ANURANS OF ABACOA

by

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ABSTRACT

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The construction of Abacoa included an attempt to conserve the wildlife in a Greenway, a set of habitats separated from the residential and commercial areas. All of the wetlands within Abacoa represent artificially constructed ponds, canals, and streams first created from 1998-2004. The present study focuses on the anuran (i.e. frog and toad) populations and looks at the number of different species that have naturally colonized six different sites around Abacoa. Each of these sites varies in qualities that may affect the probability of breeding in that section. The quality of water is known to be less ideal as the water flows away from the headwaters and mixes with water from other sources. This study aims to determine which anuran species are found at each of these sites after nearly a decade of colonization and how both anuran diversity and abundance correlates with water and habitat quality.

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Introduction

The gradual depletion of natural habitats has reached an alarming rate worldwide. Researchers have assessed this decline, discovering that natural disasters and overuse of resources by local and invasive fauna have contributed to these losses (Delis et al. 1996). However, the defining cause seems to reside in anthropogenic activities worldwide (Ficetola&Bernardi, 2003; Moreno-Mateos et al. 2012). The exponential increase in the human population naturallyresulted in urban expansion and, consequently, the destruction of natural ecosystems, only to replace them with artificial habitats. The native fauna, thus, have also suffered alongside this dramatic reduction of original habitats as they are forced out of their natural homes and into artificial habitats to survive. One group of major concern would be the amphibians for they too have been suffering a large decline in numbers in the past few decades (Delis et al. 1996; Stuart et al. 2004). Thus, the anurans (i.e. frogs and toads) were the main subjects of interest in this study and many others.

The spread of urbanization has increased the amount of artificial ponds also known as retention or stormwater ponds. These constructed wetlands function mainly to contain flooding and runoff in the system. Pollutants from stormwater runoff collecting in these ponds have become a major concern, for they have the potential to appear as a high-quality habitat to which many anuran species would be attracted (Brand & Snodgrass, 2009; Massal et al., 2007). Certain herbicides in runoff have been shown to have detrimental and even lethal effects on anuran life (Williams &Semlitsch, 2009). However, results from Massal et al. (2007) suggest that low levels of NO_3^-,one of the inorganic nitrogen compounds likely to be present in runoff, proved to have very little impact on the number of species present at any ponds. Still, these results are very specific to location and much control over pesticides would need to be implemented to prevent negative effects to the anurans. Thus, the use of these artificial habitats by the native fauna are still of interest due to the potential harm from pollutants as well as the possibility that these habitats may not be appropriate enough to accommodate them and could very well act as “ecological traps” (Brand & Snodgrass, 2009).

Seeing declines in wetlands and amphibians as well as the potential dangers of anurans inhabiting precarious ponds, a number of studies have been focused on assessing the quality of these artificial ecosystems (Brand & Snodgrass, 2009; Hamer et al. 2011; Rubbo&Kiesecker, 2004). Environmental factors such as pond age (Birx-Raybuck et al. 2009), water quality, and connectivity to other waterways (Ficetola& De Bernardi, 2003)all predict a positive effect on the number of species.The older and more pristine ponds were more attractive to the frogs and toads (Moreno-Mateos et al. 2012).In addition, the interconnection of waterways allows for a broader range of accessibility and increasing the probability of different species of anurans to encounter the artificial ponds (Ficetola& De Bernardi, 2003).

Aside from abiotic features and hydrologic mechanisms of the artificial environments, the capacities of the flora, the fauna and the different anuran species also contribute to the viability of the herpetofauna population. The presence of fish results in a negative correlation with species richness, for the fish can prey upon the tadpoles and eggs of the frogs and toads, therefore greatly diminishing their numbers (Ficetola& De

Bernardi, 2003; Monello& Wright, 1999).On the other hand, species variation also relied heavily upon the mobility of the anurans and, essentially, their colonization rate and adaptability (Ficetola& De Bernardi, 2003).Lastly, human development also played a role as species richness was seen to be higher in more rural ponds versus urban ponds with suburban areas in the intermediate values (Rubbo&Kiesecker, 2004).

