BIOGEOGRAPHY & FOREST ECOLOGY OF THE BLADEN NATURE RESERVE

Scientific Report to the Forest Department, Ministry of Natural Resources of Research Activities in the Bladen Nature Reserve 2002-2006

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This report makes conservation recommendations and summarizes the findings of S. Brewer's research from 1999 to 2006 on the biogeography and diversity of plant species in the Bladen Nature Reserve. The focus of this report will be on the more recent results of comparisons between the tree flora of the forests on volcanic substrata and those forests on limestone. The objective of this year's research has been to continue sampling the tree flora on volcanic substrata, and to collect representative plant specimens and photographs for creating reference guides for vegetation research in the Maya Mountains.

CONSERVATION IMPLICATIONS and RECOMMENDATIONS

The following recommendations are considered by the author as needing the most urgent attention, and they are by no means written to be comprehensive. These recommendations were developed based on the results of this vegetation study and personal observation in the field. They are the result of a primarily science-based perspective, rather than values or social-based considerations.

(1) *Protect high-elevation forests from fire, local climate change and resource extraction. Buffer zones around protected areas will be essential to protection.*
The high-elevation forests – particularly the limestone ridges – are sufficiently rare and unique in Belize as to warrant protection from fires, which may be the greatest threat to these drier systems. Indeed, both limestone and volcanics forests, likely for different ecological reasons, exhibit drastically altered structure and composition after burning, perhaps for centuries. As is true elsewhere in the Neotropics, severe fires in rainforests usually deflect succession to a species-poor state that may be significantly devoid of functional components such as providing habitat and holding soil against erosion. Finally, local changes in climate due to land-use changes may alter the local climate sufficiently as to facilitate increased fire frequency.

(2) *Creating a baseline of information from which the effects of external threats can be measured and monitored. Facilitate inventory and sound, rapid, basic research; development of research priorities for the Maya Mountains is urgent.*
Both limestone and volcanic forests are extremely heterogeneous at the landscape and local scales. Furthermore, many of the species found in both types of forests are regionally scarce. Finally, with exceptionally high diversity *and* high compositional uniqueness for northern Central America, the Maya Mountains appear to be an "island" of plant diversity in the region. Being able to predict and map variation in species diversity, physical structure, and species composition will require systematic inventory of both biotic and abiotic variables. Gaining baseline information is fundamental to aiding protected areas managers develop priorities for management and monitoring of protected areas. As management of the protected areas of the Maya Mountains becomes more integrated under the new National Protected Areas Policy and System Plan

(NPAPSP), more precise and quantitative analyses of the variation in abiotic conditions, vegetation, and key vertebrate fauna of the Maya Mountains will be critical for rational decisions. Even rapid biodiversity surveys in this region will greatly benefit from surrogate variables, such as vegetation, substrate and topography, for developing priorities for censusing animal diversity.

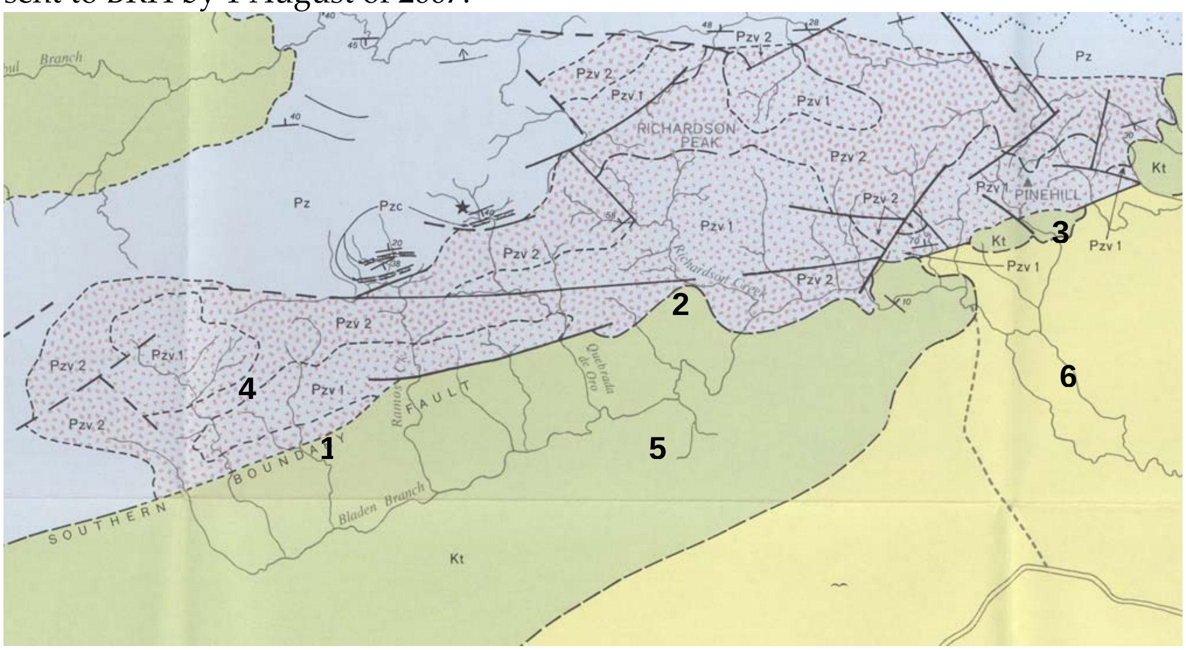
METHODS

Field methods and collections

Forests on valleys (alluvial forests on the floors of valleys, with < 5% inclination, indicated by a “V” prefix in the analyses), lower slopes (forests on the lower third of the slopes next to the valley floor, “L”), upper slopes (forests on the upper third of the slopes, “U”) and ridges ("R") were sampled along elevation gradients at multiple sites, on limestone and volcanic substrata, in the BNR watershed between 1999 and 2006 (Figure 1). These topographic positions were selected because of their unambiguous definition, comparative ease in location, and their clear relation to soil moisture as reflected by canopy height and previous studies in Belize (Furley & Newey, 1979 and references therein). As sample plots, belt transects, rather than regular plots, are best suited to following contours that represented the topographic positions and are more feasible for rapid sampling of the variation within and among the topographic positions in the difficult terrain of the BNR. The method used here is a modification of Gentry’s (1982, 1988) method, which has become a standard for rapid sampling of plant diversity in tropical forests. One transect 2 X 500 m (0.1 ha.) was placed within each topographic position, along contour lines and skipping over treefall gaps in the canopy. While gaps are an important constituent of tropical forests, the irregular occurrence and highly variable physical structure of gaps would require an order of magnitude increase in the number of sample units to account for their effect on variation in diversity and composition. This was not justified given the objectives of the study. Orientation and percent slope were measured at six points spaced evenly along each transect. The valley transects were placed 50 - 60 m away from the base of the nearby slope, and the lower slope and upper slope transects were placed in the middle of the lower and upper thirds of the slope face at each site, respectively.

The sites were c. 10 km apart and were located in the far northeastern part of the BNR, where the Bladen Branch begins to emerge from the main gorge of the watershed, the approximate middle of the watershed, and the upper part of the watershed (Figure 1). The sites were chosen to reduce variability, other than topographic position and substrate, and were selected to: (1) represent separate, approximately equally-spaced locations in the watershed, (2) be comprised of mature-phase forest, (3) have similar orientations of the slopes (all approximately north-facing), and (4) have slope faces that were of similar overall inclination and total elevation change from their respective valley forests. Trees that were within transects were identified and their diameter measured at 130 cm above the soil surface (DBH, or diameter). Trees included all woody, free-standing plants (including palms) ≥ 5 cm DBH. Palms with developed stems, regardless of diameter, were also included in the surveys.

