The FIU Nature Preserve: Achieving Biological Conservation Through Diversification of Stakeholders

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Abstract - Many institutions of higher education have sustainability initiatives; however, not all consider the importance of proximity to nature in the psychological well-being of their associated human community. Florida International University (FIU) is near the Florida Everglades, and, thus, is strategically positioned to educate the community about South Florida's rich natural history. In the past, the FIU Nature Preserve was underutilized, under-managed, and even dangerous. With minimal visitation, investment, and administrative support, its future looked dim. By enhancing the facility to appeal to a larger target-audience and expanding educational programming for a wider array of participants, a dramatic increase in visitation took place. Visitation grew from <1000 people a year in 2010, to 30,586 in 2015. These changes led the university to invest in and protect this forested park, which has long served as an important outdoor classroom for the FIU community.

Introduction

An educational institution is enriched when it has a wide diversity of resources for its students and faculty to use to their advantage. Herein, we examine the value of natural areas in institutions of higher education, the challenges of maintaining such places, and the importance of their existence to diverse members of the university and surrounding communities.

Among the reasons that trees and forests are important are that they increase biodiversity and provide aesthetically pleasing elements in the human landscape (Henwood and Pidgeon 2001). They must be properly managed in order to provide a wealth of ecosystem services (Andersson et al. 2007) and instill a sense of place. A sense of place and attachment to that place (Altman and Low 1992) are foundational values (Brandenburg and Carroll 1995) that foster a state of psychological well-being (Davenport and Anderson 2005) in community members. In place-based education (Sobel 2005), students learn about the world by observing things living nearby; thus, community natural areas are invaluable resources for discovery and knowledge in one's own backyard (Thomashow 2002). It is often challenging to find natural areas in close proximity to locations in large cities, but some universities fill this void. A well-planned campus may contain thousands of mature shade trees or even have fully forested natural areas for research and leisure purposes.

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Manuscript Editor: Scott Markwith

Environmental education is important in promoting conservation and enhancing the success of conservation projects (Hughes 2012). Humans value natural areas because they are aesthetically pleasing and provide ecological services. On-campus open spaces offer opportunities for students to learn about ecological systems and become involved in their stewardship. Students in the humanities and mathematics tend to be less aware of environmental problems than those in the natural sciences; thus, environmental education should seek to reach out beyond the science classes to the entire university community (de Carvalho Maffia et al. 2011). The greater the connection people feel to nature, the more likely they are to view themselves as conservationists and support environmental initiatives (Lokhorst et al. 2014). Time spent involved in nature-based stewardship can provide direct benefits to campus natural areas through activities such as tree planting, but it also fosters engagement in other sustainability initiatives like reducing consumption and carbon footprints, both personally and by the institution overall (Krasny and Delia 2015).

A basic tenet of biophilic urban planning is that urban green spaces, including natural areas, are important in making cities more livable (Beatley 2011). A "humane metropolis" (Pickett et al. 2011) is described as one that protects and restores ecological services; promotes physical and mental health of residents; promotes efficiency by conserving energy, water, and time; and maintains a sense of community. We are convinced that having a well-managed nature preserve utilized by many people for a variety of purposes is a step toward creating a "humane campus".

We are fortunate to have such a place at Florida International University (FIU). An urban, public research institution located in Miami, FL, FIU has 2 primary campuses and several small satellite campuses. The Modesto Maidique Campus is the main campus where ~86% (FIU 2014) of the 54,000-student population (FIU 2015a) attends classes and where the FIU Nature Preserve is located. Founded in the 1970s, only a few years after the university's inception, the FIU Nature Preserve is now an established outdoor classroom and symbol of university history and pride.

Background

According to FIU's main website, the FIU Nature Preserve is one of 8 iconic landmarks on FIU's main campus (FIU 2015b), which is something that becomes clear when looking at an aerial photo or map of the campus. Over its 40-year history, there have been many people involved in sustaining the FIU Nature Preserve, but only 2 can be given credit for its creation: a visionary groundskeeper, Charlie Henington, and an energetic professor of Environmental studies, Dr. John "Jack" Parker. These people realized that as Miami urban sprawl spread to FIU, small, but ecologically important remnant tracts of the Florida Everglades would soon disappear (Alonso and Heinen 2011). Their goal was to transform undeveloped university property into an outdoor environmental science laboratory to enhance teaching and learning about South Florida ecology.

