MONITORING BUTTERFLY POPULATIONS IN THE ROBERT J. HUCKSHORN ARBORETUM

by

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A Thesis Submitted to the Faculty of The Wilkes Honors College in Partial Fulfillment of the Requirements of the Degree of Bachelors of Arts in Liberal Arts and Science With a Concentration in Biology

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This thesis was prepared under direction of the candidate's thesis advisor, Dr. Jon Moore, as well as Professor Alana Edwards, and has been approved by the members of her/his supervisory committee. It was submitted to the faculty of the Honors College and was accepted in partial fulfillment of the requirements for the degree of Bachelor of Arts in Liberal Arts and Sciences.

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ABSTRACT

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The Robert J. Huckshorn Arboretum is an established man-made habitat on the FAU Jupiter campus grounds, which features native Florida plants that showcase four of Florida's major habitats (Mixed Hardwood Swamp, Pine Flatwoods, Oak/Cabbage Palm Hammock, and Tropical Hardwood Hammock). The arboretum also contains a butterfly garden, which includes specific Florida native plants that attract over 20 different species of *Lepidoptera.* This study uses a variation of the transect count method developed by E. Pollard (1977), to obtain data on *Lepidoptera* populations within the arboretum and to determine which habitats are preferred most. Sidewalks that pass through each habitat were used as the transects, and *Lepidoptera* species were counted and recorded at least twice a week. A total of 17 individual *Lepidoptera* taxa were identified, with 382 total individuals counted in the fall/winter and 275 individuals in the spring. The Butterfly Garden was by far the most densely populated habitat, with a total of 399 individuals identified there throughout the study.

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INTRODUCTION

The Robert J. Huckshorn Arboretum (26°53’19.7” N 80°07’04.1” W) was originally proposed by Dr. Huckshorn and later named in honor of his service to the University. Construction of the arboretum began in 2005, and native plant species were gradually added to the arboretum and grouped to showcase some of Florida’s major habitats (Figure 1). Foot paths, benches, and a gazebo were added gradually to make it appealing to public visitors, and to make it more accessible for educational and recreational purposes.

In order to obtain accurate representations of *Lepidoptera* populations within this arboretum, an intensive and specific method of recording these populations was necessary to ensure that results were consistent and counts on different days could be easily compared. Transect count and mark-recapture methods are some of the most common methods used to monitor butterfly populations and are also some of the most rigorous (Brown and Boyce 1998; Haddad et al. 2008, cited in Henry et al. 2015). Since mark-recapture involves making physical contact with captured butterflies, it often poses a fatal threat to *Lepidoptera* that are more fragile, according to Murphy (1987, cited in Henry et al., 2015). To avoid this problem, transect-count methods were used within the arboretum so that population data could be acquired without any adverse effects on the butterfly populations (Murphy 1987). On these transects, distance-sampling techniques were utilized to establish a ‘corridor’ in which species can be identified, even if only briefly viewed.

Figure 1. The Robert J. Huckshorn Arboretum features a variety of native trees and shrubs from several different ecosystems, including Tropical Hardwood Hammock, Cabbage Palm/Oak Hammock, Pine Flatwoods & Mixed Hardwood Swamp. The Arboretum also features a Butterfly Garden and the FP&L Right Tree, Right Place Demonstration Project.

The main difference between this study and traditional transect-count studies (Pollard 1977) also known as the Pollard Walk, is that the transects are pre-determined, since they follow the constructed footpaths within the arboretum, which were originally built to accommodate visitors. Normally transects are randomly selected across a certain target habitat (Buckland *et al,* 2001). The traditional distance-sampling margin used in the Pollard Walk is five meters on each side (Pollard *et al* 1975; Pollard 1977), but due to limited space in this study, the margins were reduced to one meter on either side of the shorter and more linear transects (Pine Flatwoods, Mixed Hardwood Swamp, Tropical Hardwood Hammock), and two meters on the inside margin or the more circular transects (Butterfly Garden and Oak/Cabbage Palm Hammock). While most of the areas in the arboretum contain dense vegetation, the presence of the footpaths provides convenient access passing either directly through each habitat, or around it.

METHODS

Butterfly Data Collection

The methods used in this study to collect population data on *Lepidoptera* were very similar to traditional transect-count methods. Each species that was observed was tallied on a sheet and best efforts were made not to double count any individuals. For the Fall/Winter subset, butterfly data were recorded on twenty-four separate days from 9-21-2015 to 12-4-2015. For the Spring subset, butterfly data were recorded on twenty-one separate days from 2-23-2016 to 4-5-2016. Maintaining a slow but steady walking pace ensured that the transect was evenly surveyed, and repeated counts of the same individual were avoided as much as possible. Equal distance sampling margins were utilized for

each transect so that populations observed within different specific habitats could be compared with little variation in data collection. Three of the habitats (Mixed Hardwood Swamp, Pine Flatwoods, and Tropical Hardwood Hammock) have footpaths that bisect the habitat. In these habitats, a one-meter margin was established on each side of the path. Any butterfly sighted that was not within one meter of either side of these transects was not counted. For the remaining habitats (Oak/Cabbage Palm Hammock and the Butterfly Garden), the footpaths encircled the habitats. For these transects, a two-meter margin was established on the inside rim on the transect to account for the fact the habitat is technically only present on one 'side' of the transect. The transect lengths for each habitat are listed in **Table 1**. Counts were performed during hours of peak sunlight (roughly 1000 hours to 1600 hours EST), to ensure that counts were taken at times when butterfly activity was at its peak. Temperatures and approximations of percent cloud coverage were recorded each day that data was collected.