Although anthropogenic activitiesseem to remain a negative impact on natural and even synthetic ecosystems, many attempts at readjusting the balance between humans and nature have resulted in not only the creation of artificial habitats, like theretention ponds, but also the attempt in restoring degraded wetlands. While these alternatives do not perfectly replace the original habitats, they still play a large role in the accommodations of local flora and fauna (Brand & Snodgrass, 2009; Moreno-Mateos et al., 2012).Analysis of the functional value in restored wetlands have shown that the habitats do recover but does so slowly and often are not able to fully regain its original functionality (Moreno-Mateos et al., 2012). Thus, whether or not there will be a perfect method to accommodate for the loss of natural habitats will have to be further evaluated in the future.

Overall, many attempts have been implemented to establish a proper replacement for the loss of natural lands. The knowledge ofthe assortment of factors that can impact the viability of a habitat and the survivability of the frogs and toads will assist in the construction of high-quality ecosystems. This particular study aims to take what is known about reconstructed and artificial wetlands to roughly assess the capacity of a recently developed area known as Abacoa, in Jupiter, Florida.The goals of this project consist of obtaining a preliminary survey of the composition of the anuran population in Abacoa and also to achieve a better understanding of what constitutes a sustaining artificial environment.

Methods

Study Area:

Thisstudy took place in AbacoaDevelopment of Jupiter, Florida – a combination of commercialized and residential areas (Figure 1). Before construction began in 1998, the overall vicinity consisted of agricultural territory and mesicflatwoods that included marshy wetlands (Figure 2). Much of the natural lands were built over. However, a subsection of the original flatwoods and wetland, referred to as the Upland Preserve and also known as the AbacoaGreenway, is still maintained in Abacoa today. The retention ponds, nature trails, and human-influenced habitats were created for anthropological reasons. However, the management plan also intended to preserve the local flora and fauna within those boundaries as well (Painter 1996). The AbacoaGreenway is expected to maintain herpetofauna, similarly to the manner in which other communities have done before it, but no survey assessing the composition of the amphibian population has been conducted previously.

Observation Sites:

A total of six sites from five different ponds inAbacoa were evaluated (Figure 3). A majority of the sites (67%) resided in Ranges IV and V of the Upland Preserve (Figure 4) and located along the same waterway system which travels northward from the first designated pond, near Main Street and then heads east to A1A in which the water empties into the channel (Figure 5). The northeast end of the first pond consists of a cypress marsh. The control pond, a completely man-made lake adjacent to a golf course, lies on a different waterway, which runs east alongside Donald Ross Road. The last site is located in the middle of a well-developed area on the FAU campus and is a small, semi-permanent pond independent from any hydrologic system (RF pond).

Most of the observations at all the sites were maintained however, one location, labeled as Site 3A proved to be inconsequential due to the absence of calls. It was thus replaced with Site 2A which was inadvertently left out of the original sites. However, with the later reevaluation of the locations, Pond 2was determined to be a site of herpetofauna activity and so, was incorporated into the list of observation sites.

Habitat Conditions:

Each of the six observation sites differed in habitat quality and the amount of human influences. The type of land, distance from the closest building/road and a land development index (LDI) were all identified and recorded (Table 1). The LDI was developed by Brown and Vivas (2005) and essentially determines the ratio of anthropogenic versus natural activity, where the higher the index, the higher the level of development. So, on Table 1, the lowest LDI at 3.7 indicates that site 1B has the lowest degree of urbanization.

Land Development Index (LDI) was calculated for each observation site by estimating the proportion of different land cover types found within a 100 m radius circle centered on the site. The percentage of each land cover type was estimated within the circle and multiplied by the LDI coefficient (Brown and Vivas 2005: Table 2). The sum of the individual values for each land cover type gives the total LDI for each site. The wooded areas of the Abacoa Greenway were considered Recreational low-intensity areas with a LDI coefficient of 1.83, whereas both the artificially constructed ponds and grassy lawn areas were classified as Recreational medium-intensity areas with a LDI coefficient of 4.49. Other land cover types encountered near these observation sites included: Single family residential medium-intensity (LDI coefficient 7.47), Multi-family residential low-intensity (8.66), Institutional (8.07), Transportation low-intensity (7.81), Transportation high-intensity (8.28),

Another assessment on habitat conditions consisted of the identification and classification of flora and fauna as either tolerant or sensitive species (Fore et al. 2007). With the exception of two identified species, all of the floral species recorded were emergent vegetation discovered at one or more of the observation sites (Table 2). The plants were categorized as exotic or native and then further classified as tolerant, somewhat sensitive, or truly sensitive species. In addition, one sensitive species of freshwater invertebrate was included in this analysis.

