis interstincta*, *Eleocharis mutata*, *Elephantopus mollis*, *Enydra sessilis*, *Heteranthera reniformis*, *Hygrophila costata*, *Hyptis atrorubens*, *Justicia comata*, *Ludwigia octovalvis*, *Ludwigia peploides*, *Mimosa pudica* var. *unijuga*, *Murdannia nudiflora*, *Neptunia plena*, *Oxalis barrelieri*, *Phyllanthus nodiflora*, *Phyllanthus amarus*, *Phyllanthus urinaria*, *Polygonum punctatum*, *Pseudelephantopus spicatus*, *Rolandra fruticosa*, *Ruellia blechum*, *Sagittaria lancifolia*, *Scleria pterota*, *Sida rhombifolia*, *Spermacoce verticillata*, *Struchium sparganophorum*, and *Torenia crustacea*

Graminoids: *Abildgaardia ovata*, *Axonopus compressus*, *Cynodon dactylon*, *Cyperus haspan*, *Digitaria horizontalis*, *Eleocharis flavescens*, *Eleocharis interstincta*, *Eleocharis mutata*, *Fimbristylis dichotoma*, *Kyllinga brevifolia*, *Leersia hexandra*, *Panicum laxum*, *Paspalum conjugatum*, *Paspalum vaginatum*, *Rhynchospora ciliata*, *Rhynchospora corymbosa*, *Schoenoplectus americanus*, *Scleria pterota*, *Setaria parviflora*, *Stenotaphrum secundatum*, and *Urochloa distachya*

Lichens: *Parmotrema* sp.

Associated Species

Six inventory sites yielded a total of 121 species inventoried. Another 20 species were observed near the inventory sites: *Bursera simaruba*, *Chamaecrista nictitans* var. *diffusa*, *Clitoria falcata*, *Cyperus giganteus*, *Cyperus odoratus*, *Erythroxylum brevipes*, *Ludwigia leptocarpa*, *Paspalum pleostachyum*, *Paspalum setaceum*, *Pluchea carolinensis*, *Pterocarpus officinalis*, *Rhynchosia reticulata*, *Senna alata*, *Sesuvium portulacastrum*, *Stigmaphyllon emarginatum*, *Synedrella nodiflora*, *Thelypteris tetragona*, *Typha domingensis*, *Urochloa maxima*, and *Zanthoxylum martinicense*.

Site Features

The inventory sites are mostly dominated by shrubs and small trees and are located at low elevations along the island's northeastern region. Some sites occur within or near floodplain areas.

Inventoried or associated species that are generally known for being cultivated for consumption include *Psidium guajava*, *Passiflora laurifolia*, and *Terminalia catappa*.

Notable Species

Rare, regional, and/or other notable inventory species are *Aniseia martinicensis*, *Ceratopteris thalictroides*, *Enydra sessilis*, *Lantana horrida*, *Sagittaria lancifolia*, *Schoenoplectus americanus*, and *Struchium sparganophorum* (Gann and Trejo-Torres 2015–2023). The first two have been cataloged as Critical Elements by the Natural Heritage Program of the PRDNER (2007).

SHRUBLAND INVENTORY SITE 13
Municipality of Caguas (Bo. Río Turabo)

INVENTORY SPECIES:

Shrubs and small trees (≥ 4 cm DBH and ≥ 2.7 m height):
Albizia procera, *Casearia decandra*, *Casearia guianensis*,
Guapira fragrans, and *Spathodea campanulata*

Shrubs and subshrubs (< 4 cm DBH and < 2 m height):
Casearia decandra, *Casearia guianensis*, *Casearia*
sylvestris, *Guapira fragrans*, *Melochia nodiflora*, *Senna*
hirsuta var. *hirsuta*, *Spathodea campanulata*, and
Triumfetta semitriloba

Seedlings and saplings: *Albizia procera*, *Casearia*
decandra, *Casearia guianensis*, *Casearia sylvestris*,
Eugenia monticola, *Guapira fragrans*, *Miconia prasina*, and
Spathodea campanulata

Lianas and vines: *Cissampelos pareira*, *Cissus verticillata*,
Desmodium incanum, *Hippocratea volubilis*, *Ipomoea*
setifera, *Jasminum fluminense*, *Mimosa casta*, *Passiflora*
rubra, *Passiflora suberosa*, *Senna nitida*, *Tournefortia*
hirsutissima, *Trichostigma octandrum*, and *Vigna*
adenantha

Herbs: *Chamaecrista nictitans* var. *glabrata*, *Cuphea*
strigulosa, *Mimosa pudica* var. *unijuga*, and *Sida acuta*

Graminoids: *Urochloa maxima*

Mosses and lichens: Undetermined moss and
undetermined lichen.

Associated Species

One inventory site yielded a total of 29 species inventoried. Another eight species were observed near the inventory site: *Citharexylum spinosum*, *Cupania americana*, *Guarea guidonia*, *Mikania micrantha*, *Nephrolepis multiflora*, *Roystonea borinquena*, *Schefflera morototoni*, and *Urena lobata*.

Site Features

This inventory site is located in the Caguas Valley, at the eastern range of the central mountainous region. At the time the vegetation inventory was conducted, the site was mostly dominated by shrubs and small trees of *Albizia procera* and *Spathodea campanulata*.



Branch and seed pods of *Senna nitida*, a native scandent shrub or liana recorded at the Caguas shrubland site. Forest Service photo by Johann D. Crespo-Zapata.

Results and Discussion

PIONEERS

The 15 pioneer inventory sites are located in the municipalities of Utuado (Bo. Las Palmas), Lajas (Bo. Sabana Yeguas), Cabo Rojo (Bo. Pedernales), Fajardo (Bo. Sardinera and Bo. Quebrada Fajardo), Luquillo (Bo. Juan Martín and Bo. Pitahaya), Canóvanas (Bo. San Isidro), Loíza (Bo. Torrecilla Alta), and Caguas (Bo. Río Turabo), within the subtropical moist forest and subtropical dry forest ecological life zones (Ewel and Whitmore 1973; figs. 19, 20, and 21), and range from approximately sea level to 352 m above sea level. Some inventory species may be repeated among different categories if they have been observed in more than one biological stage (i.e., seedling, sapling, and/or shrub) or displaying multiple growth

habits (e.g., *Sphagneticola trilobata*, a species generally seen as a decumbent herb, was observed exhibiting trailing habits and thus was also classified as a vine). Since inventory sites assessed in this succession stage occur in different ecological life zones, across considerably distant areas, and/or have distinctive vegetation assemblages, the results are grouped by locality: three inventory sites from the municipality of Utuado; three from the municipalities of Lajas, Cabo Rojo, and Fajardo; eight from the municipalities of Luquillo, Fajardo, Canóvanas, and Loíza; and one from the municipality of Caguas. Refer to appendix A for summarized descriptions, vegetation, and additional information on each inventory site.

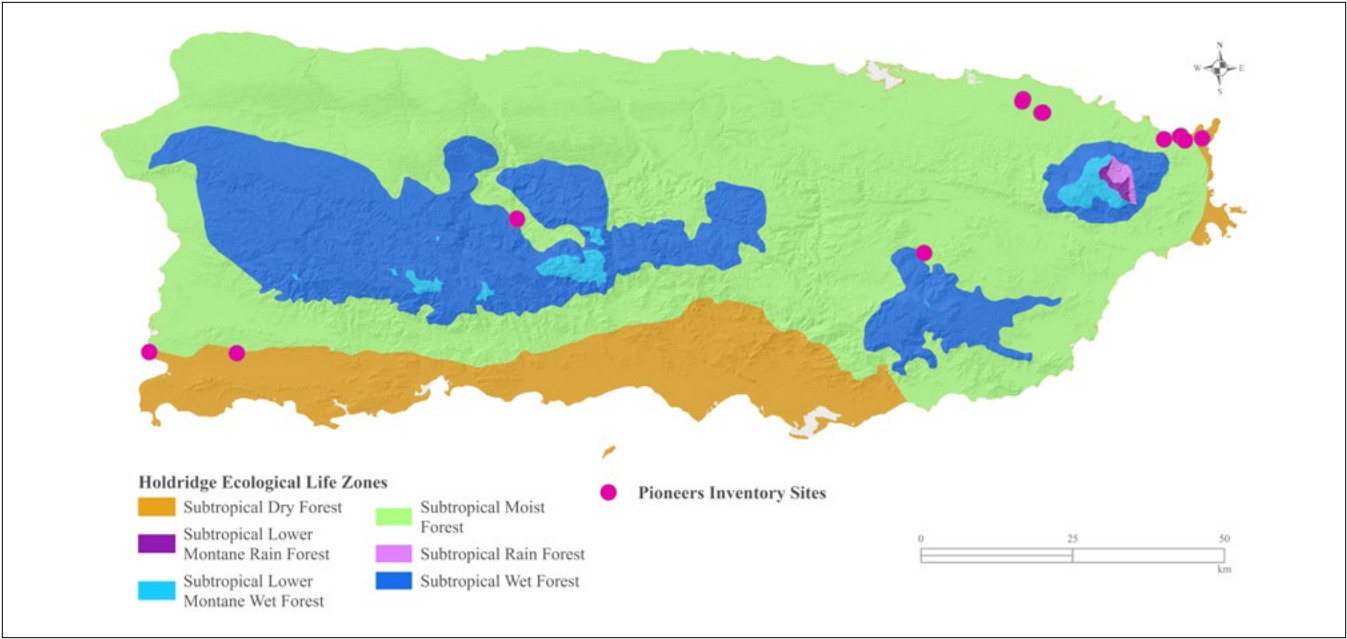


Figure 19—Pioneer inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973).

PIONEER INVENTORY SITES 1–3*Municipality of Utuado (Bo. Las Palmas)***INVENTORY SPECIES:****Shrubs** (≥ 4 cm DBH and ≥ 2 m height): *Gliricidia sepium***Shrubs and subshrubs** (< 4 cm DBH and < 2 m height):*Calliandra surinamensis*, *Capsicum annuum* var. *glabriusculum*, *Chromolaena odorata*, *Clidemia cymosa*, *Clidemia hirta*, *Cordia polycephala*, *Guarea guidonia*, *Miconia laevigata*, *Piper aduncum*, *Psidium guajava*, *Tibouchina longifolia*, *Trema micrantha*, and *Urena lobata***Seedlings and saplings:** *Cupania americana*, *Gliricidia sepium*, and *Guarea guidonia***Lianas and vines:** *Asystasia gangetica*, *Centrosema virginianum*, *Chromolaena odorata*, *Cissus verticillata*, *Commelina diffusa* var. *diffusa*, *Cordia polycephala*, *Cucurbita moschata*, *Desmodium incanum*, *Dissotis rotundifolia*, *Ipomoea tiliacea*, *Iresine diffusa*, *Melanthera**nivea*, *Melothria pendula*, *Merremia umbellata*, *Mikania micrantha*, *Odontosoria aculeata*, *Pueraria phaseoloides*, *Rubus rosifolius*, *Securidaca virgata*, *Tournefortia hirsutissima*, and *Trichostigma octandrum***Ferns:** *Nephrolepis multiflora*, *Odontosoria aculeata*, and *Pityrogramma calomelanos***Herbs:** *Asystasia gangetica*, *Commelina diffusa* var. *diffusa*, *Desmodium incanum*, *Dissotis rotundifolia*, *Emilia praetermissa*, *Euphorbia heterophylla*, *Iresine diffusa*, *Melanthera nivea*, and *Stachytarpheta cayennensis***Graminoids:** *Cyperus sphacelatus*, *Panicum laxum*, *Pennisetum purpureum*, undetermined Poaceae sp., *Rhynchospora ciliata*, and *Urochloa maxima***Associated Species**

Three inventory sites yielded a total of 45 species inventoried. Another 13 species were observed near the inventory sites: *Bambusa vulgaris*, *Callisia fragrans*, *Casearia sylvestris*, *Cecropia schreberiana* ssp. *schreberiana*, *Cyathea arborea*, *Cyathea* sp., *Gouania polygama*, *Heliconia* sp., *Manihot esculenta*, *Musa* sp., *Spondias purpurea*, *Tabebuia heterophylla*, and *Zanthoxylum martinicense*.

Site Features

The inventory sites are located in a farm. The farm's historical land use included mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Inventoried or associated species that are generally known for being cultivated for production and/or consumption include *Capsicum annuum* var. *glabriusculum*, *Cucurbita moschata*, *Manihot esculenta*, *Musa* sp., *Psidium guajava*, and *Spondias purpurea*.

Results and Discussion

PIONEER INVENTORY SITES 4–6

Municipalities of Lajas (Bo. Sabana Yeguas), Cabo Rojo (Bo. Pedernales), and Fajardo (Bo. Sardinera)

INVENTORY SPECIES:

Shrubs (≥ 4 cm DBH and ≥ 1.8 m height): *Leucaena leucocephala*

Shrubs and subshrubs (< 4 cm DBH and < 1.8 m height): *Bastardia viscosa*, *Capparis indica*, *Corchorus siliquosus*, *Cordia bullata* ssp. *humilis*, *Desmanthus virgatus*, *Jatropha gossypifolia*, *Leucaena leucocephala*, *Malachra urens*, *Malvastrum coromandelianum*, *Melochia nodiflora*, *Melochia pyramidata*, *Pithecellobium unguis-cati*, *Senna obtusifolia*, *Triphasia trifolia*, *Triumfetta lappula*, and *Wissadula periplocifolia*

Seedlings and saplings: *Andira inermis*, *Capparis indica*, *Casearia aculeata*, *Cynophalla flexuosa*, *Erythroxylum brevipes*, *Eugenia biflora*, *Guapira fragrans*, *Guazuma ulmifolia*, *Leucaena leucocephala*, and *Samanea saman*

Lianas and vines: *Abrus precatorius*, *Antigonon*

leptopus, *Centrosema pubescens*, *Cissampelos pareira*, *Cissus trifoliata*, *Cissus verticillata*, *Commelina diffusa* var. *diffusa*, *Commelina erecta*, *Cynophalla flexuosa*, *Galactia dubia*, *Gouania lupuloides*, *Ipomoea tiliacea*, *Jasminum fluminense*, *Macfadyena unguis-cati*, *Merremia quinquefolia*, *Merremia umbellata*, *Momordica charantia*, *Paullinia pinnata*, *Rhynchosia reticulata*, *Serjania lucida*, *Serjania polyphylla*, *Stigmaphyllon emarginatum*, *Teramnus labialis*, *Tragia volubilis*, *Trichostigma octandrum*, and *Vigna vexillata*

Herbs: *Achyranthes aspera* var. *aspera*, *Commelina diffusa* var. *diffusa*, *Commelina erecta*, *Eleutheranthera ruderalis*, *Euphorbia hypericifolia*, *Melochia pyramidata*, *Oeceoclades maculata*, and *Petiveria alliacea*

Graminoids: *Digitaria eriantha*, *Paspalum fasciculatum*, and *Urochloa maxima*



Figure 20—General view of a pioneer vegetation inventory site (Bo. Sabana Yeguas, municipality of Lajas), dominated by subshrubs and herbaceous vegetation. Forest Service photo by Johann D. Crespo-Zapata.

Associated Species

Three inventory sites yielded a total of 57 species inventoried. Another 35 species were observed near the inventory sites: *Acalypha alopecuroides*, *Acalypha chamaedryfolia*, *Adelia ricinella*, *Argythamnia candidans*, *Bidens cynapiifolia*, *Bouchea prismatica*, *Cardiospermum microcarpum*, *Chloris barbata*, *Chloris radiata*, *Cleome viscosa*, *Cordia dichotoma*, *Dactyloctenium aegyptium*, *Delonix regia*, *Desmodium incanum*, *Echinochloa colona*, *Eleusine indica*, *Euphorbia ophthalmica*, *Jacquemontia cumanensis*, *Parthenium hysterophorus*, *Pectis prostrata*, *Phyllanthus amarus*, *Physalis angulata*, *Prosopis juliflora*, *Rivina humilis*, *Samyda dodecandra*, *Sansevieria hyacinthoides*, *Schaefferia frutescens*, *Senna uniflora*, *Sida abutilifolia*, *Solanum torvum*, *Spermacoce confusa*, *Swietenia mahagoni*, *Tillandsia recurvata*, *Trichilia hirta*, and *Zanthoxylum martinicense*.

Site Features

The inventory sites are located at low elevations along the island's southwestern and eastern regions, and the locations vary from a protected nature reserve to relatively anthropized vegetated areas. At the time the vegetation inventories were conducted, inventory sites were in a succession phase, mostly dominated by vines and subshrubs.

Notable Species

Rare and notable species inventoried or observed near the inventory sites are mainly *Acalypha alopecuroides* and *Casearia aculeata* (Gann and Trejo-Torres 2015–2023). On the other hand, *Serjania lucida*, a species of vine or liana inventoried in Fajardo, has a distribution restricted to the northeastern/eastern coast and adjacent islands (Acevedo-Rodríguez 2005, Axelrod 2011, Gann and Trejo-Torres 2015–2023).



Branches and leaves of *Leucaena leucocephala*, an exotic tree species regularly encountered at the Lajas, Cabo Rojo, and Fajardo pioneer sites. Forest Service photo by Johann D. Crespo-Zapata.

Results and Discussion

PIONEER INVENTORY SITES 7–14

Municipalities of Luquillo (Bo. Juan Martín and Bo. Pitahaya), Fajardo (Bo. Quebrada Fajardo), Canóvanas (Bo. San Isidro), and Loíza (Bo. Torrecilla Alta)

INVENTORY SPECIES:

Shrubs and small trees (≥ 4 cm DBH and ≥ 4.3 m height):
Annona glabra

Shrubs and subshrubs (< 4 cm DBH and < 2 m height):
Aeschynomene sensitiva, *Annona glabra*, *Casearia guianensis*, *Casearia sylvestris*, *Cestrum diurnum*, *Chromolaena odorata*, *Cryptostegia madagascariensis*, *Desmanthus virgatus*, *Jatropha gossypifolia*, *Ludwigia leptocarpa*, *Melochia nodiflora*, *Mimosa pigra*, *Physalis* sp., *Randia aculeata*, *Senna obtusifolia*, *Senna occidentalis*, *Sida rhombifolia*, *Solanum torvum*, *Triumfetta semitriloba*, *Triumfetta* sp., *Vachellia farnesiana* var. *farnesiana*, *Vachellia tortuosa*, and *Zanthoxylum monophyllum*

Saplings: *Andira inermis*, *Annona glabra*, *Casearia guianensis*, *Casearia sylvestris*, *Cestrum diurnum*, *Eugenia biflora*, *Mimosa pigra*, *Peltophorum pterocarpum*, *Senna bicapsularis*, *Solanum torvum*, *Vachellia tortuosa*, and *Zanthoxylum martinicense*

Vines: *Aniseia martinicensis*, *Centrosema virginianum*, *Chromolaena odorata*, *Cissampelos pareira*, *Cissus verticillata*, *Clitoria falcata*, *Commelina diffusa* var. *diffusa*, *Cryptostegia madagascariensis*, *Desmodium incanum*, *Desmodium scorpiurus*, *Ipomoea setifera*, *Ipomoea tiliacea*, *Melothria pendula*, *Merremia umbellata*, *Mikania cordifolia*, *Mikania micrantha*, *Mimosa casta*, *Mimosa pudica* var. *unijuga*, *Momordica charantia*, *Neptunia plena*, *Passiflora foetida*, *Passiflora suberosa*, *Rhynchosia reticulata*, *Sphagneticola trilobata*, *Syngonium podophyllum*, *Thunbergia fragrans*, *Tournefortia hirsutissima*,

Trichostigma octandrum, *Vigna adenantha*, *Vigna hosei*, *Vigna luteola*, and *Vigna vexillata*

Ferns: *Acrostichum danaeifolium* and *Ceratopteris thalictroides*

Herbs: *Achyranthes aspera* var. *aspera*, *Alternanthera philoxeroides*, *Amaranthus spinosus*, *Calyptocarpus vialis*, *Centella erecta*, *Colocasia esculenta*, *Commelina diffusa* var. *diffusa*, *Cuphea strigulosa*, *Cyanthillium cinereum*, *Cyperus giganteus*, *Desmodium scorpiurus*, *Eclipta prostrata*, *Eleocharis flavescens*, *Eleocharis interstincta*, *Eleocharis mutata*, *Enydra sessilis*, *Melochia pyramidata*, *Mimosa pudica* var. *unijuga*, *Neptunia plena*, *Nymphoides humboldtiana*, *Oldenlandia corymbosa*, *Oldenlandia lancifolia*, *Oxalis barrelieri*, *Phyllanthus amarus*, *Phyllanthus urinaria*, *Ruellia blechum*, *Scleria microcarpa*, *Scleria pterota*, *Sphagneticola trilobata*, *Synedrella nodiflora*, and *Typha domingensis*

Graminoids: *Cyperus compressus*, *Cyperus giganteus*, *Cyperus haspan*, *Cyperus odoratus*, *Cyperus polystachyos*, *Cyperus sphacelatus*, *Digitaria horizontalis*, *Eleocharis flavescens*, *Eleocharis interstincta*, *Eleocharis mutata*, *Fuirena umbellata*, *Hymenachne amplexicaulis*, *Kyllinga nemoralis*, *Leersia hexandra*, *Panicum laxum*, *Paspalum conjugatum*, *Paspalum pleostachyum*, *Rhynchospora corymbosa*, *Rhynchospora holoschoenoides*, *Scleria microcarpa*, *Scleria pterota*, *Typha domingensis*, and *Urochloa mutica*



Figure 21—General views of two pioneer vegetation inventory sites (Bo. Quebrada Fajardo [A] and Bo. Pitahaya [B], municipalities of Fajardo and Luquillo, respectively). Forest Service photos by Johann D. Crespo-Zapata.

Associated Species

Eight inventory sites yielded a total of 102 species inventoried. Another 19 species were observed near the inventory sites: *Bourreria succulenta*, *Citharexylum spinosum*, *Coccoloba venosa*, *Cyperus iria*, *Cyperus ligularis*, *Gliricidia sepium*, *Lagerstroemia speciosa*, *Lantana horrida*, *Paspalum fasciculatum*, *Paspalum virgatum*, *Paullinia pinnata*, *Phyla nodiflora*, *Rhynchospora ciliata*, *Scleria eggersiana*, *Serjania lucida*, *Sida glomerata*, *Spathodea campanulata*, *Terminalia catappa*, and *Ziziphus mauritiana*.

Site Features

The eight inventory sites are located at low elevations along the island's northeastern and eastern regions, and locations vary from a protected nature reserve to other vegetated areas that are prone to flooding. At the time the vegetation inventories were conducted, inventory sites were in a succession phase mostly dominated by herbaceous vegetation.

Inventoried or associated species that are generally known for having ethnobotanical uses (e.g., food, traditional medicine, and arts and crafts) include *Annona glabra*, *Colocasia esculenta*, *Cyperus giganteus*, *Passiflora foetida*, *Terminalia catappa*, *Trichostigma octandrum*, and *Typha domingensis*.

Notable Species

Rare and/or regional species inventoried or observed near the inventory sites are *Aniseia martinicensis*, *Ceratopteris thalictroides*, *Enydra sessilis*, *Lantana horrida*, *Scleria eggersiana*, and *Serjania lucida* (Gann and Trejo-Torres 2015–2023). *Aniseia martinicensis* and *Ceratopteris thalictroides*, have been listed as Critical Elements by the Natural Heritage Program of the PRDNER (2007).



Pinnae of *Ceratopteris thalictroides*, a native and aquatic fern recorded at a wetland pioneer site (municipality of Canóvanas). Forest Service photo by Johann D. Crespo-Zapata.

Results and Discussion

PIONEER INVENTORY SITE 15

Municipality of Caguas (Bo. Río Turabo)

INVENTORY SPECIES:

Shrubs and small trees (≥ 4 cm DBH and ≥ 2.7 m height):

Albizia procera and *Spathodea campanulata*

Subshrubs: *Chromolaena odorata* and *Triumfetta semitriloba*

Saplings: *Albizia procera* and *Casearia decandra*

Vines: *Chromolaena odorata*, *Cissus verticillata*,

Commelina diffusa var. *diffusa*, *Ipomoea setifera*, *Jasminum fluminense*, *Melothria pendula*, *Mikania micrantha*, *Mimosa casta*, *Vigna adenantha*, and *Vigna hosei*

Ferns: *Nephrolepis multiflora*

Herbs: *Commelina diffusa* var. *diffusa*

Associated Species

One inventory site yielded a total of 15 species inventoried. Another six species were observed near the inventory site: *Casearia guianensis*, *Desmodium incanum*, *Melinis repens*, *Pennisetum purpureum*, *Schefflera morototoni*, and *Zanthoxylum martinicense*.

Site Features

This inventory site is located in the Caguas Valley, at the eastern range of the central mountainous region, and at the time the vegetation inventory was conducted, the site was dominated by *Nephrolepis multiflora* ferns.



Flowers of *Chromolaena odorata*, a native small shrub recorded at the Caguas pioneer site. Forest Service photo by Johann D. Crespo-Zapata.

ABANDONED TILLAGE CROP

The 10 inventory sites are located in the municipalities of Santa Isabel (Bo. Boca Velázquez and Bo. Descalabrado), Loíza (Bo. Canóvanas), and Manatí (Bo. Tierras Nuevas Poniente), within the subtropical dry forest and subtropical moist forest ecological life zones (Ewel and Whitmore 1973; figs. 22, 23, and 24), and range from approximately sea level to 25 m above sea level. Some inventory species may be repeated among different categories if they have been observed in more than one biological stage (i.e., seedling, sapling, and/or shrub) or displaying multiple growth habits (e.g., *Commelina diffusa*

var. *diffusa*, a species generally seen as a decumbent or erect herb, was observed exhibiting climbing habits, and thus was also classified as a vine). Since the inventory sites assessed in this land use occur in different ecological life zones, across considerably distant areas, and/or have distinctive vegetation assemblages, the results below are grouped locality: four inventory sites from the municipality of Santa Isabel, and six from the municipalities of Loíza and Manatí. Refer to appendix A for summarized descriptions, vegetation, and additional information on each inventory site.

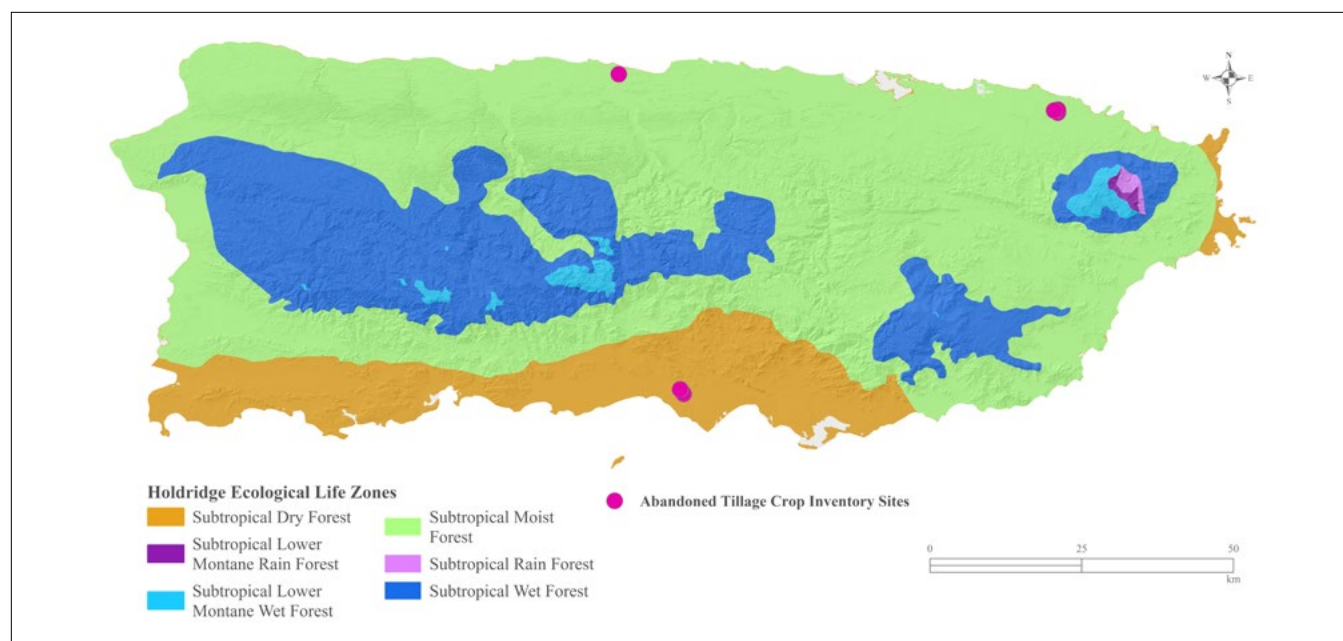


Figure 22—Abandoned tillage crop inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973).

Results and Discussion

ABANDONED TILLAGE CROP INVENTORY SITES 1-4

Municipality of Santa Isabel (Bo. Boca Velázquez and Bo. Descalabrado)

INVENTORY SPECIES:

Subshrubs: *Amaranthus dubius*, *Cleome viscosa*, *Datura inoxia*, *Desmanthus virgatus*, and *Parthenium hysterophorus*

Vines: *Cucumis melo* and *Cucurbita moschata*

Herbs: *Amaranthus dubius*, *Amaranthus spinosus*, *Boerhavia erecta*, *Cleome viscosa*, *Euphorbia heterophylla*,

Helianthus annuus, *Malvastrum coromandelianum*, *Melochia pyramidata*, *Parthenium hysterophorus*, *Portulaca oleracea*, and *Trianthema portulacastrum*

Graminoids: *Chloris barbata*, *Cyperus rotundus*, *Echinochloa colona*, *Eleusine indica*, *Leptochloa panicea* ssp. *brachiata*, and *Sorghum halepense*

Associated Species

Four inventory sites yielded a total of 21 species inventoried. Another nine species were observed near the inventory sites: *Carica papaya*, *Cucumis anguria*, *Cynodon dactylon*, *Dactyloctenium aegyptium*, *Eclipta prostrata*, *Macroptilium atropurpureum*, *Malvastrum corchorifolium*, *Rhynchosia minima*, and *Sorghum bicolor*.

Site Features

The inventory sites are mostly dominated by herbaceous vegetation, both wild and cultivated. At the time the vegetation inventories were conducted, inventory sites varied from a field crop that was inactive and devoid of cultivation for a few months to neglected pumpkin/squash (*Cucurbita moschata*) crops with overgrown weeds, grasses, and other vegetation. Inventoried or associated species that were present as cultivated only or persisting from past crops are *Carica papaya*, *Cucurbita moschata*, *Helianthus annuus*, and *Sorghum bicolor*.



Figure 23—General views of two abandoned tillage crop inventory sites (Bo. Boca Velázquez [A] and Bo. Descalabrado [B], municipality of Santa Isabel). Forest Service photos by Johann D. Crespo-Zapata.

ABANDONED TILLAGE CROP INVENTORY SITES 5–10

Municipalities of Loíza (Bo. Canóvanas) and Manatí (Bo. Tierras Nuevas Poniente)

INVENTORY SPECIES:**Shrubs and subshrubs** (<4 cm DBH and <2 m height):

Caperonia palustris, *Capsicum chinense*, *Capsicum frutescens*, *Cestrum diurnum*, *Chromolaena odorata*, *Corchorus siliquosus*, *Heliotropium indicum*, *Hyptis verticillata*, *Ludwigia erecta*, *Ludwigia octovalvis*, *Manihot esculenta*, *Mimosa pigra*, *Physalis angulata*, *Pithecellobium dulce*, *Pluchea carolinensis*, *Pluchea odorata*, *Senna occidentalis*, *Sida acuta*, *Sida rhombifolia*, *Solanum americanum*, *Solanum melongena*, *Solanum torvum*, and *Urena sinuata*

Seedlings and saplings: *Cecropia schreberiana* ssp.

schreberiana, *Mimosa pigra*, *Muntingia calabura*, *Pithecellobium dulce*, *Pluchea carolinensis*, *Pluchea odorata*, *Solanum torvum*, *Spathodea campanulata*, and *Zanthoxylum martinicense*

Lianas and vines: *Aniseia martinicensis*, *Centrosema pubescens*, *Cissus verticillata*, *Commelina diffusa* var. *diffusa*, *Cucurbita moschata*, *Ipomoea setifera*, *Ipomoea tiliacea*, *Melothria pendula*, *Merremia umbellata*, *Mikania cordifolia*, *Mikania micrantha*, *Mimosa casta*, *Mimosa pudica* var. *unijuga*, *Momordica charantia*, *Passiflora suberosa*, *Trichostigma octandrum*, *Vigna adenantha*, *Vigna hosei*, *Vigna luteola*, and *Vigna vexillata*

Ferns: *Nephrolepis multiflora* and *Pityrogramma calomelanos*

Herbs: *Achyranthes aspera* var. *aspera*, *Alysicarpus vaginalis*, *Amaranthus dubius*, *Amaranthus spinosus*, *Boerhavia coccinea*, *Caperonia palustris*, *Chromolaena odorata*, *Commelina diffusa* var. *diffusa*, *Cuphea strigulosa*, *Cyanthillium cinereum*, *Eclipta prostrata*, *Eleutheranthera ruderalis*, *Emilia fosbergii*, *Emilia sonchifolia*, *Enydra sessilis*, *Euphorbia heterophylla*, *Euphorbia hirta*, *Euphorbia hypericifolia*, *Euphorbia serpens*, *Euphorbia thymifolia*, *Heliotropium indicum*, *Hemiscola aculeata*, *Hibiscus bifurcatus*, *Hyptis verticillata*, *Ludwigia erecta*, *Ludwigia octovalvis*, *Malvastrum coromandelianum*, *Mecardonia procumbens*, *Mimosa pudica* var. *unijuga*, *Murdannia nudiflora*, *Musa* × *paradisiaca*, *Oldenlandia corymbosa*, *Oldenlandia lancifolia*, *Phyllanthus nodiflora*, *Phyllanthus amarus*, *Phyllanthus debilis*, *Phyllanthus urinaria*, *Physalis angulata*, *Pilea microphylla*, *Pluchea odorata*, *Portulaca oleracea*, *Scoparia dulcis*, *Sida acuta*, *Solanum americanum*, *Spermacoce prostrata*, *Spermacoce remota*, *Spermacoce verticillata*, *Synedrella nodiflora*, *Torenia crustacea*, and *Urena sinuata*

Graminoids: *Chloris radiata*, *Cynodon dactylon*, *Cyperus digitatus*, *Cyperus iria*, *Cyperus ligularis*, *Cyperus odoratus*, *Cyperus polystachyos*, *Cyperus sphacelatus*, *Digitaria ciliaris*, *Digitaria horizontalis*, *Echinochloa colona*, *Eleusine indica*, *Fimbristylis dichotoma*, *Kyllinga brevifolia*, *Leptochloa scabra*, *Paspalum fasciculatum*, *Paspalum virgatum*, *Urochloa distachya*, and *Urochloa maxima*



Figure 24—General views of two abandoned tillage crop inventory sites (Bo. Canóvanas, municipality of Loíza): an abandoned pumpkin/squash crop (A), and a neglected or unmanaged plantain crop (B). Forest Service photos by Johann D. Crespo-Zapata.

Results and Discussion

Associated Species

Six inventory sites yielded a total of 105 species inventoried. Another 24 species were observed near the inventory sites: *Abelmoschus esculentus*, *Ananas comosus*, *Cajanus cajan*, *Carica papaya*, *Ceratopteris thalictroides*, *Cocos nucifera*, *Cordia collococca*, *Cordia polycephala*, *Cyperus ochraceus*, *Erythrina fusca*, *Indigofera tinctoria*, *Jatropha gossypifolia*, *Laportea aestuans*, *Malachra capitata*, *Paspalum paniculatum*, *Saccharum officinarum*, *Saccharum spontaneum*, *Scleria eggersiana*, *Sesbania sericea*, *Sorghum halepense*, *Spigelia anthelmia*, *Typha domingensis*, *Urena lobata*, and *Xanthosoma sagittifolium*.

Site Features

The six inventory sites are primarily dominated by herbaceous vegetation, followed by graminoids and small shrubs. At the time the vegetation inventories were conducted, inventory sites consisted mostly of neglected or unmanaged plantain (*Musa × paradisiaca*) crops with overgrown weeds, grasses, and shrubs, some of which also included pumpkin/squash (*Cucurbita moschata*), chili peppers (*Capsicum chinense*), cassava (*Manihot esculenta*), and eggplant (*Solanum melongena*) as secondary or persisting crops. In addition to those species, associated species that were present as cultivated only or persisting from past crops include *Abelmoschus esculentus*, *Ananas comosus*, *Cajanus cajan*, *Carica papaya*, *Cocos nucifera*, and *Saccharum officinarum*.

Inventoried or associated species that are known to have ethnobotanical uses (i.e., food and traditional medicine) include *Capsicum frutescens*, *Jatropha gossypifolia*, and *Portulaca oleracea*.

Notable Species

Rare and/or regional species inventoried or associated with inventory sites are *Aniseia martinicensis*, *Ceratopteris thalictroides*, *Cyperus digitatus*, *Enydra sessilis*, *Hyptis verticillata*, and *Scleria eggersiana* (Gann and Trejo-Torres 2015–2023). *A. martinicensis*, *C. thalictroides*, *C. digitatus*, and *H. verticillata* have been listed as Critical Elements by the Natural Heritage Program of the PRDNER (2007). *Capsicum chinense* became a new species record, as it had not been formally reported for Puerto Rico (see Crespo-Zapata et al. 2023).



Branches and fruits of *Capsicum frutescens*, a species of chili pepper recorded at an abandoned tillage crop site (municipality of Manatí). Forest Service photo by Johann D. Crespo-Zapata.

MANAGED GRASSLAND

The 13 managed grassland inventory sites are located in the municipalities of Jayuya (Bo. Saliente and Bo. Collores), Lajas (Bo. Sabana Yeguas and Bo. Palmarejo), Loíza (Bo. Canóvanas), Manatí (Bo. Tierras Nuevas Poniente), and Canóvanas (Bo. San Isidro), within the subtropical wet forest, subtropical dry forest, and subtropical moist forest ecological life zones (Ewel and Whitmore 1973; figs. 25, 26, and 27), and range from approximately sea level to 685 m above sea level. Some inventory species may be repeated among different categories if they have been observed in more than one biological stage (i.e., sapling and/or shrub) or displaying

multiple growth habits (e.g., *Macroptilium lathyroides*, a species that may be considered as an erect herb, was observed exhibiting climbing habits, and thus was also classified as a vine). Since inventory sites assessed in this land use occur in different ecological life zones, across considerably distant areas, and/or have distinctive vegetation assemblages, the results are grouped by locality: four inventory sites from the municipality of Jayuya; three from the municipality of Lajas; and six from the municipalities of Loíza, Manatí, and Canóvanas. Refer to appendix A for summarized descriptions, vegetation, and additional information on each inventory site.

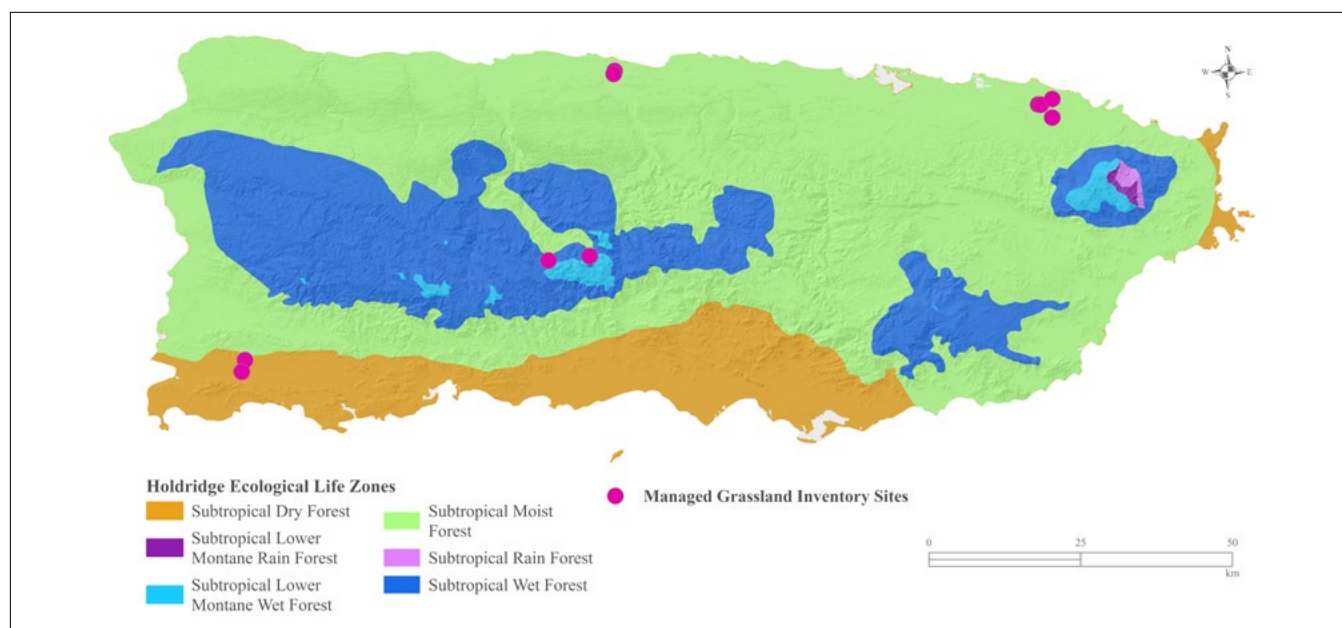


Figure 25—Managed grassland inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973).

Results and Discussion

MANAGED GRASSLAND INVENTORY SITES 1–4

Municipality of Jayuya (Bo. Saliente and Bo. Collores)

INVENTORY SPECIES:

Shrubs and subshrubs (<4 cm DBH and <2 m height): *Clidemia hirta*, *Crotalaria brevidens*, *Crotalaria pallida*, *Gomphocarpus physocarpus*, *Miconia racemosa*, *Sida urens*, *Sida rhombifolia*, *Tibouchina longifolia*, and *Urena lobata*

Vines: *Centrosema virginianum*, *Ipomoea tiliacea*, *Iresine diffusa*, *Mikania micrantha*, *Mimosa pudica* var. *unijuga*, *Pteridium caudatum*, *Rhynchosia reticulata*, *Teramnus uncinatus*, and *Vigna hosei*

Ferns: *Nephrolepis multiflora*, *Pteridium caudatum*, and *Thelypteris kunthii*

Herbs: *Chamaecrista nictitans* var. *glabrata*, *Commelina diffusa* var. *diffusa*, *Conyza canadensis*, *Crotalaria*

brevidens, *Crotalaria pallida*, *Desmodium adscendens*, *Drymaria cordata*, *Elephantopus mollis*, *Iresine diffusa*, *Lycopodiella cernua* var. *cernua*, *Macroptilium lathyroides*, *Mimosa pudica* var. *unijuga*, *Oldenlandia lancifolia*, *Oxalis corniculata*, *Phyllanthus urinaria*, *Pterolepis glomerata*, *Spathoglottis plicata*, *Spermacoce verticillata*, *Xanthosoma sagittifolium*, and *Youngia japonica*

Graminoids: *Andropogon bicornis*, *Axonopus compressus*, *Cynodon nlemfuensis*, *Cyperus mutisii*, *Cyperus sphacelatus*, *Fimbristylis dichotoma*, *Kyllinga brevifolia*, *Melinis minutiflora*, *Panicum laxum*, *Paspalum conjugatum*, *Pennisetum purpureum*, *Rhynchospora ciliata*, *Setaria parviflora*, *Setaria* sp., *Sporobolus jacquemontii*, *Urochloa maxima*, and *Urochloa mutica*

Associated Species

Four inventory sites yielded a total of 53 species inventoried. Another 24 species were observed near the inventory sites: *Andira inermis*, *Casuarina equisetifolia*, *Cecropia schreberiana* ssp. *schreberiana*, *Cordia polycephala*, *Cordia sulcata*, *Dieffenbachia seguine*, *Guarea guidonia*, *Indigofera suffruticosa*, *Mangifera indica*, *Miconia impetolaris*, *Miconia laevigata*, *Miconia serrulata*, *Mikania cordifolia*, *Musa acuminata*, *Piper aduncum*, *Pleopeltis polypodioides*, *Pseudelephantopus spicatus*, *Psidium guajava*, *Roystonea borinquena*, *Spathodea campanulata*, *Spondias purpurea*, *Stachytarpheta cayennensis*, *Syngonium podophyllum*, and *Vigna luteola*.

Site Features

The inventory sites are located in farms or other private properties. The historical land uses of the sites included mostly grazing and coffee plantations. At the time the vegetation inventories were conducted, inventory sites were located within areas that had been identified as having consistently received some form of management or disturbance, such as grazing and recurring fires.

Associated species that are generally known for being cultivated for production and/or consumption include *Mangifera indica*, *Musa acuminata*, *Psidium guajava*, and *Spondias purpurea*. *Urochloa maxima* is a grass species commonly seeded for pasture and hay.

Notable Species

The most uncommon species encountered within managed grassland inventory sites are *Cyperus mutisii* and *Pterolepis glomerata* (Gann and Trejo-Torres 2015–2023). Also observed was *Pteridium caudatum*, a fern known to colonize and thrive on previously burned fields and other land uses in the neotropics (Ramírez-Trejo et al. 2010), which is consistent with our observations at those sites.



Figure 26—Landscape view of the mountain where two managed grassland sites are located (Bo. Saliente, municipality of Jayuya). According to the landowner, this mountain has been managed and disturbed over the years with recurring fires. Forest Service photo by Johann D. Crespo-Zapata.



Pinnae of *Pteridium caudatum*, a native fern that frequently colonizes burnt areas, recorded at a managed grassland site in the municipality of Jayuya. Forest Service photo by Johann D. Crespo-Zapata.

Results and Discussion

MANAGED GRASSLAND INVENTORY SITES 5–7
Municipality of Lajas (Bo. Sabana Yeguas and Bo. Palmarejo)

INVENTORY SPECIES:

Shrubs and subshrubs (<4 cm DBH and <1 m height): *Aeschynomene rudis*, *Chromolaena odorata*, *Desmanthus virgatus*, *Malachra alceifolia*, *Melochia pyramidata*, *Sida abutilifolia*, and *Wissadula periplocifolia*

Saplings: *Samanea saman*

Vines: *Rhynchosia minima*

Herbs: *Alysicarpus vaginalis*, *Cyanthillium cinereum*, *Desmanthus virgatus*, *Melochia pyramidata*, *Mimosa pudica* var. *unijuga*, *Phyla fruticosa*, *Ruellia blechum*, *Ruellia tuberosa*, and *Sida abutilifolia*

Graminoids: *Bothriochloa pertusa*, *Cynodon dactylon*, *Cynodon nlemfuensis*, *Paspalum millegrana*, *Pennisetum purpureum*, *Sporobolus jacquemontii*, *Urochloa dictyoneura*, and *Urochloa maxima*

Associated Species
Three inventory sites yielded a total of 23 species inventoried. Another 21 species were observed near the inventory sites: <i>Achyranthes aspera</i> var. <i>aspera</i> , <i>Albizia procera</i> , <i>Azadirachta indica</i> , <i>Caperonia palustris</i> , <i>Chloris barbata</i> , <i>Commelina diffusa</i> var. <i>diffusa</i> , <i>Cyperus iria</i> , <i>Cyperus odoratus</i> , <i>Cyperus</i> sp., <i>Dichanthium annulatum</i> , <i>Digitaria eriantha</i> , <i>Indigofera spicata</i> , <i>Macroptilium atropurpureum</i> , <i>Melochia nodiflora</i> , <i>Merremia umbellata</i> , <i>Parthenium hysterophorus</i> , <i>Pithecellobium dulce</i> , <i>Randia aculeata</i> , <i>Roystonea borinquena</i> , <i>Sorghum halepense</i> , and <i>Vachellia farnesiana</i> var. <i>farnesiana</i> .
Site Features
The inventory sites are located in a farm that carries out multiple activities related to agriculture and livestock. At the time the vegetation inventories were conducted, inventory sites varied from a hayfield to other grass plots used exclusively for grazing.
Notable Species
The most uncommon species inventoried is <i>Aeschynomene rudis</i> (Gann and Trejo-Torres 2015–2023). In addition, <i>Urochloa dictyoneura</i> , a dominant grass in an inventory site, became a new location record for the species in Puerto Rico (see Maldonado-Silvestrini et al. 2023).



Figure 27—A hay production field, one of three managed grassland inventory sites located in the municipality of Lajas (Bo. Sabana Yeguas). Forest Service photo by Johann D. Crespo-Zapata.

