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**A STUDY OF NATURE PLAY SPACE SUSTAINABILITY IN THE PIEDMONT  
REGION OF MARYLAND**

by

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## **ABSTRACT**

Most of the United States population lives in urban areas, where heightened anthropogenic activity acts as a source of the majority of greenhouse gases (Hoorweg, 2011). Adaptive ways to deal with regional land management efforts need to be addressed in an effort to combat the effects of spreading urbanization (Roling, 1997). A positive environmental ethic is developed through children's regular contact with nature, as well as substantial nature-based play (Bunting and Cousins, 1985). This paper proposes targeting the age when children first begin developing their bond with earth to harness a generation of environmentally conscious thinkers that will integrate sustainable practices in their behaviors and careers (Sobel, 1994). The most rapidly urbanizing region of Maryland, the Piedmont, can be studied to discern the present-day perspectives of best sustainable practices for naturalization of outdoor spaces specifically targeted to children ages four to seven years old in that area.

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**1****Introduction**

The environmental issues facing society today are growing more numerous. Whether you are concerned with the implications of climate change and the global warming debate (National Climate Assessment, 2014), energy production and consumption (Bin and Dowlatabadi, 2005), urban heat islands (Huang, Zhou, and Cadenasso, 2011), pollution of the Earth's water, air, and land (Peng et. Al, 2004), loss of biodiversity (Barbier et. al 2006), human reproduction rates leading to overpopulation (Hurlbert, 2011), or the impact of consumerism on the production and treatment of waste (Smart, 2010), answers to each respective environmental challenge can be found in the field of land management. By responsibly regulating the use and development of land resources today, humankind can increase quality of life for current and future generations.

Desertification, deforestation, polar ice melting, and erosion are just a few of the easily identifiable, immediate threats addressed by land management experts and a wide range of environmental scientists, but there is also a need to think of long-term dangers that arise from unsustainable land use. To create an overall sustainable future, land management choices must be made to serve the planet and its inhabitants (Jepson, 2010). By tapping into this scientific field of knowledge, it is possible to achieve goals on educational, societal, political, and economic levels that prove to have lasting benefits. A popular phenomena to investigate when speaking of land management, and one that is of useful study to scientists, is the trending increase in the proportion of populations living in urban areas.

There is a global trend of pervasive, rapidly spreading urbanization as shown by World Bank data reporting the percent of urban population for each country since 1980. The latest data set shows that 81% of the U.S. population now lives in urban areas, which is accompanied by a decline in rural populations (World Bank, 2014). These high and concentrated population densities, coupled with increased industrialization and construction, provide perfect conditions for human-induced landscape changes to lead to environmental degradation (Pickett et. al, 2010). Because there are so many people living in densely populated areas, these places display heavy consumerism habits, profuse use of fossil fuel energy, and emission of the majority of the world's greenhouse gas, (GHG), due to the many buildings developed and used in these areas (Hoornweg, 2011). In spite of the negative environmental effects urbanization tends to display, this paper will explain how this phenomena can be manipulated into an opportunity for the scientific community, namely environmental educators, to accomplish the goal of providing the public with the knowledge and skills to act in environmentally responsible ways.

The counties of the Northeast Mid-Atlantic region have been subjected to urban sprawl, with 21% being categorized as urban based on population density (Kaza, 2012). These jurisdictions experiencing rapid urbanization may feel the urgency to enact policies that protect the provision of public goods like preservation of open space, but in doing so inadvertently contribute to urban sprawl (Hardie and Lichtenberg, 2007). Studies suggest that sprawl patterns of new development tend towards areas of undeveloped land rather than centralizing in already existing high density urban locations (Bockstael and Irwin, 2004). Therefore, it is important that issues of sustainability be addressed in the context of economic, political, institutional, and legal parameters so that all possible variables are

considered before making land changes that degrade the environment (Kruseman et. al. 1996). Essential to the sustainable management of land is the use of an adaptive method, over the attempt to control biophysical processes, that allows for continuous probing, monitoring, and adjustment of our interventions (Roling, 1997). There is a need to supply environmental specialists such as educators, managers, and field technicians with skills such as environmental data collection as well as economic sustainability context and practices that can apply to data gathered from the field, thus reinforcing the effectiveness of multidisciplinary research techniques in environmental science. In addition, policymakers need to be cognizant of the complexities of sustainability ingenuities like zero waste programs and building new green spaces, so coordination between research experts, corporate leaders, and policymakers is effective, but even more so to find impactful ways to promote environmental mindfulness and keep nature accessible for our citizens in the face of spreading urbanization.

With so much of the nation becoming concentrated in metropolitan areas, it is possible to provide environmental education programs to large numbers of children more efficiently, and fuel a new era of proper management that will help regional planning and conservation efforts become more economically and ecologically sustainable in the future (Platt, 1994). David Sobel (1996), who studies children's cognitive development and who has had a large part in the development of the philosophy of place-based education, suggested that the first stage of development for bonding with the Earth occurs in early childhood, during ages four to six. His research identified the two elements necessary for influencing children to develop into environmentally responsible adults, namely being taught by an adult to respect nature, and creating a vivid and sentimental memory of a

wild place in childhood (Sobel, 2008). In support of place-based environmental education, studies show that an individual's connection to a natural setting is significantly related to environmentally responsible behaviors, as this emotional affinity leads to more empathetic and altruistic nature-protective actions (Vaske and Kobrin, 2001, Mayer and Frantz 2004). Furthermore, a person's eco-psychological self, or environmental identity, is developed in place-based settings rather than indirect or vicarious learning experiences (Kellert, 2002). A child's environmental identity is how they perceive themselves in relation to the context of the natural environment and their experiences in it (Clayton and Opatow, 2003). Research addresses the importance for sufficient early opportunities in nature prior to age 11 (Wells and Lekies, 2006) because by the time student reach age 10, they are actively searching for information and forming attitudes towards wildlife (Westervelt and Llewellyn, 1985). The best time to cultivate a person's environmental identity is in the "development window of opportunity" between early and middle childhood when children develop understandings of the plant and animal world (Kals and Ittner, 2003). A strong environmental identity corresponds to later career choices to preserve nature (Bixler and Floyd, 1997). It is this stage that should be a primary focus for environmental educators in order to have the maximum impact on young lives.

The children of today must be considered and actively recruited to fill future environmental positions that discover sustainable solutions to the planet's growing list of environmental concerns, and therefore youth and adolescents especially, need to be exposed to the natural environment early in childhood to develop an appreciation for the resources they use, as well as environmental stewardship behavior and understanding (Ernest and Theimer, 2011). The most pertinent action that can be taken is to integrate

nature activities into schools, and research shows that a positive environmental ethic is developed through children's regular contact with nature, as well as substantial nature-based play (Bunting and Cousins, 1985). Even federal organizations have adopted the mission of instilling concern and care for nature in children across America. The National Wildlife Federation (NWF) established a Certified Wildlife Habitat program which encourages the public to create mini-habitats for native fauna in schoolyards and backyards (NWF, 2014). It becomes apparent when comparing childhood experiences amongst various generations that children are becoming increasingly removed from nature. Current generations are beginning to seek outdoor experiences for themselves and their children because of this realization, which is beneficial to environmental education because childhood experiences in nature have been shown to create a large potential for manifestation into the long-term benefit of adult environmental stewardship (Chawla & Derr, 2012). Even so, if society intends to conserve and restore North America's natural resources, then it must become standard in education to make sure that students know their connectedness to the ecosystem in which they live because small-scale grassroots efforts alone cannot provide enough political power to institutionalize such thought.

## 1.1 PURPOSE

By the end of the 20<sup>th</sup> century, environmental education made school grounds naturalization a forerunner in its worldwide initiatives. These projects are an attempt to employ ecological restoration techniques to reintroduce indigenous flora and return the area to its natural state (Hutchinson, 2004). The purpose of this study is to investigate and report the present-day perspectives of sustainable practices for naturalization of outdoor spaces specifically targeted to children ages three to five years old within the Maryland

Piedmont region. The sustainable nature of these areas, coupled with the potential and importance of reaching this age group, creates the need for a merger of the currently available resources, research, and ways of thinking in the field into a comprehensive report that can be referenced by a wide range of audiences who may employ this educational tool. For this age group, the outdoor spaces are designed to encourage unstructured play and are defined as nature play spaces. Here it is important to define the meaning of “nature play space” as it has many synonymous terms but is different from the environmental education tool known as “outdoor classrooms”.

The Department of Natural Resources defines a nature play space as a space intentionally designed to integrate natural components into a place for structured and unstructured play and learning (DNR, 2014). These spaces are specifically designed for children in pre-elementary education or younger because they invite outdoor activity such as places to explore, sit, and investigate. Terms that are also used in reference to these sites include natural play areas, or greenscapes (Hynson, 1989). Outdoor classrooms, in contrast, are intentionally designed for structured learning outside and provide an experiential component to classroom curriculum (Riordan and Klein, 2010). These are more so teaching-learning spaces that supplement institutional curriculum. Sometimes an outdoor classroom is described as a naturalized outdoor learning environment (OLE), or specially certified sites like Wildlife Habitats, or Nature Explore classrooms, are considered as a sub-segment of the larger outdoor classroom category (Parsons, 2011).

Whichever term is used, outdoor classrooms and nature play spaces alike produce beneficial community resources, are constructed in locally sustainable ways, and yield educational value without compromising the quality of these spaces for future

generations. The difference simply lies in the goal of providing either unstructured play to children, or classroom instruction outdoors after early education. Therefore, when describing sustainable practices for the physical naturalization and educational use of nature play spaces, the research considers all data whether participants refer to projects specifically categorized as outdoor classrooms, or whether participants describe experiences with nature play spaces specifically. This research project also uses the terms synonymously. Though the research supports nature play spaces explicitly, it is not unexpected that children can also engage in structured learning in these places as well, making data regarding outdoor classrooms equally relevant to the study. The notion that nature play spaces could persevere as environmentally neutral, and effective teaching tools throughout the entire education of a child and even beyond into higher education (Marcum, Marquez, Gill, and Medved, 2011), makes these spaces worthy of continuous research developments and standardized use in educational institutions (Fjortoft, 2001; Lippiatt, 2007). This study will address the financial, and educational benefits and complications of nature play space installment. The research will produce a resource with qualitative data supporting the effectiveness and importance of nature play spaces as environmental education tools, and eventually the findings should advocate for increased support of nature play space construction projects across the state of Maryland.