The following species were considered tolerant of environmental disturbance: Brazilian pepper, *Schinusterebinthifolius*, earleaf acacia, *Acacia auriculiformis*, melaleuca, *Melaleuca* sp., hydrilla, *Hydrillaverticillata*, and water pennywort, *Hydrocotyleranunculoides*. The following species were considered somewhat sensitive species: giant bulrush, *Scirpuscalifornicus*, duck potato, *Sagittarialatifolia*, and Egyyptianpaspalidium, *Paspalidiumgeminatum*. The following species were considered truly sensitive species: white water lily, *Nymphaeaodorata*, bald cypress, *Taxodiumdistichum*, and Florida apple snail, *Pomaceapaludosa*.

Sampling Procedures:

Data collection occurred in the months of January 2012 to March 2012 for a total of seven separate visits to each site (see Appendix 1). Surveys were done after nightfall between the times of 9:30 PM and 12:30 AM, primarily on days with precipitation. The temperature ranged from a low of 69˚ to a high of 77˚. Observations consisted of quiet listening by the shoreline for five to ten minuteswhile recordingthe call type and the intensity of the calls. The species calling were identified through comparing the calls to recorded mating calls from the audio CDs "Voices of the Night" (Cornell Laboratory of Ornithology 1996) and "Sounds of North American Frogs" (Bogert 1958). Table 3 gives a list of anuran species that are known from the region (Bartlett and Bartlett 1999).

Lastly, the call intensities were assessed with the scale ratings supplied on the website called FrogWatchUSA – a volunteer program established by the Association of Zoos and Aquariums to contribute to the understanding of conservation strategies (http://www.aza.org/frogwatch/). On this scale, a value of 0 represents no calls heard during the observation period, 1 means at least one or a few individuals were calling, 2 signifies frequent calls but with gaps, and 3 indicates a continuous chorus of calls.

Results

A total of five different mating calls were identified at the six sites (Figure 4). Three of these species were native to South Florida with the other two considered as invasive species (Bartlett and Bartlett 1999). The native anurans recorded included the southern cricket frog (*Acrisgryllus*),which was the most frequently recorded species at five of the six sites, whereas the southern leopard frog (*Lithobatessphenocephalus*) and the southern toad (*Anaxyrusterrestris*) were both present at only three of the locations. The two invasive species were the cane toad (*Rhinella marina*), heard at only two sites and the Cuban tree frog (*Osteopilusseptentrionalis*), which called sparsely at three locations.

Each of the six locations housed a different assortment of anurans. Species variation roughly correlated with the level of development (i.e. the land development index) and the number of sensitive plant species present (Table 5). The observation site Pond 1B had four call types, the highest number out of all the ponds. Two of the species, the cane toad and southern cricket frog, called more frequently than the other two, the Cuban tree frog and southern leopard frog. This cypress marsh location consisted of six different sensitive native plant species and no tolerant species possibly attributable to the low LDI of 3.7.

Pond 1A and 2A both house three different anuran species with the southern cricket frog and Cuban tree frog common to both sites whereas the southern leopard frog was only at Pond 1A and the cane toad was at Pond 2A. The LDIs were very similar at 4.16 and 4.4, respectively. In addition, the two locations had five sensitive plant species.

The control pond, RF pond and Pond 3B all lacked or had few of the sensitive foliage and also had the highest LDI out of the six observation sites. These three sites had a few calling individuals with the southern toad being the common species at all three locations.

Discussion

The construction of communities like Abacoa would be optimal if the management plans proposed actually proved to preserve the quality of habitat necessary to maintain species abundance and diversity. The current projectintends to initiate the study of the anuran population in the area and to examine if there are certain factors in an environment that maycorrelate with species richness. From the data recorded, it appears that the habitats that allowed for the greatest number of sensitive plant species also correlated with the greatest number of anuran species (Table 5). This was exemplified in the locations: Pond 1A, 1B, and 2A, since all of these sites had at least three anuran species present. The three aforementioned sites also accommodatedat least two frog species, which called most frequently out of all the speciesat any of the other sites. Although three species were also detected at Pond 3B, the low frequency of the calls indicates that very few individuals are there, making this location less favorable than the three listed above.