MANAGED GRASSLAND INVENTORY SITES 8–13

Municipalities of Loíza (Bo. Canóvanas), Manatí (Bo. Tierras Nuevas Poniente), and Canóvanas (Bo. San Isidro)

INVENTORY SPECIES:**Shrubs and subshrubs** (<4 cm DBH and <2 m height):

Aeschynomene sensitiva, *Caperonia palustris*, *Cleome viscosa*, *Jatropha gossypifolia*, *Malachra alceifolia*, *Mimosa pigra*, *Physalis angulata*, and *Sesbania sericea*

Saplings: *Mimosa pigra*

Vines: *Cissus verticillata*, *Desmodium incanum*, *Ipomoea tiliacea*, *Macroptilium lathyroides*, *Merremia umbellata*, *Mikania cordifolia*, *Mimosa casta*, *Mimosa pudica* var. *unijuga*, *Rhynchosia minima*, *Vigna luteola*, and *Vigna vexillata*

Herbs: *Alysicarpus vaginalis*, *Amaranthus dubius*, *Caperonia palustris*, *Cleome viscosa*, *Commelina diffusa* var. *diffusa*, *Cyanthillium cinereum*, *Desmodium incanum*, *Dieffenbachia seguine*, *Eclipta prostrata*, *Eleocharis retroflexa*, *Eleutheranthera ruderalis*, *Euphorbia heterophylla*, *Euphorbia hirta*, *Euphorbia hypericifolia*, *Euphorbia hyssopifolia*, *Euphorbia serpens*, *Hemiscola*

aculeata, *Hyptis atrorubens*, *Ludwigia erecta*, *Ludwigia octovalvis*, *Macroptilium lathyroides*, *Mecardonia procumbens*, *Mimosa pudica* var. *unijuga*, *Musa × paradisiaca*, *Oldenlandia lancifolia*, *Phyllanthus amarus*, *Phyllanthus debilis*, *Physalis angulata*, *Rorippa palustris*, *Spermacoce remota*, *Spigelia anthelmia*, and *Synedrella nodiflora*

Graminoids: *Axonopus compressus*, *Chloris radiata*, *Cynodon dactylon*, *Cyperus esculentus*, *Cyperus iria*, *Cyperus odoratus*, *Cyperus polystachyos*, *Cyperus rotundus*, *Cyperus spachelatus*, *Dactyloctenium aegyptium*, *Dichanthium annulatum*, *Digitaria bicornis*, *Digitaria ciliaris*, *Digitaria eriantha*, *Digitaria violascens*, *Echinochloa colona*, *Eleocharis retroflexa*, *Eleusine indica*, *Eriochloa punctata*, *Fimbristylis dichotoma*, *Kyllinga nemoralis*, *Leersia hexandra*, *Leptochloa scabra*, *Panicum laxum*, *Paspalum fasciculatum*, *Saccharum officinarum*, *Setaria parviflora*, *Sorghum halepense*, *Urochloa maxima*, *Urochloa mutica*, and *Zoysia matrella*

Associated Species

Six inventory sites yielded a total of 75 species inventoried. Another 47 species were observed near the inventory sites: *Abildgaardia ovata*, *Acrostichum danaeifolium*, *Albizia procera*, *Alternanthera philoxeroides*, *Amaranthus spinosus*, *Ceiba pentandra*, *Centella erecta*, *Cestrum diurnum*, *Chloris barbata*, *Clidemia hirta*, *Cocos nucifera*, *Cucurbita moschata*, *Cuphea strigulosa*, *Cyperus giganteus*, *Desmanthus virgatus*, *Euphorbia lasiocarpa*, *Euphorbia thymifolia*, *Fuirena umbellata*, *Heteranthera reniformis*, *Hyptis verticillata*, *Indigofera tinctoria*, *Ipomoea setifera*, *Kyllinga brevifolia*, *Lemna valdiviana*, *Lindernia diffusa*, *Melanthera nivea*, *Melothria pendula*, *Miconia racemosa*, *Momordica charantia*, *Nelsonia canescens*, *Oxycaryum cubense*, *Passiflora multiflora*, *Peltophorum pterocarpum*, *Pistia stratiotes*, *Portulaca oleracea*, *Rhynchospora corymbosa*, *Ricinus communis*, *Rottboellia cochinchinensis*, *Saccharum spontaneum*, *Sagittaria intermedia*, *Salix humboldtiana*, *Salvinia minima*, *Spathodea campanulata*, *Spondias mombin*, *Tarenaya spinosa*, *Torenia crustacea*, and *Urena lobata*.

Site Features

At the time the vegetation inventories were conducted, the varied inventory sites included grass fields used for grazing and the production of ornamental lawn, an active sugarcane plantation, and hayfields for fodder.

Inventoried grasses that are generally known for being cultivated for production or having other uses include *Cynodon dactylon*, *Digitaria eriantha*, *Saccharum officinarum*, *Sorghum halepense*, *Urochloa maxima*, and *Zoysia matrella*. For instance, *D. eriantha* and *U. maxima* are commonly seeded for pasture or hay, whereas *S. officinarum* is usually cultivated for the production of sugar, and *Z. matrella* is cultivated for ornamental purposes.

Notable Species

Rare and/or regional species observed near the inventory sites are primarily *Hyptis verticillata*, *Lemna valdiviana*, and *Sagittaria intermedia* (Gann and Trejo-Torres 2015–2023). *H. verticillata* and *S. intermedia* have been listed as Critical Elements by the Natural Heritage Program of the PRDNER (2007).

Results and Discussion

ABANDONED GRASSLAND

The 17 abandoned grassland inventory sites are located in the municipalities of Utuado (Bo. Las Palmas and Bo. Caonillas Arriba), Lajas (Bo. Sabana Yeguas), Cabo Rojo (Bo. Boquerón), Fajardo (Bo. Quebrada Fajardo), Luquillo (Bo. Pitahaya), Canóvanas (Bo. Canóvanas), Loíza (Bo. Canóvanas and Bo. Torrecilla Alta), and Manatí (Bo. Tierras Nuevas Poniente), within the subtropical moist forest and subtropical dry forest ecological life zones (Ewel and Whitmore 1973; figs. 28, 29, and 30), and range from approximately sea level to 346 m above sea level. Some inventory species may be repeated among different categories if they have been observed in more than one biological stage (i.e., seedling, sapling, and/

or shrub) or displaying multiple growth habits (e.g., *Chromolaena odorata*, a species generally considered a shrub or subshrub, was observed exhibiting climbing habits, and thus was also classified as a vine). Since inventory sites assessed in this land use occur in different ecological life zones, across considerably distant areas, and/or have distinctive vegetation assemblages, the results are grouped by locality: four inventory sites from the municipality of Utuado; five from the municipalities of Lajas and Cabo Rojo; and eight from the municipalities of Fajardo, Luquillo, Canóvanas, Loíza, and Manatí. Refer to appendix A for summarized descriptions, vegetation, and additional information on each inventory site.

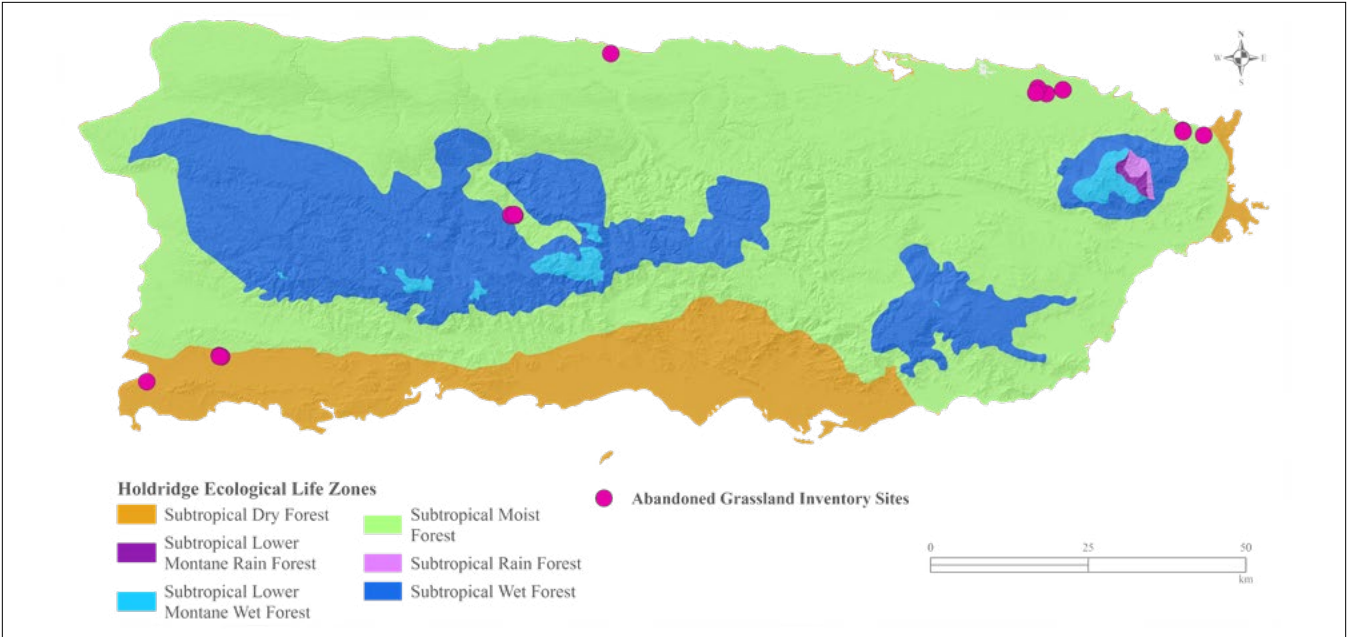


Figure 28—Abandoned grassland inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973).

ABANDONED GRASSLAND INVENTORY SITES 1–4*Municipality of Utuado (Bo. Las Palmas and Bo. Caonillas Arriba)***INVENTORY SPECIES:****Shrubs and subshrubs** (<4 cm DBH and <2 m height):

Casearia sylvestris, *Chromolaena odorata*, *Clidemia cymosa*, *Clidemia hirta*, *Cordia polycephala*, *Cupania americana*, *Gliricidia sepium*, *Guarea guidonia*, *Miconia racemosa*, *Piper aduncum*, *Psidium guajava*, *Schefflera morototoni*, *Stachytarpheta cayennensis*, *Tibouchina longifolia*, and *Urena lobata*

Saplings: *Guarea guidonia* and *Spathodea campanulata*

Lianas and vines: *Asystasia gangetica*, *Centrosema virginianum*, *Chromolaena odorata*, *Cissampelos pareira*, *Cissus verticillata*, *Commelina diffusa* var. *diffusa*, *Cordia polycephala*, *Desmodium incanum*, *Dissotis rotundifolia*, *Gouania polygama*, *Ipomoea setifera*, *Ipomoea tiliacea*, *Iresine diffusa*, *Melanthera nivea*, *Melothria pendula*, *Merremia umbellata*, *Mikania cordifolia*, *Mikania micrantha*, *Mimosa pudica* var. *unijuga*, *Momordica charantia*, *Odontosoria aculeata*, *Passiflora rubra*,

Passiflora suberosa, *Pueraria phaseoloides*, *Rubus rosifolius*, *Securidaca virgata*, *Stigmaphyllon floribundum*, *Thunbergia alata*, *Trichostigma octandrum*, and *Vigna vexillata*

Ferns: *Nephrolepis multiflora*, *Odontosoria aculeata*, and *Pityrogramma calomelanos*

Herbs: *Asystasia gangetica*, *Commelina diffusa* var. *diffusa*, *Desmodium incanum*, *Dissotis rotundifolia*, *Elephantopus mollis*, *Emilia praetermissa*, *Iresine diffusa*, *Melanthera nivea*, *Mimosa pudica* var. *unijuga*, *Oeceoclades maculata*, and *Scleria pterota*

Graminoids: *Andropogon bicornis*, *Cynodon nlemfuensis*, *Cyperus aggregatus*, *Digitaria insularis*, *Oplismenus hirtellus* ssp. *setarius*, *Pennisetum purpureum*, undetermined *Poaceae* sp., *Scleria pterota*, and *Urochloa maxima*

Associated Species

Four inventory sites yielded a total of 58 species inventoried. Another 15 species were observed near the inventory sites: *Andira inermis*, *Bambusa vulgaris*, *Casearia guianensis*, *Cecropia schreberiana* ssp. *schreberiana*, *Cyathea* sp., *Heliconia* sp., *Hyptis capitata*, *Miconia impetiolaris*, *Miconia laevigata*, *Mucuna pruriens*, *Roystonea borinquena*, *Serjania polyphylla*, *Tabebuia heterophylla*, *Tillandsia utriculata*, and *Zanthoxylum martinicense*.

Site Features

The inventory sites are located in a farm. The farm's historical land use included mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain. At the time the vegetation inventories were conducted, inventory sites were located within areas in an abandoned or unmanaged state.

Results and Discussion

ABANDONED GRASSLAND INVENTORY SITES 5–9

Municipalities of Lajas (Bo. Sabana Yeguas) and Cabo Rojo (Bo. Boquerón)

INVENTORY SPECIES:

Shrubs (≥ 4 cm DBH and ≥ 2 m height): *Leucaena leucocephala*

Shrubs and subshrubs (< 4 cm DBH and < 2 m height): *Adelia ricinella*, *Aeschynomene sensitiva*, *Amaranthus spinosus*, *Casearia aculeata*, *Cestrum diurnum*, *Corchorus siliquosus*, *Desmanthus virgatus*, *Jatropha gossypifolia*, *Lantana* sp., *Leucaena leucocephala*, *Ludwigia octovalvis*, *Melochia nodiflora*, *Melochia pyramidata*, *Mimosa pigra*, *Mimosa pudica* var. *unijuga*, *Neptunia oleracea*, *Samanea saman*, *Sida abutilifolia*, *Sida rhombifolia*, *Symphyotrichum subulatum* var. *parviflorum*, *Triumfetta lappula*, *Turnera ulmifolia*, *Vachellia farnesiana* var. *farnesiana*, *Waltheria indica*, and *Wissadula periplocifolia*

Seedlings and saplings: *Bourreria succulenta*, *Casearia aculeata*, *Guazuma ulmifolia*, *Pithecellobium dulce*, *Pithecellobium unguis-cati*, and *Prosopis juliflora*

Vines: *Alysicarpus vaginalis*, *Centrosema pubescens*, *Commelina diffusa* var. *diffusa*, *Cucumis dipsaceus*,

Desmodium incanum, *Desmodium scorpiurus*, *Ipomoea tiliacea*, *Ipomoea triloba*, *Jasminum fluminense*, *Macroptilium lathyroides*, *Merremia umbellata*, *Mimosa pudica* var. *unijuga*, *Momordica charantia*, *Neptunia oleracea*, *Passiflora foetida*, *Passiflora suberosa*, *Rhynchosia minima*, and *Stigmaphyllon emarginatum*

Herbs: *Achyranthes aspera* var. *aspera*, *Alysicarpus vaginalis*, *Amaranthus spinosus*, *Commelina diffusa* var. *diffusa*, *Crotalaria retusa*, *Cyanthillium cinereum*, *Desmanthus virgatus*, *Desmodium incanum*, *Desmodium scorpiurus*, *Euphorbia heterophylla*, *Euphorbia hypericifolia*, *Ludwigia octovalvis*, *Macroptilium lathyroides*, *Melochia pyramidata*, *Phyllanthus amarus*, *Ruellia blechum*, *Ruellia tuberosa*, *Symphyotrichum subulatum* var. *parviflorum*, and *Turnera ulmifolia*

Graminoids: *Bothriochloa pertusa*, *Cynodon nlemfuensis*, *Cyperus sphaclatus*, *Dichanthium annulatum*, *Digitaria eriantha*, *Paspalum millegrana*, *Sporobolus jacquemontii*, and *Urochloa maxima*



Figure 29—Abandoned grassland inventory sites located in the municipality of Lajas (Bo. Sabana Yeguas). Forest Service photos by Johann D. Crespo-Zapata.

Associated Species

Five inventory sites yielded a total of 62 species inventoried. Another 19 species were observed near the inventory sites: *Cissus verticillata*, *Cocos nucifera*, *Delonix regia*, *Ficus citrifolia*, *Fimbristylis dichotoma*, *Indigofera suffruticosa*, *Malachra alceifolia*, *Mangifera indica*, *Melicoccus bijugatus*, *Randia aculeata*, *Rauvolfia nitida*, *Roystonea borinquena*, *Senna siamea*, *Spermacoce confusa*, *Spermacoce remota*, *Swietenia macrophylla*, *Swietenia mahagoni*, *Tamarindus indica*, and *Trichilia hirta*.

Site Features

Inventory sites are located at low elevations on the island's southwestern region, and locations vary from an agricultural and livestock farm to a moderately anthropized mountain biking and motorcycling area. At the time the vegetation inventories were conducted, inventory sites were in an abandoned or unmanaged state.

Associated species that are generally known for being cultivated for production and/or consumption include *Cocos nucifera*, *Mangifera indica*, *Melicoccus bijugatus*, and *Tamarindus indica*. In addition, *Samanea saman* was commonly seen planted as a shade tree throughout most inventory sites in the municipality of Lajas.

Notable Species

The most uncommon species inventoried is *Casearia aculeata* (Gann and Trejo-Torres 2015–2023). An undetermined *Lantana* sp. could correspond to at least four possible species or hybrids based on the inventory location.



Sapling of *Casearia aculeata*, a rare native shrub recorded at an abandoned grassland site in the municipality of Lajas. Forest Service photo by Johann D. Crespo-Zapata.

Results and Discussion

ABANDONED GRASSLAND INVENTORY SITES 10–17

Municipalities of Fajardo (Bo. Quebrada Fajardo), Luquillo (Bo. Pitahaya), Canóvanas (Bo. Canóvanas), Loíza (Bo. Canóvanas and Bo. Torrecilla Alta), and Manatí (Bo. Tierras Nuevas Poniente)

INVENTORY SPECIES:

Shrubs and subshrubs (<4 cm DBH and <2 m height):

Aeschynomene sensitiva, *Chromolaena odorata*, *Jatropha gossypifolia*, *Ludwigia leptocarpa*, *Mimosa pigra*, *Neptunia plena*, *Sesbania sericea*, and *Sida glomerata*

Seedlings and saplings: *Sesbania sericea* and *Vachellia farnesiana* var. *farnesiana*

Vines: *Aniseia martinicensis*, *Centrosema pubescens*, *Chromolaena odorata*, *Cissampelos pareira*, *Clitoria falcata*, *Desmodium incanum*, *Ipomoea setifera*, *Ipomoea tiliacea*, *Melothria pendula*, *Merremia umbellata*, *Mikania cordifolia*, *Mikania micrantha*, *Mimosa casta*, *Mimosa pudica* var. *unijuga*, *Passiflora foetida*, *Vigna adenantha*, *Vigna luteola*, and *Vigna vexillata*

Ferns: *Acrostichum danaeifolium*

Herbs: *Colocasia esculenta*, *Commelina diffusa* var. *diffusa*, *Cuphea strigulosa*, *Eleocharis mutata*, *Hyptis atrorubens*, *Mimosa pudica* var. *unijuga*, *Neptunia plena*, *Phyla nodiflora*, *Rolandra fruticosa*, *Ruellia blechum*, *Scleria eggersiana*, *Scleria pterota*, *Spermacoce verticillata*, and *Typha domingensis*

Graminoids: *Cynodon dactylon*, *Cyperus ligularis*, *Echinochloa crus-gavonis*, *Eleocharis mutata*, *Leersia hexandra*, *Panicum laxum*, *Paspalidium geminatum*, *Paspalum fasciculatum*, *Paspalum pleostachyum*, *Paspalum vaginatum*, *Paspalum virgatum*, *Saccharum spontaneum*, *Schoenoplectus americanus*, *Scleria eggersiana*, *Scleria pterota*, *Typha domingensis*, *Urochloa arrecta*, *Urochloa maxima*, and *Urochloa mutica*



Figure 30—General views of two abandoned or unmanaged grassland inventory sites (Bo. Quebrada Fajardo and Bo. Pitahaya, municipalities of Fajardo and Luquillo, respectively), dominated by *Paspalum virgatum* (A) and *Paspalum fasciculatum* (B). Forest Service photos by Johann D. Crespo-Zapata.

Associated Species

Eight inventory sites yielded a total of 54 species inventoried. Another 40 species were observed near the inventory sites: *Acrostichum aureum*, *Albizia procera*, *Andira inermis*, *Annona glabra*, *Bidens alba* var. *radiata*, *Casearia guianensis*, *Casearia sylvestris*, *Casuarina equisetifolia*, *Ceratopteris thalictroides*, *Cestrum diurnum*, *Cissus verticillata*, *Citharexylum spinosum*, *Cocos nucifera*, *Cyanthillium cinereum*, *Cyperus articulatus*, *Cyperus giganteus*, *Cyperus polystachyos*, *Enydra sessilis*, *Gliricidia sepium*, *Guapira fragrans*, *Hymenachne amplexicaulis*, *Jasminum fluminense*, *Ludwigia octovalvis*, *Machaerium lunatum*, *Musa × paradisiaca*, *Oxalis barrelieri*, *Paullinia pinnata*, *Peltophorum pterocarpum*, *Ricinus communis*, *Roystonea borinquena*, *Senna bicapsularis*, *Senna obtusifolia*, *Sesuvium maritimum*, *Sesuvium portulacastrum*, *Spathodea campanulata*, *Sphagneticola trilobata*, *Terminalia catappa*, *Triumfetta semitriloba*, *Vigna hosei*, and *Ziziphus mauritiana*.

Site Features

The inventory sites are located at low elevations along the island's north and northeastern regions. At the time the vegetation inventories were conducted, the sites were in areas in an abandoned or unmanaged state.

Inventoried or associated species that are generally known for having ethnobotanical uses (e.g., food, traditional medicine, arts and crafts, among others) include *Annona glabra*, *Cocos nucifera*, *Colocasia esculenta*, *Cyperus giganteus*, *Musa × paradisiaca*, *Passiflora foetida*, *Paullinia pinnata*, *Ricinus communis*, *Roystonea borinquena*, *Sesuvium portulacastrum*, *Terminalia catappa*, *Typha domingensis*, and *Ziziphus mauritiana*.

Notable Species

Uncommon, regional, and/or other notable species inventoried or observed near the inventory sites are: *Aniseia martinicensis*, *Ceratopteris thalictroides*, *Enydra sessilis*, *Schoenoplectus americanus*, *Scleria eggersiana*, and *Sesuvium maritimum* (Gann and Trejo-Torres 2015–2023). *A. martinicensis*, *C. thalictroides*, and *S. maritimum* have been listed as Critical Elements by the Natural Heritage Program of the PRDNER (2007).



Some fern species, such as *Acrostichum danaeifolium*, often colonize abandoned grasslands prone to flooding and near wetlands (municipality of Loíza). Forest Service photo by Johann D. Crespo-Zapata.

Results and Discussion

ABANDONED HORTICULTURE

Abandoned horticulture inventory sites 1–4 are located in the municipality of Utuado (Bo. Las Palmas and Bo. Caonillas Arriba), within the subtropical moist forest ecological life zone (Ewel and Whitmore 1973; figs. 31 and 32), and range from approximately 291 to 396 m above sea level. Some inventory species may be repeated among different categories if they have been observed in more than one biological stage (i.e., seedling, sapling, subshrub,

and/or shrub) or displaying multiple growth habits (e.g., *Rubus rosifolius*, a species that may be considered as a shrub or subshrub, was observed exhibiting climbing habits in an inventory site, and thus was also classified as a vine). Refer to appendix A for summarized descriptions, vegetation, and additional information on each inventory site.

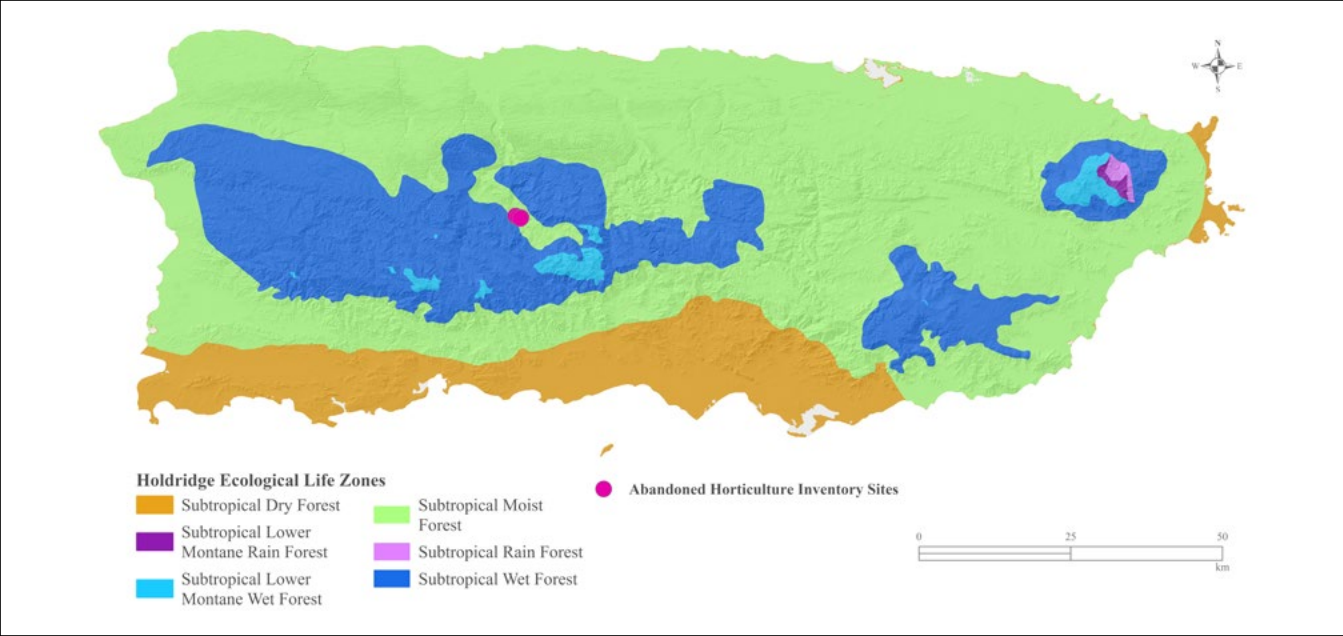


Figure 31—Abandoned horticulture inventory sites among the Holdridge Ecological Life Zones of Puerto Rico (Ewel and Whitmore 1973).

INVENTORY SPECIES:

Shrubs (≥ 4 cm DBH and ≥ 2 m height; recorded within two fixed-area square plots): *Coffea arabica*, *Gliricidia sepium*, and *Psidium guajava*

Table 11—Abandoned horticulture species (sites 2 and 3), site frequency, site density, relative frequency, relative density, relative dominance, and importance value of shrubs ≥ 4 cm DBH and ≥ 2 m height, recorded within two fixed-area square plots

Species	Site Frequency	Site Density	Relative Frequency	Relative Density	Relative Dominance	Importance Value
<i>Coffea arabica</i>	1	2	33.33	33.33	21.47	29.38
<i>Gliricidia sepium</i>	1	2	33.33	33.33	29.32	31.99
<i>Psidium guajava</i>	1	2	33.33	33.33	49.19	38.62

Totals: two inventory sites (sampled area = 0.02 ha); three species; six stems (sum of basal area = 0.01 m²). Stems ≥ 4 cm DBH and ≥ 2 m height were recorded in two of four inventory sites, but the total sampled area (0.04 ha) was applied for all corresponding calculations (i.e., basal area, relative density, and relative dominance).

Shrubs and subshrubs (<4 cm DBH and <2 m height):

Andira inermis, *Casearia guianensis*, *Chromolaena odorata*, *Clidemia hirta*, *Coffea arabica*, *Gliricidia sepium*, *Guarea guidonia*, *Inga vera*, *Lepianthes peltata*, *Manihot esculenta*, *Miconia prasina*, *Ocotea floribunda*, *Physalis pubescens*, *Piper amalago*, *Piper glabrescens*, *Piper hispidum*, *Psidium guajava*, *Rubus rosifolius*, *Sida rhombifolia*, *Theobroma cacao*, *Triumfetta semitriloba*, *Urena lobata*, and *Vernonia sericea*

Seedlings and saplings: *Cupania americana*, *Guarea guidonia*, *Ocotea leucoxylon*, and *Zanthoxylum martinicense*

Lianas and vines: *Centrosema virginianum*, *Chromolaena odorata*, *Cissus verticillata*, *Commelina diffusa* var. *diffusa*, *Desmodium incanum*, *Dissotis rotundifolia*, *Gouania polygama*, *Ipomoea setifera*, *Iresine diffusa*, *Melanthera nivea*, *Melothria pendula*, *Merremia quinquefolia*, *Mikania cordifolia*, *Mikania micrantha*, *Momordica charantia*, *Mucuna pruriens*, *Passiflora rubra*, *Passiflora suberosa*, *Paullinia pinnata*, *Pueraria phaseoloides*, *Rubus rosifolius*, *Securidaca virgata*, *Stigmaphyllon floribundum*,

Syngonium podophyllum, *Thunbergia alata*, *Trichostigma octandrum*, and *Vigna vexillata*

Ferns: *Blechnum occidentale*, *Cnemidaria horrida*, *Nephrolepis multiflora*, *Pityrogramma calomelanos*, *Tectaria incisa*, and *Thelypteris dentata*

Herbs: *Ananas comosus*, *Begonia hirtella*, *Chamaecrista nictitans* var. *diffusa*, *Commelina diffusa* var. *diffusa*, *Cyperus aggregatus*, *Desmodium incanum*, *Diodia ocyimifolia*, *Dissotis rotundifolia*, *Elephantopus mollis*, *Emilia fosbergii*, *Emilia praetermissa*, *Euphorbia heterophylla*, *Iresine diffusa*, *Melanthera nivea*, *Musa acuminata*, *Musa × paradisiaca*, *Oeceoclades maculata*, and *Scleria pterota*.

Graminoids: *Cynodon nlemfuensis*, *Cyperus aggregatus*, *Digitaria ciliaris*, *Digitaria horizontalis*, *Ichnanthus pallens* var. *pallens*, *Lithachne pauciflora*, *Pharus lappulaceus*, Undetermined Poaceae sp., *Scleria pterota*, and *Urochloa maxima*

Mosses and lichens: *Parmotrema* sp. and *Plagiochila* sp.

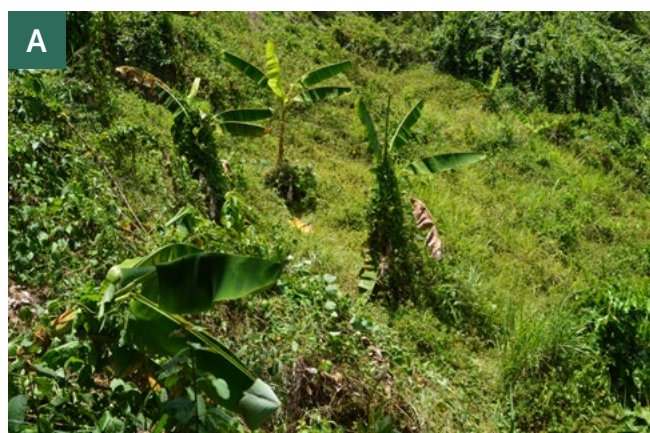


Figure 32—General views of two abandoned horticulture inventory sites (Bo. Las Palmas, municipality of Utuado). Neglected *Musa × paradisiaca* plantation (A), and an abandoned small-scale plantation of primarily *Manihot esculenta*, *Theobroma cacao*, and *Coffea arabica* (B). Forest Service photos by Johann D. Crespo-Zapata.

Results and Discussion

Associated Species

Four inventory sites yielded a total of 80 species inventoried. Another 36 species were observed near the inventory sites: *Adiantum pyramidale*, *Adiantum* sp., *Andropogon bicornis*, *Bambusa vulgaris*, *Bixa orellana*, *Cajanus cajan*, *Casearia sylvestris*, *Cecropia schreberiana* ssp. *schreberiana*, *Chrysophyllum cainito*, *Citrus* × *aurantium*, *Cocos nucifera*, *Coffea liberica* var. *liberica*, *Colocasia esculenta*, *Cordia polycephala*, *Cordia sulcata*, *Cuphea strigulosa*, *Cyperus* sp., *Digitaria* sp., *Macfadyena unguis-cati*, *Mangifera indica*, *Miconia impatiolalis*, *Mimosa pudica* var. *unijuga*, *Musa* sp., *Persea americana*, *Phoradendron* sp., *Piper aduncum*, *Piper umbellatum*, *Ricinus communis*, *Solanum americanum*, *Spathodea campanulata*, *Spondias dulcis*, *Swietenia* × *aubrevilleana*, *Syzygium jambos*, *Thespesia grandiflora*, *Tournefortia hirsutissima*, and *Xanthosoma sagittifolium*.

Site Features

Inventory sites comprise several abandoned small-scale plantations or horticulture areas that include coffee (*Coffea arabica*), cocoa (*Theobroma cacao*), cassava (*Manihot esculenta*), and banana/plantain (*Musa* spp.), among others.

Associated species that are widely known for being cultivated for production or personal consumption include *Bixa orellana*, *Cajanus cajan*, *Citrus* × *aurantium*, *Cocos nucifera*, *Colocasia esculenta*, *Mangifera indica*, *Persea americana*, and *Syzygium jambos*. At the time the vegetation inventories were conducted, the sites were in areas in an abandoned or neglected state.



Branch and unripe fruits of a *Coffea arabica* shrub, recorded in an abandoned horticulture site. Forest Service photo by Johann D. Crespo-Zapata.

Glossary

abandoned grassland—Community phase or succession stage dominated by one or several species of grasses. The majority of these communities typically result from the long-term abandonment or temporary neglect of grass fields, grasslands, or other areas associated with this land use that were formerly managed for diverse purposes.

abandoned horticulture—Community phase or succession stage mostly dominated by shrubs and herbs. These communities result from the long-term abandonment or temporary neglect of small-scale crop areas that have not been plowed for planting purposes. While species composition and richness are variable, these communities primarily consist of a combination of wild vegetation and persisting cultivated plants for food.

abandoned tillage crop—Community phase or succession stage typically dominated by herbs and nonwoody plants such as vines and/or graminoids. These communities result from the long-term abandonment or temporary neglect of plowed, cultivated fields or areas. While species composition and richness are variable, these communities primarily consist of a combination of wild vegetation and persisting cultivated plants for food.

basal area (BA)—The cross-sectional area of stems at breast height. In this work, only stems ≥ 4 cm DBH, recorded within fixed-area square plots, were considered for this unit of measurement (expressed as m^2).

basal area factor (BAF)—The ratio of DBH (diameter at breast height) or BA (basal area) to the distance from a variable-radius plot's cruiser location or center. The corresponding value is determined in accordance with the size and number of trees to be tallied or sampled, as well as the device used (e.g., cruising wedge prism, angle gauge, relascope).

biological stages—The different stages of growth and development of a particular plant group, which are cyclical in structure and complexity (i.e., seed, seedling, sapling).

borderline trees—Trees that cannot be determined as “in” or “out” of a variable-radius plot when using a cruising wedge prism. This occurs when the distance from the plot's cruiser point to the center of a tree is the same as the DBH times the plot radius factor—a value used to determine the maximum distance between the cruiser point and a tree in order to be tallied.

cacti—Fleshy or succulent plants, usually bearing spines and lacking leaves. Although multiple types of growth habits are present among this group, most species are considered as shrubs or trees. All of its members belong to the Cactaceae family.

diameter at breast height (DBH)—Tree diameter measured at 4.5 ft (1.37 m) above the ground; the standard for measuring trees in forestry.

epiphytes—Plants that grow on other plants and are not parasites to their host. Members of plant families such as Bromeliaceae and Orchidaceae compose the majority of this group.

ferns—Vascular plants that are seedless and reproduce mainly by spores. In this work, they are broadly treated as pteridophytes (including lycophytes), and multiple types of growth habits are present among this group.

fixed-square plot—Square-shaped sampling plot with an established fixed-area of 10 x 10 m (0.01 ha). All plants occurring within the established dimensions are sampled and recorded.

gemel trees—Two conjoined trees that have fused together in a process called inosculation.

graminoids—Grasses and other grass-like plants such as sedges and rushes. Most species within this group would otherwise be considered herbs, but some of its members are considered vines (e.g., *Lasiacis* spp., *Scleria* spp.). Others are sometimes considered as shrubs or trees due to their woody growth and large size (e.g., *Bambusa* spp.).

growth habits—The different characteristic forms in which plants grow (i.e., mosses, ferns, graminoids, herbs, vines, lianas, subshrubs, shrubs, and trees), which are mainly typified by their size, woodiness, and distinct biological features.

herbs—Nonwoody vascular plants, with the exception of graminoids. The members of this group are nonclimbing and usually do not exceed 1 m in height.

importance value—A percent measure of how dominant a species is in a given area (ha). It is calculated by summing and averaging relative frequency, relative density, and relative dominance of a species.

Glossary

lianas—Woody vines that are rooted in the soil and typically produce long serpentine stems that climb into the canopy of trees to reach sunlight.

lichens—Complex organisms composed of a fungus in symbiotic union with an alga.

managed grassland—Grass fields or areas under some form of active management and dominated by one or several species of grasses. The primary activities associated with this land use are livestock grazing and production of food, hay, and ornamental lawns.

mature forest—Community phase or succession stage mostly dominated by large, old trees that has developed over a period of time without recent human disturbance. These climax communities are usually composed of native species and are often limited to certain areas or locations that foster very specific sets of ecological features.

mosses—A generic term for nonvascular terrestrial plants, including bryophytes, liverworts, and hornworts. These plants are smaller in size compared to vascular plants and are usually found forming dense green mats in moist places.

pioneers—Community phase or succession stage mostly dominated by herbs and vines. While species composition and richness are variable, these communities primarily comprise plants that are typically the first to colonize barren areas or recently disturbed environments. Generally, these communities are transitory and of relatively short duration.

relative density—Percent of recorded and measured stems ≥ 4 cm DBH of a particular species in a given area (ha).

relative dominance—Percent of the basal area (m^2) of a particular species in a given area (ha).

relative frequency—Percent of inventory sites in which a species of tree or shrub ≥ 4 cm DBH was recorded.

restored forest—Areas that have been planted with different species of trees and occasionally nonwoody plants. They are the product of restoration or environmental mitigation efforts. While species composition varies, these areas comprise mostly native trees that occur naturally in mature forests. These species are planted as an attempt to promote and/or accelerate regeneration by recreating climax communities.

saplings—Young trees that are more mature than a seedling but are not yet seed producing. This biological stage typically includes trees < 4 cm DBH and under 1 m in height.

secondary forest—Community phase or succession stage mostly dominated by trees of varying sizes that has naturally regenerated or regrown after considerable human and/or natural disturbances. The species composition and richness are highly variable.

seedlings—Young plants growing from a recently germinated seed and that has not yet reached a height of 0.15 m.

seeds—Plant structures that develop from an ovule and house the embryo. They are the principal dispersion unit of vascular plants, with the exception of ferns, and are usually contained within or adhered to the fruit.

shrubland—Community phase or succession stage mostly dominated by shrubs, bushes, and/or small trees generally less than 4 m in height, usually succeeding the pioneers or grassland community phase and preceding the forest succession stage.

shrubs—Woody plants without a well-defined main stem and shorter in height than a tree. (In this report, smaller trees [< 4 cm DBH] are included in this category.)

site density—Number of recorded and measured stems ≥ 4 cm DBH of a particular species in a given area (ha).

site frequency—Number of inventory sites in which a species of tree or shrub ≥ 4 cm DBH was recorded.

subshrubs—Small woody plants with multiple stems, usually not as large as a shrub and mostly woody at the base.

trees—Woody plants that generally exhibit a main stem and are larger than mature shrubs, usually exceeding 5 m in height.

variable-radius plot—Sampling plot in which each tree has a given plot area in accordance with its size. Trees are tallied or sampled from one (or several) established cruiser point(s).

vines—Herbaceous plants that produce flexible stems that climb, trail, or creep. Some may lie prostrate on the ground, while others have tendrils, twining stems, or other mechanisms to cling to natural and human-made structures.

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Appendix A: Inventory Sites

Each of the 99 sites is identified by its vegetation community phase or land use and inventory site ID. The sites appear in the following order:

- **Mature forest sites 1–3**
- **Restored forest sites 1–6**
- **Secondary forest sites 1–18**
- **Shrubland sites 1–13**
- **Pioneer sites 1–15**
- **Abandoned tillage crop sites 1–10**
- **Managed grassland sites 1–13**
- **Abandoned grassland sites 1–17**
- **Abandoned horticulture sites 1–4**

Appendix A

Mature Forest Site 1

Ecological Life Zone: Subtropical wet forest

Location: Bo. Saliente, municipality of Jayuya, PR

Site Description and Disturbance History: The site (fig. A-1) is located on an upper backslope at an elevation of approximately 805 m above sea level, with an estimated slope of 42.4 percent and estimated canopy cover of 96.3 percent. An unfrequented dirt trail is nearby. There are no signs of recent disturbances at the site. The area's historical land use includes mostly coffee plantations.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: Dominant tree species are *Casearia sylvestris*, *Zanthoxylum martinicense*, and *Cinnamomum elongatum*, while secondary dominant tree species include *Famea occidentalis*, *Ocotea leucoxydon*, *Tabebuia heterophylla*, and *Cordia sulcata*. Woody understory species are mostly shrubs of *Famea occidentalis* and *Vitis tiliifolia* lianas, followed by *Casearia sylvestris* shrubs and saplings of *Prestoea acuminata* var. *montana*. Other understory species include mostly *Adiantum pyramidale* and *Blechnum occidentale* ferns, followed by vines, lianas, grasses, and herbs such as *Securidaca virgata*, *Rhynchosia phaseoloides*, *Cydista aequinoctialis*, *Ichnanthus pallens* var. *pallens*, and *Heliconia caribaea*. Other minor or less represented species include *Tetragastris balsamifera*, *Alchornea latifolia*, *Urera baccifera*, *Dioscorea alata*, *Ruellia coccinea*, and *Arachniodes chaerophylloides*.

Associated Species: *Alsophila portoricensis*, *Ardisia obovata*, *Bocconia frutescens*, *Cestrum macrophyllum*, *Cissus verticillata*, *Cordia alliodora*, *Dendropanax arboreus*, *Gozalagunia hirsuta*, *Guarea glabra*, *Henriettea fascicularis*, *Lasiacis sorghoidea*, *Lobelia robusta*, *Mecranium latifolium*, *Passiflora sexflora*, *Pharus lappulaceus*, *Piper glabrescens*, *Piper umbellatum*, *Pisonia roqueae*, *Psychotria berteriana*, and *Turpinia occidentalis*



Figure A-1—(A) General view of the site and (B) flowers of *Famea occidentalis*, a common shrub species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Mature Forest Site 2

Ecological Life Zone: Subtropical lower montane wet forest

Location: Bo. Saliente, municipality of Jayuya, PR

Site Description and Disturbance History: The site (fig. A-2) is located on a lower backslope at an elevation of approximately 785 m above sea level, with an estimated slope of 49.5 percent and estimated canopy cover of 94 percent. A drainage is area nearby. There are no signs of recent disturbances at the site. The area's historical land use includes mostly coffee plantations.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species is *Guarea guidonia*, while the secondary dominant tree is *Cordia sulcata*. Notable additional trees are *Cordia alliodora*, *Cedrela odorata*, *Prunus occidentalis*, and *Zanthoxylum martinicense*. The understory is mostly dominated by saplings of *Prunus occidentalis* and *Prestoea acuminata* var. *montana*. Notable nonwoody understory species are mainly *Arachniodes chaerophylloides*, *Blechnum occidentale*, and *Pharus lappulaceus*. Other notable understory species include seedlings, saplings, and/or shrubs of *Chrysophyllum argenteum*, *Tetragastris balsamifera*, *Inga vera*, *Dendropanax arboreus*, *Chionanthus domingensis*, *Myrcia splendens*, and *Cedrela odorata*.

Associated Species: *Andira inermis*, *Anthurium crenatum*, *Calophyllum antillanum*, *Campyloneurum* sp., *Cecropia schreberiana* ssp. *schreberiana*, *Faramea occidentalis*, *Gouania lupuloides*, *Oxalis debilis* var. *corymbosa*, *Pecluma* sp., *Piper hispidum*, *Piper marginatum*, *Smilax domingensis*, *Spathodea campanulata*, *Tradescantia zanonina*, *Trichilia pallida*, *Urera baccifera*, and *Zanthoxylum martinicense*



Figure A-2—(A) General view of the site and (B) flowers of *Pharus lappulaceus*, a grass observed throughout the understory. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Mature Forest Site 3

Ecological Life Zone: Subtropical wet forest

Location: Bo. Zamas, municipality of Jayuya, PR

Site Description and Disturbance History: The site (fig. A-3) is located on a lower backslope at an elevation of approximately 845 m above sea level, with an estimated slope of 49.5 percent and estimated canopy cover of 96.7 percent. An unfrequented hiking trail and drainage area are nearby. There are no signs of recent disturbances at the site. The area's historical land use includes mostly coffee plantations.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species is *Cordia alliodora*, followed by palm trees of *Prestoea acuminata* var. *montana*. Other trees include *Ocotea floribunda*, *Inga vera*, and *Ilex nitida*. The understory is mostly dominated by *Dennstaedtia bipinnata* ferns, followed by saplings of *Prestoea acuminata* var. *montana*, *Blechnum occidentale* ferns, and *Ichnanthus pallens* var. *pallens*. Understory shrub species are mostly *Urera baccifera*, *Piper glabrescens*, *Piper hispidum*, *Clusia gundlachii*, and *Guarea guidonia*. Other notable understory species include *Gouania lupuloides*, *Cissus verticillata*, *Mimosa ceratonia*, and *Trichostigma octandrum*, followed by *Gibasis geniculata*, *Ruellia coccinea*, *Pilea nummulariifolia*, *Oeceoclades maculata*, and *Lasiacis sorghoidea*. Other secondary species include *Guarea glabra*, *Gonzalagunia hirsuta*, *Diplazium unilobum*, and *Palicourea crocea*.

Associated Species: *Adiantum pyramidale*, *Alchornea latifolia*, *Alsophila portoricensis*, *Blechnum fragile*, *Bocconia frutescens*, *Callisia monandra*, *Cecropia schreberiana* ssp. *schreberiana*, *Cnemidaria horrida*, *Cordia polycephala*, *Desmodium axillare* var. *axillare*, *Ficus trigonata*, *Hypolepis repens*, *Iresine diffusa*, *Microgramma piloselloides*, *Musa acuminata*, *Niphidium crassifolium*, *Oxalis debilis* var. *corymbosa*, *Prunus occidentalis*, *Rajania cordata*, *Trema micrantha*, *Turpinia occidentalis*, and *Vernonia sericea*



Figure A-3—(A) General view of the site and (B) *Dennstaedtia bipinnata* blades, a fern observed throughout the understory. Forest Service photos by Johann D. Crespo-Zapata.

Restored Forest Site 1

Ecological Life Zone: Subtropical moist forest

Location: Bo. Pitahaya, municipality of Luquillo, PR

Site Description and Disturbance History: The site (fig. A-4) is located on a lowland plain at an elevation of approximately 7 m above sea level, with an estimated slope of 0 percent and estimated canopy cover of 92.7 percent. It is a plantation of trees as part of a mitigation project (planting started in late 2014 in a former seasonally flooded grassland area). A frequented dirt road is nearby. This site is prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: This site is dominated by planted trees of *Pterocarpus officinalis*, followed by planted trees and shrubs of *Amphitecna latifolia*, *Hura crepitans*, *Annona glabra*, and *Stahlia monosperma*. Recruitment (seedlings and/or saplings) was observed in all five species throughout the site. Other notable understory species include mostly ferns and vines such as *Thelypteris dentata*, *Adiantum latifolium*, and *Vigna hosei*.

