The Great Outdoors: An ArcGIS Approach Integrating Geographic Knowledge and Environmental Education in Florida

David Riera, Department of Earth and Environment, Florida International University

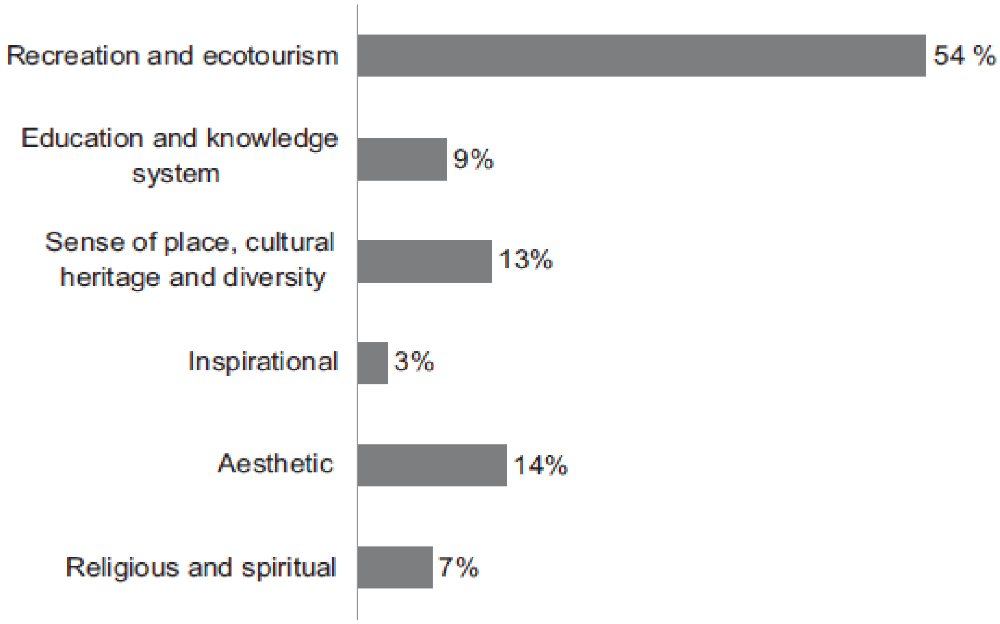
Abstract

The outdoors provides opportunities to experience nature first-hand, serving as a critical alternative to traditional educational facilities for community members and stakeholders to acquire a more intimate understanding of what natural resources are, while becoming increasingly aware of their interconnectedness with those resources. It is used as a tool by researchers, educators, resource managers, and government officials in demonstrating "hands-on" methods that vastly enhance any curriculum by simply moving outdoors. The outdoors as a classroom can radically enrich an educator's prospects to diversify concepts and teach skills, objectives, models, and results introduced in either Powerpoints, research articles, or textbooks. In this study, we identify where public schools intersect with government parks within a five-mile radius and aquatic preserves within a one-mile radius. According to the 2014 census in the state of Florida, there are currently 7,423 K-12 schools and institutions of higher education. We report that of those schools, only 536 schools are within a five-mile radius of a government park and 524 are within a one-mile radius of an aquatic preserve. As a result of this study, we make the case that these protected areas should be integrated into institutional curricula for the aforementioned benefits. Moreover, this will facilitate the passing of cultural knowledge to the emergent generation of environmental stewards and Floridians, enhancing both the stakeholders' worth and the environments' intrinsic value. We conclude that incorporating these habitats and natural resources into institutional and community-wide activities can be economical and sustainable.

Keywords: Parks, Experiential Learning, Cultural Ecological Knowledge, Stewardship

Introduction

The natural world is often perceived as a separate entity from our society, health, and economy, when in fact, it is an integral part of our growth, survival, and evolution as individuals, as a species, and more importantly as a civilization. Indeed, these natural spaces provide a wide variety of ecosystem services which are critical in supporting human life (Daily, 1997). The ecosystem services (ESS) framework enables us to illustrate the vital connections between environmental and human systems (Schägner et al., 2013) (Figure 1). These services have been identified to enhance and benefit mankind through various contributions of the structures and functions of each unique ecosystem to human well-being (Burkhard et al. 2012). In this context and under the Millennium Ecosystem Assessment (MEA) published in 2005, ESS have been described and placed into four categories: provisional, regulatory, supporting, and recreational/cultural. Each category is characterized by a grouping of ecological functions; for instance, provisional ESS are considered to "provide" humans with such fundamental needs as food, potable water, fuel, fibers, and medicines. The regulatory services account for climate, flood, disease, and water filtration regulation across the globe. The supporting services primarily contribute to nutrient processing and recycling, formation of soils/organic substrates, and primary production, all of which play a very vital role in sustaining our food systems. Lastly, the recreational ESS is correlated to the social value, i.e. aesthetic, spiritual, cultural, and educational significance. By crossing the threshold of any government managed park (GMP) or aquatic preserve (AP), we, the stakeholders, are directly redeeming the benefits of these ESS.



Percentage of cultural service indicator categories.

Figure 1. Above is a summarized illustration wherein Hernández-Morcillo and colleagues (2013) classified (using Millennium Assessment terminology) cultural services identified across 200 studies into 70 indicators. These were further compartmentalized into six specific indicator areas which revolve around the *recreational* ecosystem service description as identified by the MEA (2005).

This study's aim is to reveal the abundant recreational ESS opportunities that communities across the state of Florida can and should take advantage of, while getting familiar with the great outdoors (Rios and Brewer, 2014) (Figure 1). Each social value previously recognized can be focused through the lens of education (Gondwe and Longnecker, 2015, Park and Riley, 2015, Chawla, 2015). Historically, nature has been humankind's most effective teacher; for example, all indigenous (tribal) civilizations utilized the land to extract daily provisions (water, food, wood, and medicinal plants) (Brookfield, 2015). Each tribe was and could still be considered an environmental steward within their region, complete with their ancestral lands' cultural knowledge of terrain, water sources, and an extreme familiarity with a variety of local and transient species of flora and fauna. Numerous tribes, prior to European influences, managed to develop intimate understandings and attributes which led them to cultivate (i.e. farm) their native lands to become effective food producers and land managers (i.e. the Aztecs, the Maya, the Navajo, and including our local Seminoles) (Moore, 2014, Rossier and Lake, 2014, Sturtevant and Cattelino, 2004). Today, we continue to glean this type of knowledge due to tribal elders and chiefs entrusting their descendants with their tribes' vast cultural knowledge, meaning that tribal youths and young adults were educated by engaging in frequent interactions with the natural world around them (Quigley, 2009). The environment to many historical and emergent indigenous tribes has merited spiritual and aesthetic devotion. As a major category within the greater ESS framework, recreational services which nature provides can and have been valued by private, governmental and non-governmental organizations alike, but with opposing agendas. This has led to the fragmentation and deterioration of native habitats, threatening the survival and existence of a number of species, ultimately pushing these ecosystems well past their thresholds/"tipping point" (Plagányi et al., 2014, Andersen et al., 2009, Adams, 2013).