Voucher specimens were collected for all tree species, with the exceptions of species that were common and distinctive, and for which there was no confusion about their identity. Vascular plant taxa not previously collected in the BNR were opportunistically collected as well from surrounding areas. Most specimens are currently being identified by S. Brewer, while some specimens have been sent to specialists. Duplicates of all taxa will be sent to the Belize Herbarium (BRH), the Missouri Botanical Garden (MO), and the UNCW (WNC) herbarium when all have been labeled and mounted. A part time staff member in Brewer's lab is currently mounting specimens, and a batch of mounted and labeled specimens is expected to be sent to BRH by 1 August of 2007.



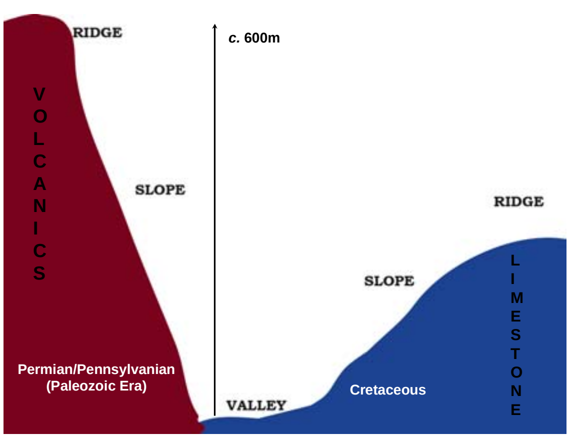


Figure 1. Geology (modified from Bateson and Hall 1977) and topographic positions sampled in the Bladen Nature Reserve. Numbers correspond to areas where study sites were located. Pz = Paleozoic volcanics (acid substrata); Kt = Cretaceous limestone (basic substrata).

Data Analyses

Data analyses for transect and collection data are in progress. Richness, diversity, composition and abundance will be compared with other forests in Belize and Central America using various techniques in ordination as well as traditional statistical analyses. Please refer to Brewer et al. (2003) for details of statistical methods.

RESULTS & DISCUSSION

Physical Structure

Approximately 1100 plant collections were made by Brewer while on volcanic substrata, and these collections are in the final stages of identification and processing. Final determinations will be made on approximately 15% of these specimens when Brewer takes his specimens to MO for comparison with the herbarium specimens already identified there. Until all specimens have their identities confirmed, the following results should be considered preliminary.

Stem density at all topographic positions was significantly greater on volcanics than limestone (Figures 1 and 2). Unlike for limestone forests, however, tree density on volcanics was not significantly positively correlated with increasing elevation. The differences in physical structure between the two forest types are likely due to differences in drainage and water availability, with limestone forests having very porous soils and substrata and being very well drained, while volcanics soils have higher clay content and are perched on impermeable rock. Where exposed on ridges and on poorer soils (low water on limestone, low nutrients on volcanics), however, both forest types exhibited short stature and higher density of small trees.

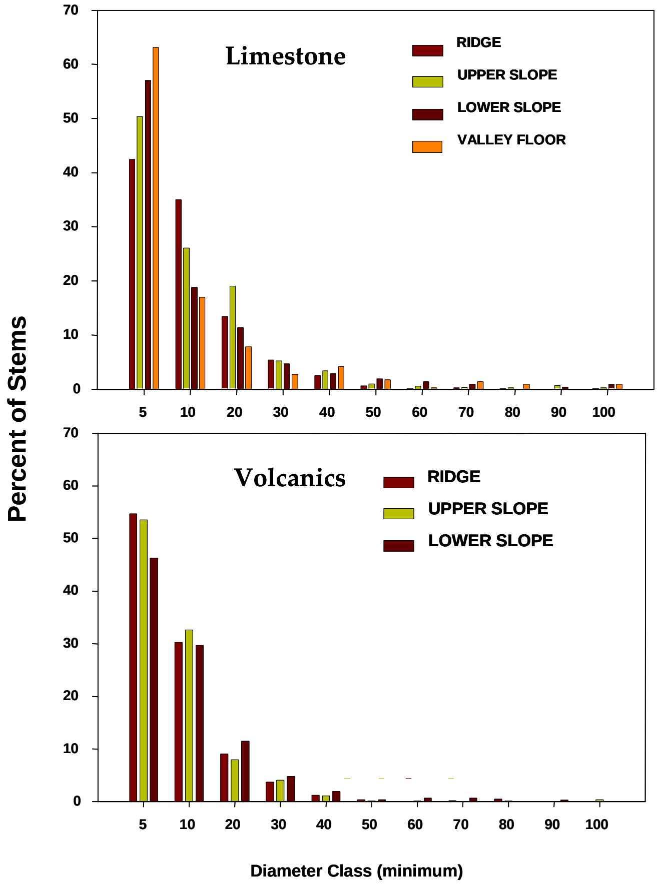


Figure 2. Stem diameter distribution at different topographic positions on limestone and volcanic substrata in the Bladen Nature Reserve.

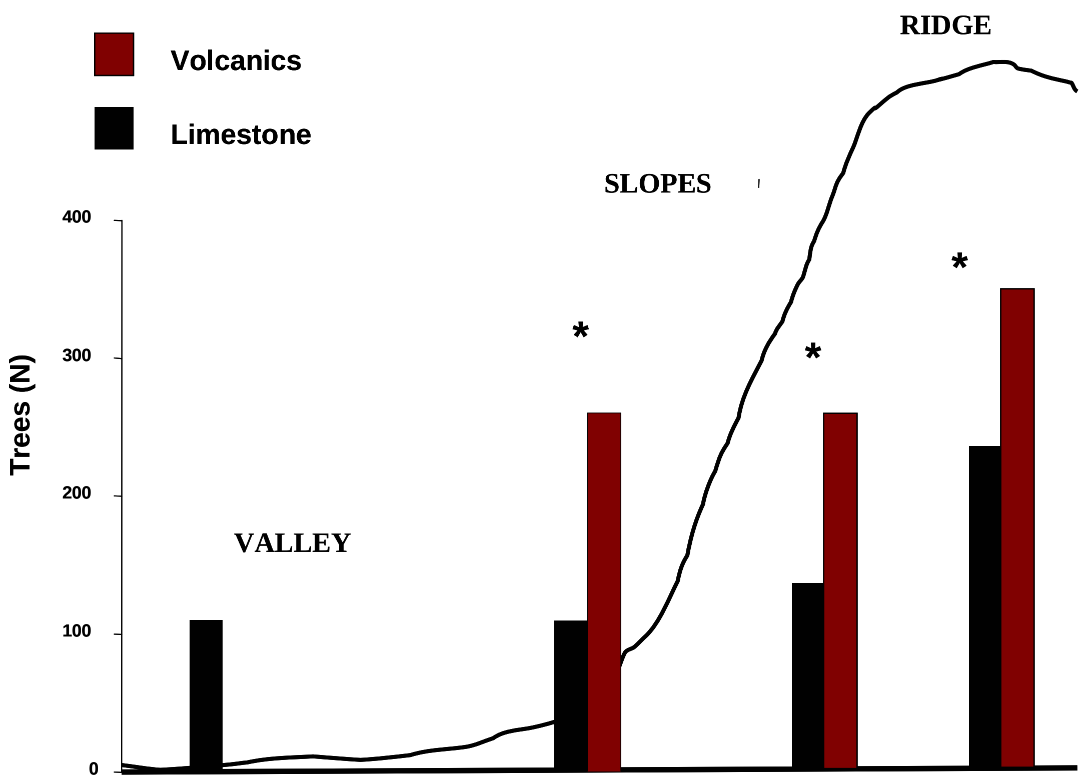


Figure 3. A comparison of the abundance of trees on volcanic and limestone substrata.