Early on, Jack Parker initiated a system of student service-learning, urging students to think globally, yet act locally. This approach inspired other environmental studies professors to get students involved in conducting biological surveys, developing forest-management plans, constructing trails, and planting trees. These projects were not widely publicized and mostly went unnoticed by the university community. Although the university officially embraced "responsibility as stewards of the environment" as one of the university's core values (FIU 2015a), with development and prosperity as overriding driving forces, FIU had been far from the idealized "biophilic university" (Jones 2013). This trend of minimal interest and investment in the Nature Preserve by the university and almost complete dependence on student volunteers for its maintenance continued throughout the first 30 years of the preserve's existence. Dr. Parker acted as the informal director for many of those years with some support from the FIU Environmental Preserve Committee; the preserve needed additional help. In the late 1980s, FIU established a fund (with money received from environmental mitigation) to support an environmental preserve intern each semester to study/monitor the site, oversee any projects taking place, and interpret the natural environment to any student volunteers. This successful internship program continues to this day, with past interns going on to graduate school or positions with the National Park Service, Miami-Dade County, and other environmental science/service agencies, but it was not sufficient to meet the preserve's needs.

Preserve management was largely dependent upon a temporary, part-time, undergraduate student-intern and the preserve had no management plan or sufficient means for improvement. Trails were poorly developed and sometimes impassable due to a lack of maintenance. Much of the preserve went completely unmanaged for decades, leading to degraded habitats overrun with invasive, exotic pest-plants. There were areas of illegally dumped debris, and the infrastructure had deteriorated and become unsightly and dangerous. At various times throughout its history, the preserve harbored stray dogs, homeless visitors, and drug/alcohol abusers, as well as the occasional runaway criminal (Buteau 2011, Valens 2011). The Nature Preserve was also a frequent target for vandalism: a palm-thatched chickee hut and split-log benches, a water fountain, trail signs, trees, and 9 of 10 outdoor fitness stations were destroyed.

The Nature Preserve lacked aesthetic appeal because it had no signage, lighting, formal trails, or trail entrances, and its landscaped areas were unattractive. Most university administrators ignored the preserve or considered it to be an eyesore. Decades of work focused solely on ecological restoration within the interior of the preserve went almost completely unnoticed by unsympathetic university administrators who continually proposed to have the unprotected area destroyed and repurposed for increased monetary gain. Eventually, it became apparent that without an annual operating budget and only the work of a part-time student intern, the preserve could not be maintained (Fiestas 2010).

Approach

The university decided to employ a different strategy, and in 2010 they hired a new preserve manager. This person arrived with a clear goal in mind: to have the area formally conserved as an educational nature preserve. In order to be protected, the Nature Preserve would have to become a formal, managed, and deliberate feature of campus, something that many skeptics thought impossible. By looking at this area from a broader perspective (including those of a university administrator, a science professor, a college student, an investor, a police officer, a park manager, or a member of the general public), the new manager envisioned many ways in which the Nature Preserve could be improved. An informal development plan was created to renovate the preserve in an attempt to appeal to these stakeholder groups. The plan called for the preserve to grow in a number of ways: revenues, facilities, programming, participants, and marketing.

A diverse financial portfolio was needed to support all the necessary work. Dr. Joel Heinen took over the directorship from Jack Parker (retiring) and began an ambitious fundraising program. Heinen knew that much of the restoration work necessary could not be done by student volunteers, due to potential safety hazards associated with the work; therefore, contracted professionals with protective equipment and heavy machinery were needed. Heinen established a $100,000 endowment for preserve maintenance and later, with help from others, worked to persuade the university administration to create a full-time position housed within the Office of University Sustainability, which significantly increased support for Nature Preserve operations (dedicated staff time and budget, other supporting administrative staff, office and storage space, access to a fleet of vehicles, etc.). Additional interns and project grants were also sought. The increased staff and budget from FIU and other sources enabled preserve development to occur rapidly in the following years.