The research elucidated the dominant characteristics of nature play spaces in the Piedmont region of Maryland, the variable and reoccurring uses for public and private environmental education and community engagement, and ways in which sustainability of the space is addressed. It drew upon academic knowledge and current qualitative data to support the case for increasing the development of nature play spaces in the Maryland

Piedmont. The hypothesis was that nature play spaces serve as an economically resourceful, scientifically sound, and sustainable way to address the need for more environmentally literate populations.

## 1.2 RESEARCH QUESTIONS

The available research and advocacy material for increased nature play and sustainable practices is vast and readily available to those who seek it, yet this research intends to contribute new knowledge to the field by identifying regional phenomena within the Piedmont Region of Maryland via thematic analysis techniques. By doing so, not only will the research provide new advocacy and scientific support for the field, but this region of Maryland can be cited as an example of the current state of Mid-Atlantic nature play spaces.

Upon initial investigation, I targeted available literature regarding the process of brainstorming, land development, and diverse utilization of nature play spaces and outdoor classrooms, and measureable cognitive and affective outcomes for youth who learn and play in these spaces. In Maryland, numerous resources can be analyzed to provide information on the prevalence, financial challenges, diversity of designs, and various accreditations offered by government and private agencies to prospective builders. Therefore, in order to keep the overall purpose of the research on track and aid in relevant data collection, the following research questions were formulated to guide this study:

1. What are the characteristics of nature play spaces in the Piedmont region of Maryland?

2. What are the predominant uses of nature play spaces in the Maryland Piedmont?  
Are these uses the same for the general public?
3. How are issues of sustainability addressed in nature play spaces of the Piedmont region in Maryland?

Table 1 summarizes the data collection and analysis techniques that were assigned for each research question. The qualitative strategy of answering these research questions required the creation of questionnaires and interview questions which correlate to the three focal research questions. By adapting the surveys from the research questions, I hoped to assure that the collected data would be relevant to the research goals. As previously mentioned, there was an adequate amount of research literature describing what has been found in the field of environmental education and nature play spaces regarding academic and pro-environmental behavior improvement, but this research intended to identify the collective outlook and processes of environmental education centers, and private and government agencies in Maryland's Piedmont regarding the financial necessities and sustainable practices for building, utilizing, and maintaining nature play spaces. The inclusion of sustainability principles in the research serves to supplement the hypothesis that these spaces are practical economic choices and scientifically supported, as well as aid in the prospective builder's assessment of project attainability and site longevity.

## Literature Review

### 2.1 EARLY CHILDHOOD AND NATURE

The Chairman of the Children in Nature Network, Richard Louv, has been a convincing advocate for children's outdoor experiences. His national bestselling book *Last Child in The Woods* sparked a movement to reconnect children with nature because parents were alarmed to hear of "nature deficit disorder." Louv coined the term in his book, referring to personal costs that accompany the rising phenomenon of a strong disconnect of humans to nature, such as decreased quality of physical health and decreased ability to retain knowledge and apply focus to activities (Louv, 2008). He, like many other contributors, insists that children's access to outdoor play is, in fact, a civil right. In September 2012 the International Union for the Conservation of Nature (IUCN) passed a resolution promoting the inclusion of childrens' human right to experience the natural world within the framework of the 1989 United Nations Convention on the Rights of the Child (UNCRC). Today, there exists a widespread notion that the natural environment has intrinsic qualities that promote positive influences on physical and mental health, cognitive processes, and overall well-being (Bowler et al., 2010).

E. O. Wilson (1984) explained that the human connection to nature is innate when he first forwarded the concept of "biophilia" along to the public. This idea assumes there is a genetic, inherent desire for humans to feel a personal relationship with nature. This innate tendency suggests that nature supplies us with satisfaction beyond aesthetics and cognition, and we actually need a relationship with nature to feel intellectually and spiritually satisfied (Kellert and Wilson, 1993). The philosopher Thomas Berry (1999)

further explained that humans and nature are interrelated and interdependent on one another, therefore creating an inseparable link between the two.

### *2.1.1 Benefits of getting outside*

There are numerous studies showing that natural outdoor experiences induce beneficial physiological as well as psychological responses in humans of all ages, including increased recall abilities, reduced stress, and creative problem-solving (White and Stoecklin, 1998). When children play in natural settings, anti-social behavior like bullying is reduced, motor skills become advanced, cognitive development increases, and their development of imagination and creative inquiry is developed into a prerequisite for lifelong learning (Coffey, 2001; Louv, 1991; Pyle, 2002). Because environmental education is a holistic approach to environmental science education, all aspects of the child are developed including mental and social factors as well as physical. This informal type of learning reestablishes the child's connection to nature, which in turn develops competent levels of environmental literacy and the ability for pro-environmental decision-making (Dillon et al., 2005; Hudson 2001). Studies show that when children engage in imaginative and structured play in the outdoors, there is a significant increase in their environmental awareness, concern, and interest (Fjortoft, 2001; Chawla, 1988; Hart, 1997). Children must be allowed healthy development and plenty of self-directed learning, which most easily occurs when given free time outdoors. Not only is outdoor play a vital tool in the development of a child's eco-psychological self, but it also assists educators in creating well-rounded students (Miller et al., 2013). Research shows that schools and other education centers which adopt environmental education as the central

focus of their lessons have improved math, reading and science scores (Archie, 2003; Lieberman et al., 2005).

### *2.1.2 Framework for Maryland*

The Maryland Association for Environmental and Outdoor Education (MAEOE) began as grassroots efforts in 1985, but has grown into a leader and professional authority that provides training, conferences, workshops, awards, networking, and other resources to environmental educators throughout the state. MAEOE makes suggestions for the best management practices of “green schools” which could also apply to the use of outdoor classrooms as the most pertinent environmental concepts to teach in these spaces, including water conservation, energy conservation, solid waste reduction, habitat restoration, and responsible transportation (MAEOE, 2014). The first step in getting stakeholders, especially teachers, on board with an attempt to allow children substantive nature play is to build confidence in their ability to use the outdoors as a classroom where children learn through exploration and inquiry rather than verbal direction (Dietrich et al., 2012). MAEOE operates and assists the Maryland Green Schools Program (MDGS), which was founded in 1999 and integrates hands-on, inquiry based learning that helps schools meet the Maryland State Department of Education’s environmental literacy standards. This program promotes responsible environmental stewardship practices by integrating hands-on, inquiry-based instruction that will empower youth to apply sustainability knowledge at home, school, and in their communities. Being a part of these organizations helps Maryland schools increase recognition, secure funding, and have access to many educational resources across the country. Currently, 20% of schools in Maryland have this title, with a large portion located within Maryland’s Piedmont region.

In 2006, Richard Louv helped co-found the Children and Nature Network (C&NN). C&NN was founded to encourage and support the people and organizations working nationally and internationally to reconnect children with nature (Charles et al., 2009). The mission of this federal entity is to connect all children to nature using a variety of methods like providing resources, tools, and support. From this parent organization, the Greater Baltimore Children and Nature Network was created to specifically provide these resources to Maryland educators. The Maryland Department of Natural Resources is a key player in nature play space projects in Maryland. They provide nature play space resources, including safety, liability, and physical guidelines for the creation of these spaces on their website. In 2008, DNR established the Maryland Partnership for Children in Nature to further ensure every child direct experiences and connections with the outdoors. With such a far-reaching network of members as part of the Partnership, the avenues for funding and collaborative efforts becomes more extensive and more readily available to the public. Even further, all conceivable stakeholders have been considered and included in this group, which is a very commendable effort made by Governor Martin O'Malley. It provides that critical resource link between researchers, educators and organizations dedicated to children's health and well-being. This Partnership finds creative ways to get children outside and make environmental literacy a staple across curriculum. One such way they've done this is by collaborating with the Maryland Park Service to establish the Maryland Conservation Corps (MCC), which enlists youth for natural resource management and park conservation projects. The MCC was expanded in 2012 to introduce a Civic Justice

Corps, which is a summer program for at-risk urban youth to gain the skills to protect Maryland's natural resources.

Due to the implementation of the national "No Child Left Inside" Act which was first introduced in 2009, the federal government is now responsible for supporting the implementation of environmental literacy plans that include environmental education standards and teacher training. As a result, the Code of Maryland Regulations details instructions for environmental education and literacy in Title 13A. This includes a list of requirements for environmental education instructional programs for preschool through 12<sup>th</sup> grade. Of course, the Maryland Department of Education (MSDE) operates on a state and local level to carry out these legislative commands. Another occurrence in 2009 was Maryland's adoption of a "Children's Outdoor Bill of Rights." The document acknowledges nature deficit disorder as a real threat, and accepts the truth about the tangible benefits of frequent time spent outdoors. The Governor of Maryland mandated government action by proclaiming that every child in Maryland would have the opportunity to play and learn outdoors. The Governor set up a Nature Play Space Work Group under the Maryland Partnership for Children in Nature, and defined their direct responsibility to include creating nature play space areas within communities and creating outdoor classroom programs (CIN, 2008).

Biophilia provides a compelling rationale for the emergence of environmental education and literacy programs in schools. In addition to that case, incentives to naturalize schools are provided in the form of tax exemptions and grant money from state and federal resources (DNR, 2014). Formal education in K-12 schools and informal educational programs are tasked with the large responsibility of endowing students with

the necessary skills and knowledge for making responsible and productive environmental decisions. The simple act of learning outside brings relief to the mundane routine of traditional classrooms, but also has measurable effects on student performance and environmental literacy, specifically (McBeth and Volk, 2010).

## 2.2 MARYLAND PIEDMONT PLATEAU PROVINCE

Maryland is home to a wide range of different ecosystems and diverse areas representing six physiographic provinces. Starting at the Fall Line between the hard rock of the Appalachian Piedmont and the soft sediment of the Atlantic Coastal Plain is Maryland's Piedmont Plateau. It makes up about 29% of the state. The fertile valleys support agricultural land use in this region because it is deep, permeable, and well drained. The Piedmont is also known as Central Maryland, and encompasses what is known as the Baltimore Metropolitan Area. This area is ranked 20<sup>th</sup> largest by the U.S. States Office of Management and Budget on a list of North American metropolitan statistical areas. The Baltimore Metropolitan Area is comprised of Anne Arundel, Baltimore, Carroll, Harford, and Howard Counties as well as Baltimore City.