Species Composition and Diversity
Non-metric multidimensional scaling reveals significant and quite large differences in the species compositions of the two forest types (Figure 4). In fact, the two forest types rarely shared more than 10% of their species, despite being virtually side by side in the landscape. Soil and topographic differences may be driving the differences in composition, and it is critical to understand why exactly these forest types are so different. In species composition and physical structure.

Volcanic forests had higher species richness and diversity, especially on lower slopes, than did limestone forests, but the differences were surprisingly small (and were statistically insignificant) (Figures 5 and 6). Rarefaction appears to confirm these differences exist at all scales within the landscape (Figure 7). It appears that there may be compensation for effects of higher moisture availability (volcanic soils) on diversity by lower nutrient availability and higher aluminum toxicity.

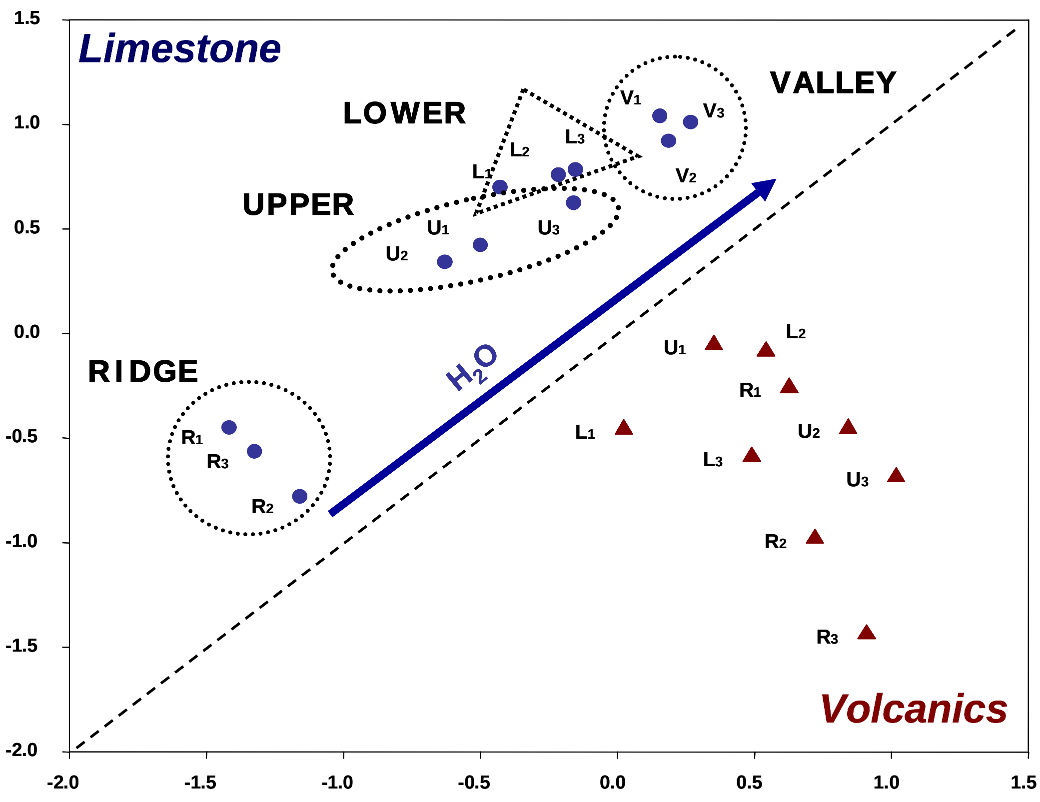


Figure 4. Ordination of transects based on species compositions. Transects that are closer together in the ordination space are more similar in species composition.

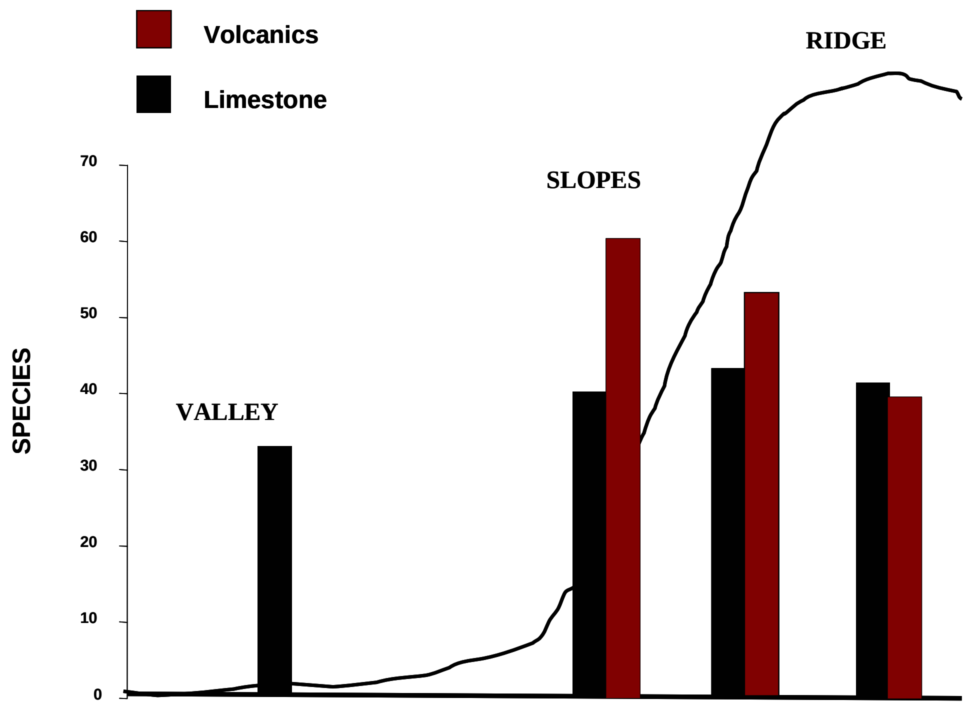


Figure 5. Species richness of trees on volcanic and limestone substrata.

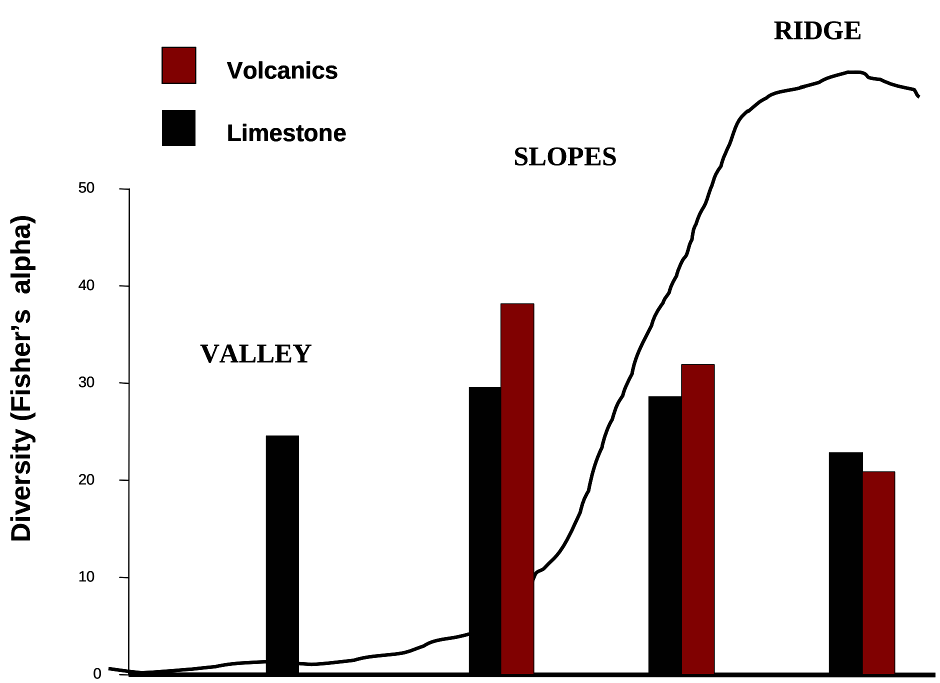


Figure 6. A comparison of diversity of tree species, using the diversity index of Fisher, in the 2 m by 500 m plots, on volcanic and limestone substrata.