Associated Species: *Achyranthes aspera* var. *aspera*, *Acrostichum danaeifolium*, *Calophyllum antillanum* (planted), *Calophyllum inophyllum* (planted), *Calopogonium caeruleum*, *Caperonia palustris*, *Casearia decandra*, *Casearia guianensis*, *Ceiba pentandra* (planted), *Centrosema pubescens*, *Chromolaena odorata*, *Chrysophyllum argenteum* (planted), *Clidemia hirta*, *Conocarpus erectus* (planted), *Cupania americana* (planted), *Cuphea strigulosa*, *Dissotis rotundifolia*, *Guarea guidonia* (planted), *Hernandia sonora* (planted), *Hibiscus tiliaceus* var. *pernambucensis* (planted), *Hyptis capitata*, *Inga laurina* (planted), *Manilkara bidentata* ssp. *surinamensis* (planted), *Melothria pendula*, *Ocotea leucoxylon*, *Pityrogramma calomelanos*, *Scleria eggersiana*, *Securidaca virgata*, *Sida rhombifolia*, *Spondias mombin* (planted), *Syngonium podophyllum*, *Tabebuia heterophylla*, *Terminalia catappa*, *Thelypteris reticulata*, *Trichostigma octandrum*, and *Urena lobata*



Figure A-4—(A) General view of the site and (B) branch/leaves of *Stahlia monosperma*, a planted species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Restored Forest Site 2

Ecological Life Zone: Subtropical moist forest

Location: Bo. Canóvanas, municipality of Canóvanas, PR

Site Description and Disturbance History: The site (fig. A-5) is located on a lowland plain at an elevation of approximately 12 m above sea level, with an estimated slope of 0 percent and estimated canopy cover of 93.5 percent. It is a plantation of trees as part of a mitigation project, near urban commercial and residential areas (planting started in 2011 in a former grassland area dominated by *Paspalum fasciculatum*). Active roads/highway and urban development are nearby. This site is prone to flooding; some areas around the site were mildly flooded at the time the vegetation inventory was conducted (ankle-deep water and mud).

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: This site is dominated by planted trees of *Pterocarpus officinalis*, followed by planted palm trees of *Roystonea borinquena*. Other planted woody species include trees and shrubs of *Amphitecna latifolia*, *Annona glabra*, *Thespesia populnea*, and *Manilkara bidentata* ssp. *surinamensis*. Recruitment (seedlings and/or saplings) was observed in all aforementioned species except for *T. populnea* and *M. bidentata* ssp. *surinamensis*. Nonplanted woody species include small individual trees of *Nectandra coriacea* and *Guarea guidonia*, as well as shrubs of *Casearia aculeata*, *Casearia guianensis*, and *Cupania americana*. Notable understory species include a variety of ferns such as *Thelypteris reticulata*, *Thelypteris dentata*, *Adiantum latifolium*, and *Tectaria incisa*.

Associated Species: *Calophyllum antillanum*, *Coccoloba rugosa* (planted), *Colocasia esculenta*, *Hibiscus tiliaceus* var. *pernambucensis* (planted), *Hyptis capitata*, *Justicia comata*, *Mimosa pigra*, *Scleria eggersiana*, *Stahlia monosperma* (planted), *Struchium sparganophorum*, and *Tournefortia hirsutissima*



Figure A-5—(A) General view of the site and (B) trunk/roots of *Pterocarpus officinalis*, a planted species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Restored Forest Site 3

Ecological Life Zone: Subtropical moist forest

Location: Bo. Canóvanas, municipality of Canóvanas, PR

Site Description and Disturbance History: The site (fig. A-6) is located on a lowland plain at an elevation of approximately 12 m above sea level, with an estimated slope of 0 percent and estimated canopy cover of 95.5 percent. It is a plantation of trees as part of a mitigation project, near urban commercial and residential areas (planting started in 2011 in a former grassland area), and used by cows for shade and resting (cows were present at the time the vegetation inventory was conducted). Frequented cattle trails, active roads, and urban development are nearby. This site is prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: This site is dominated by planted trees of *Pterocarpus officinalis*, followed by planted trees and shrubs of *Annona glabra*, *Amphitecna latifolia*, and *Thespesia populnea*. Other planted woody species include an *Erythrina fusca* tree, palm trees of *Roystonea borinquena*, and a shrub of *Hibiscus tiliaceus* var. *pernambucensis*. Recruitment (seedlings and/or saplings) was observed in all aforementioned species except *R. borinquena* and *H. tiliaceus* var. *pernambucensis*. Other notable understory species include mostly vines, herbs, and ferns such as *Syngonium podophyllum*, *Trichostigma octandrum*, *Callisia repens*, *Adiantum latifolium*, and *Thelypteris dentata*.

Associated Species: *Acrostichum danaeifolium*, *Casearia decandra*, *Casearia sylvestris*, *Ceratopteris thalictroides*, *Citharexylum spinosum*, *Cordia collococca*, *Cuphea strigulosa*, *Cynodon dactylon*, *Famea occidentalis*, *Ficus citrifolia*, *Heteranthera reniformis*, *Ludwigia* sp., *Machaerium lunatum* (planted), *Nephrolepis multiflora*, *Oldenlandia lancifolia*, *Panicum laxum*, *Passiflora suberosa*, *Piper aduncum*, *Ruellia simplex*, *Sacciolepis indica*, *Senna alata*, *Stahlia monosperma* (planted), *Tabebuia rosea* (planted), and *Urena lobata*



Figure A-6—(A) General view of the site and (B) branch/leaves of *Amphitecna latifolia*, a planted species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Restored Forest Site 4

Ecological Life Zone: Subtropical moist forest

Location: Bo. Tierras Nuevas Poniente, municipality of Manatí, PR

Site Description and Disturbance History: The site (fig. A-7) is located on a lowland plain at an elevation of approximately 5 m above sea level, near a floodplain area, with an estimated slope of 0 percent and estimated canopy cover of 96.6 percent. It is a plantation of trees as part of a mitigation/restoration project (planting started in early 2013 in a former sugarcane field and subsequently a seasonally flooded herbaceous vegetation wetland). Water ditches are nearby. This site is prone to flooding; most of the site was in a mildly flooded state at the time the vegetation inventory was conducted (ankle-deep water and mud).

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: This site is dominated by planted trees of *Pterocarpus officinalis*, followed by planted trees and shrubs of *Annona glabra*. Recruitment (seedlings and/or saplings) was observed in both species within the site. Most of the lower canopy and understory are dominated by lianas and vines of *Cissus verticillata*. Minor or less represented species include *Acrostichum danaeifolium*, *Bursera simaruba*, and *Ipomoea tiliacea*.

Associated Species: *Ammannia latifolia*, *Canna glauca* (planted), *Caperonia palustris*, *Casearia sylvestris*, *Commelina diffusa* var. *diffusa*, *Cupania americana*, *Cyperus ochraceus*, *Eclipta prostrata*, *Ludwigia octovalvis*, *Lygodium japonicum*, *Mikania cordifolia*, *Mikania micrantha*, *Mimosa pudica* var. *unijuga*, *Paullinia pinnata*, *Pithecellobium dulce*, *Sagittaria lancifolia*, *Trichostigma octandrum*, *Typha domingensis*, and *Urochloa mutica*



Figure A-7—(A) General view of the site and (B) fruit/seedpod of *Pterocarpus officinalis*, a planted species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Restored Forest Site 5

Ecological Life Zone: Subtropical moist forest

Location: Bo. Tierras Nuevas Poniente, municipality of Manatí, PR

Site Description and Disturbance History: The site (fig. A-8) is located on a lowland plain at an elevation of approximately 5 m above sea level, near a floodplain area, with an estimated slope of 0 percent and estimated canopy cover of 95 percent. It is a plantation of trees as part of a mitigation/restoration project (planting started in early 2013 in a former sugarcane field and subsequently a seasonally flooded herbaceous vegetation wetland). Water ditches and a dirt road are nearby. This site is prone to flooding; most of the site was in a mildly flooded state at the time the vegetation inventory was conducted (ankle-deep water and mud).

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: This site is dominated by planted trees of *Pterocarpus officinalis*, followed by planted trees and shrubs of *Annona glabra*. Recruitment (seedlings and/or saplings) was observed in both species throughout the site. Most of the lower canopy is dominated by lianas and vines of *Cissus verticillata*. The understory is mostly dominated by seedlings and/or saplings of several tree species, most notably *Pterocarpus officinalis*, *Guapira fragrans*, *Calophyllum antillanum*, *Roystonea borinquena*, *Spathodea campanulata*, *Casearia guianensis*, *Licaria triandra*, and *Coccoloba diversifolia*.

Associated Species: *Amphitecna latifolia* (planted), *Caperonia palustris*, *Cecropia schreberiana* ssp. *schreberiana*, *Ceiba pentandra* (planted), *Coccoloba rugosa* (planted), *Cyperus odoratus*, *Euphorbia heterophylla*, *Ipomoea tiliacea*, *Melothria pendula*, *Phyllanthus urinaria*, *Ruellia blechum*, *Sideroxylon foetidissimum*, *Solanum torvum*, *Terminalia catappa*, and *Zanthoxylum caribaeum*



Figure A-8—(A) General view of the site and (B) sapling of *Licaria triandra*, a tree species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Restored Forest Site 6

Ecological Life Zone: Subtropical moist forest

Location: Bo. Tierras Nuevas Poniente, municipality of Manatí, PR

Site Description and Disturbance History: The site (fig. A-9) is located on a lowland plain at an elevation of approximately 5 m above sea level, near floodplain areas, with an estimated slope of 0 percent and estimated canopy cover of 90.3 percent. It is a plantation of trees as part of a mitigation/restoration project (planting started in early 2013 in a former sugarcane field and subsequently a seasonally flooded herbaceous vegetation wetland). Water ditches and a dirt road are nearby. This site is prone to flooding; some areas around the site were mildly flooded at the time the vegetation inventory was conducted (ankle-deep water and mud).

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: This site is dominated by trees and shrubs of *Annona glabra* (planted and recruited), followed by planted palm trees of *Roystonea borinquena*, as well as *Pterocarpus officinalis* trees. A planted *Spondias mombin* tree is also present within the site. Recruitment (seedlings and/or saplings) was observed in all planted species except for *S. mombin*. Notable understory species are *Acrostichum danaeifolium*, *Cissus verticillata*, *Trichostigma octandrum*, *Zanthoxylum caribaeum*, and *Lygodium japonicum*.

Associated Species: *Calophyllum antillanum*, *Hibiscus tiliaceus* var. *pernambucensis*, *Paspalum fasciculatum*, and *Thelypteris dentata*



Figure A-9—(A) General view of the site and (B) pinnae of *Lygodium japonicum*, a climbing fern observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Secondary Forest Site 1

Ecological Life Zone: Subtropical moist forest

Location: Bo. Las Palmas, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-10) is located on a footslope at an elevation of approximately 296 m above sea level, near a small creek, with an estimated slope of 21.2 percent and estimated canopy cover of 95.8 percent. There are no signs of recent disturbances at the site. The area's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: Dominant tree species are *Inga nobilis* ssp. *quaternata*, *Guarea guidonia*, and *Ocotea leucoxylon*, while secondary dominant tree species are *Psidium guajava* and *Cupania americana*. Woody understory species are mostly shrubs of *Inga nobilis* ssp. *quaternata*, *Ocotea leucoxylon*, *Ocotea floribunda*, and *Psidium guajava*. Notable nonwoody understory species are mostly *Syngonium podophyllum*, *Tectaria incisa*, and *Dieffenbachia seguine*. Additional minor or less represented species include *Andira inermis*, *Blechnum occidentale*, *Casearia guianensis*, *Casearia sylvestris*, *Paullinia pinnata*, *Phytolacca rivinoides*, *Piper glabrescens*, *Cissus verticillata*, *Syzygium jambos*, and *Erythroxylon hirtella*.

Associated Species: *Alsophila portoricensis*, *Artocarpus altalis*, *Cecropia schreberiana* ssp. *schreberiana*, *Costus guianensis* var. *macrostrobilus*, *Hymenaea courbaril*, *Inga vera*, *Miconia impatiolalis*, *Piper hispidum*, and *Xanthosoma violaceum*



Figure A-10—(A) General view of the site and (B) *Syngonium podophyllum* vines, commonly seen throughout the understory. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Secondary Forest Site 2

Ecological Life Zone: Subtropical moist forest

Location: Bo. Las Palmas, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-11) is located on a footslope at an elevation of approximately 290 m above sea level, near a small creek, with an estimated slope of 35.3 percent and estimated canopy cover of 90.4 percent. There are no signs of recent disturbances at the site. The area's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species throughout the site is *Guarea guidonia*, although *Zanthoxylum martinicense* and *Chrysophyllum argenteum* are also present. The understory is mostly dominated by *Guarea guidonia* seedlings/saplings and *Syngonium podophyllum* vines. Other understory species include *Inga vera*, *Cissus verticillata*, and *Blechnum occidentale*. Other secondary species include *Piper amalago*, *Piper glabrescens*, *Syzygium jambos*, *Inga laurina*, *Andira inermis*, and *Trichostigma octandrum*.

Associated Species: *Artocarpus altilis*, *Calophyllum antillanum*, *Cecropia schreberiana* ssp. *schreberiana*, *Chromolaena odorata*, *Citrus × aurantium*, *Clidemia hirta*, *Cordia sulcata*, *Dioscorea bulbifera*, *Erythroxylon hirtella*, *Gouania polygama*, *Miconia laevigata*, *Mucuna pruriens*, *Piper hispidum*, *Piper jacquemontianum*, *Piper aduncum*, and *Zanthoxylum martinicense*



Figure A-11—(A) General view of the site and (B) a view of the understory showing mostly *Blechnum occidentale* ferns. Forest Service photos by Johann D. Crespo-Zapata.

Secondary Forest Site 3

Ecological Life Zone: Subtropical moist forest

Location: Bo. Caonillas Arriba, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-12) is located on an upper backslope at an elevation of approximately 455 m above sea level, with an estimated slope of 35.3 percent and estimated canopy cover of 94.5 percent. Low-density urban development is nearby. There are no signs of recent disturbances at the site. The area's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species is *Guarea guidonia*, followed by shrubs/small trees of *Casearia sylvestris*. A notable additional tree species is *Mangifera indica*. The understory is mostly dominated by *Guarea guidonia* seedlings/saplings, although other notable woody understory species include shrubs of *Ocotea leucoxyton*, *Ocotea floribunda*, and *Casearia sylvestris*. Other notable understory species include lianas and ferns such as *Gouania polygama*, *Blechnum occidentale*, and *Adiantum pyramidale*. Additional minor or less represented understory species include *Miconia impetiolaris*, *Annona muricata*, *Piper amalago*, *Piper hispidum*, *Coffea liberica* var. *liberica*, *Cordia sulcata*, *Schefflera morototoni*, *Piper glabrescens*, and *Roystonea borinquena*.

Associated Species: *Chromolaena odorata* and *Miconia prasina*



Figure A-12—(A) General view of the site and (B) one of a few *Miconia impetiolaris* shrubs observed in the understory. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Secondary Forest Site 4

Ecological Life Zone: Subtropical moist forest

Location: Bo. Caonillas Arriba, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-13) is located on an upper backslope at an elevation of approximately 288 m above sea level, with an estimated slope of 56.5 percent and estimated canopy cover of 44 percent. An abandoned or unfrequented dirt road is nearby. Possible landslide and abandoned horticulture areas are also nearby. The area's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species throughout the site is *Cecropia schreberiana* ssp. *schreberiana*. The understory is mostly dominated by herbs and vines such as *Dissotis rotundifolia* and *Iresine diffusa*. Other understory species include *Trema micrantha*, *Rubus rosifolius*, and *Vigna vexillata*. Additional minor or less represented secondary understory species include *Piper hispidum*, *Piper amalago*, *Guarea guidonia*, *Tournefortia hirsutissima*, *Urena lobata*, *Clidemia hirta*, and *Oxalis debilis* var. *corymbosa*.

Associated Species: *Canna indica*, *Cupania americana*, *Gouania polygama*, *Spathodea campanulata*, and *Trichostigma octandrum*



Figure A-13—(A) General view of the site and (B) a view of the understory showing ferns, shrubs, herbs, vines, and lianas. Forest Service photos by Johann D. Crespo-Zapata.

Secondary Forest Site 5

Ecological Life Zone: Subtropical wet forest

Location: Bo. Saliente, municipality of Jayuya, PR

Site Description and Disturbance History: The site (fig. A-14) is located on a lower backslope at an elevation of approximately 785 m above sea level, with an estimated slope of 35.3 percent and estimated canopy cover of 93.3 percent. An unfrequented dirt trail is nearby. The area's historical land use includes mostly coffee plantations.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species is *Guarea guidonia*. Notable additional trees are *Prunus occidentalis*, *Cordia alliodora*, *Guapira fragrans*, *Famea occidentalis*, and *Ocotea leucoxydon*. Woody understory species are mostly shrubs and saplings of *Prunus occidentalis*, followed by shrubs of *Famea occidentalis* and saplings/seedlings of *Guarea guidonia* and *Prestoea acuminata* var. *montana*. Notable nonwoody understory species are mostly *Arachniodes chaerophylloides*, *Thelypteris poiteana*, and *Blechnum occidentale* ferns. Other understory species include lianas, grasses, and herbs such as *Paullinia pinnata*, *Trichostigma octandrum*, *Macfadyena unguis-cati*, *Cydista aequinoctialis*, *Pharus lappulaceus*, and *Xanthosoma acevedoi*. Additional minor or less represented secondary species include *Nectandra patens*, *Lycianthes virgata*, *Lasiacis sorghoidea*, *Byrsonima spicata*, *Myrcia splendens*, *Casearia decandra*, *Cestrum macrophyllum*, and *Gonolobus stephanotrichus*.

Associated Species: *Adiantum pyramidale*, *Andira inermis*, *Buchenavia tetraphylla*, *Casearia sylvestris*, *Clusia rosea*, *Dendropanax arboreus*, *Dieffenbachia seguine*, *Ficus citrifolia*, *Ficus trigonata*, *Guapira fragrans*, and *Pisonia roqueae*

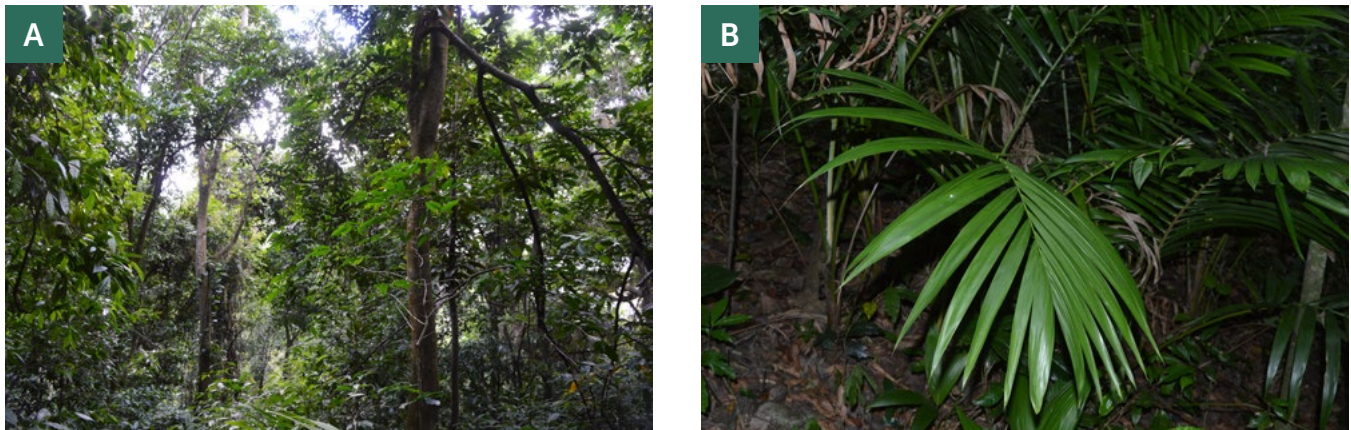


Figure A-14—(A) General view of the site and (B) saplings of *Prestoea acuminata* var. *montana* observed in the understory. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Secondary Forest Site 6

Ecological Life Zone: Subtropical dry forest

Location: Bo. Sabana Yeguas, municipality of Lajas, PR

Site Description and Disturbance History: The site (fig. A-15) is located on a lowland plain at an elevation of approximately 33 m above sea level, with an estimated slope of 0 percent and estimated canopy cover of 87.3 percent. It is an abandoned or unmanaged *Swietenia macrophylla* plantation near a grazing field used by cows for shade and resting (cows were absent at the time the vegetation inventory was conducted). The trees were planted 40+ years ago. An active road and low-density urban development are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: This site is dominated by planted trees of *Swietenia macrophylla*. Notable additional trees are *Melicoccus bijugatus*, *Andira inermis*, and *Cordia laevigata*. Woody understory species include *Schaefferia frutescens*, *Trichilia hirta*, *Adelia ricinella*, *Randia aculeata*, *Thespesia grandiflora*, and *Bourreria succulenta*. Other notable understory species include *Triumfetta lappula*, *Achyranthes aspera* var. *aspera*, *Commelina diffusa* var. *diffusa*, *Cynodon nlemfuensis*, *Tragia volubilis*, *Jasminum fluminense*, and *Passiflora suberosa*.

Associated Species: *Asystasia gangetica* ssp. *micrantha*, *Casearia aculeata*, *Cestrum diurnum*, *Corchorus siliquosus*, *Cordia collococca*, *Cynophalla flexuosa*, *Desmanthus virgatus*, *Desmodium incanum*, *Inga laurina*, *Jatropha gossypifolia*, *Leucaena leucocephala*, *Malvastrum corchorifolium*, *Melicoccus bijugatus*, *Mimosa pudica* var. *unijuga*, *Phyllanthus urinaria*, *Senna siamea*, *Sida rhombifolia*, *Solanum bahamense*, *Sterculia apetala*, *Tamarindus indica*, and *Trichostigma octandrum*



Figure A-15—(A) General view of the site and (B) details of a *Swietenia macrophylla* trunk, the dominant tree within the site. Forest Service photos by Johann D. Crespo-Zapata.

Secondary Forest Site 7

Ecological Life Zone: Subtropical dry forest

Location: Bo. Boquerón, municipality of Cabo Rojo, PR

Site Description and Disturbance History: The site (fig. A-16) is located on a coastal plain at an elevation of approximately 12 m above sea level, with an estimated slope of 7 percent and estimated canopy cover of 85.3 percent. It is an abandoned hiking/biking trail area. A frequented mountain biking, motorcycling, and hiking trail/dirt road is nearby. This site is located in an area primarily used for mountain biking and motorcycling.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species is *Tabebuia heterophylla*. A notable additional tree species is *Bursera simaruba*. Other woody species are mostly shrubs of *Amyris elemifera* and *Thouinia striata* var. *striata*, followed by *Sideroxylon salicifolium*, *Jacquinia arborea*, *Zanthoxylum monophyllum*, and *Pictetia aculeata*. Notable understory species include other shrubs such as *Croton glabellus* ssp. *polytrichus*, *Eugenia rhombea*, *Comocladia dodonaea*, *Erythroxylum areolatum*, *Krugiodendron ferreum*, and *Croton betulinus*, followed by vines and lianas such as *Distictis lactiflora*, *Heteropterys purpurea*, *Senegalia westiana*, and *Chiococca alba*. Additional minor or less represented secondary species include other vines and herbs such as *Tournefortia scabra*, *Jacquemontia cumanensis*, *Galactia striata*, *Siphonoglossa sessilis*, and *Oeceoclades maculata*.

Associated Species: *Bromelia pinguin*, *Cordia rickseckeri*, *Cynophalla flexuosa*, *Samyda dodecandra*, *Stigmaphyllon emarginatum*, and *Zanthoxylum flavum*



Figure A-16—(A) General view of the site and (B) details of a *Bursera simaruba* trunk, a tree species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Secondary Forest Site 8

Ecological Life Zone: Subtropical dry forest

Location: Bo. Boquerón, municipality of Cabo Rojo, PR

Site Description and Disturbance History: The site (fig. A-17) is located on a coastal plain at an elevation of approximately 10 m above sea level, with an estimated slope of 7 percent and estimated canopy cover of 60.4 percent. A mountain biking, motorcycling, and hiking trail/dirt road is nearby. This site is located in an area primarily used for mountain biking and motorcycling.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species is *Tamarindus indica*. Other woody species include *Crescentia linearifolia*, *Guapira fragrans*, *Capparis hastata*, *Pithecellobium unguis-cati*, and *Zanthoxylum monophyllum*. The understory is mostly dominated by shrubs of *Guapira fragrans*, followed by *Cynophalla flexuosa*, *Bromelia pinguin*, *Jasminum fluminense*, and *Serjania polyphylla*. Other notable understory species include shrubs of *Jacquinia arborea*, *Rochefortia acanthophora*, *Randia aculeata*, and *Adelia ricinella*, followed by saplings of *Guaiaacum officinale* and *Bouyeria succulenta*, as well as vines such as *Macfadyena unguis-cati* and *Cydista aequinoctialis*. Other understory species include herbs, vines, epiphytes, and cacti such as *Argythamnia candicans*, *Commelina diffusa* var. *diffusa*, *Rivina humilis*, *Stigmaphyllon emarginatum*, *Tillandsia recurvata*, and *Opuntia repens*.

Associated Species: *Croton betulinus*, *Desmodium scorpiurus*, *Exostema caribaeum*, *Hylocereus trigonus*, *Krugiodendron ferreum*, *Myriopus volubilis*, *Pilosocereus royenii*, *Piscidia carthagenensis*, *Prosopis juliflora*, *Ruellia tuberosa*, *Schaefferia frutescens*, and *Trichilia hirta*



Figure A-17—(A) General view of the site and (B) inflorescence of *Bromelia pinguin*, a bromeliad observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Secondary Forest Site 9

Ecological Life Zone: Subtropical moist forest

Location: Bo. Quebrada Fajardo, municipality of Fajardo, PR

Site Description and Disturbance History: The site (fig. A-18) is located on a lowland plain at an elevation of approximately 13 m above sea level, with an estimated slope of 7 percent and estimated canopy cover of 95.6 percent. It is a secondary forest near a grazing area, used by feral cows for shade and resting (cows were absent at the time the vegetation inventory was conducted). Frequent feral cattle trails and urban development are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species is *Peltophorum pterocarpum*. A notable additional tree species is *Andira inermis*. The understory is mostly dominated by saplings and shrubs of *Peltophorum pterocarpum*, as well as vines and lianas of *Paullinia pinnata* and *Heteropterys laurifolia*. Other understory species include shrubs of *Miconia laevigata*, *Cordia dichotoma*, *Casearia sylvestris*, and *Melicoccus bijugatus*, followed by lianas of *Hippocratea volubilis* and saplings of *Andira inermis* and *Guapira fragrans*. Additional minor or less represented species include shrubs, herbs, vines, and ferns such as *Cestrum laurifolium*, *Casearia decandra*, *Eugenia biflora*, *Oeceoclades maculata*, *Desmodium incanum*, *Teliostachya alopecuroidea*, *Gouania lupuloides*, *Mimosa ceratonia*, *Chiococca alba*, *Thelypteris dentata*, and *Thelypteris tetragona*.

Associated Species: *Achyranthes aspera* var. *aspera*, *Adiantum latifolium*, *Bourreria succulenta*, *Bursera simaruba*, *Casearia guianensis*, *Chromolaena odorata*, *Cissampelos pareira*, *Cissus verticillata*, *Commelina diffusa* var. *diffusa*, *Cordia collococca*, *Elephantopus mollis*, *Erythroxylum brevipes*, *Ficus trigonata*, *Ixora coccinea*, *Oplismenus hirtellus* ssp. *setarius*, *Petiveria alliacea*, *Piper amalago*, *Senna bicapsularis*, *Sphagnetica trilobata*, and *Terminalia catappa*



Figure A-18—(A) General view of the site and (B) branch/leaves of *Miconia laevigata*, a shrub observed in the understory. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Secondary Forest Site 10

Ecological Life Zone: Subtropical moist forest

Location: Bo. Hato Candal, municipality of Río Grande, PR

Site Description and Disturbance History: The site (fig. A-19) is located on a lowland plain at an elevation of approximately 22 m above sea level, with an estimated slope of 7 percent and estimated canopy cover of 95.3 percent. It is a secondary forest patch near urban commercial and residential areas. Active roads/highway, urban development, and abandoned or unmanaged small-scale horticulture patches are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species is *Spathodea campanulata*. Notable additional tree species include *Zanthoxylum martinicense*, *Terminalia catappa*, *Albizia procera*, *Mangifera indica*, and a *Roystonea borinquena* palm. Other woody species include mostly small trees and shrubs of *Casearia guianensis*, followed by *Casearia sylvestris* and a single individual of *Ocotea leucoxylon*. The understory is dominated primarily by vines of *Syngonium podophyllum* and *Epipremnum aureum*, which were also observed in other strata and climbing over tree trunks toward the canopy. Other understory species include shrubs of *Casearia decandra*, *Guarea guidonia*, and *Calophyllum inophyllum*. Additional minor or less represented secondary species include vines and ferns such as *Cissus verticillata*, *Paullinia pinnata*, *Trichostigma octandrum*, *Adiantum latifolium*, *Phymatosorus grossus*, and *Campyloneurum phyllitidis*, as well as saplings of *Andira inermis*, *Cupania americana*, *Calophyllum antillanum*, and *Melicoccus bijugatus*.

Associated Species: *Ardisia elliptica*, *Cordia collococca*, *Hippocratea volubilis*, *Miconia impetiolaris*, *Passiflora edulis*, *Syzygium jambos*, *Thelypteris dentata*, and *Thelypteris tetragona*



Figure A-19—(A) General view of the site and (B) trunk of *Spathodea campanulata*, the dominant tree species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Secondary Forest Site 11

Ecological Life Zone: Subtropical moist forest

Location: Bo. Juan Martín, municipality of Luquillo, PR

Site Description and Disturbance History: The site (fig. A-20) is located on a coastal plain area at an elevation of approximately 10 m above sea level, near a river, with an estimated slope of 0 percent and estimated canopy cover of 94.1 percent. It is a secondary forest near grazing areas, used by cows for shade and resting (cows were present at the time the vegetation inventory was conducted). Frequented cattle trails and dirt roads are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species is mostly *Andira inermis*, followed by *Terminalia catappa*. Notable additional tree species include *Calophyllum antillanum* and a *Roystonea borinquena* palm. The understory is dominated primarily by vines of *Epipremnum pinnatum* and *Syngonium podophyllum*, which were also observed in other strata and climbing over tree trunks towards the canopy. Other notable understory species include shrubs of *Inga laurina*, *Eugenia biflora*, *Mammea americana*, and *Cinnamomum elongatum*. Other notable species include vines and lianas of *Dioscorea chondrocarpa*, *Heteropterys laurifolia*, *Paullinia pinnata*, *Hippocratea volubilis*, and *Trichostigma octandrum*. Additional minor or less represented secondary species include *Xanthosoma acevedoi*, *Dieffenbachia seguine*, *Costus pictus*, *Casearia sylvestris*, and *Petiveria alliacea*.

Associated Species: *Achyranthes aspera* var. *aspera*, *Casearia guianensis*, *Chrysophyllum argenteum*, *Chrysophyllum oliviforme*, *Colocasia esculenta*, *Genipa americana*, *Gonzalagunia hirsuta*, *Guarea guidonia*, *Hernandia sonora*, *Mangifera indica*, *Melicoccus bijugatus*, *Peltophorum pterocarpum*, *Spathodea campanulata*, *Thelypteris tetragona*, and *Thunbergia fragrans*



Figure A-20—(A) General view of the site and (B) stipels/leaflets of *Andira inermis*, a dominant tree species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Secondary Forest Site 12

Ecological Life Zone: Subtropical moist forest

Location: Bo. Tierras Nuevas Poniente, municipality of Manatí, PR

Site Description and Disturbance History: The site (fig. A-21) is located on a lowland plain at an elevation of approximately 0 m above sea level, near a stream, with an estimated slope of 0 percent and estimated canopy cover of 91.2 percent. A frequented dirt road and abandoned hiking trails are nearby. This site is somewhat prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species is mostly *Terminalia catappa*, followed by *Spathodea campanulata*. Notable additional tree species are single individuals of *Cupania americana* and *Calophyllum antillanum*. Other woody species include mostly shrubs of *Licaria triandra* and *Casearia guianensis*, followed by *Guarea guidonia*, *Eugenia biflora*, *Randia aculeata*, *Cordia laevigata*, and *Thespesia grandiflora*. Other notable understory species are vines of *Trichostigma octandrum* and *Serjania polyphylla*, as well as seedlings of *Cupania americana* and saplings of *Calophyllum antillanum*, *Roystonea borinquena*, and *Terminalia catappa*. Additional minor or less represented secondary species include mostly seedlings and saplings of *Picramnia pentandra*, *Andira inermis*, *Casearia decandra*, *Bursera simaruba*, *Annona glabra*, and *Erythroxylum brevipes*, as well as herbs and vines such as *Desmodium incanum*, *Vigna vexillata*, and *Jasminum fluminense*.

Associated Species: *Acrocomia media*, *Acrostichum danaeifolium*, *Amphitecna latifolia*, *Citharexylum spinosum*, *Coccoloba venosa*, *Commelina diffusa* var. *diffusa*, *Cordia dichotoma*, *Cynodon dactylon*, *Cyperus giganteus*, *Eichhornia crassipes*, *Guapira fragrans*, *Ipomoea tiliacea*, *Mimosa pigra*, *Nectandra coriacea*, *Oxycaryum cubense*, *Paspalum fasciculatum*, *Polygonum acuminatum*, *Saccharum spontaneum*, *Salvinia minima*, *Tournefortia hirsutissima*, *Typha domingensis*, and *Urochloa mutica*



Figure A-21—(A) General view of the site and (B) sapling of *Calophyllum antillanum*, a tree species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Secondary Forest Site 13

Ecological Life Zone: Subtropical moist forest

Location: Bo. Tierras Nuevas Poniente, municipality of Manatí, PR

Site Description and Disturbance History: The site (fig. A-22) is located on a lowland plain at an elevation of approximately 0 m above sea level, near a stream, with an estimated slope of 0 percent and estimated canopy cover of 92.8 percent. A frequented dirt road nearby. This site is somewhat prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species is *Terminalia catappa*. Other tree species are *Cupania americana* and a single individual of *Albizia procera*. The understory is mostly dominated by vines and lianas of *Trichostigma octandrum*, followed by small shrubs of *Eugenia biflora*, *Casearia guianensis*, *Cupania americana*, *Terminalia catappa*, *Randia aculeata*, and *Mimosa pigra*. Other notable understory species are vines and lianas of *Paullinia pinnata* and saplings of *Roystonea borinquena*. Additional minor or less represented species include saplings of *Pithecellobium dulce* and *Cordia laevigata* and seedlings of *Erythroxylum brevipes*, as well as herbs, vines, and graminoids such as *Commelina diffusa* var. *diffusa*, *Desmodium incanum*, *Cissus verticillata*, *Jasminum fluminense*, and *Cynodon dactylon*.

Associated Species: *Acrocomia media*, *Acrostichum aureum*, *Acrostichum danaeifolium*, *Calophyllum antillanum*, *Citharexylum spinosum*, *Coccoloba diversifolia*, *Coccoloba venosa*, *Cyperus giganteus*, *Lygodium japonicum*, *Muntingia calabura*, *Paspalum fasciculatum*, *Saccharum spontaneum*, *Spathodea campanulata*, *Spermacoce remota*, *Thespesia grandiflora*, *Trichilia hirta*, *Typha domingensis*, and *Zanthoxylum martinicense*



Figure A-22—(A) General view of the site and (B) fruits/leaves of *Terminalia catappa*, the dominant species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Secondary Forest Site 14

Ecological Life Zone: Subtropical moist forest

Location: Bo. Quebrada Vueltas, municipality of Fajardo, PR

Site Description and Disturbance History: The site (fig. A-23) is located on a lowland plain at an elevation of approximately 5 m above sea level, near a stream, with an estimated slope of 0 percent and estimated canopy cover of 90 percent. It is a secondary forest patch near urban commercial and residential areas. A frequented dirt road, active roads, and urban development are nearby. This site is likely prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species is mostly *Peltophorum pterocarpum*, followed by palm trees of *Roystonea borinquena*. An *Andira inermis* tree is also present within the site. The understory is mostly dominated by shrubs and saplings of *Peltophorum pterocarpum*, followed by vines and lianas of *Trichostigma octandrum* and *Paullinia pinnata*. Minor or less represented secondary species are *Casearia guianensis*, *Guapira fragrans*, *Cordia dichotoma*, and *Acrostichum danaeifolium*.

Associated Species: *Achyranthes aspera* var. *aspera*, *Annona glabra*, *Bursera simaruba*, *Calophyllum inophyllum*, *Cissus verticillata*, *Citharexylum spinosum*, *Cocos nucifera*, *Commelina diffusa* var. *diffusa*, *Cordia collococca*, *Cynophalla flexuosa*, *Cyperus alternifolius* ssp. *flabelliformis*, *Erythroxylum brevipes*, *Eugenia biflora*, *Guettarda scabra*, *Heteropterys laurifolia*, *Ipomoea tiliacea*, *Leucaena leucocephala*, *Machaerium lunatum*, *Melicoccus bijugatus*, *Melochia nodiflora*, *Mikania micrantha*, *Mimosa pigra*, *Momordica charantia*, *Muntingia calabura*, *Oeceoclades maculata*, *Ouratea litoralis*, *Paspalum fasciculatum*, *Passiflora suberosa*, *Petiveria alliacea*, *Pithecellobium dulce*, *Randia aculeata*, *Ricinus communis*, *Ruellia simplex*, *Samanea saman*, *Sansevieria hyacinthoides*, *Senna bicapsularis*, *Senna spectabilis*, *Tabebuia heterophylla*, *Terminalia catappa*, *Tournefortia hirsutissima*, and *Urochloa mutica*



Figure A-23—(A) General view of the site and (B) leaf of *Peltophorum pterocarpum*, the dominant species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Secondary Forest Site 15

Ecological Life Zone: Subtropical moist forest

Location: Bo. Guzmán Abajo, municipality of Río Grande, PR

Site Description and Disturbance History: The site (fig. A-24) is located on a lowland plain at an elevation of approximately 12 m above sea level, near a stream, with an estimated slope of 0 percent and estimated canopy cover of 95.6 percent. It is a secondary forest patch near sports stadiums, as well as urban commercial and residential areas. Active roads/highways and urban development are nearby. This site is prone to flooding; some areas around the site were mildly flooded at the time the vegetation inventory was conducted (ankle-deep water and mud). Despite this site's location and species composition, it appears to be a natural (nonplanted) forest. No evidence or insight of any mitigation/restoration project in the area was found to suggest otherwise.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species is *Pterocarpus officinalis*. Other tree species are *Terminalia catappa* and *Nectandra coriacea*. Additional woody species include shrubs of *Guarea guidonia*, *Calophyllum antillanum*, *Casearia guianensis*, *Albizia procera*, and *Citharexylum spinosum*. The understory is mostly dominated by saplings and shrubs of *Pterocarpus officinalis*, followed by *Adiantum latifolium* ferns. Other notable species include vines and lianas of *Hippocratea volubilis* and *Heteropterys laurifolia*. Minor species include *Piper aduncum*, *Miconia prasina*, *Thelypteris reticulata*, and *Microgramma lycopodioides*.

Associated Species: *Acrostichum danaeifolium*, *Amphitecna latifolia*, *Canna glauca*, *Cecropia schreberiana* ssp. *schreberiana*, *Cocos nucifera*, *Commelina diffusa* var. *diffusa*, *Cupania americana*, *Cyperus giganteus*, *Desmodium adscendens*, *Dissotis rotundifolia*, *Hygrophila costata*, *Ipomoea setifera*, *Miconia impatiolalis*, *Miconia racemosa*, *Peltophorum pterocarpum*, *Pueraria phaseoloides*, *Scleria microcarpa*, *Spathodea campanulata*, *Tectaria incisa*, *Thalia geniculata*, *Thelypteris poiteana*, *Tournefortia hirsutissima*, *Trichostigma octandrum*, and *Tripogandra serrulata*



Figure A-24—(A) General view of the site and (B) sapling of *Pterocarpus officinalis*, the dominant species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Secondary Forest Site 16

Ecological Life Zone: Subtropical moist forest

Location: Bo. Guzmán Abajo, municipality of Río Grande, PR

Site Description and Disturbance History: The site (fig. A-25) is located on a lowland plain at an elevation of approximately 13 m above sea level, with an estimated slope of 7 percent and estimated canopy cover of 91.1 percent. It is a secondary forest patch near sports stadiums, as well as urban commercial and residential areas. Active roads/highways and urban development are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species is *Guarea guidonia*, followed by *Peltophorum pterocarpum* and *Albizia procera*. Additional woody species are small trees and shrubs of *Casearia guianensis* and *Cupania americana*. Other notable species include lianas and vines of *Trichostigma octandrum*, *Pisonia aculeata*, and *Paullinia pinnata*. Minor or less represented species include small shrubs of *Casearia decandra*, *Ocotea leucoxylon*, and *Nectandra turbacensis*, as well as herbs, vines, and ferns such as *Oeceoclades maculata*, *Petiveria alliacea*, *Cissus verticillata*, *Jasminum fluminense*, and *Adiantum latifolium*.

Associated Species: *Casearia sylvestris*, *Citharexylum spinosum*, *Commelina diffusa* var. *diffusa*, *Guapira fragrans*, *Miconia impetolaris*, *Nephrolepis multiflora*, *Pharus latifolius*, *Piper aduncum*, *Syngonium podophyllum*, *Thelypteris dentata*, *Tournefortia hirsutissima*, and *Urochloa maxima*



Figure A-25—(A) General view of the site and (B) fruit/seedpod of *Oeceoclades maculata*, an orchid observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Secondary Forest Site 17

Ecological Life Zone: Subtropical moist forest

Location: Bo. Mameyes II, municipality of Río Grande, PR

Site Description and Disturbance History: The site (fig. A-26) is located on a lowland plain at an elevation of approximately 18 m above sea level, near a stream, with an estimated slope of 7 percent and estimated canopy cover of 94 percent. It is a secondary forest patch near urban commercial and residential areas. An active road and urban development are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species is *Guarea guidonia*. Other trees include *Pterocarpus indicus* and *Andira inermis*. Additional woody species include shrubs of *Urera baccifera*, *Nectandra turbacensis*, and *Casearia guianensis*. The understory is primarily dominated by *Costus pictus* herbs, followed by vines and lianas of *Syngonium podophyllum* and *Stigmaphyllon puberum*. Other species include *Alpinia purpurata*, *Xiphidium caeruleum*, *Odontonema cuspidatum*, *Costus scaber*, *Epipremnum aureum*, and *Macfadyena unguis-cati*.

Associated Species: *Adiantum pyramidale*, *Adiantum tetraphyllum*, *Blechnum occidentale*, *Bolbitis nicotianifolia*, *Calathea lutea*, *Campyloneurum phyllitidis*, *Caryota mitis*, *Chrysophyllum argenteum*, *Cinnamomum elongatum*, *Cissus verticillata*, *Colocasia esculenta*, *Commelina diffusa* var. *diffusa*, *Cordyline fruticosa*, *Cyathea arborea*, *Cyperus alternifolius* ssp. *flabelliformis*, *Dendropanax arboreus*, *Dracaena fragrans*, *Dypsis lutescens*, *Eucharis amazonica*, *Gonzalagunia hirsuta*, *Hemigraphis reptans*, *Hernandia sonora*, *Hirtella triandra*, *Inga laurina*, *Inga vera*, *Lagerstroemia speciosa*, *Miconia impetolaris*, *Microgramma piloselloides*, *Mikania micrantha*, *Morinda citrifolia*, *Musa acuminata*, *Oeceoclades maculata*, *Olyra latifolia*, *Pachystachys spicata*, *Pennisetum purpureum*, *Pimenta racemosa*, *Piper hispidum*, *Pisonia aculeata*, *Polyscias guilfoylei*, *Psychotria grandis*, *Pueraria phaseoloides*, *Ruellia simplex*, *Selaginella plana*, *Syzygium jambos*, *Syzygium malaccense*, *Tectaria incisa*, *Thelypteris dentata*, *Thelypteris poiteana*, *Thelypteris reticulata*, *Turpinia occidentalis*, and *Xanthosoma sagittifolium*



Figure A-26–(A) General view of the site and (B) young leaves of *Stigmaphyllon puberum*, a vine/liana observed in the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Secondary Forest Site 18

Ecological Life Zone: Subtropical moist forest

Location: Bo. Río Turabo, municipality of Caguas, PR

Site Description and Disturbance History: The site (fig. A-27) is located on a lower backslope at an elevation of approximately 140 m above sea level, with an estimated slope of 28.2 percent and estimated canopy cover of 84.8 percent. An abandoned/unfrequented utility pole access road, an active road/highway, and urban development are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha) and variable-radius plot

Summarized Inventory Species: The dominant tree species is *Spathodea campanulata*. Other notable tree species are *Albizia procera*, *Guarea guidonia*, *Cordia sulcata*, *Casearia guianensis*, and *Guapira fragrans*. Additional woody species include shrubs of *Cupania americana*, *Nectandra turbacensis*, *Senna nitida*, *Cecropia schreberiana* ssp. *schreberiana*, *Casearia decandra*, and *Casearia sylvestris*. Other notable species include vines and lianas of *Paullinia pinnata* and *Hippocratea volubilis*, followed by *Nephrolepis multiflora* and *Adiantum latifolium* ferns. Minor or less represented species include herbs and vines such as *Dissotis rotundifolia*, *Vigna hosei*, and *Ipomoea tiliacea*, as well as seedlings and/or saplings of *Roystonea borinquena*, *Miconia laevigata*, *Miconia prasina*, and *Citharexylum spinosum*.

Associated Species: *Bambusa vulgaris*, *Commelina diffusa* var. *diffusa*, *Eugenia biflora*, *Oxalis barrelieri*, *Pueraria phaseoloides*, *Schefflera morototoni*, *Sphagneticola trilobata*, and *Urochloa maxima*



Figure A-27—(A) General view of the site and (B) flower/leaves of *Dissotis rotundifolia*, a creeping herb observed in the site. Forest Service photos by Johann D. Crespo-Zapata.

Shrubland Site 1

Ecological Life Zone: Subtropical moist forest

Location: Bo. Caonillas Arriba, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-28) is located on a mountain shoulder area at an elevation of approximately 374 m above sea level, with an estimated slope of 21.2 percent and estimated canopy cover of 16.8 percent. An abandoned or unfrequented dirt road is nearby. Possible landslide and abandoned horticulture areas are also nearby. The area's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by *Nephrolepis multiflora* ferns, followed by *Gouania polygama*, *Pueraria phaseoloides*, *Ipomoea tiliacea*, and *Mikania micrantha* vines covering shrubs of *Casearia sylvestris*, *Miconia laevigata*, and *Clidemia hirta*. Also present are *Guarea guidonia*, *Cupania americana*, and *Spathodea campanulata* shrubs. Additional minor or less represented species include *Dissotis rotundifolia*, *Cissampelos pareira*, *Passiflora rubra*, *Centrosema virginianum*, *Scleria pterota*, and *Cynodon nlemfuensis*.

Associated Species: *Abrus precatorius*, *Andira inermis*, *Casearia guianensis*, *Commelina diffusa* var. *diffusa*, *Elephantopus mollis*, *Hippocratea volubilis*, *Iresine diffusa*, *Miconia prasina*, *Myrsine coriacea*, *Piper amalago*, *Psidium guajava*, *Schefflera morototoni*, *Securidaca virgata*, *Syngonium podophyllum*, and *Urena lobata*

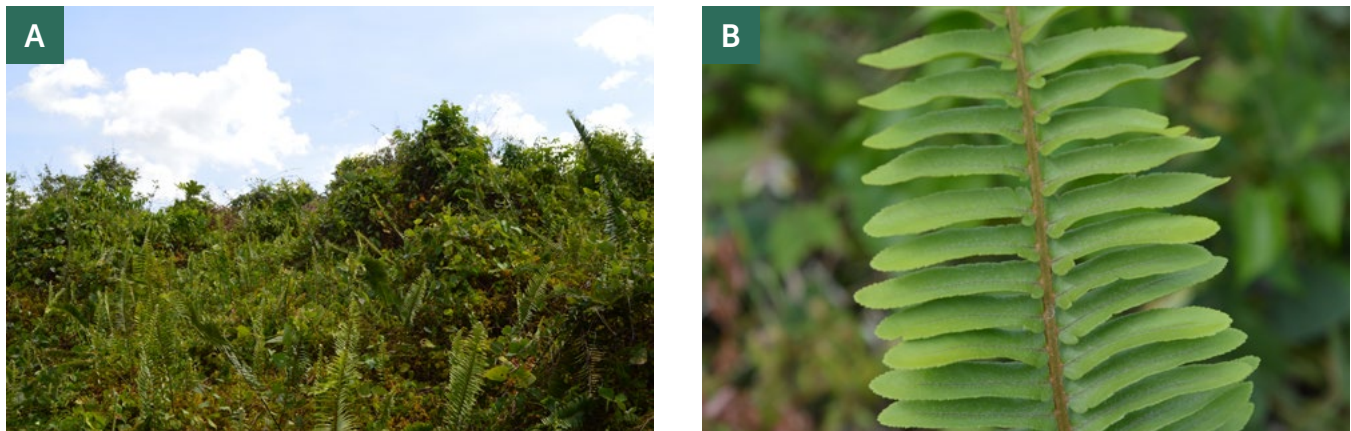


Figure A-28—(A) General view of the site and (B) pinnae of *Nephrolepis multiflora*, a common fern within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Shrubland Site 2

Ecological Life Zone: Subtropical moist forest

Location: Bo. Las Palmas, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-29) is located on a lower backslope at an elevation of approximately 299 m above sea level, with an estimated slope of 28.2 percent and estimated canopy cover of 31.3 percent. Low-density urban development is nearby. There are no signs of recent disturbances at the site. The area's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by *Gouania polygama* lianas mainly covering *Cordia polycephala* shrubs and *Chromolaena odorata* subshrubs. Other notable shrubs include *Miconia impatiolaris*, *Casearia guianensis*, *Triumfetta semitriloba*, *Cupania americana*, and *Psidium guajava*. Secondary or less represented species are vines, herbs, and subshrubs such as *Ipomoea setifera*, *Cissus verticillata*, *Pueraria phaseoloides*, *Mikania micrantha*, *Centrosema virginianum*, *Desmodium incanum*, and *Clidemia hirta*.