Maryland's temperate climate is relatively stable and mild. There is an average of 40-44 inches of precipitation a year in the Piedmont, with the northern portion tending to be cooler than the southern portion. Streams and river substrates in the Piedmont are typically formed by bedrock, and the relatively steeper gradient in this region results in faster moving water. These conditions result in water tumbling over rocks, which creates higher levels of dissolved oxygen in these streams (USGS, 1999). Studying the geology of the Maryland Piedmont region, as well as any region across the nation or globe, is

important for ecological reasons such as defining the abundance, distribution, and health of numerous different wildlife habitats.

### *2.2.1 Overview of attributes*

Maryland is also home to the largest estuary in the United States. The Chesapeake Bay itself is divided into numerous habitats of wetlands, rivers, and streams. Although a very productive ecosystem, the bay has been suffering from anoxic conditions due to sediment and nutrient loading, and has become a major focus of water quality improvement operations. This particular ecosystem is treasured historically and economically by the state, and should be included in each child's educational foundation in order to relay the importance of its presence for ecosystem services. One example of a bay problem that needs to be addressed by future generations is the anoxic conditions that have led to a detrimental decline in once flourishing oyster populations (Newell, 1988). Ongoing studies are attempting to remediate the anoxia because the ecological effects are widespread, and costing the state economically (Officer et al., 2012). It is necessary to recruit resourceful minds that can pursue environmental careers that investigate possible solutions to Chesapeake Bay management challenges on practical and academic fronts.

In addition to the Chesapeake Bay, Maryland scientists and environmental educators are also especially concerned with the health of the state's rivers because they carry terrestrial sediment and toxins to the Bay, affecting its overall health. Of main concern is the Susquehanna River, which is the Bay's largest tributary in terms of freshwater discharge, and nitrogen and phosphorus loading (Brady et al., 2013). Based on volume, the Susquehanna River is the nation's 16<sup>th</sup>- largest, and at 464 miles long it is the

longest on the east coast to drain into the Atlantic Ocean (Oladosu and Rose, 2007). The Susquehanna River basin drains thousands of square miles of Maryland land, and nutrient loading in surrounding agricultural areas is carried to the Chesapeake Bay by the Susquehanna River, contributing to summer time anoxic conditions.

### 2.3 NATURE PLAY SPACES

Certainly not a new idea, but taken for granted fifty years ago, nature play spaces are now gaining a large following and plenty of support (Clements, 2004). As previously defined, these spaces are designed specifically with unstructured outdoor play in mind, though they do not exclude structured learning as an activity which can occur in these areas. For preschool children, outdoor play is the main source of physical activity and the best opportunity to meet recommended physical activity requirements, as well as being the best opportunity to develop physically, socially, and mentally (Bahar et al., 2013). Nature play spaces provide an important and strongly influential element of informal learning about the environment at a young age through play (Rivkin, 1990). The use of nature play spaces as a major component of environmental education puts heavy focus on fostering eco-psychological development in children, which in turn, is found to impact positively the development of children's environmental stewardship values, and thus serves as an effective tool for the creation of environmentally conscious next generation of leaders (Sobel, 2004). Though learning becomes a subconscious benefit of these spaces, evidence shows that learning environmental concepts becomes more effective in nature-based contexts and results in higher incidences of pro-environmental behavior post program participation whether it is a full school year, a one week camp, or a one day event (Lieberman et al., 2000; Parrish et al., 2005). So although we are not aiming at

teaching children environmental stewardship in nature play spaces, they are able to attain those values just by playing in nature. In addition to increasing eco-friendly attitudes and behaviors, nature-based experiential learning also yields higher retention rates for knowledge in math, science, social studies, language arts, and fine arts, which contributes to the compelling need for more outdoor learning opportunities (Marks, 2000). Nature play spaces can prime children for future academic, personal, and professional success in the immediate and distant future.

Since early education does not teach raw cognitive principles, but rather helps the child develop physically, socially, linguistically, and emotionally it makes sense for early educators to allow children ample opportunity for play that enriches those developments (Pellegrini and Smith, 1998). Nature play spaces are an excellent way to sustain our natural environments and benefit human beings in return. They are also a way to show young children what an element of sustainable design looks like, so they will grow up understanding that architecture and the built environment can and should work with the natural environment rather than against it (Kleinman, 2009). These nature play spaces are a smart way to employ sustainable development techniques to the revitalization of early childhood play.

### *2.3.1 Brief History of the Playground*

What is now known as the National Recreation and Park Association (NRPA) began in 1906, with President Roosevelt serving as Honorary President (National Recreation Association, 1910). Today, this organization is the leader in advancement of public parks, recreation, and conservation. American psychologists and educators such as

John Dewey and G. Stanley Hall were influenced by Frederick Froebel who created the first kindergarten in Germany in 1837, and played a large part in instituting playgrounds for young children as fundamental for child development, and vital in the education process (Frost, 2012). In the early 1900s, Dewey emphasized periods for outdoor nature experiences, and other forms of natural activity. The late 19<sup>th</sup> century brought an emphasis on social factors of the play movement. During the Industrial Revolution, New York City prohibited playing in the streets by law and many children were forced to stand trial for disobedience; this led to what is known as the “Child Saving” movement (Gagen, 2001). In 1922, stages of playground development were identified, beginning with “sand gardens.” The first “model playground” in America was located in Chicago on three-quarters of an acre. It had sand piles, swings, building blocks, benches, and a small-sized baseball field.

A majority of playgrounds after the first “model playground” remained of similar design and function. The idea rapidly spread from place to place, and eventually equipment manufacturers tapped into the market. As a result, it was necessary to create a government agency that regulates playground equipment. The United States Consumer Safety Product Commission was created as recently as 1972, and regulates the sale and manufacture of all products that are not covered by the National Highway Traffic Safety Administration, Bureau of Alcohol, Tobacco, Firearms, and Explosives, or the Food and Drug Administration. The Commission published its first *Handbook for Playground Safety* in 1981. Some of the guidelines in the Handbook apply to nature play spaces, particularly “common sense” guidelines related to safety, but the use of completely natural material in a relatively undisturbed site does not require compliance with the

same standards as conventional public playgrounds. In many states today, school officials are not allotting time during the day for recess, which is given a minimum recommendation of 20 minutes per day for elementary school children by the National Association for Sport and Physical Education (Walker, 2012). In children and adolescents, regular physical activity is associated with physical and psychological health benefits, and the intensity of physical activity they engage in is dependent upon the surrounding physical environment; namely the perceived safety of the environment, supervision, and proximity to recreational facilities (Boonzajer, 2015).

### *2.3.2 Maryland Resources for Outdoor Play*

In addition to state government agencies like DNR and the Maryland Park Service, Marylanders can call upon federal organizations to assist in the pursuit of increased outdoor play for youth as well. U.S. Fish and Wildlife Services is one such entity, and sponsors the Schoolyard Habitat program. The program assists school communities in creating wildlife habitats that act as learning sites for wildlife conservation and cross-curricular learning.

There are other resources in Maryland that provide a foundation for nature play space assistance such as each county's Recreation and Parks Department. The Parks and People Foundation was established in 1984 in Baltimore and aims at lessening the government burden by raising and managing funds, and developing programs for the system of parks and recreation facilities in Baltimore and surrounding areas. For most counties, there is a Department of Planning that includes an Office of Sustainability which develops and advocates for programs, policies, and action to improve long-term environmental and economic viability of the county.

Additional resources for nature play spaces in Maryland include the Chesapeake Bay Trust which was created in 1985 to provide financial assistance to environmental education, community outreach, and local watershed restoration efforts through grant-making, National Oceanic and Atmospheric Administration (NOAA) whose roots go back to 1807 and mission is to enrich lives by keeping citizens informed about the environment around them, and Blue Water Baltimore which began as grassroots organizations in 2010 and now focuses on community based restoration, advocacy, and education to reestablish clean water in Baltimore watersheds. Also, the Chesapeake Bay Foundation established in 1967 is an independent conservation organization, the Nature Conservancy created in 1951 aims to conserve land and water, and the National Wildlife Federation created in 1936 specifically sought to unify outdoor and wildlife enthusiasts as well as sportsmen under the common goal of conservation.

Of course citizens can seek guidance from the nation's environmental department, the Environmental Protection Agency (EPA). There also exists an organization called the National Association for the Education of Young Children (NAEYC) which was established in 1926 to promote high quality early learning for children, the National Environmental Education Foundation (NEEF) created in 1990 as a complimentary organization to the United States EPA, and the Alliance for the Chesapeake Bay created in 1971 to find collaborative solutions to the land and water issues of the Bay. Additional assistance can come from the Maryland Park Service, which manages all of Maryland's state parks. After legislative reform, organizations like the ones mentioned above must be called upon to provide a bridge between the doors that have been opened by law and the citizens who may not be well-versed enough to take advantage of hidden opportunities.

These are the organizations that citizens can call upon when mobilizing efforts to make nature play spaces standard parts of their school systems.

## 2.4 SUSTAINABILITY

One key thinker to name who pioneered sustainability thought and ecological consciousness was Aldo Leopold, who set the stage for a conservation movement in 1949 with the formation a new mental model called the land ethic. Leopold wanted land use to be thought of not solely in terms of economic context, but for the public to think of land of part of their community; to protect and preserve it for the mutual benefit of all (1970). Sustainability has become a budding topic that is permeating throughout a diverse range of fields. To think sustainably, thought and planning must be done in a long-term future orientation. The interesting fact is that the sustainability agenda was only recently recognized in the last three decades (Rands, Starik, and Throop, 1993). There is also emphasis on the existing connections between human welfare and environmental justice in the field (Milbrath, 1989). The two main challenges of integrating sustainability into the lives of people lie in instilling them with a meaningful understanding of the concept that portrays the importance of humankind's future, and in finding an effective means by which to aide in the transformation of society (Stead, 2004). A simple dictionary search provides an explanation of sustainability in reference to resource management, which touches on the scientific aspect of the term, but many other factors have played a role in shaping the current way of thinking about sustainability as well.

