A Survey of Forest Structure on Mount Joy

By Ali Duffel

Dominica 2004
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Dr. Lacher
Dr. Woolley

Abstract

The area on top of Mount Joy at the end of Fifi road trial is an area of secondary vegetation. A permanent transect 50m by 2m was set up and the forest structure was measured. The diameter at breast height (DBH), canopy cover, species identification, and herbaceous ground cover were the focus of the study. The data collected was used to look at the biodiversity on top of Mount Joy. From the data, a baseline for biodiversity was observed. The data and transect can be used in future years to study the change in biodiversity and the way Mount Joy is affected by different environmental events.

Introduction

The purpose of this project was to set up a modified Gentry plot on the Springfield estate and to collect data on the area. All of the procedures were taken from the Team initiative data may be used in the future to measure the change of biodiversity over time. At the time the transect was measured, Dominica had received no dry season and a continual wet season. This could have an impact on how the vegetation is growing and subsequently measured. website (http://www.teaminitiative.org/). Due to the large scale of the plot used in the Team initiative website, one transect was set up instead of the five parallel transects. From the transect a survey of the ground cover, diameter at breast height, canopy cover, and tree identification was taken. This

Materials

meter tape measure

string

bamboo measured to 4.5 feet

bamboo measured to 1 meter

Spherican Densiometer Model-C

Flora of Dominica, Part 2: Dicotyledoneae

Dominica Nature Island of the Caribbean

Springfield's Herbarium database

Ziploc bags

trash bags

PVC pipe

drill

mallet

flagging tape

compass

GPS receiver

Methods

The area needed for the modified Gentry plot is one with flat land that does not have a drastic change in landscape. The area chosen is on top of Mount Joy at the end of the Fifi road trial, N15° 21.121' W61° 21.782' (Stewart Peck). Since Mount Joy is located on Springfield property it made access to the plot easy.

To set up the plot a minimum of ten pieces of PVC pipe were needed. The pipes did not need to be a specific length because they will be put in the ground. Thus my stakes were about 70cm long. At one end of each piece of PVC a hole was drilled through both sides. This helped in flagging the stakes. A piece of bamboo 1.0 meter long and one 1.3 meter long was needed. The 1.3 meter piece was used to simplify measuring the diameter at breast height (DBH). The piece 1.0 meter long was used to help put up the string and to measure the width of the transect.

To begin setting up the transect a random point on the top of Mount Joy was chosen. At the top I took seven steps forward and established the origin of my transect. From that point the plot was set in a prefect northerly direction. Having the plot set in the perfect northerly direction simplified the placement of the following stakes. Using a mallet helped put the stakes in the ground. It is not impossible to put the stakes in the ground without the mallet, but it does make the job easier. Once the first stake was put in place, the meter tape measure was used to measure a distance of 10 meters in a perfect northerly direction. A compass was needed to make sure the transect followed the correct direction. It was helpful to have someone help at this point. It would have been almost impossible to do it alone. Six stakes were put in a row using this method.

Once the transect was set up the four pieces of PVC that were left over were used to mark off the one meter area on each side of the center line. The modified Gentry plot was composed of a center line that incorporates all vegetation within one meter on each side. To simplify the determination of what vegetation was inside the modified Gentry plot, one piece of PVC was put one meter to the west and one meter to the east of the zero meter stake and the ten meter stake. A string ran from west side stake to west side stake. The same was done for the stakes on the east side. Care was used in running the strings. The string needed to be exactly one meter from the centerline.

Once an area was marked the DBH was measured and recorded. Tree diameters were measured by determining the diameter at 1.3 meters above the ground. This is called diameter at breast height (DBH). Placing the 1.3 meter piece of bamboo against the tree aided in determining where to measure. Since there was no DBH tape in the lab, A meter tape measure was used and the data were later converted into diameter. This was done using the formula =X/3.14 in an Excel spreadsheet. All trees with a DBH greater than 2.5cm or a circumference greater than 7.9cm are considered trees and are measured. (www.teaminitiative.org) Once a tree was measured, it was tagged with the biodegradable tagging tape and marked with a letter or number. The biodegradable tape was used because it was easy to write on.

For all of the trees that were tagged, the meter tape measure was used to find their distance from the origin. This data was used to plot all the trees on a graph.

Since I had no background knowledge on naming tree species I sought assisance. Nancy Osler was able to go up Mount Joy with me. We were not able to identify many trees in the field, but we did collect samples of the leaves and made notes on characteristics of the trees. At the station Nancy and I used the Springfield herbarium database, *Dominica Nature Island of the Caribbean, Flora of Dominica, Part 2: Dicotyledoneae*, and "Key to the Families of Trees and shrubs at Springfield Centre for Environmental Protection, Research and Education (formerly Springfield and Mt. Joy Estates) Dominica, W.I.". With the help of these four resources we were able to identify all of the trees to families and most to the genus and species. For the rest of the ground vegetation samples were taken and later identified by Nancy.