Table 1. The total length of transects for each habitat are provided from the beginning to the end of each transect.

Habitat	Length (m)
Mixed Hardwood Swamp	33
Pine Flatwoods	33
Oak/Cabbage Palm Hammock	92.5
Tropical Hardwood Hammock	25.5
Butterfly Garden	93.5

Plant Surveys

Each transect was surveyed to obtain a representation of the flora present within the distance-sampling margins established for butterfly counts. The same distance margins were used (1 meter on either side for tropical hardwood hammock, pine flatwoods, and mixed hardwood swamp, and 2 meter inside margins for oak/cabbage palm hammock and the butterfly garden) and each individual plant was tallied. For plants that make individual counts difficult, for instance widespread grasses, vines and large clusters of shrubs, square meter counts were measured and recorded. Plants that were recorded with square meter counts include *Passiflora incarnata, Lonicera sempervirens, Aristolochia durior, Plumbago auriculata, Mimosa strigillosa* and *Plumbago scandens.*

RESULTS

Habitat Descriptions

MIXED HARDWOOD SWAMP

The mixed hardwood swamp section of the arboretum is comprised predominantly of moderate to large sized trees, large woody shrubs, with some low lying shrubs. *Myrsine guianensis, Celtis laevigata, Acer barbatum and Annona glabra* are the most abundant large trees in this habitat (Figure 2). I observed these trees often provide roosting locations for *Lepidoptera*, especially *Eumaeus atala,* and *Urbanus proteus.* The predominant large/woody shrubs include *Chrysobalanus icaco, Hamelia patens,* and *Viburnum obovatum.* These plants produce flowers that are appealing to several species of *Lepidoptera* (Hammer 2015 and Traas 1999). The dominant smaller shrubs present in

this habitat include *Cordia globosa* and *Heliotropium angiospermum.* Both of these shrubs have flowers that I saw several butterfly species nectar on.

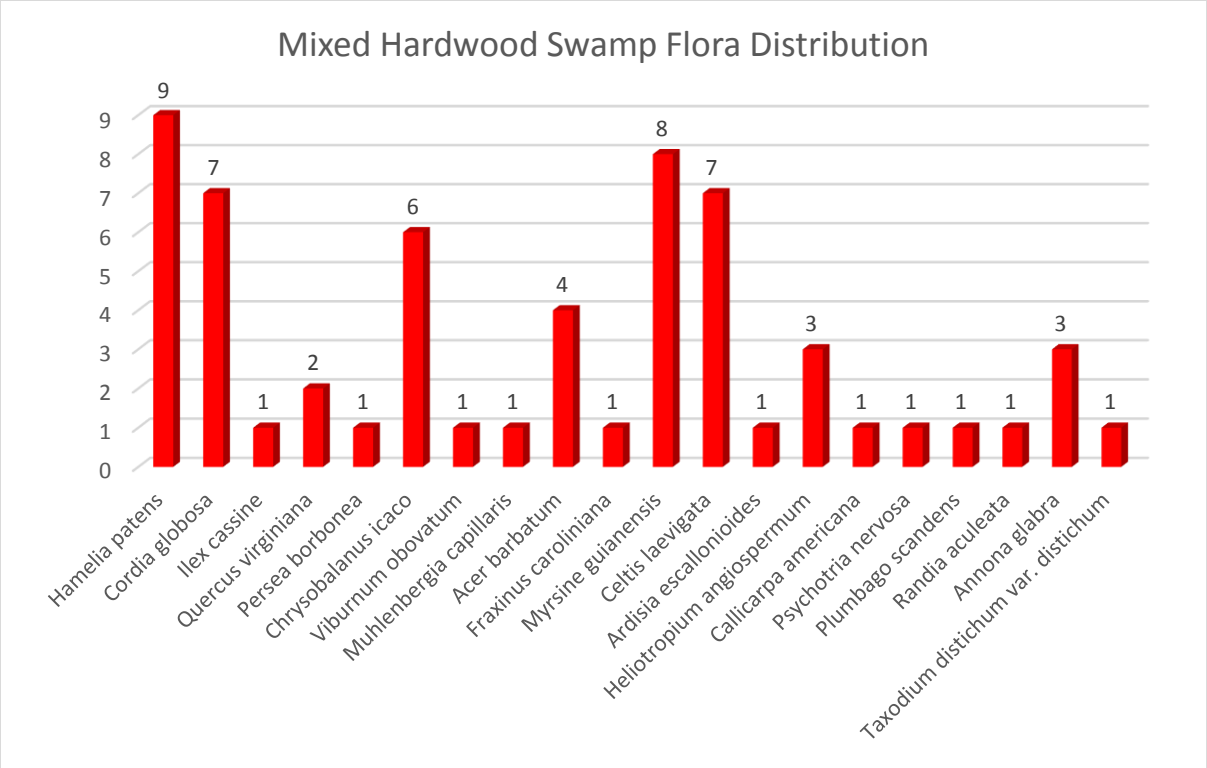

Figure 2. This bar graph shows the distribution of plants in the Mixed Hardwood Swamp habitat.