### *2.4.1 Definition*

Sustainability is grounded in several scientific concepts and theories of the relationships among economic activity, society, and nature. The first concept is that the Earth is a living system with biological functions that are all interdependent on one another and rely upon the delicate interaction between the system and its environment (Van Gigch, 1978). In addition to that, Gaia theory explains that earth's biological and physical forces are a result of a coevolution between the earth's living and non-living components (Margulis and Hinkle, 1991). The first two laws of thermodynamics cannot be ignored when discussing the concept of sustainability. The first law, the conservation of energy, says that energy released during the formation of the universe 15 million years ago is a constant value, and that energy can only be transformed rather than destroyed or created. The second law, entropy, is the certainty that stored energy loses its ability to do work over time, thus becoming useless to the system (Ayres, 1994). Luhmann (1989), a sociologist who made significant contributions to systems theory, used the term "autopoiesis" to refer to the capacity of living systems to maintain their autonomy and unity through their very own operations. In other words, each individual process within a system supports another, creating a self-sustaining and balanced structure. When speaking of systems theory, a system is sustainable when it can continuously support itself based on its own internal actions and reactions, and endure in perpetuity. In sustainable systems, autocatalytic processes must be present to counteract the drift toward entropic disorder, meaning the system must have the ability to regulate and maintain its own energy use to remain at equilibrium (Moeller, 2006).

The World Commission on Environment and Development standardized the meaning of sustainable development in 1987 by describing it as the harmonious combination of socio-economic development and environmental conservation (WCED, 1987). There are many other variations on this definition, including one which suggests that sustainability refers to the ability of human society to persist in the long term in a manner that satisfies human development demands but without threatening the integrity of the natural world (Dovers, 2005).

The economic geographer Eric Neumayer was not the first to argue that various versions of sustainability exist to balance questions of social, economic, and environmental needs in different ways. To reflect varying degrees of sustainability practices, two categorical forms of sustainability are assigned; weak and strong (Connelly, 2007; Neumayer, 2004). Weak sustainability is based on the belief that technological or human capital can replace depleted natural resources, and actually does not require the adoption of sustainability practices. Strong sustainability, on the other hand, believes that natural capital can't be substituted in long term scenarios. To analyze the sustainability of nature play spaces in Maryland's Piedmont region, the spaces will be assessed to determine if the WCED definition for sustainable development is met. When looking at nature play spaces as localized systems, those which can be defined as sustainable should be able to meet human development demands while making negligible environmental impact and lasting several generations in to the future. These elements allow for assessment of the environmental and societal sustainability of nature play spaces, but in order to meet all three standards of sustainability, economic issues must also be addressed.

#### 2.4.2 *Economic*

While environmentalists and environmental educators do not typically put a heavy focus on acquiring manufactured or natural capital, they are more likely to insist upon human and social capital as an area of importance because that is the target which needs change, so it is critical to be able to present economic context for their proposed studies or projects. When discussing economic sustainability, Stead assumes that entropy law should be of particular attention in economic practice because presently economic systems do not consider natural resources like sunlight in the economic cycle until they are purchased or converted for fuel, nor do they consider the waste generated internal to the system (Stead, 2004). Taking the law of entropy into consideration first, ensures that natural resources are properly valued. One such parameter that can be used to present economic context for these projects is called a sustainable yield, and constitutes the amount of resource that can be taken from an environmental system up to which it can naturally replenish (Kutting, 2010). Ecological economist Herman Daly questions sustainable yield management's ability to maintain growth and development patterns that would be stable given the nature of entropy (Dresner, 2002). Instead, he proposes the concept of a steady-state economy in which stable patterns of production and consumption do not exceed ecological limits (Daly, 1977). Daly's concept aims to achieve a stable level in the system's population and consumption of energy and natural resources, so it can apply to nature play spaces because these areas have a measurable population and resources. Nature play spaces produce stable patterns of production and consumption, with various elements that can be utilized by the general public. Life cycle analysis (LCA) is a tool used to assess the environmental impact of an organization's

product or service at various stages of its existence. The stages of LCA include an inventory of the raw materials and energy required for the project along with the environmental impacts of acquiring it, then an assessment of manufacturing impacts, followed by transportation and distribution, product use, potential for reuse, and finally its ultimate disposal (Stead, 1995).

Discussions of economics mainly center on expenses because many organizations are interested in getting the most value for their dollar. Therefore, it becomes essential to consider economic sustainability when proposing new nature play space projects. In the case of nature play spaces, the builder must take steps to ensure that the natural, outdoor area will be able to serve the community as long as possible, while still remaining cost effective to operate. This means they must weigh the total amount of people they serve every year against the total cost to run their environmental education center, namely, maintaining the nature play space.

One thing all the environmental legislation in Maryland has accomplished is to plainly provide the opportunity for funding for environmental education programs through grants. Government funding is usually given to institutions and organizations that are able show the how the funding helped them improve their revenue and societal impact (Thomson, 2007). When using Piedmont counties as case studies as is done in a forthcoming chapter, referring to county budgets can normalize environmental expenses in this region. The first step is to investigate the amount that the state of Maryland allots to environmental education, and for health and the environment. These figures can be compared to the cost of traditional science education at public institutions throughout the region.

### 2.4.3 Development

The push for sustainable development began with the publication of G.H. Brundtland's "Our common future – Call for action" in *Environmental Conservation* in 1987. In this narrative, Brundtland explained sustainable development is that which fulfills the current needs of society without hindering the ability of future generations to fulfill their needs as well. To begin, the concept of "needs" refers to the needs of the poor, and sustainable development insists that those needs deserve overriding priority (Christensen et al., 2003). Second, sustainable development recognizes the limitations imposed by technology, social organization, and biophysical environmental characteristics on the environment's ability to meet needs. This report provides much of the framework and principles for contemporary sustainable development, and shifts the collective thought from development working against the environment to developers working with the environment. Other authors describe sustainable development in terms of it being a higher order social goal, such as calling it "a universally agreed goal of human progress" (Harrison, 1992). The requirement to think long-term makes sustainability a generational task that must be consistently pursued over decades, and by way of learning, policy, and institutional change (Connor and Dovers, 2004).

The Environmental Management System (EMS) is a comprehensive set of processes and practices that allow for the reduction of environmental impacts, and has been implemented for approximately 20 years. EMS shows considerable positive environmental influence for sustainable development in the construction industry, but current research suggests it is not fully effective on its own (Scott and Gough, 2003). "Green specifications" are a suggested tool to include in EMS when implementing

sustainable construction because they provide contractual requirements that place a reasonable amount of consideration for the environment while still considering economic integrity (Lam et al., 2010). The types of development projects that employ EMS and green specifications are usually bigger buildings, such as those that would pursue LEED certification or larger scale construction. Stead suggests that organizations that want to implement sustainable strategic management must expand the EMS system to a sustainable management system (SMS) which integrates economic, ecological, and social sustainability (Stead, 2004). In general, land development usually aims at making revenue, but the struggle of sustainability is to avoid socio-ecological collapse (Whitehead, 2012). Because nature play spaces are usually considerably smaller scale than typical land development projects, there is a dramatic ease of creating these spaces in relation to big buildings. Natural Step, an international educational organization, developed a model outlining four conditions a system must meet to represent components of sustainability. The first condition is the system must ensure that nature's functions and diversity is not subject to increasing concentrations of substances extracted from Earth's crust. The second is that it can't be subject to increasing concentrations of substances produced by society. The third is that a system can't be impoverished by overharvesting or other forms of ecosystem manipulation. And finally, the fourth condition ensures that resources are used fairly and efficiently to meet basic human needs worldwide (Nattrass and Altomare, 2002).

Robin Moore is a leading architect in environmental design, and published the book "Play for all Guidelines: Planning, Design, and Management of Outdoor Settings for All Children" (1988). He designs nature play spaces using three conceptual ideas of

the effects the environment has on children's behavior. The first is the inclusion of behavior settings that are ecological units where the physical environment and child's behavior are indubitably connected, and therefore researchers can predict behaviors that may occur in the setting as a result of the way it was designed (Barker, 1976). One such example would be the creation of a gathering area where children know the boundaries, routine events that happen there, and functional components. The second concept of affordance refers to the tendency of children to learn about themselves and the functional properties of the environment by identifying and using the environment in relation to their abilities (Gibson and Pick, 2004). The final concept is territorial development which explains that maturing children explore, discover, and make sense of the world through experience, spatial understanding, and learned skills (Costco and Moore, 2007). This can be interpreted as placing children in environments that provide reasonable daily challenges that continue to evolve, such as is presented in outdoor play areas. By incorporating these three concepts of the environment's effect on children, nature play spaces or any outdoor area, can achieve sustainability by having a positive impact on early childhood experiences that could produce adults who are more likely to understand natural processes and support healthy ecosystems by various methods (Cosco and Moore, 2009).

Especially in urbanized places, there is a movement to naturalize school grounds so children can encounter nature through play and exploration (Chawla et al., 2014). Studies from Baltimore show that areas with the highest need for environmental amenities like parks have the best access to them but less acreage and more park congestion, suggesting that there is an inequity in the way parks and access to them are

distributed (Boone et al., 2009). In fact, park distribution disparities are obviously evident in areas with low income and populations of ethnic people (National Recreation and Park Association, 2011). These projects can attempt to target urbanized areas of Maryland such that the neighborhoods with the greatest needs can regularly expose children to nature, and urban areas slated for development can be naturalized (Kuo, Sullivan, Taylor, and Wiley, 1998).

The principal obstacles of nature play space construction are not related to a lack of interest or skepticism of their many benefits, but rather lie in funding, space availability, and maintenance challenges. There is a large pool of stakeholders including parents and guardians, educators, healthcare professionals, business owners, farmers, economists, politicians, scientists, and others interested in the welfare of children and the environment that can advocate and convey the practicality of employing this kind of standardized early education experience.

## 2.5 USING COUNTIES AS CASE STUDIES

This research aims to examine a small group of environmental educators' and professionals' opinions on the current best sustainable practices for nature play spaces in the Counties of Maryland's Piedmont province. In order to use the Piedmont region of Maryland as an example for recommended practices across the Mid-Atlantic, economic information for each County in the study is presented. The Maryland Department of Budget and Management releases an operational budget report each year. In 2014, the Department of Natural Resources received a budget of \$51,940,000 to spend towards their vision of inspiring people to enjoy and live in harmony with their environment

(DNR, 2014). The report shows a DNR allowance of \$53,290,000 for 2015. This figure represents only a state budget, which is made accessible to the public in addition to federal funding initiatives. For example, the National Oceanic and Atmospheric Administration is also able to contribute to funding for environmental education through their Office of Education. They have a number of grants to offer agencies in relation to educational efforts including environmental literacy, Chesapeake Bay Watershed education, and many others. In 2014, NOAA reported awarded grants totaling approximately \$1,500,000 over three years to five institutions as part of the Environmental Literacy Grants competition for Building Capacity of Informal and Formal Educators. The Chesapeake Bay Trust is a non-profit grant-making organization created in 1985 specifically dedicated to improving Maryland's Chesapeake Bay, and they've awarded \$55,000,000 to organizations that engage citizens in environmental education, community outreach, and local watershed restoration. The Trust reports awarding \$5,400,000 in grants in 2013 to over 330 organizations, in every county in Maryland and Baltimore City. They were able to fund grassroots organizations, schools, community groups, and others. They provide three categories for grants offered, including restoration and retrofits, outreach, and environmental education.