Associated Species: *Bambusa vulgaris*, *Cyathea arborea*, *Manihot esculenta*, *Passiflora rubra*, *Psidium guajava*, *Rhynchospora ciliata*, *Schefflera morototoni*, *Spondias dulcis*, *Urochloa maxima*, and *Zanthoxylum martinicense*



Figure A-29—(A) General view of the site and (B) details of *Clidemia hirta* leaves, a subshrub species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Shrubland Site 3

Ecological Life Zone: Subtropical moist forest

Location: Bo. Las Palmas, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-30) is located around an upper backslope at an elevation of approximately 299 m above sea level, with an estimated slope of 35.3 percent and estimated canopy cover of 46.5 percent. It is a possible landslide area. Additional possible landslide areas are nearby. The area's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by *Nephrolepis multiflora* ferns, followed by *Cyathea arborea* and *Odontosoria aculeata*. Shrub species include *Myrsine coriacea*, *Miconia laevigata*, *Piper aduncum*, and *Psidium guajava*. Notable additional species include *Securidaca virgata* lianas and *Sticherus bifidus* ferns. Additional minor or less represented secondary species include vines, lianas, grasses, and herbs such as *Ipomoea tiliacea*, *Pueraria phaseoloides*, *Syngonium podophyllum*, *Cissampelos pareira*, *Centrosema virginianum*, *Pennisetum purpureum*, *Melanthera nivea*, *Thunbergia alata*, *Gouania polygama*, *Spermacoce verticillata*, and *Stigmaphyllon floribundum*.

Associated Species: *Andira inermis*, *Cecropia schreberiana* ssp. *schreberiana*, *Cnemidaria horrida*, *Gonzalagunia hirsuta*, *Guarea guidonia*, *Hippocratea volubilis*, *Ichnanthus pallens* var. *pallens*, *Miconia impetioararis*, *Miconia prasina*, *Mucuna pruriens*, *Rubus rosifolius*, *Trema micrantha*, and *Vitis tiliifolia*



Figure A-30—(A) General view of the site and (B) a young *Cyathea arborea* frond, a common tree fern within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Shrubland Site 4

Ecological Life Zone: Subtropical dry forest

Location: Bo. Boquerón, municipality of Cabo Rojo, PR

Site Description and Disturbance History: The site (fig. A-31) is located on a coastal plain at an elevation of approximately 6 m above sea level, with an estimated slope of 0 percent and estimated canopy cover of 32.7 percent. A frequented mountain biking, motorcycling, and hiking trail/dirt road is nearby. This site is located in an area mostly used for mountain biking and motorcycling.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by *Pilosocereus royerii* cacti, followed by a variety of shrub species such as *Prosopis juliflora*, *Leucaena leucocephala*, *Zanthoxylum monophyllum*, and *Rochefortia acanthophora*. Other shrubs include *Cordia bullata* ssp. *humilis*, *Citharexylum spinosum*, *Capparis indica*, and *Randia aculeata*. Notable nonwoody species include *Urochloa maxima* and *Bothriochloa pertusa* grasses, as well as *Jasminum fluminense* and *Cissus trifoliata* vines. Other notable species include *Guaiacum officinale*, *Solanum bahamense*, *Lantana involucrata*, *Wissadula periplocifolia*, *Sida abutilifolia*, *Ruellia tuberosa*, and *Tillandsia recurvata*. Additional minor or less represented secondary species include other shrubs, subshrubs, herbs, and vines such as *Melochia nodiflora*, *Bastardia viscosa*, *Tamonea boxiana*, *Rauvolfia viridis*, *Desmodium scorpiurus*, *Cynophalla flexuosa*, *Passiflora pallida*, *Cucumis dipsaceus*, and *Clitoria ternatea*.

Associated Species: *Pithecellobium unguis-cati*

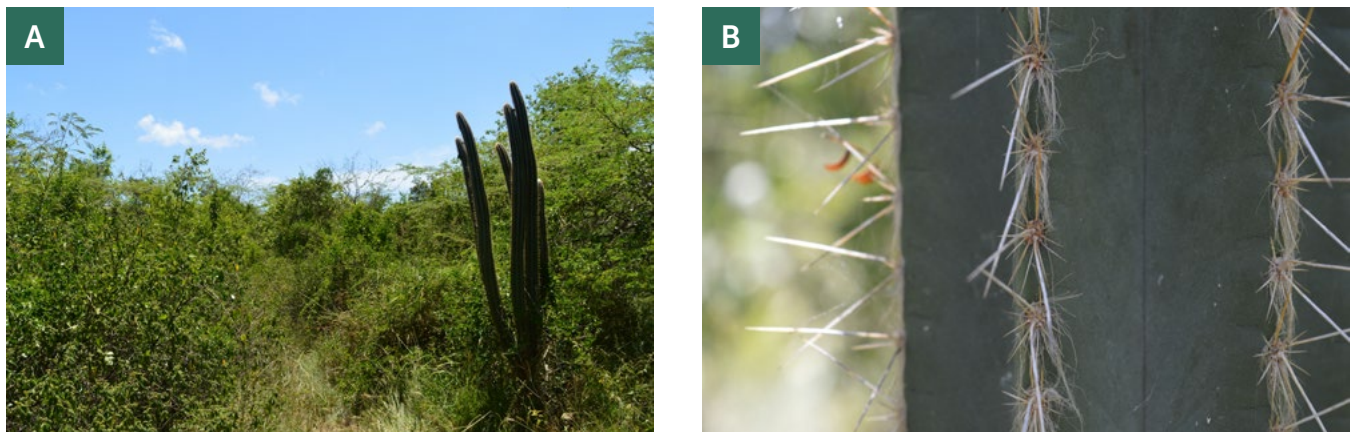


Figure A-31—(A) General view of the site and (B) stem details of *Pilosocereus royerii*, a common cactus within the site. Forest Service photos by Johann D. Crespo-Zapata.

Shrubland Site 5

Ecological Life Zone: Subtropical dry forest

Location: Bo. Boquerón, municipality of Cabo Rojo, PR

Site Description and Disturbance History: The site (fig. A-32) is located on a coastal plain at an elevation of approximately 6 m above sea level, with an estimated slope of 0 percent and estimated canopy cover of 49.5 percent. A frequented mountain biking, motorcycling, and hiking trail/dirt road is nearby. This site is located in an area mostly used for mountain biking and motorcycling.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by several shrub species, most notably *Crescentia linearifolia* and *Prosopis juliflora*, followed by *Tamarindus indica*, *Parkinsonia aculeata*, *Leucaena leucocephala*, and *Capparis indica*. Other shrubs include *Cordia bullata* ssp. *humilis*, *Bouyeria succulenta*, *Randia aculeata*, and *Zanthoxylum monophyllum*. Notable nonwoody species include vines such as *Metastelma decipiens* and *Jasminum fluminense*, as well as *Dalechampia scandens*. Other notable species include *Myriopus volubilis*, *Jatropha gossypifolia*, *Erythroxylum areolatum*, *Sida abutilifolia*, *Bothriochloa pertusa*, *Urochloa maxima*, and *Pilosocereus royerii*. Additional minor or less represented secondary species include other shrubs, vines, and herbs such as *Cryptostegia madagascariensis*, *Tragia volubilis*, *Cissus trifoliata*, *Passiflora pallida*, and *Commelina erecta*.

Associated Species: *Guapira fragrans* and *Waltheria indica*



Figure A-32—(A) General view of the site and (B) fruit/flowers of *Jatropha gossypifolia*, a subshrub observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Shrubland Site 6

Ecological Life Zone: Subtropical dry forest

Location: Bo. Pedernales, municipality of Cabo Rojo, PR

Site Description and Disturbance History: The site (fig. A-33) is located on a coastal plain at an elevation of approximately 17 m above sea level, with an estimated slope of 14.1 percent and estimated canopy cover of 68.1 percent. A frequented hiking/biking dirt trail is nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by *Leucaena leucocephala* shrubs, followed by *Pithecellobium unguis-cati* and vines of *Jasminum fluminense*. Other shrub species include *Bourreria succulenta*, *Schaefferia frutescens*, *Guapira fragrans*, *Comocladia dodonaea*, and *Cordia bullata* ssp. *humilis*. Other notable species are vines of *Tragia volubilis* and *Serjania polyphylla*, as well as subshrubs of *Tephrosia senna*. Additional minor or less represented secondary species include *Cissus trifoliata*, *Jacquemontia cumanensis*, *Myriopus volubilis*, *Commelina erecta*, *Erythroxylum brevipes*, *Zanthoxylum monophyllum*, *Bursera simaruba*, and *Cordia collococca*.

Associated Species: *Casearia guianensis*, *Desmanthus virgatus*, *Lasiacis divaricata*, *Melicoccus bijugatus*, *Oeceoclades maculata*, *Rauvolfia viridis*, and *Wissadula periplocifolia*



Figure A-33—(A) General view of the site and (B) flower of *Bourreria succulenta*, a common species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Shrubland Site 7

Ecological Life Zone: Subtropical moist forest

Location: Bo. Quebrada Fajardo, municipality of Fajardo, PR

Site Description and Disturbance History: The site (fig. A-34) is located on a lowland plain at an elevation of approximately 22 m above sea level, with an estimated slope of 14.1 percent and estimated canopy cover of 36.7 percent. It is a wilderness area used by feral horses (horses were absent at the time the vegetation inventory was conducted). Feral horse trails are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by a variety of shrub species, most notably *Randia aculeata*, *Casearia sylvestris*, and *Casearia guianensis*. Other shrubs include *Eugenia biflora*, *Cordia polycephala*, and *Lantana horrida*. Notable nonwoody species include mostly vines and herbs such as *Cissampelos pareira*, *Jasminum fluminense*, *Ipomoea setifera*, and *Scleria pterota*. Additional minor or less represented secondary species include *Vigna hosei*, *Centrosema virginianum*, *Passiflora foetida*, *Mimosa casta*, and *Desmodium incanum* vines, as well as subshrubs, graminoids, and herbs such as *Chromolaena odorata*, *Sida glomerata*, *Jatropha gossypifolia*, *Panicum laxum*, *Cynodon dactylon*, *Setaria parviflora*, *Cuphea strigulosa*, *Phyllanthus amarus*, and *Rolandra fruticosa*.

Associated Species: *Chamaecrista nictitans* var. *diffusa*, *Citharexylum spinosum*, *Erythroxylum brevipes*, *Rhynchosia reticulata*, *Samanea saman*, *Stigmaphyllon emarginatum*, *Urochloa maxima*, and *Zanthoxylum martinicense*



Figure A-34—(A) General view of the site and (B) flowers/leaves of *Lantana horrida*, a shrub species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Shrubland Site 8

Ecological Life Zone: Subtropical moist forest

Location: Bo. Pitahaya, municipality of Luquillo, PR

Site Description and Disturbance History: The site (fig. A-35) is located on a lowland plain at an elevation of approximately 11 m above sea level, with an estimated slope of 7 percent and estimated canopy cover of 71.5 percent. It is a wilderness area used by feral horses (horses were present at the time the vegetation inventory was conducted). Feral horse trails and an active road/highway are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by shrubs of *Vachellia tortuosa*. Other shrubs include *Randia aculeata*, *Schefflera morototoni*, *Samanea saman*, *Psidium guajava*, *Casearia sylvestris*, *Casearia guianensis*, and *Miconia prasina*. Notable nonwoody species are mostly *Cynodon dactylon* grass and *Ipomoea setifera* vines, followed by *Mikania micrantha* and *Mimosa casta*, as well as *Chromolaena odorata*, *Hyptis atrorubens*, and saplings of *Guapira fragrans*. Additional minor or less represented species include several shrubs, subshrubs, herbs, vines, and graminoids such as *Mimosa pigra*, *Cordia polycephala*, *Eugenia biflora*, *Citharexylum spinosum*, *Sida rhombifolia*, *Clidemia hirta*, *Elephantopus mollis*, *Ruellia blechum*, *Scleria pterota*, *Desmodium adscendens*, *Passiflora laurifolia*, *Cissus verticillata*, *Cissampelos pareira*, and *Axonopus compressus*.

Associated Species: *Centrosema pubescens*, *Fimbristylis dichotoma*, *Senna obtusifolia*, *Sida glomerata*, *Synedrella nodiflora*, *Terminalia catappa*, and *Thelypteris tetragona*



Figure A-35—(A) General view of the site and (B) inflorescence/leaf of *Vachellia tortuosa*, a dominant shrub within the site. Forest Service photos by Johann D. Crespo-Zapata.

Shrubland Site 9

Ecological Life Zone: Subtropical moist forest

Location: Bo. Juan Martín, municipality of Luquillo, PR

Site Description and Disturbance History: The site (fig. A-36) is located on a coastal plain area at an elevation of approximately 13 m above sea level, with an estimated slope of 7 percent and estimated canopy cover of 29.5 percent. This area had been consistently cleared and disturbed, on average yearly, at least since the last century. It is a grazing area used by cows (cows were present at the time the vegetation inventory was conducted). Frequent cattle trails and dirt roads are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by shrubs of *Mimosa pigra*. Other shrubs include *Vachellia farnesiana* var. *farnesiana* and *Cestrum diurnum*. Other notable species include a variety of graminoids such as *Cynodon dactylon*, *Axonopus compressus*, *Panicum laxum*, and *Paspalum conjugatum*. Other secondary species include *Randia aculeata*, *Vigna hosei*, *Mimosa pudica* var. *unijuga*, and *Centrosema pubescens*.

Associated Species: *Casearia guianensis*, *Casearia sylvestris*, *Cissampelos pareira*, *Citharexylum spinosum*, *Clitoria falcata*, *Cordia polycephala*, and *Senna alata*



Figure A-36—(A) General view of the site and (B) flower of *Centrosema pubescens*, a species of vine observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Shrubland Site 10

Ecological Life Zone: Subtropical moist forest

Location: Bo. San Isidro, municipality of Canóvanas, PR

Site Description and Disturbance History: The site (fig. A-37) is located on a floodplain at an elevation of approximately 0 m above sea level, with an estimated slope of 0 percent and estimated canopy cover of 49.8 percent. Its location is in a farm that mostly conducts livestock-related activities such as grazing, breeding, and maintenance. It is a seasonally flooded shrubland near grazing areas used by cows and horses (cows were present at the time the vegetation inventory was conducted). Frequent cattle trails, a dirt road, and urban development are nearby. This site is prone to flooding; some areas around the site were flooded at the time the vegetation inventory was conducted (almost knee-deep water and mud).

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by shrubs of *Annona glabra* and *Mimosa pigra*. Notable secondary species include herbs and graminoids such as *Hygrophila costata*, *Eleocharis interstincta*, and *Panicum laxum*. Additional minor or less represented species include a variety of herbs, vines, graminoids, and ferns such as *Enydra sessilis*, *Polygonum punctatum*, *Phyllanthus nodiflorus*, *Ludwigia peploides*, *Struthium sparganophorum*, *Mikania cordifolia*, *Aniseia martinicensis*, *Cissus verticillata*, *Rhynchospora corymbosa*, *Kyllinga brevifolia*, *Ceratopteris thalictroides*, and *Salvinia minima*.

Associated Species: *Axonopus compressus*, *Cuphea strigulosa*, *Cynodon dactylon*, *Cyperus giganteus*, *Cyperus odoratus*, *Eleocharis mutata*, *Leersia hexandra*, *Ludwigia leptocarpa*, and *Typha domingensis*



Figure A-37—(A) General view of the site and (B) fruit/leaves of *Annona glabra*, a dominant species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Shrubland Site 11

Ecological Life Zone: Subtropical moist forest

Location: Bo. Torrecilla Alta, municipality of Loíza, PR

Site Description and Disturbance History: The site (fig. A-38) is located on a floodplain at an elevation of approximately 0 m above sea level, with an estimated slope of 0 percent and estimated canopy cover of 30.8 percent. It is a former grazing area located in a farm that harbors areas with tree plantations as a result of different mitigation projects. It is a seasonally flooded shrubland in a wilderness area used by feral horses (horses were present at the time the vegetation inventory was conducted). Feral horse trails and plantations of trees are nearby. This site is prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by shrubs of *Mimosa pigra*. The main secondary species are *Ipomoea tiliacea* vines and *Leersia hexandra* grass. Additional minor or less represented secondary species include several herbs, vines, and graminoids such as *Enydra sessilis*, *Commelina diffusa* var. *diffusa*, *Eleocharis mutata*, *Alternanthera philoxeroides*, *Sagittaria lancifolia*, *Neptunia plena*, *Mikania cordifolia*, *Vigna luteola*, *Cyperus haspan*, and *Schoenoplectus americanus*.

Associated Species: *Ludwigia leptocarpa*, *Mimosa casta*, *Phyla nodiflora*, and *Pterocarpus officinalis* (planted)



Figure A-38—(A) General view of the site and (B) inflorescences of *Mimosa pigra*, the dominant shrub species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Shrubland Site 12

Ecological Life Zone: Subtropical moist forest

Location: Bo. Torrecilla Alta, municipality of Loíza, PR

Site Description and Disturbance History: The site (fig. A-39) is located on a lowland plain at an elevation of approximately 0 m above sea level, near floodplain areas, with an estimated slope of 0 percent and estimated canopy cover of 27.4 percent. Its location is in a farm that harbors areas with tree plantations as a result of different mitigation projects. It is shrubland near grazing areas used by cows and horses (horses were present at the time the vegetation inventory was conducted). Cow and horse trails and plantations of trees are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by shrubs of *Randia aculeata* and *Vachellia farnesiana* var. *farnesiana*, followed by subshrubs of *Chromolaena odorata* and vines of *Jasminum fluminense* and *Cissus verticillata*. Other notable species are shrubs of *Mimosa pigra*, as well as several herbs, vines, and graminoids such as *Phylla nodiflora*, *Ruellia blechum*, *Desmodium incanum*, *Paullinia pinnata*, *Mimosa casta*, *Merremia umbellata*, *Stenotaphrum secundatum*, and *Paspalum vaginatum*. Additional minor or less represented secondary species include *Desmanthus virgatus*, *Cynophalla flexuosa*, *Cordia polycephala*, *Passiflora suberosa*, *Melothria pendula*, *Centrosema pubescens*, *Galactia striata*, *Digitaria horizontalis*, and *Leersia hexandra*.

Associated Species: *Bursera simaruba*, *Cynodon dactylon*, *Paspalum pleostachyum*, *Paspalum setaceum*, *Pluchea carolinensis*, and *Sesuvium portulacastrum*

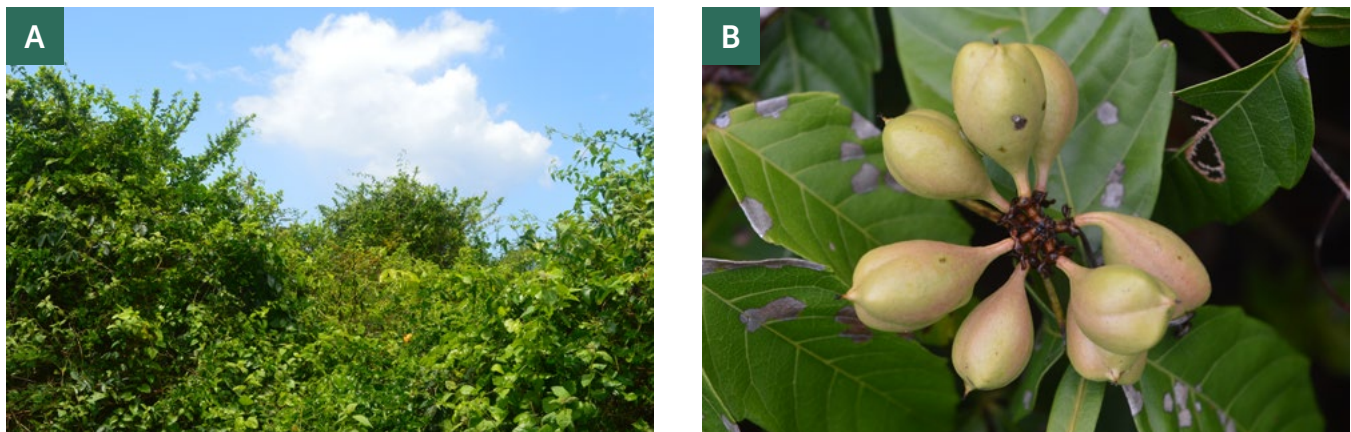


Figure A-39—(A) General view of the site and (B) fruits/leaves of *Paullinia pinnata*, a species of vine observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Shrubland Site 13

Ecological Life Zone: Subtropical moist forest

Location: Bo. Río Turabo, municipality of Caguas, PR

Site Description and Disturbance History: The site (fig. A-40) is located on a lower backslope at an elevation of approximately 142 m above sea level, with an estimated slope of 28.2 percent and estimated canopy cover of 58.2 percent. An abandoned/unfrequented dirt road, an active road/highway, and urban development are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by shrubs of *Spathodea campanulata*. Secondary shrub species are *Albizia procera*, *Guapira fragrans*, *Casearia guianensis*, and *Casearia decandra*. Other notable species include several vines and lianas such as *Tournefortia hirsutissima*, *Trichostigma octandrum*, *Senna nitida*, *Jasminum fluminense*, *Mimosa casta*, and *Ipomoea setifera*. Additional minor or less represented secondary species comprise mostly herbs and subshrubs including *Mimosa pudica* var. *unijuga*, *Chamaecrista nictitans* var. *glabrata*, *Cuphea strigulosa*, *Sida acuta*, *Senna hirsuta* var. *hirsuta*, *Melochia nodiflora*, and *Triumfetta semitriloba*.

Associated Species: *Citharexylum spinosum*, *Cupania americana*, *Guarea guidonia*, *Mikania micrantha*, *Nephrolepis multiflora*, *Roystonea borinquena*, *Schefflera morototoni*, and *Urena lobata*



Figure A-40—(A) General view of the site and (B) leaves of *Tournefortia hirsutissima*, a vine/liana observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Pioneers Site 1

Ecological Life Zone: Subtropical moist forest

Location: Bo. Las Palmas, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-41) is located on a mountain shoulder area at an elevation of approximately 352 m above sea level, with an estimated slope of 35.3 percent. Because no canopy photos were obtained at this site, canopy cover estimation is not applicable. An active road and low-density urban development are nearby. A possible landslide area is also nearby. The area's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by nonwoody shrubs of *Piper aduncum*, *Clidemia cymosa*, *Miconia laevigata*, and *Trema micrantha* and subshrubs of *Chromolaena odorata*. Other nonwoody shrubs/subshrubs include *Cordia polycephala*, *Calliandra surinamensis*, *Clidemia hirta*, *Tibouchina longifolia*, and *Urena lobata*. Notable additional species include *Pennisetum purpureum* and *Urochloa maxima* grasses. Additional minor or less represented secondary species include mostly vines, herbs, and ferns such as *Mikania micrantha*, *Iresine diffusa*, *Nephrolepis multiflora*, and *Pityrogramma calomelanos*.

Associated Species: *Bambusa vulgaris*, *Callisia fragrans*, *Cyathea arborea*, *Gouania polygama*, *Guarea guidonia*, and *Psidium guajava*

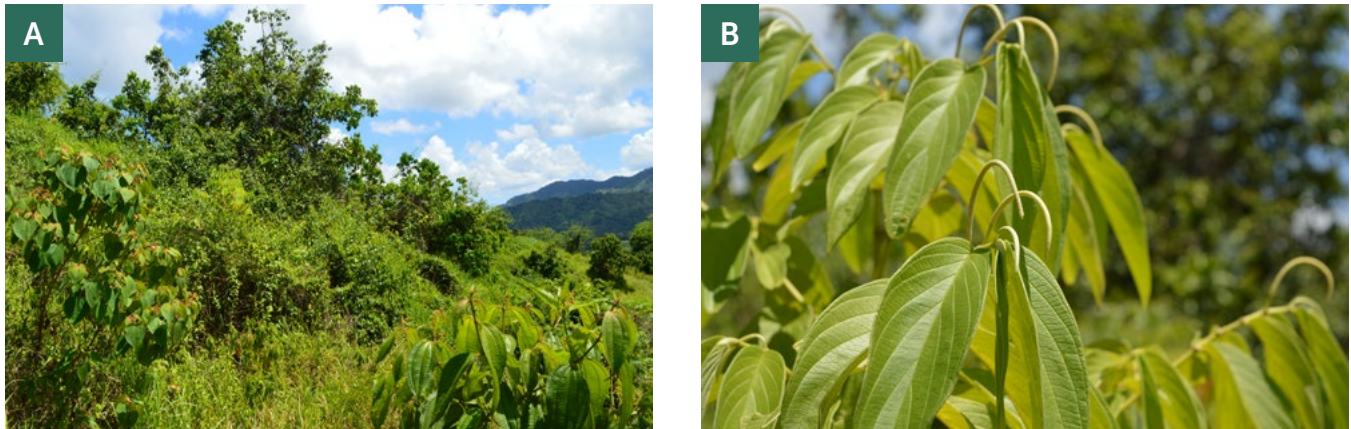


Figure A-41—(A) General view of the site and (B) *Piper aduncum* with inflorescences, a common pepper species in the site. Forest Service photos by Johann D. Crespo-Zapata.

Pioneers Site 2

Ecological Life Zone: Subtropical moist forest

Location: Bo. Las Palmas, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-42) is located on an upper backslope, near the ridge of a mountain, at an elevation of approximately 341 m above sea level, with an estimated slope of 28.2 percent and canopy cover of 0 percent. A possible abandoned tillage crop and/or horticulture area is nearby. An unfrequented dirt road is also nearby. The area's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by herbs and vines such as *Asystasia gangetica*, *Melanthera nivea*, and *Centrosema virginianum*, followed by *Iresine diffusa*, *Mikania micrantha*, and *Trichostigma octandrum*. Additional minor or less represented secondary species include mainly *Chromolaena odorata*, *Cissus verticillata*, *Commelina diffusa* var. *diffusa*, *Dissotis rotundifolia*, *Ipomoea tiliacea*, *Merremia umbellata*, *Pueraria phaseoloides*, *Tournefortia hirsutissima*, *Psidium guajava*, and *Gliricidia sepium*.

Associated Species: *Bambusa vulgaris*, *Casearia sylvestris*, *Cecropia schreberiana* ssp. *schreberiana*, *Cupania americana*, *Cyathea* sp., *Guarea guidonia*, *Heliconia* sp., *Psidium guajava*, *Tabebuia heterophylla*, and *Zanthoxylum martinicense*

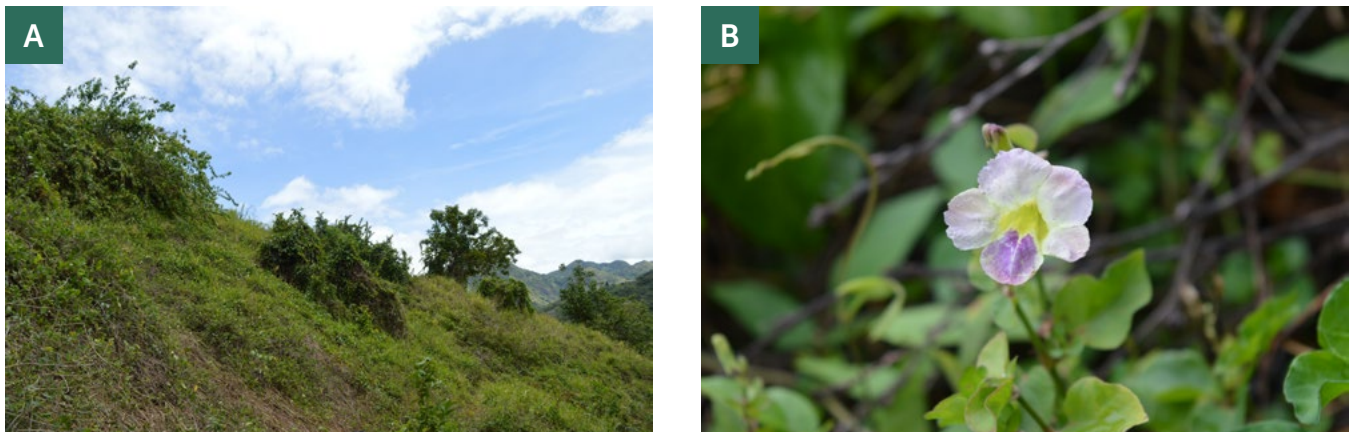


Figure A-42—(A) General view of the site and (B) flower of *Asystasia gangetica*, a common herb observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Pioneers Site 3

Ecological Life Zone: Subtropical moist forest

Location: Bo. Las Palmas, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-43) is located on an upper backslope at an elevation of approximately 333 m above sea level, with an estimated slope of 28.2 percent and canopy cover of 0 percent. It is a former grazing area. Low-density urban development is nearby. The area's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by herbs and vines such as *Asystasia gangetica*, *Melanthera nivea*, *Mikania micrantha*, and *Pueraria phaseoloides*. Additional minor or less represented species include other herbs, vines, and grasses such as *Cucurbita moschata*, *Euphorbia heterophylla*, *Urena lobata*, *Cissus verticillata*, *Commelina diffusa* var. *diffusa*, *Urochloa maxima*, *Melothria pendula*, and *Merremia umbellata*.

Associated Species: *Cecropia schreberiana* ssp. *schreberiana*, *Gliricidia sepium*, *Manihot esculenta*, *Musa* sp., *Piper aduncum*, *Psidium guajava*, *Spondias purpurea*, and *Trichostigma octandrum*



Figure A-43—(A) General view of the site and (B) *Euphorbia heterophylla*, a common spurge species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Pioneers Site 4

Ecological Life Zone: Subtropical dry forest

Location: Bo. Sabana Yeguas, municipality of Lajas, PR

Site Description and Disturbance History: The site (fig. A-44) is located on a lowland plain at an elevation of approximately 36 m above sea level, with an estimated slope of 7 percent and canopy cover of 0 percent. It is a former forested area that had been cleared/disturbed and devoid of trees for around a year at the time the vegetation inventory was conducted. A water canal, an unfrequented dirt trail, and low-density urban development are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by nonwoody shrubs, subshrubs, vines, and other herbaceous species such as *Bastardia viscosa*, *Leucaena leucocephala*, *Malachra urens*, *Corchorus siliquosus*, *Desmanthus virgatus*, *Malvastrum coromandelianum*, *Melochia nodiflora*, *Ipomoea tiliacea*, *Centrosema pubescens*, *Merremia quinquefolia*, and *Merremia umbellata*. Additional notable species include other vines and herbs such as *Teramnus labialis*, *Achyranthes aspera* var. *aspera*, and *Melochia pyramidata*.

Associated Species: *Acalypha alopecuroides*, *Andira inermis*, *Bidens cynapiifolia*, *Bouchea prismatica*, *Cardiospermum microcarpum*, *Chloris barbata*, *Chloris radiata*, *Cissus verticillata*, *Cleome viscosa*, *Dactyloctenium aegyptium*, *Delonix regia*, *Echinochloa colona*, *Eleusine indica*, *Euphorbia ophthalmica*, *Jasminum fluminense*, *Parthenium hysterophorus*, *Pectis prostrata*, *Phyllanthus amarus*, *Physalis angulata*, *Rivina humilis*, *Sansevieria hyacinthoides*, *Senna uniflora*, *Sida abutilifolia*, *Solanum torvum*, *Spermacoce confusa*, and *Trichilia hirta*

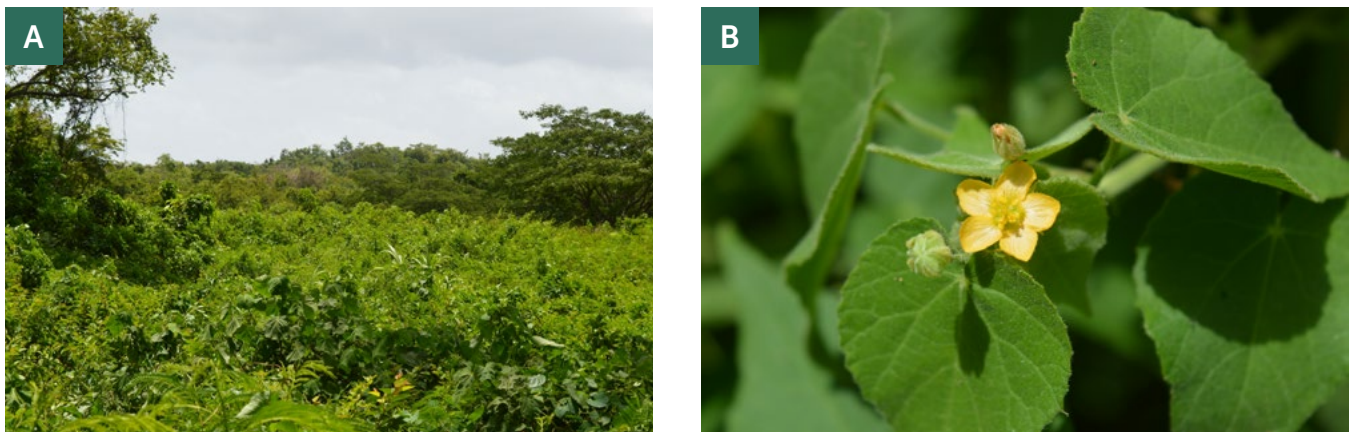


Figure A-44—(A) General view of the site and (B) flower of *Bastardia viscosa*, a subshrub species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Pioneers Site 5

Ecological Life Zone: Subtropical dry forest

Location: Bo. Pedernales, municipality of Cabo Rojo, PR

Site Description and Disturbance History: The site (fig. A-45) is located on a coastal plain at an elevation of approximately 12 m above sea level, with an estimated slope of 7 percent and canopy cover of 0 percent. A frequented hiking/biking dirt trail is nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by vines of *Jasminum fluminense*. Other notable species are small shrubs of *Leucaena leucocephala* and *Cordia bullata* ssp. *humilis*, as well as vines of *Gouania lupuloides* and *Serjania polyphylla*. Additional secondary species include mostly vines such as *Abrus precatorius*, *Stigmaphyllon emarginatum*, *Galactia dubia*, *Vigna vexillata*, *Rhynchosia reticulata*, *Cissus trifoliata*, and *Tragia volubilis*.

Associated Species: *Acalypha chamaedryfolia*, *Adelia ricinella*, *Argythamnia candicans*, *Bastardia viscosa*, *Desmodium incanum*, *Erythroxylum brevipes*, *Guapira fragrans*, *Jacquemontia cumanensis*, *Prosopis juliflora*, *Rivina humilis*, *Samyda dodecandra*, *Schaefferia frutescens*, *Swietenia mahagoni*, *Tillandsia recurvata*, and *Trichostigma octandrum*



Figure A-45—(A) General view of the site and (B) flowers of *Jasminum fluminense*, the dominant species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Pioneers Site 6

Ecological Life Zone: Subtropical dry forest

Location: Bo. Sardinera, municipality of Fajardo, PR

Site Description and Disturbance History: The site (fig. A-46) is located on a lowland plain at an elevation of approximately 21 m above sea level, with an estimated slope of 0 percent and canopy cover of 0 percent. An active highway, low-density urban development, and frequented mountain biking areas and hiking trails/dirt roads are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by vines and lianas such as *Antigonon leptopus*, *Cissus verticillata*, *Ipomoea tiliacea*, and *Trichostigma octandrum*. Other notable species include lianas of *Paullinia pinnata* and *Serjania lucida*, followed by shrubs of *Leucaena leucocephala*, *Capparis indica*, and *Triphasia trifolia*. Additional minor or less represented secondary species include *Centrosema pubescens*, *Cynophalla flexuosa*, *Oeceoclades maculata*, *Andira inermis*, *Urochloa maxima*, *Cissampelos pareira*, *Guapira fragrans*, *Commelina diffusa* var. *diffusa*, and *Paspalum fasciculatum*.

Associated Species: *Andira inermis*, *Cordia dichotoma*, and *Zanthoxylum martinicense*



Figure A-46—(A) General view of the site and (B) flowers of *Antigonon leptopus*, a dominant vine species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Pioneers Site 7

Ecological Life Zone: Subtropical moist forest

Location: Bo. Juan Martín, municipality of Luquillo, PR

Site Description and Disturbance History: The site (fig. A-47) is located on a coastal plain at an elevation of approximately 23 m above sea level, with an estimated slope of 28.2 percent and canopy cover of 0 percent. This area had been consistently cleared and disturbed, on average yearly, at least since the last century. It is a grazing area used by cows (cows were present at the time the vegetation inventory was conducted). Frequent cattle trails and dirt roads are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by subshrubs of *Chromolaena odorata*, followed by *Paspalum conjugatum* grass. Other notable species include subshrubs of *Senna occidentalis* and *Senna obtusifolia*, followed by *Jatropha gossypifolia*, *Cryptostegia madagascariensis*, *Sida rhombifolia*, and *Melochia nodiflora*. Additional minor or less represented secondary species include mostly shrubs, herbs, vines, and graminoids such as *Mimosa pigra*, *Casearia sylvestris*, *Casearia guianensis*, *Achyranthes aspera* var. *aspera*, *Cissus verticillata*, *Mimosa casta*, *Panicum laxum*, *Kyllinga nemoralis*, and *Cyperus sphacelatus*.

Associated Species: *Andira inermis*, *Coccoloba venosa*, *Colocasia esculenta*, *Cyperus iria*, *Ipomoea tiliacea*, *Paullinia pinnata*, *Peltophorum pterocarpum*, *Rhynchospora ciliata*, *Serjania lucida*, *Sida glomerata*, *Spathodea campanulata*, and *Terminalia catappa*



Figure A-47—(A) General view of the site and (B) fruit/flowers of *Jatropha gossypifolia*, a subshrub observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Pioneers Site 8

Ecological Life Zone: Subtropical moist forest

Location: Bo. Juan Martín, municipality of Luquillo, PR

Site Description and Disturbance History: The site (fig. A-48) is located on a coastal plain at an elevation of approximately 12 m above sea level, with an estimated slope of 7 percent and canopy cover of 0 percent. This area had been consistently cleared and disturbed, on average yearly, at least since the last century. It is a grazing area used by cows (cows were present at the time the vegetation inventory was conducted). Frequent cattle trails and dirt roads are nearby. This site is likely prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by vines of *Cissus verticillata*, followed by *Mimosa casta* and *Colocasia esculenta*. Other notable species are shrubs of *Mimosa pigra* and *Paspalum conjugatum* grass. Additional secondary species include *Syngonium podophyllum*, *Vigna vexillata*, *Ruellia blechum*, and *Sphagneticola trilobata*.

Associated Species: *Andira inermis*, *Coccoloba venosa*, *Peltophorum pterocarpum*, *Spathodea campanulata*, and *Terminalia catappa*

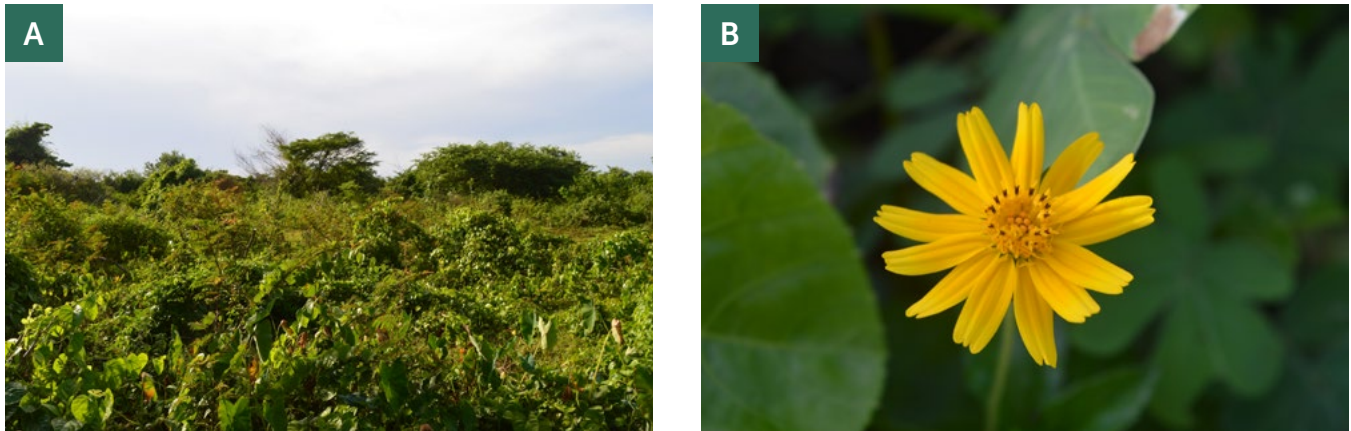


Figure A-48—(A) General view of the site and (B) flower of *Sphagneticola trilobata*, a creeping herb observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Pioneers Site 9

Ecological Life Zone: Subtropical moist forest

Location: Bo. Quebrada Fajardo, municipality of Fajardo, PR

Site Description and Disturbance History: The site (fig. A-49) is located on a lowland plain at an elevation of approximately 19 m above sea level, with an estimated slope of 7 percent and canopy cover of 0 percent. It is a wilderness area used by feral horses (horses were present at the time the vegetation inventory was conducted). Feral horse trails are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by vines of *Momordica charantia*. Other notable species are mostly vines and herbs such as *Vigna adenantha*, *Ipomoea setifera*, *Cissampelos pareira*, *Mimosa casta*, and *Scleria pterota*. Additional minor or less represented secondary species include *Triumfetta semitriloba*, *Melochia nodiflora*, *Chromolaena odorata*, *Ruellia blechum*, *Commelina diffusa* var. *diffusa*, *Cissus verticillata*, *Centrosema virginianum*, *Vigna hosei*, *Rhynchosia reticulata*, *Desmodium incanum*, and *Mimosa pudica* var. *unijuga*.

Associated Species: *Bouyeria succulenta*, *Citharexylum spinosum*, *Lantana horrida*, *Paspalum virgatum*, and *Senna bicapsularis*



Figure A-49—(A) General view of the site and (B) flower of *Vigna adenantha*, a species of vine observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Pioneers Site 10

Ecological Life Zone: Subtropical moist forest

Location: Bo. Pitahaya, municipality of Luquillo, PR

Site Description and Disturbance History: The site (fig. A-50) is located on a lowland plain at an elevation of approximately 8 m above sea level, with an estimated slope of 0 percent and canopy cover of 0 percent. A frequented dirt road, parking lot, and active road/highway are nearby. This site is prone to flooding; most of the site was in a mildly flooded state at the time the vegetation inventory was conducted (ankle-deep water and mud).

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Colocasia esculenta*. Other notable species are *Ipomoea tiliacea*, *Melothria pendula*, and *Mikania micrantha* vines. Additional minor or less represented secondary species are *Commelina diffusa* var. *diffusa*, *Merremia umbellata*, and *Mimosa pigra*.

Associated Species: *Cestrum diurnum*, *Citharexylum spinosum*, *Gliricidia sepium*, *Hymenachne amplexicaulis*, *Mimosa casta*, *Scleria eggersiana*, *Terminalia catappa*, *Vigna adenantha*, and *Ziziphus mauritiana*



Figure A-50—(A) General view of the site and (B) flower of *Ipomoea tiliacea*, a species of vine observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Pioneers Site 11

Ecological Life Zone: Subtropical moist forest

Location: Bo. San Isidro, municipality of Canóvanas, PR

Site Description and Disturbance History: The site (fig. A-51) is located on a floodplain at an elevation of approximately 0 m above sea level, near a lagoon and freshwater marsh areas, with an estimated slope of 0 percent and estimated canopy cover of 47.6 percent. Its location is in a farm that mostly conducts livestock-related activities such as grazing, breeding, and maintenance. It is a giant flatsedge stand in a grazing area used by cows and horses (cows were present at the time the vegetation inventory was conducted). Frequented cattle trails, a dirt road, and urban development are nearby. This site is prone to flooding; most of the site was in a flooded state at the time the vegetation inventory was conducted (almost knee-deep water and mud).

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Cyperus giganteus* sedges. The main secondary species is *Urochloa mutica* grass, followed by small shrubs of *Mimosa pigra* and *Ludwigia leptocarpa*. Additional minor or less represented secondary species include *Typha domingensis*, *Vigna vexillata*, *Alternanthera philoxeroides*, *Commelina diffusa* var. *diffusa*, *Mikania cordifolia*, and *Aniseia martinicensis*.

Associated Species: *Lagerstroemia speciosa* and *Peltophorum pterocarpum*



Figure A-51—(A) General view of the site and (B) flower of *Ludwigia leptocarpa*, a subshrub species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Pioneers Site 12

Ecological Life Zone: Subtropical moist forest

Location: Bo. San Isidro, municipality of Canóvanas, PR

Site Description and Disturbance History: The site (fig. A-52) is located on a floodplain at an elevation of approximately 0 m above sea level, near a lagoon and freshwater marsh areas, with an estimated slope of 0 percent and canopy cover of 0 percent. Its location is in a farm that mostly conducts livestock-related activities such as grazing, breeding, and maintenance. It is a seasonally flooded spikerush patch, bordered by shrubs, in a grazing area used by cows and horses (cows were present at the time the vegetation inventory was conducted). Frequent cattle trails and urban development are nearby. This site is prone to flooding; some areas around the site were mildly flooded at the time the vegetation inventory was conducted (ankle-deep water and mud).

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Eleocharis interstincta* spikerush. Secondary species are mostly herbs and graminoids such as *Nymphoides humboldtiana*, *Enydra sessilis*, *Rhynchospora corymbosa*, and *Fuirena umbellata*, followed by shrubs of *Annona glabra* and *Mimosa pigra*. Additional minor or less represented secondary species include *Centella erecta*, *Scleria microcarpa*, *Eleocharis mutata*, *Hymenachne amplexicaulis*, *Vigna luteola*, and *Clitoria falcata*.

Associated Species: *Cyperus odoratus*, *Mimosa casta*, and *Vigna vexillata*



Figure A-52—(A) General view of the site and (B) *Nymphoides humboldtiana*, an aquatic herb observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Pioneers Site 13

Ecological Life Zone: Subtropical moist forest

Location: Bo. Torrecilla Alta, municipality of Loíza, PR

Site Description and Disturbance History: The site (fig. A-53) is located on a floodplain at an elevation of approximately 0 m above sea level, with an estimated slope of 0 percent and canopy cover of 0 percent. Its location is in a farm that harbors areas with tree plantations as a result of different mitigation projects. It is a former grazing area and seasonally flooded spikerush patch in a wilderness area used by feral horses (horses were present at the time the vegetation inventory was conducted). Feral horse trails and an unfrequented dirt road are nearby. This site is prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Eleocharis mutata* spikerush. Notable secondary species are *Enydra sessilis* and *Neptunia plena* herbs. Other secondary species are subshrubs of *Aeschynomene sensitiva* and *Ludwigia leptocarpa*, as well as *Paspalum pleostachyum* grass. Additional minor or less represented secondary species comprise other herbs, vines, and grasses such as *Commelina diffusa* var. *diffusa*, *Ipomoea tiliacea*, *Vigna luteola*, and *Urochloa mutica*.

Associated Species: *Cyperus giganteus*, *Cyperus ligularis*, *Cyperus odoratus*, *Fuirena umbellata*, *Mimosa pigra*, *Paspalum fasciculatum*, *Phyla nodiflora*, and *Typha domingensis*



Figure A-53—(A) General view of the site and (B) flower of *Vigna luteola*, a species of vine observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Pioneers Site 14

Ecological Life Zone: Subtropical moist forest

Location: Bo. Torrecilla Alta, municipality of Loíza, PR

Site Description and Disturbance History: The site (fig. A-54) is located on a floodplain at an elevation of approximately 0 m above sea level, near a small pond, with an estimated slope of 0 percent. Because no canopy photos were obtained at this site, canopy cover estimation is not applicable. The site is located in a farm that harbors areas with tree plantations as a result of different mitigation projects. It is a former grazing area and seasonally flooded cattail patch in a wilderness area used by feral horses (horses were absent at the time the vegetation inventory was conducted). Feral horse trails and plantations of trees are nearby. This site is prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Typha domingensis* cattails. The main secondary species are herbs and graminoids such as *Eleocharis mutata*, *Neptunia plena*, and *Cyperus haspan*. Less represented secondary species are herbs, subshrubs, and vines such as *Nymphoides humboldtiana*, *Enydra sessilis*, *Ludwigia leptocarpa*, *Aeschynomene sensitiva*, *Ipomoea tiliacea*, and *Vigna luteola*, as well as *Leersia hexandra* grass.