At each stake five canopy cover readings were taken. After they were all taken the average was found using the formula =Average(X,X,X,X,X) in an Excel spreadsheet. To find the basal area for each tree, I used the formula =3.14(DBH/2)^2 in the excel spreadsheet.

Results

Found on the Excel spreadsheet.

Discussion

"The structure of a plant community refers to the vertical arrangement and spatial organization of the plants." (340, *Forest Ecology*) Since no one species has a numerical percentage of eighty percent or greater, the stand where the plot was taken from is classified as an uneven-aged stand. Do to the uneven-aged nature, the stand will automatically be less dense than an even-aged stand. This is caused by the competition that arises between the dominant trees and the saplings that are found in the suppressed and intermediate site classes (Appendix E). From the samples taken of the trees found in the dominant and codominant class, leaves are smaller in comparison to those of the same species found in the suppressed and intermediate classes. This is due to the trees ability to change its morphology as it matures. The higher up the tree is in the canopy, the less the tree needs to fight to capture sunlight. "Trees that are exposed to the physical stresses of wind, to high light intensities in the upper crown, and to rapid transpiration stress have strong woody stems and branches, large spreading or deep root systems, and bear foliage with xeromorphic characteristics." (342, *Forest Ecology*)

When comparing the percentage of dominant trees to the percentage of suppressed trees, there are almost seven times the amount of suppressed trees as the amount of dominant trees (figure 3). This is due to the large dominant tree's ability and necessity to accumulate nutrients and water close to its roots. Having a dominant tree in an area stunts the growth of other trees in the vicinity.

Two of the tree families found in the dominant site class are Boraginaceae and Lauraceae. These trees were classified in the dominant class because they formed the upper part of the canopy and exhibit dominance over the other trees. These trees are often called the wolf trees because their seeds are the ones that regenerate most of the forest floor. The data found in tables 2 and 4 shows the comparison. Looking at table 4 Myrtaceae and Malpighiaceae should be found in the dominant class as well. This could be a sign of increasing biodiversity. Another example of increasing biodiversity is found in the list of herbaceous ground cover found in the transect. The Fabaceae *Inga laurina* is a tree species that is only found in the sapling stage. Due to the fact that there are no mature inga trees in the area lends itself to the idea of increasing biodiversity. Another instance is the documentation of the Rubiaceae. The Rubiaceae was found only once in the DBH readings. This means that there was only one tree with a diameter at 1.3 meters of 2.5cm or greater. The Rubiaceae that was found had a DBH of 3.40cm. A DBH of 3.40cm is classified in the suppressed class. This indicates that these species are either encroaching in the area of Mount Joy but have not been around long enough to grow into the dominant class or are on a decline. With the data I have I am not able to make a definite conclusion

When looking at the basal area of all the trees, the two leading families are Boraginaceae and Lauraceae. (Appendix B table 5) Comparing this table to the "Trees per Family" table (Appendix B table 4) reveals the large size of the boraginaceae and the Lauraceae compared to the relatively small size Dichapetalaceae and Rubiaceae. Trees with a larger basal are tend to be in stands that are less densely crowded. The less dense stands give way to an open under story which benefits wildlife and biodiversity.

One problem we ran into was the absence of flowers and fruits. During the time of late May and early June, few trees on Mount Joy are flowering or producing fruit. This left us with just the leaves and trunk of the tree for identification purposes.

Conclusion

After viewing all the data, there is evidence of a possible increase in biodiversity. The large number of Rubiaceae and Inga are representative of this. The area on Mount Joy where the transect is located is only about 30 years old (Nancy). The abundance of species and the degree of growth shows the rapid growth rate found in the tropics. "Diversity for most groups of organisms generally decreases from lowland tropical to high-latitude or high-altitude ecosystems. (377, *Forest Ecology*) This ability for rapid regeneration and growth allows for a quick turn around time for new species encroaching in the area. On the other hand, the data will also reveal the decline of certain species. More monitoring of the area will produce more complete data. The data we do have points to a maturing of the forest on top of Mount Joy.