The facility improved steadily over the next several years. The primary goals were to clean up the site following decades of neglect, develop an attractive exterior and safe interior, and create a planned infrastructure of trails and facility amenities that met the intended users' interests. Work began with relatively inexpensive yet deliberate restoration and landscaping projects. A previously hidden lake, obscured from sight by massive, exotic *Schinus terebinthifolia* Raddi (Brazilian Pepper) trees, was revealed (Cochrane 2011b) and the area was revegetated to display a variety of freshwater wetland plants (Martinez 2015). The *Pinus* (pine) trees overtaken by tropical hardwood trees were exposed to their full potential as a small example of critically endangered pine–rockland habitat. In one area, understory vegetation was cleared and the soil excavated to display remarkable geologic formations. An underutilized and unattractive roadside swale for stormwater retention was replanted as a demonstration cypress dome; this project may have been the first of its kind (Fig. 1). In partnership with the adjacent dormitory and student affairs department, the Preserve and abutters installed large directional signs, entrance signs, and maps (Fig. 2) at every trailhead, interpretive educational signs along each trail, and several hundred tree tags to identify the most interesting plant species. An old trail entrance was redesigned to be a welcoming gateway between the nature preserve and the adjacent student residence hall (Parkview; Giller 2014), and the former fitness course was replaced with modern outdoor exercise equipment, all linked by a recycled-rubber jogging path (Fig. 3) with outdoor lighting (Fernandez

Figure 1. Stormwater swale landscaped as a demonstration "cypress dome" on the southern edge of the FIU Nature Preserve. Photograph © Thelma Velez.

Figure 2. Map of FIU Nature Preserve posted at each of its entrances.

2013a, b). The entire exterior façade of the preserve was also improved with decorative garden beds, properly pruned shade trees, benches, and trash cans.

Programming was greatly expanded to include more topics of interest to a wide audience. FIU Nature Preserve staff worked with many faculty from various university departments (including those mentioned in Table 1), as well as teachers from nearby community colleges and grade schools, to develop an extensive collection of field-based environmental education activities to be used with children and adults on site and off campus. Many of these lessons are related to natural-resource management and include topics such as surveying flora and fauna; land-use planning; endangered-species management for in situ and ex situ conservation; invasive, exotic species control/eradication; ecological restoration of native ecosystems; and the creation and analysis of wildlife-specific habitat elements (shallow wetlands, debris for refuge and foraging, pollen/nectar sources, soil chemistry). Programs were organized by age/grade level, time required, level of physical activity, topic, number of participants, and several other variables to allow adaptation for groups with diverse skill levels. All Nature Preserve programming had previously been related only to the natural sciences, despite the growing increase and demand for teambuilding and outdoor recreation/exercise activities. New plans included a greater emphasis on developing physical fitness opportunities (Giller 2013) through collaboration with the university center for leadership and service (e.g., low-ropes activities, teambuilding workshops, trust exercises), university recreation center (e.g., outdoor personal-training sessions, fitness bootcamps, 5-km runs), athletic arenas (e.g., baseball-player volunteering, soccer player cross-training, football tailgating), and many university fitness clubs (e.g., faculty walking club, martial arts clubs, running clubs, and cancer/disease awareness groups).

Historically, participation in all Nature Preserve activities was limited to students within only 2 university departments—environmental studies and biology—it was now available to anyone. Any department/teacher/entity/individual could now request an event/field trip at the Nature Preserve, or for Nature Preserve naturalists to come to their location and give a presentation or run an activity for their group. Student service-learning activities have always played a critical role in raising environmental awareness, building community, and providing much needed maintenance at the preserve (Leonor 2012, Maruri 2014), yet the volunteer program

Figure 3. FIU Nature Preserve south entrance with cypress dome in background behind cork fitness trail and bench on left, trail on right. Photograph © Alexander Zuleta.

Table 1. A partial list of subject activities carried out in the Nature Preserve by FIU classes grouped by subject area and course. [Table continued on next page.]