PINE FLATWOODS

The pine flatwoods section is dominated by low-lying grasses, small shrubs, and pine trees. The dominant grasses in the pine flatwoods include *Muhlenbergia capillaris, M. strigillosa* and *Tripsacum dactyloides* (Figure 3). *T. dactyloides* serves as the larval food plant for two species of *Hesperiidae, Cymaenes tripunctus* and *Lerema accius* (Minno and Minno 1999), with only the first of these two found in the study. *M. strigillosa* was measured in approximate square meter coverage, since counting of individuals was not

possible. The dominant shrubs in this region are predominantly *Serenoa repens and Rivina humilis*, and some *Callicarpa americana.* These plants are known mainly as food sources for birds and ground dwelling herbivores/omnivores (Osorio 2001). This area also has a high concentration of *Salvia coccinea*, which has red/pink flowers that are very attractive to *Lepidoptera* (Hammer 2015). The only large trees present in this habitat are several young *P. elliotti v. densa* and one *Sabal Palmetto.*

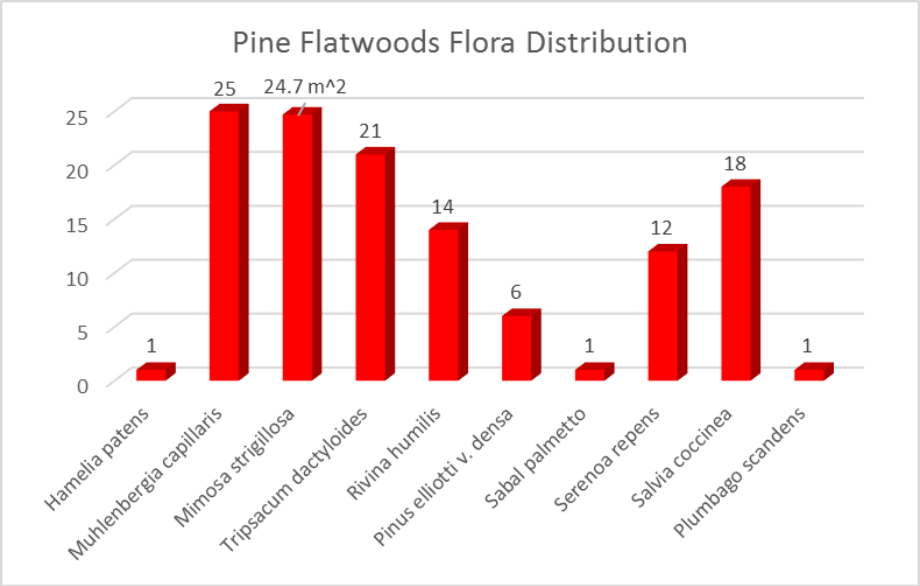

Figure 3. This bar graph shows the distribution of plants in the Pine Flatwoods habitat. Species measured in square meters are denoted with "m^2" next to the value.

OAK/CABBAGE PALM HAMMOCK

The oak/cabbage palm hammock is an open area dominated by large trees and a few small/moderate sized shrubs. The dominant trees in this area are *Quercus virginiana, Quercus laurifolia, and Sabal palmetto* (Figure 4). The area contains some small/moderate sized flowering plants/shrubs. *C. globosa, C. americana, P. scandens,* and *H. patens* are found here, in relatively low numbers. This area had the lowest

concentration of butterflies, which is to be expected since it is comprised mainly of large trees and contains few flowering plants.