Associated Species: *Acrostichum danaeifolium*, *Aniseia martinicensis*, and *Mikania cordifolia*



Figure A-54—(A) General view of the site and (B) inflorescence of *Neptunia plena*, an aquatic herb observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Pioneers Site 15

Ecological Life Zone: Subtropical moist forest

Location: Bo. Río Turabo, municipality of Caguas, PR

Site Description and Disturbance History: The site (fig. A-55) is located on an upper backslope at an elevation of approximately 147 m above sea level, with an estimated slope of 14.1 percent and canopy cover of 0 percent. It is a possible landslide area. An active road/highway and urban development are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Nephrolepis multiflora* ferns. Notable secondary species are shrubs of *Albizia procera* and *Spathodea campanulata*, followed by vines of *Jasminum fluminense* and *Vigna hosei*. Additional minor or less represented species include other vines such as *Vigna adenantha*, *Mimosa casta*, *Melothria pendula*, *Mikania micrantha*, *Ipomoea setifera*, and *Cissus verticillata*, as well as herbs and subshrubs including *Commelina diffusa* var. *diffusa* and *Chromolaena odorata*.

Associated Species: *Casearia guianensis*, *Desmodium incanum*, *Melinis repens*, *Pennisetum purpureum*, *Schefflera morototoni*, and *Zanthoxylum martinicense*

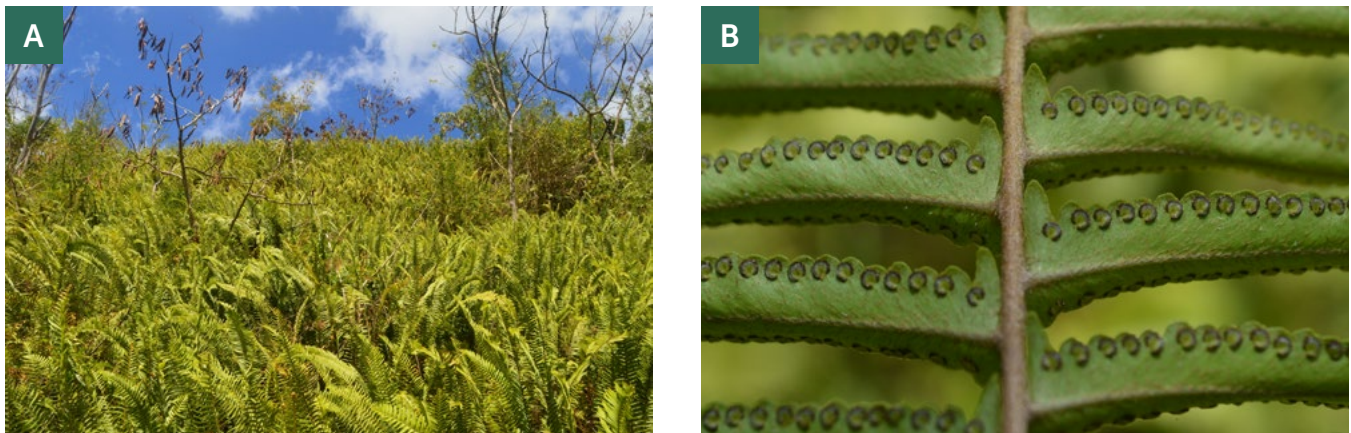


Figure A-55—(A) General view of the site and (B) sori of *Nephrolepis multiflora*, a dominant fern species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Abandoned Tillage Crop Site 1

Ecological Life Zone: Subtropical dry forest

Location: Bo. Boca Velázquez, municipality of Santa Isabel, PR

Site Description and Disturbance History: The site (fig. A-56) is located on a lowland plain at an elevation of approximately 15 m above sea level, with an estimated slope of 0 percent and canopy cover of 0 percent. It is a field crop area that had been inactive and devoid of cultivation for a number of months. At the time the vegetation inventory was conducted, the site had recently started being managed with herbicides. Windmills and frequented dirt roads are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Cleome viscosa* herbs. Other notable species are *Datura inoxia* and *Boerhavia erecta*. Additional minor or less represented secondary species are herbs, subshrubs, and graminoids such as *Amaranthus dubius*, *Melochia pyramidata*, *Desmanthus virgatus*, *Cyperus rotundus*, and *Echinochloa colona*.

Associated Species: *Chloris barbata*, *Cucumis anguria*, *Cucumis melo*, *Euphorbia heterophylla*, *Parthenium hysterophorus*, and *Trianthema portulacastrum*



Figure A-56—(A) General view of the site and (B) flowers of *Boerhavia erecta*, an herb species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Abandoned Tillage Crop Site 2

Ecological Life Zone: Subtropical dry forest

Location: Bo. Boca Velázquez, municipality of Santa Isabel, PR

Site Description and Disturbance History: The site (fig. A-57) is located on a lowland plain at an elevation of approximately 16 m above sea level, with an estimated slope of 0 percent and canopy cover of 0 percent. It is an abandoned or unmanaged pumpkin/squash (*Cucurbita moschata*) crop. The site had not been plowed for several months at the time the vegetation inventory was conducted. Plastic row covers were present throughout the site. Windmills and frequented dirt roads are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by herbaceous vegetation and grasses such as *Cucurbita moschata* (cultivated/neglected), *Parthenium hysterophorus*, and *Leptochloa panicea* ssp. *brachiata*. Other notable species include additional herbs and graminoids such as *Portulaca oleracea*, *Trianthema portulacastrum*, *Chloris barbata*, *Eleusine indica*, *Echinochloa colona*, *Sorghum halepense*, and *Cyperus rotundus*. Additional minor or less represented secondary species are other herbs such as *Cleome viscosa*, *Cucumis melo*, *Euphorbia heterophylla*, *Amaranthus dubius*, and *Malvastrum coromandelianum*.

Associated Species: *Carica papaya* (cultivated/persistent), *Desmanthus virgatus*, *Eclipta prostrata*, *Macroptilium atropurpureum*, *Melochia pyramidata*, *Rhynchosia minima*, and *Sorghum bicolor* (cultivated/persistent)



Figure A-57—(A) General view of the site and (B) flowers of *Parthenium hysterophorus*, an aster species observed in the site. Forest Service photos by Johann D. Crespo-Zapata.

Abandoned Tillage Crop Site 3

Ecological Life Zone: Subtropical dry forest

Location: Bo. Descalabrado, municipality of Santa Isabel, PR

Site Description and Disturbance History: The site (fig. A-58) is located on a lowland plain at an elevation of approximately 25 m above sea level, with an estimated slope of 0 percent and canopy cover of 0 percent. It is an abandoned or unmanaged pumpkin/squash (*Cucurbita moschata*) crop. The site had not been plowed for several months at the time the vegetation inventory was conducted. Plastic row covers were present throughout the site. An active road and frequented dirt roads are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Cucurbita moschata* (cultivated/neglected) and *Amaranthus spinosus* herbs. Other notable species include herbs and grasses such as *Portulaca oleracea*, *Trianthema portulacastrum*, *Leptochloa panicea* ssp. *brachiata*, and *Eleusine indica*. Additional secondary species are other herbs and grasses such as *Melochia pyramidata*, *Parthenium hysterophorus*, and *Echinochloa colona*.

Associated Species: *Chloris barbata*, *Cleome viscosa*, *Cucumis melo*, *Dactyloctenium aegyptium*, *Helianthus annuus* (cultivated/persistent), and *Malvastrum coromandelianum*



Figure A-58—(A) General view of the site and (B) leaves/bud of *Amaranthus spinosus*, a dominant species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Abandoned Tillage Crop Site 4

Ecological Life Zone: Subtropical dry forest

Location: Bo. Descalabrado, municipality of Santa Isabel, PR

Site Description and Disturbance History: The site (fig. A-59) is located on a lowland plain at an elevation of approximately 25 m above sea level, with an estimated slope of 0 percent and canopy cover of 0 percent. It is an abandoned or unmanaged pumpkin/squash (*Cucurbita moschata*) crop and a previous sunflower (*Helianthus annuus*) crop. The site had not been plowed for several months at the time the vegetation inventory was conducted. Plastic row covers were present throughout the site. An active road and frequented dirt roads are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Cucurbita moschata* (cultivated/neglected) and *Amaranthus spinosus* herbs. Additional minor or less represented secondary species are *Portulaca oleracea*, *Trianthema portulacastrum*, *Helianthus annuus* (persisting from a previous crop), *Leptochloa panicea* ssp. *brachiata*, and *Eleusine indica*.

Associated Species: *Boerhavia erecta*, *Chloris barbata*, *Cleome viscosa*, *Cucumis melo*, *Cynodon dactylon*, *Dactyloctenium aegyptium*, *Desmanthus virgatus*, *Malvastrum corchorifolium*, *Melochia pyramidata*, and *Parthenium hysterophorus*

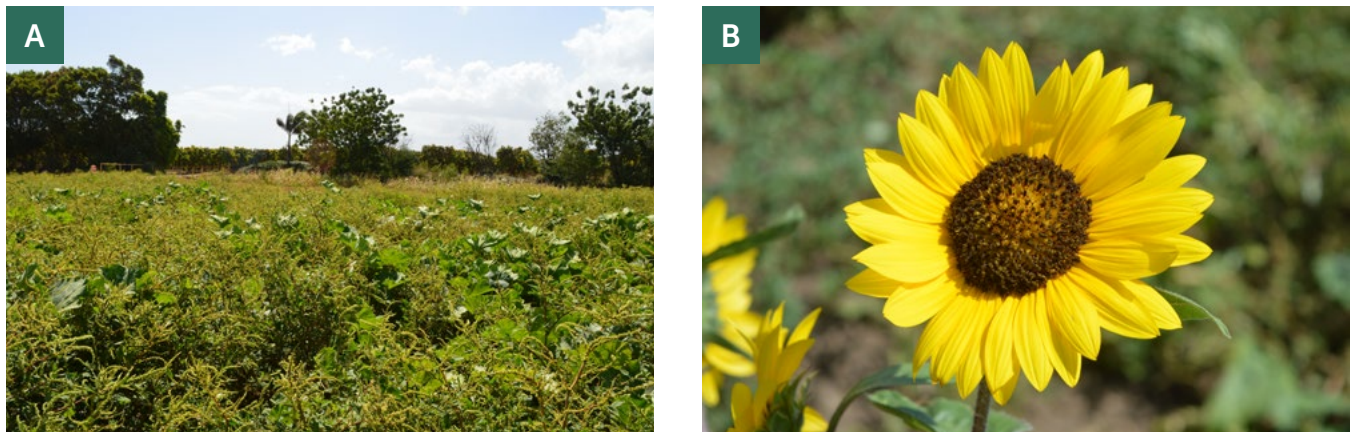


Figure A-59—(A) General view of the site and (B) flower of *Helianthus annuus*, a persistent species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Abandoned Tillage Crop Site 5

Ecological Life Zone: Subtropical moist forest

Location: Bo. Canóvanas, municipality of Loíza, PR

Site Description and Disturbance History: The site (fig. A-60) is located on a lowland plain at an elevation of approximately 0 m above sea level, near a floodplain area, with an estimated slope of 0 percent and canopy cover of 0 percent. Its location is in a farm that was previously used for grazing but shifted to agriculture in 2014 and, by the time the vegetation inventory was conducted, was producing a variety of fruits, vegetables, and other produce such as banana/plantain, papaya, pumpkin/squash, cassava, okra, and sugarcane. It is an abandoned or unmanaged pumpkin/squash (*Cucurbita moschata*) crop. The site was first plowed in 2021. A frequented dirt road and active plantain (*Musa × paradisiaca*) crops are nearby. This site is prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by herbs and graminoids such as *Ludwigia erecta*, *Heliotropium indicum*, *Commelina diffusa* var. *diffusa*, *Physalis angulata*, *Eleusine indica*, *Cyperus digitatus*, *Cyperus odoratus*, *Cyperus polystachyos*, and *Cyperus iria*. Additional minor or less represented species include small shrubs and saplings of *Mimosa pigra*, *Pluchea carolinensis*, and *Solanum torvum*, as well as other graminoids, herbs, and vines such as *Cynodon dactylon*, *Echinochloa colona*, *Eclipta prostrata*, *Oldenlandia lancifolia*, and neglected *Cucurbita moschata* (cultivated/persisting).

Associated Species: *Aniseia martinicensis*, *Cajanus cajan* (cultivated), *Ceratopteris thalictroides*, *Cissus verticillata*, *Enydra sessilis*, *Erythrina fusca*, *Euphorbia hirta*, *Euphorbia serpens*, *Hemiscala aculeata*, *Ipomoea setifera*, *Kyllinga brevifolia*, *Malachra capitata*, *Merremia umbellata*, *Musa × paradisiaca* (cultivated), *Scleria eggersiana*, *Sesbania sericea*, and *Urena lobata*

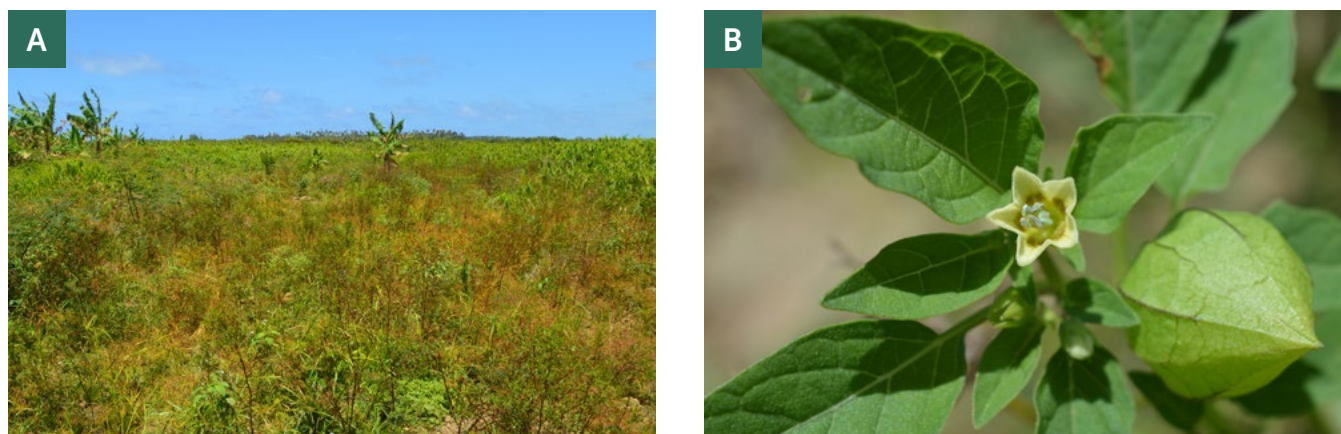


Figure A-60—(A) General view of the site and (B) *Physalis angulata*, a species of groundcherry observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Abandoned Tillage Crop Site 6

Ecological Life Zone: Subtropical moist forest

Location: Bo. Canóvanas, municipality of Loíza, PR

Site Description and Disturbance History: The site (fig. A-61) is located on a lowland plain at an elevation of approximately 0 m above sea level, near a floodplain area, with an estimated slope of 0 percent and estimated canopy cover of 57.2 percent. Its location is in a farm that was previously used for grazing but shifted to agriculture in 2014 and, by the time the vegetation inventory was conducted, was producing a variety of fruits, vegetables, and other produce such as banana/plantain, papaya, pumpkin/squash, cassava, okra, and sugarcane. It is an abandoned or unmanaged plantain (*Musa × paradisiaca*) crop that also includes pumpkin/squash (*Cucurbita moschata*), eggplant (*Solanum melongena*), and chili peppers (*Capsicum chinense*) to a lesser extent. The site was first plowed in 2021. A frequented dirt road and active plantain crops are nearby. This site is likely prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by *Musa × paradisiaca* (cultivated/neglected), *Solanum torvum* shrubs, and *Commelina diffusa* var. *diffusa* herbs. Other notable species include shrubs of *Mimosa pigra* and vines of *Cissus verticillata*, *Merremia umbellata*, *Vigna luteola*, and *Vigna hosei*. Other neglected cultivated and/or persisting crop species are *Cucurbita moschata*, *Solanum melongena*, and *Capsicum chinense*. Additional minor or less represented species include *Hyptis verticillata*, *Phyllanthus debilis*, and *Cyperus ligularis*.

Associated Species: *Amaranthus dubius*, *Chloris radiata*, *Cuphea strigulosa*, *Heliotropium indicum*, *Ludwigia erecta*, *Mikania cordifolia*, *Physalis angulata*, *Spermacoce verticillata*, *Torenia crustacea*, and *Zanthoxylum martinicense*



Figure A-61—(A) General view of the site and (B) flower of *Solanum torvum*, a shrub species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Abandoned Tillage Crop Site 7

Ecological Life Zone: Subtropical moist forest

Location: Bo. Canóvanas, municipality of Loíza, PR

Site Description and Disturbance History: The site (fig. A-62) is located on a lowland plain at an elevation of approximately 0 m above sea level, near a stream, with an estimated slope of 0 percent and estimated canopy cover of 20.8 percent. Its location is in a farm that was previously used for grazing but shifted to agriculture in 2014 and, by the time the vegetation inventory was conducted, was producing a variety of fruits, vegetables, and other produce such as banana/plantain, papaya, pumpkin/squash, cassava, okra, and sugarcane. It is an abandoned or unmanaged plantain (*Musa × paradisiaca*) crop that also includes cassava (*Manihot esculenta*), and chili peppers (*Capsicum chinense*) to a lesser extent. The site was first plowed between 2019 and 2020. A frequented dirt road and active plantain crops are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by *Musa × paradisiaca* (cultivated/neglected) covered by several vine species, most notably *Vigna vexillata* and *Cissus verticillata*. Other notable species include a variety of graminoids, shrubs, and herbs such as *Eleusine indica*, *Cyperus odoratus*, *Cyperus polystachyos*, *Echinochloa colona*, *Mimosa pigra*, *Solanum torvum*, *Cestrum diurnum*, *Commelina diffusa* var. *diffusa*, and *Cyanthillium cinereum*. Other crop species are *Manihot esculenta* and *Capsicum chinense*.

Associated Species: *Abelmoschus esculentus* (cultivated/persistent), *Aniseia martinicensis*, *Cajanus cajan* (cultivated/persistent), *Carica papaya* (cultivated/persistent), *Heliotropium indicum*, *Oldenlandia lancifolia*, *Saccharum officinarum* (cultivated/persistent), and *Typha domingensis*

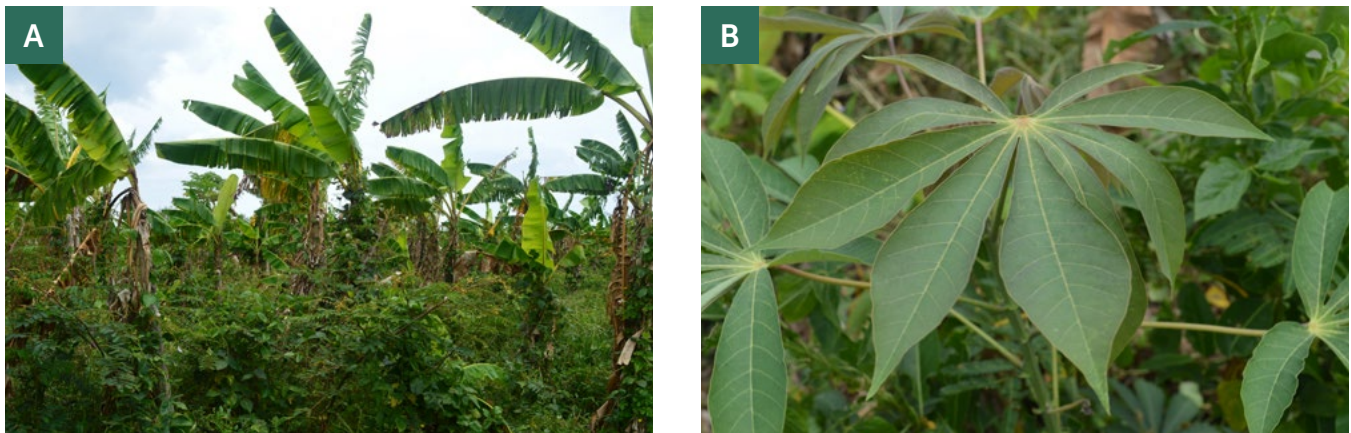


Figure A-62—(A) General view of the site and (B) leaves of *Manihot esculenta*, one of three crop species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Abandoned Tillage Crop Site 8

Ecological Life Zone: Subtropical moist forest

Location: Bo. Canóvanas, municipality of Loíza, PR

Site Description and Disturbance History: The site (fig. A-63) is located on a lowland plain at an elevation of approximately 0 m above sea level, near a floodplain and marsh area, with an estimated slope of 0 percent and estimated canopy cover of 12.4 percent. Its location is in a farm that was previously used for grazing but shifted to agriculture in 2014 and, by the time the vegetation inventory was conducted, was producing a variety of fruits, vegetables, and other produce such as banana/plantain, papaya, pumpkin/squash, cassava, okra, and sugarcane. It is an abandoned or unmanaged plantain (*Musa × paradisiaca*) crop that also includes pumpkin/squash (*Cucurbita moschata*) to a lesser extent. The site was first plowed in 2021. Active plantain crops are nearby. This site is likely prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mainly dominated by several vine species, most notably *Mikania cordifolia*, followed by *Ipomoea tiliacea*, *Merremia umbellata*, and *Mimosa casta*. Other notable species include *Musa × paradisiaca* (cultivated/neglected), *Solanum torvum*, *Commelina diffusa* var. *diffusa*, *Paspalum fasciculatum*, and neglected *Cucurbita moschata* (cultivated/persisting).

Associated Species: *Heliotropium indicum*



Figure A-63—(A) General view of the site and (B) a decaying fruit of *Cucurbita moschata*, a secondary crop species in the site. Forest Service photos by Johann D. Crespo-Zapata.

Abandoned Tillage Crop Site 9

Ecological Life Zone: Subtropical moist forest

Location: Bo. Tierras Nuevas Poniente, municipality of Manatí, PR

Site Description and Disturbance History: The site (fig. A-64) is located on a lowland plain at an elevation of approximately 5 m above sea level, near a floodplain area, with an estimated slope of 0 percent and estimated canopy cover of 38.9 percent. It is an abandoned or unmanaged plantain (*Musa × paradisiaca*) crop. The site was last plowed in 2019 and subsequently planted with plantain. This field has alternated between digitgrass and plantain cultivation throughout the last decade. Frequent dirt roads and active plantain crops are nearby. This site is somewhat prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by *Musa × paradisiaca* (cultivated/neglected) and *Digitaria horizontalis* grass, followed by several vine species such as *Momordica charantia*, *Mikania micrantha*, *Vigna vexillata*, and *Trichostigma octandrum*. Other notable species are *Hibiscus bifurcatus* herbs and *Urochloa maxima* grass. Less represented secondary species include *Phyllanthus urinaria*, *Commelina diffusa* var. *diffusa*, *Cissus verticillata*, *Cyperus odoratus*, *Capsicum frutescens*, *Solanum torvum*, and *Cecropia schreberiana* ssp. *schreberiana*.

Associated Species: *Cyperus ochraceus*, *Emilia sonchifolia*, *Laportea aestuans*, *Paspalum paniculatum*, *Physalis angulata*, *Saccharum spontaneum*, *Sorghum halepense*, and *Spigelia anthelmia*



Figure A-64—(A) General view of the site and (B) decaying fruits of *Musa × paradisiaca*, a crop species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Abandoned Tillage Crop Site 10

Ecological Life Zone: Subtropical moist forest

Location: Bo. Canóvanas, municipality of Loíza, PR

Site Description and Disturbance History: The site (fig. A-65) is located on a lowland plain at an elevation of approximately 0 m above sea level, with an estimated slope of 0 percent and estimated canopy cover of 55.9 percent. Its location is in a farm that was previously used for grazing but shifted to agriculture in 2014 and, by the time the vegetation inventory was conducted, was producing a variety of fruits, vegetables, and other produce such as banana/plantain, papaya, pumpkin/squash, cassava, okra, and sugarcane. It is an abandoned or unmanaged plantain (*Musa × paradisiaca*) crop that also includes cassava (*Manihot esculenta*) to a lesser extent. The site was first plowed between 2020 and 2021. A frequented dirt road and active small-scale sugarcane (*Saccharum officinarum*) plantations are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by *Musa × paradisiaca* (cultivated/neglected) and *Mimosa pigra* shrubs, followed by vines of *Mimosa casta* and *Cyanthillium cinereum* herbs. Other notable species include mainly herbs, vines, and graminoids such as *Eleutheranthera ruderalis*, *Emilia sonchifolia*, *Phyllanthus debilis*, *Vigna adenantha*, *Ipomoea setifera*, *Eleusine indica*, and *Echinochloa colona*. A secondary crop species is *Manihot esculenta*. Less represented species include other herbs, vines, and graminoids such as *Portulaca oleracea*, *Euphorbia heterophylla*, *Spermacoce prostrata*, *Mikania cordifolia*, *Trichostigma octandrum*, *Cyperus polystachyos*, and *Cyperus odoratus*.

Associated Species: *Achyranthes aspera* var. *aspera*, *Ananas comosus*, *Cestrum diurnum*, *Cissus verticillata*, *Cocos nucifera*, *Cordia collococca*, *Cordia polycephala*, *Indigofera tinctoria*, *Jatropha gossypifolia*, *Muntingia calabura*, *Saccharum officinarum*, *Solanum torvum*, and *Xanthosoma sagittifolium*

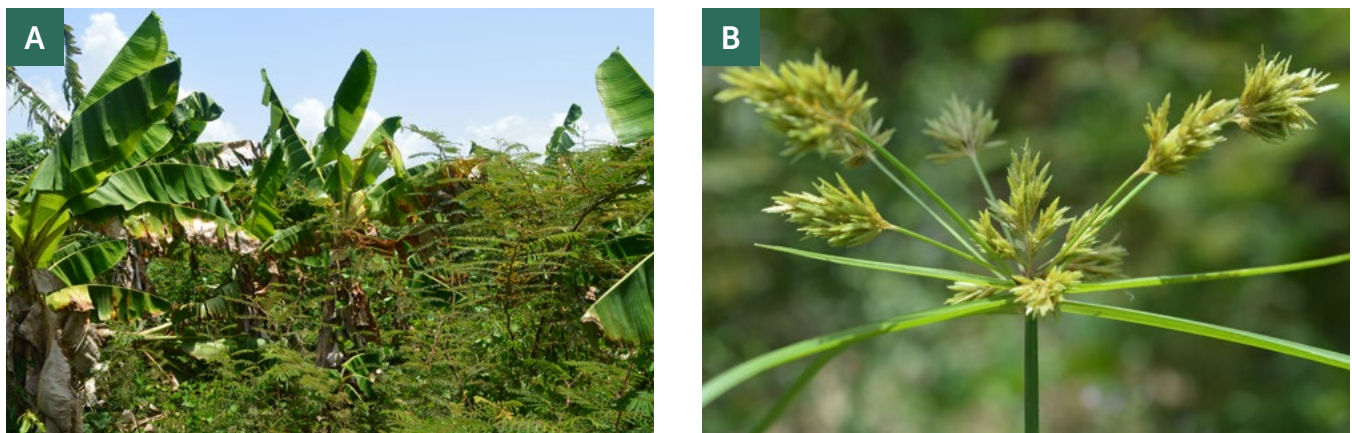


Figure A-65—(A) General view of the site and (B) inflorescence of *Cyperus polystachyos*, a sedge species observed in the site. Forest Service photos by Johann D. Crespo-Zapata.

Managed Grassland Site 1

Ecological Life Zone: Subtropical wet forest

Location: Bo. Saliente, municipality of Jayuya, PR

Site Description and Disturbance History: The site (fig. A-66) is located on a mountain shoulder area at an elevation of approximately 685 m above sea level, with an estimated slope of 49.5 percent and canopy cover of 0 percent. An active road and low-density urban development are nearby. This site is located on a mountain that has been managed and disturbed throughout the years with recurring fires. This mountain's historical land use includes mainly coffee plantations and grazing.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Melinis minutiflora* grass. Notable additional species include *Andropogon bicornis* grass, *Pteridium caudatum* and *Nephrolepis multiflora* ferns, and *Spathoglottis plicata* orchids. Additional minor or less represented species are vines, herbs, and graminoids such as *Ipomoea tiliacea*, *Rhynchosia reticulata*, *Centrosema virginianum*, *Spermacoce verticillata*, and *Fimbristylis dichotoma*.

Associated Species: *Andira inermis*, *Clidemia hirta*, *Cordia polycephala*, *Elephantopus mollis*, *Piper aduncum*, *Psidium guajava*, *Sida urens*, *Spathodea campanulata*, *Urena lobata*, and *Vigna luteola*

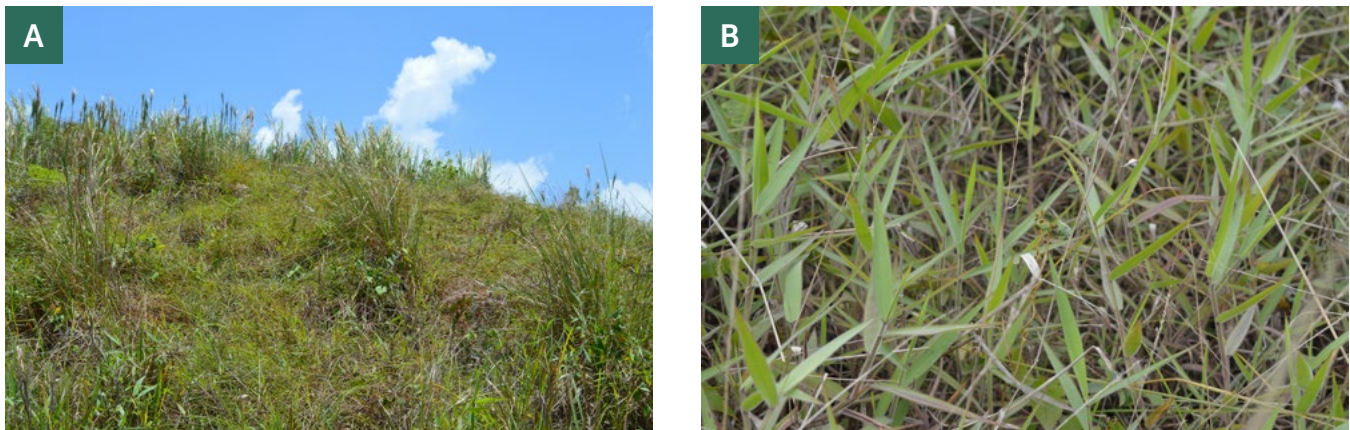


Figure A-66—(A) General view of the site and (B) leaf blades of *Melinis minutiflora*, the dominant grass within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Managed Grassland Site 2

Ecological Life Zone: Subtropical wet forest

Location: Bo. Saliente, municipality of Jayuya, PR

Site Description and Disturbance History: The site (fig. A-67) is located on a mountain shoulder area at an elevation of approximately 672 m above sea level, with an estimated slope of 63.6 percent and canopy cover of 0 percent. An active road and low-density urban development are nearby. This site is located on a mountain that has been managed and disturbed throughout the years with recurring fires. This mountain's historical land use includes mainly coffee plantations and grazing.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Andropogon bicornis* and *Urochloa maxima* grasses. Notable additional species include *Melinis minutiflora* grass and subshrubs of *Clidemia hirta*. Additional minor or less represented secondary species include vines, herbs, shrubs, and graminoids such as *Centrosema virginianum*, *Mikania micrantha*, *Iresine diffusa*, *Drymaria cordata*, *Tibouchina longifolia*, *Sida urens*, and *Cyperus mutisii*.

Associated Species: *Cyperus sphacelatus*, *Elephantopus mollis*, *Indigofera suffruticosa*, *Mikania cordifolia*, *Nephrolepis multiflora*, *Pteridium caudatum*, and *Setaria* sp.

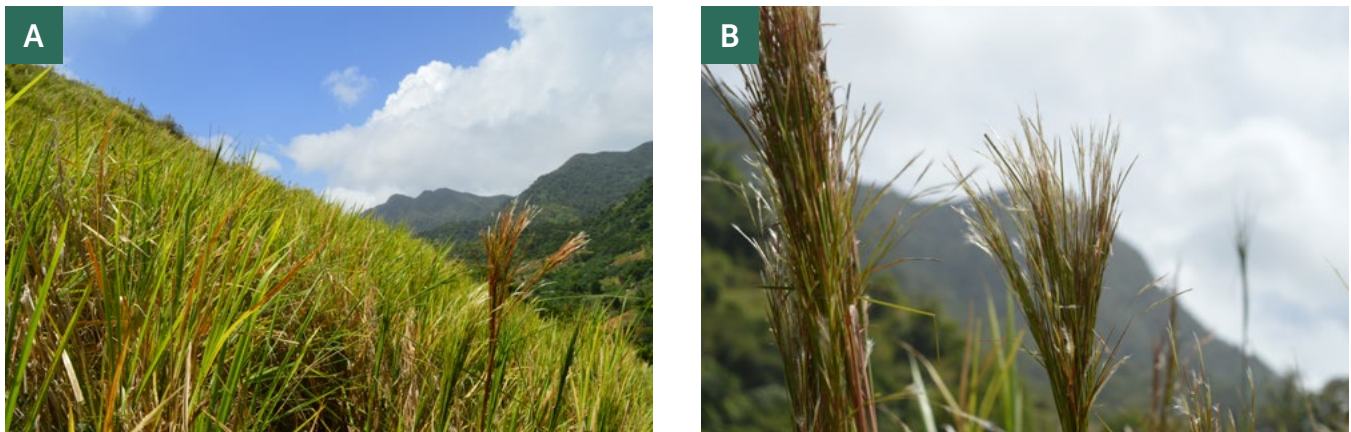


Figure A-67—(A) General view of the site and (B) inflorescences of *Andropogon bicornis*, a dominant grass within the site. Forest Service photos by Johann D. Crespo-Zapata.

Managed Grassland Site 3

Ecological Life Zone: Subtropical wet forest

Location: Bo. Collores, municipality of Jayuya, PR

Site Description and Disturbance History: The site (fig. A-68) is located on a toeslope area at an elevation of approximately 583 m above sea level, with an estimated slope of 7 percent and canopy cover of 0 percent. Unfrequent dirt trails and low-density urban development are nearby. This site is located in a grass field where young cows actively graze for several days and then are rotated. At the time the vegetation inventory was conducted, the cows had not been in the area for a few days. Nevertheless, several horses were observed grazing. The area's historical land use includes mostly grazing and, to a lesser extent, coffee plantations.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Urochloa mutica* grass. Additional minor or less represented secondary species include *Paspalum conjugatum*, *Panicum laxum*, *Axonopus compressus*, *Desmodium adscendens*, *Gomphocarpus physocarpus*, *Commelina diffusa* var. *diffusa*, *Xanthosoma sagittifolium*, and *Urena lobata*.

Associated Species: *Andropogon bicornis*, *Casuarina equisetifolia*, *Cecropia schreberiana* ssp. *schreberiana*, *Clidemia hirta*, *Cordia sulcata*, *Dieffenbachia seguine*, *Guarea guidonia*, *Mangifera indica*, *Miconia impatiolalis*, *Miconia laevigata*, *Miconia serrulata*, *Musa acuminata*, *Piper aduncum*, *Pleopeltis polypodioides*, *Pseudelephantopus spicatus*, *Rhynchospora ciliata*, *Roystonea borinquena*, *Spondias purpurea*, *Stachytarpheta cayennensis*, *Syngonium podophyllum*, and *Urochloa maxima*



Figure A-68—(A) General view of the site and (B) spikelets of *Urochloa mutica*, the dominant grass within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Managed Grassland Site 4

Ecological Life Zone: Subtropical wet forest

Location: Bo. Collores, municipality of Jayuya, PR

Site Description and Disturbance History: The site (fig. A-69) is located on a toeslope area at an elevation of approximately 592 m above sea level, with an estimated slope of 28.2 percent and canopy cover of 0 percent. Unfrequented dirt trails and low-density urban development are nearby. This site is located within a grass field area where young cows actively graze for several days and then are rotated. At the time the vegetation inventory was conducted, the cows had not been in the area for a few days. The area's historical land use includes mostly grazing and, to a lesser extent, coffee plantations.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Andropogon bicornis* and *Urochloa maxima* grasses. Other notable graminoids are *Panicum laxum*, *Axonopus compressus*, *Rhynchospora ciliata*, and *Setaria parviflora*. Additional minor or less represented species include herbs, shrubs, and ferns such as *Crotalaria brevidens*, *Mimosa pudica* var. *unijuga*, *Elephantopus mollis*, *Macroptilium lathyroides*, *Lycopodiella cernua* var. *cernua*, *Drymaria cordata*, *Gomphocarpus physocarpus*, *Tibouchina longifolia*, *Clidemia hirta*, *Urena lobata*, *Thelypteris kunthii*, and *Nephrolepis multiflora*.

Associated Species: *Casuarina equisetifolia*, *Piper aduncum*, and *Stachytarpheta cayennensis*



Figure A-69—(A) General view of the site and (B) flowers/buds of *Gomphocarpus physocarpus*, a shrub observed in the site. Forest Service photos by Johann D. Crespo-Zapata.

Managed Grassland Site 5

Ecological Life Zone: Subtropical dry forest

Location: Bo. Sabana Yeguas, municipality of Lajas, PR

Site Description and Disturbance History: The site (fig. A-70) is located on a lowland plain at an elevation of approximately 33 m above sea level, with an estimated slope of 0 percent and canopy cover of 0 percent. It is a hayfield/ grass plot used for hay production. This field has been previously seeded, mostly with ‘Mombasa’ (*Urochloa maxima* cv. *Mombasa*) and ‘Maralfalfa’ (*Pennisetum purpureum* cv. *Maralfalfa*). An active road and low-density urban development are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Urochloa maxima* grass. Secondary species are *Bothriochloa pertusa* and *Desmanthus virgatus*, followed by *Rhynchosia minima* and *Alysicarpus vaginalis*.

Associated Species: *Albizia procera*, *Dichanthium annulatum*, *Indigofera spicata*, *Macroptilium atropurpureum*, *Merremia umbellata*, *Pennisetum purpureum*, *Roystonea borinquena*, *Sorghum halepense*, and *Vachellia farnesiana* var. *farnesiana*

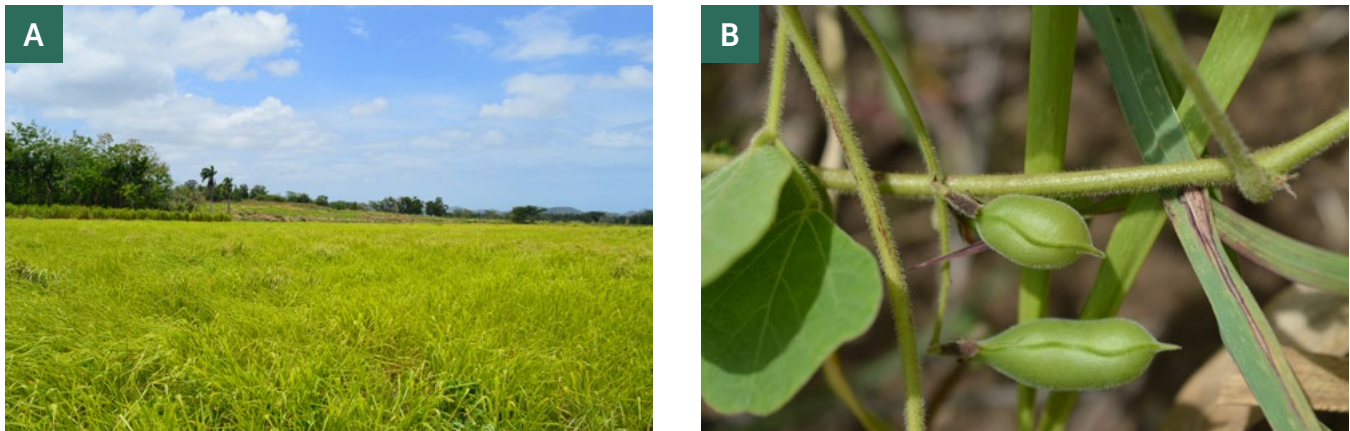


Figure A-70—(A) General view of the site and (B) fruits of *Rhynchosia minima*, a species of vine observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Managed Grassland Site 6

Ecological Life Zone: Subtropical dry forest

Location: Bo. Palmarejo, municipality of Lajas, PR

Site Description and Disturbance History: The site (fig. A-71) is located on a lowland plain at an elevation of approximately 19 m above sea level, with an estimated slope of 0 percent and canopy cover of 0 percent. It is a grass plot used for grazing. Cows actively graze in this field for several days and then are rotated. This field is usually left to regrow for about a week before repeating. At the time the vegetation inventory was conducted, cows had not been in the plot for about a week. An active road and low-density urban development are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by *Cynodon dactylon* grass. Other notable grasses are *Paspalum millegrana*, followed by *Sporobolus jacquemontii* and *Urochloa maxima*. Additional minor or less represented secondary species include *Sida abutilifolia*, *Chromolaena odorata*, *Phyla fruticosa*, and *Samanea saman*.

Associated Species: *Achyranthes aspera* var. *aspera*, *Aeschynomene rudis*, *Azadirachta indica*, *Caperonia palustris*, *Chloris barbata*, *Commelina diffusa* var. *diffusa*, *Cynodon nlemfuensis*, *Cyperus iria*, *Cyperus odoratus*, *Cyperus* sp., *Desmanthus virgatus*, *Digitaria eriantha*, *Melochia nodiflora*, *Parthenium hysterophorus*, *Pithecellobium dulce*, *Randia aculeata*, *Roystonea borinquena*, *Samanea saman*, and *Urochloa dictyoneura*



Figure A-71—(A) General view of the site and (B) inflorescences of *Cynodon dactylon*, a dominant grass within the site. Forest Service photos by Johann D. Crespo-Zapata.

Managed Grassland Site 7

Ecological Life Zone: Subtropical dry forest

Location: Bo. Palmarejo, municipality of Lajas, PR

Site Description and Disturbance History: The site (fig. A-72) is located on a lowland plain at an elevation of approximately 19 m above sea level, with an estimated slope of 0 percent and canopy cover of 0 percent. It is a grass plot used for grazing. Cows actively graze in this field for several days and then are rotated. This field is usually left to regrow for about a week before repeating. At the time the vegetation inventory was conducted, cows had not been in the plot for about a week. An active road and low-density urban development are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Urochloa dictyoneura* grass. Secondary dominant species are mostly *Cynodon nlemfuensis* and *Aeschynomene rudis*. Additional minor or less represented secondary species are *Alysicarpus vaginalis*, *Cyanthillium cinereum*, *Sida abutilifolia*, *Melochia pyramidata*, and *Desmanthus virgatus*.

Associated Species: *Achyranthes aspera* var. *aspera*, *Azadirachta indica*, *Caperonia palustris*, *Chloris barbata*, *Chromolaena odorata*, *Commelina diffusa* var. *diffusa*, *Cynodon dactylon*, *Cyperus iria*, *Cyperus odoratus*, *Cyperus* sp., *Digitaria eriantha*, *Malachra alceifolia*, *Melochia nodiflora*, *Mimosa pudica* var. *unijuga*, *Parthenium hysterophorus*, *Paspalum millegrana*, *Pennisetum purpureum*, *Pithecellobium dulce*, *Randia aculeata*, *Roystonea borinquena*, *Ruellia blechum*, *Ruellia tuberosa*, *Samanea saman*, *Sporobolus jacquemontii*, *Urochloa maxima*, and *Wissadula periplocifolia*



Figure A-72—(A) General view of the site and (B) spikelets of *Urochloa dictyoneura*, the dominant grass within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Managed Grassland Site 8

Ecological Life Zone: Subtropical moist forest

Location: Bo. Canóvanas, municipality of Loíza, PR

Site Description and Disturbance History: The site (fig. A-73) is located on a lowland plain at an elevation of approximately 3 m above sea level, with an estimated slope of 7 percent and canopy cover of 0 percent. It is a grass plot used for ornamental lawn production. This field was initially plowed and subsequently seeded with *Zoysia matrella* about 30 years ago. This site is sporadically treated with selective herbicides. A frequented dirt road, managed grass plots, and irrigation/drainage canals are nearby. This site is prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Zoysia matrella* grass. Secondary species include mostly graminoids and herbs such as *Chloris radiata*, *Digitaria bicornis*, *Eriochloa punctata*, and *Mimosa pudica* var. *unijuga*.

Associated Species: *Amaranthus dubius*, *Cestrum diurnum*, *Chloris barbata*, *Cissus verticillata*, *Cocos nucifera*, *Cuphea strigulosa*, *Cyanthillium cinereum*, *Cyperus iria*, *Cyperus odoratus*, *Euphorbia hypericifolia*, *Euphorbia hyssopifolia*, *Euphorbia thymifolia*, *Ipomoea tiliacea*, *Ludwigia octovalvis*, *Mecardonia procumbens*, *Melothria pendula*, *Oldenlandia lancifolia*, *Oxycaryum cubense*, *Paspalum fasciculatum*, *Passiflora multiflora*, *Portulaca oleracea*, *Sagittaria intermedia*, *Spondias mombin*, and *Urochloa maxima*

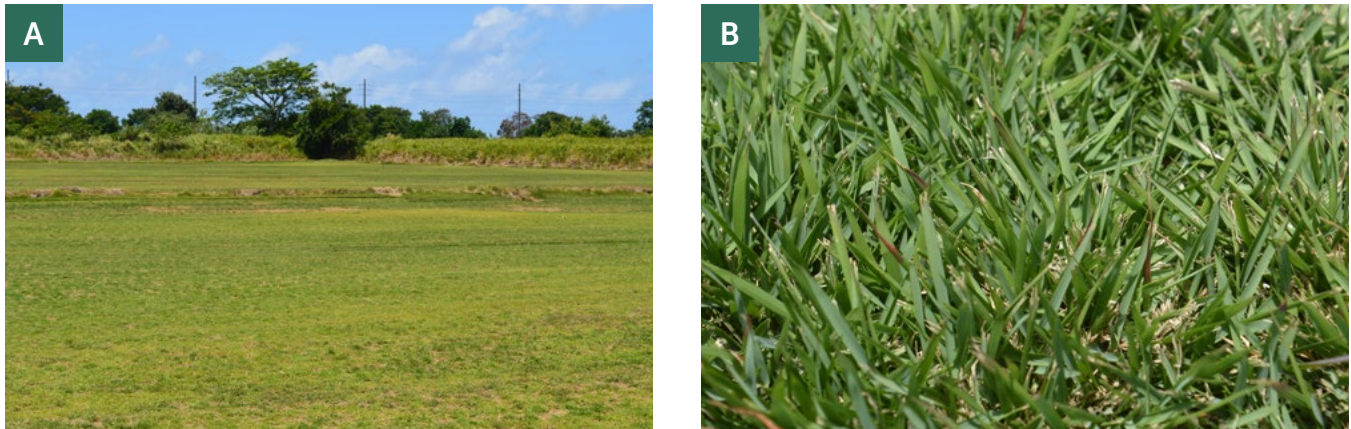


Figure A-73—(A) General view of the site and (B) leaf blades of *Zoysia matrella*, the dominant grass within the site. Forest Service photos by Johann D. Crespo-Zapata.

Managed Grassland Site 9

Ecological Life Zone: Subtropical moist forest

Location: Bo. Tierras Nuevas Poniente, municipality of Manatí, PR

Site Description and Disturbance History: The site (fig. A-74) is located on a lowland plain at an elevation of approximately 5 m above sea level, near a stream, with an estimated slope of 0 percent and canopy cover of 0 percent. It is a hayfield/grass plot used for hay production. This site has been mostly a digitgrass field throughout the years, and it is usually cut and harvested every 4 months. An active road is nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Digitaria eriantha* grass. Other notable grass species are *Sorghum halepense*, *Cynodon dactylon*, and *Dichanthium annulatum*. Less represented secondary species include mostly herbs and vines such as *Euphorbia heterophylla*, *Euphorbia hyssopifolia*, *Caperonia palustris*, *Spermacoce remota*, *Alysicarpus vaginalis*, *Macroptilium lathyroides*, *Cissus verticillata*, and *Vigna vexillata*.