In contrast, local governments may have a more difficult time appropriating funding for environmental education. The Baltimore County Executive reports a 2014 budget for the Department of Planning in the amount of \$2,960,000, while the Department of Environmental Protection and Sustainability had a 2014 budget of just \$288,000. The Department of Planning and Land Acquisition administers recreational

facility development funds via Program Open Space. Program Open Space draws funds from the Outdoor Recreation Land Loan of 1969, as well as dipping into federal budgets from the Department of the Interior's Land and Water Conservation Fund.

According to the most recently available United States Census estimates, the total population of Maryland residents in 2013 was approximately 5,938,737. The capital budget for the fiscal year 2015 is reported as \$3,606,648,852, with an allocation of \$715,187,000 to education and \$504,165,966 to health and the environment. Of the eight counties included in this study, half of them are reported by the Department of Planning to be approaching or surpassing 50% developed land. To reiterate, the Department of Natural resources also recognizes that the most highly developed areas in Maryland are located in the Piedmont. The following subtitles provide various parameters that define each county in Maryland's Piedmont region, and Table 4 summarizes these parameters in order from most to least populated county. This information was retrieved from interactive government maps created by combining geographical information with government-collected data. Due to the delayed nature of reporting by the U.S. Census, data within five years of the study is considered for comparison.

### *2.5.1 Cecil*

Located furthest north and sharing borders with Delaware, Cecil is the least populated of all the counties included in the Piedmont region of Maryland, with 101,913 residents. This represents only about 2% of the entire state population. In 2010, 25% of the population was under the age of 18 years. Thirty-eight percent of the land was used for agriculture, and 13% developed. Of the seven counties inside the Piedmont, Cecil has

allocated the largest amount of its budget towards education in the county this year with over eight million representing 49% of the total budget (Cecil county 2013). As a result, other budgeting categories receive less funding, with health and the environment only being allotted 2% of the total county budget. The Maryland Park Service manages two state parks in Cecil, including Elk Neck and Susquehanna State Parks. Earleville Wildlife Management Area encompasses 190 acres of the county, and the Fair Hill Natural Resources Management area encompasses 5,600 acres. Fair Hill Nature Center serves Cecil county residents and acts as an outdoor school. Non-profit agencies in Cecil County received \$244,571 in budget allocations in 2010.

### *2.5.2 Carroll*

Carroll is the second least-populated county in Maryland's Piedmont, just slightly above Cecil with 167,564 residents and representing 3% of the entire state. It shares northern borders with Pennsylvania. One quarter of the population here was also under 18 years old in 2010. Forty-six percent of Carroll's land is devoted to agriculture and 29% is developed. The local government has equally allocated 21% of the total 18 million dollar budget each to education and health and the environment (Carroll county 2012). Patapsco Valley State Park ranges 16,043 acres over three other counties in the Piedmont including Carroll. There are a number of nature centers in Carroll County, including Bear Branch, Reptile Wonders, and Piney Run Nature Centers. In 2010, Piney Run Nature Center was given a budget of \$545,069.

### *2.5.3 Baltimore*

Positioned in the center of the Piedmont, Baltimore indisputably represents the most highly populated county there. Even when speaking about the entire state of Maryland, Baltimore holds second place only to Prince George's county, which shares its borders with the Nation's capital. With 823,015 residents, Baltimore County represents 14% of Marylanders and received 8% of the entire state budget. In 2010, 22% of the population living in Baltimore County was under the age of 18. Only 22% of the land in Baltimore is used for agriculture, and 47% developed. Twenty-six percent of the more than 290 million dollars was reserved for education in Baltimore, and 18% for health and the environment. Gunpowder Falls, North Point, Patapsco Valley State parks are established in Baltimore, as well as a number of nature centers like Oregon Ridge, Irvine, or Marshy Point Nature Centers. In 2010, Irvine Nature Center in Baltimore County reported a total expense budget of \$2,119,987 for fundraising, management, and programming.

### *2.5.4 Baltimore City*

This city in Maryland is not the capital, but holds 622,104 residents which represents 10% of the entire population. Though less populated than its county counterpart, Baltimore city was given 15% of Maryland's 2015 fiscal budget. Twenty-nine percent of that was designated for education and 37% to health and the environment. Like Baltimore County, 22% of Baltimore city's population was under 18 years old in 2010, but an astonishing 92% of the land was developed making this an area of unique concern. In northern Baltimore city is a 426-acre urban state park called Cromwell

Valley. Here you can find institutions guided by government and private partnerships that mobilize land restoration such as the Masonville Cove Environmental Education, Patterson Park Audubon Center, or the Carrie Murray Nature Center. Cylburn Arboretum is a public garden and nature preserve in Baltimore City that had offers educational, recreational, and environmental benefits with a 2010 budget under \$400,000.

### *2.5.5 Harford*

Housing just 4% of Maryland's entire population, 249,215 residents live in Harford County. 29% of this county's land was used for agricultural purposes in 2010, while 38% is classified as developed. One quarter of the population was under the age of 18 years old, but only 1% of the state's total fiscal budget is given to Harford County. The county chooses to use 29% of that budget towards education and 26% to health and the environment (Harford County 2010). Rocks, Palmer, and Susquehanna State Park exist in this area and some nature centers include Masonville Environmental Education Center and Eden Mill Nature Center. The 2010 capital budget for Harford County allocated \$8,708,415 to the Parks and Recreation Department.

### *2.5.6 Howard*

Situated west of Baltimore County, Howard is home to 304,580 residents. This constitutes 5% of total Marylanders. In 2010, residents under 18 years old represented 26% of the population. More than half of the county was developed, specifically 51%, and 22% for agriculture. Howard County receives approximately 2% of the state budget, which it spends over \$21 million on education, but shockingly reports \$0 allocated for

health and the environment (Howard county 2010). Howard County's department of Recreation and Parks was given \$29,738,104.

#### *2.5.7 Frederick*

With 241,409 residents living in Frederick County, it has been given just 1% of the state budget to allocate amongst its departments (Frederick county 2010). Frederick focuses much of the budget on education (47%), and a smaller portion for health and environment (1%). In 2010, Frederick was comprised of 25% under 18 year olds. Twenty-four percent of the land was reported to be developed and a notable 46% for agriculture. Frederick County allocated \$5,173,562 to the department of Recreation and Parks in 2010.

#### *2.5.8 Anne Arundel*

Though considered a Coastal Pacific province, this county constitutes part of the Baltimore Metropolitan Area, which is the nation's 20<sup>th</sup> largest market (Anne Arundel County, 2010). Outside of Baltimore County and City, Anne Arundel constitutes the third most populated county in this study. The over 500,000 residents represented 9% of the population in 2013, and in 2010 the under 18 age group represented 23% of Anne Arundel's population. Anne Arundel received almost the same amount of funding as it contributed to the population at 8% of the total Maryland budget. Twelve percent was designated for educational spending and 5% for health and the environment. The budget for a project on the property of Jug Bay Wetlands Sanctuary was \$2,075,000.

## 3

**Research Design and Methods**

## 3.1 METHODS

In order to generate data about nature play spaces, which constitute a specific man-made entity used in social settings, a qualitative research approach was taken in which surveys were used to search for regional phenomenon and interviews were conducted and thematically analyzed to identify explicit patterns among the group of participants. The participation of human subjects in the study required the completion of a Towson University Institutional Review Board application. In August 2014, the project was granted exemption from general Human Participants requirements according to CFR 46.101(b)(2). The identity of those interviewees was kept anonymous to facilitate free speech and information sharing, as well as protect personal interests of participants. Survey responses were not kept anonymous because organizations were able to report as a collective entity rather than individual representatives' opinions. The Piedmont region of Maryland was chosen as the target geographic location for this study. The Piedmont region is a flat plateau that separates the Appalachian Mountains to the west from the coastal lowlands on the east. The eastern boundary is abruptly defined by the Fall Line which houses a string of major cities. Counties included in the categorization of Piedmont areas are Baltimore, Cecil, Carroll, Frederick, Harford, Howard, and Montgomery counties. Also included in the Piedmont region is Baltimore City. Data were also collected from Anne Arundel county and Washington, DC in the Coastal Plain province. It is included in the findings of the research as well.

### 3.2 CONTEXT

The strategy of backyard research, or studying an area that the researcher has previous rapport and connections with, is useful in that it builds upon the knowledge base of information that is advantageous to the researcher's personal and professional life (Patton, 2002). It also allows the familiar, native researcher to minimize costs and increase likelihood of buy-in from prospective participants (Maxwell, 1996). The recruitment of study participants was aided by the researcher's three year'-long personal experience in the environmental education field in Maryland, and the recommendations of the researcher's committee chairperson, who served on the Partnership for Children in Nature and has many year' longs experience with environmental education in Maryland.

Additional advantages of studying nature play spaces within the Piedmont region of Maryland include the region's high rate of urbanization as compared to the other physiographic provinces within Maryland. The Piedmont region of Maryland contains the largest city in the state by far, Baltimore, as well as many of the most populated counties in the state according to a 2010 U.S. census. The most highly populated counties in Maryland include Montgomery, Baltimore, Howard, Harford, Frederick, and Carroll. Anne Arundel and Prince George's counties also house a majority of Maryland residents. It is important to study areas of rapid residential and commercial development because it is a major contributor to habitat loss. The effects of metropolitan pollution in the Chesapeake Bay watershed are significant contributors to biodiversity loss, soil erosion and poor water quality (Baldwin, Dobson, and Noss, 2011). The Piedmont is positioned in a central location of Maryland, so in addition to the polluting effects of development originating in this geographic location, agricultural practices above the state in

Pennsylvania drift to down-wind Maryland and are transported into the Chesapeake Bay. The Coastal Plain of Maryland and Virginia are also affected by pollution and agricultural waste originating in surrounding areas (Ball, Brady, and Zhang, 2013).