Sources

Nancy Osler

Stewart Peck

www.teaminitiative.org

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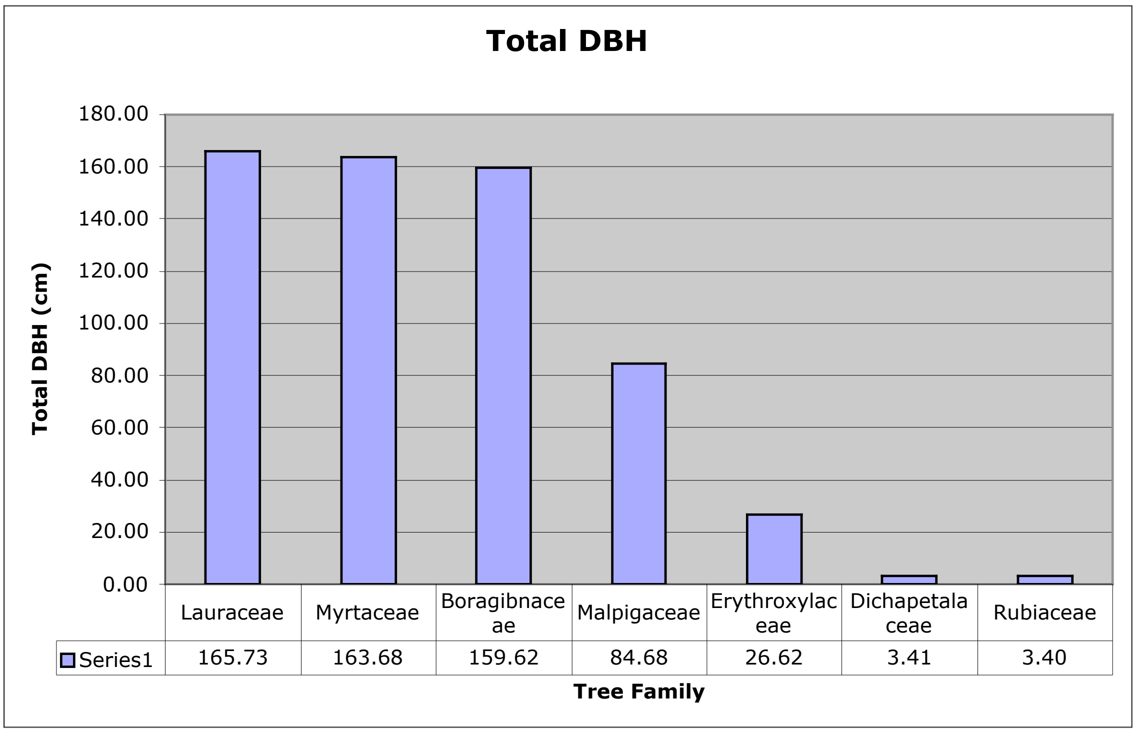
Appendix A

Family	Genus	Species	Common name
Myrtaceae	*Eugenia*		
Lauraceae			
Lauraceae			
Myrtaceae			
Dichapetalaceae			
Lauraceae			
Myrtaceae			
Boraginaceae	*Cordia*	*suculata DC.*	"Bois Bre"
Lauraceae			
Lauraceae			
Lauraceae			
Malpighiaceae	*Bunchosia*	*polystachia (Andrews) A.P. Candolle*	Bois masse'
Boraginaceae	*Cordia*	*suculata DC.*	"Bois Bre"
Malpighiaceae	*Bunchosia*	*polystachia (Andrews) A.P. Candolle*	Bois masse'
Malpighiaceae	*Bunchosia*	*polystachia (Andrews) A.P. Candolle*	Bois masse'
Malpighiaceae	*Bunchosia*	*polystachia (Andrews) A.P. Candolle*	Bois masse'
Malpighiaceae	*Bunchosia*	*polystachia (Andrews) A.P. Candolle*	Bois masse'
Myrtaceae			
Boraginaceae	*Cordia*	*suculata DC.*	"Bois Bre"
Boraginaceae	*Cordia*	*suculata DC.*	"Bois Bre"
Lauraceae			
Boraginaceae	*Cordia*	*suculata DC.*	"Bois Bre"
Boraginaceae	*Cordia*	*suculata DC.*	"Bois Bre"
Erythroxylaceae	*Erythroxylum*	*squamatum Sw.*	"Ti feuille"
Myrtaceae	*Myrcia*	*Splendens (Sw.) DC.*	
Myrtaceae	*Myrcia*	*Splendens (Sw.) DC.*	
Lauraceae			
Erythroxylaceae	*Erythroxolem*	*squometum*	
Myrtaceae	*Myrcia*	*Splendens (Sw.) DC.*	
Malpighiaceae	*Bunchosia*	*polystachia (Andrews) A.P. Candolle*	Bois masse'
Myrtaceae	*Eugenia*		
Lauraceae			
Lauraceae			
Myrtaceae	*Eugenia*		
Boraginaceae	*Cordia*	*suculata DC.*	Bois Bre
Erythroxylaceae			
Rubiacea			
Myrtaceae			
Myrtaceae	*Syzygium*	*jambos (L.)*	
Myrtaceae	*Syzygium*	*jambos (L.)*	
Myrtaceae			Zedcrab
Myrtaceae	*Syzygium*	*jambos (L.)*	
Malpighiaceae			
Malpighiaceae			
Malpighiaceae			