Associated Species: *Ceiba pentandra*



Figure A-74—(A) General view of the site and (B) flower of *Macroptilium lathyroides*, a vine species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Managed Grassland Site 10

Ecological Life Zone: Subtropical moist forest

Location: Bo. Tierras Nuevas Poniente, municipality of Manatí, PR

Site Description and Disturbance History: The site (fig. A-75) is located on a lowland plain at an elevation of approximately 5 m above sea level, with an estimated slope of 0 percent and canopy cover of 0 percent. It is a hayfield/ grass plot used for hay production. This site has been mostly a digitgrass field for around 7 years and is usually cut and harvested every 4 months. An active road is nearby. This site is somewhat prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by *Cynodon dactylon* grass. Other notable grass species are *Digitaria eriantha* and *Sorghum halepense*. Minor or less represented secondary species include several herbs, subshrubs, a shrub, and graminoids such as *Euphorbia hypericifolia*, *Mecardonia procumbens*, *Malachra alceifolia*, *Sesbania sericea*, *Paspalum fasciculatum*, *Setaria parviflora*, *Cyperus odoratus*, and *Cyperus iria*.

Associated Species: *Albizia procera*, *Caperonia palustris*, *Ceiba pentandra*, *Cyperus rotundus*, *Desmanthus virgatus*, *Melanthera nivea*, *Portulaca oleracea*, *Ricinus communis*, *Rottboellia cochinchinensis*, *Saccharum spontaneum*, and *Urochloa maxima*



Figure A-75—(A) General view of the site and (B) inflorescences of *Cynodon dactylon*, the dominant grass within the site. Forest Service photos by Johann D. Crespo-Zapata.

Managed Grassland Site 11

Ecological Life Zone: Subtropical moist forest

Location: Bo. Canóvanas, municipality of Loíza, PR

Site Description and Disturbance History: The site (fig. A-76) is located on a lowland plain at an elevation of approximately 0 m above sea level, with an estimated slope of 0 percent and canopy cover of 0 percent. It is a grass plot used for ornamental lawn production. This field was initially plowed and subsequently seeded with *Zoysia matrella* about 30 years ago. This site is sporadically treated with selective herbicides. Frequent dirt roads, managed grass plots, irrigation/drainage canals, and an active road are nearby. Abandoned or unmanaged small-scale horticulture patches are also nearby. This site is prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Zoysia matrella* grass. Additional minor or less represented secondary species include other graminoids such as *Echinochloa colona*, *Eleusine indica*, and *Leptochloa scabra*.

Associated Species: *Abildgaardia ovata*, *Acrostichum danaeifolium*, *Alternanthera philoxeroides*, *Cocos nucifera*, *Eclipta prostrata*, *Euphorbia serpens*, *Lemna valdiviana*, *Paspalum fasciculatum*, *Peltophorum pterocarpum*, *Pistia stratiotes*, *Portulaca oleracea*, and *Salvinia minima*



Figure A-76—(A) General view of the site and (B) stolon details of *Zoysia matrella*, the dominant grass within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Managed Grassland Site 12

Ecological Life Zone: Subtropical moist forest

Location: Bo. Canóvanas, municipality of Loíza, PR

Site Description and Disturbance History: The site (fig. A-77) is located on a lowland plain at an elevation of approximately 0 m above sea level, with an estimated slope of 7 percent and estimated canopy cover of 79.5 percent. Its location is in a farm that was previously used for grazing but shifted to agriculture in 2014 and, by the time the vegetation inventory was conducted, was producing a variety of fruits, vegetables, and other produce such as banana/plantain, papaya, pumpkin/squash, cassava, okra, and sugarcane. This site is an active/managed sugarcane (*Saccharum officinarum*) plantation. It was first plowed between 2015 and 2016, and for a few years it was an active plantain (*Musa × paradisiaca*) crop. The sugarcane was planted in 2021, without re-plowing, and it is usually cut and harvested every 6 months. Active plantain crops, frequented dirt roads, and urban development are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Saccharum officinarum* grass. Secondary species include graminoids and herbs such as *Cynodon dactylon*, *Leptochloa scabra*, *Urochloa maxima*, *Chloris radiata*, *Kyllinga nemoralis*, and *Ludwigia erecta*.

Associated Species: *Ceiba pentandra*, *Commelina diffusa* var. *diffusa*, *Cucurbita moschata*, *Cyperus iria*, *Desmanthus virgatus*, *Echinochloa colona*, *Euphorbia lasiocarpa*, *Indigofera tinctoria*, *Macroptilium lathyroides*, *Mecardonia procumbens*, *Mimosa pigra*, *Momordica charantia*, *Portulaca oleracea*, *Rhynchosia minima*, *Ricinus communis*, *Sesbania sericea*, *Spathodea campanulata*, and *Tarenaya spinosa*



Figure A-77—(A) General view of the site and (B) inflorescence of *Kyllinga nemoralis*, a sedge species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Managed Grassland Site 13

Ecological Life Zone: Subtropical moist forest

Location: Bo. San Isidro, municipality of Canóvanas, PR

Site Description and Disturbance History: The site (fig. A-78) is located on a lowland plain at an elevation of approximately 5 m above sea level, near a floodplain area, with an estimated slope of 0 percent and canopy cover of 0 percent. Its location is in a farm that mostly conducts livestock-related activities such as grazing, breeding, and maintenance. It is a grassland near a lagoon and freshwater marsh areas used for grazing by cows and horses (cows and horses were present at the time the vegetation inventory was conducted). Frequent cattle trails and urban development are nearby. This site is likely prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Axonopus compressus* grass, followed by *Panicum laxum*, another grass species. Additional minor or less represented secondary species include *Aeschynomene sensitiva*, *Hyptis atrorubens*, *Dieffenbachia seguine*, *Desmodium incanum*, *Ludwigia erecta*, and *Mimosa pudica* var. *unijuga*.

Associated Species: *Amaranthus spinosus*, *Centella erecta*, *Cissus verticillata*, *Clidemia hirta*, *Commelina diffusa* var. *diffusa*, *Cuphea strigulosa*, *Cyperus giganteus*, *Fuirena umbellata*, *Heteranthera reniformis*, *Hyptis verticillata*, *Ipomoea setifera*, *Kyllinga brevifolia*, *Lindernia diffusa*, *Miconia racemosa*, *Mimosa pigra*, *Nelsonia canescens*, *Rhynchospora corymbosa*, *Salix humboldtiana*, *Torenia crustacea*, and *Urena lobata*

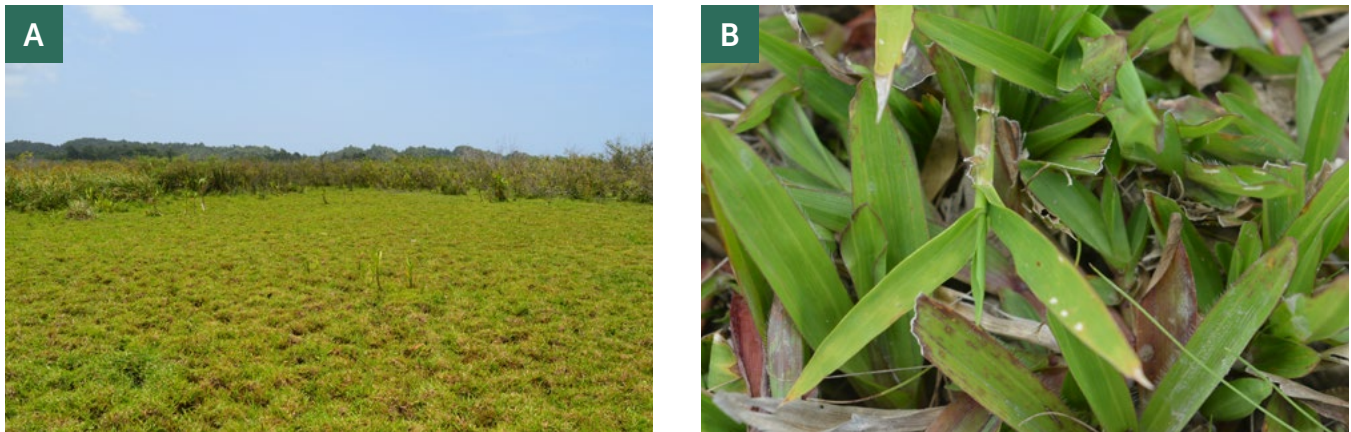


Figure A-78—(A) General view of the site and (B) leaf blades of *Axonopus compressus*, the dominant grass within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Abandoned Grassland Site 1

Ecological Life Zone: Subtropical moist forest

Location: Bo. Las Palmas, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-79) is located on an upper backslope, near the shoulder of a mountain, at an elevation of approximately 335 m above sea level, with an estimated slope of 28.2 percent and estimated canopy cover of 90.6 percent. It is an abandoned or unmanaged grassland. A possible abandoned tillage crop and/or horticulture area is nearby. An unfrequented dirt road is also nearby. The area's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Pennisetum purpureum* grass. Notable additional species include *Cissus verticillata* and *Gouania polygama* vines, followed mostly by *Chromolaena odorata*, *Clidemia hirta*, *Dissotis rotundifolia*, *Ipomoea tiliacea*, *Passiflora rubra*, *Trichostigma octandrum*, *Cordia polycephala*, and *Rubus rosifolius*. Additional minor or less represented secondary species include *Iresine diffusa*, *Melanthera nivea*, *Oeceoclades maculata*, *Melothria pendula*, and *Momordica charantia*.

Associated Species: *Bambusa vulgaris*, *Casearia sylvestris*, *Cecropia schreberiana* ssp. *schreberiana*, *Cupania americana*, *Cyathea* sp., *Guarea guidonia*, *Heliconia* sp., *Psidium guajava*, *Tabebuia heterophylla*, and *Zanthoxylum martinicense*



Figure A-79—(A) General view of the site and (B) *Dissotis rotundifolia*, a creeping herb observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Abandoned Grassland Site 2

Ecological Life Zone: Subtropical moist forest

Location: Bo. Las Palmas, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-80) is located on an upper backslope, near the ridge of a mountain, at an elevation of approximately 346 m above sea level, with an estimated slope of 28.2 percent and canopy cover of 0 percent. It is an abandoned or unmanaged grassland. An abandoned or unfrequented dirt road is nearby. Possible landslide and abandoned horticulture areas are also nearby. The area's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Urochloa maxima* grass. Shrub species include *Psidium guajava*, *Clidemia hirta*, *Gliricidia sepium*, *Cupania americana*, *Chromolaena odorata*, *Urena lobata*, and *Miconia racemosa*. Additional minor or less represented secondary species include mostly herbs, vines, and lianas such as *Ipomoea tiliacea*, *Mikania micrantha*, *Cissampelos pareira*, *Pueraria phaseoloides*, *Gouania polygama*, *Thunbergia alata*, *Elephantopus mollis*, *Desmodium incanum*, and *Dissotis rotundifolia*.

Associated Species: *Casearia guianensis*, *Casearia sylvestris*, *Cissus verticillata*, *Hyptis capitata*, *Iresine diffusa*, *Melothria pendula*, *Miconia impatiolaris*, *Momordica charantia*, *Mucuna pruriens*, *Nephrolepis multiflora*, *Oeceoclades maculata*, *Passiflora rubra*, *Roystonea borinquena*, *Serjania polyphylla*, *Spathodea campanulata*, *Tabebuia heterophylla*, and *Tillandsia utriculata*



Figure A-80—(A) General view of the site mostly showing *Urochloa maxima* grass and (B) details of its flowers and seeds. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Abandoned Grassland Site 3

Ecological Life Zone: Subtropical moist forest

Location: Bo. Las Palmas, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-81) is located on a lower backslope at an elevation of approximately 324 m above sea level, with an estimated slope of 42.4 percent and canopy cover of 0 percent. It is an abandoned or unmanaged grassland and a former grazing area. A drainage area is nearby. Possible landslide and abandoned horticulture areas are also nearby. The area's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Urochloa maxima* grass. Notable additional species include vines such as *Mikania micrantha*, *Pueraria phaseoloides*, *Cissus verticillata*, and *Merremia umbellata*. Additional minor or less represented secondary species are other vines and herbs such as *Centrosema virginianum*, *Melothria pendula*, *Vigna vexillata*, *Iresine diffusa*, and *Commelina diffusa* var. *diffusa*.

Associated Species: *Andira inermis*, *Asystasia gangetica*, *Clidemia hirta*, *Cordia polycephala*, *Nephrolepis multiflora*, *Psidium guajava*, and *Schefflera morototoni*

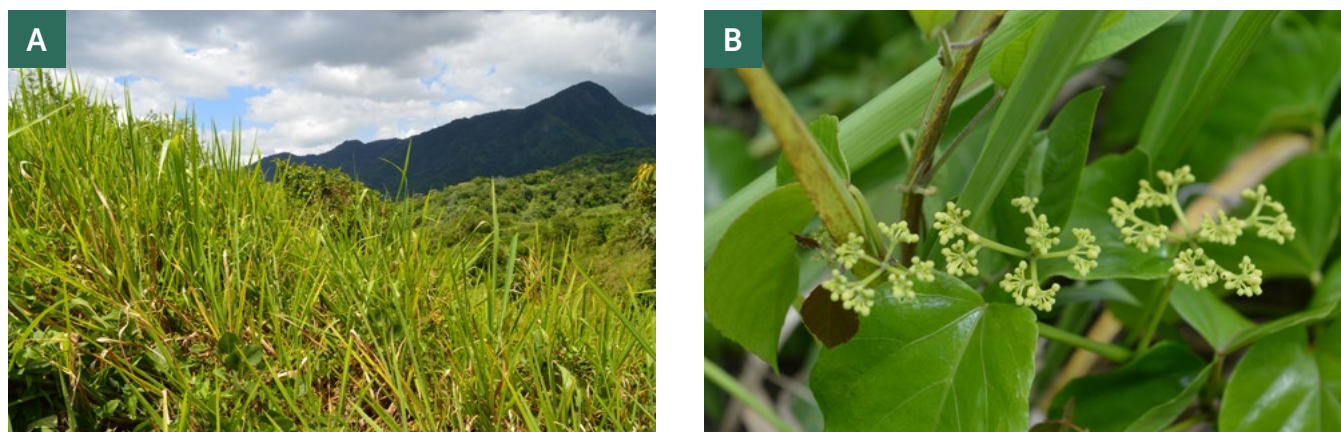


Figure A-81—(A) General view of the site and (B) *Cissus verticillata* with flower buds, a vine species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Abandoned Grassland Site 4

Ecological Life Zone: Subtropical moist forest

Location: Bo. Caonillas Arriba, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-82) is located on a lower backslope at an elevation of approximately 316 m above sea level, with an estimated slope of 49.5 percent and canopy cover of 0 percent. It is an abandoned or unmanaged grassland. A possible landslide area is nearby. The area's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Cynodon nlemfuensis* grass. Notable additional species include ferns, vines, and shrubs such as *Nephrolepis multiflora*, *Pityrogramma calomelanos*, *Cissus verticillata*, *Chromolaena odorata*, *Guarea guidonia*, and *Piper aduncum*. Additional minor or less represented secondary species include mostly vines, herbs, shrubs, ferns, and graminoids such as *Thunbergia alata*, *Rubus rosifolius*, *Pueraria phaseoloides*, *Mikania micrantha*, *Passiflora rubra*, *Melothria pendula*, *Momordica charantia*, *Mimosa pudica* var. *unijuga*, *Stachytarpheta cayennensis*, *Psidium guajava*, *Cordia polycephala*, *Odontosoria aculeata*, *Andropogon bicornis*, and *Digitaria insularis*.

Associated Species: *Cecropia schreberiana* ssp. *schreberiana*, *Cupania americana*, *Miconia impetiolaris*, *Miconia laevigata*, and *Spathodea campanulata*



Figure A-82—(A) General view of the site and (B) pinnae of *Odontosoria aculeata*, a spiny fern observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Abandoned Grassland Site 5

Ecological Life Zone: Subtropical dry forest

Location: Bo. Sabana Yeguas, municipality of Lajas, PR

Site Description and Disturbance History: The site (fig. A-83) is located on a lowland plain at an elevation of approximately 36 m above sea level, with an estimated slope of 0 percent and estimated canopy cover of 24 percent. It is an abandoned or unmanaged grassland/grazing field. A water canal is nearby. An unfrequented dirt trail and low-density urban development are also nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by *Urochloa maxima* grass, followed by shrubs of *Leucaena leucocephala* and *Adelia ricinella*. Other shrubs include *Samanea saman*, *Jatropha gossypifolia*, *Vachellia farnesiana* var. *farnesiana*, and an undetermined *Lantana* species. Other notable species are *Melochia nodiflora*, *Ipomoea tiliacea*, and *Centrosema pubescens*. Additional species are herbs and vines such as *Desmodium incanum*, *Cyanthillium cinereum*, *Commelina diffusa* var. *diffusa*, and *Passiflora suberosa*.

Associated Species: *Cestrum diurnum*, *Cissus verticillata*, *Delonix regia*, *Desmanthus virgatus*, *Jasminum fluminense*, *Merremia umbellata*, *Pithecellobium dulce*, *Roystonea borinquena*, *Sida abutilifolia*, *Trichilia hirta*, and *Triumfetta lappula*



Figure A-83—(A) General view of the site and (B) inflorescence/buds of *Leucaena leucocephala*, a common species in the site. Forest Service photos by Johann D. Crespo-Zapata.

Abandoned Grassland Site 6

Ecological Life Zone: Subtropical dry forest

Location: Bo. Sabana Yeguas, municipality of Lajas, PR

Site Description and Disturbance History: The site (fig. A-84) is located on a lowland plain at an elevation of approximately 33 m above sea level, with an estimated slope of 0 percent and canopy cover of 0 percent. It is an abandoned or unmanaged grassland/grazing field. An active road and low-density urban development are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Urochloa maxima* grass. Other notable species include saplings and shrubs of *Casearia aculeata* and subshrubs/shrubs of *Melochia nodiflora*. Other graminoids include mainly *Cynodon nlemfuensis*, *Digitaria eriantha*, *Bothriochloa pertusa*, and *Dichanthium annulatum*. Additional minor or less represented secondary species include herbs and vines such as *Melochia pyramidata*, *Ludwigia octovalvis*, *Ruellia blechum*, *Centrosema pubescens*, and *Passiflora foetida*.

Associated Species: *Cocos nucifera*, *Ficus citrifolia*, *Fimbristylis dichotoma*, *Malachra alceifolia*, *Mangifera indica*, *Melicoccus bijugatus*, *Paspalum millegrana*, *Passiflora suberosa*, *Pithecellobium dulce*, *Samanea saman*, *Senna siamea*, *Sporobolus jacquemontii*, and *Swietenia macrophylla*



Figure A-84—(A) General view of the site and (B) flowers of *Melochia pyramidata*, an herb species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Abandoned Grassland Site 7

Ecological Life Zone: Subtropical dry forest

Location: Bo. Sabana Yeguas, municipality of Lajas, PR

Site Description and Disturbance History: The site (fig. A-85) is located on a lowland plain at an elevation of approximately 33 m above sea level, with an estimated slope of 0 percent and canopy cover of 0 percent. It is an abandoned or unmanaged grassland/grazing field. An active road and low-density urban development are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Urochloa maxima* grass. Other notable species are shrubs of *Mimosa pigra* and *Corchorus siliquosus*. Additional minor or less represented secondary species include other grasses, shrubs, and herbs such as *Dichanthium annulatum*, *Digitaria eriantha*, *Cynodon nlemfuensis*, *Sida rhombifolia*, *Sida abutilifolia*, *Cestrum diurnum*, *Euphorbia hypericifolia*, and *Ipomoea tiliacea*.

Associated Species: *Cocos nucifera*, *Ficus citrifolia*, *Fimbristylis dichotoma*, *Indigofera suffruticosa*, *Lantana* sp., *Mangifera indica*, *Melicoccus bijugatus*, *Melochia nodiflora*, *Paspalum millegrana*, *Passiflora suberosa*, *Pithecellobium dulce*, *Samanea saman*, *Senna siamea*, *Spermacoce remota*, *Sporobolus jacquemontii*, and *Swietenia macrophylla*

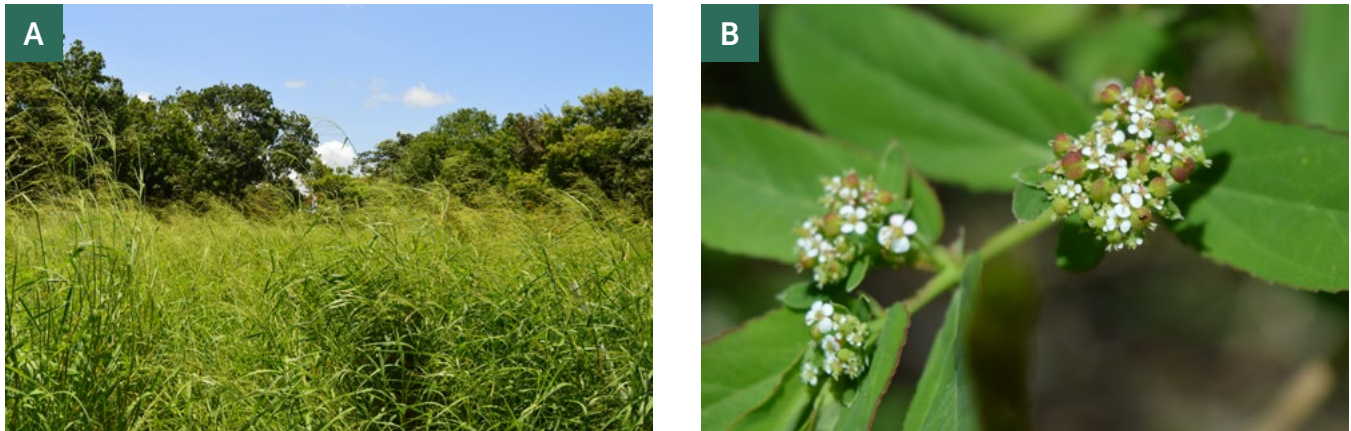


Figure A-85—(A) General view of the site and (B) flowers of *Euphorbia hypericifolia*, a spurge species observed in the site. Forest Service photos by Johann D. Crespo-Zapata.

Abandoned Grassland Site 8

Ecological Life Zone: Subtropical dry forest

Location: Bo. Sabana Yeguas, municipality of Lajas, PR

Site Description and Disturbance History: The site (fig. A-86) is located on a lowland plain at an elevation of approximately 33 m above sea level, with an estimated slope of 7 percent and canopy cover of 0 percent. It is an abandoned or unmanaged grassland/grazing field. An active road and low-density urban development are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Digitaria eriantha* grass. Other notable grasses are *Paspalum millegrana* and *Dichanthium annulatum*. Additional minor or less represented secondary species are shrubs, vines, and other grasses such as *Vachellia farnesiana* var. *farnesiana*, *Triumfetta lappula*, *Centrosema pubescens*, and *Urochloa maxima*.

Associated Species: *Leucaena leucocephala*, *Mimosa pigra*, and *Samanea saman*



Figure A-86—(A) General view of the site and (B) spikelets of *Paspalum millegrana*, a grass observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Abandoned Grassland Site 9

Ecological Life Zone: Subtropical dry forest

Location: Bo. Boquerón, municipality of Cabo Rojo, PR

Site Description and Disturbance History: The site (fig. A-87) is located on a coastal plain at an elevation of approximately 10 m above sea level, with an estimated slope of 0 percent and canopy cover of 0 percent. It is an abandoned or unmanaged grassland. Frequent mountain biking, motorcycling, and hiking trails/dirt roads are nearby. This site is located in an area mostly used for mountain biking and motorcycling.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Bothriochloa pertusa* grass. Notable shrubs include *Vachellia farnesiana* var. *farnesiana* and *Waltheria indica*. Other notable species are mostly herbs and vines such as *Crotalaria retusa*, *Turnera ulmifolia*, *Desmodium scorpiurus*, *Rhynchosia minima*, *Stigmaphyllon emarginatum*, and *Jasminum fluminense*. Additional minor or less represented secondary species include other vines and herbs such as *Ipomoea triloba*, *Macroptilium lathyroides*, and *Alysicarpus vaginalis*.

Associated Species: *Randia aculeata*, *Rauvolfia nitida*, *Spermacoce confusa*, *Swietenia mahagoni*, and *Tamarindus indica*



Figure A-87—(A) General view of the site and (B) flowers of *Crotalaria retusa*, an herb species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Abandoned Grassland Site 10

Ecological Life Zone: Subtropical moist forest

Location: Bo. Quebrada Fajardo, municipality of Fajardo, PR

Site Description and Disturbance History: The site (fig. A-88) is located on a lowland plain at an elevation of approximately 25 m above sea level, with an estimated slope of 14.1 percent and canopy cover of 0 percent. It is an abandoned or unmanaged grassland and a wilderness area used by feral horses (horses were absent at the time the vegetation inventory was conducted). Feral horse trails are nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Paspalum virgatum* grass. Other notable species are vines of *Ipomoea setifera*, *Mimosa casta*, and *Passiflora foetida*. Additional minor or less represented secondary species include *Chromolaena odorata*, *Scleria pterota*, *Vigna adenantha*, *Rolandra fruticosa*, and *Mimosa pudica* var. *unijuga*.

Associated Species: *Casearia guianensis*, *Casearia sylvestris*, *Citharexylum spinosum*, *Jasminum fluminense*, *Mimosa pigra*, *Oxalis barrelieri*, *Peltophorum pterocarpum*, *Senna bicapsularis*, *Senna obtusifolia*, and *Triumfetta semitriloba*



Figure A-88—(A) General view of the site and (B) spikelets of *Paspalum virgatum*, the dominant grass within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Abandoned Grassland Site 11

Ecological Life Zone: Subtropical moist forest

Location: Bo. Pitahaya, municipality of Luquillo, PR

Site Description and Disturbance History: The site (fig. A-89) is located on a lowland plain at an elevation of approximately 7 m above sea level, with an estimated slope of 0 percent and canopy cover of 0 percent. It is an abandoned or unmanaged grassland. A frequented dirt road is nearby. This site is likely prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Urochloa mutica* grass. Other notable species are mostly vines of *Mimosa casta*, *Mikania micrantha*, and *Ipomoea tiliacea*. Additional minor or less represented secondary species include mainly *Colocasia esculenta*, *Melothria pendula*, *Ipomoea setifera*, and *Commelina diffusa* var. *diffusa*.

Associated Species: *Andira inermis*, *Chromolaena odorata*, *Cissus verticillata*, *Guapira fragrans*, *Mimosa pigra*, *Terminalia catappa*, *Vigna adenantha*, and *Vigna hosei*



Figure A-89—(A) General view of the site and (B) spikelets of *Urochloa mutica*, the dominant grass within the site. Forest Service photos by Johann D. Crespo-Zapata.

Abandoned Grassland Site 12

Ecological Life Zone: Subtropical moist forest

Location: Bo. Pitahaya, municipality of Luquillo, PR

Site Description and Disturbance History: The site (fig. A-90) is located on a lowland plain at an elevation of approximately 7 m above sea level, with an estimated slope of 0 percent and canopy cover of 0 percent. It is an abandoned or unmanaged grassland. A frequented dirt road and parking lot are nearby. This site is prone to flooding; some areas around the site were mildly flooded at the time the vegetation inventory was conducted (ankle-deep water and mud).

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Paspalum fasciculatum* grass. Secondary species are primarily *Mimosa casta*, *Ipomoea tiliacea*, and *Colocasia esculenta*. Additional minor or less represented species include *Ipomoea setifera*, *Mikania micrantha*, *Melothria pendula*, *Commelina diffusa* var. *diffusa*, *Mimosa pigra*, and *Merremia umbellata*.

Associated Species: *Cestrum diurnum*, *Citharexylum spinosum*, *Gliricidia sepium*, *Hymenachne amplexicaulis*, *Scleria eggersiana*, *Terminalia catappa*, and *Ziziphus mauritiana*

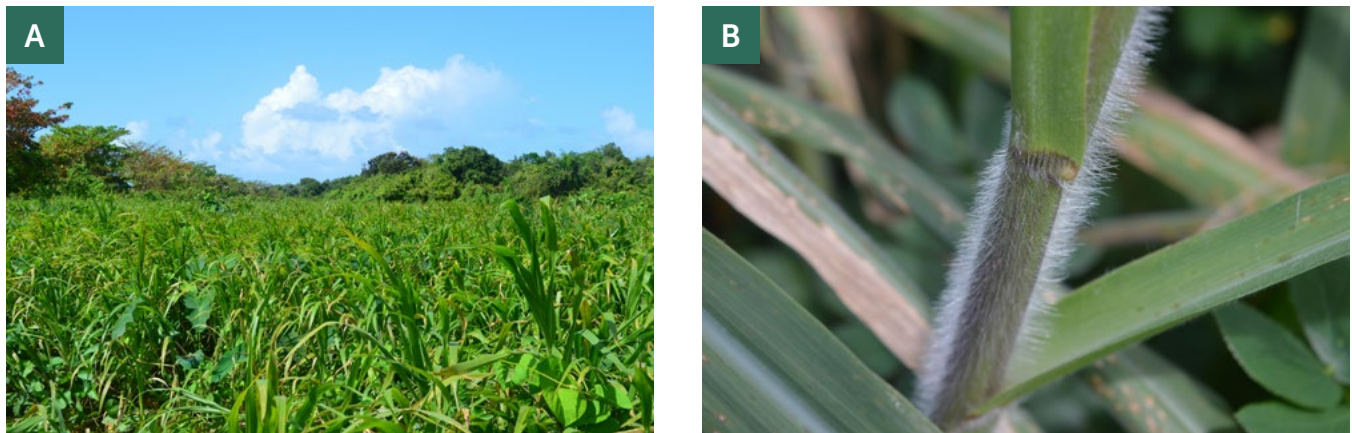


Figure A-90—(A) General view of the site and (B) sheath details of *Paspalum fasciculatum*, the dominant grass within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Abandoned Grassland Site 13

Ecological Life Zone: Subtropical moist forest

Location: Bo. Canóvanas, municipality of Canóvanas, PR

Site Description and Disturbance History: The site (fig. A-91) is located on a lowland plain at an elevation of approximately 0 m above sea level, near a stream, with an estimated slope of 0 percent and canopy cover of 0 percent. It is an abandoned or unmanaged grassland. Frequent dirt roads, managed grass plots, and an active road are nearby. This site is prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Paspalum fasciculatum* grass. Another notable graminoid species is *Scleria eggersiana*. Additional minor or less represented secondary species include vines of *Ipomoea tiliacea*, *Melothria pendula*, *Merremia umbellata*, and *Mimosa casta*.

Associated Species: *Cocos nucifera*, *Cyperus articulatus*, *Mimosa pigra*, *Peltophorum pterocarpum*, *Ricinus communis*, *Roystonea borinquena*, and *Sphagneticola trilobata*



Figure A-91—(A) General view of the site and (B) inflorescence/nutlets of *Scleria eggersiana*, a nutrush observed in the site. Forest Service photos by Johann D. Crespo-Zapata.

Abandoned Grassland Site 14

Ecological Life Zone: Subtropical moist forest

Location: Bo. Canóvanas, municipality of Loíza, PR

Site Description and Disturbance History: The site (fig. A-92) is located on a floodplain at an elevation of approximately 0 m above sea level, near a water canal (marsh area), with an estimated slope of 0 percent and canopy cover of 0 percent. Its location is in a farm that was previously used for grazing but shifted to agriculture in 2014 and, by the time the vegetation inventory was conducted, was producing a variety of fruits, vegetables, and other produce such as banana/plantain, papaya, pumpkin/squash, cassava, okra, and sugarcane. It is an abandoned or unmanaged grassland. Active plantain (*Musa × paradisiaca*) crops are nearby. This site is prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Paspalum pleostachyum* grass. Other notable species are *Paspalum vaginatum* grass and *Cyperus ligularis* sedges. Additional minor or less represented secondary species include *Mikania cordifolia* and *Vigna luteola* vines, as well as *Acrostichum danaeifolium* ferns, and other graminoids such as *Echinochloa crus-galli*, *Paspalum fasciculatum*, and *Eleocharis mutata*.

Associated Species: *Acrostichum aureum*, *Annona glabra*, *Casuarina equisetifolia*, *Ceratopteris thalictroides*, *Cyperus giganteus*, *Cyperus polystachyos*, *Machaerium lunatum*, *Mimosa pigra*, *Musa × paradisiaca* (cultivated), *Peltophorum pterocarpum*, *Sesuvium maritimum*, *Sesuvium portulacastrum*, and *Typha domingensis*

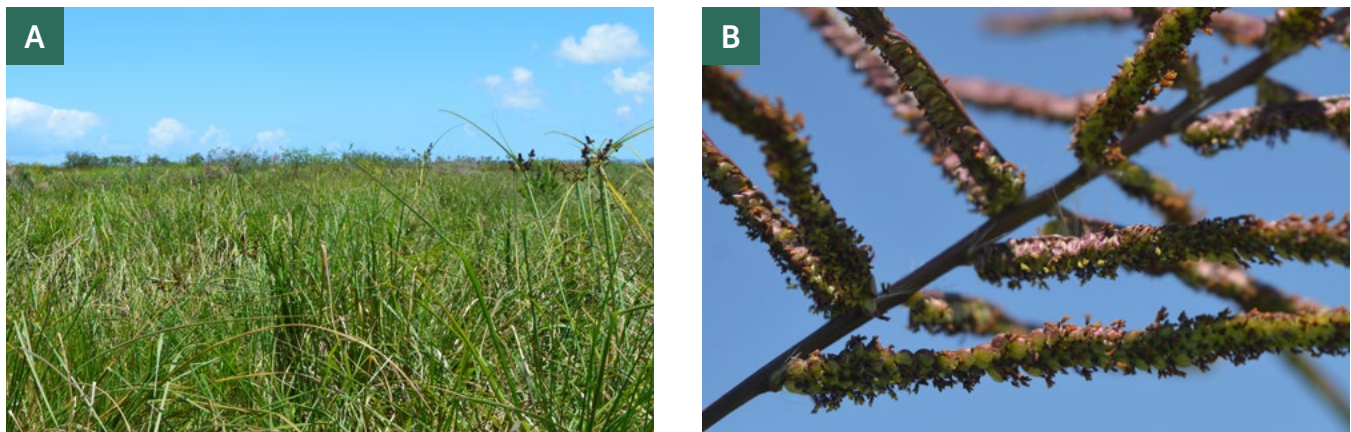


Figure A-92—(A) General view of the site and (B) spikelets of *Paspalum pleostachyum*, the dominant grass within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Abandoned Grassland Site 15

Ecological Life Zone: Subtropical moist forest

Location: Bo. Torrecilla Alta, municipality of Loíza, PR

Site Description and Disturbance History: The site (fig. A-93) is located on a lowland plain at an elevation of approximately 5 m above sea level, near floodplain areas, with an estimated slope of 0 percent and canopy cover of 0 percent. Its location is in a farm that harbors areas with tree plantations as a result of different mitigation projects. It is a former grazing area and abandoned or unmanaged grassland in a wilderness area used by feral horses (horses were absent at the time the vegetation inventory was conducted). Feral horse trails and an unfrequented dirt road are nearby. Plantations of trees are also nearby. This site is likely prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Paspalum vaginatum* grass. The main secondary species is *Paspalum pleostachyum* grass, followed by *Mikania cordifolia* vines. Other notable grasses are *Cynodon dactylon*, *Urochloa mutica*, and *Paspalidium geminatum*. Less represented species include *Eleocharis mutata*, *Phyla nodiflora*, *Schoenoplectus americanus*, *Neptunia plena*, *Typha domingensis*, and *Vigna luteola*.

Associated Species: *Acrostichum danaeifolium*, *Annona glabra*, *Cyperus giganteus*, *Cyperus ligularis*, *Enydra sessilis*, *Mimosa pigra*, and *Paullinia pinnata*



Figure A-93—(A) General view of the site and (B) inflorescence of *Mikania cordifolia*, a vine species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Abandoned Grassland Site 16

Ecological Life Zone: Subtropical moist forest

Location: Bo. Torrecilla Alta, municipality of Loíza, PR

Site Description and Disturbance History: The site (fig. A-94) is located on a floodplain at an elevation of approximately 0 m above sea level, near a small pond, with an estimated slope of 0 percent and canopy cover of 0 percent. Its location is in a farm that harbors areas with tree plantations as a result of different mitigation projects. It is a former grazing area and abandoned or unmanaged grassland in a wilderness area used by feral horses (horses were absent at the time the vegetation inventory was conducted). Feral horse trails and plantations of trees are nearby. This site is prone to flooding, but it was dry at the time the vegetation inventory was conducted.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Urochloa arrecta* grass. Secondary grasses are *Leersia hexandra* and *Urochloa mutica*. Additional minor or less represented secondary species include mostly small shrubs, subshrubs, and herbs such as *Mimosa pigra*, *Ludwigia leptocarpa*, *Aeschynomene sensitiva*, *Eleocharis mutata*, and *Neptunia plena*.

Associated Species: *Acrostichum danaeifolium*, *Annona glabra*, *Ipomoea tiliacea*, *Mikania cordifolia*, *Mimosa casta*, and *Typha domingensis*



Figure A-94—(A) General view of the site and (B) spikelets of *Urochloa arrecta*, the dominant grass within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Abandoned Grassland Site 17

Ecological Life Zone: Subtropical moist forest

Location: Bo. Tierras Nuevas Poniente, municipality of Manatí, PR

Site Description and Disturbance History: The site (fig. A-95) is located on a lowland plain at an elevation of approximately 0 m above sea level, near a stream, with an estimated slope of 0 percent and estimated canopy cover of 56.7 percent. It is an abandoned or unmanaged grassland. A frequented dirt road is nearby.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is dominated by *Saccharum spontaneum* grass. Less represented grasses are *Urochloa maxima* and *Urochloa mutica*. Minor or less represented species include shrubs of *Mimosa pigra* and several vine species such as *Passiflora foetida*, *Ipomoea tiliacea*, *Melothria pendula*, and *Vigna luteola*.

Associated Species: *Albizia procera*, *Bidens alba* var. *radiata*, *Commelina diffusa* var. *diffusa*, *Cuphea strigulosa*, *Cyanthillium cinereum*, *Ludwigia octovalvis*, *Merremia umbellata*, *Mikania cordifolia*, *Ruellia blechum*, and *Spathodea campanulata*



Figure A-95—(A) General view of the site and (B) opening flower of *Passiflora foetida*, a vine species observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Abandoned Horticulture Site 1

Ecological Life Zone: Subtropical moist forest

Location: Bo. Las Palmas, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-96) is located on a footslope at an elevation of approximately 291 m above sea level, with an estimated slope of 21.2 percent and canopy cover of 0 percent. Low-density urban development is nearby. An active banana/plantain plantation is also nearby. The area's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by vines and herbs such as *Ipomoea setifera*, *Pueraria phaseoloides*, *Mikania micrantha*, *Dissotis rotundifolia*, and *Centrosema virginianum*. Shrub and subshrub species include *Psidium guajava*, *Casearia guianensis*, *Urena lobata*, *Chromolaena odorata*, and *Clidemia hirta*. Additional species include vines such as *Passiflora rubra*, *Merremia quinquefolia*, and *Momordica charantia*.

Associated Species: *Andira inermis*, *Bambusa vulgaris*, *Bixa orellana*, *Casearia sylvestris*, *Cecropia schreberiana* ssp. *schreberiana*, *Cocos nucifera*, *Colocasia esculenta*, *Cordia polycephala*, *Cupania americana*, *Cyperus* sp., *Guarea guidonia*, *Miconia impetolaris*, *Mucuna pruriens*, *Musa* sp., *Piper aduncum*, *Ricinus communis*, *Spathodea campanulata*, *Spondias dulcis*, *Stigmaphyllon floribundum*, *Syzygium jambos*, *Tournefortia hirsutissima*, *Trichostigma octandrum*, *Urena lobata*, *Xanthosoma sagittifolium*, and *Zanthoxylum martinicense*



Figure A-96—(A) General view of the site and (B) flower of *Passiflora rubra*, a species of vine observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Abandoned Horticulture Site 2

Ecological Life Zone: Subtropical moist forest

Location: Bo. Las Palmas, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-97) is located around a mountain shoulder area at an elevation of approximately 330 m above sea level, with an estimated slope of 35.3 percent and estimated canopy cover of 28.2 percent. It is an abandoned *Musa × paradisiaca* plantation and *Ananas comosus* to a lesser extent. An abandoned or unfrequented dirt road is nearby. A possible landslide area is also nearby. The area's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by vines and herbs such as *Thunbergia alata*, *Mikania micrantha*, *Dissotis rotundifolia*, and *Commelina diffusa* var. *diffusa*. Other notable species are *Musa × paradisiaca*, *Psidium guajava*, *Melanthera nivea*, *Pueraria phaseoloides*, *Urochloa maxima*, *Cupania americana*, *Stigmaphyllon floribundum*, *Sida rhombifolia*, *Iresine diffusa*, and *Ipomoea setifera*. Additional minor or less represented secondary species include mainly *Ananas comosus*, *Urena lobata*, *Cissus verticillata*, *Rubus rosifolius*, *Centrosema virginianum*, *Nephrolepis multiflora*, and *Cynodon nlemfuensis*.

Associated Species: *Casearia guianensis*, *Casearia sylvestris*, *Digitaria* sp., *Euphorbia heterophylla*, *Mangifera indica*, *Miconia impetioaralis*, *Mimosa pudica* var. *unijuga*, *Musa × paradisiaca*, *Phoradendron* sp., *Solanum americanum*, *Spathodea campanulata*, *Spondias dulcis*, and *Tournefortia hirsutissima*



Figure A-97—(A) General view of the site and (B) flowers of *Dissotis rotundifolia*, a creeping herb observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Abandoned Horticulture Site 3

Ecological Life Zone: Subtropical moist forest

Location: Bo. Caonillas Arriba, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-98) is located on a lower backslope, near a footslope, at an elevation of approximately 395 m above sea level, with an estimated slope of 42.4 percent and estimated canopy cover of 58.2 percent. It is a former coffee (*Coffea arabica*) plantation (ceased in 2017). Low-density urban development is nearby. Herbicides are used infrequently in the site's surroundings. The area's historical land use includes mostly grazing and plantations of tobacco, coffee and, to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by *Coffea arabica*, *Inga vera*, *Piper amalago*, and *Guarea guidonia* shrubs. Other notable species include *Musa acuminata*, *Gliricidia sepium*, *Miconia prasina*, *Piper hispidum*, *Piper glabrescens*, and *Ocotea leucoxydon*. Additional secondary species include herbs, vines, lianas, and ferns such as *Diodia ocymifolia*, *Begonia hirtella*, *Euphorbia heterophylla*, *Momordica charantia*, *Mikania micrantha*, *Paullinia pinnata*, *Tectaria incisa*, *Blechnum occidentale*, and *Cnemidaria horrida*.

Associated Species: *Adiantum pyramidale*, *Adiantum* sp., *Casearia sylvestris*, *Citrus × aurantium*, *Coffea liberica* var. *liberica*, *Cordia sulcata*, *Macfadyena unguis-cati*, *Persea americana*, *Piper aduncum*, *Piper umbellatum*, and *Thespesia grandiflora*

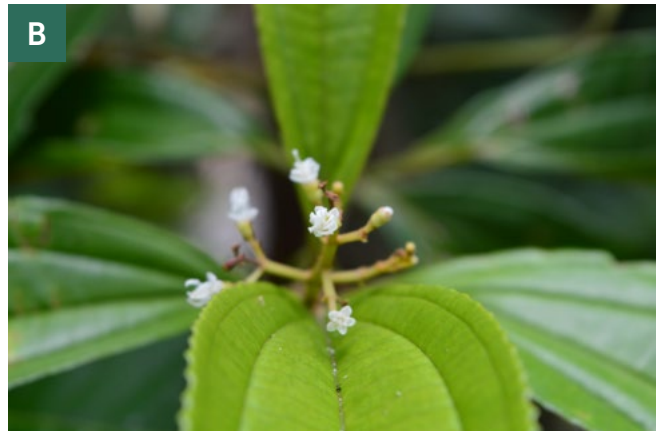


Figure A-98—(A) General view of the site and (B) flowers of *Miconia prasina*, a species of shrub observed within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix A

Abandoned Horticulture Site 4

Ecological Life Zone: Subtropical moist forest

Location: Bo. Las Palmas, municipality of Utuado, PR

Site Description and Disturbance History: The site (fig. A-99) is located on a lower backslope at an elevation of approximately 396 m above sea level, with an estimated slope of 35.3 percent. Because no canopy photos were obtained at this site, canopy cover estimation is not applicable. It is an abandoned cassava (*Manihot esculenta*), cocoa (*Theobroma cacao*), and coffee (*Coffea arabica*) plantation. Low-density urban development is nearby. The area's historical land use includes mostly grazing and plantations of tobacco, coffee, and to a lesser extent, banana/plantain.

Sampling Plot(s): Fixed-area square plot (10 x 10 m; 0.01 ha)

Summarized Inventory Species: This site is mostly dominated by shrubs of *Manihot esculenta*, *Theobroma cacao*, and *Coffea arabica* and subshrubs of *Chromolaena odorata*. Notable additional species include *Melanthera nivea*, *Clidemia hirta*, *Mikania micrantha*, *Ipomoea setifera*, and *Triumfetta semitriloba*. Additional minor or less represented species include herbs, vines, lianas, and ferns such as *Iresine diffusa*, *Commelina diffusa* var. *diffusa*, *Syngonium podophyllum*, *Cissus verticillata*, *Gouania polygama*, and *Nephrolepis multiflora*.

Associated Species: *Andropogon bicornis*, *Cajanus cajan*, *Cecropia schreberiana* ssp. *schreberiana*, *Chrysophyllum cainito*, *Cocos nucifera*, *Cuphea strigulosa*, *Mangifera indica*, *Miconia impatiolaris*, *Spathodea campanulata*, *Swietenia × aubrevilleana*, and *Syzygium jambos*



Figure A-99—(A) General view of the site and (B) flowers of *Theobroma cacao*, a dominant species within the site. Forest Service photos by Johann D. Crespo-Zapata.

Appendix B: Species List

The growth habits listed here are generally the most representative of each respective species. However, numerous plants may exhibit multiple growth habits, depending on a variety of factors. Therefore, inconsistencies may be noted when cross-referencing with growth habits and/or biological stages applied elsewhere in this report (see Vegetation Data in the Methodology section). Furthermore, the categories of ferns, lianas, cacti, and epiphytes are excluded here, and the growth habits applied below for corresponding species' cases are herbs, vines, subshrubs, shrubs, and trees instead. The graminoid category is applied to sedges, grasses, and cattails (i.e., Cyperaceae, Poaceae, and Typhaceae).

The origin of each species is indicated as native (N) or introduced (I). The relation to sampling plots is shown as inventory only (I), associated only (A), or both associated and inventory (B). See Vegetation Data in the Methodology section for specifics regarding the terms “inventory species” and “associated species.”