Preventing, mitigating, and/or completely halting further degradation of our global and local natural capital cannot be solely accomplished by researchers alone. Marshall and colleagues (2011) coined the term *Action Ecology*, referring to the need for a novel and integrated approach where scientists would work and develop strategies alongside a diverse community of stakeholders. Chapin and colleagues (2011) would further identify these stakeholders, including non-expert members of the community (i.e. practitioners, hobbyists, and many other professionals from related disciplines). Both authors agree that the solution with the greatest efficacy to succeed is based upon integrating disciplines, forging committed partnerships, and most importantly incorporating local/cultural forms of knowledge to each solution. Furthermore, Marshall and colleagues (2011) do specifically recommend that the description of stakeholders needs to include youths/young adults in order for them to foster and develop intimate/personal relationships with the ecosystems around them; preparing them for future collaborations and career pathways with non-governmental agencies, environmental advocates, policy-makers, existing stewards, and educators. Krasny and Tidball's (2012) study concluded by illustrating how interconnected environmental and social outcomes can truly be when urban communities choose to merge, self-organize, and utilize civic ecological practices in ways that will augment and enhance any ecological conservation, restoration, and educational initiative or agenda (i.e. Ecological Society of America's Earth Stewardship and Action Ecology) throughout the globe.

Environmental initiatives and programs, like the ones mentioned above, succeed and progress because individuals, groups, and entire communities decided to 1) expose themselves to the out-of-doors, 2) engage/embrace nature, and 3) learn to develop intimate relationships with local ecosystems and their stakeholders (Rios and Brewer, 2014). Identifying, introducing, and implementing outdoor educational curriculums further supports and provides hands-on (experiential) learning opportunities that include interdisciplinary approaches which unify both environmental (ekistic and ecosystemic relationships) and adventure (intrapersonal and interpersonal relationships) educational paradigms (Priest, 1986). Contemporary environmental and ecological education programs are principally delivered at indoor classrooms, especially across the United States, due to institutions' dependence on multimedia technologies as vehicles for cognitive improvement and understanding.

Experiential learning both as a tool and an educational model can and has addressed the previously mentioned disparity, especially in the natural sciences. Experiential learning theory (ELT) emphasizes the critical role of transformative experiences in driving developmental and educational processes, where both multilinear and holistic models support our understanding of how humans and numerous other species grow, learn, adapt, and evolve (Kolb and Kolb, 2012). Kolb and his colleagues represented this theory as a four stage cyclic model, which elaborated on the ELT as the following: 1) a concrete experience occurs when the individual has a new experience or reinterprets an existing one, 2) a reflective observation delves into the process where experiences are reviewed and evaluated to distinguish inconsistencies between understanding and experience, 3) an abstract conceptualization provides individuals with the ability to reflect upon their experiences to learn new ideas and modify unclear (emotional) concepts, and 4) an active experimentation challenges the learner to plan and execute what they have just assimilated from the previous three phases (Kolb, 1984). This cyclic process can be categorized as a processing and perception continuum which can add to an individual's fundamental cognitive structure, augment educational experiences, and enhance social environments.

Experiential education programs have long been touted as vital components of standard educational curricula, particularly outdoor environmental activities such as field trips (Morag, Tal, and Rotem-Keren, 2013). This study further strengthens Kolb's ELT, because students could develop a rich environmental awareness through an inquiry-based approach (students in the field could contextualize their experiences and implement action plans based on theoretical knowledge to solve environmental problems). Therefore, participants acquired a deeper, more intimate relationship with the outdoors, enhancing their potential for lifelong learning. This change in attitude has been integrated within a psychological framework, elucidating cognitive benefits of experiential education towards improving poignant interdisciplinary issues which are presently affecting society, such as human well-being (obesity, post-traumatic stress syndrome, and dyslexia), educational achievement deficits, and stewardship of the natural world (MacKenzie, Son, and Hollenhorst, 2014). This has led to the generation of novel and dynamic allied programs (i.e. combining scientific curriculums centered around field activities with recommended exercise). Belgrave and Berry (2016) report on the efficacy of such programs in enhancing psychological well-being, repressing negative behaviors, treating anxiety and depression, and promoting TEK to enhance underrepresented students' physical (asthma) and mental health (self-esteem). The literature illustrates myriad instances where experiential learning has created and fostered unique learning opportunities and has been utilized as a holistic therapy to combat deleterious health issues while motivating, inspiring, and producing a new generation of environmental stewards (Evans, Ching, and Ballard, 2012; MacKenzie, Son, and Hollenhorst, 2014; Belgrave and Berry, 2016). Studies continue to indicate that spending time outdoors improves mental and physical health (Hartig et al., 2014; Sandifer, Sutton-Grier and Ward, 2015).

In this study, we aim to acknowledge and bridge subtle gaps in the educational process. Moreover, the findings of this research will demonstrate that it is imperative and almost effortless to connect or reconnect with nature, by simply "stepping outside." Lastly, we will reflect and provide recommendations in favor of novel environmental education opportunities, enhanced implementation strategies, and reintroduction/fortification of indigenous/native cultural ecological knowledge specifically focused in the state of Florida.