Tree	DBH	Position	Quadrant	Basal Area
A	2.90	39.47	40A	6.51
C	6.40	40.00	40B	31.76
D	5.80	37.90	38B	26.04
E	4.81	37.69	38B	17.92
G	3.31	37.35	38B	8.50
H	3.57	33.00	33B	9.86
I	17.32	37.80	38B	232.62
J	5.35	35.65	36A	22.19
K	4.75	35.25	36A	17.45
L	7.42	32.60	33B	42.67
M	13.18	32.10	33A	134.72
N	11.78	31.60	32A	107.61
O	20.73	27.10	28A	333.12
P	20.19	25.70	26A	315.95
Q	19.08	25.20	26B	282.03
R	6.62	24.50	25A	34.01
S	9.81	24.50	25B	74.57
T	10.22	20.20	21A	80.99
U	3.69	20.50	21A	10.58
V	5.00	20.00	20A	19.38
W	24.71	20.00	20B	473.33
X	54.90	23.20	24B	2,336.24
Y	49.94	35.65	36A	1,932.57
Z	9.00	19.50	20B	62.78
1	15.80	18.00	18A	193.47
2	17.10	14.30	15A	226.62
3	21.10	14.51	15B	345.04
4	11.00	13.50	14B	93.78
5	17.20	12.50	13B	229.28
6	7.40	9.30	10B	42.44
7	7.10	9.43	10B	39.07
8	64.10	9.25	10A	3,184.33
9	14.70	8.95	9A	167.47
10	10.20	3.40	4A	80.63
11	20.00	14.75	15B	310.00
12	6.62	40.5	41B	34.01
13	3.40	43.2	44B	8.97
14	22.45	44.2	45A	390.57
15	12.64	44.3	45B	123.89
16	3.44	45.15	46A	9.17
17	9.62	46.07	47A	71.78
18	12.87	45.53	46A	128.36
19	3.18	48.5	49A	7.86
20	3.33	49.2	50A	8.60
22	3.28	47.91	48A	8.34

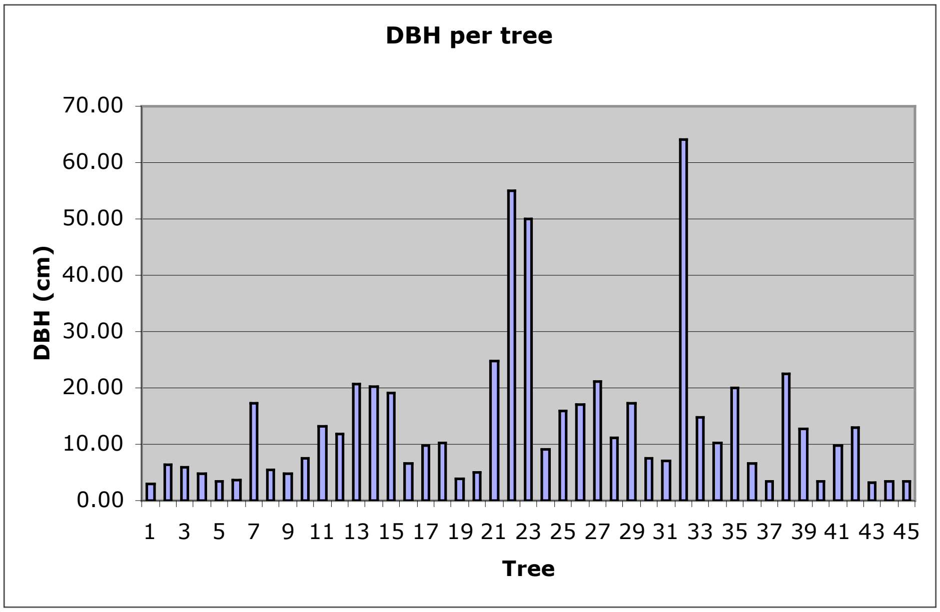
Appendix B

Total DBH key	
Lauraceae	165.73
Myrtaceae	163.68
Boragibnaceae	159.62
Malpigaceae	84.68
Erythroxylaceae	26.62
Dichapetalaceae	3.41
Rubiaceae	3.40