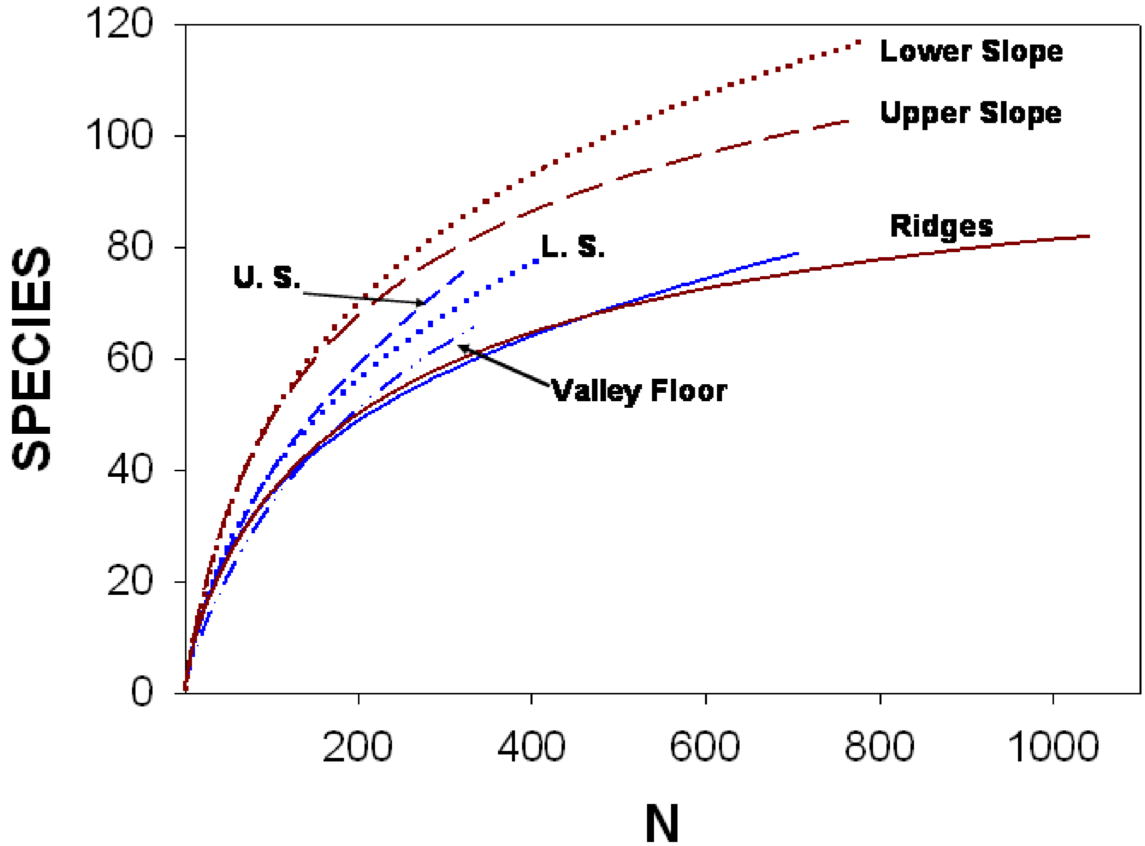


Figure 7. A comparison of diversity of tree species, using rarefaction curves, in the 2 m by 500 m plots, on volcanic (red) and limestone (blue) substrata.

Biogeographical Affinities

On limestone, with increasing elevation both the proportional abundance and richness of species that have geographical affinities for the Greater Antilles increases significantly. This may not be surprising given the shared substrate that is otherwise rare in the Neotropics, and given the unique effects that limestone has on soils. However, the two forest types are surprisingly similar in their species representation of Antillean affinities (Figure 8). It was expected that volcanic soils would have greater representation by South American taxa, but the results do not support this hypothesis, despite the great age of the Maya Mountains and therefore adequate time for colonization from the south. This unexpected result indicates that the Caribbean relationships of the flora – and the mechanisms for maintaining species compositions – are likely to be quite complex. At the Neotropical scale, however, volcanics are relatively poorly represented in northern Central American species compared to limestone, at upper slopes and ridge topographic positions (Figure 9). At the landscape scale, limestone ridge forests are essentially islands, being as different (and having extremely high fidelity) from other limestone forests in composition as from volcanic forests. However, the biogeographical origins of ridge limestone forests are certainly more similar to other limestone forests than volcanics.