Methods

Spatial analysis was processed by utilizing GIS software. Current park and preserve location data was accessed and collected from Florida Geographic Data Library (Florida GIS clearinghouse website) and imported into GIS. Florida school location information was accessed and collected from the Florida public school database website and imported in GIS. Once summary tables were generated using mapping software, census tracts were designed to illustrate and develop two essential relationships: 1) school densities by Florida counties (67 counties in Florida) versus actual locations of GMPs and APs, and 2) location of Florida ecological management zones (EMZ) (Florida is divided into 34 EMZs (Florida DEP)) (Figure 6) versus densities of schools which lie within these ecosystem boundaries. State defined boundaries denoting ecological regions, anthropogenic biomes, and their buffer areas, or EMZs, are described as parcels of terrestrial and aquatic habitats which share common but not homogeneous environmental conditions (microclimates) consisting of, but not limited to, similar temperatures, moisture, mean rainfalls, and soil fertilities which typically indicate the likely distributions of flora and fauna populations (Simon et al., 2005, Izeta, 2010).

The state of Florida contains over 7,423 educational establishments (and growing), including kindergarten to twelfth grade (K-12) and other numerous institutions of higher learning (colleges, universities, and vocational/trade schools) (UFGC). All base maps were accessed from ESRI through GIS and primarily incorporated for the purpose of visual referencing of geographic features (i.e. boundary lines for counties and EMZs). Also, GIS was employed to further illustrate the geographical locations and borders of currently recognized government (federal, state, and local) managed parks and marine/aquatic preserves/protected areas. The buffer tool in GIS was used to extend and intersect the borders of identified terrestrial parks about five miles off center and aquatic preserves about one mile off center. The differentiated buffer zones were selected to capture schools that may be considered coastal (within one mile of an aquatic preserve, i.e. the coast) and to ensure that buffers would extend beyond the boundaries of the terrestrial park to incorporate the surrounding educational centers. Thus, while the buffer for the terrestrial parks is set at five miles from the centroid, many of the schools falling within this buffer zone are actually much closer to the outer bounds of the park.

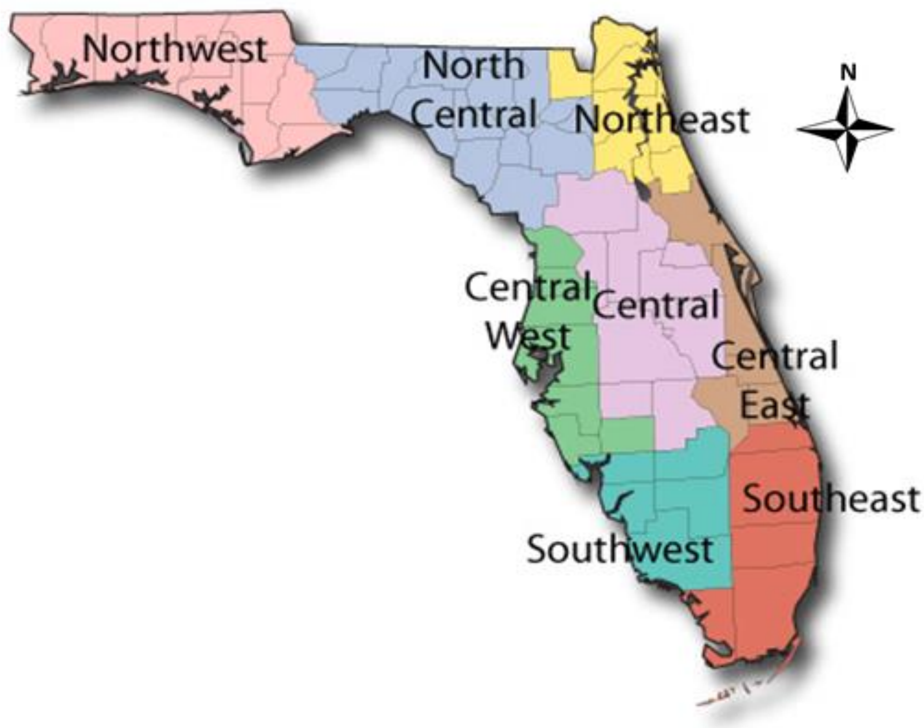


Figure 2. Illustrates a categorical map of the State of Florida, adapted from FDRP, 2015. This is presented here as a conceptual outline to further relate this study's recommendations of multidisciplinary efforts and cross-county cooperatives (especially, in terms of schools that persist at the fringes of these geographical boundaries and sometimes legal limits). Florida is separated into eight nationally recognized districts which mostly encompass related national, state, and county parks. The color code on this map is not relevant, but understanding these districts and where the boundaries are located is vital. The significance is that boundary lines on a map identify geographical limits, not physical or ecological barriers, further fortifying the conclusions and future directions of this study.

The small distance was selected to highlight to school officials and students that protected areas were both close enough to walk to, thereby promoting cardiovascular health on school campuses, and eliminating the argument that field trips are economically unviable due to transportation costs. The schools that are found in the buffer zone represent the average student's ability to bike less than five miles (based on an average 8-12 mph biking speed) to a terrestrial preserve and walk one mile (based on an average 2.7 mph) to a coastal one, thus requiring only an approximately 30-minute travel time from the school (National Center for Safe Routes to School, 2016).

Lastly, GIS analyses were conducted by relating academic institutions' and GMPs' geographic locations to each other, using a five-mile buffer circumference to illustrate GMPs (with camping sites). Similarly, we related academic institutions and AP geographic locations to one another, using a one mile buffer circumference to show APs. Both maps were generated to define visually and quantitatively the density of educational establishments within an acceptable distance for citizens and students (youths, young adults, and adults) to walk, run, and or bike. For all additional data analysis, spreadsheet software was employed.