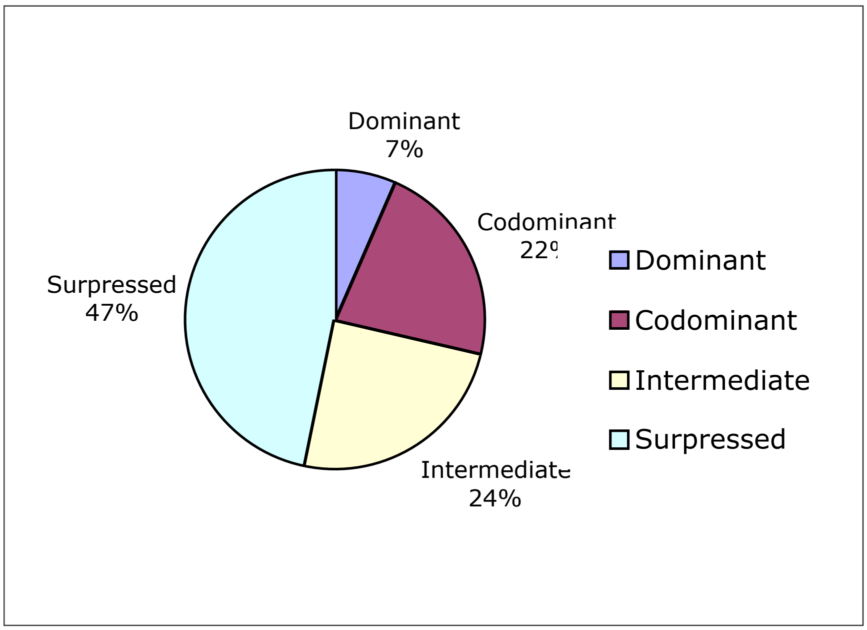
DBH per tree key

To corralate the numbers to the actual size, look at the above data.



Tree Classification	
Dominant	3
Codominant	10
Intermediate	11
Surpressed	21

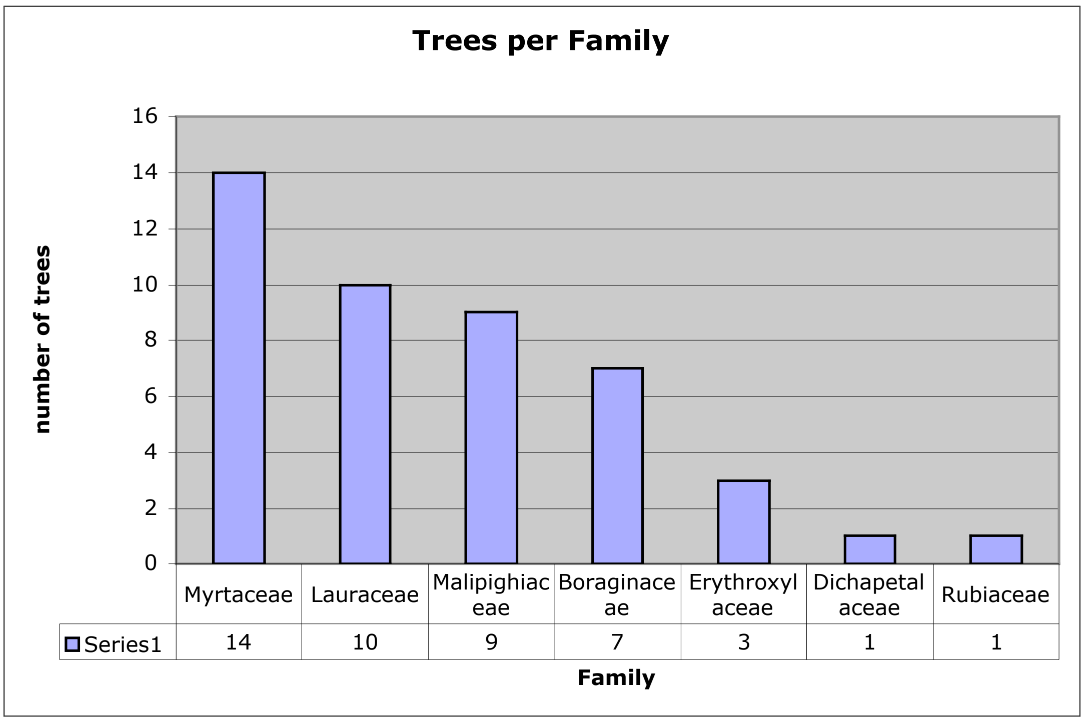
Table 3:



Trees per family

Myrtaceae	14
Lauraceae	10
Malipighiaceae	9
Boraginaceae	7
Erythroxylaceae	3
Dichapetalaceae	1
Rubiaceae	1

table 4:



GPS readings (from Stewart Peck)
N15∞ 21.121'
W61∞ 21.782'
550m
Ridge at top of road above Mt. Joy