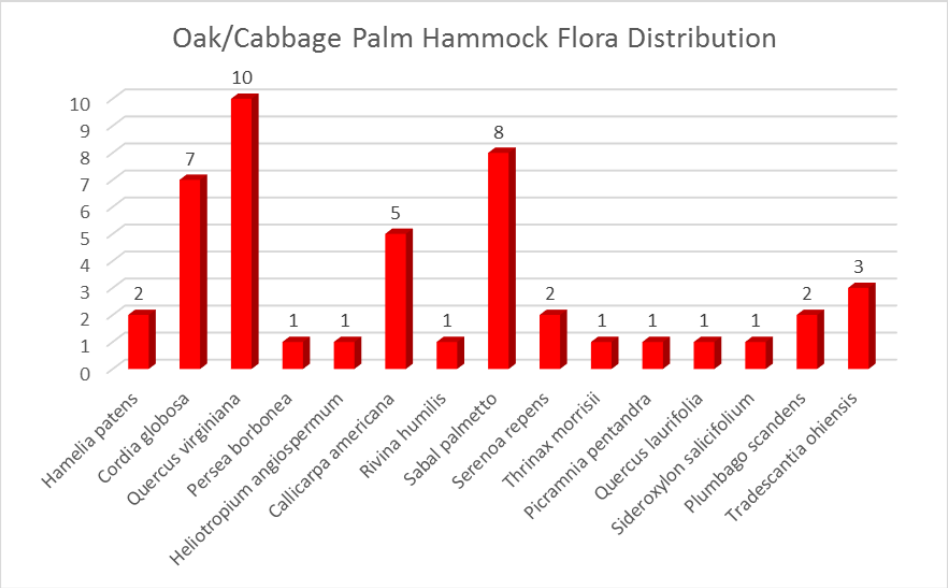

Figure 4. This bar graph shows the distribution of plants in the Oak/Cabbage Palm Hammock habitat.

TROPICAL HARDWOOD HAMMOCK

The tropical hardwood hammock has a mix of large trees and moderate sized shrubs. The dominant trees in this section include *Bursera simaruba, Guapira discolor, Capparis cynophallophora,* and one large *Cocoloba uvifera* (Figure 5). Dominant shrubs include *H. patens, C. globosa, Psychotria nervosa, Picramnia pentandra, V. obovatum and Ardisia escallonioides.*

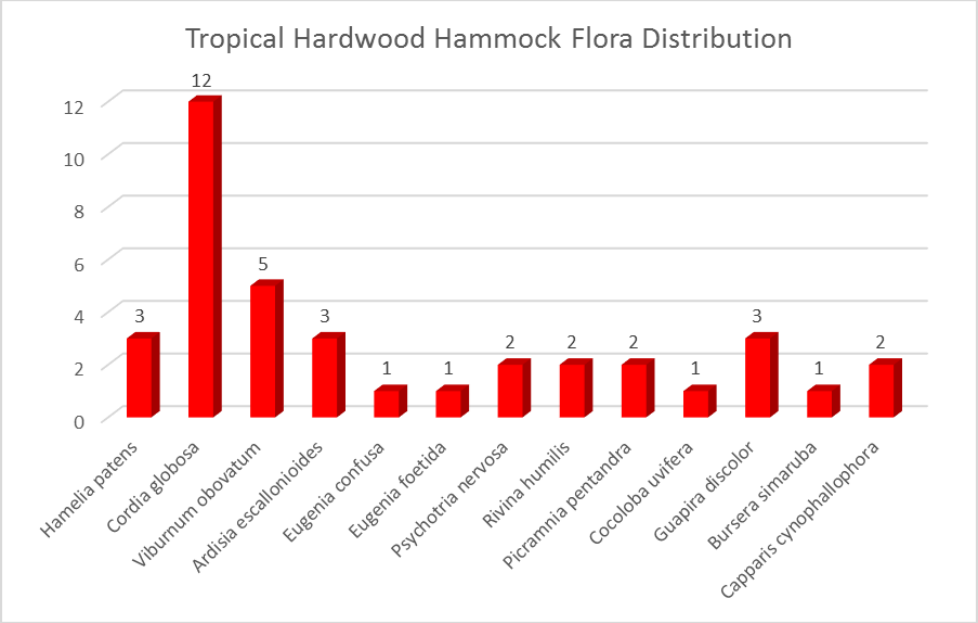

Figure 5. This bar graph shows the distribution of plants in the Tropical Hardwood Hammock habitat.

BUTTERFLY GARDEN

The butterfly garden is dominated by small-moderate sized flowering shrubs, with some large trees and several species of flowering vines. The predominant shrubs include *H. patens, C. globosa, H. angiospermum, P. nervosa, Zamia pumila, R. humilis, S. coccinea, Senna ligustrina, P. auriculata, and P. scandens* (Figure 6). Both *Plumbago* species were measured in approximate square meter coverage, since these plants were so dense that a definite number of individuals could not be accurately obtained. *Z. pumila* serves as the larval food plant for *Eumaeus atala,* which explains the abundance of *E. atala* found in this region. Trees in this area include *Z. fagara, Bourerria succulenta, Piscidia piscipula, Lysiloma latisiliqua, and Q. virginiana.* Numerous *Zanthoxylum fagara* plants are scattered throughout the butterfly garden, serving as a larval food plant

for *Papilio cresphontes*. The few *S. ligustrina* individuals present may have served as the larval host plant for the few *Phoebis philea* sighted in the study. While *P. philea* is known to lay their eggs on *S. ligustrina* (Minno and Minno 1999), this was not verified with sightings of larvae on the plants or ovipositing females. The gazebo in the center of the garden contains a high-density of flowering vines, including *P. incarnata, L. sempervirens,* and *A. durior*. These vines had to be measured by approximate square meter coverage (Figure 6). *P. incarnata* is the larval food plant for *Heliconius charithonia, Agraulis vanillae* and *Dryus Julia* (Minno and Minno 1999).