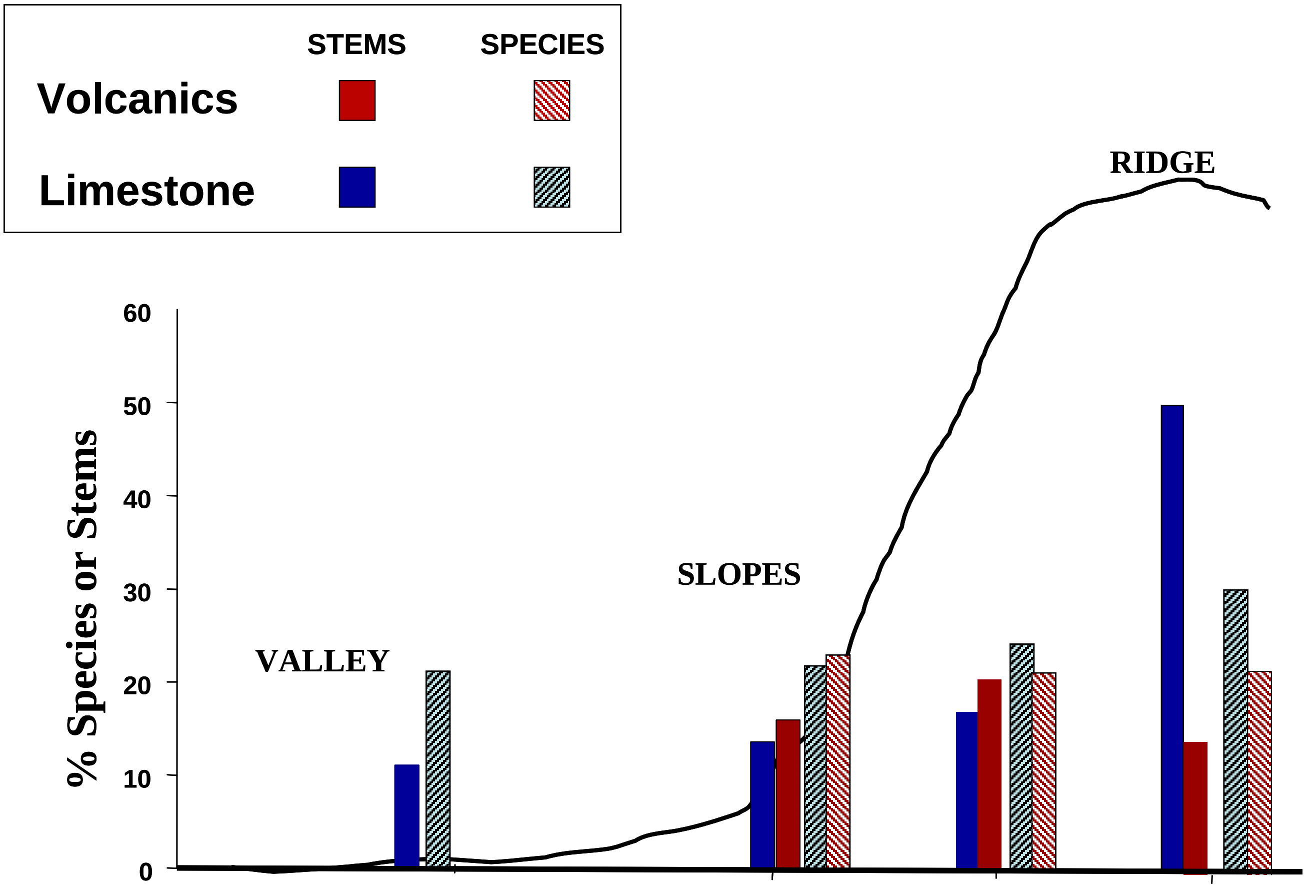


Figure 8. Geographic affinities of tree taxa at the regional scale, as sampled at three topographic positions on volcanic and limestone substrata in the Bladen Nature Reserve, 2002-2005. Percent of species and their representation in abundance (percent of stems sample per transect) with geographic affinities to the Greater Antilles and their respective topographic positions.

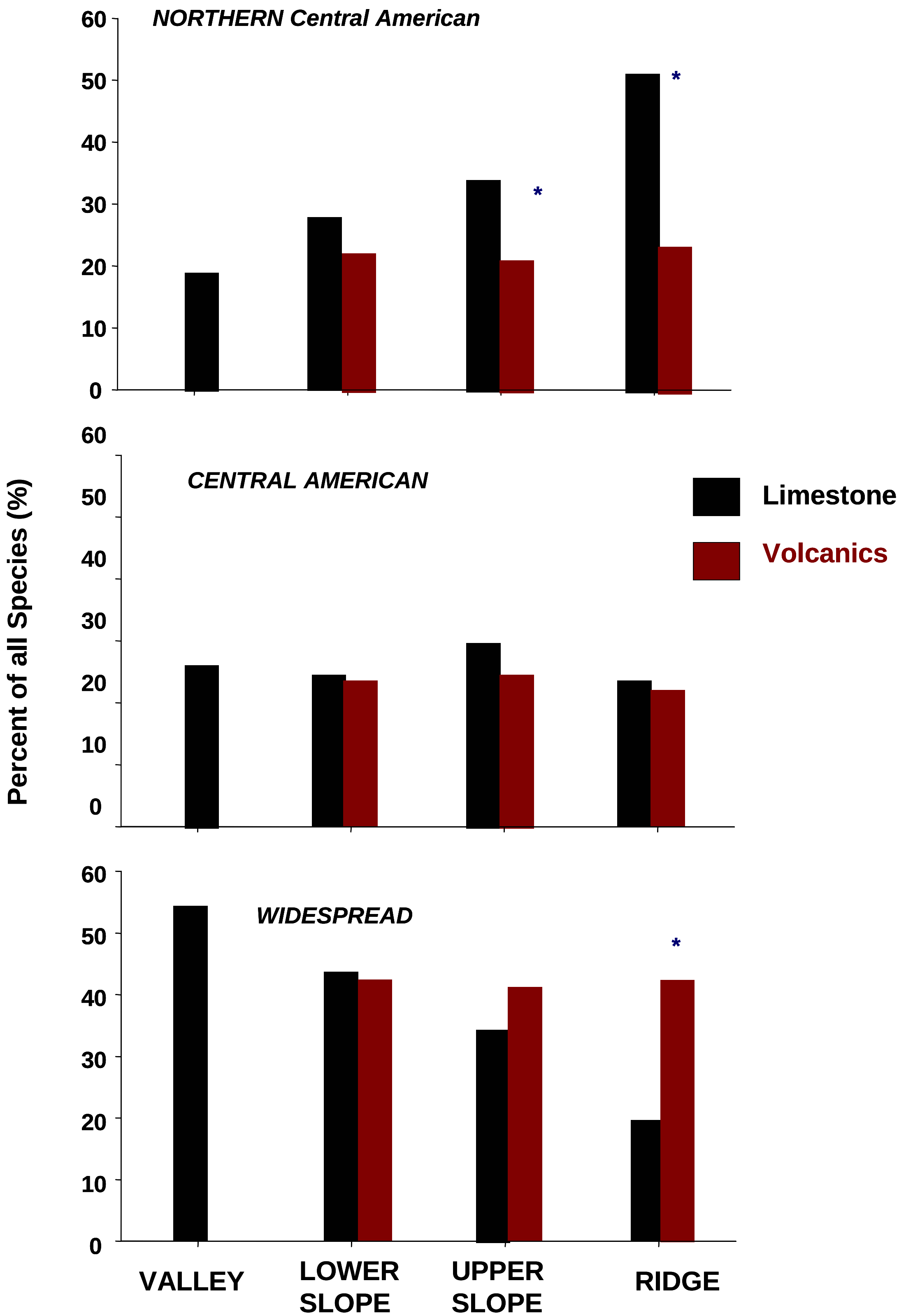


Figure 9. Geographic affinities of tree taxa sampled at three topographic positions on volcanic and limestone substrata in the Bladen Nature Reserve, 2002-2005.

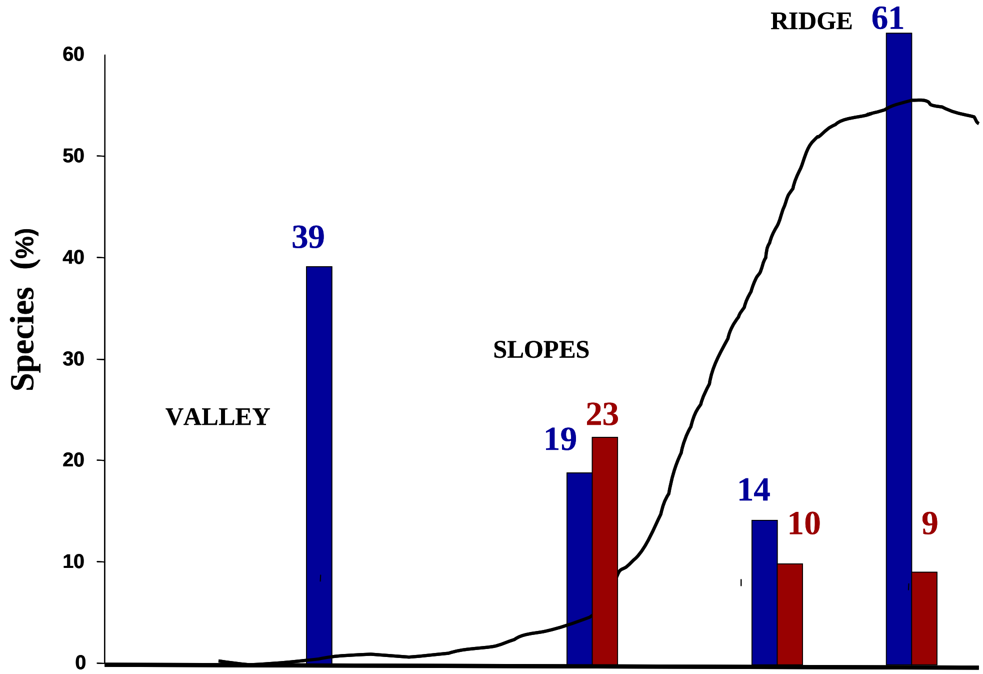


Figure 10. Geographic affinities of tree taxa at the landscape scale, as sampled at three topographic positions on volcanic and limestone substrata in the Bladen Nature Reserve, 2002-2005. Percent of species unique to their respective topographic positions are given at the tops of each bar.