Past studies of retention ponds located in various areas have exhibited anuran behavioral patterns similar to what was found in Abacoa. That is, the locations with optimal qualities housed more varieties of species (Ficetola& De Bernardi, 2003; Hamer et al., 2011; Monello& Wright, 1999). In addition, several cases had identified the most common species found and speculated that these anurans may have had the capacity to colonize or adapt to the environment faster thanthe other species. This was the case for the pool frog (*Ranasynkleptonesculenta)* in a study conducted in Northern Italy. The pool frog was the most common species detected in all their observation sites and was found to have mobility through isolated lands as well as withstand polluted waters (Ficetola& De Bernardi, 2003). The same concepts may be applied to the southern cricket frog commonly observed throughout Abacoa.

The present findings are relative to the results from past studies but it is possible that the current number of observed species may be abnormal for Abacoa. Several conditions may have influenced anuran behavior and accordingly resulted in a lower species count. Primarily, the survey period associated with this project incorporated only the early spring mating season. It is very possible that the observations of some anuran species were missed due to their preference to mate during the fall or even the summer instead of spring.

Still, an underlying reason for the low species presence may easily be the age of the ponds (with the exception of the control pond). All except one of the ponds are permanently established bodies of water created around the year 1998. The exception, the RF pond, has had inconsistent water levels and was created around the year 2004. The lower species count at this site may stem from the difference in years, more so than from habitat variables. An analysis of a number of wetlands depicted how even the restoration of degraded wetlands does not necessarily ensure that the habitat reverts back to the pre-impact state even after 30 years (Moreno-Mateos et al., 2012) However, it would not be surprising if the composition of anurans continues to changein Abacoaover time, for the present survey could possibly be detecting the primary colonizers.

Conversely, other studies found that vertebrate activity appears to assemble in five to ten years into recovery (Moreno-Mateos et al., 2012). Again, this may be representative of the primary colonizing species but another residential area in Tampa, Florida exhibited high species activity in 1992 after construction had taken place in 1982 (Delis et al., 1996). A survey of the pre-impact lands in 1974 identified 16 anuran species to be present. In roughly the same time period as Abacoa has faced, a total of 11 of the 16 original frogs and toads were present in that area. The missing species proved to be either a rare type or ones that cannot withstand pollution (Delis et al., 1996). Thus, it may be possible that the original composition of Abacoa anurans is as limited as what were presented in this project. However, a later and more detailed study would give more conclusive evidence.

Future Research:

From Abacoa's inception to present day, a little over a decade has elapsed. As previous studies have shown, it is important to conduct another survey of the composition of the anuran population in the coming years to properly assess the viability and variability the local herpetofauna in the Greenway (Delis et al. 1996). However, in future endeavors, multiple observers and methods of detecting anuran presence should be consideredin order to give a more accurate account of which species are located in which ponds. Studies have used techniques such as visual encounters, dipnetting (tadpole search), or egg searches (Brand & Snodgrass, 2009; Ficetola& De Bernardi, 2003; Monello& Wright, 1999). These methods further assist in anuran detection and would also allow for the investigation of species abundance. Analyzing species abundance (approximately how many individuals of a particular species are present) would also help elucidate the quality of a habitat.

Another component of a species-rich pond is interconnectiveness of waterways (Ficetola& De Bernardi, 2003). Since the Greenway has a fairly linear water system, with one pond leading to the next, this ecosystem is meagerly associated to any other waterways. However, construction plans had also included the creation of underground burrows for the connectivity feature, allowing for the mobility of local fauna. Whether or not these channels are of use to the anuran population is still questionable and again more studies would need to be implemented to come to a more conclusive understanding.

Lastly, the presence of fish consistently showed anuran absence in past studies. In regards to Abacoa, there were sightings of large-mouthed bass at ponds 2 and 3 which may have influenced the potential of some anurans since these fish are known to prey on frogs and toads. Thus, the presence of fish in the Abacoa ponds should also be considered in future endeavors. It may also be advantageous to distinguish between the fauna that may perceive frogs and toads as prey. In addition to fish, the presence of snakes may be highly unfavorable to the anurans. A single black racer was spotted on one occasion at the RF pond site and seeing as they prey on frogs, the presence of such predators shouldalso be taken into consideration. Overall, future endeavors may greatly elucidate the advantages of communities incorporating preserves in their design, like Abacoa had.