Of special concern is the sole aquifer in the Piedmont region, which is shared by Montgomery, Frederick, Howard, and Carroll counties; it serves as the principal source of drinking water for those areas. Therefore commercial and residential development in this area should be carefully considered as contamination to the aquifer would pose public health hazards. Areas like the Piedmont region of Maryland that face many man-made environmental stressors are critical in understanding how to move towards symbiotic, sustainable relationships between humans and natural habitats.

### 3.3 CONTEXT WITH SIMILAR STUDIES

To understand the context of the present study, reference to previous similar studies provide of examples qualitative techniques used to answer specific research questions related to nature play in a region. The first goal of this research paper is to provide evidence supporting the need for nature play spaces in Maryland. The Children & Nature Network (2012) conducted an exploration of children's outdoor experiences to identify associated risks and benefits of nature-based play. This review synthesized survey research on populations of youth across the world. It highlights some of the important recent progress, including a report by The Nature Conservancy (2011) in which American youth participated in online interviews. This investigative study supports existing evidence on the positive effects of outdoor play on children's physical and cognitive development as reported in the literature review.

A study by Lynch and Lovell (2003) provides context for the use of survey data and GIS mapping information. Spatial and GIS data were collected from individual farms in four Maryland counties (Montgomery, Carroll, Calvert, and Howard) and analyzed to determine the factors influencing agricultural landowners to purchase development rights or transfer them to farmland preservation programs. By combining data from a telephone survey with GIS data, researchers were able to quantify the discrete and direct variables influencing the respondents' participation in agricultural land preservation programs. This study demonstrates how survey responses can be categorized and compared for trends and can be used for comparative analysis of physical characteristics.

Gotschol et al. (2014) investigated the extent to which environmental management is an economically sustainable business. This article touches on concepts used in this qualitative study of nature play spaces, including sustainable management practices, and cost-effectiveness. In their study, researchers distributed questionnaires to managers of different industrial organizations. From this data, they were able to conclude that environmental management positively influences economic performance as a long term target, and businesses can increase their economic performance by investing in green practices.

### 3.4 DATA SOURCES

Qualitative methods of literature review, coupled with comparative analysis of survey responses and thematic analysis of transcribed interviews with professionals revealed trends in the development of nature play spaces across the Piedmont region and Coastal Plain of Maryland. Beginning in September 2014, e-mails were sent out to

prospective study participants asking to schedule interviews, or complete surveys. Table 1 shows the connection between data sources and data analysis.

In addition to the literature review to gather data on the current state of the research topic, it was assumed that some of the most recent developments in this field are likely known to working professionals. In order retrieve data from these valuable sources, the researcher had to make direct contact with professionals through questionnaires and interviews to extract information from their narratives

#### *3.4.1 Nature Play Space Surveys*

During the drafting of a research proposal for this project in May 2014, a list was made of 20 facilities in the Piedmont area that have complete, functioning nature play spaces built on their property. The organizations were also targeted for their primary educational goals being focused on environmental education. A brief, introductory e-mail outlining the purpose of this research was sent to each of the 20 organizations with the requested deadline for response by December 2014. An electronic copy of the questionnaire and IRB approval letter (Appendix A) was attached to each e-mail. I received responses from 10 organizations; four in Anne Arundel County, three in Baltimore County, two in Harford County, and one in Frederick County. The surveys were electronically filed on a USB upon receipt. Table 2 reports the physical size, financial cost, serving capacity, frequency of use, and major repair projections. When the complete data set was reached, Table 3 was adapted to provide a quick view of this quantitative data as a comparative matrix. Data regarding physical attractions, educational uses, physical structures for learning, and maintenance challenges was

summarized separately in Table 4, and Table 5 was adapted to quickly summarize the recurring themes of those survey responses.

The thought process behind the design of the questionnaire was to ask questions that would capture data related to the planning, cost, material selection, informal educational uses, maintenance challenges, and financial support that may be put into a nature play space project. A sample of the survey that was sent out for this research can be found in Appendix B.

### *3.4.2 Nature Play Space Interviews*

An internet search was used to compile a prospective list of interviewees that play a part in the development of nature play spaces in Maryland, but also around North America. The staff directory on each website was utilized to identify a point of contact for the organization. A brief, introductory e-mail outlining the purpose of this research was sent to one individuals within each of the 20 organizations found during the internet search. An electronic copy of the questionnaire and IRB approval letter was attached to each e-mail. This prompted the recipient to schedule a telephone interview, or suggest further recommendations for interviewees. Participants that completed the survey included representatives of private and government agencies who are involved in administering, supporting, or creating environmental outreach programs across Maryland. The interview questions (Appendix C) were designed to target data related to construction requirements, financial assistance, general successful and unsuccessful experiences such as unfinished nature play space construction projects or those which were brainstormed but never initiated, frequency of nature play space construction projects, and building material suggestions. To maximize the richness of the body of data

collected, questions were left open-ended and follow-up questions were used to elicit more detailed information about particular locations and programs. By the end of January 2015, a data set of 12 interviews was collected. From these data, Table 7 was adapted to summarize explicit patterns that arose among the interview responses. Of the 12 interviews, Baltimore County was the most represented by the data with 42%, Cecil County with 23%, Washington D.C. with 17%, Anne Arundel County with 8%, and private industry with 8%. More than a third of the interview population (42%), or 5 participants, completed a member check to confirm if the researcher accurately represented the nature play spaces or outdoor classrooms described by them.

### 3.5 DATA ANALYSIS

The current state of nature play space innovation is steadily evolving in Maryland as well as around the globe. The goal of the research is to get an in-depth understanding of a small target audience's behavior and perceptions regarding nature play spaces, and construct hypotheses based on the data. For this reason, qualitative research was chosen as the best approach to conducting a scientific study on the topic. This allowed first for a thorough document review of the current research and best practices regarding nature play spaces. Gaps in existing knowledge were identified, and available resources were assembled and presented in a way that made information apparent and easily accessible to a general audience.

The data were analyzed using qualitative thematic analysis (Boyatzis, 1998). This type of qualitative approach is rooted in grounded theory that involves constant comparative analysis to develop theory regarding the research topic (Strauss and Corbin,

1994). Thematic analysis entails reviewing a small portion of the data to first identify relevant themes and patterns based on participants' responses that relate to the research questions (Glesne, 2011). Once initial data coding was finished, the corpus of data was analyzed again and additional categories were added as necessary to represent aspects of the data. The process of transcribing and coding the body of data lasted several weeks, from January to March 2015. All codes that emerged from the interview data are listed in Appendix D.

Upon completion of data analysis, the categories that evolved from emergent coding were reviewed for similarities; similar categories were then placed into a common theme that encapsulated the overarching meaning of the data. Table 6 was created to show the main emergent codes along with their corresponding sub-codes. Figure 2 shows the method by which data coding is performed as part of thematic analysis. Figure 3 shows a diagram for the aggregation of similar codes into groups and subgroups. Table 8 lists the disconfirming codes, or those that contradict the themes in some way. These themes serve as the structure for describing the characteristics of outdoor classrooms and related activities as sustainable. Each research question is addressed by specific interview questions. For example, research question number one corresponds to question nine of the interview. Research question two corresponds to questions one through four, and research question three corresponds to interview questions one through eight as well as ten. Although designed this way, it is important to consider that codes for each research question were found throughout the transcripts without being restricted to one specific question. For example, though research question number one corresponds to interview question number nine, coding for characteristics of nature play spaces were also found in

interview question number two that asked, “What are some of your success stories?” The findings of this research elaborate the themes for data analysis and provide data segments to warrant the claims made by the researcher.

Various steps were taken to address issues of validity and trustworthiness. First, several sources of data, including questionnaires and interviews, supporting program documents, and government reports were collected to triangulate the findings. By using multiple data collection methods from multiple sources, readers can confirm or disconfirm in the credibility of findings. In addition, member checking was undertaken to increase reliability of the findings. For this project, the participants were given access to interview transcripts and a draft list of the themes emergent from data analysis. Participants were asked to review and provide feedback regarding the verisimilitude of the themes, and their feedback was used to revise the final thematic framework. Peer review is a third method by which validity of the study is increased. Correspondence between the researcher and thesis committee was done via e-mail from June 2014 until April 2015.

It is important to note the limitations of qualitative methods of research design when analyzing and drawing conclusions from qualitative data. For instance, the findings of this research are unique to the Piedmont region of Maryland, and may not be generalizable to other physiographic provinces and states. In addition, though the data will reveal monetary patterns for Maryland’s Piedmont, it is difficult to predict unknown quantitative data for future projections using qualitative techniques.

## 4

**Findings**

To discern if nature play spaces in Maryland's Piedmont region serve as economically resourceful, scientifically sound, and sustainable ways to produce environmentally literate populations, I analyzed and compared all collected forms of data including current research literature, questionnaires, economic data, and interviews. The data analysis process resulted in the development of 13 emergent categorical codes, which will be discussed in this chapter. The emergent sub-codes are further discussed as they relate to each emergent categorical code. Professional narratives were coded based on the aim of the three research questions, and the data from questionnaires were analyzed by comparative analysis. The literature review is used in this study to support conclusions of the research. When reporting the findings, it is important to remember the context of the study being located in an urbanized area of Maryland, therefore Figure 1 orients the reader to the current level of anthropogenic activity in the United States and Figure 2 magnifies the state of Maryland and displays 2010 patterns of land use. Figure 2 shows the highest areas of development in Maryland occurring within or near the Piedmont province. It is important to consider that each piece of data was not discretely limited to one category or another, and overlap of codes was observed. Some codes were also overwhelmingly mentioned across all interviews, which is noted in the findings rather than being depicted in the Table 7. First survey data is reported, then emergent codes are discussed.

#### 4.1 CHARACTERISTICS

The dominant characteristics of nature play spaces in the Piedmont region of Maryland are identified by way of questionnaires and interviews. Table 3 summarizes the survey data set of 10 environmental education centers with functioning nature play spaces grouped by county and organized by increasing area of space. Anne Arundel County represents 40% of the survey data, Baltimore County accounts for 30%, Harford County for 20%, and Frederick County for 10% of the data. The oldest reported nature play space project in this data set was constructed in 2006, with the newest projects being completed as recently as 2013. None of the centers report making major repairs to the nature play space more than once a year, and all of the centers use the space at least every day of the business week. Sandy Point State Park represents an outlier in the data, as the survey response reflects the entire parcel of land being used as a nature play space rather than reporting on one defined area. With that said, the largest nature play space project reported was 18,000 square feet, and the smallest was 100 square feet. The Key School did not report the area of its nature play space, and Sandy Point was omitted, so the average area in square feet of nature play spaces in the Piedmont was 6,487.5 based on the survey data. The largest nature play space reports serving the most children annually, even more than the State Park. The smallest space, however, does not correlate with the smallest annual serving. Table 4 provides a visual of comparative analysis between the 10 survey responses. The figure shows that majority (70%) of nature play spaces reported were government-sponsored projects. It shows that most projects are more than 1,000 square feet spaces.