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Appendix. Tree species abundances (N) in forest transects at three topographic positions, on limestone and volcanic substrata. Data sorted by family. Species authorities removed for brevity.

		Valley Floor	Lower Slope		Upper Slope		Ridge	
SPECIES	**FAMILY**	**Limestone**	**Limestone**	**Volcanics**	**Limestone**	**Volcanics**	**Limestone**	**Volcanics**
Saurauia yasicae	Actinidiaceae	0	2	0	1	1	0	0
Astronium graveolens	Anacardiaceae	0	1	7	0	0	2	0
Comocladia guatemalensis	Anacardiaceae	0	0	0	0	0	3	0
Metopium brownei	Anacardiaceae	0	0	0	0	0	25	0
Spondias mombin	Anacardiaceae	6	2	0	0	0	0	0
Annona primigenia	Annonaceae	0	0	0	0	0	1	0
Annona scleroderma	Annonaceae	0	1	3	1	2	0	2
Cymbopetalum mayanum	Annonaceae	2	0	0	0	0	0	0
Guatteria amplifolia	Annonaceae	0	0	5	0	12	0	0
Mosannona depressa	Annonaceae	0	0	0	0	0	1	0
Mossanona depressa	Annonaceae	0	0	1	0	2	0	0
Oxandra belizensis	Annonaceae	1	12	0	17	0	2	0
Stenanona stenopetala	Annonaceae	0	1	0	1	0	0	0
Xylopia frutescens	Annonaceae	0	0	14	0	9	0	44
Aspidosperma megalocarpon	Apocynaceae	2	0	0	0	5	0	3
Aspidosperma spruceanum	Apocynaceae	0	4	12	9	6	1	7
Mortoniella pittieri	Apocynaceae	1	0	0	0	0	0	0
Plumeria obtusa	Apocynaceae	0	0	0	0	0	1	0
Stemmadenia donnell-smithii	Apocynaceae	4	1	0	0	0	0	0
Ilex guianensis	Aquifoliaceae	0	0	0	0	0	0	4
Dendropanax arboreus	Araliaceae	0	5	1	4	7	0	2
Astrocaryum mexicanum	Arecaceae	150	82	19	88	14	0	16
Attalea cohune	Arecaceae	3	1	0	0	0	0	0
Colpothrinax cookii	Arecaceae	0	0	2	0	26	0	5
Cryosophila stauracantha	Arecaceae	2	4	5	18	3	7	4
Euterpe precatoria	Arecaceae	0	0	19	0	28	0	19
Geonoma cf.	Arecaceae	0	0	0	0	3	0	0
Sabal mauritiiformis	Arecaceae	0	3	0	5	0	0	0
Koanophyllon sp.	Asteraceae	0	0	0	0	1	0	0
Amphitecna breedlovei	Bignoniaceae	0	0	2	0	8	0	15
Tabebuia aff.	Bignoniaceae	0	0	1	0	0	1	0
Ceiba pentandra	Bombacaceae	1	0	0	0	0	0	0
Pseudobombax ellipticoideum	Bombacaceae	0	1	2	1	0	7	0
Quararibea funebris	Bombacaceae	1	20	0	7	0	0	0
Cordia bicolor	Boraginaceae	0	0	0	0	3	0	7
Protium copal	Burseraaceae	0	4	0	6	0	31	0
Protium schippii	Burseraaceae	20	0	14	0	19	0	6

Bursera simaruba	Burseraceae	0	0	1	0	2	18	0
Capparis discolor	Capparidaceae	1	0	3	0	2	0	0
Jacaratia dolichaula	Caricaceae	1	0	0	0	0	0	0
Pourouma bicolor	Cecropiaceae	0	0	3	0	2	0	0
Celastraceae	Celastraceae	0	0	2	0	0	0	0
Crossopetalum parviflorum	Celastraceae	0	0	0	1	0	0	0
Maytenus schippii	Celastraceae	0	0	0	0	0	13	0
Wimmeria bartlettii	Celastraceae	0	1	0	5	0	5	0
Zinowiewia pallida	Celastraceae	0	0	14	0	9	0	24
Celtis schippii	Celtidaceae	3	1	1	0	0	0	0
Hirtella racemosa	Chrysobalanaceae	0	0	0	1	0	1	2
Hirtella triandra	Chrysobalanaceae	1	1	0	0	0	0	0
Licania hypoleuca	Chrysobalanaceae	0	0	70	0	68	0	60
Licania sparsipilis	Chrysobalanaceae	0	0	19	0	18	0	111
Calophyllum brasiliense	Clusiaceae	0	2	20	0	18	0	28
Clusia massoniana	Clusiaceae	0	0	0	0	0	8	0
Clusia rosea	Clusiaceae	0	0	7	0	21	4	56
Garcinia intermedia	Clusiaceae	2	3	3	5	3	0	7
Symphonia globulifera	Clusiaceae	0	0	3	0	12	0	15
Bucida buceras	Combretaceae	0	0	0	0	0	4	0
Terminalia amazonia	Combretaceae	4	2	18	3	16	0	8
Terminalia oblonga	Combretaceae	0	1	0	0	0	0	0
Cyathea divergens	Cyatheaceae	0	0	1	0	2	0	0
Cyathea sp.	Cyatheaceae	0	0	0	0	0	0	4
Cyathea sp.	Cyatheaceae	0	0	11	0	40	0	4
Cyrilla racemiflora	Cyrillaceae	0	0	1	0	6	0	18
Purdaea belizensis	Cyrillaceae	0	0	1	0	12	0	126
Diospyros digyna	Ebenaceae	1	1	0	2	0	0	0
Diospyros salicifolia	Ebenaceae	0	0	0	0	0	8	0
Sloanea longipes	Elaeocarpaceae	0	0	0	0	1	0	3
Sloanea meianthera	Elaeocarpaceae	0	0	2	0	3	0	0
Sloanea sp.4	Elaeocarpaceae	0	0	0	0	0	0	5
Sloanea tuerckheimii	Elaeocarpaceae	0	0	39	0	38	0	47
Alchornea latifolia	Euphorbiaceae	3	0	0	0	0	0	0
Alchorneopsis floribunda	Euphorbiaceae	0	0	2	0	0	0	0
Croton arboreus	Euphorbiaceae	0	0	0	0	0	4	0
Croton schiedianus	Euphorbiaceae	0	0	0	0	1	0	0
Drypetes brownii	Euphorbiaceae	2	10	0	12	0	0	0
Drypetes lateriflora	Euphorbiaceae	0	0	0	0	1	3	5
Euphorbiaceae	Euphorbiaceae	0	0	0	0	0	0	2
Gymnanthes lucida	Euphorbiaceae	0	0	0	0	0	23	0
Indet #7	Euphorbiaceae	0	0	0	0	1	0	0
Pera barbellata	Euphorbiaceae	0	0	1	0	0	0	7