Table 1: Level of Development

Sites	Land Type	Nearest building	Nearest road	LDI*
Control pond	lawn	309 m	11 m	5.66
RF pond	lawn	44 m	93 m	5.1
Pond 1A (Bridge)	woods	27 m	13 m	4.16
Pond 1B (Cypress marsh)	woods	88 m	58 m	3.7
Pond 2A	woods	21 m	9 m	4.4
Pond 3A (Culvert)	wood/road	26 m	5 m	5.33
Pond 3B (Stream)	woods	18 m	4 m	4.78

Table 2A: Sensitive Species

	Somewhat Sensitive Native			Truly Sensitive Native		
Sites	**Giant bullrush**	**Duck potato**	**Egyptian Paspalidium**	**Bald cypress**	**White water lily**	**Apple snail**
Control Pond	-	-	-	-	-	-
RF pond	-	-	-	-	-	-
Pond 1A	+	+	+	+	-	+
Pond 1B	+	+	+	+	+	+
Pond 2A	+	+	+	+	-	+
Pond 3A	-	-	+	+	-	-
Pond 3B	-	-	-	+	-	+

Table 2B: Tolerant Species

	Tolerant Exotic			Tolerant Native
Sites	**Brazilian pepper**	**Melaleuca**	**Hydrilla**	**Water pennywort**
Control Pond	+	-	-	+
RF pond	+	+	-	+
Pond 1A	-	-	-	-
Pond 1B	-	-	-	-
Pond 2A	-	-	+	-
Pond 3A	-	-	+	+
Pond 3B	-	-	-	-

Table 3: Catalogue of Possible Anuran Species

Common Name	Scientific Name
Barking Treefrog	*Hylagratiosa*
Bull Frog	*Ranacatesbeiana*
Bird-voiced Treefrog	*Hylaavivocaavivoca*
Cane Toad	*Rhinella marina*
Cope's Gray Treefrog	*Hylachrysoscelis*
Cuban Treefrog	*Osteopilusseptentrionalis*
Eastern Narrowmouth Toad	*Gastrophrynecarolinensis*
Eastern Spadefoot Toad	*Scaphiopusholbrookiiholbrookii*
Gopher Frog	*Ranacapito*
Greenhouse Frog	*Eleutherodactylusplanirostrisplanirostris*
Green Treefrog	*Hylacinerea*
Little Grass Frog	*Pseudacrisocularis*
Oak Toad	*Anaxyrusquercicus*
Ornate Chorus Frog	*Pseudoacris ornate*
Pig Frog	*Ranagrylio*
Pinewoods Treefrog	*Hylafemoralis*
Southern Chorus Frog	*Pseudoacrisnigritanigrita*
Southern Cricket Frog	*Acrisgryllus*
Southern Leopard Frog	*Lithobatessphenocephalus*
Southern Toad	*Anaxyrusterrestris*
Squirrel Treefrog	*Hylasquirella*

Table 4: Call Intensity

Sites	Cane Toad	Cuban Tree Frog	Southern Cricket Frog	Southern Leopard Frog	Southern Toad
Control	0	0	0	0	1
RF Pond	0	0	1	0	2
Pond 1A	0	1	2	1	0
Pond 1B	2	1	2	1	0
Pond 2A	2	1	2	0	0
Pond 3B	0	0	1	1	1

FrogWatch USA "Calling Intensity Index"

0 = No frogs or toads heard calling.

1 = Individuals could be counted; there was space between calls.

2 = Calls of individuals could be distinguished, some overlapping of calls.

3 = Full chorus, calls were constant, continuous and overlapping.

Table 5: Summary

Sites	LDI	# of Tolerant Species	# of Sensitive Species	# of Anuran Species
Control	5.66	2	0	1
RF Pond	5.1	3	0	2
Pond 1A	4.16	0	5	3
Pond 1B	3.7	0	6	4
Pond 2A	4.4	1	5	3
Pond 3B	5.33	2	2	3