Subject area	Activity or project	FIU courses involved
Art and Art History	Drawing, painting, sculpture creation and staging	Artistic Expression (Global Learning Seminar), Drawing (multiple levels), 2D Design, Visual Thinking
Biology	Guided walks, observations on diversity, form and function of living things	General Biology, Introductory Botany, Human Biology
Botany	Guided walks, exercise on how to ask research questions, plant identification, plant collecting to make herbarium specimens or for detailed study in the lab	Introductory Botany, Local Flora, Plant Life-Histories, Tropical Botany, Tropical Plant Taxonomy, Medical Botany, Economic Botany
Ecology and Environmental Studies	Guided walks to observe examples of different habitats; sampling vegetation for diversity study; mark–recapture techniques for population estimation; using baits to estimate ant abundance, activity, and implications for protection of plants with extrafloral nectaries; measuring predation rates of birds on caterpillars using clay models; topographic mapping; soil characterization and analysis; examination of competition, ecotypic differentiation, phenotypic plasticity, plant dispersion, predation, seed dispersal, and tritrophic interactions.	Ecology, Ecology of South Florida, Evolutionary Ecology, Plant Ecology, Applied Field-Ecology, Limnology, Microbial Ecology, Introduction to Environmental Science, The Global Environment and Society, Resource Pollution
Education	Guided walks to observe diversity of organisms and learn about local habitats, examination of butterfly host-plants and study of life cycle, butterfly gardening, and planning for the creation of schoolyard gardens and habitats	Elementary Education, Early Childhood Education, Exceptional Student Education, Secondary Science Methods, Graduate Science STEM Certificate Program K–5 and 6–8
History	Human plant-use and mythology	World Civilization

Table 1, continued.

Subject area	Activity or project	FIU courses involved
Interdisciplinary/Honors/Liberal Studies	Nature observation, journaling, writing and sketching in nature journals, nature contemplation	"The Everglades" course, Nature Teaching, 1st- and 2nd-year Honors courses, Inhabiting Other Lives, Hearts Art Club
Microbiology	"Natural soil" samples for the isolation of bacterial viruses (phages)	HHMI supported SEA PHAGES lab course
Physical Education	Nature's gym activities using trees and landscape features to exercise and build strength; peaceful location for quiet activities; track for walking, jogging, and running	PantherFIT group fitness classes, most notably Wellness in the Woods, Yoga, Meditation, and Boot Camp
Zoology	Guided explorations, field observations, behavioral experiments, specimen capture for examination and release	Herpetology, Ornithology, Animal Behavior, Behavioral Ecology, Entomology
Graduate workshops in Biology, Earth, and Environmental Studies	Herbivores associated with various species of plants, light-trapping of insect prey (bat food), predator–prey systems associated with garden vegetables, floral visitors of numerous species, bromeliads and their tank-occupying guests, plants and insect mutualists, the fate of caterpillars in hurricanes, host-plants of various Lepidoptera, fungal fruiting bodies and their inhabitants, pre-dispersal seed predators of native plants, butterflies discerning previous visitation of flowers, and tracking floral visitor movements with fluorescent powders	Natural History Techniques in Insect/Plant Interactions, Field techniques in Pollination Biology, Wetlands Plants, Nutrient Analysis, Field Biology Methods

from which the Nature Preserve was forged in the 1970s had undergone little change in all that time and needed to be updated. The preserve began to publicize volunteer opportunities to more people, streamline registration and allocation of volunteer credit, make more information readily available online beforehand, and properly document participation. Preserve staff developed a volunteer day manual, and staff was scheduled to make volunteering in the Nature Preserve efficient, legitimate, and transparent. These efforts led to increased participation from a level of about 250 volunteers in 2010 to an average of 750 volunteers each year thereafter (FIU 2016). Additionally, the internship program originally developed in the 1980s underwent some major changes; more attention was devoted to intern recruitment, training, and planned daily work activities, and interns were provided with training in management and social skills (budgeting, graphic design, public speaking), science knowledge and experience, and offered opportunities to obtain technical professional certifications (first aid, CPR, golf cart license, wildlife handling license, arborist certification). Not only were there now more event participants, volunteers, and interns, but these people came from more-diverse backgrounds, and included faculty, staff (S. Garland 2015), retirees, alumni, government agencies (Cochrane 2011a), elementary/middle/high school students (Perez 2013), graduate students, Greek (McCoach 2013) and other student organizations, students from various majors (Cantero 2015), on-campus housing students, and student athletes (FIU 2013).