Table B-1—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Abelmoschus esculentus</i> (L.) Moench	Malvaceae	I	Subshrub	A
<i>Abildgaardia ovata</i> (Burm. f.) Kral	Cyperaceae	N	Graminoid	B
<i>Abrus precatorius</i> L.	Fabaceae	I	Vine	B
<i>Acalypha alopecuroides</i> Jacq.	Euphorbiaceae	N	Herb	A
<i>Acalypha chamaedryfolia</i> (Lam.) Müll. Arg.	Euphorbiaceae	N	Herb	A
<i>Achyranthes aspera</i> L. var. <i>aspera</i>	Amaranthaceae	I	Herb	B
<i>Acrocomia media</i> O. F. Cook	Arecaceae	N	Tree	A
<i>Acrostichum aureum</i> L.	Pteridaceae	N	Herb	A
<i>Acrostichum danaeifolium</i> Langsd. & Fisch.	Pteridaceae	N	Herb	B
<i>Adelia ricinella</i> L.	Euphorbiaceae	N	Shrub	B
<i>Adiantum latifolium</i> Lam.	Pteridaceae	N	Herb	B
<i>Adiantum pyramidale</i> (L.) Willd.	Pteridaceae	N	Herb	B
<i>Adiantum tetraphyllum</i> Humb. & Bonpl. ex Willd.	Pteridaceae	N	Herb	A
<i>Adonidia merrillii</i> (Becc.) Becc.	Arecaceae	I	Tree	I
<i>Aeschynomene rudis</i> Benth.	Fabaceae	N	Shrub	B
<i>Aeschynomene sensitiva</i> Sw.	Fabaceae	N	Subshrub	I
<i>Albizia procera</i> (Roxb.) Benth.	Fabaceae	I	Tree	B
<i>Alchornea latifolia</i> Sw.	Euphorbiaceae	N	Tree	B
<i>Alocasia macrorrhizos</i> (L.) G. Don	Araceae	I	Herb	I
<i>Alpinia purpurata</i> (Vieill.) K. Schum.	Zingiberaceae	I	Herb	I
<i>Alsophila portoricensis</i> (Spreng. ex Kuhn) Conant	Cyatheaceae	N	Tree	A
<i>Alternanthera philoxeroides</i> (Mart.) Griseb.	Amaranthaceae	I	Herb	B
<i>Alysicarpus vaginalis</i> (L.) DC.	Fabaceae	I	Herb	I
<i>Amaranthus dubius</i> Mart. ex Thell.	Amaranthaceae	N	Herb	B
<i>Amaranthus spinosus</i> L.	Amaranthaceae	N	Herb	B
<i>Ammannia latifolia</i> L.	Lythraceae	N	Herb	A
<i>Amphitecna latifolia</i> (Mill.) A. H. Gentry	Bignoniaceae	N	Tree	B
<i>Amyris elemifera</i> L.	Rutaceae	N	Shrub	I
<i>Ananas comosus</i> (L.) Merr.	Bromeliaceae	I	Herb	B

Appendix B

Table B-1 (cont.)—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Andira inermis</i> (W. Wright) Kunth ex DC.	Fabaceae	N	Tree	B
<i>Andropogon bicornis</i> L.	Poaceae	N	Graminoid	B
<i>Aniseia martinicensis</i> (Jacq.) Choisy	Convolvulaceae	N	Vine	B
<i>Annona glabra</i> L.	Annonaceae	N	Tree	B
<i>Annona montana</i> Macfad.	Annonaceae	N	Tree	I
<i>Annona muricata</i> L.	Annonaceae	I	Tree	I
<i>Anthurium crenatum</i> (L.) Kunth	Araceae	N	Herb	A
<i>Antigonon leptopus</i> Hook. & Arn.	Polygonaceae	I	Vine	I
<i>Arachniodes chaerophylloides</i> (Poir.) Proctor	Dryopteridaceae	N	Herb	I
<i>Ardisia elliptica</i> Thunb.	Primulaceae	I	Shrub	A
<i>Ardisia obovata</i> Desv. ex Ham.	Primulaceae	N	Tree	A
<i>Argythamnia candicans</i> Sw.	Euphorbiaceae	N	Herb	B
<i>Argythamnia fasciculata</i> (Vahl ex A. Juss.) Müll. Arg.	Euphorbiaceae	N	Shrub	I
<i>Artocarpus altilis</i> (Parkinson) Fosberg	Moraceae	I	Tree	A
<i>Asystasia gangetica</i> (L.) T. Anderson	Acanthaceae	I	Herb	B
<i>Asystasia gangetica</i> (L.) T. Anderson ssp. <i>micrantha</i> (Nees) Ensermu	Acanthaceae	I	Herb	A
<i>Axonopus compressus</i> (Sw.) P. Beauv.	Poaceae	N	Graminoid	B
<i>Azadirachta indica</i> A. Juss.	Meliaceae	I	Tree	A
<i>Bambusa vulgaris</i> Schrad. ex J. C. Wendl.	Poaceae	I	Graminoid	A
<i>Bastardia viscosa</i> (L.) Kunth	Malvaceae	N	Subshrub	B
<i>Begonia hirtella</i> Link	Begoniaceae	I	Herb	I
<i>Bidens alba</i> (L.) DC. var. <i>radiata</i> (Sch. Bip.) Ballard ex T. E. Melchert	Asteraceae	N	Herb	A
<i>Bidens cynapiifolia</i> Kunth	Asteraceae	N	Herb	A
<i>Bidens reptans</i> (L.) G. Don	Asteraceae	N	Vine	I
<i>Bixa orellana</i> L.	Bixaceae	I	Shrub	B
<i>Blechnum fragile</i> (Liebm.) Morton & Lellinger	Blechnaceae	N	Vine	A
<i>Blechnum occidentale</i> L.	Blechnaceae	N	Herb	B
<i>Bocconia frutescens</i> L.	Papaveraceae	N	Shrub	A
<i>Boerhavia coccinea</i> Mill.	Nyctaginaceae	N	Herb	I
<i>Boerhavia erecta</i> L.	Nyctaginaceae	N	Herb	B
<i>Bolbitis nicotianifolia</i> (Sw.) Alston	Dryopteridaceae	N	Herb	A
<i>Bothriochloa pertusa</i> (L.) A. Camus	Poaceae	I	Graminoid	I
<i>Bouchea prismatica</i> (L.) Kuntze	Verbenaceae	N	Herb	A
<i>Bourreria succulenta</i> Jacq.	Boraginaceae	N	Tree	B
<i>Bromelia pinguin</i> L.	Bromeliaceae	N	Herb	B
<i>Buchenavia tetraphylla</i> (Aubl.) Howard	Combretaceae	N	Tree	A
<i>Bucida buceras</i> L.	Combretaceae	N	Tree	I
<i>Bursera simaruba</i> (L.) Sarg.	Burseraceae	N	Tree	B
<i>Byrsonima spicata</i> (Cav.) Kunth	Malpighiaceae	N	Tree	I
<i>Cajanus cajan</i> (L.) Millsp.	Fabaceae	I	Shrub	A

Table B-1 (cont.)—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Calathea lutea</i> (Aubl.) Schult.	Marantaceae	I	Herb	A
<i>Calliandra surinamensis</i> Benth.	Fabaceae	I	Shrub	I
<i>Callisia fragrans</i> (Lindl.) Woodson	Commelinaceae	I	Herb	A
<i>Callisia monandra</i> (Sw.) Schult. & Schult. f.	Commelinaceae	N	Herb	A
<i>Callisia repens</i> (Jacq.) L.	Commelinaceae	N	Herb	I
<i>Calophyllum antillanum</i> Britton	Calophyllaceae	N	Tree	B
<i>Calophyllum inophyllum</i> L.	Calophyllaceae	I	Tree	B
<i>Calopogonium caeruleum</i> (Benth.) Suav.	Fabaceae	I	Vine	A
<i>Calyptocarpus vialis</i> Less.	Asteraceae	N	Herb	I
<i>Campyloneurum phyllitidis</i> (L.) C. Presl	Polypodiaceae	N	Herb	B
<i>Canna glauca</i> L.	Cannaceae	N	Herb	B
<i>Canna indica</i> L.	Cannaceae	N	Herb	A
<i>Caperonia palustris</i> (L.) A. St.-Hil.	Euphorbiaceae	N	Herb	B
<i>Capparis hastata</i> Jacq.	Capparaceae	N	Shrub	I
<i>Capparis indica</i> (L.) Druce	Capparaceae	N	Tree	I
<i>Capsicum annuum</i> L. var. <i>glabriusculum</i> (Dunal) Heiser & Pickersgill	Solanaceae	N	Shrub	I
<i>Capsicum chinense</i> Jacq.	Solanaceae	I	Shrub	I
<i>Capsicum frutescens</i> L.	Solanaceae	N	Shrub	I
<i>Cardiospermum microcarpum</i> Kunth	Sapindaceae	N	Vine	A
<i>Carica papaya</i> L.	Caricaceae	I	Shrub	A
<i>Caryota mitis</i> Lour.	Arecaceae	I	Tree	A
<i>Casearia aculeata</i> Jacq.	Salicaceae	N	Shrub	B
<i>Casearia decandra</i> Jacq.	Salicaceae	N	Shrub	B
<i>Casearia guianensis</i> (Aubl.) Urb.	Salicaceae	N	Shrub	B
<i>Casearia sylvestris</i> Sw.	Salicaceae	N	Tree	B
<i>Casuarina equisetifolia</i> L.	Casuarinaceae	I	Tree	A
<i>Cecropia schreberiana</i> Miq. var. <i>schreberiana</i>	Urticaceae	N	Tree	B
<i>Cedrela odorata</i> L.	Meliaceae	N	Tree	I
<i>Ceiba pentandra</i> (L.) Gaertn.	Malvaceae	N	Tree	A
<i>Centella erecta</i> (L. f.) Fernald	Apiaceae	N	Herb	B
<i>Centrosema pubescens</i> Benth.	Fabaceae	N	Vine	B
<i>Centrosema virginianum</i> (L.) Benth.	Fabaceae	N	Vine	I
<i>Ceropteris thalictroides</i> (L.) Brongn.	Pteridaceae	N	Herb	B
<i>Cestrum diurnum</i> L.	Solanaceae	N	Shrub	B
<i>Cestrum laurifolium</i> L'Hér.	Solanaceae	N	Shrub	I
<i>Cestrum macrophyllum</i> Vent.	Solanaceae	N	Shrub	B
<i>Chamaecrista nictitans</i> (L.) Moench var. <i>diffusa</i> (DC.) H. S. Irwin & Barneby	Fabaceae	N	Herb	B
<i>Chamaecrista nictitans</i> (L.) Moench var. <i>glabrata</i> (Vogel) H. S. Irwin & Barneby	Fabaceae	N	Herb	I
<i>Chiococca alba</i> (L.) Hitchc.	Rubiaceae	N	Vine	I

Appendix B

Table B-1 (cont.)—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Chionanthus domingensis</i> Lam.	Oleaceae	N	Tree	I
<i>Chloris barbata</i> Sw.	Poaceae	N	Graminoid	B
<i>Chloris radiata</i> (L.) Sw.	Poaceae	N	Graminoid	B
<i>Chromolaena odorata</i> (L.) R. M. King & H. Rob.	Asteraceae	N	Subshrub	B
<i>Chrysophyllum argenteum</i> Jacq.	Sapotaceae	N	Tree	B
<i>Chrysophyllum cainito</i> L.	Sapotaceae	N	Tree	A
<i>Chrysophyllum oliviforme</i> L.	Sapotaceae	N	Tree	B
<i>Cinnamomum elongatum</i> (Vahl ex Nees) Kosterm.	Lauraceae	N	Tree	B
<i>Cissampelos pareira</i> L.	Menispermaceae	N	Vine	B
<i>Cissus trifoliata</i> (L.) L.	Vitaceae	N	Vine	I
<i>Cissus verticillata</i> (L.) Nicolson & Jarvis	Vitaceae	N	Vine	B
<i>Citharexylum spinosum</i> L.	Verbenaceae	N	Tree	B
<i>Citrus × aurantium</i> L.	Rutaceae	I	Tree	A
<i>Cleome viscosa</i> L.	Cleomaceae	I	Herb	B
<i>Clerodendrum chinense</i> (Osb.) Mabberley	Lamiaceae	I	Subshrub	I
<i>Clidemia cymosa</i> (Wendl. ex Spreng.) Alain	Melastomataceae	N	Shrub	I
<i>Clidemia hirta</i> (L.) D. Don	Melastomataceae	N	Subshrub	B
<i>Clitoria falcata</i> Lam.	Fabaceae	N	Vine	B
<i>Clitoria ternatea</i> L.	Fabaceae	I	Vine	I
<i>Clusia gundlachii</i> Stahl	Clusiaceae	N	Shrub	I
<i>Clusia rosea</i> Jacq.	Clusiaceae	N	Tree	A
<i>Cnemidaria horrida</i> (L.) C. Presl	Cyatheaceae	N	Shrub	B
<i>Coccoloba diversifolia</i> Jacq.	Polygonaceae	N	Tree	B
<i>Coccoloba rugosa</i> Desf.	Polygonaceae	N	Tree	A
<i>Coccoloba uvifera</i> (L.) L.	Polygonaceae	N	Tree	I
<i>Coccoloba venosa</i> L.	Polygonaceae	N	Tree	B
<i>Cocos nucifera</i> L.	Arecaceae	I	Tree	B
<i>Coffea arabica</i> L.	Rubiaceae	I	Shrub	I
<i>Coffea liberica</i> W. Bull ex Hiern. var. <i>liberica</i>	Rubiaceae	I	Shrub	B
<i>Colocasia esculenta</i> (L.) Schott	Araceae	I	Herb	B
<i>Colubrina arborescens</i> (Mill.) Sarg.	Rhamnaceae	N	Tree	I
<i>Colubrina glandulosa</i> G. Perkins var. <i>antillana</i> (M. C. Johnst.) M. C. Johnst	Rhamnaceae	N	Tree	I
<i>Commelina diffusa</i> Burm. f. var. <i>diffusa</i>	Commelinaceae	N	Herb	B
<i>Commelina erecta</i> L.	Commelinaceae	N	Herb	I
<i>Comocladia dodonaea</i> (L.) Urb.	Anacardiaceae	N	Shrub	I
<i>Conocarpus erectus</i> L.	Combretaceae	N	Tree	A
<i>Conyza canadensis</i> (L.) Cronquist	Asteraceae	N	Herb	I
<i>Corchorus siliquosus</i> L.	Malvaceae	N	Subshrub	B
<i>Cordia alliodora</i> (Ruiz & Pav.) Oken	Boraginaceae	N	Tree	B
<i>Cordia bullata</i> (L.) Roem. & Schult. ssp. <i>humilis</i> (Jacq.) Gavigria	Boraginaceae	N	Shrub	I

Table B-1 (cont.)—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Cordia collococca</i> L.	Boraginaceae	N	Tree	B
<i>Cordia dichotoma</i> G. Forst.	Boraginaceae	I	Tree	B
<i>Cordia laevigata</i> Lam.	Boraginaceae	N	Tree	I
<i>Cordia polycephala</i> (Lam.) I. M. Johnst.	Boraginaceae	N	Shrub	B
<i>Cordia rickseckeri</i> Millsp.	Boraginaceae	N	Tree	A
<i>Cordia sulcata</i> DC.	Boraginaceae	N	Tree	B
<i>Cordyline fruticosa</i> (L.) A. Chev	Asparagaceae	I	Shrub	A
<i>Costus guanaiensis</i> Rusby var. <i>macrostrobilus</i> (K. Schum.) Maas	Costaceae	N	Herb	A
<i>Costus pictus</i> D. Don	Costaceae	I	Herb	I
<i>Costus scaber</i> Ruiz & Pav.	Costaceae	I	Herb	I
<i>Crescentia linearifolia</i> Miers	Bignoniaceae	N	Tree	I
<i>Crossopetalum rhacoma</i> Crantz	Celastraceae	N	Shrub	I
<i>Crotalaria brevidens</i> Benth.	Fabaceae	I	Herb	I
<i>Crotalaria pallida</i> Aiton	Fabaceae	I	Herb	I
<i>Crotalaria retusa</i> L.	Fabaceae	I	Herb	I
<i>Croton betulinus</i> Vahl	Euphorbiaceae	N	Shrub	B
<i>Croton flavens</i> L.	Euphorbiaceae	N	Shrub	I
<i>Croton glabellus</i> L. ssp. <i>polytrichus</i> (Urb.) B. W. van Ee	Euphorbiaceae	N	Shrub	I
<i>Cryptostegia madagascariensis</i> Bojer ex Decne.	Apocynaceae	I	Vine	I
<i>Cucumis anguria</i> L.	Cucurbitaceae	I	Vine	A
<i>Cucumis dipsaceus</i> C. G. Ehrenb. ex Spach	Cucurbitaceae	I	Vine	I
<i>Cucumis melo</i> L.	Cucurbitaceae	I	Vine	B
<i>Cucurbita moschata</i> Duchesne	Cucurbitaceae	I	Vine	B
<i>Cupania americana</i> L.	Sapindaceae	N	Tree	B
<i>Cuphea strigulosa</i> Kunth	Lythraceae	N	Herb	B
<i>Cuscuta americana</i> L.	Convolvulaceae	N	Vine	I
<i>Cyanthillium cinereum</i> (L.) H. Rob.	Asteraceae	I	Herb	B
<i>Cyathea arborea</i> (L.) Sm.	Cyatheaceae	N	Tree	B
<i>Cyclopogon elatus</i> (Sw.) Schltr.	Orchidaceae	N	Herb	I
<i>Cydista aequinoctialis</i> (L.) Miers	Bignoniaceae	N	Vine	I
<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	I	Graminoid	B
<i>Cynodon nlemfuensis</i> Vanderyst	Poaceae	I	Graminoid	B
<i>Cynophalla flexuosa</i> (L.) J. Presl	Capparaceae	N	Shrub	B
<i>Cyperus aggregatus</i> (Willd.) Endl.	Cyperaceae	N	Graminoid	I
<i>Cyperus alternifolius</i> L. ssp. <i>flabelliformis</i> Kük.	Cyperaceae	I	Graminoid	A
<i>Cyperus articulatus</i> L.	Cyperaceae	N	Graminoid	A
<i>Cyperus compressus</i> L.	Cyperaceae	N	Graminoid	I
<i>Cyperus digitatus</i> Roxb.	Cyperaceae	N	Graminoid	I
<i>Cyperus esculentus</i> L.	Cyperaceae	I	Graminoid	I
<i>Cyperus giganteus</i> Vahl	Cyperaceae	N	Graminoid	B

Appendix B

Table B-1 (cont.)—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Cyperus haspan</i> L.	Cyperaceae	N	Graminoid	I
<i>Cyperus iria</i> L.	Cyperaceae	I	Graminoid	B
<i>Cyperus ligularis</i> L.	Cyperaceae	N	Graminoid	B
<i>Cyperus mutisii</i> (Kunth) Griseb.	Cyperaceae	N	Graminoid	I
<i>Cyperus ochraceus</i> Vahl	Cyperaceae	N	Graminoid	A
<i>Cyperus odoratus</i> L.	Cyperaceae	N	Graminoid	B
<i>Cyperus polystachyos</i> Rottb.	Cyperaceae	N	Graminoid	B
<i>Cyperus rotundus</i> L.	Cyperaceae	I	Graminoid	B
<i>Cyperus sphacelatus</i> Rottb.	Cyperaceae	N	Graminoid	B
<i>Dactyloctenium aegyptium</i> (L.) Willd.	Poaceae	I	Graminoid	B
<i>Dalechampia scandens</i> L.	Euphorbiaceae	N	Vine	I
<i>Datura innoxia</i> Mill.	Solanaceae	I	Subshrub	I
<i>Delonix regia</i> (Bojer ex Hook.) Raf.	Fabaceae	I	Tree	A
<i>Dendropanax arboreus</i> (L.) Decne. & Planch. ex Britton	Araliaceae	N	Tree	B
<i>Dennstaedtia bipinnata</i> (Cav.) Maxon	Dennstaedtiaceae	N	Herb	I
<i>Desmanthus virgatus</i> (L.) Willd.	Fabaceae	N	Subshrub	B
<i>Desmodium adscendens</i> (Sw.) DC.	Fabaceae	N	Herb	B
<i>Desmodium axillare</i> (Sw.) DC. var. axillare	Fabaceae	N	Herb	B
<i>Desmodium incanum</i> DC.	Fabaceae	N	Vine	B
<i>Desmodium scorpiurus</i> (Sw.) Desv.	Fabaceae	N	Herb	B
<i>Dichanthium annulatum</i> (Forssk.) Stapf	Poaceae	I	Graminoid	B
<i>Dieffenbachia seguine</i> (Jacq.) Schott	Araceae	N	Herb	B
<i>Digitaria bicornis</i> (Lam.) Roem. & Schult.	Poaceae	I	Graminoid	I
<i>Digitaria ciliaris</i> (Retz.) Koeler	Poaceae	I	Graminoid	I
<i>Digitaria eriantha</i> Steud.	Poaceae	I	Graminoid	B
<i>Digitaria horizontalis</i> Willd.	Poaceae	I	Graminoid	I
<i>Digitaria insularis</i> (L.) Mez ex Ekman	Poaceae	N	Graminoid	I
<i>Digitaria violascens</i> Link	Poaceae	I	Graminoid	I
<i>Diodia ocymifolia</i> (Willd. ex Roem. & Schult.) Bremek.	Rubiaceae	N	Herb	I
<i>Diodia sarmentosa</i> Sw.	Rubiaceae	N	Vine	I
<i>Dioscorea alata</i> L.	Dioscoreaceae	I	Vine	I
<i>Dioscorea bulbifera</i> L.	Dioscoreaceae	I	Vine	B
<i>Dioscorea chondrocarpa</i> Griseb.	Dioscoreaceae	N	Vine	I
<i>Diplazium unilobum</i> (Poir.) Hieron.	Athyriaceae	N	Herb	I
<i>Dissotis rotundifolia</i> (Sm.) Triana	Melastomataceae	I	Herb	B
<i>Distictis lactiflora</i> (Vahl) DC.	Bignoniaceae	N	Vine	I
<i>Dracaena fragrans</i> (L.) Ker Gawl.	Asparagaceae	I	Shrub	A
<i>Drymaria cordata</i> (L.) Willd. ex Schult.	Caryophyllaceae	I	Herb	I
<i>Dypsis lutescens</i> (H. Wendl.) Beentje & Dransf.	Arecaceae	I	Tree	A
<i>Echinochloa colona</i> (L.) Link	Poaceae	I	Graminoid	B
<i>Echinochloa crus-pavonis</i> (Kunth) Schult.	Poaceae	I	Graminoid	I

Table B-1 (cont.)—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Eclipta prostrata</i> (L.) L.	Asteraceae	N	Herb	B
<i>Eichhornia crassipes</i> (Mart.) Solms	Pontederiaceae	I	Herb	A
<i>Eleocharis flavescens</i> (Poir.) Urb.	Cyperaceae	N	Graminoid	I
<i>Eleocharis interstincta</i> (Vahl) Roem. & Schult.	Cyperaceae	N	Graminoid	I
<i>Eleocharis mutata</i> (L.) Roem. & Schult.	Cyperaceae	N	Graminoid	B
<i>Eleocharis retroflexa</i> (Poir.) Urb.	Cyperaceae	N	Graminoid	I
<i>Elephantopus mollis</i> Kunth	Asteraceae	N	Herb	B
<i>Eleusine indica</i> (L.) Gaertn.	Poaceae	I	Graminoid	B
<i>Eleutheranthera ruderalis</i> (Sw.) Sch. Bip.	Asteraceae	N	Herb	I
<i>Emilia fosbergii</i> Nicolson	Asteraceae	I	Herb	I
<i>Emilia praetermissa</i> Milne-Redh.	Asteraceae	I	Herb	I
<i>Emilia sonchifolia</i> (L.) DC.	Asteraceae	I	Herb	B
<i>Enydra sessilis</i> (Sw.) DC.	Asteraceae	N	Herb	B
<i>Epipremnum aureum</i> (Lindl. & André) Bunting	Araceae	I	Vine	I
<i>Epipremnum pinnatum</i> (L.) Engl.	Araceae	I	Vine	I
<i>Eriochloa punctata</i> (L.) Desv. ex Ham.	Poaceae	N	Graminoid	I
<i>Erythrina fusca</i> Lour.	Fabaceae	I	Tree	B
<i>Erythroides hirtella</i> (Sw.) Fawc. & Rendle	Orchidaceae	N	Herb	B
<i>Erythroxylum areolatum</i> L.	Erythroxylaceae	N	Shrub	I
<i>Erythroxylum brevipes</i> DC.	Erythroxylaceae	N	Shrub	B
<i>Eucharis amazonica</i> Linden ex Planch.	Amoryllidaceae	I	Herb	A
<i>Eugenia biflora</i> (L.) DC.	Myrtaceae	N	Shrub	B
<i>Eugenia foetida</i> Pers.	Myrtaceae	N	Tree	I
<i>Eugenia monticola</i> (Sw.) DC.	Myrtaceae	N	Tree	I
<i>Eugenia rhombea</i> (Berg) Krug & Urb.	Myrtaceae	N	Shrub	I
<i>Euphorbia heterophylla</i> L.	Euphorbiaceae	N	Herb	B
<i>Euphorbia hirta</i> L.	Euphorbiaceae	N	Herb	B
<i>Euphorbia hypericifolia</i> L.	Euphorbiaceae	N	Herb	B
<i>Euphorbia hyssopifolia</i> L.	Euphorbiaceae	N	Herb	B
<i>Euphorbia lasiocarpa</i> Klotzsch	Euphorbiaceae	N	Herb	A
<i>Euphorbia ophthalmica</i> Pers.	Euphorbiaceae	N	Herb	A
<i>Euphorbia serpens</i> Kunth	Euphorbiaceae	N	Herb	B
<i>Euphorbia thymifolia</i> L.	Euphorbiaceae	N	Herb	B
<i>Exostema caribaeum</i> (Jacq.) Schult.	Rubiaceae	N	Shrub	B
<i>Exothea paniculata</i> (Juss.) Radlk.	Sapindaceae	N	Tree	I
<i>Famea occidentalis</i> (L.) A. Rich.	Rubiaceae	N	Shrub	B
<i>Ficus citrifolia</i> Mill.	Moraceae	N	Tree	A
<i>Ficus trigonata</i> L.	Moraceae	N	Tree	A
<i>Fimbristylis dichotoma</i> (L.) Vahl	Cyperaceae	N	Graminoid	B
<i>Fuirena umbellata</i> Rottb.	Cyperaceae	N	Graminoid	B
<i>Galactia dubia</i> DC.	Fabaceae	N	Vine	I

Appendix B

Table B-1 (cont.)—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Galactia striata</i> (Jacq.) Urb.	Fabaceae	N	Vine	I
<i>Genipa americana</i> L.	Rubiaceae	N	Tree	A
<i>Gibasis geniculata</i> (Jacq.) Rohw.	Commelinaceae	N	Herb	I
<i>Gliricidia sepium</i> (Jacq.) Kunth ex Walp.	Fabaceae	I	Tree	B
<i>Gomphocarpus physocarpus</i> E. Mey.	Apocynaceae	I	Shrub	I
<i>Gonolobus stephanotrichus</i> Griseb.	Apocynaceae	N	Vine	I
<i>Gonzalagunia hirsuta</i> (Jacq.) K. Schum.	Rubiaceae	N	Shrub	B
<i>Gouania lupuloides</i> (L.) Urb.	Rhamnaceae	N	Vine	B
<i>Gouania polygama</i> (Jacq.) Urb.	Rhamnaceae	N	Vine	B
<i>Guaicum officinale</i> L.	Zygophyllaceae	N	Tree	I
<i>Guapira fragrans</i> (Dum. Cours.) Little	Nyctaginaceae	N	Tree	B
<i>Guarea glabra</i> Vahl	Meliaceae	N	Shrub	B
<i>Guarea guidonia</i> (L.) Sleumer	Meliaceae	N	Tree	B
<i>Guazuma ulmifolia</i> Lam.	Malvaceae	N	Tree	I
<i>Guettarda odorata</i> (Jacq.) Lam.	Rubiaceae	N	Shrub	I
<i>Guettarda scabra</i> (L.) Vent.	Rubiaceae	N	Tree	A
<i>Helianthus annuus</i> L.	Asteraceae	I	Herb	B
<i>Heliconia caribaea</i> Lam.	Heliconiaceae	N	Herb	I
<i>Heliotropium indicum</i> L.	Boraginaceae	N	Herb	B
<i>Hemigraphis reptans</i> (G. Forst.) T. Anderson ex Hemsl.	Acanthaceae	I	Herb	A
<i>Hemiscola aculeata</i> (L.) Raf.	Cleomaceae	N	Herb	B
<i>Henriettea fascicularis</i> (Sw.) G. Maza	Melastomataceae	N	Tree	A
<i>Hernandia sonora</i> L.	Hernandiaceae	N	Tree	A
<i>Heteranthera reniformis</i> Ruiz & Pav.	Pontederiaceae	N	Herb	B
<i>Heteropterys laurifolia</i> (L.) A. Juss.	Malpighiaceae	N	Vine	B
<i>Heteropterys purpurea</i> (L.) Kunth	Malpighiaceae	N	Vine	I
<i>Hibiscus bifurcatus</i> Cav.	Malvaceae	N	Herb	I
<i>Hibiscus tiliaceus</i> L. var. <i>pernambucensis</i> (Arruda) I. M. Johnst.	Malvaceae	N	Shrub	B
<i>Hippocratea volubilis</i> L.	Celastraceae	N	Vine	B
<i>Hirtella triandra</i> Sw.	Chrysobalanaceae	N	Tree	A
<i>Hura crepitans</i> L.	Euphorbiaceae	N	Tree	I
<i>Hygrophila costata</i> Nees	Acanthaceae	N	Herb	B
<i>Hylocereus trigonus</i> (Haw.) Saff.	Cactaceae	N	Vine	A
<i>Hymenachne amplexicaulis</i> (Rudge) Nees	Poaceae	N	Graminoid	B
<i>Hymenaea courbaril</i> L.	Fabaceae	N	Tree	A
<i>Hypolepis repens</i> (L.) C. Presl	Dennstaedtiaceae	N	Vine	A
<i>Hyptis atrorubens</i> Poit.	Lamiaceae	N	Herb	I
<i>Hyptis capitata</i> Jacq.	Lamiaceae	N	Herb	A
<i>Hyptis verticillata</i> Jacq.	Lamiaceae	N	Subshrub	B
<i>Ichnanthus pallens</i> (Sw.) Munro ex Benth. var. <i>pallens</i>	Poaceae	N	Graminoid	B

Table B-1 (cont.)—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Ilex nitida</i> (Vahl) Maxim.	Aquifoliaceae	N	Tree	I
<i>Indigofera spicata</i> Forssk.	Fabaceae	I	Herb	A
<i>Indigofera suffruticosa</i> Mill.	Fabaceae	N	Shrub	A
<i>Indigofera tinctoria</i> L.	Fabaceae	I	Subshrub	A
<i>Inga laurina</i> (Sw.) Willd.	Fabaceae	N	Tree	B
<i>Inga nobilis</i> Willd. ssp. <i>quaternata</i> (Poepp. & Endl.) T. D. Penn.	Fabaceae	I	Tree	I
<i>Inga vera</i> Willd.	Fabaceae	N	Tree	B
<i>Ipomoea setifera</i> Poir.	Convolvulaceae	N	Vine	B
<i>Ipomoea tiliacea</i> (Willd.) Choisy	Convolvulaceae	N	Vine	B
<i>Ipomoea triloba</i> L.	Convolvulaceae	N	Vine	I
<i>Iresine diffusa</i> Humb. & Bonpl. ex Willd.	Amaranthaceae	N	Herb	B
<i>Ixora coccinea</i> L.	Rubiaceae	I	Shrub	A
<i>Jacquemontia cumanensis</i> (Kunth) Kuntze	Convolvulaceae	N	Vine	B
<i>Jacquinia arborea</i> Vahl	Primulaceae	N	Shrub	I
<i>Jasminum fluminense</i> Vell.	Oleaceae	I	Vine	B
<i>Jatropha gossypifolia</i> L.	Euphorbiaceae	N	Subshrub	B
<i>Justicia comata</i> (L.) Lam.	Acanthaceae	N	Herb	B
<i>Krugiodendron ferreum</i> (Vahl) Urb.	Rhamnaceae	N	Tree	B
<i>Kyllinga brevifolia</i> Rottb.	Cyperaceae	N	Graminoid	B
<i>Kyllinga nemoralis</i> (J. R. Forst. & G. Forst.) Dandy ex Hutch. & Dalziel	Cyperaceae	I	Graminoid	I
<i>Lagerstroemia speciosa</i> (L.) Pers.	Lythraceae	I	Tree	A
<i>Lantana horrida</i> Kunth	Verbenaceae	N	Shrub	B
<i>Lantana involucrata</i> L.	Verbenaceae	N	Shrub	I
<i>Laportea aestuans</i> (L.) Chew	Urticaceae	N	Herb	A
<i>Lasiacis divaricata</i> (L.) Hitchc.	Poaceae	N	Graminoid	B
<i>Lasiacis sorghoidea</i> (Desv. ex Ham.) Hitchc. & Chase	Poaceae	N	Graminoid	B
<i>Lastreopsis effusa</i> (Sw.) Tindale	Dryopteridaceae	N	Herb	I
<i>Leersia hexandra</i> Sw.	Poaceae	N	Graminoid	B
<i>Lemna valdiviana</i> Phil.	Araceae	N	Herb	A
<i>Lepianthes peltata</i> (L.) Raf.	Piperaceae	N	Subshrub	I
<i>Leptochloa panicea</i> (Retz.) Ohwi ssp. <i>brachiata</i> (Steud.) N. Snow	Poaceae	N	Graminoid	I
<i>Leptochloa scabra</i> Nees	Poaceae	N	Graminoid	I
<i>Leucaena leucocephala</i> (Lam.) de Wit	Fabaceae	I	Tree	B
<i>Licaria parvifolia</i> (Lam.) Kosterm.	Lauraceae	N	Tree	I
<i>Licaria triandra</i> (Sw.) Kosterm.	Lauraceae	N	Tree	I
<i>Lindernia diffusa</i> (L.) Wettst.	Linderniaceae	N	Herb	A
<i>Lithachne pauciflora</i> (Sw.) P. Beauv.	Poaceae	N	Graminoid	B
<i>Lobelia robusta</i> Graham	Campanulaceae	N	Herb	B
<i>Ludwigia erecta</i> (L.) H. Hara	Onagraceae	N	Herb	B

Appendix B

Table B-1 (cont.)—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Ludwigia leptocarpa</i> (Nutt.) H. Hara	Onagraceae	N	Subshrub	B
<i>Ludwigia octovalvis</i> (Jacq.) P. H. Raven	Onagraceae	N	Herb	B
<i>Ludwigia peploides</i> (Kunth) P. H. Raven	Onagraceae	N	Herb	I
<i>Lycianthes virgata</i> (Lam.) Bitter	Solanaceae	N	Vine	I
<i>Lycopodiella cernua</i> (L.) Pic. Serm. var. cernua	Lycopodiaceae	N	Herb	I
<i>Lygodium japonicum</i> (Thunb.) Sw.	Lygodiaceae	I	Vine	B
<i>Macfadyena unguis-cati</i> (L.) A. H. Gentry	Bignoniaceae	N	Vine	B
<i>Machaerium lunatum</i> (L. f.) Ducke	Fabaceae	N	Shrub	A
<i>Macroptilium atropurpureum</i> (Moc. & Sessé ex DC.) Urb.	Fabaceae	I	Vine	A
<i>Macroptilium lathyroides</i> (L.) Urb.	Fabaceae	N	Vine	B
<i>Malachra alceifolia</i> Jacq.	Malvaceae	N	Subshrub	B
<i>Malachra capitata</i> (L.) L.	Malvaceae	N	Subshrub	B
<i>Malachra urens</i> Poit. ex Ledeb.	Malvaceae	N	Subshrub	I
<i>Malvastrum corchorifolium</i> (Desv.) Britton ex Small	Malvaceae	N	Herb	A
<i>Malvastrum coromandelianum</i> (L.) Garcke	Malvaceae	N	Herb	B
<i>Mammea americana</i> L.	Calophyllaceae	N	Tree	I
<i>Mangifera indica</i> L.	Anacardiaceae	I	Tree	B
<i>Manihot esculenta</i> Crantz	Euphorbiaceae	I	Shrub	B
<i>Manilkara bidentata</i> (A. DC.) A. Chev ssp. surinamensis (Miq.) T. D. Penn.	Sapotaceae	N	Tree	B
<i>Mecardonia procumbens</i> (Mill.) Small	Plantaginaceae	N	Herb	B
<i>Mecranium latifolium</i> (Cogn.) Slean	Melastomataceae	N	Shrub	B
<i>Melanthera nivea</i> (L.) Small	Asteraceae	N	Herb	B
<i>Melicoccus bijugatus</i> Jacq.	Sapindaceae	I	Tree	B
<i>Melinis minutiflora</i> P. Beauv.	Poaceae	I	Graminoid	I
<i>Melinis repens</i> (Willd.) Zizka	Poaceae	I	Graminoid	A
<i>Melochia nodiflora</i> Sw.	Malvaceae	N	Subshrub	B
<i>Melochia pyramidata</i> L.	Malvaceae	N	Herb	B
<i>Melothria pendula</i> L.	Cucurbitaceae	N	Vine	B
<i>Merremia quinquefolia</i> (L.) Hallier f.	Convolvulaceae	N	Vine	I
<i>Merremia umbellata</i> (L.) Hallier f.	Convolvulaceae	N	Vine	B
<i>Metastelma decipiens</i> Schltr.	Apocynaceae	N	Vine	I
<i>Miconia impetolaris</i> (Sw.) D. Don ex DC.	Melastomataceae	N	Shrub	B
<i>Miconia laevigata</i> (L.) D. Don	Melastomataceae	N	Shrub	B
<i>Miconia prasina</i> (Sw.) DC.	Melastomataceae	N	Shrub	B
<i>Miconia racemosa</i> (Aubl.) DC.	Melastomataceae	N	Shrub	B
<i>Miconia serrulata</i> (DC.) Naud.	Melastomataceae	N	Shrub	A
<i>Microgramma lycopodioides</i> (L.) Copeland	Polypodiaceae	N	Vine	I
<i>Microgramma piloselloides</i> (L.) Copeland	Polypodiaceae	N	Vine	A
<i>Mikania cordifolia</i> (L. f.) Willd.	Asteraceae	N	Vine	B
<i>Mikania micrantha</i> Kunth	Asteraceae	N	Vine	B

Table B-1 (cont.)—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Mimosa casta</i> L.	Fabaceae	I	Vine	B
<i>Mimosa ceratonia</i> L.	Fabaceae	N	Vine	I
<i>Mimosa pigra</i> L.	Fabaceae	I	Shrub	B
<i>Mimosa pudica</i> L. var. <i>unijuga</i> (Duchass. & Walp.) Griseb.	Fabaceae	N	Herb	B
<i>Momordica charantia</i> L.	Cucurbitaceae	I	Vine	B
<i>Morinda citrifolia</i> L.	Rubiaceae	I	Tree	A
<i>Mucuna pruriens</i> (L.) DC.	Fabaceae	I	Vine	B
<i>Mucuna urens</i> (L.) Medik.	Fabaceae	N	Vine	I
<i>Muntingia calabura</i> L.	Muntingiaceae	I	Tree	B
<i>Murdannia nudiflora</i> (L.) Brenan	Commelinaceae	I	Herb	I
<i>Musa × paradisiaca</i> L.	Musaceae	I	Herb	B
<i>Musa acuminata</i> Colla	Musaceae	I	Herb	B
<i>Myrcia splendens</i> (Sw.) DC.	Myrtaceae	N	Tree	I
<i>Myriopus volubilis</i> (L.) Small	Boraginaceae	N	Vine	B
<i>Myrsine coriacea</i> (Sw.) R. Br. ex Roem. & Schult.	Primulaceae	N	Shrub	B
<i>Nectandra coriacea</i> (Sw.) Griseb.	Lauraceae	N	Tree	B
<i>Nectandra patens</i> (Sw.) Griseb.	Lauraceae	N	Shrub	I
<i>Nectandra turbacensis</i> (Kunth) Nees	Lauraceae	N	Tree	I
<i>Nelsonia canescens</i> (Lam.) Spreng.	Acanthaceae	I	Herb	A
<i>Nephrolepis multiflora</i> (Roxb.) Jarrett ex Morton	Nephrolepidaceae	I	Herb	B
<i>Neptunia oleracea</i> Lour.	Fabaceae	N	Subshrub	I
<i>Neptunia plena</i> (L.) Benth.	Fabaceae	N	Herb	I
<i>Nipidium crassifolium</i> (L.) Lellinger	Polypodiaceae	N	Herb	A
<i>Nymphoides humboldtiana</i> (Kunth) Kuntze	Menyanthaceae	N	Herb	I
<i>Ocotea floribunda</i> (Sw.) Mez	Lauraceae	N	Tree	I
<i>Ocotea leucoxydon</i> (Sw.) De Laness.	Lauraceae	N	Tree	B
<i>Odontonema cuspidatum</i> (Nees) Kuntze	Acanthaceae	I	Herb	I
<i>Odontosoria aculeata</i> (L.) J. Sm.	Lindsaeaceae	N	Vine	I
<i>Oeceoclades maculata</i> (Lindl.) Lindl.	Orchidaceae	I	Herb	B
<i>Oldenlandia corymbosa</i> L.	Rubiaceae	I	Herb	I
<i>Oldenlandia lancifolia</i> (Schumach.) DC.	Rubiaceae	I	Herb	B
<i>Olyra latifolia</i> L.	Poaceae	N	Graminoid	A
<i>Oplismenus hirtellus</i> (L.) P. Beauv. ssp. <i>setarius</i> (Lam.) Mez ex Ekman	Poaceae	N	Graminoid	B
<i>Opuntia repens</i> Bello	Cactaceae	N	Subshrub	I
<i>Ouratea litoralis</i> Urb.	Ochnaceae	N	Tree	B
<i>Oxalis barrelieri</i> L.	Oxalidaceae	N	Herb	B
<i>Oxalis corniculata</i> L.	Oxalidaceae	N	Herb	I
<i>Oxalis debilis</i> Kunth var. <i>corymbosa</i> (DC.) Lourteig	Oxalidaceae	I	Herb	B
<i>Oxycaryum cubense</i> (Poepp. & Kunth) Lye	Cyperaceae	I	Graminoid	A
<i>Pachystachys spicata</i> (Ruiz & Pav.) Wassh.	Acanthaceae	I	Shrub	A

Appendix B

Table B-1 (cont.)—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Palicourea crocea</i> (Sw.) Schult.	Rubiaceae	N	Shrub	I
<i>Panicum laxum</i> Sw.	Poaceae	N	Graminoid	B
<i>Parkinsonia aculeata</i> L.	Fabaceae	I	Tree	I
<i>Parthenium hysterophorus</i> L.	Asteraceae	N	Herb	B
<i>Paspalidium geminatum</i> (Forssk.) Stapf	Poaceae	N	Graminoid	I
<i>Paspalum conjugatum</i> P. J. Bergius	Poaceae	N	Graminoid	I
<i>Paspalum fasciculatum</i> Willd. ex Flueggé	Poaceae	I	Graminoid	B
<i>Paspalum millegrana</i> Schrad.	Poaceae	N	Graminoid	B
<i>Paspalum paniculatum</i> L.	Poaceae	N	Graminoid	A
<i>Paspalum pleostachyum</i> Döll	Poaceae	N	Graminoid	B
<i>Paspalum setaceum</i> Michx.	Poaceae	N	Graminoid	A
<i>Paspalum vaginatum</i> Sw.	Poaceae	N	Graminoid	I
<i>Paspalum virgatum</i> L.	Poaceae	N	Graminoid	B
<i>Passiflora edulis</i> Sims	Passifloraceae	I	Vine	B
<i>Passiflora foetida</i> L.	Passifloraceae	N	Vine	I
<i>Passiflora laurifolia</i> L.	Passifloraceae	N	Vine	I
<i>Passiflora multiflora</i> L.	Passifloraceae	N	Vine	A
<i>Passiflora pallida</i> L.	Passifloraceae	N	Vine	I
<i>Passiflora rubra</i> L.	Passifloraceae	N	Vine	B
<i>Passiflora sexflora</i> Juss.	Passifloraceae	N	Vine	B
<i>Passiflora suberosa</i> L.	Passifloraceae	N	Vine	B
<i>Paullinia pinnata</i> L.	Sapindaceae	N	Vine	B
<i>Pavonia spinifex</i> (L.) Cav.	Malvaceae	N	Subshrub	I
<i>Pectis prostrata</i> Cav.	Asteraceae	N	Herb	A
<i>Peltophorum pterocarpum</i> (DC.) Backer ex K. Heyne	Fabaceae	I	Tree	B
<i>Pennisetum purpureum</i> Schumach.	Poaceae	I	Graminoid	B
<i>Persea americana</i> Mill.	Lauraceae	I	Tree	A
<i>Petiveria alliacea</i> L.	Phytolaccaceae	N	Herb	B
<i>Pharus lappulaceus</i> Aubl.	Poaceae	N	Graminoid	B
<i>Pharus latifolius</i> L.	Poaceae	N	Graminoid	A
<i>Phyla fruticosa</i> (Mill.) Kennedy	Verbenaceae	N	Herb	I
<i>Phyla nodiflora</i> (L.) Greene	Verbenaceae	N	Herb	B
<i>Phyllanthus amarus</i> Schumach. & Thonn.	Phyllanthaceae	N	Herb	B
<i>Phyllanthus debilis</i> J. G. Klein ex Willd.	Phyllanthaceae	I	Herb	I
<i>Phyllanthus urinaria</i> L.	Phyllanthaceae	I	Herb	B
<i>Phymatosorus grossus</i> (Langsd. & Fisch.) Brownlie	Polypodiaceae	I	Herb	I
<i>Physalis angulata</i> L.	Solanaceae	N	Herb	B
<i>Physalis pubescens</i> L.	Solanaceae	N	Subshrub	I
<i>Phytolacca rivinoides</i> Kunth & Bouché	Phytolaccaceae	N	Subshrub	I
<i>Picramnia pentandra</i> Sw.	Picramniaceae	N	Tree	I
<i>Pictetia aculeata</i> (Vahl) Urb.	Fabaceae	N	Tree	I

Table B-1 (cont.)—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Pilea inaequalis</i> (Juss. ex Poir.) Weddell	Urticaceae	N	Herb	I
<i>Pilea microphylla</i> (L.) Liebm.	Urticaceae	N	Herb	I
<i>Pilea nummulariifolia</i> (Sw.) Weddell	Urticaceae	N	Herb	I
<i>Pilea parietaria</i> (L.) Blume	Urticaceae	N	Herb	I
<i>Pilosocereus royenii</i> (L.) Byles & Rowley	Cactaceae	N	Tree	B
<i>Pimenta racemosa</i> (Mill.) J. W. Moore	Myrtaceae	I	Tree	A
<i>Piper aduncum</i> L.	Piperaceae	N	Shrub	B
<i>Piper amalago</i> L.	Piperaceae	N	Shrub	B
<i>Piper glabrescens</i> (Miq.) C. DC.	Piperaceae	N	Shrub	B
<i>Piper hispidum</i> Sw.	Piperaceae	N	Shrub	B
<i>Piper jacquemontianum</i> Kunth	Piperaceae	N	Shrub	A
<i>Piper marginatum</i> Jacq.	Piperaceae	N	Shrub	A
<i>Piper umbellatum</i> L.	Piperaceae	N	Subshrub	B
<i>Piscidia carthagenensis</i> Jacq.	Fabaceae	N	Tree	A
<i>Pisonia aculeata</i> L.	Nyctaginaceae	N	Vine	B
<i>Pisonia roqueae</i> Trejo & Caraballo	Nyctaginaceae	N	Tree	A
<i>Pistia stratiotes</i> L.	Araceae	N	Herb	A
<i>Pithecellobium dulce</i> (Roxb.) Benth.	Fabaceae	I	Tree	B
<i>Pithecellobium unguis-cati</i> (L.) Benth.	Fabaceae	N	Tree	B
<i>Pityrogramma calomelanos</i> (L.) Link	Pteridaceae	N	Herb	B
<i>Pleopeltis polypodioides</i> (L.) Andrews & Windham	Polypodiaceae	N	Herb	A
<i>Pluchea carolinensis</i> (Jacq.) G. Don	Asteraceae	N	Shrub	B
<i>Pluchea odorata</i> (L.) Cass.	Asteraceae	N	Subshrub	I
<i>Polygonum acuminatum</i> Kunth	Polygonaceae	N	Herb	A
<i>Polygonum punctatum</i> Elliott	Polygonaceae	N	Herb	I
<i>Polyscias guilfoylei</i> (W. Bull.) L. H. Bailey	Araliaceae	I	Shrub	A
<i>Portulaca oleracea</i> L.	Portulacaceae	N	Herb	B
<i>Prestoea acuminata</i> (Willd.) H. E. Moore var. montana (Graham) A. Hend. & G. Galeano	Arecaceae	N	Tree	I
<i>Prosopis juliflora</i> (Sw.) DC.	Fabaceae	I	Tree	B
<i>Prunus occidentalis</i> Sw.	Rosaceae	N	Tree	B
<i>Pseudelephantopus spicatus</i> (Juss. ex Aubl.) C. F. Baker	Asteraceae	N	Herb	B
<i>Psidium guajava</i> L.	Myrtaceae	N	Tree	B
<i>Psilotum nudum</i> (L.) P. Beauv.	Psilotaceae	N	Herb	I
<i>Psychotria berteriana</i> DC.	Rubiaceae	N	Shrub	A
<i>Psychotria grandis</i> Sw.	Rubiaceae	N	Tree	A
<i>Pteridium caudatum</i> (L.) Maxon	Dennstaedtiaceae	N	Vine	B
<i>Pterocarpus indicus</i> Willd.	Fabaceae	I	Tree	I
<i>Pterocarpus officinalis</i> Jacq.	Fabaceae	N	Tree	B
<i>Pterolepis glomerata</i> (Rottb.) Miq.	Melastomataceae	N	Herb	I
<i>Ptychosperma macarthurii</i> (H. Wendl. ex H. J. Veitch) H. Wendl. ex Hook. f.	Arecaceae	I	Tree	I