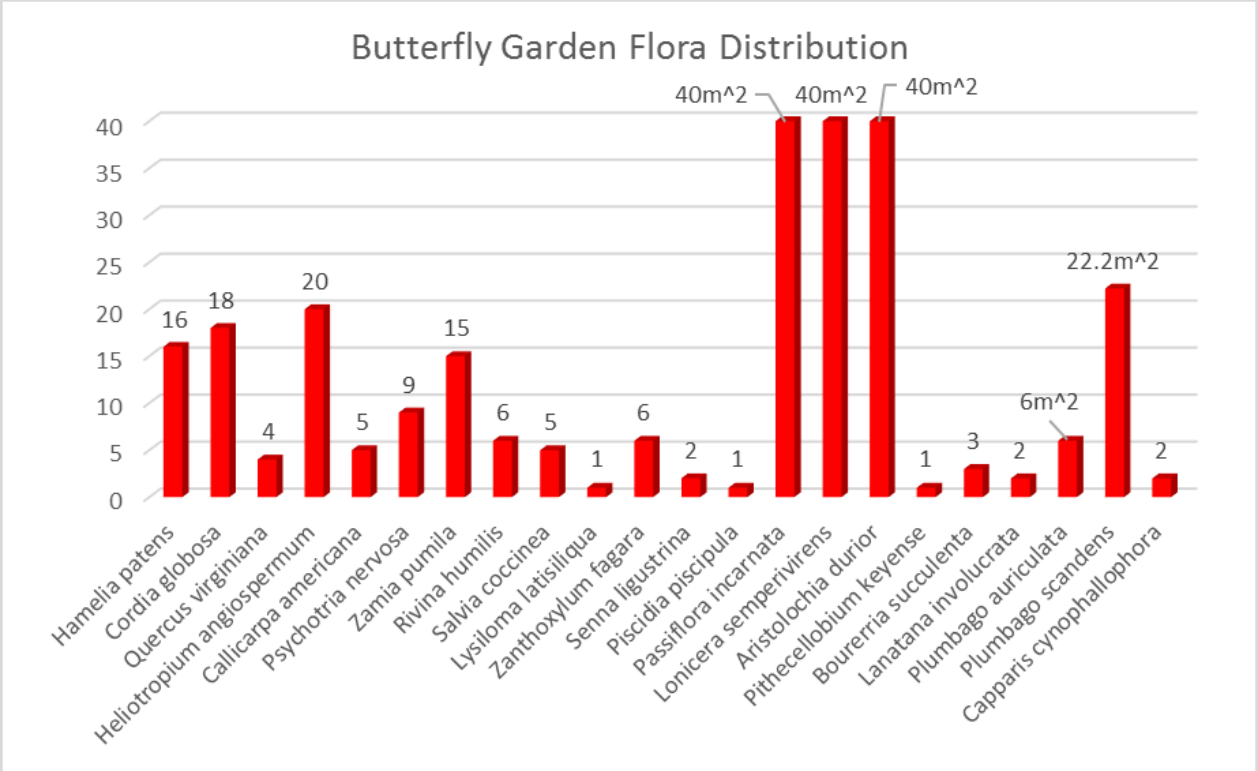

Figure 6. This bar graph shows the distribution of plants in the Butterfly Garden habitat.

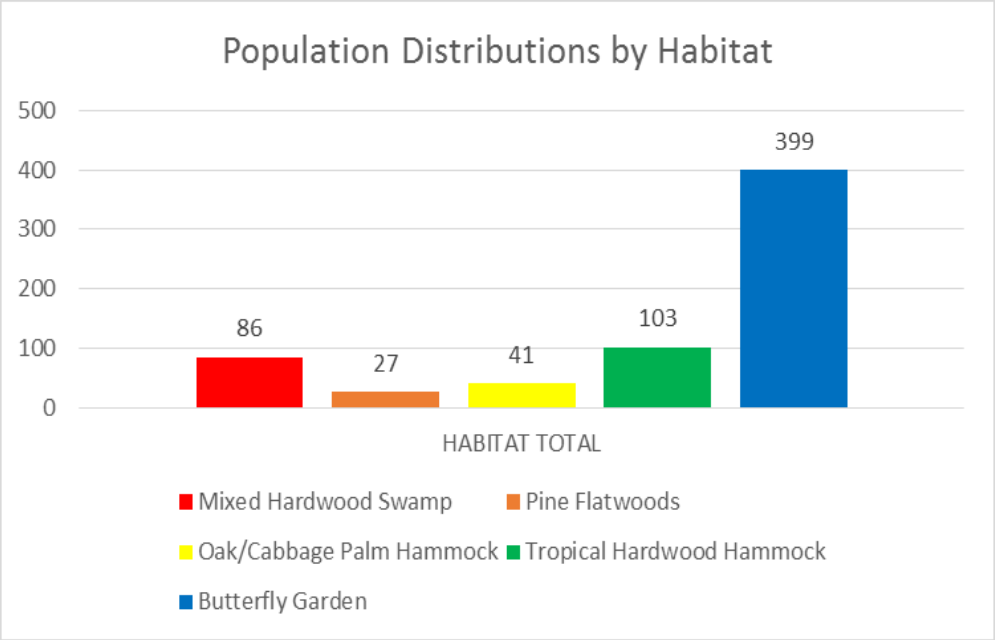

Figure 7. Butterfly population distributions by the habitat that were identified throughout the study.