Prior to 2010, the Nature Preserve had no marketing plan; in fact, the area did not even have an official name and was referred to by different names depending on the source. In 2010, the “FIU Nature Preserve” appellation was adopted, with hope that a simple name would be recognizable and memorable. A website was created to provide information to volunteers, but the site quickly grew to provide much more. Traditionally, Nature Preserve information was available only on paper flyers posted in the biology and environmental studies departments. The new strategy was to reach out more widely via use of departmental websites, affiliate websites, social media, news articles, and many public presentations on and off campus about the facility and its programs.

Outcome

Preparing our contribution to his special issue of the *Southeastern Naturalist* prompted us to reflect on the journey of the FIU Nature Preserve and its importance in providing opportunities for natural history education and health improvement for our students and the surrounding community. The efforts in the preserve exemplify how scientists and non-scientists can work together to accomplish conservation of a small but important natural area. Despite the political environment of the university during this period when most remnant tracts of green space on campus became building sites for large edifices, many projects were implemented at the Nature Preserve that led to its acceptance as an established university facility.

Though visitor statistics were not formally collected between 2010 and 2014, the unprecedented growth in the number and kind of participants was apparent to many university students and employees, particularly Nature Preserve staff. Visitation in all years prior to 2010 was always low (considering FIUs large enrollment), estimated to be less than 1000 visitors per year. Almost all visitors prior to 2010 were FIU students; now 31% of annual visits are made by FIU employees and external unaffiliated visitors. Prior to 2010, most preserve use was for academic purposes, and now only 15% of current visits are made for that reason. In 2015, a visitation study recorded 30,586 visits for the year, a dramatic increase from the estimated visitation prior to 2010 (FIU 2015d).

During this period of growth, the Nature Preserve was recognized with 8 awards and certifications from various local environmental organizations for its impact within the local community (Powell 2014, Vogel 2015). Having a diverse group of stakeholders, including seemingly unrelated departments (Garcia 2013), was helpful in the development and rejuvenation of the FIU Nature Preserve. Students majoring in the natural sciences as well as other areas all learned alongside one another about South Florida ecology. We suggest that by making activities fun for college-aged students, Nature Preserve staff were able to impart a sense of environmental ethics upon these young adults, regardless of their academic background. Visiting and learning became so enjoyable that once word began to spread, it was contagious, and more people than ever wanted to personally experience the FIU Nature Preserve.

Many FIU courses have incorporated environmental education and field trips to the preserve into their curricula (Table 1). Extensive plant and animal surveys were conducted that documented 15 state threatened, 12 state endangered (including *Ipomoea microdactyla* Griseb. [Calcareous Morning-glory] and *Jacquemontia pentanthos* (Jacq.) G. Don [Skyblue Clustervine]), and 1 federally endangered species (*Amorpha herbacea* Walter var. *crenulata* (Rydb.) Isely [Clusterspike False Indigo]) among a total of 266 plant species (FIU 2015c). Each professor has found her or his own innovative way to use this outdoor laboratory: an outdoor field lab for science courses; a backdrop for design development for architecture courses; inspiration, studio, and exhibit space for art classes; practice and performance areas for drama and music classes; and a tool for modeling active learning methods and good teaching for education courses. Many faculty find this outdoor classroom to be conveniently located, offering experiential learning opportunities beyond what any other classroom or laboratory on campus can provide. One professor who has been teaching an upper-division interdisciplinary course titled "The Everglades: From Beginning to End?" since 1997 described his use of the Nature Preserve:

> "The initial class always takes place in the FIU Nature Preserve, where students first use their binoculars and field guides, and where we begin to discover the characteristics of the various Everglades habitats … It really is a magical location on campus, which has that chance element to it, just as the natural Everglades does … a juvenile Cooper's Hawk trying to catch a Gray Squirrel in a Live Oak … a great beginning to our year-long course, and students are often surprised that such a location exists at FIU!" (P. Machonis, Modern Languages and Honors College, FIU, Miami, FL, pers. comm.)