Data

Florida School Districts versus Nature and Aquatic Parks

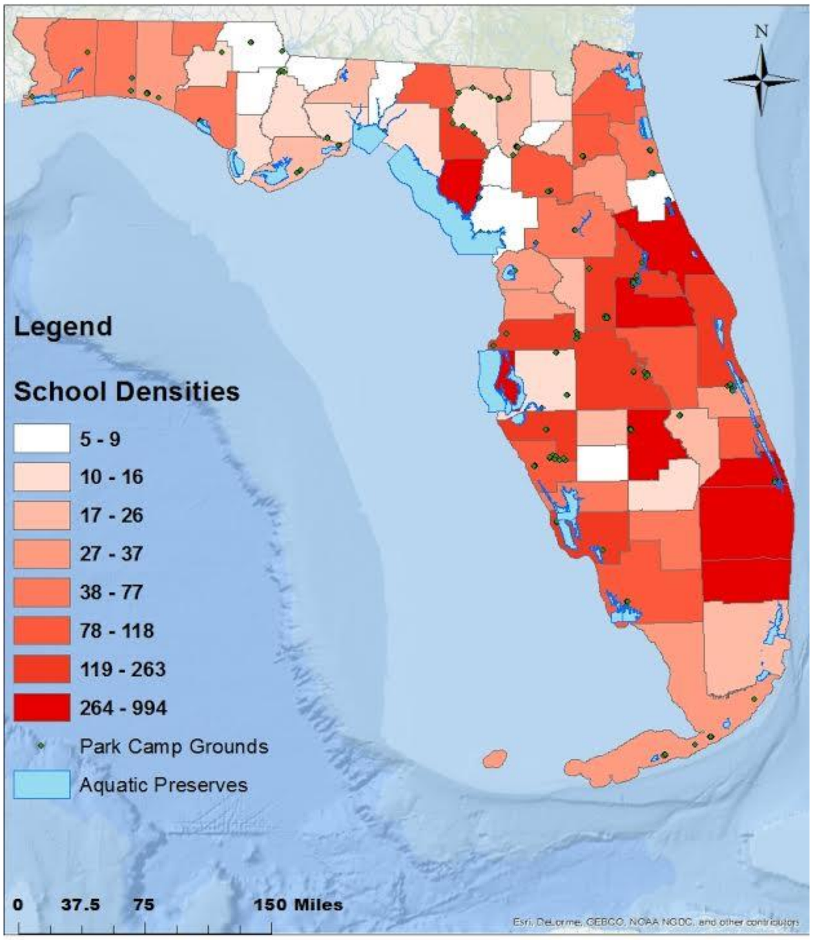


Figure 3. This is a geographical representation of the State of Florida, overlaid on a base map, subdivided into its 67 counties and labeled (serving as a primer for comprehending subsequent figures in this study). The color scale (white to shades of increasing red hues) was used to denote incremental changes in educational center densities by county area (therefore, some counties may have many schools but an equally vast land area, while others have small land areas but still have numerous schools). The legend illustrates parks with campgrounds (i.e. parks that can be visited and be camped at) as green dots with a black border and aquatic preserves are identified by a blue surface area surrounded by a solid darker blue border. These borders recognize the existing expanse of the aquatic preserves.

Figure 4. This is a geographical representation of the State of Florida, subdivided into its 67 counties. The color yellow was used in the overlaid map as a neutral base to better denote points of importance on this map. The legend illustrates related schools (i.e. institutions that lie within a five-mile radius of the parks) as green dots with a black border and nature camp areas are identified by an open circle with a solid green border. These borders are GIS buffer zones, delineating a five-mile radius from park centers to encapsulate proximal educational institutions. Moreover, when two park buffer zones overlapped, GIS calculated the intersections and joined the areas together as a union while maintaining the five-mile buffer zones.

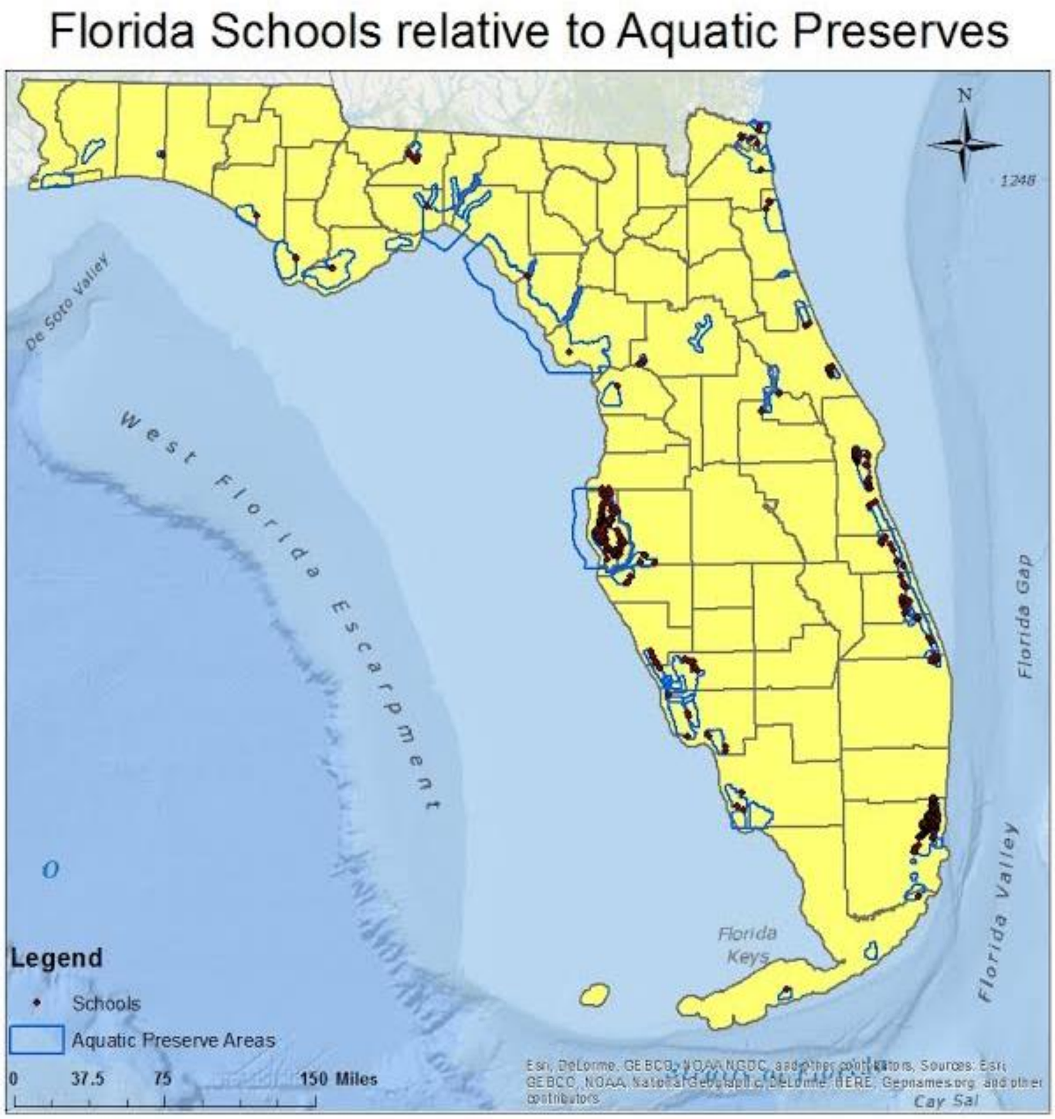


Figure 5. This is a geographical representation of the State of Florida, subdivided into its 67 counties. The color yellow was used in the overlaid map as a neutral base to better denote points of importance on this map. The legend illustrates related schools as black dots with a black border and aquatic preserves are identified by open polygons with solid blue borders. These borders are GIS buffer zones, delineating a one mile radius from preserve boundaries to encapsulate proximal educational institutions. Moreover, when two preserve buffer zones overlapped, GIS calculated the intersections and joined the areas together as a union while maintaining the one mile buffer zones.