Butterfly Abundance

Butterflies were most abundant in the butterfly garden habitat (Fig. 7). This is not surprising since this area contains the most flowering plants. The butterflies were least abundant in the pine flatwoods habitat. This area had few flowering plants (*T. dactyloides, R. humilis*), and was isolated on the edge of the arboretum away from the other habitats. It is not surprising that very little butterflies were found here, but it was curious to not find any *L. accius*, and only one *C. tripunctus*, since *T. dactyloides* serves as a larval host for these butterflies, and the plant is found in great numbers in the habitat (Minno and Minno 1999). The one *C. tripunctus* individuals and the one *A. campestris* individual spotted comprised the least sighted butterflies, and *L. cassius* was the most abundant, followed by *H. charithonia, E. atala,* and *U. proteus.*

Table 2 lists the species of butterflies that were identified throughout the study with the total number of individuals and the number sighted in each habitat. The species are listed in taxonomical order. The common names and the family of each species are included as well (Vane-Wright and Glassberg 2001).

Species Name	**Common Name**	**Family**	**MHS**	**PF**	**OCH**	**THH**	**BG**	**Total Individuals**
Papilio polyxenes	Black Swallowtail	*Papilionidae*	0	0	1	1	3	5
Papilio cresphontes	Giant Swallowtail	*Papilionidae*	0	0	1	1	0	2
Phoebis philea	Orange-barred Sulphur	*Pieridae*	1	1	2	1	5	10
Ascia monuste	Great Southern White	*Pieridae*	1	0	1	1	3	6
Eumaeus atala	Atala Hairstreak	*Lycaenidae*	34	1	5	26	33	99
Leptotes cassius	Cassius Blue	*Lycaenidae*	6	17	14	7	214	258
Hemiargus ceraunus	Ceraunus Blue	*Lycaenidae*	0	2	0	0	3	5
Heliconius charithonia	Zebra Heliconian	*Nymphalidae*	22	1	9	44	72	148
Dryas julia	Julia Heliconian	*Nymphalidae*	0	0	0	0	2	2
Anartia jatrophae	White Peacock	*Nymphalidae*	0	2	0	0	1	3
Danaus plexippus	Monarch	*Nymphalidae*	0	0	0	1	2	3
Urbanus proteus	Long-tailed Skipper	*Hesperiidae*	18	1	5	9	55	88
Erynnis horatius	Horace's Duskywing	*Hesperiidae*	3	2	3	0	5	13
Lerodea eufala	Eufala Skipper	*Hesperiidae*	0	0	0	1	1	2
Atalopedes campestris	Sachem Skipper	*Hesperiidae*	1	0	0	0	0	1
Cymaenes tripunctus	Three-spotted Skipper	*Hesperiidae*	1	0	0	0	0	1
Panoquina ocola	Ocola Skipper	*Hesperiidae*	0	0	0	0	11	11

Table 2. The butterfly species found throughout the study

DISCUSSION

Habitat Preferences

More butterfly individuals were identified in the butterfly garden than any other section. This is to be expected since this area contains plants that specifically attract *Lepidoptera* species of all families (Smith, 1994). The distance-sampling margins contained a high amount of *P. incarnata, L. semperivirens, A. durior, P. auriculata,* and *P. scandens. Passiflora incarnata* is known to attract *H. charithonia* and *D. iulia* (Minno and Minno 1999) and would explain the high density of *H. charithonia.* The abundance of *P. scandens* and *P. auriculata,* would explain the high number of *Leptotes cassius* individuals as these plants are known to serve as food sources for many *Lepidoptera* species, and *L. cassius* is known to be quite a common garden butterfly (Smith 1994). The recorded portion of the butterfly garden habitat also contained the highest amount of *C. globosa* (see Figures 2-6), which attracts many species of *Lepidoptera (personal observation).*

The mixed hardwood swamp and tropical hardwood hammock contained nearly the same number of individuals. These areas contained some flowering plants, such as *C. globosa, H. patens,* and *H. angiospermum.* Both sampled areas from these habitats contained adequate roosting areas. The mixed hardwood swamp contained several *C. laevigata, C. icaco, V. obovatum,* and *M. guianensis* (Figure 2); many *E. atala,* and *U. proteus* individuals were spotted roosting on these plants. The tropical hardwood hammock contained a large *C. uvifera* individual, and several *V. obovatum* individuals

(Figure 5). *E. atala* and many species of *Hesperiidae* were spotted roosting on these plants.

The pine flatwoods and oak/cabbage palm hammock contained relatively low counts of individuals, which was expected from the plant counts shown in Figure 3 and 4. Although the pine flatwoods region contained some butterfly plants, such as *T. dactyloides, M. strigillosa* and *S. coccinea,* it is dominated by *S. repens, M. capillaris, and R. humilis.* The oak/cabbage palm hammock is an area comprised mainly of trees (*S. palmetto, Q. laurifolia, and Q. virginiana),* with a few *H. patens* and *C. globosa* individuals. Most *L. cassius* and *H. charithonia* individuals were spotted here, but some *U. proteus* and *E. horatius* individuals were spotted. It is curious that no *Asbolis capucinus* individuals were spotted here, since *S. palmetto* is known as a larval host for these individuals (Minno and Minno 1999).