Figure 1: Map of Abacoa

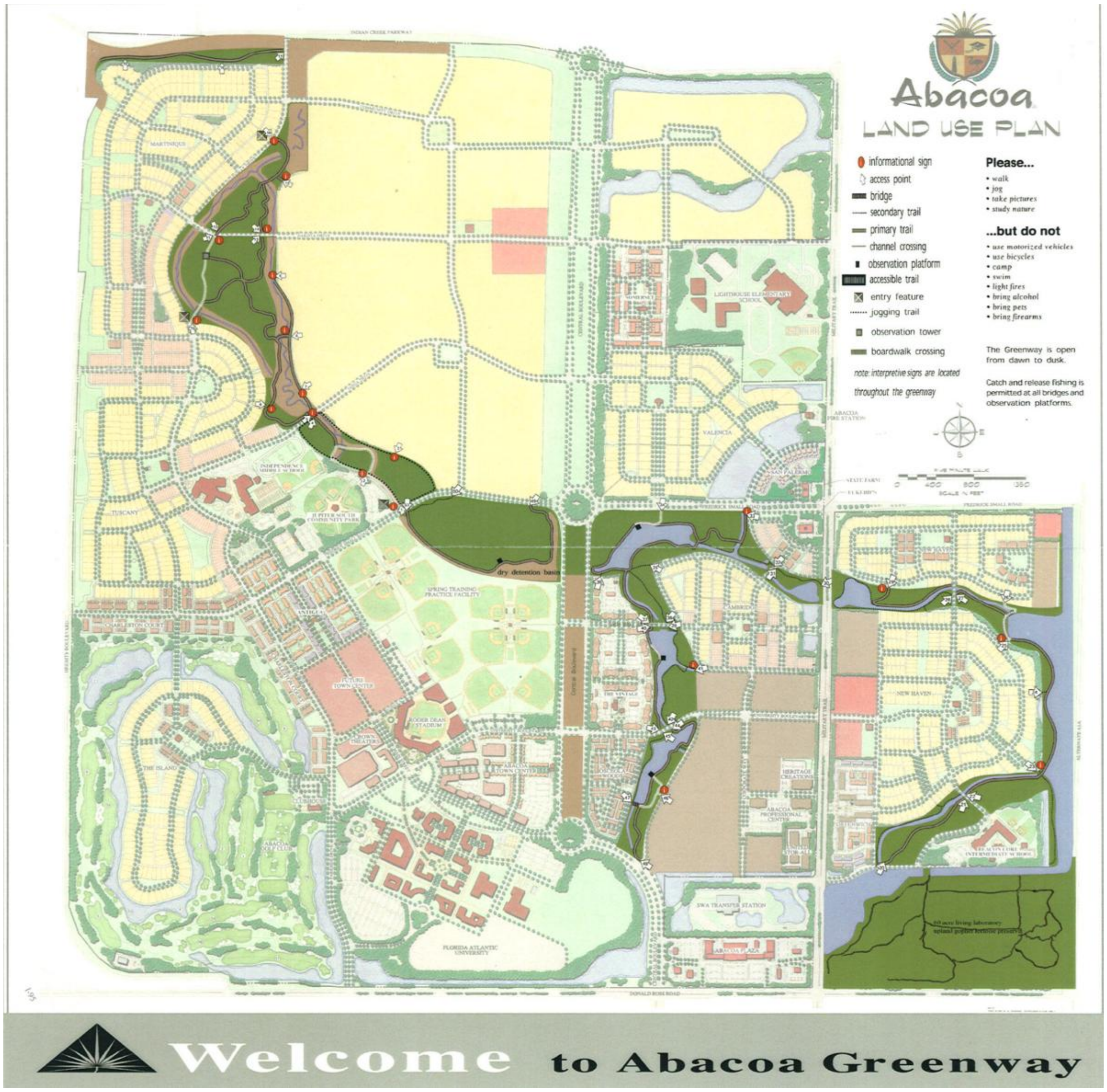

Figure 2: Abacoa Observation Sites

Figure 3: Upland Preserve Range Designation

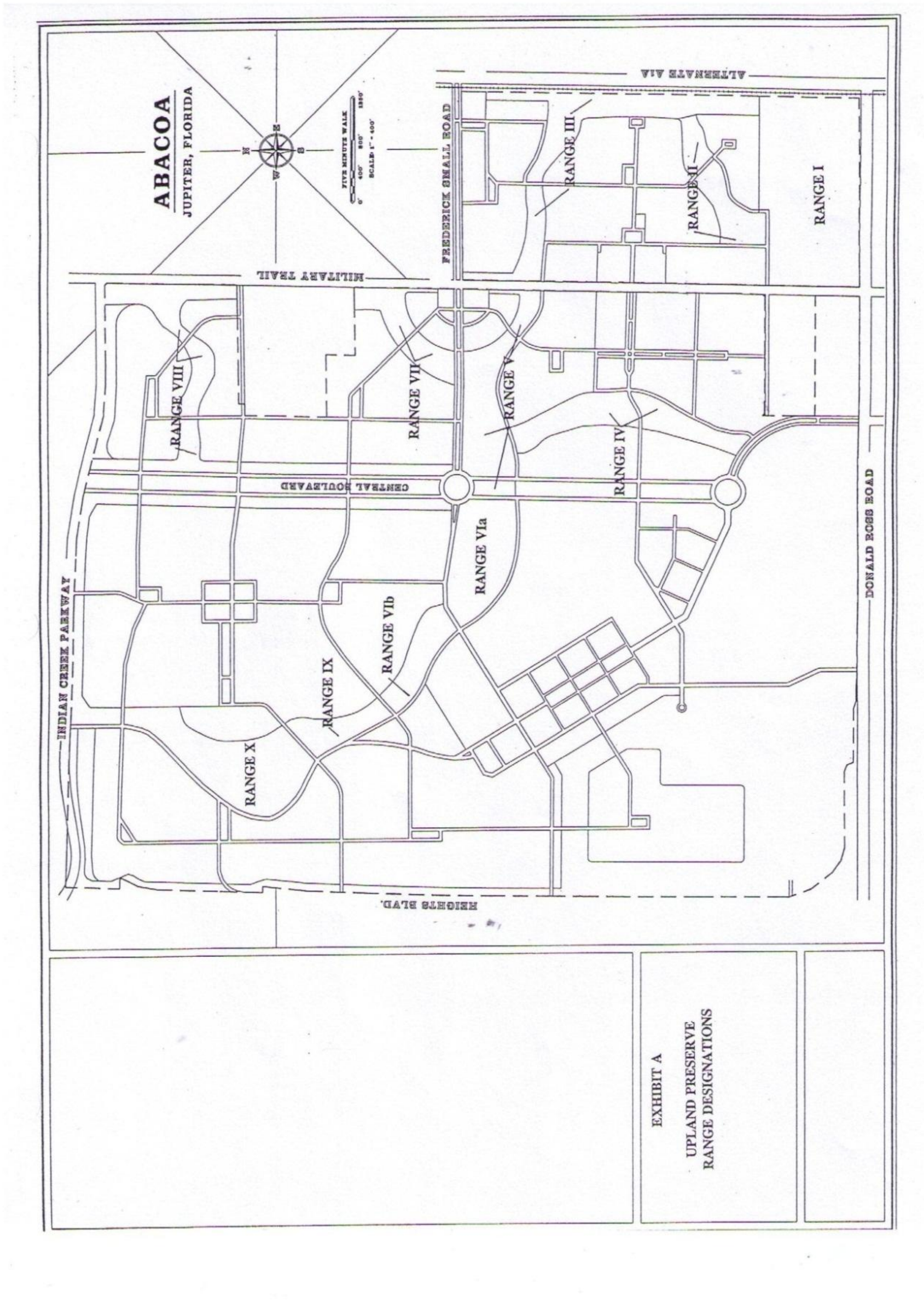

Figure 4: Hydrologic Systems of Range IV and V

Appendix 1: Field Notes

1. January 24, 2012 - 69˚, rained early morning
    a. Control Pond – 11:10 pm (no calls)
    b. Site 1A (Bridge) – 11:55 pm
        i. Southern Cricket Frog
        ii. Southern Leopard Frog
    c. Site 1B (Cypress Marsh) – 11:21 pm
        i. Southern Cricket Frog
        ii. Cuban Tree Frog
    d. Site 3A (Culvert) – 11:33 pm
        i. Southern Cricket Frog?
        ii. Unidentifiable: sparse bird-like call?
    e. Site 3B (Stream) – 11:41 pm
        i. Southern Leopard Frog
2. February 3, 2012 - 72˚, rained the day before
    a. Site 1A (Bridge) – 10:34 pm
        i. Cuban Tree Frog – intensity: 1
        ii. Southern Leopard Frog – intensity: 1
    b. Site 1B (Cypress Marsh) – 11:13 pm
        i. Southern Leopard Frog – intensity: 1
    c. Site 3A (Culvert) – 10:59 pm
        i. Cuban Tree Frog?
    d. Site 3B (Stream) – 10:49 pm
        i. Cuban Tree Frog – intensity: 1
3. February 6, 2012 - 71˚, rained all day
    a. Site 1A (Bridge) – 10:20 pm
        i. Cuban Tree Frog – intensity: 1
        ii. Southern Cricket Frog – intensity: 2
        iii. Possibly heard "squeaky wheel" sounds
    b. Site 1B (Cypress Marsh) – 10:38 pm
        i. Southern Toad – intensity: 2
        ii. Southern Leopard Frog – intensity: 2
    c. Site 3A (Culvert) – 10:52 pm (no calls)
    d. Site 3B (Stream) – 11:03 pm
        i. Cuban Tree Frog – intensity: 1
4. March 11, 2012 – 71˚, slight rain during the day
    a. Control Pond – 9:15 pm (no calls)
    b. RF Pond – 9:25 pm
        i. Southern Toad – intensity: 1
    c. Site 1A (Bridge) – 9:45 pm
        i. Cane Toad – intensity: 1
        ii. Southern Cricket Frog – intensity: 2
        iii. Had one other sparse and unidentifiable