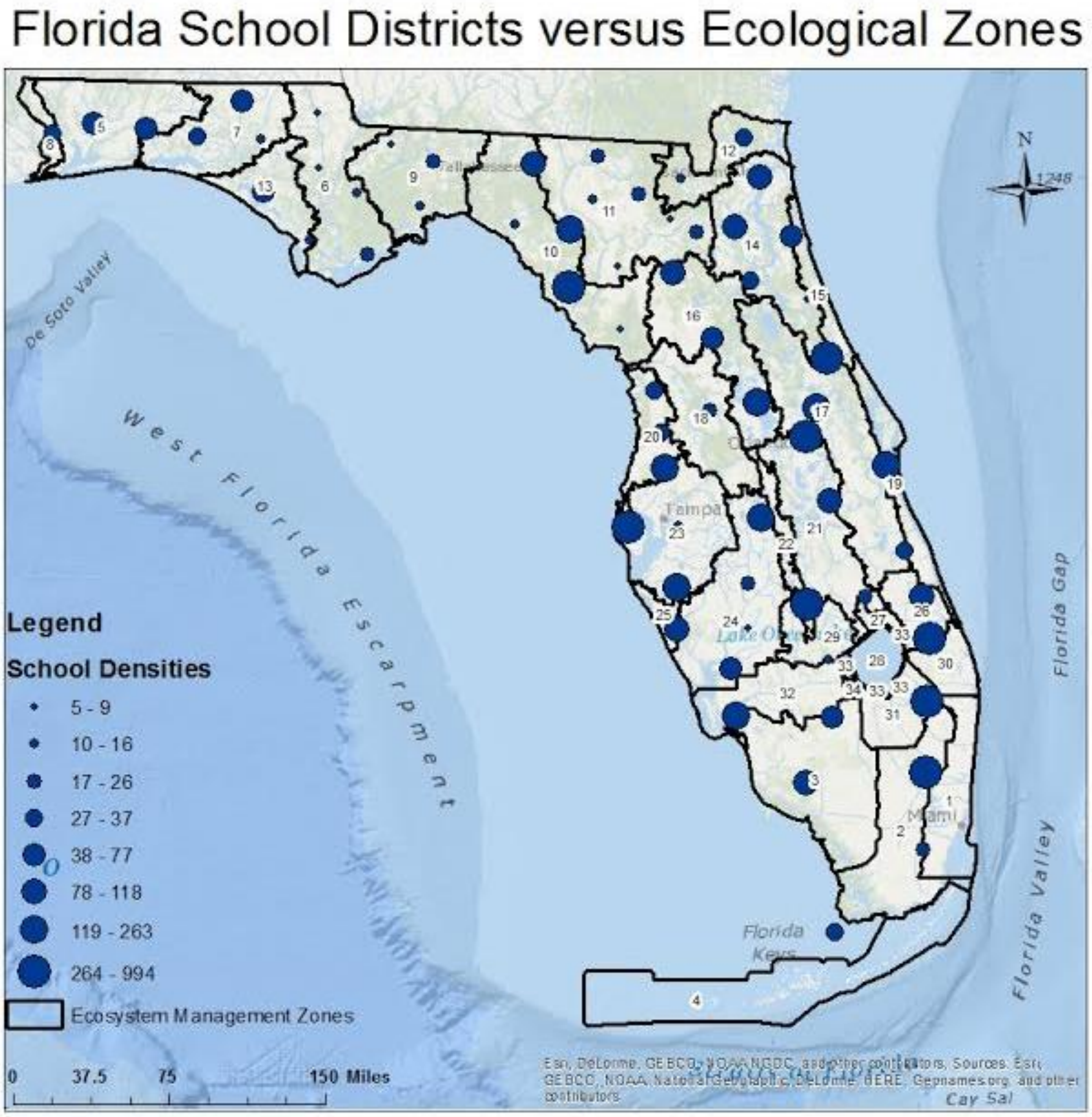


Figure 6. This is a geographical representation of the State of Florida, subdivided into its 34 EMZs and labeled. This is a *base map* from GIS' library with no overlay to better highlight the importance of this map. The circle scale (in blue) was used to denote educational center densities within related EMZs (therefore, some EMZs may have many schools but an equally vast land area, while others have small land areas but still have numerous schools). An enlargement in diameter of the circles represents an increase in school densities, while a reduction in circle diameter indicates a decrease in school densities. EMZ boundaries are distinguished as solid black lines.

Conclusions

The state of Florida recognizes and hosts a total of 7,423 educational establishments of which 4,295 are registered and supported as public schools (USDoE, 2014). There is a total of 4,335 primary (K-5), secondary (6-12), and postsecondary (trade schools, colleges, and universities) institutions eligible to receive state funding; the remaining 3,088 schools are privately owned and operated (including emerging charter schools). A geographic analysis in GIS of Florida academic center locations revealed that the following five counties contained the highest density (number of institutions per square mile per county) of schools: Martin (994), Orange (624), Broward (560), Highlands (475), and Dixie (394) (according to decennial U.S. census data, 2010). Furthermore, these counties manage various wilderness, park, and greenspaces which are supported through national, state, and city funds.