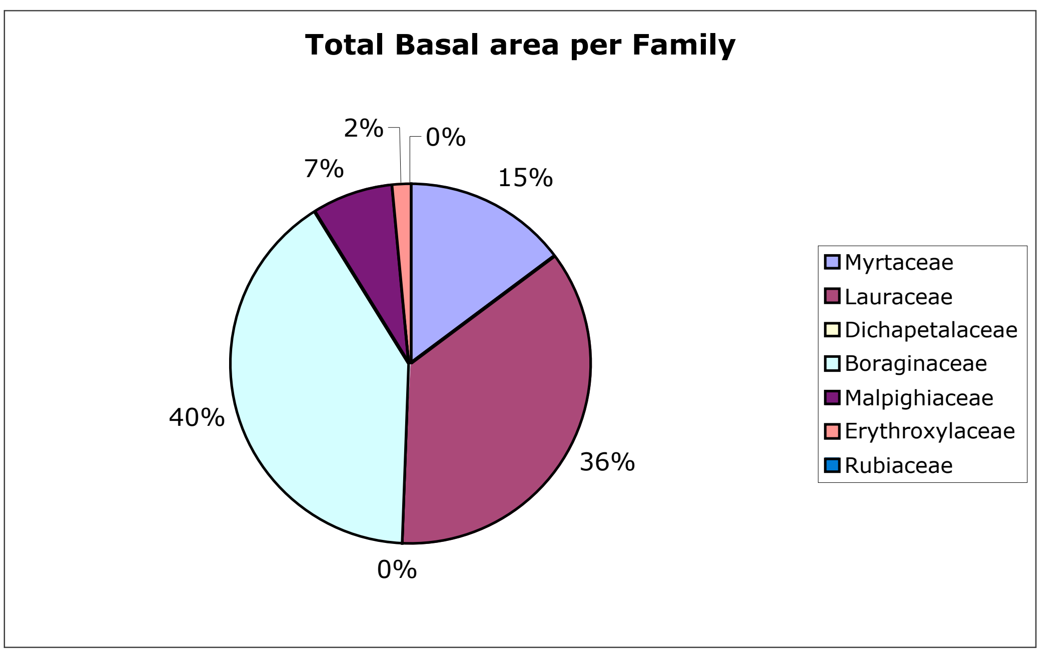
Canopy Cover

Position	**Percent**					**Average**
0m	74.88	82.16	71.76	72.8	82.16	76.96
10m	90.48	88.4	95.68	93.6	96.72	93.25
20m	85.28	95.68	93.6	87.36	99.84	93.14
30m	80.08	91.52	82.16	69.68	66.56	77.77
40m	81.12	73.84	85.28	78	69.68	77.19
50m	71.76	80.08	81.12	86.32	76.96	80.08

Total Basal Area:

Myrtaceae		1,821.45	15%
Lauraceae		4,432.67	36%
Dichapetalaceae		8.50	0%
Boraginaceae		4,964.06	40%
Malpighiaceae		881.40	7%
Erythroxylaceae		190.56	2%
Rubiaceae		8.97	0%
	total:	12,307.61	

table 5:



Appendix C

	shrubs found in the area	
Meter 10		
	Piperaceae *Peperomia*	herbaceous shrub
	Convolvulaceae	vine
	unknown A	tree seedling
	unknown B	tree seedling
	unknown C	tree seedling
	Myrtaceae *Eugenia*	seedling
	"ribbion grass"	grass
Meter 20		
	unknown D	vine
	unknown E	tree seedling
	Fabaceae *Inga laurina (Sw.) Willd.* "Pois Doux"	tree seedling
	unknown F	shrub
	Polypodeace	fern
	"ribbion grass"	grass
	unknown G	tree seedling
	unknown H	fern
	unknown I	fern
	unknown J	shrub
Meter 30		
	Fabaceae Inga laurina (Sw.) Willd. "Pois Doux"	tree seedling
	unknown C	tree seedling
	Heliconiaceae *Heliconia*	herbaceous vegetation
	pasa florace	vine
	aerace	hervaceous vegetation
	ribbion grass	grass
	unknown K	ground cover
Meter 40		
	unknown B	tree seedling
	unknown E	tree seedling
	Fabaceae Inga laurina (Sw.) Willd. "Pois Doux"	tree seeding
	unknown F	vine
Meter 50		
	Fabaceae Inga laurina (Sw.) Willd. "Pois Doux"	tree seedling
	ribbion grass	grass
	unknown K	ground cover
	unknown H	fern
	Eugenia Mertaceae	

Appendix D

Appendix D

Key to the Families of Trees and Shrubs at
Springfield Centre for Environmental Protection, Research and Education
(formerly Springfield and Mt. Joy Estates)
Dominica, W.I.

by

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The following key is based on vegetative rather than floral characteristics and is designed to identify with a 10X hand lens the correct families of individual dicotyledonous trees and shrubs found on the Springfield property of the Archbold Tropical Research and Education Consortium in Dominica. Springfield Centre is located at 380m elevation in the Antrim Valley north of Roseau in the lower rain forest zone. Secondary forest characterizes most of the property which between 1936 and 1979 was cultivated and comprised of Springfield and Mt. Joy estates.