The Nature Preserve has also been utilized by a number of graduate students in the sciences for their thesis or dissertation research (Geiger 2007, Matthews 2009, Sanchez 2014, Scharnagl 2013). Graduate students who study plant–animal interactions in native habitat fragments may wish to carry out their experiments in this outdoor laboratory because it is a good place to conduct plant manipulations over the course of several days or around-the-clock with the involvement and help of undergraduate student assistants. One student studied the effects of leaf damage on extrafloral nectar production and ant recruitment (Jones and Koptur 2015), and another student is investigating the effect of urbanization on community structure, organization patterns, ecomorphology, and social networks of *Anolis* (anole) lizards. Forensic scientists have utilized soil samples for their research (Jantzi and Almirall 2011), and agricultural researchers have found seed-borne pathogens that may be used to control exotic pest-plants (Shetty et al. 2011). FIU science and environmental education students have used the preserve as a place to conduct experiments; one investigated the potential benefits of different experiential education methods (issue investigation, deep ecology experience, and service learning) versus traditional lecture methods of teaching (Matthews 2009). That study demonstrated that by being actively involved in the process of learning, students learned more and usually had more-favorable attitudes toward the natural world.

One student newspaper author described their feelings in the newly renovated nature preserve:

> "… while I jogged, the feeling became almost heavenly. I was around nature, breathing fresh air while listening to songs and exploring this new mystery that lay before me … these pathways appear to be quite inviting as they leap into the middle of the forest and hence provide an amazing opportunity for adventure … I would recommend everyone to check out the forest because it really is inspiring and brings you close to nature after a whole week of stress, work, and assignments" (Shehryar 2013).

Conclusion

After the many improvements described above, and as evidenced by a 30-fold increase in visitation, FIU Nature Preserve has become a popular destination for fitness, recreation, environmental education, and simply enjoying its beauty (Delgado 2014; Editors, FIU News 2013; Fernandez 2015; Garland 2013; Graham 2015; Herrera 2015). We suggest that by seizing this opportunity to teach our students outside and letting them actively participate and engage with the local environment around them, they can begin to understand and conceptualize the vast complexities of global environmental change (Thomashow 2002). Now integrated into the academic and social fabric of the university (D. Garland 2015), the FIU Nature Preserve is clearly an important resource for the university and surrounding community. We hope that the preserve will be secure and safeguarded from development for future FIU students to use, study, and enjoy for many years to come.

Acknowledgments

The authors thank Ryan Vogel for his major contributions to this manuscript. We also thank all the faculty, staff, students, and administrators of Florida International University who helped during any part of the establishment of the FIU Nature Preserve, including but not limited to: the Office of University Sustainability, Department of Environmental Studies, Department of Biological Sciences, Facilities Management and Housing, Recreation Services, and Student Affairs. We appreciate many colleagues for sharing information about their use of the Nature Preserve, including Ligia Collado-Vides, John Cozza, Robert Frye, Joel Heinen, John Kominoski, Hong Liu, Peter Machonis, John Makemson, George O'Brien, Brian Peterson, Mike Ross, Seema Sah, Gretchen Scharnagl, Kathleen Sparrow, Philip Stoddard, Jeff Wells, and others. We are grateful to the following agencies and companies for donating necessary resources: Florida Forest Service, Miami-Dade Department of Environmental Resource Management, Fairchild Tropical Botanic Garden, Florida Fish and Wildlife Commission, National Park Service South Florida/Caribbean Network, US Geological Survey, University of Florida Institute of Food and Agricultural Sciences, Baptist Health of South Florida, Aramark, Florida Native Plant Society, M and M Landscaping, True Tree Service, Hangmen Inc., Karin Designs, Kelly's Tropical, Monte's Equipment, Precision Signs, Silent Native Nursery, and Veber's Jungle Garden. We also thank Alana Edwards, editor Scott Markwith, and an anonymous reviewer for constructive criticism that improved the manuscript. This is Publication Number 323 of the Tropical Biology Program at Florida International University.

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