Sebastiana longicuspis	Euphorbiaceae	0	11	0	15	0	2	0
Abarema idiopoda	Fabaceae	0	0	1	0	5	0	9
Acacia cookii	Fabaceae	0	1	0	4	0	1	0
Acacia cornigera	Fabaceae	0	1	0	0	0	0	0
acacia skleroxyla	Fabaceae	0	0	0	0	0	22	0
Acacia sp.	Fabaceae	0	0	1	0	5	0	1
Bauhinia divaricata	Fabaceae	0	0	0	1	0	1	0
Caesalpinia aff.	Fabaceae	0	0	0	0	0	1	0
Cojoba arborea	Fabaceae	0	0	0	1	0	0	0
Cojoba graciliflora	Fabaceae	0	0	0	0	3	0	2
Cynometra retusa	Fabaceae	0	2	1	2	0	0	0
Dalbergia stevensonii	Fabaceae	0	0	3	0	2	0	0
Dialium guianense	Fabaceae	5	4	8	3	4	0	1
Erythrina sp.	Fabaceae	0	0	0	0	0	1	0
Inga davidsei	Fabaceae	0	0	1	0	4	0	2
Inga sapindoides	Fabaceae	1	0	0	0	1	0	0
Lecointea amazonica	Fabaceae	0	0	2	0	0	0	1
Lonchocarpus pentaphyllus	Fabaceae	3	0	0	1	0	0	0
Pterocarpus rohrii	Fabaceae	0	0	1	2	0	3	0
Schizolobium parahyba	Fabaceae	1	0	0	0	0	0	0
Swartzia cubensis	Fabaceae	0	0	0	1	0	1	0
Swartzia simplex	Fabaceae	1	0	34	0	4	0	0
Zygia confusa	Fabaceae	0	0	0	0	0	1	0
Casearia bartlettii	Flacourtaceae	0	2	1	2	0	0	0
Casearia tremula	Flacourtaceae	0	1	3	0	1	0	1
Chiangiodendron mexicanum	Flacourtaceae	0	1	0	0	0	0	0
Laetia thamnia	Flacourtaceae	0	0	7	3	3	37	0
Lunania mexicana	Flacourtaceae	0	0	0	0	0	1	0
Pleuranthodendron lindenii	Flacourtaceae	2	0	0	0	0	0	0
Casearia arborea	Flacourteaceae	0	0	1	0	0	0	0
Casearia commersoniana	Flacourteaceae	0	0	1	0	0	0	0
Casearia sylvestris	Flacourteaceae	0	0	0	0	0	0	2
Macrohasseltia macroterantha	Flacourteaceae	0	0	7	0	20	0	9
Ottoschulzia pallida	Icacinaceae	0	0	0	1	0	69	0
Indet #1	indet	0	1	0	0	0	0	0
indet #2	indet	0	1	0	0	0	0	0
indet #4	indet	0	0	0	0	0	1	0
Indet #5	indet	0	0	0	0	0	1	0
Indet #6	indet	0	0	0	0	0	0	1
Indet #7	indet	0	0	3	0	0	0	0
Indet. #6	indet	0	0	0	0	0	1	0
Cinnamomum aff.	Lauraceae	1	0	0	0	0	0	0

Lauraceae cf.	Lauraceae	0	1	0	2	0	0	0
Licaria peckii	Lauraceae	1	0	0	0	0	0	0
Nectandra coriacea	Lauraceae	0	1	0	4	0	18	0
Nectandra longicaudata	Lauraceae	0	0	1	0	1	0	0
Nectandra lundellii	Lauraceae	3	2	0	1	0	0	0
Ocotea cernua	Lauraceae	2	0	0	0	0	0	0
Ocotea helicterifolia	Lauraceae	0	0	4	0	4	0	0
Ocotea leucoxylon	Lauraceae	0	0	6	0	14	0	1
Ocotea veraguensis	Lauraceae	0	0	1	0	1	1	5
Magnolia yoroconte	Magnoliaceae	0	0	1	0	0	0	0
Bunchosia cornifolia	Malpighiaceae	0	0	0	1	0	0	0
Bunchosia ocellata	Malpighiaceae	1	0	0	0	0	0	0
Bunchosia swartziana	Malpighiaceae	0	0	0	0	0	6	0
Byrsonima crassifolia	Malpighiaceae	0	0	0	0	0	0	1
Malpighia souzae	Malpighiaceae	0	1	0	1	0	0	0
Malpighiaceae	Malpighiaceae	0	1	0	0	0	1	0
Henriettea succosa	Melastomataceae	0	0	5	0	4	0	0
Melasomataceae 2434	Melastomataceae	0	0	0	0	1	0	0
Melastome 12	Melastomataceae	0	0	1	0	0	0	0
Melastome 14	Melastomataceae	0	0	0	0	2	0	0
Melastome 16	Melastomataceae	0	0	0	0	2	0	0
Melastome 2	Melastomataceae	0	0	1	0	0	0	0
Melastome 38	Melastomataceae	0	0	2	0	5	0	7
Miconia chrysophylla	Melastomataceae	0	0	3	0	1	0	5
Miconia elata	Melastomataceae	0	0	1	0	5	0	2
Miconia fulvostellata	Melastomataceae	0	1	0	0	0	0	0
Miconia impetiolaris	Melastomataceae	2	0	0	0	0	0	0
Miconia lateriflora	Melastomataceae	0	0	3	0	0	0	0
Miconia sp.	Melastomataceae	0	0	0	0	1	0	0
Mouriri exilis	Melastomataceae	2	1	10	0	7	0	0
Mouriri myrtilloides	Melastomataceae	0	0	13	0	0	0	0
Guarea (new	Meliaceae	0	0	1	0	0	0	0
Guarea glabra	Meliaceae	10	5	1	2	0	0	0
Guarea grandifolia	Meliaceae	4	3	0	1	1	0	0
Swietenia macrophylla	Meliaceae	0	1	11	1	9	0	6
Trichilia erythrocarpa	Meliaceae	0	0	0	0	0	2	0
Trichilia martiana	Meliaceae	0	0	0	1	0	0	0
Trichilia minutiflora	Meliaceae	0	0	0	3	0	7	0
Trichilia moschata	Meliaceae	1	5	0	1	0	0	0
Trichilia pallida	Meliaceae	0	0	0	1	0	0	0
Hyperbaena mexicana	menispermaceae	0	0	0	0	0	2	0
Mollinedia guatemalensis	Monimiaceae	0	0	1	0	3	0	2
Brosimum alicastrum	Moraceae	4	8	1	7	0	0	0