Species belonging to thirty-five families of Dicotyledoneae including three sub-families have been identified. Names of genera appear in parentheses when the genera noted are the only ones having the given character(s) and are the only genera of the family found at Springfield. New families, if found, will be added as necessary in the future and the key updated.

Vegetative Characteristic	Family
1. Compound leaves	2
1. Simple leaves	9
2. Opposite leaves	Bignoniaceae
2. Alternate leaves	3
3. Leaves with stipules	4
3. Leaves without stipules	6
4. Leaves imparipinnate	Papilionaceae (Fábaceae)
4. Leaves paripinnate or bipinnate	5
5. Leaves paripinnate or bipinnate with nectaries	Mimosaceae (Fabaceae)
5. Leaves paripinnate or bipinnate without nectaries	Caesalpiniaceae (Fabaceae)
6. Leaves with pellucid dots	Rutaceae
6. Leaves without pellucid dots	7

7.	Leaves with mango or turpentine odor and without bitter taste	Burseraceae
7.	Leaves without mango or turpentine odor	8
8.	Leaves with bitter taste, clear sap	Simaroubaceae
8.	Leaves with milky sap	Caricaceae
9.	Leaves opposite or whorled	10
9.	Leaves alternate	16
10.	Leaves with stipules	11
10.	Leaves without stipules	12
11.	Stipules interpetiolar	Rubiaceae
11.	Stipules intrapetiolar or free	Malpighiaceae
12.	Leaves with scalariform veins	Melastomataceae
12.	Leaves without scalariform veins	13
13.	Leaf veins prominent	14
13.	Leaf veins obscure, finger-like with creamy latex	Clusiaceae
14.	Leaves with pinnate veins and with fused marginal vein, lacking latex	Myrtaceae
14.	Leaves with pinnate, but open veins	15
15.	Branchlets quadrangular	Verbenaceae
15.	Branchlets with white latex	Apocynaceae
16.	Leaves with stipules	17
16.	Leaves without stipules	27
17.	Bark stringy when peeled from twig	18
17.	Bark not stringy when peeled from twig	21
18.	Stems mucilaginous, leaves 3-5 veined	19
18.	Stems not mucilaginous, leaves 3-5 veined	Elaeocarpaceae
19.	Stipules revolute	Bombacaceae
19.	Stipules not revolute	20
20.	Petals yellow (Guazuma) or united sepals a cream color (Sterculia)	Sterculiaceae
20.	Petals orange-red to dark crimson (Hibiscus)	Malvaceae
21.	Stems with white latex	22
21.	Stems without white latex	23

22.	Prominent terminal stipule scar, false marginal leaf vein, transverse lenticels on the stem	Moraceae
22.	Extrafloral nectaries present, leaves spirally arranged	Euphorbiaceae
23.	Stems with brownish exudation, prominent terminal stipule scar, leaves palmately lobed, white beneath	Cecropiaceae
23.	Stems without exudation	24
24.	Stipules intrapetiolar	25
24.	Stipules not intrapetiolar	26
25.	Stipules hairy, bark brittle	Chrysobalanaceae
25.	Stipules not hairy, bark not brittle, central leaf area different texture	Erythroxylaceae
26.	Leaf nodes swollen, inflorescence a vertical spike	Piperaceae
26.	Trunk fluted, blaze turns orange	Dichapetalaceae
27.	Bark stringy	28
27.	Bark not stringy	30
28.	Leaves aromatic, distichous	Annonaceae
28.	Leaves not aromatic or distichous	29
29.	Sympodial branching, verticillate at ends (Cordia)	Boraginaceae
29.	Nonsympodially branched shrub or tree to 15m, bitter inner bark	Thymalaeaceae
30.	Leaves aromatic (or with bad odor)	31
30.	Leaves nonaromatic	34
31.	Leaves with mango odor, resinous exudate is dark upon drying	Anacardiaceae
31.	Leaves with other than mango odor	32
32.	Leaves with bad odor, often having stellate hairs	Solanaceae
32.	Leaves with pleasant smell	33
33.	Leaves with pellucid dots, citrus smell	Rutaceae
33.	Leaves without pellucid dots, spirally arranged, sulcate stem	Lauraceae
34.	Leaves with white latex	35
34.	Leaves with other than white latex or none	36
35.	Turbinate buds, fruit in pairs, finger-like glands	Apocynaceae
35.	Buds not turbinate, bottle-shaped petiole	Sapotaceae