Florida, at the state level, is subdivided into eight districts of interest as follows: Northwest, North Central, and Northeast, encompassing an area from the Florida panhandle to Jacksonville (omitting Ocala and De Land); Central West, Central, and Central East, accounting for an area from Clearwater to Titusville (west to east) and Ocala to Okeechobee (north to south); Southwest and Southeast, approximating an area from Punta Gorda to Miami (west to east) and Moore Haven/ Stuart to Key West (north to south). Fundamentally, we can relate longitudinal boundaries to simplify the above into three geographical sections: northern (31^o to 29^o N), central (29^o to 27^o N), and southern (27^o to 24^o N). Martin and Broward are located in the southern reach, Orange and Highland are in the central location, and Dixie is situated in the northern range. EMZ's in Florida, as previously discussed, are agreed upon environmental boundaries that encompass certain counties (Figure 2); for example, both Martin and Broward are listed in the South Florida EMZ, Southeast district (includes 1, 2, 26,27, 28,30 and 31); Orange and Highlands counties are listed as Upper St. Johns River EMZ and South Florida EMZ respectively, Central district (includes 16, 17, 19, and 21); and Dixie is listed under the Nature Coast EMZ, North Central district (include 9, 10 , and 11). Lastly, through GIS mapping, we identified a set of three 33 EMZ's and one 34 EMZ, which are centralized around Lake Okeechobee at the fringes between other noted EMZs, but it remains unclear which district is responsible for their management. This ambiguity might be perceived due to Lake Okeechobee's location at the intersection of the central, central east, southeast, and southwest districts.

Based on this study's results, the highest school densities correspond to the following districts: southeast, central, and north central. Moreover, this study revealed 206 state and national conservation areas (SNCA); of these, there are approximately 69 camp-able parks and 41 state protected aquatic preserves. When taking into consideration the location of these nature areas within the context of their corresponding EMZ's, we noticed that in the southeastern district there are 23 SNCAs (including Jonathan Dickinson, Seabranch Preserve, and St. Lucie Inlet in Martin county; Hugh Taylor Birch and John U Lloyd in Broward county); in the central district we identified 13 SNCAs (including Wekiwa Springs in Orange county; Highlands Hammock and Lake June in Winter Scrub State Park in Highlands county); while the north central district did have an abundant diversity of SNCAs (about 35) we could not detect any terrestrial state parks in Dixie county. We did, however, illustrate that Dixie county's entire Gulf coast is recognized as an aquatic preserve (including both Manatee Springs and Big Bend

Seagrasses State Aquatic Preserve). Dixie is also the steward of the St. Mark's and Lower Suwannee National Wildlife Refuges, Deadman's Bay, Horseshoes Cove, and Suwannee Sound.

In this study, we further elucidate that within five miles of the aforementioned parks there are 536 educational centers in proximity (i.e. physically and economically accessible), which account for approximately 7.22% of all Florida academic institutions. Alternatively, 524 educational centers are located within one mile of illustrated aquatic preserves, accounting for 7.10% of all Florida academic institutions. Lastly, through this GIS analysis, note that Lake Okeechobee's recognized EMZs and unclear fringes does show at least eight school counties that from an ecosystem services perspective are receiving quantitative and qualitative benefits from its myriad functions. Therefore, future collaborative efforts between those counties can positively support the protection, conservation and restoration of one of the largest freshwater sources in Florida which is strongly interconnected with the health and stability of the Everglades and the communities which depend upon it (Ingebritsen et al., 1999; CERP, 2000; Aumen et al., 2015; Schmidt, Cai, and Mechler, 2015).

Within the scope of this study, the aim was to substantiate geographically that throughout much of Florida, educational centers are within physical and economical accessibility of "the Great Outdoors" (i.e. land based parks and aquatic preserves) within a distance of one to five miles of the identified academic institutions. Furthermore, this GIS analysis revealed that Florida counties have long standing EMZ agreements which fosters county collaborations and an exchange of knowledge, experience, and materials. We will address some of the broader implications and provide recommendations for establishing promising pathways for students and educators to develop or re-develop relationships with the outdoors, provide novel environmental opportunities to prevent the further loss of cultural ecological knowledge, describe and integrate experiential learning engagements into academic professional curriculums, and cultivate future environmental stewards, especially within the pre-existing Floridian EMZs' boundaries (Figure 2). Ultimately, this study and others would argue that most recreational ecosystem services are increasingly successful at fostering human well-being considering decreasing or gentrified rural and cultural landscapes.

State natural conservation areas are ideal proving grounds for re-establishing this critical human connection. The Florida state park system alone has an annual visitation of over 20 million people (FPS, 2011). A demographic study by Outdoor Industries Association (2012) indicates that 51% of Florida residents utilize green spaces for their recreational service value (approximately 10,524,857 stakeholders). Additionally, Hernández-Morcillo and colleagues (2013) identified cultural ecosystem services across the literature and categorized them into six indicator areas, reporting 54% of existing studies developed and quantify the recreational aspect of ecosystems, followed by cultural heritage (13%), education (9%), and inspiration (3%) (Figure 1). Addressing this disparity in Florida will require local action; students and teachers in the K-12 institution statewide account for 2,737,396 individuals, meaning residential visitation to state parks can be increased by nearly 26% by incorporating students and teachers. Areas where school density (and the number of students) are high, such as Broward and Orange counties, could incentivize students to visit these SNCAs to support the park system economically and create experiential learning opportunities that would serve to bolster the less developed indicators above. Moreover, the future of sustainable land management and nature conservation is bound to our awareness of cultural ecological services and their socio-cultural value to human well-being.

Future Research

While this study focuses its implementation recommendations locally in Florida, it is noteworthy to mention that a major finding of Tengberg and colleagues (2012) suggested filling the gap between the vastly promoted ecosystem service approach (as defined by the MEA and implemented by the Convention on Biological Diversity, United Nations Convention to Combat Desertification, Convention on Migratory Species, and the Ramsar Convention on Wetlands) with the less valued heritage research and cultural landscape approach described by both UNESCO Conventions for the Safeguarding of the Intangible Cultural Heritage and on the Protection and Promotion of the Diversity of Cultural Expressions (also practiced by both World Heritage Conventions and the European Landscape Convention). Ultimately, future directions must integrate traditional scientific disciplines to conserve nature and cultural heritage at its intersection.