Papilionidae

Only 7 *Papilionidae* individuals were identified throughout the study. These individuals include *P. cresphontes,* and *P. polyxenes.* The numbers for *P. cresphontes* are quite low considering the presence of known larval host sources for this species (*Z. fagara).* Six individuals of *Z. fagara,* were identified in the butterfly garden transect (Figure 6), but nowhere else, and all of these individuals were relatively close together. It is possible that neighboring property owners do not have a sufficient amount of citrus plants nearby to facilitate considerable reproduction for *P. cresphontes.* Due to the high amount of *A. durior* individuals in the butterfly garden, it is odd that no *B. polydamas*

individuals were found, since this plant serves as a larval host for *B. polydamas* (Minno and Minno 1999).

Pieridae

Only 16 total individuals in this family were identified, and only two species within this family were identified. These species are *P. philea* and *A. monuste.* The majority of these individuals were identified in the fall/winter season. Only 2 *Pieridae* were identified in the Spring. *Phoebis philea* appears to particularly enjoy roosting/feeding on the flowers of *H. patens* in all areas. Most of the *P. philea* individuals I saw during the study gravitated heavily to *H. patens.*

Lycaenidae

The *Lycaenidae* family was the most commonly seen family throughout this study. With a total count of 362 individuals, primarily *L. cassius,* and with a significant amount of *E. atala,* it is apparent that the arboretum is well suited for these individuals. Large numbers of *Plumbago auriculata* and *scandens* are known to attract *L. cassius* as a larval food source (Minno and Minno 1999) and the vast majority of *L. cassius* individuals seen were observed on or near these plants. *Eumaeus atala* is known to lay its eggs on the *Z. pumila* plant (Koi 2008), and there are many of these plants found in the arboretum (see Figures 2-6). *E. atala* also requires sufficient plants for roosting and feeding (Koi 2008) some of which are found across the arboretum (Fig. 1-5). I observed *E. atala* individuals roosting frequently on *C. laevigata, C. icaco,* and *I. cassine,* and observed them nectaring on *C. globosa* and *H. patens.* The presence of this combination of plants seems to support *E. atala* populations quite well.

Nymphalidae

A total of 156 individuals in this family were identified throughout the study. This family was almost entirely represented by *H. charithonia*, with a final count of 148 individuals. Very few other *Nymphalidae* were identified (*D. plexippus, D. julia, and A. jatrophae).* These individuals are less common than *H. charithonia*, and no more than 5 individuals were spotted. It is very strange that no *Agraulis vanilla*e individuals were seen, considering the presence of *P. incarnata*, which serves as a larval host as well as for *H. charithonia* (Minno and Minno 1999). It is possible that the male *H. charithonia* individuals are highly territorial and chase out the *A. vanilla* individuals, but I could find no relative literature which shows that *H. charithonia* individuals target *A. vanilla* individuals in such a manner, other than that male butterflies can tend to be aggressive and territorial (Minno 2000).

Hesperiidae

A total of 116 *Hesperiidae* individuals were identified in this study. Over 75% of the individuals identified in this family were *U. proteus.* The arboretum does not have the larval food plant specifically planted for this species. However, the legume that it lays its eggs on, Desmodium sp., can be found in some of the weedy areas just outside of the arboretum (A. Edwards, personal communication, April 27, 2016). *Urbanus Proteus* is known to nectar on many species of flowering plants, including *Bougainvillea* plants (Hammer 2015), which were found nearby but not within the arboretum. Other *Hesperiidae* included *C. tripunctus, A. campestris, P. ocola,* and *L. eufala.* No more than 15 of these other *Hesperiidae* were identified throughout the study. Since all of these are

grass-feeding skippers, and the arboretum contains little wide-bladed grasses (Fig. 2-6) it is no surprise that their numbers were relatively low.

CONCLUSION

Native plants play a vital role in sustaining wildlife in the natural world around us. Presence of native plants in backyards, landscaped areas, and other outdoor spaces facilitates the life cycle of numerous native animals, including *Lepidoptera. Lepidoptera* require very specific plants depending on the species for reproduction, and many species prefer only a few plants to feed on, so it is imperative that we maintain these plants in the natural world around us, so that these *Lepidoptera* species may thrive and continue to pollinate. The arboretum is a fantastic environment for *Lepidoptera* of many species. It contains an abundance of plants whose flowers serve as a food source for these butterflies, and many who serve as exclusive larval hosts for certain species.

Overall I believe this study successfully documented butterfly populations in the Robert J. Huckshorn Arboretum. If I were to perform this study again, I would conduct even more counts, perhaps at least five a week, to obtain even finer results. Early morning counts would also have been a great inclusion alongside the afternoon counts, but my schedule did not permit this. I also would have liked to have continued the counts into the summer, but the study needed to be completed by May. I would like to see someone in the future conduct this study in the summer time to attain a full documentation of butterfly life in the arboretum.