d. Site 1B (Cypress Marsh) – 9:59 pm
    i. Cane Toad – intensity: 1
    ii. Cuban Tree Frog – intensity: 1
    iii. Southern Leopard Frog – intensity: 1
    iv. Southern Cricket Frog – intensity: 2
e. Site 3A (Culvert) – 10:17 pm (no calls)
f. Site 3B (Stream) – 10:26 pm
    i. Southern Cricket Frog – intensity: 2
    ii. Cuban Tree Frog – intensity: 1
    iii. Possibly heard Southern Leopard Frog (chitter sound), called once in five minutes.

5. March 15, 2012 - 75˚, sporadic rains throughout the day
    a. Control Pond – 9:28 pm
        i. Southern Toad – intensity: 1
    b. RF Pond – 9:34 pm
        i. Southern Toad – intensity: 2
    c. Site 1A (Bridge) – 9:45 pm
        i. Southern Cricket Frog – intensity: 2
        ii. Southern Leopard Frog – intensity: 1
        iii. Also heard call like "glass bells" or could be confused with crickets
    d. Site 1B (Cypress Marsh) – 9:57 pm
        i. Cane Toad – intensity: 2
        ii. Southern Cricket Frog – intensity: 2
        iii. Cuban Tree Frog – intensity: 1
        iv. Southern Leopard Frog – intensity: 1
    e. Site 2A – 10:10 pm
        i. Southern Cricket Frog – intensity: 1
        ii. Southern Leopard Frog – intensity: 1
    f. Site 3B (Stream) – 10:21
        i. Southern Leopard Frog – intensity: 1
        ii. Cuban Tree Frog – intensity: 1
        iii. Southern Cricket Frog – intensity: 2
6. March 21, 2012 - 76˚, slight drizzle
    a. Control Pond – 9:45 pm
        i. Southern Toad – intensity: 1
        ii. Southern Cricket Frog?
    b. RF Pond – 9:56 pm
        i. Southern Toad – intensity: 2
        ii. Southern Cricket Frog – intensity: 1
    c. Site 1A (Bridge) – 10:13 pm
        i. Southern Cricket Frog – intensity: 2
        ii. Southern Toad – intensity: 1
    d. Site 1B (Cypress Marsh) – 10:27 pm

        i. Cane Toad – intensity: 2
        ii. Southern Cricket Frog – intensity: 2
    e. Site 2A – 10:40 pm
        i. Southern Cricket Frog – intensity: 1
    f. Site 3B (Stream) – 10:54 pm
        i. Southern Cricket Frog – intensity: 2
        ii. Southern Leopard Frog? Or Cuban Tree Frog?

7. March 30, 2012 - 77˚, wet out
    a. Site 1A (Bridge) – 9:34 pm
        i. Southern Cricket Frog – intensity: 2
    b. Site 1B (Cypress Marsh) – 9:48 pm
        i. Southern Cricket Frog – intensity: 2
    c. Site 2A – 10:03 pm
        i. Cuban Tree Frog – intensity: 1
        ii. Southern Cricket Frog – intensity: 2
        iii. Cane Toad – intensity: 2
        iv. Another call was heard but was not able to identify it
    d. Site 3B (Stream) – 10:15 pm
        i. Southern Toad – intensity: 1

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