In the context of the present study, the emphasis placed on students and their families visiting parks within reasonable walking, running or biking distances can counter the growing obesity epidemic (Skinner and Skelton, 2014). It is recommended that individuals engage in moderately intense physical activities for no less than two hours and thirty minutes per week (AHA, 2013). While this can be completed through numerous ten minute sessions, to enhance their physical and mental health, we argue that community members could achieve this prescribed goal by walking to their GMPs or APs (Irvine et al., 2013; Owen et al., 2014). Using the schools as a *starting point* an individual could either briskly walk at a pace of four miles per hour, thereby reaching a GMP within 75 minutes and an AP within 15 minutes (remember GMPs are located at a maximum of five miles and APs are located at a maximum of one mile). Thus, making one weekly round trip to their local GMP or five to their local AP would significantly improve their health and well-being. Again, this study primarily recommends that school administrators and faculty partner with identified/proximal GMP and AP managers and rangers to support their students' community service learning projects, incentivize them to attain greater levels of physical engagement, and ultimately develop and guide the new generation of naturalists, environmental advocates, and stewards.

As mentioned previously, a multidisciplinary approach is required to ameliorate many Floridian environmental impacts, making collaboration between students both within and outside the institution a vital process to their intrinsic growth and their communities' development, while maintaining Floridian ecological areas across related county borders and safeguarding the planet one steward at time. Through the use of global information systems, like GIS, researchers, managers, and planners can conduct spatial analyses to identify and design various social and academic experiences for themselves, families, and communities. Anthropocentric perceptions of the natural world frequently separate it from our society, health, and economy. This study suggests more than ever that it is the substrate from whence we grow, progress, adapt, and evolve as children, students, and more importantly, as a diverse culture of environmental caretakers and stewards.

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References

Adams, M. A. (2013). Mega-fires, tipping points and ecosystem services: Managing forests and woodlands in an uncertain future. *Forest Ecology and Management*, *294*, 250-261.

American Heart Association (AHA). (2013). "Walking 101." Accessed May 1, 2016 http://www.heart.org/idc/groups/heart-public/@wcm/@fc/documents/downloadable/ucm_449259.pdf

Andersen, T., Carstensen, J., Hernandez-Garcia, E., & Duarte, C. M. (2009). Ecological thresholds and regime shifts: approaches to identification. *Trends in Ecology & Evolution*, *24*(1), 49-57.

Aumen, N. G., Havens, K. E., Best, G. R., & Berry, L. (2015). Predicting ecological responses of the Florida Everglades to possible future climate scenarios: Introduction. *Environmental management*, *55*(4), 741-748.

Belgrave, F. Z., & Berry, B. M. (2016). Community Approaches to Promoting Positive Mental Health and Psychosocial Well-Being. In *Handbook of Mental Health in African American Youth* (pp. 121-140). Springer International Publishing.

Brookfield, H. (2015). *Shifting Cultivators and the Landscape: An Essay through Time*. In Cairns, M. (Ed.). *Shifting cultivation and environmental change: Indigenous people, agriculture and forest conservation* (25-61). New York: Routledge.

Burkhard, B., de Groot, R., Costanza, R., Seppelt, R., Jørgensen, S. E., & Potschin, M. (2012). Solutions for sustaining natural capital and ecosystem services. *Ecological Indicators*, *21*, 1-6.

Chapin, F. S., Power, M. E., Pickett, S. T., Freitag, A., Reynolds, J. A., Jackson, R. B., ... & Bartuska, A. (2011). Earth Stewardship: science for action to sustain the human-earth system. *Ecosphere*, *2*(8), 1-20.

Chawla, L. (2015). Benefits of nature contact for children. *Journal of Planning Literature*, 0885412215595441.

Comprehensive Everglades Restoration Plan (CERP). (2000). http://www.cerp.org. Accessed November 2005. http://link.springer.com/article/10.1007/s11077-006-9027-2

Daily, G. (1997). *Nature's services: societal dependence on natural ecosystems*. Island Press.

Dennis Jr, S. F., Wells, A., & Bishop, C. (2014). A Post-Occupancy Study of Nature-Based Outdoor Classrooms in Early Childhood Education. *Children Youth and Environments*, *24*(2), 35-52.

Evans, E., Ching, C. C., & Ballard, H. L. (2012). Volunteer guides in nature reserves: exploring environmental educators' perceptions of teaching, learning, place and self. *Environmental Education Research*, *18*(3), 391-402.

Florida Department of Environmental Protection (Florida DEP). "FDEP Ecosystem Management Areas." Accessed May 1, 2016. http://www.fgdl.org/metadataexplorer/explorer.jsp

Florida Division of Recreation and Parks (FDRP). (2015). Retrieved April 15, 2016, from http://www.dep.state.fl.us/parks/

Florida Park Service (FPS). "Florida Park Service Volunteer Handbook - Winter 2011 Revision " Accessed May 1, 2016.

https://www.floridastateparks.org/sites/default/files/Division%20of%20Recreation%20and%20Parks/documents/Vol_Handbook_Winter2011.pdf

Gondwe, M., & Longnecker, N. (2015). Scientific and cultural knowledge in intercultural science education: Student perceptions of common ground.*Research in Science Education*, *45*(1), 117-147.

Hartig, T., Mitchell, R., De Vries, S., & Frumkin, H. (2014). Nature and health. *Annual Review of Public Health*, *35*, 207-228.

Havens, K. E., & Steinman, A. D. (2015). Ecological responses of a large shallow lake (Okeechobee, Florida) to climate change and potential future hydrologic regimes. *Environmental management*, *55*(4), 763-775.

Hernández-Morcillo, M., Plieninger, T., & Bieling, C. (2013). An empirical review of cultural ecosystem service indicators. *Ecological Indicators*, *29*, 434-444.

Hillman, C. H., Erickson, K. I., & Kramer, A. F. (2008). Be smart, exercise your heart: exercise effects on brain and cognition. *Nature reviews neuroscience*, *9*(1), 58-65.

Ingebritsen, S. E., McVoy, C., Glaz, B., & Park, W. (1999). Florida Everglades: Subsidence threatens agriculture and complicates ecosystem restoration. *Land subsidence in the United States. Circ*, *1182*, 95-106.

Irvine, K. N., Warber, S. L., Devine-Wright, P., & Gaston, K. J. (2013). Understanding urban green space as a health resource: A qualitative comparison of visit motivation and derived effects among park users in Sheffield, UK. *International journal of environmental research and public health*, *10*(1), 417-442.

Izeta, A. D. (2010). Ecological Zones. In B. Warf (Ed.), *Encyclopedia of Geography* (p. 844). Thousand Oaks, CA: Sage Publications, Inc.