Table 5 provides descriptive detail of the dominant characteristics reported by surveys in the form of main physical attractions and the physical structures for learning. Table 6 categorizes the recurring survey responses from Table 5, showing a condensed list of the leading characteristics of these spaces, as well as some uses and sustainability issues. The main physical attractions in these spaces, which can be viewed as characteristics of these spaces, are gardens, logs, trees, shrubs, sand, and huts while the dominant physical structures for learning are mainly the gathering area and native flora. Educational uses include outreach environmental education, and extended classrooms. And finally, the dominant maintenance challenges, which have an effect on the sustainability, include loose parts repair, safety monitoring, and grounds keeping.

The interviews were coded to identify dominant characteristics that emerged within professional narratives. Of the 12 interviews, Baltimore County was the most represented by the data with 42%, Cecil County with 23%, Washington D.C. with 17%, Anne Arundel County with 8%, and private industry with 8%. Table 7 lists the confirming codes that emerged from the interview data. These are codes that positively support research question one. Disconfirming codes, reported in Table 8, are those that contradict the research question in that they represent examples of narratives that are in conflict with the emergent codes. Though the disconfirming codes for nature play space characteristics are much fewer than those that confirm the theme, it is important to include these codes in the interpretation to reveal underlying complexities and provide examples of nature play space characteristics that may go against the success of these spaces, and should therefore be avoided.

#### *4.1.1 Place based*

When searching through the transcripts for characteristics of nature play spaces, I found many examples of ways in which place based learning, or immersion in the local heritage, cultures, and landscapes, is a main theme of these spaces in the Piedmont. These codes were categorized into sub-codes named natural, repurposed areas, and preserved areas. Because place based education is an authentic experience, natural captures all the ways in which nature play spaces facilitate an authentic connection with the natural environment including on site/experiential learning, reflecting natural history, presence of native flora, presence in State parks, use of natural habitats, vegetation, and the acknowledgement of ecosystem services. Use of natural habitats was adapted from the response, “The last thing you want to see in these forested areas is this big, bright, yellow play instrument.” The code “reflect natural history” was adapted from the following interview response to interview question number nine: “Sometimes they’re located in places that have strong history or beautiful natural formation of rocks, or you’re right on the water.”

Repurposed areas also contributes to these spaces’ place based characteristic because it explains the ways in which nature play spaces are true to using the local resources to their advantage. This sub-code includes naturalization, professional development, repurpose materials, restoration, repurposed resources, and natural objects. Through this sub-code, it is shown that no foreign resources are brought in to create nature play spaces and students must get out of the classroom to interact with the community and natural environment. One statement, “We give those [downed] trees new life.” explains the tendency for builders to repurpose natural resources they find on site.

Codes included in preserved areas are State parks, conservation, and preservation. This shows the element of collaboration between students and local citizens, organizations, businesses, and government that is necessary for place based learning and projects. One interviewee mentioned, “Campgrounds are mostly preserved areas. Sometimes there’s less hoops to jump through because they are already conserved.”

#### *4.1.2 Experiential*

The emergent code experiential was one of the most noticeable reoccurring codes in the data and was thus named as the second main theme for characteristics of nature play spaces. Not only did this code appear in every single interview, but it reappeared in multiple questions throughout, and even had more than one mention within a single question for many interviewees. Defined as “a reflection on doing”, experiential learning entails learning through experience and is supported by the sub-codes, physical play, real world experience, acknowledging ecosystem services, and cognitive development.

Physical play includes environmental education, communication, tunnels, and interactive. One example of a piece of transcript that constitutes the code environmental education is, “It was in a natural area, taught hands on stream science, and demonstrated lessons about the ocean.” The sub-code real world experience is supplemented with codes such as live sampling, immersion, wilderness, and making connections. Live sampling was adapted from an interviewee’s explanation of her teaching experience in one of these spaces, “[We did] sampling for macro fauna diversity, quality of water, and salt versus fresh water sampling.”

The sub-code of ecosystem services is explained in terms of the previous research that alludes us to what the environment provides, and students' ability to go out and quantify it or qualitatively describe the service. For example, one participant explained, "Usually [grants are for] raised beds, or storm water reduction benefits." Finally, cognitive development is listed as a sub-code of experiential learning and is supplemented with codes like structured learning, unstructured learning, cognitive exploration, and imagination skills. A sentence from which the code "imagination skills" was developed is, "Natural free play has benefits for early childhood because they are allowed very untimed periods to allow their thoughts to play out fully... and fully utilize their imaginary potential and social problem-solving skills."

#### *4.1.3 Physical location*

The physical location was an important characteristic to identify when investigating nature play spaces in this region due to the presumably low availability of land in urbanized areas. This code begins to identify actual requirements for construction. The emergent sub-codes complementing this theme include compliance, visibility, accessibility, and attractions. These themes provide a preliminary set of currently considered guidelines to explore when choosing the location for these types of projects. In terms of compliance, emergent codes include zoning, minimal permitting, liability one pagers, national standards, safety, NWF guidelines, and a soft surface requirement. One example to clarify the code "compliance" is, "Yes, we design the space according to PSCG [Product Sensory Consulting Group] regular inspections, safety forms, and consult insurance policies."

In the Piedmont, codes which emerged in relation to visibility of the physical location of nature play spaces include co-location, signage, boundaries, and large elements. Co-location was described when referring to methods that led to successful nature play space utilization: “I know sometimes it’s easier than others because in state parks people just come. We’ve also located them near existing playgrounds.” and “The location helps a lot, if it’s somewhere that people are already going that’s really going to help.” A leader of one Conservation Corp. crew noted, “We definitely didn’t have much signage, but we made it very visible like, we did have a nice visible boundary.” in reference to creating boundaries for nature play spaces. Signage is adapted from statements such as, “People could move away that did the project, and if the sign is there people will understand it’s an intentional space and maintain it accordingly.” Accessibility codes include anthropogenic changes, semi-public spaces, and community open-space land. A director of an environmental education center states, “The biggest challenge is one: getting the kids there. If a school group is trying to come out, trying to find busing. Many kids can’t afford to do the field trips and things.” This statement gives insight to the accessibility of semi-public spaces. Finally, attractions include campgrounds, non-permanent structures, attention grabbing elements, and fun. When talking about the success of her nature play space, one ranger gave an example of a post-event assessment, “We got a lot of positive feedback from it and over 1100 people that participated... rated it as the most interactive for kids because it was more than just walking and reading plaques.”

#### *4.1.4 Legislative support*

The sub-codes show that legislative support for nature play spaces in Maryland's Piedmont comes only in the form of various government responsibilities and in funding. Government responsibilities as shown by emergent codes include government policy, state responsibility, state legislation, government installation, state initiatives, and environmental literacy. One educator who uses these spaces explained her personal academic research in relation to legislative support for nature play spaces, "My research is looking at implementation of Maryland's environmental literacy standards in early childhood. So pre-k to five, looking at developmentally appropriate practices in teaching about the environment." This sentence provides an example for the code, environmental literacy.

The sub-code funding does not have many avenues of support, with data listing only grant funding and government funding as options for these projects. The interviews bring to light the difficulty Maryland has with funding nature play spaces, with one participant noting, "We did get grants through the Chesapeake Bay Trust, but those are mainly about storm water for the rain garden and also about environmental education." which was coded as "gov't funding". An example of "state responsibility" was adapted from the following response, "State parks have crew, we have access to boulders and stuff, and we also have charge to maintain public spaces and create play areas and playgrounds."

#### *4.1.5 Community involvement*

Community involvement also emerged as a main theme of the characteristics of nature play spaces. There were three sub-codes that outline ways in which community should be involved in these projects. The first is in planning, then staffing, and maintenance. Planning simply implies public and parental buy-in. One participant explains how his crew caters to achieving parental buy-in, “We also thought that parents have a big influence over what their kids do... so we really thought about putting in cool photo-ops. So parents would lead their kids there because they want a picture of their kid on the element while they’re playing.”

Staffing is an important consideration when undergoing nature play space projects, as confirmed by interview data. According to participants, community involvement is imperative for the success of these spaces, and the element of staffing these areas with volunteers is a main theme. Within this sub-code, I found supplemental codes like staff turnover, teachers, and staff availability. The challenge of staff turnover is described in the statements, “...especially urban environments and city schools tend to have a lot of transition among teaching staff.” and “I would say leadership change or teacher turnover at schools [is the biggest obstacle].” The struggle of having teachers to use the space is explained by an educational director, “That’s one of the big roadblocks sometimes are the teachers... they’re not familiar enough with being outside to take their kids out.” Finally, staff availability, particularly in the summer, was a very noticeable reoccurring theme throughout the data. The statement, “Summertime maintenance has always been a problem. I don’t have any easy answer for that outside of engaged parents.” accurately describes the collective perception of this code.

The final community involvement sub-code, maintenance, is also heavily affected by staff availability; “Summer maintenance is also huge, can’t figure out how to solve that problem.” Community effort and grounds maintenance are the codes which fit into this sub-code of the characteristics of nature play spaces. Community effort is displayed in statements like, “A lot of it is in planning and getting all the right players to the table. Making sure that everyone who is impacted by the project is involved...” or “We need to get to that point where it’s automatic. So you have to work with everybody, that’s part of the sustainability structure around it.” There are many examples to contribute to the code “grounds maintenance” but here I will give one example: “Nature play spaces in particular require maintenance because they’re organic and using organic materials... Weeding, watering, mulching, maintaining and replacing material when necessary. That goes for outdoor classrooms as well.”