Brosimum guianense	Moraceae	0	0	11	0	13	0	7
Castilla elastica	Moraceae	2	0	0	0	0	0	0
Coussapoa oligocephala	Moraceae	0	0	0	0	0	3	0
Ficus colubrinae	Moraceae	0	1	0	0	0	1	0
Ficus guajavoides	Moraceae	3	1	0	0	0	0	0
Ficus insipida	Moraceae	1	0	0	0	0	0	0
Ficus pertusa	Moraceae	0	0	0	0	1	0	0
Ficus popenoei	Moraceae	0	0	1	0	0	0	0
Poulsenia armata	Moraceae	19	8	0	0	0	0	0
Pourouma bicolor	Moraceae	1	0	0	0	0	0	0
Pseudolmedia spuria	Moraceae	1	6	26	28	23	2	10
Trophis mexicana	Moraceae	1	2	0	2	0	0	1
Trophis racemosa	Moraceae	1	0	1	0	0	0	0
Compsoneura sprucei	Myristicaceae	1	0	17	1	3	0	0
Virola koschnyi	Myristicaceae	5	0	0	0	0	0	0
Ardisia compressa	Myrsinaceae	0	0	0	0	0	1	0
Myrsine cubana	Myrsinaceae	0	0	0	0	0	0	0
Calyptranthes calderonii	Myrtaceae	0	0	5	0	1	0	0
Calyptranthes cuneifolia	Myrtaceae	0	0	3	0	11	0	135
Chamguava schippii	Myrtaceae	0	0	0	0	0	0	0
Eugenia aeruginea	Myrtaceae	0	0	0	0	0	73	0
Eugenia sp.	Myrtaceae	0	0	0	0	0	0	1
Eugenia trikii	Myrtaceae	0	0	0	0	0	16	0
MRT 10	Myrtaceae	0	0	1	0	0	0	0
MRT 11	Myrtaceae	0	0	3	0	0	0	0
MRT 13	Myrtaceae	0	0	0	0	0	0	0
MRT 13	Myrtaceae	0	0	0	0	2	0	0
MRT 4	Myrtaceae	0	0	0	0	12	0	5
MRT 6	Myrtaceae	0	0	29	0	4	0	0
MRT 7	Myrtaceae	0	0	2	0	0	0	0
MRT 8	Myrtaceae	0	0	0	0	0	0	2
Myrcia splendens	Myrtaceae	0	0	0	0	13	0	2
Neea fagifolia	Nyctaginaceae	0	0	0	0	0	1	0
Neea psychotrioides	Nyctaginaceae	0	0	9	3	1	6	6
Heisteria media	Olacaceae	2	17	0	9	0	0	0
Ouratea insulae	Olacaceae	0	1	2	0	8	1	17
Chionanthus oblanceolatus	Oleaceae	0	4	0	7	0	0	7
Chionanthus panamensis	Oleaceae	0	0	0	0	0	4	0
Piper schippianum	Piperaceae	0	1	0	2	1	0	0
Podocarpus guatemalensis	Podocarpaceae	0	0	5	0	17	0	16
Coccoloba acapulcensis	Polygonaceae	0	0	0	0	0	1	0
Coccoloba belizensis	Polygonaceae	0	0	0	0	3	0	2
Coccoloba diversifolia	Polygonaceae	0	0	4	0	0	82	0

Coccoloba tuerckheimii	Polygonaceae	1	1	0	0	0	0	0
Roupala montana	Proteaceae	0	0	1	0	4	0	1
Quiina schippii	Quinnaceae	0	0	3	0	1	0	0
Rhamnaceae	Rhamnaceae	0	0	0	0	0	15	0
Cassipourea guianensis	Rhizophoraceae	0	0	15	0	11	0	2
Photinia micorcarpa	Rosaceae	0	0	0	0	0	0	0
Prunus lundelliana	Rosaceae	0	0	0	1	0	11	0
Alseis yucatanensis	Rubiaceae	1	11	1	7	0	0	0
Amaiouia corymbosa	Rubiaceae	0	0	3	0	4	0	11
Chione venosa	Rubiaceae	0	0	0	0	0	1	0
Chomelia protracta	Rubiaceae	0	0	8	0	5	0	3
Exostema mexicanum	Rubiaceae	0	1	0	1	0	1	0
Faramea occidentalis	Rubiaceae	0	2	4	1	0	0	0
Glossostipula concinna	Rubiaceae	0	0	0	0	0	15	0
Guettarda combsii	Rubiaceae	0	0	1	0	0	4	0
Guettarda elliptica	Rubiaceae	0	0	0	0	0	6	0
Guettarda macrosperma	Rubiaceae	2	1	0	0	0	0	0
Platymiscium dimorphandrum	Rubiaceae	1	0	0	0	0	0	0
Posoqueria latifolia	Rubiaceae	0	0	3	1	1	0	0
Psychotria chiapensis	Rubiaceae	1	0	0	1	0	0	0
Psychotria panamensis	Rubiaceae	0	0	0	0	2	0	1
Psychotria pubescens	Rubiaceae	0	0	0	1	0	0	0
Psychotria simiarum	Rubiaceae	8	5	0	2	0	0	0
Randia aculeata	Rubiaceae	0	0	0	0	0	2	0
Randia armata	Rubiaceae	1	0	0	0	0	0	0
Randia genipifolia	Rubiaceae	1	1	0	2	0	0	0
Randia matudae	Rubiaceae	0	0	4	0	9	0	14
Rondeletia belizensis	Rubiaceae	0	0	0	0	0	16	0
Rubiaceae indet	Rubiaceae	0	0	0	0	1	0	0
Simira salvadorensis	Rubiaceae	0	0	1	0	0	0	0
Stenostomum lucidum	Rubiaceae	0	4	0	10	0	1	0
Amyris aff.	Rutaceae	0	0	0	1	0	0	0
Zanthoxylum acuminatum	Rutaceae	0	0	3	0	1	6	0
Zanthoxylum ekmanii	Rutaceae	3	0	0	0	0	0	0
Zanthoxylum riedelianum	Rutaceae	5	0	0	0	0	0	0
Lacistema aggregata	Salicaceae	0	0	11	0	4	0	1
Allophylus camptostachys	Sapindaceae	0	0	0	0	0	1	0
Allophylus psilospermus	Sapindaceae	0	0	0	0	0	1	0
Cupania belizensis	Sapindaceae	0	0	12	3	6	0	5
Cupania rufescens	Sapindaceae	0	0	0	0	0	0	1
Exothea paniculata	Sapindaceae	0	0	0	0	0	10	0
Matayba apetala	Sapindaceae	0	0	2	1	13	0	8
Sapindaceae	Sapindaceae	0	0	0	0	0	2	0

Sapindus saponaria	Sapindaceae	0	1	0	0	0	0	0
Chrysophyllum mexicanum	Sapotaceae	0	0	1	0	0	0	0
Chrysophyllum venezuelanense	Sapotaceae	0	1	0	1	0	0	0
Manilkara chicle	Sapotaceae	3	2	1	0	1	4	1
Manilkara staminodella	Sapotaceae	0	0	0	7	0	7	0
Manilkara zapota	Sapotaceae	0	0	15	1	5	0	0
Pouteria amygdalina	Sapotaceae	0	2	0	7	0	5	0
Pouteria belizensis	Sapotaceae	0	0	14	0	2	0	8
Pouteria campechiana	Sapotaceae	1	1	8	3	0	0	1
Pouteria durlandii	Sapotaceae	3	1	13	7	5	0	0
Pouteria izabalensis	Sapotaceae	9	0	2	1	13	0	10
Pouteria reticulata	Sapotaceae	0	3	0	20	0	45	0
Pouteria sp.	Sapotaceae	0	1	0	0	0	7	0
Sideroxylon salicifolium	Sapotaceae	0	0	1	0	7	0	3
Simarouba glauca	Simaroubaceae	0	0	0	0	1	0	3
Guazuma ulmifolia	Sterculiaceae	0	1	0	0	0	0	0
Ternstroemia tepezapote	Theaceae	0	0	0	0	0	0	22
Deherainia smaradigna	Theophrastaceae	0	0	0	1	0	0	0
Jacquinia longifolia	Theophrastaceae	0	0	0	0	0	1	0
Heliocarpus americanus	Tiliaceae	0	0	0	1	0	2	0
Luehea speciosa	Tiliaceae	0	0	2	0	0	0	0
Mortoniodendron sp.	Tiliaceae	0	0	0	1	0	0	0
Trichospermum grewiifolium	Tiliaceae	1	1	0	0	0	0	0
Erblichia odorata	Turneraceae	0	0	2	0	0	0	0
Ampelocera hottlei	Ulmaceae	2	3	0	6	0	0	0
Urera alceifolia	Urticaceae	0	0	0	2	0	0	0
Vitex gaumeri	Verbenaceae	0	1	4	0	0	0	0
Rinorea guatemalensis	Violaceae	0	0	14	0	5	0	0
Rinorea hummelii	Violaceae	2	26	36	18	18	0	3
Vochysia hondurensis	Vochysiaceae	0	0	6	0	6	0	9