Appendix B

Table B-1 (cont.)—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Pueraria phaseoloides</i> (Roxb.) Benth.	Fabaceae	I	Vine	B
<i>Rajania cordata</i> L.	Dioscoreaceae	N	Vine	A
<i>Randia aculeata</i> L.	Rubiaceae	N	Tree	B
<i>Rauvolfia nitida</i> Jacq.	Apocynaceae	N	Tree	A
<i>Rauvolfia viridis</i> Roem. & Schult.	Apocynaceae	N	Subshrub	B
<i>Rhynchosia minima</i> (L.) DC.	Fabaceae	N	Vine	B
<i>Rhynchosia phaseoloides</i> (Sw.) DC.	Fabaceae	N	Vine	I
<i>Rhynchosia reticulata</i> (Sw.) DC.	Fabaceae	N	Vine	B
<i>Rhynchospora ciliata</i> (G. Mey.) Kük.	Cyperaceae	N	Graminoid	B
<i>Rhynchospora corymbosa</i> (L.) Britton	Cyperaceae	N	Graminoid	B
<i>Rhynchospora holoschoenoides</i> (Rich.) Herter	Cyperaceae	N	Graminoid	I
<i>Ricinus communis</i> L.	Euphorbiaceae	I	Shrub	A
<i>Rivina humilis</i> L.	Phytolaccaceae	N	Herb	B
<i>Rochefortia acanthophora</i> (DC.) Griseb.	Ehretiaceae	N	Tree	I
<i>Rolandra fruticosa</i> (L.) Kuntze	Asteraceae	N	Herb	I
<i>Rorippa palustris</i> (L.) Besser	Brassicaceae	I	Herb	I
<i>Rottboellia cochinchinensis</i> (Lour.) W. D. Clayton	Poaceae	I	Graminoid	A
<i>Roystonea borinquena</i> O. F. Cook	Arecaceae	N	Tree	B
<i>Rubus rosifolius</i> Sm.	Rosaceae	I	Vine	B
<i>Ruellia blechum</i> L.	Acanthaceae	N	Herb	B
<i>Ruellia coccinea</i> (L.) Vahl	Acanthaceae	N	Herb	I
<i>Ruellia simplex</i> C. Wright	Acanthaceae	I	Herb	A
<i>Ruellia tuberosa</i> L.	Acanthaceae	N	Herb	B
<i>Saccharum officinarum</i> L.	Poaceae	I	Graminoid	B
<i>Saccharum spontaneum</i> L.	Poaceae	I	Graminoid	B
<i>Sacciolepis indica</i> (L.) Chase	Poaceae	I	Graminoid	A
<i>Sagittaria intermedia</i> Micheli	Alismataceae	N	Herb	A
<i>Sagittaria lancifolia</i> L.	Alismataceae	N	Herb	B
<i>Salix humboldtiana</i> Willd.	Salicaceae	I	Tree	A
<i>Salvinia minima</i> Baker	Salviniaceae	I	Herb	B
<i>Samanea saman</i> (Jacq.) Merr.	Fabaceae	I	Tree	B
<i>Samyda dodecandra</i> Jacq.	Salicaceae	N	Shrub	B
<i>Sansevieria hyacinthoides</i> (L.) Druce	Asparagaceae	I	Herb	A
<i>Schaefferia frutescens</i> Jacq.	Celastraceae	N	Tree	B
<i>Schefflera morototoni</i> (Aubl.) Maguire, Steyerf. & Frodin.	Araliaceae	N	Tree	B
<i>Schoenoplectus americanus</i> (Pers.) Volkart ex Schinz & R. Keller	Cyperaceae	N	Graminoid	I
<i>Scleria eggersiana</i> Boeckeler	Cyperaceae	N	Graminoid	B
<i>Scleria microcarpa</i> Nees ex Kunth	Cyperaceae	N	Graminoid	B
<i>Scleria pterota</i> C. Presl ex C. B. Clarke	Cyperaceae	N	Graminoid	I
<i>Scoparia dulcis</i> L.	Plantaginaceae	N	Herb	I

Table B-1 (cont.)—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Securidaca virgata</i> Sw.	Polygalaceae	N	Vine	B
<i>Selaginella plana</i> (Desv. ex Poir.) Hieron.	Selaginellaceae	I	Herb	A
<i>Senegalia westiana</i> (DC.) Britton & Rose	Fabaceae	N	Vine	I
<i>Senna alata</i> (L.) Roxb.	Fabaceae	N	Shrub	A
<i>Senna bicapsularis</i> (L.) Roxb.	Fabaceae	N	Shrub	B
<i>Senna hirsuta</i> (L.) Irwin & Barneby var. <i>hirsuta</i>	Fabaceae	N	Subshrub	I
<i>Senna nitida</i> (Rich.) Irwin & Barneby	Fabaceae	N	Vine	I
<i>Senna obtusifolia</i> (L.) Irwin & Barneby	Fabaceae	N	Subshrub	B
<i>Senna occidentalis</i> (L.) Link	Fabaceae	N	Subshrub	I
<i>Senna siamea</i> (Lam.) Irwin & Barneby	Fabaceae	I	Tree	A
<i>Senna spectabilis</i> (DC.) Irwin & Barneby	Fabaceae	I	Tree	A
<i>Senna uniflora</i> (Mill.) Irwin & Barneby	Fabaceae	N	Herb	A
<i>Serjania lucida</i> Schumach.	Sapindaceae	N	Vine	B
<i>Serjania polyphylla</i> (L.) Radlk.	Sapindaceae	N	Vine	B
<i>Sesbania sericea</i> (Willd.) Link	Fabaceae	I	Shrub	B
<i>Sesuvium maritimum</i> (Walter) Britton, Sterns & Poggenb.	Aizoaceae	N	Herb	A
<i>Sesuvium portulacastrum</i> (L.) L.	Aizoaceae	N	Herb	A
<i>Setaria parviflora</i> (Poir.) Kerguelen	Poaceae	N	Graminoid	I
<i>Sida abutilifolia</i> Mill.	Malvaceae	N	Herb	B
<i>Sida acuta</i> Burm. f.	Malvaceae	N	Herb	I
<i>Sida glomerata</i> Comm. ex Cav.	Malvaceae	N	Subshrub	B
<i>Sida rhombifolia</i> L.	Malvaceae	N	Subshrub	B
<i>Sida urens</i> L.	Malvaceae	N	Subshrub	B
<i>Sideroxylon foetidissimum</i> Jacq.	Sapotaceae	N	Tree	A
<i>Sideroxylon obovatum</i> Lam.	Sapotaceae	N	Shrub	I
<i>Sideroxylon salicifolium</i> (L.) Lam.	Sapotaceae	N	Tree	I
<i>Siphonoglossa sessilis</i> (Jacq.) D. Gibson	Acanthaceae	N	Herb	I
<i>Smilax domingensis</i> Willd.	Smilacaceae	N	Vine	B
<i>Solanum americanum</i> Mill.	Solanaceae	N	Herb	B
<i>Solanum bahamense</i> L.	Solanaceae	N	Subshrub	B
<i>Solanum melongena</i> L.	Solanaceae	I	Shrub	I
<i>Solanum rugosum</i> Dunal	Solanaceae	N	Shrub	I
<i>Solanum torvum</i> Sw.	Solanaceae	N	Shrub	B
<i>Sorghum bicolor</i> (L.) Moench	Poaceae	I	Graminoid	A
<i>Sorghum halepense</i> (L.) Pers.	Poaceae	I	Graminoid	B
<i>Spathodea campanulata</i> P. Beauv.	Bignoniaceae	I	Tree	B
<i>Spathoglottis plicata</i> Blume	Orchidaceae	I	Herb	I
<i>Spermacoce confusa</i> Rendle	Rubiaceae	N	Herb	A
<i>Spermacoce prostrata</i> Aubl.	Rubiaceae	N	Herb	I
<i>Spermacoce remota</i> Lam.	Rubiaceae	N	Herb	B
<i>Spermacoce verticillata</i> L.	Rubiaceae	N	Herb	B

Appendix B

Table B-1 (cont.)—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Sphagneticola trilobata</i> (L.) Pruski	Asteraceae	I	Herb	B
<i>Spigelia anthelmia</i> L.	Loganiaceae	N	Herb	B
<i>Spondias dulcis</i> Parkinson	Anacardiaceae	I	Tree	A
<i>Spondias mombin</i> L.	Anacardiaceae	N	Tree	B
<i>Spondias purpurea</i> L.	Anacardiaceae	I	Tree	A
<i>Sporobolus jacquemontii</i> Kunth	Poaceae	N	Graminoid	B
<i>Stachytarpheta cayennensis</i> (Rich.) Vahl	Verbenaceae	N	Herb	B
<i>Stahlia monosperma</i> (Tul.) Urb.	Fabaceae	N	Tree	B
<i>Stenotaphrum secundatum</i> (Walter) Kuntze	Poaceae	N	Graminoid	I
<i>Sterculia apetala</i> (Jacq.) Karst.	Malvaceae	I	Tree	A
<i>Sticherus bifidus</i> (Willd.) Ching	Gleicheniaceae	N	Vine	I
<i>Stigmaphyllon emarginatum</i> (Cav.) A. Juss.	Malpighiaceae	N	Vine	B
<i>Stigmaphyllon floribundum</i> (DC.) C. E. Anderson	Malpighiaceae	N	Vine	B
<i>Stigmaphyllon puberum</i> (Rich.) A. Juss.	Malpighiaceae	N	Vine	I
<i>Struchium sparganophorum</i> (L.) Kuntze	Asteraceae	N	Herb	B
<i>Swietenia × aubrevilleana</i> Stehlé & Cusin	Meliaceae	I	Tree	A
<i>Swietenia macrophylla</i> King	Meliaceae	I	Tree	B
<i>Swietenia mahagoni</i> (L.) Jacq.	Meliaceae	I	Tree	A
<i>Symphotrichum subulatum</i> (Michx.) G. L. Nesom var. <i>parviflorum</i> (Nees) S. D. Sundb.	Asteraceae	N	Herb	I
<i>Synedrella nodiflora</i> (L.) Gaertn.	Asteraceae	N	Herb	B
<i>Syngonium podophyllum</i> Schott	Araceae	I	Vine	B
<i>Syzygium jambos</i> (L.) Alston	Myrtaceae	I	Tree	B
<i>Syzygium malaccense</i> (L.) Merr. & L. M. Perry	Myrtaceae	I	Tree	B
<i>Tabebuia heterophylla</i> (DC.) Britton	Bignoniaceae	N	Tree	B
<i>Tabebuia rosea</i> (Bertol.) DC.	Bignoniaceae	I	Tree	A
<i>Tamarindus indica</i> L.	Fabaceae	I	Tree	B
<i>Tamonea boxiana</i> (Moldenke) Howard	Verbenaceae	N	Subshrub	I
<i>Tarenaya spinosa</i> (Jacq.) Raf.	Cleomaceae	N	Herb	A
<i>Tectaria incisa</i> Cav.	Tectariaceae	N	Herb	B
<i>Teliostachya alopecuroidea</i> (Vahl) Nees	Acanthaceae	N	Herb	I
<i>Tephrosia senna</i> Kunth	Fabaceae	N	Subshrub	I
<i>Teramnus labialis</i> (L. f.) Spreng.	Fabaceae	N	Vine	I
<i>Teramnus uncinatus</i> (L.) Sw.	Fabaceae	N	Vine	I
<i>Terminalia catappa</i> L.	Combretaceae	I	Tree	B
<i>Tetragastris balsamifera</i> (Sw.) Oken	Burseraceae	N	Tree	I
<i>Thalia geniculata</i> L.	Marantaceae	N	Herb	A
<i>Thelypteris dentata</i> (Forssk.) E. P. St. John	Thelypteridaceae	I	Herb	B
<i>Thelypteris kunthii</i> (Desv.) Morton	Thelypteridaceae	N	Herb	I
<i>Thelypteris poiteana</i> (Bory) Proctor	Thelypteridaceae	N	Herb	B
<i>Thelypteris reticulata</i> (L.) Proctor	Thelypteridaceae	N	Herb	B

Table B-1 (cont.)—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Thelypteris tetragona</i> (Sw.) Small	Thelypteridaceae	N	Herb	B
<i>Theobroma cacao</i> L.	Malvaceae	I	Tree	I
<i>Thespesia grandiflora</i> DC.	Malvaceae	N	Tree	B
<i>Thespesia populnea</i> (L.) Sol. ex Corrêa	Malvaceae	I	Tree	B
<i>Thouinia striata</i> Radlk. var. <i>striata</i>	Sapindaceae	N	Tree	I
<i>Thunbergia alata</i> Bojer ex Sims	Acanthaceae	I	Vine	I
<i>Thunbergia fragrans</i> Roxb.	Acanthaceae	I	Vine	B
<i>Tibouchina longifolia</i> (Vahl) Baill. ex Cogn.	Melastomataceae	I	Shrub	I
<i>Tillandsia fasciculata</i> Sw.	Bromeliaceae	N	Herb	I
<i>Tillandsia recurvata</i> (L.) L.	Bromeliaceae	N	Herb	B
<i>Tillandsia utriculata</i> L.	Bromeliaceae	N	Herb	A
<i>Torenia crustacea</i> (L.) Cham. & Schltldl.	Linderniaceae	I	Herb	B
<i>Tournefortia hirsutissima</i> L.	Boraginaceae	N	Vine	B
<i>Tournefortia scabra</i> Lam.	Boraginaceae	N	Vine	I
<i>Tradescantia zanonii</i> (L.) Sw.	Commelinaceae	N	Herb	A
<i>Tragia volubilis</i> L.	Euphorbiaceae	N	Vine	I
<i>Trema micrantha</i> (L.) Blume	Cannabaceae	N	Tree	B
<i>Trianthema portulacastrum</i> L.	Aizoaceae	N	Herb	B
<i>Trichilia hirta</i> L.	Meliaceae	N	Shrub	B
<i>Trichilia pallida</i> Sw.	Meliaceae	N	Tree	B
<i>Trichostigma octandrum</i> (L.) H. Walt.	Phytolaccaceae	N	Vine	B
<i>Triphasia trifolia</i> (Burm. f.) P. Wilson	Rutaceae	I	Shrub	I
<i>Tripogandra serrulata</i> (Vahl) Handlos	Commelinaceae	N	Herb	A
<i>Triumfetta lappula</i> L.	Malvaceae	N	Shrub	B
<i>Triumfetta semitriloba</i> Jacq.	Malvaceae	N	Shrub	B
<i>Turnera ulmifolia</i> L.	Passifloraceae	N	Herb	I
<i>Turpinia occidentalis</i> (Sw.) G. Don	Staphyleaceae	N	Shrub	B
<i>Typha domingensis</i> Pers.	Typhaceae	N	Graminoid	B
<i>Urena lobata</i> L.	Malvaceae	N	Subshrub	B
<i>Urena sinuata</i> L.	Malvaceae	N	Herb	I
<i>Urera baccifera</i> (L.) Gaudich.	Urticaceae	N	Shrub	B
<i>Urochloa arrecta</i> (Hack. ex T. Dur. & Schinz) O. Morrone & F. Zuloaga	Poaceae	I	Graminoid	I
<i>Urochloa dictyoneura</i> (Fig. & De Not.) Veldkamp	Poaceae	I	Graminoid	B
<i>Urochloa distachya</i> (L.) T. Q. Nguyen	Poaceae	I	Graminoid	I
<i>Urochloa maxima</i> (Jacq.) R. Webster	Poaceae	I	Graminoid	B
<i>Urochloa mutica</i> (Forssk.) T. Q. Nguyen	Poaceae	I	Graminoid	B
<i>Vachellia farnesiana</i> (L.) Wight & Arn. var. <i>farnesiana</i>	Fabaceae	I	Shrub	B
<i>Vachellia tortuosa</i> (L.) Seigler & Ebinger	Fabaceae	N	Shrub	I
<i>Vernonia sericea</i> Rich.	Asteraceae	N	Shrub	B
<i>Vigna adenantha</i> (G. Mey.) Marechal, Mascherpa & Stanier	Fabaceae	N	Vine	B

Appendix B

Table B-1 (cont.)—Scientific name and authority, family, origin, growth habit, and relation to sampling plots for inventoried and associated species

Species and Author(s)	Family	Origin	Growth Habit	Plot
<i>Vigna hosei</i> (Craib) Backer	Fabaceae	I	Vine	B
<i>Vigna luteola</i> (Jacq.) Benth.	Fabaceae	N	Vine	B
<i>Vigna vexillata</i> (L.) A. Rich.	Fabaceae	N	Vine	B
<i>Vitis tiliifolia</i> Humb. & Bonpl. ex Schult.	Vitaceae	N	Vine	B
<i>Waltheria indica</i> L.	Malvaceae	N	Subshrub	B
<i>Wedelia calycina</i> Rich.	Asteraceae	N	Shrub	I
<i>Wissadula periplocifolia</i> (L.) C. Presl ex Thwaites	Malvaceae	N	Subshrub	B
<i>Xanthosoma acevedoi</i> Croat & Delannay	Araceae	N	Herb	I
<i>Xanthosoma sagittifolium</i> (L.) Schott	Araceae	I	Herb	B
<i>Xanthosoma violaceum</i> Schott	Araceae	I	Herb	B
<i>Xiphidium caeruleum</i> Aubl.	Haemodoraceae	I	Herb	I
<i>Youngia japonica</i> (L.) DC.	Asteraceae	I	Herb	I
<i>Zanthoxylum caribaeum</i> Lam.	Rutaceae	N	Shrub	B
<i>Zanthoxylum flavum</i> Vahl	Rutaceae	N	Tree	A
<i>Zanthoxylum martinicense</i> (Lam.) DC.	Rutaceae	N	Tree	B
<i>Zanthoxylum monophyllum</i> (Lam.) P. Wilson	Rutaceae	N	Tree	I
<i>Ziziphus mauritiana</i> Lam.	Rhamnaceae	I	Tree	A
<i>Zoysia matrella</i> (L.) Merr.	Poaceae	I	Graminoid	I

Total: 689 species (native = 497; introduced = 192) and 118 taxonomic families.

Appendix C: Unidentified Taxa

The taxa below could not be determined to species level, and the majority were identified to other taxonomic ranks such as family or genus (see Plant Identification, Collection of Samples, Taxonomic Approach, and Species in the Methodology section). It is worth considering that some of the taxa here could correspond to earlier biological stages of successfully identified species that occurred within sampling plots or nearby (listed in Appendix B). Furthermore, several taxa correspond to plants and lichens that were recorded or observed in 2 or more inventory years—between 2021 and 2023 (i.e., *Cyperus* sp., *Neckeropsis* sp., *Parmotrema* sp., *Plagiochila* sp., Lauraceae, Poaceae, undetermined lichen, and undetermined moss). Hence, these cases could correspond to either one or several species, as such taxa were inventoried or associated in different inventory locations and sites.

The origin of each taxa is indicated as native (N) or introduced (I) if a particular taxa has only native or introduced examples or if the observed individual(s) were most certainly native, but the species could not be determined with the material at hand. The relation to sampling plots is shown as inventory only (I), associated only (A), or both associated and inventory (B). See Vegetation Data in the Methodology section for specifics regarding the terms “inventory species” and “associated species.”

Appendix C

Table C-1—Genus, family, origin, growth habit, and relation to sampling plots for taxa not identified to the rank of species

Genus	Family	Origin	Growth Habit	Plot
<i>Adiantum</i> sp.	Pteridaceae	N	Herb	A
<i>Campyloneurum</i> sp.	Polypodiaceae	N	Herb	A
<i>Cyathea</i> sp.	Cyatheaceae	N	Shrub	A
<i>Cyperus</i> sp.	Cyperaceae	—	Graminoid	B
<i>Desmodium</i> sp.	Fabaceae	—	Herb	I
<i>Digitaria</i> sp.	Poaceae	—	Graminoid	A
<i>Eugenia</i> sp.	Myrtaceae	N	Shrub	I
<i>Heliconia</i> sp.	Heliconiaceae	—	Herb	A
<i>Lantana</i> sp.	Verbenaceae	—	Shrub	B
<i>Leucomium</i> sp.	Leucomiaceae	N	Moss	I
<i>Ludwigia</i> sp.	Onagraceae	—	Herb	A
<i>Musa</i> sp.	Musaceae	I	Herb	A
<i>Neckeropsis</i> sp.	Neckeraceae	N	Moss	I
<i>Parmotrema</i> sp.	Parmeliaceae	N	Lichen	I
<i>Pecluma</i> sp.	Polypodiaceae	N	Herb	A
<i>Phoradendron</i> sp.	Santalaceae	N	Shrub	A
<i>Physalis</i> sp.	Solanaceae	—	Subshrub	I
<i>Plagiochila</i> sp.	Plagiochilaceae	N	Moss	I
<i>Setaria</i> sp.	Poaceae	—	Graminoid	B
<i>Triumfetta</i> sp.	Malvaceae	N	Shrub	I
—	Cyperaceae	—	Graminoid	I
—	Fabaceae	—	Vine	I
—	Lauraceae	N	Tree	I
—	Poaceae	—	Graminoid	B
—	Ranunculaceae	N	Vine	I
—	—	N	Lichen	I
—	—	N	Moss	I

Appendix D: Herbarium Vouchers

All specimens listed below and shown in figures D-1–10 were collected by Steve Maldonado-Silvestrini and Johann D. Crespo-Zapata and subsequently processed by Maldonado-Silvestrini. The vouchers are housed at the University of Puerto Rico, Río Piedras (UPRRP) Herbarium (some have duplicates and are intended to be deposited in other herbaria). Taxa are listed here according to the scientific name and authorship as printed on each specimen label. Therefore, inconsistencies may be noted when cross-referencing with nomenclature applied elsewhere in this report (see Plant Identification, Collection of Samples, Taxonomic Approach, and Species References in the Methodology section). Additionally, some taxonomic changes have occurred after specimen mounting, vouchering, and label printing.

Table D-1—Scientific name and authority, collection date, locality, and voucher number of herbarium specimens

Species and Author(s)	Date	Locality	Voucher Number
<i>Vitis tiliifolia</i> Humb. & Bonpl. ex Schult.	5/5/2021	Utua	911
<i>Urochloa dictyoneura</i> (Fig. & De Not.) Veldkamp	7/8/2021	Lajas	913
<i>Oeceoclades maculata</i> (Lindl.) Lindl.	7/26/2021	Cabo Rojo	920
<i>Heliotropium lamarckii</i> Feuillet	7/26/2021	Cabo Rojo	921
<i>Crescentia linearifolia</i> Miers	7/26/2021	Cabo Rojo	922
<i>Diplazium unilobum</i> Hieron.	8/25/2021	Jayuya	927
<i>Oeceoclades maculata</i> (Lindl.) Lindl.	8/25/2021	Jayuya	928
<i>Microchilus hirtellus</i> (Sw.) D. Dietr.	8/25/2021	Jayuya	929
<i>Cyclopogon elatus</i> (Sw.) Schltr.	8/25/2021	Jayuya	930
<i>Blechnum fragile</i> (Liebm.) C. V. Morton & Lellinger	8/25/2021	Jayuya	931
<i>Goniopteris tetragona</i> (Sw.) C. Presl ssp. tetragona	9/8/2021	Fajardo	934
<i>Goniopteris tetragona</i> (Sw.) C. Presl ssp. tetragona	9/8/2021	Fajardo	935
<i>Rhynchosia minima</i> (L.) DC.	9/10/2021	Lajas	936
<i>Asystasia gangetica</i> (L.) T. Anderson ssp. micrantha (Nees) Ensermu	9/10/2021	Lajas	937
<i>Digitaria eriantha</i> Steud.	9/10/2021	Lajas	938
<i>Digitaria eriantha</i> Steud.	9/10/2021	Lajas	940
<i>Urochloa distachya</i> (L.) T. Q. Nguyen	4/1/2022	Luquillo	1080
<i>Casearia aculeata</i> Jacq.	4/15/2022	Canóvanas	1081
<i>Meniscium reticulatum</i> (L.) Sw.	4/15/2022	Canóvanas	1082
<i>Pterocarpus officinalis</i> Jacq.	4/15/2022	Canóvanas	1083
<i>Struthium sparganophorum</i> (L.) Kuntze	4/15/2022	Canóvanas	1084
<i>Pterocarpus officinalis</i> Jacq.	4/18/2022	Canóvanas	1097
<i>Callisia repens</i> (Jacq.) L.	4/18/2022	Canóvanas	1098
<i>Zoysia matrella</i> (L.) Merr.	4/25/2022	Loíza	1128
<i>Eriochloa punctata</i> (L.) Ham.	4/25/2022	Loíza	1129
<i>Scleria eggersiana</i> Boeckeler	4/25/2022	Loíza	1130
<i>Cyperus brevifolius</i> (Rottb.) Hassk.	5/4/2022	Loíza	1134
<i>Urochloa distachya</i> (L.) T. Q. Nguyen	5/6/2022	Loíza	1138
<i>Condea verticillata</i> (Jacq.) Harley & J. F. B. Pastore	5/6/2022	Loíza	1139
<i>Capsicum chinense</i> Jacq.	5/6/2022	Loíza	1140

Appendix D

Table D-1 (cont.)—Scientific name and authority, collection date, locality, and voucher number of herbarium specimens

Species and Author(s)	Date	Locality	Voucher Number
<i>Digitaria horizontalis</i> Willd.	5/6/2022	Loíza	1141
<i>Pluchea odorata</i> (L.) Cass.	5/6/2022	Loíza	1142
<i>Paspalum pleostachyum</i> Döll	5/6/2022	Loíza	1149
<i>Paspalum vaginatum</i> Sw.	5/6/2022	Loíza	1150
<i>Echinochloa crus-pavonis</i> (Kunth) Schult.	5/6/2022	Loíza	1151
<i>Enydra sessilis</i> DC.	5/6/2022	Loíza	1152
<i>Saccharum officinarum</i> L.	5/11/2022	Loíza	1155
<i>Salix humboldtiana</i> Willd.	5/18/2022	Canóvanas	1161
<i>Persicaria punctata</i> (Elliott) Small	5/20/2022	Canóvanas	1164
<i>Struchium sparganophorum</i> (L.) Kuntze	5/20/2022	Canóvanas	1165
<i>Eleocharis interstincta</i> (Vahl) Roem. & Schult.	5/20/2022	Canóvanas	1166
<i>Eleocharis interstincta</i> (Vahl) Roem. & Schult.	5/20/2022	Canóvanas	1167
<i>Eleocharis flavescens</i> (Poir.) Urb.	5/20/2022	Canóvanas	1168
<i>Ludwigia peploides</i> (Kunth) P. H. Raven	5/20/2022	Canóvanas	1169
<i>Panicum laxum</i> (Sw.) Zuloaga	5/20/2022	Canóvanas	1170
<i>Enydra sessilis</i> DC.	5/20/2022	Canóvanas	1171
<i>Fuirena umbellata</i> Rottb.	5/25/2022	Canóvanas	1174
<i>Rhynchospora corymbosa</i> (L.) Britton	5/25/2022	Canóvanas	1175
<i>Leersia hexandra</i> Sw.	5/25/2022	Canóvanas	1176
<i>Nymphoides humboldtiana</i> (Kunth) Kuntze	5/25/2022	Canóvanas	1177
<i>Ceratopteris thalictroides</i> (L.) Brongn.	5/25/2022	Canóvanas	1179
<i>Eleocharis flavescens</i> (Poir.) Urb.	5/25/2022	Canóvanas	1181
<i>Annona glabra</i> L.	5/25/2022	Canóvanas	1182
<i>Cyperus haspan</i> L.	6/28/2022	Loíza	1189
<i>Urochloa arrecta</i> (Hack.) Morrone & Zuloaga	6/28/2022	Loíza	1190
<i>Paspalum setaceum</i> Michx.	7/8/2022	Loíza	1195
<i>Digitaria eriantha</i> Steud.	7/11/2022	Manatí	1201
<i>Sorghum halepense</i> (L.) Pers.	7/11/2022	Manatí	1202
<i>Dichanthium annulatum</i> (Forssk.) Stapf	7/11/2022	Manatí	1203
<i>Psilotum nudum</i> (L.) P. Beauv.	7/15/2022	Manatí	1207
<i>Licaria triandra</i> (Sw.) Kosterm.	7/22/2022	Manatí	1210
<i>Paspalum fasciculatum</i> Willd. ex Flügge	7/25/2022	Manatí	1221
<i>Spermacoce prostrata</i> Aubl.	8/10/2022	Loíza	1224
<i>Phyllanthus debilis</i> J. G. Klein ex Willd.	8/10/2022	Loíza	1225
<i>Hirtella triandra</i> Sw.	2/24/2023	Río Grande	1332
<i>Mickelia nicotianifolia</i> (Sw.) R. C. Moran, Labiak & Sundue	2/24/2023	Río Grande	1333
<i>Hernandia sonora</i> L.	2/24/2023	Río Grande	1334
<i>Eucharis amazonica</i> Linden ex Planch.	2/24/2023	Río Grande	1335
<i>Alpinia purpurata</i> (Vieill.) K. Schum.	2/24/2023	Río Grande	1336
<i>Dracaena fragrans</i> (L.) Ker Gawl.	2/24/2023	Río Grande	1337
<i>Pachystachys spicata</i> (Ruiz & Pav.) Wassh.	2/24/2023	Río Grande	1338

Table D-1 (cont.)—Scientific name and authority, collection date, locality, and voucher number of herbarium specimens

Species and Author(s)	Date	Locality	Voucher Number
<i>Selaginella plana</i> (Desv.) Hieron.	2/24/2023	Río Grande	1339
<i>Dypsis lutescens</i> (H. Wendl.) Beentje & J. Dransf.	2/24/2023	Río Grande	1340
<i>Caryota mitis</i> Lour.	2/24/2023	Río Grande	1341
<i>Strobilanthes reptans</i> (G. Forst.) Moylan ex Y. F. Deng & J. R. I. Wood	2/24/2023	Río Grande	1342
<i>Lithachne pauciflora</i> (Sw.) P. Beauv.	2/24/2023	Río Grande	1343
<i>Ptychosperma macarthurii</i> (H. Wendl. ex H. J. Veitch) H. Wendl. ex Hook. f.	2/24/2023	Río Grande	1344
<i>Stigmaphyllon puberum</i> (Rich.) A. Juss.	2/24/2023	Río Grande	1345
<i>Costus scaber</i> Ruiz & Pav.	2/24/2023	Río Grande	1346
<i>Senna nitida</i> (Rich.) H. S. Irwin & Barneby	3/2/2023	Caguas	1351

Total: 80 specimens.

Plate 1



Figure D-1—(A) *Vitis tiliifolia* Humb. & Bonpl. ex Schult.; (B) *Urochloa dictyoneura* (Fig. & De Not.) Veldkamp; (C) *Oeceoclades maculata* (Lindl.) Lindl.; (D) *Heliotropium lamarckii* Feuillet; (E) *Crescentia linearifolia* Miers; (F) *Diplazium unilobum* Hieron.; (G) *Oeceoclades maculata* (Lindl.) Lindl.; and (H) *Microchilus hirtellus* (Sw.) D.Dietr.

Plate 2



Figure D-2—(A) *Cyclopogon elatus* (Sw.) Schltr.; (B) *Blechnum fragile* (Liebm.) C.V. Morton & Lellinger; (C) *Goniopteris tetragona* (Sw.) C. Presl ssp. *tetragona*; (D) *Goniopteris tetragona* (Sw.) C. Presl ssp. *tetragona*; (E) *Rhynchosia minima* (L.) DC.; (F) *Asystasia gangetica* (L.) T. Anderson ssp. *micrantha* (Nees) Ensermu; (G) *Digitaria eriantha* Steud.; and (H) *Digitaria eriantha* Steud.

Plate 3

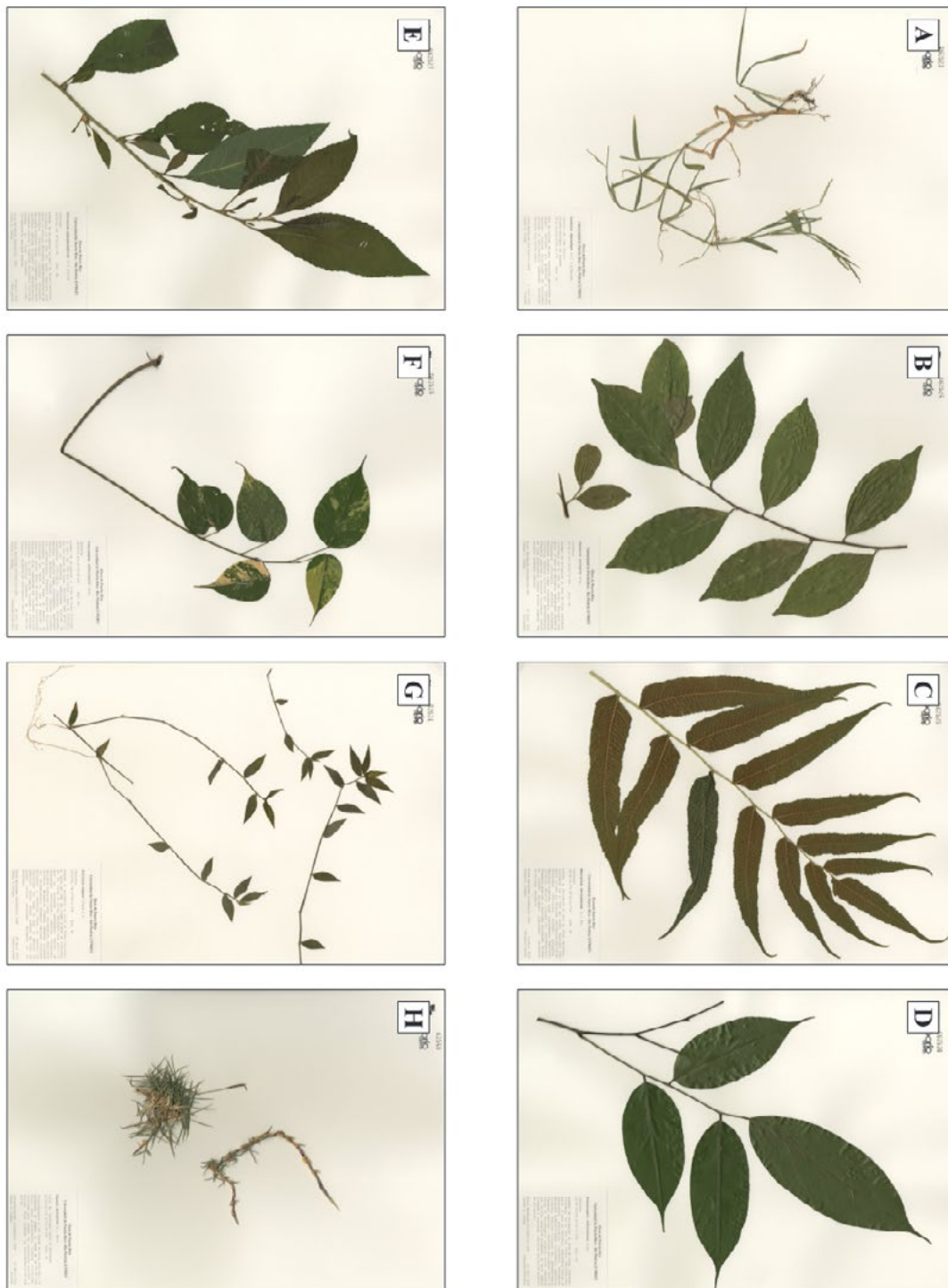


Figure D-3—(A) *Urochloa distachya* (L.) T.Q.Nguyen; (B) *Casearia aculeata* Jacq.; (C) *Meniscium reticulatum* (L.) Sw.; (D) *Pterocarpus officinalis* Jacq.; (E) *Struchium sparganophorum* (L.) Kuntze; (F) *Pterocarpus officinalis* Jacq.; (G) *Callisia repens* (Jacq.) L.; and (H) *Zoysia matrella* (L.) Merr.

Plate 4

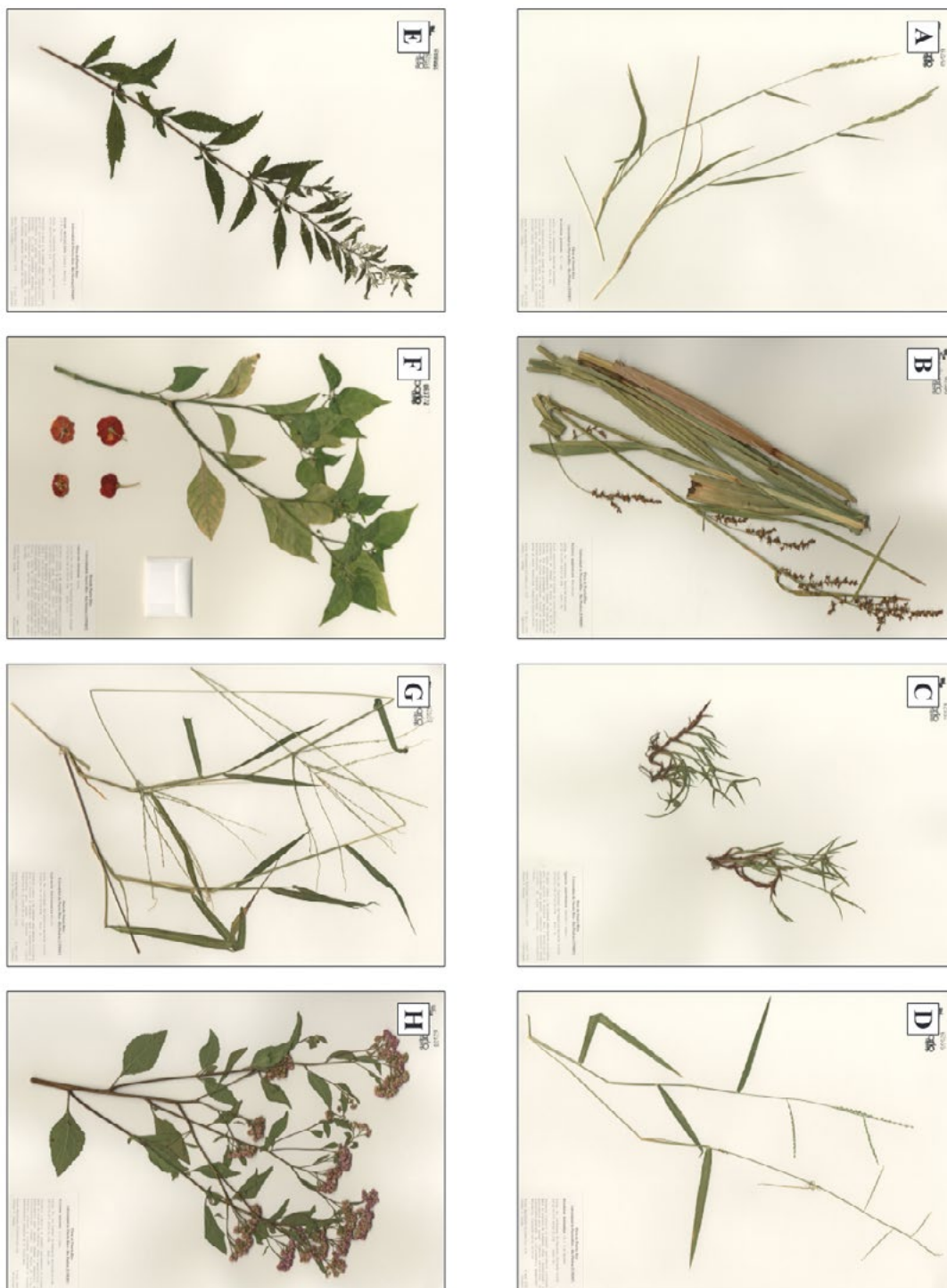


Figure D-4—(A) *Eriochloa punctata* (L.) Ham.; (B) *Scleria eggersiana* Boeckeler; (C) *Cyperus brevifolius* (Rottb.) Hassk.; (D) *Urochloa distachya* (L.) T.Q.Nguyen; (E) *Condea verticillata* (Jacq.) Harley & J.F.B.Pastore; (F) *Capsicum chinense* Jacq.; (G) *Digitaria horizontalis* Willd.; and (H) *Pluchea odorata* (L.) Cass.

Plate 5



Figure D-5—(A) *Paspalum pleostachyum* Döll; (B) *Paspalum vaginatum* Sw.; (C) *Echinochloa crus-galli* (L.) Link.; (D) *Enydra sessilis* DC.; (E) *Saccharum officinarum* L.; (F) *Salix humboldtiana* Willd.; (G) *Panicum punctatum* (L.) Link.; and (H) *Struthium sparganophorum* (L.) Kuntze.

Plate 6



Figure D-6—(A) *Eleocharis interstincta* (Vahl) Roem. & Schult.; (B) *Eleocharis interstincta* (Vahl) Roem. & Schult.; (C) *Eleocharis flavescens* (Poir.) Urb.; (D) *Ludwigia peploides* (Kunth) P.H.Raven; (E) *Panicum laxum* (Sw.) Zuloaga; (F) *Enydra sessilis* DC.; (G) *Fuirena umbellata* Rottb.; and (H) *Rhynchospora corymbosa* (L.) Britton.

Plate 7



Figure D-7—(A) *Leersia hexandra* Sw.; (B) *Nymphoides humboldtiana* (Kunth) Kuntze; (C) *Ceratopteris thalictroides* (L.) Brongn.; (D) *Eleocharis flavescens* (Poir.) Urb.; (E) *Annona glabra* L.; (F) *Cyperus haspan* L.; (G) *Urochloa arrecta* (Hack.) Morrone & Zuloaga; and (H) *Paspalum setaceum* Michx.

Plate 8



Figure D-8—(A) *Digitaria eriantha* Steud.; (B) *Sorghum halepense* (L.) Pers.; (C) *Dichanthium annulatum* (Forssk.) Stapf; (D) *Psilotum nudum* (L.) P.Beauv.; (E) *Licia triandra* (Sw.) Kosterm.; (F) *Paspalum fasciculatum* Willd. ex Flügge; (G) *Spermacoce prostrata* Aubl.; and (H) *Phyllanthus debilis* J.G.Klein ex Willd.

Plate 9

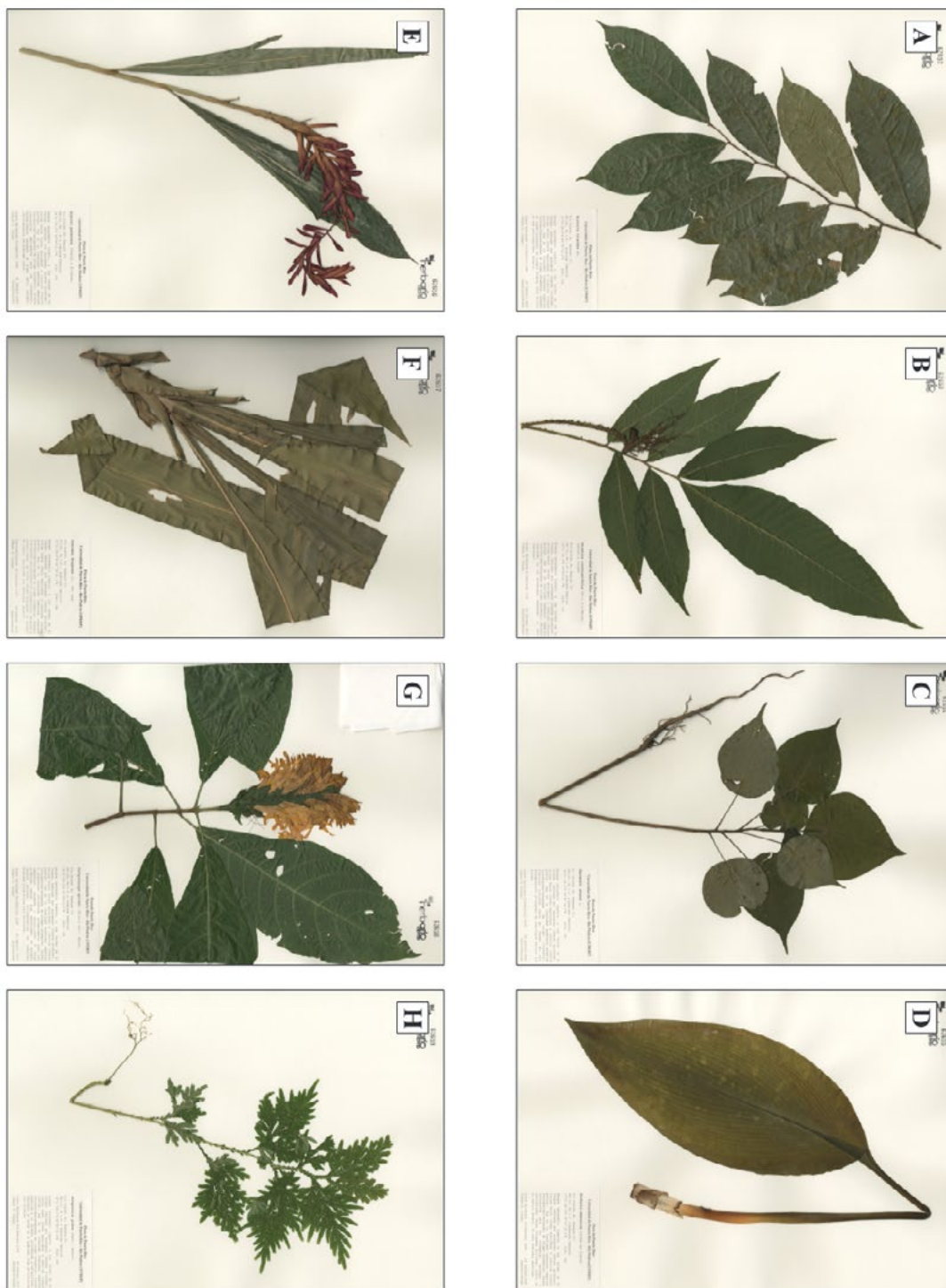


Figure D-9—(A) *Hirtella triandra* Sw.; (B) *Mickelia nicotianifolia* (Sw.) R.C.Moran, Labiak & Sundue; (C) *Hernandia sonora* L.; (D) *Eucharis amazonica* Linden ex Planch.; (E) *Alpinia purpurata* (Vieill.) K.Schum.; (F) *Dracaena fragrans* (L.) Ker Gawl.; (G) *Pachystachys spicata* (Ruiz & Pav.) Wassh.; and (H) *Selaginella plana* (Desv.) Hieron.

Plate 10



Figure D-10—(A) *Dypsis lutescens* (H. Wendl.) Beentje & J.Dransf.; (B) *Caryota mitis* Lour.; (C) *Strobilanthes reptans* (G.Forst.) Moylan ex Y.F.Deng & J.R.I. Wood; (D) *Lithachne pauciflora* (Sw.) P.Beauv.; (E) *Ptychosperma macarthurii* (H. Wendl. ex H.J. Veitch) H.endl. ex Hook.f.; (F) *Stigmaphyllon puberum* (Rich.) A.Juss.; (G) *Costus scaber* Ruiz & Pav.; and (H) *Senna nitida* (Rich.) H.S.Irwin & Barneby.

Crespo-Zapata, Johann D.; Maldonado-Silvestrini, Steve; Gould, William A. 2026. Vegetation structure and composition across select ecological succession stages and land uses in Puerto Rico. Gen. Tech. Rep. WO-111. Washington, DC: U.S. Department of Agriculture, Forest Service. 201 p. <https://doi.org/10.2737/WO-GTR-111>.

From 2021 to 2023, researchers conducted inventories to assess, survey, and describe vegetation on 99 sites in Puerto Rico. Inventory sites comprise several ecological succession stages (or vegetation community phases) and land uses across the island, encompassing mature forests, restored forests, secondary forests, shrublands, pioneers, abandoned tillage crops, managed grasslands, abandoned grasslands, and abandoned horticulture grounds. These were located among the municipalities of Cabo Rojo, Caguas, Canóvanas, Fajardo, Jayuya, Lajas, Loíza, Luquillo, Manatí, Río Grande, Santa Isabel, and Utuado. Some 689 plant species were recorded during this period and are included in this report, accounting for approximately 20 percent of the total suggested flora of Puerto Rico. A total of 80 plant samples were collected and processed, and the corresponding imaged herbarium specimen vouchers are also included. This report presents an overview of the floristic makeup and dynamics, based on the areas and sites assessed, and provides inventory data summaries, as well as descriptive analyses and other general results. The information is intended to serve as a multipurpose planning tool and to support conservation, land-use management, and other practices to mitigate the effects of climate change and extreme weather events.

Keywords: plants, flora, species, Puerto Rico, island, ecological succession stages, land uses