References

Brown, J. A., & Boyce, M. S. (1998). Line transect sampling of Karner blue butterflies (Lycaeides melissa samuelis). *Environmental and Ecological Statistics*, *5*(1), 81-91.

Buckland, S. T. (2006). Point-transect surveys for songbirds: robust methodologies. *The Auk*, *123*(2), 345-357.

Buckland, S. T., Anderson, D. R., Burnham, K. P., Laake, J. L., Borchers, D. L., & Thomas, L. (2001). Introduction to distance sampling estimating abundance of biological populations.

Hammer, Roger. (2015) *Attracting Hummingbirds and Butterflies in Tropical Florida: A Companion for Gardeners. University Press of Florida*, Gainesville, FL: University Press of Florida.

Koi, S. (2008). Nectar Sources for Eumaeus atala (Lepidoptera: Lycaenidae: Theclinae). *The Florida Entomologist*, *91*(1), 118-120.

Murphy, D. D. (1987). Are we studying our endangered butterflies to death?.*Journal of Research on the Lepidoptera*, *26*(1), 236-239.

Henry, E. H., Haddad, N. M., Wilson, J., Hughes, P., & Gardner, B. (2015). Point-count methods to monitor butterfly populations when traditional methods fail: a case study with Miami blue butterfly. *Journal of Insect Conservation*, *19*(3), 519-529.

Glassberg, J., Minno, M. C., & Calhoun, J. V. (2000). Butterflies through binoculars: Florida.

Minno, M. C., & Minno, M. (1999). Florida Butterfly Gardening: A Complete Guide to Attracting, Identifying, and Enjoying Butterflies (pp. 6-7). University Press of Florida, Gainesville.

Osorio, Rufino (2001) *A Gardener's Guide to Florida's Native Plants.* Gainesville, FL: University of Florida Press.

"New Butterfly Handout," *biospherenursery.com*, last modified 2006, http://www.biospherenursery.com/pdf/New%20Butterfly%20Handout.pdf

Smith, David S. (1994) *Butterflies of the West Indies and South Florida.* Oxford: Oxford University Press

Traas, Pamela F. (1999) *Gardening for Florida's Butterflies*. St. Petersburg, FL: Great Outdoors Publishing.

Dick Vane-Wright, Jeffrey Glassberg. (2001) "Checklist of North American Butterflies Occurring North of Mexico." *North American Butterfly Association.* 2001. http://www.naba.org/pubs/enames2_2.html

Appendix A: The date for every count performed, including the temperature for that day, the time of day that the count was performed, and an approximation of percent cloud coverage are provided in Appendix A. The total number of *Lepidoptera* taxa spotted for that day is listed as well.

Appendix A

Date	Time	Temperature (C)	Cloud Coverage	Total Butterflies
9/21/2015	12:48 PM	31	50%	11
9/28/2015	12:32 PM	31	70%	31
9/30/2015	12:50 PM	31	40%	31
10/1/2015	3:34 PM	29	50%	29
10/12/2015	12:32 PM	28	20%	28
10/14/2015	12:37 PM	31	40%	30
10/19/2015	12:19 PM	26	90%	11
10/26/2015	1:55 PM	28	60%	29
10/28/2015	1:55 PM	28	80%	15
10/29/2015	3:06 PM	29	75%	15
11/2/2015	10:35 AM	30	25%	20
11/3/2015	3:31 PM	30	40%	10
11/4/2015	1:51 PM	31	90%	23
11/5/2015	3:24 PM	29	50%	17
11/9/2015	10:33 AM	30	60%	22
11/16/2015	1:54 PM	27	60%	13
11/17/2015	3:30 PM	27	40%	10
11/18/2015	11:47 AM	27	75%	17
11/19/2015	2:51 PM	28	85%	12
11/23/2015	11:58 AM	23	85%	15
11/24/2015	3:25 PM	23	30%	13
11/25/2015	11:58 AM	26	60%	15
12/3/2015	3:12 PM	25	100%	12
12/4/2015	11:30 AM	24	100%	4
2/23/2016	3:13 PM	26	90%	8
2/28/2016	1:56 PM	22	80%	5
3/1/2016	3:27 PM	26	10%	6
3/2/2016	10:30 AM	26	5%	10
3/5/2016	12:57 PM	24	90%	10

3/8/2016	1:37 PM	24	60%	21
3/9/2015	12:07 PM	26	80%	20
3/10/2016	11:13 AM	26	60%	24
3/11/2016	11:07 AM	27	45%	15
3/14/2016	11:47 AM	28	50%	17
3/16/2016	12:46 PM	27	40%	14
3/18/2016	1:18 PM	28	85%	15
3/22/2016	12:30 PM	22	20%	11
3/23/2016	11:03 AM	24	25%	13
3/24/2016	12:27 PM	25	100%	16
3/28/2016	11:17 AM	27	95%	6
3/30/2016	1:04 PM	22	100%	5
3/31/2016	12:48 PM	28	60%	13
4/4/2016	12:33 PM	24	100%	8
4/5/2016	1:02 PM	27	5%	19