36. Leaves with reddish exudation, falsely whorled long branches, distichous — Myristicaceae

36. Leaves without latex, obovate, crowded near branch ends, sympodial branching — Combretaceae

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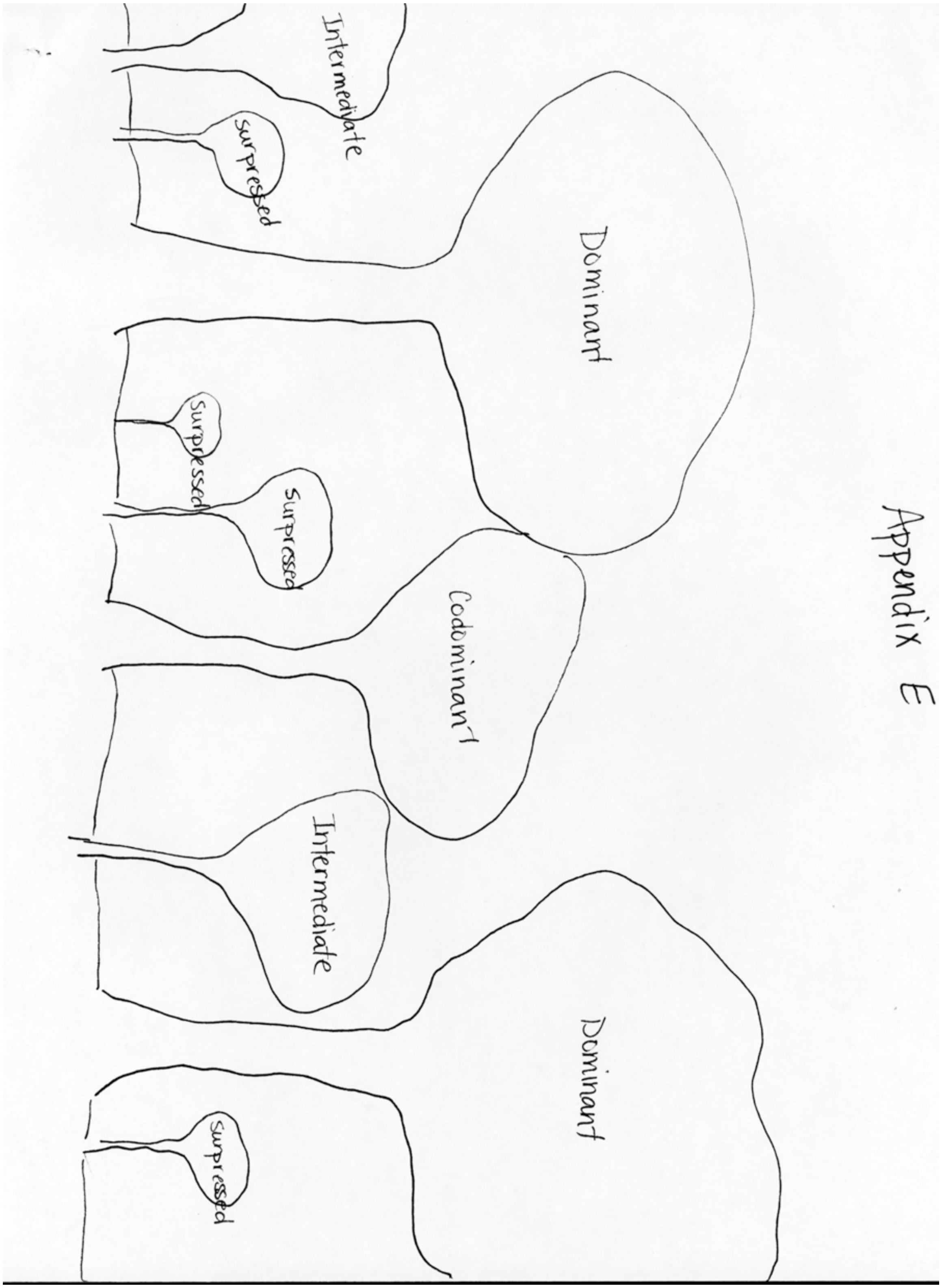
I am grateful to Dr. Humberto Jiménez of the Tropical Science Center, San Jose, Costa Rica for helpful instruction in tropical dendrology and to Dr. Steven Hill of the Illinois Natural History Survey whose Springfield herbarium collection of the flora of Dominica was invaluable in the preparation of this key.

May 1, 2001

Appendix E


Appendix E
Intermediate
surpressed
Dominant
Surpressed
Surpressed
Codominant
Intermediate
Dominant
Surpressed