Krasny, M. E., & Tidball, K. G. (2012). Civic ecology: a pathway for Earth Stewardship in cities. *Frontiers in Ecology and the Environment*, *10*(5), 267-273.

Kolb, A. Y., & Kolb, D. A. (2012). Experiential learning theory. In *Encyclopedia of the Sciences of Learning* (pp. 1215-1219). Springer US.

Kolb, D. A. (2014). *Experiential learning: Experience as the source of learning and development*.

FT press.

Louv, R. (2008). *Last child in the woods: Saving our children from nature-deficit disorder*. Algonquin Books.

Marshall, K., Hamlin, J., Armstrong, M., Mendoza, J., Lee, C., Pieri, D., ... & Bailey, J. (2011). Science for a social revolution: ecologists entering the realm of action. *The Bulletin of the Ecological Society of America*, *92*(3), 241-243.

Mackenzie, S. H., Son, J. S., & Hollenhorst, S. (2014). Unifying psychology and experiential education: Toward an integrated understanding of why it works. *Journal of Experiential Education*, 1053825913518894.

Millennium Ecosystem Assessment. (2005). *Ecosystems and human well-being*. Washington, DC

Moore, Jerry D. (2014). *Origins and consequences of agriculture in South America*. In Moore, J.D., *A Prehistory of South America: Ancient Cultural Diversity on the Least Known Continent* (131-171). Boulder, CO: University Press of Colorado.

Morag, O., Tal, T., & Rotem-Keren, T. (2013). Long-Term Educational Programs in Nature Parks: Characteristics, Outcomes and Challenges. *International Journal of Environmental and Science Education*, *8*(3), 427-449.

National Center for Safe Routes to School (NCSRC). What distances are reasonable to expect elementary school students to bike to school? (2016). Accessed February 27, 2017. http://www.saferoutesinfo.org/program-tools/what-distances-are-reasonable-expect-elementary-school-students-bike-school.

Outdoor Industries Association. (2012). "The Florida Outdoor Recreation Economy Report." Accessed May 1, 2016. https://outdoorindustry.org/images/ore_reports/FL-florida-outdoorrecreationeconomy-oia.pdf

Owen, N., Salmon, J., Trost, S., Dunstan, D., Eakin, E., Healy, G., ... & Shilton, T. (2014). Sedentary behaviour and health: Strengthening the evidence base. *Journal of Science and Medicine in Sport*, *18*, e131.

Palomo, I., Martín-López, B., Potschin, M., Haines-Young, R., & Montes, C. (2013). National Parks, bufferzones and surrounding lands: mapping ecosystem service flows. *Ecosystem Services*, *4*, 104-116.

Park, M. H., & Riley, J. (2015). Play in natural outdoor environments: A healthy choice. *Dimensions of Early Childhood*, *43*(2), 22-28.

Plagányi, É. E., Ellis, N., Blamey, L. K., Morello, E. B., Norman-Lopez, A., Robinson, W., ... & Sweatman, H. (2014). Ecosystem modelling provides clues to understanding ecological tipping points. *Marine Ecology Progress Series*, *512*, 99-113.

Plieninger, T., Dijks, S., Oteros-Rozas, E., & Bieling, C. (2013). Assessing, mapping, and quantifying cultural ecosystem services at community level. *Land use policy*, *33*, 118-129.

(Priest, S. (1986). Redefining outdoor education: A matter of many relationships. *The Journal of environmental education*, *17*(3), 13-15.

Quigley, C. (2009). Globalization and Science Education: The Implications for Indigenous Knowledge Systems. *International Education Studies*, *2*(1), 76-88.

Rios, J. M., & Brewer, J. (2014). Outdoor education and science achievement. *Applied Environmental Education & Communication*, *13*(4), 234-240.

Rossier, C. and Lake, F. (2014). Indigenous Traditional Ecological Knowledge in Agroforestry. *Agroforestry Notes*, *44*.

Sandifer, P. A., Sutton-Grier, A. E., & Ward, B. P. (2015). Exploring connections among nature, biodiversity, ecosystem services, and human health and well-being: Opportunities to enhance health and biodiversity conservation. *Ecosystem Services*, *12*, 1-15.

Schägner, J. P., Brander, L., Maes, J., & Hartje, V. (2013). Mapping ecosystem services' values: Current practice and future prospects.*Ecosystem Services*, *4*, 33-46.

Schmidt, M. F., Cai, J., & Mechler, S. E. (2015). A Fast-Track, Multi-Benefit Solution for Lake Okeechobee and Everglades Restoration. *Proceedings of the Water Environment Federation*, *2015*(15), 5051-5060.

Simon, S. A., Collins, T. K., Kauffman, G. L., McNab, W. H., & Ulrey, C. J. (2005). *Ecological zones in the Southern Appalachians: First approximation*. US Department of Agriculture, Forest Service, Southern Research Station.

Skinner, A. C., & Skelton, J. A. (2014). Prevalence and trends in obesity and severe obesity among children in the United States, 1999-2012. *JAMA pediatrics*, *168*(6), 561-566.

Sturtevant, W. C., & Cattelino, J. R. (2004). Florida Seminole and Miccosukee. *Handbook of North American Indians (Southeast)*, *14*, 429-449.

Tengberg, A., Fredholm, S., Eliasson, I., Knez, I., Saltzman, K., & Wetterberg, O. (2012). Cultural ecosystem services provided by landscapes: assessment of heritage values and identity. *Ecosystem Services*, *2*, 14-26.

University of Florida Geoplan Center (UFGC). "Florida Public and Private Schools 2012." Accessed May 1, 2016
http://www.fgdl.org/metadataexplorer/full_metadata.jsp?docId=%7B6D62CEF6-9809-4FB3-8703-5C6B98C4C378%7D&loggedIn=false

U.S. Department of Education (USDoE), National Center for Education Statistics, Common Core of Data (school-level data), 2013-14.

Warren, K., Roberts, N. S., Breunig, M., & Alvarez, M. A. T. G. (2014). Social Justice in Outdoor Experiential Education A State of Knowledge Review. *Journal of Experiential Education*, *37*(1), 89-103.

Williams, D. R., & Dixon, P. S. (2013). Impact of garden-based learning on academic outcomes in schools synthesis of research between 1990 and 2010. *Review of Educational Research*, 0034654313475824.