#### *4.1.6 Malleability*

The final main theme that emerged from the interview data was the malleability of these spaces. I noticed many ways in which interviewee’s described a versatility as a characteristic of nature play spaces in the Piedmont, so I divided this theme into sub-codes called “cost”, “age range”, “schools” and “other”. These sub-codes describe ways in which there are flexibilities within the categories. For example, in reference to cost there is leniency in the protocol for monetary reporting and a wide range of minimal cost. When asked about the total amount of money distributed to nature play spaces through grants, one participant explains, “It’s difficult to get a comprehensive idea because not everyone is really tracking that, and dollars invested isn’t a requirement to report.” Minimal cost was reflected in a ranger’s explanation of the Maryland Park Service’s

handling of nature play space construction, “No permits required, no ground was disturbed, there was no digging other than poking holes for signage. So cost was minimal, everything was done in-house.”

#### *4.1.7 Disconfirming codes*

In relation to the characteristics of nature play spaces in Maryland’s Piedmont, two main themes of disconfirming codes were found. These themes are time/space constraints, and financial challenges. To remind the reader, these disconfirming codes are rare responses that contradict the main confirming themes. So, for example, though there is a confirming theme called physical location, there is a disconfirming theme called time/space constraints to contradict the norm of what the data shows. For this disconfirming theme, the sub-code limited space was created. Limited space is supported by codes like non-conducive habitats, inadequate campus space, and the Home Owner’s Association. These codes provide examples for ways in which the characteristics of nature play spaces are disconfirmed by specific instances described by participants. Habitats such as wetlands were described to be non-conducive, some urban locations reported inadequate campus space, and one education center reported being stopped from using a potential nature play space due to conflicts with the Home Owner’s Association.

Financial challenges are divided into sub-codes called “maintenance” and “funding”. Again, although confirming codes of legislative support and community involvement provide confirming instances to support those themes, I also found disconfirming instances to contradict those themes. For example, one characteristic of nature play spaces is the legislative support offered by government and grant funding, but

the disconfirming code of financial challenges offers a different perspective on funding availability. Included in the disconfirming sub-code of funding are codes such as lack of support, pet project, and jurisdictional permitting. Though not widely reported, these challenges do exist and present obstacles to the development and use of nature play spaces in the Piedmont.

## 4.2 USES

The various, and most common, uses for environmental education in these spaces were shown by the survey data. The questionnaires asked one question related to the uses of nature play spaces, which is summarized in Table 5 and further abbreviated in Table 6 as outreach environmental education and extended classrooms. The first four interview questions were tailored to retrieve information about nature play space uses. The narrative data in Table 7 reveals four recurring themes for the use of nature play spaces including environmental education, eco-psychological development, community benefit, and hindrances.

### *4.2.1 Environmental education*

Environmental education attempts to holistically teach the public about how natural environments function in a way that explains how humans can manage their behavior to live sustainably, and this was a prominent theme in the use of nature play spaces. This main theme was divided into sub-codes that included school programs, professional development, experiential, and other. The codes to support the use of nature play spaces for environmental education that's incorporated into schools are facilitating, child engagement, school curriculum, age specific, early education, and Common Core.

Facilitating refers to the assistance offered by environmental educators or other trained in outdoor education and is explained by one example of an educator explaining techniques for project success, “Pairing people up with representatives from parks.” One participant stated, “Montgomery County wants it to be a requirement for 4<sup>th</sup> grade teachers.” when describing ocean literacy lessons, and this was coded as school curriculum. When describing the nature play space at Tawes Play and Learn, one participant stated, “We were the first project for pre-kindergarten children, so things like these are exciting.” which provides an example for the early education code. Common Core also emerged as a code for nature play space uses; “So I can teach the math standard in the classroom with data that’s made up, or I can teach that same math standard with data the students collected from a stream they sampled.” When it comes to implementing environmental education in schools, one participant stated: “It’s also figuring out what the school needs because sometimes it’s not just a green space, sometimes it’s just nature play spaces” which suggests that schools can easily decide what they want to get from the space, and plan accordingly.

#### *4.2.2 Eco-psychological development*

Eco-psychological development is the second main theme that emerged as a use of nature play spaces. The sub-codes refer to whether the development is immediate or has a delayed onset. Immediate eco-psychological development is supported by codes like free play, build confidence, creative thinking, native fauna, and educational play. Free play emerged in casual statements like, “Acorn Hill Preschool has natural environment where kids are allowed day to day to continue with their own themes.” There were many stories, especially from educators, about children building their confidence in handling nature by

being in it; “So watching them freak out for the first night and be afraid to leave their tent and then overcoming that to the point where we can take them out to southern Maryland where there’s nothing around.” Delayed-onset eco-psychological development includes codes like environmental literacy standards, lifestyle changes, long-term stewardship, and create bonds. Creative thinking codes emerged from recollections of specific student actions in these spaces, like using tools for building, creating artwork, or finding creative solutions to social problems. A specific example of eco-psychological development as a use of this space exists when a park ranger describes one element of a nature play space, “...we had a tree that woodpeckers were constantly pecking on and had carved worn-in holes so we built some benches just for them to sit and rest and bird watch, and watch woodpeckers.” Educational play also emerged as an eco-psychological use because many environmental education games described made children think about themselves in relation to their environment or community.

#### *4.2.3 Community benefit*

Nature play spaces in the Piedmont were shown to be used for community benefit as well. Sub-codes include families, and neighborhoods. Pertaining to families, codes such as family experiences, family influence, memory making, and parental inclusion are listed. Family experiences emerged in narratives such as, “We’re a dog-friendly park so we had families with their dogs on top the [hay] bales.” Family influence was observed in narratives explaining the use of nature play spaces; “We left it up until December 1<sup>st</sup> because we had a lot of interactive families come and want to do it again.” Memory making emerged throughout narratives in many different recollections from participants. A specific example of parental inclusion comes from an explanation of a statewide,

annual program called Park Quest; "... they were here for kids and parents to interact... We saw parents out there acting silly playing tic-tac-toe or climbing over hay bales."

Neighborhoods are supported by codes like public use, public activities engagement, technical support, community engagement, and public awareness. Professionals from the Park Service have a specific mission to "manage the natural, cultural, historical and recreational resources to provide the best use for the benefit of people." which contributed to the emergent code of public use. Only a few professional interviewed provided narrative data of their involvement in technical support to help prospective builders plan and develop; "I've helped to brainstorm and design on at least three or four, and also provided technical assistance." The emergent code of community engagement is slightly different from community involvement in that engagement refers to the use of the space after development, and involvement refers to the planning process. In relation to community engagement, one example of a narrative from which this emerged is, "The best ones that are really successful and really thrive over time are those that are installed and take care of as something that's more than just a classroom... it needs to have a lot of people from various age groups to really use that space." When describing a characteristics of a successful nature play space, one educator mentioned the importance of community involvement by comparing two projects, "The one at Towson is very nice and definitely linked to the University. At UMBC the place is rented out to the YMCA."

#### *4.2.4 Hindrances*

There were many codes that emerged in the interview transcripts which described the challenges or difficulties encountered by people building or using nature play spaces. The sub-codes for the hindrances theme include institutional, cultural, financial, and parental. The institutional hindrances include codes such as resources lectures, academic preparation, programmatic approach, public school structure, learning objectives pre-determined, caretaker comfort level, staff turnover, volunteer reliance, small steps, placement restrictions, and untrained teachers. Educators described examples in which traditional lecture-style techniques, academic preparation, programmatic approaches, and pre-determined learning objectives took precedence over student-guided, experiential learning outdoors. Many narratives described the struggle to and get teachers trained and comfortable enough to break out of the public school structure of indoor teaching. There were also mentions of placement restrictions, “Parks and Recreation park planners deal with permitting.” and the small steps necessary in the planning process as a hindrance to gathering support of the use of these spaces because with slow progress, stakeholders tend to drop out at various phases of the project. Volunteer reliance emerged from the numerous volunteers mentioned as being called upon for mostly manual labor including Conservation Corps, Civic Justice Corps, Boys and Girls Club, and others. Staff turnover was a widely reoccurring theme and is adapted from narratives such as, “One of the challenges too is, especially dealing with preschools, is having someone come in six months later who wasn’t involved in the process and thinks they’re doing something good but destroys the project.”

Cultural hindrances include codes such as lack of appreciation, indoor societal phenomenon, biophobia, fear of the boogeyman, metal and plastic replacements, old idea, limited urban access to green space, and awareness of resources. The first three hindrances listed here involve phenomenon regarding the drift of Western civilization increasingly away from nature. Metal and plastic replacements were sometimes described in that organizations may have decided to replace an old, rotted, wooden canoe with the actual manufactured item. Limited urban access to green space and awareness of resources refer to environmental injustices that are stopping these projects from being standardized.

The financial hindrances are inspections, funding lobbying, summertime absence, consultants, low budget, court binding documents for manufactured equipment, yearly application, asphalt removal, heavy maintenance, time constraints, long process, time commitment, and natural deterioration. Due to nature play space funding being scarce, many hindrances to these projects emerge in the form of financial struggles. Inability to pay for inspection, asphalt removal, heavy maintenance, consultants, or a yearly application could lead to the space being deemed unusable. Sometimes manufactured equipment is preferred over those without court binding documents for liability reasons. A low budget could make it impossible to achieve the desired naturalization of the space, or summertime absence and natural deterioration could create problems in the space that are too big to effectively remediate. Finally, parental hindrances include child reassurance, learned fear of nature, parental supervision, parental pre-existing ideas of outdoor play benefits, and parent planning sessions. I found that children needed parental reassurance to go out into nature without their supervision, and also to overcome any fear

of nature they may have. Some parents have pre-existing ideas of what benefits come from outdoor play, and those ideas may prevent them from allowing their children to engage. Parent planning sessions were also mentioned as a hindrance to nature play space use, “One big mistake I see a lot? Nature play spaces that were clearly built by adults who were thinking in terms of what they think children will like and how they play... this is often very different from what kids actually will be interested in or do with it.” To further stress the unintended negative effects of parent planning sessions, the following statement can be of example: “It’s good to have kids involved in the process, to physically get down on look at a space from a kid’s perspective.”

#### *4.2.5 Disconfirming codes*

A corresponding disconfirming code to contradict the notion that environmental education is a main use for nature play spaces is traditional education. Within this disconfirming theme are two sub-codes, indoor lectures and pre-established parks. Indoor lectures are one way in which the confirming uses are disconfirmed and includes codes such as pre-registration, No Child Left Behind, standardized testing, equipment labeling, imaginary data, and activities break. Pre-registration, for example, constitutes a disconfirming code because the data shows that this normally is not required to use nature play spaces. In some instances, however, pre-registration was necessary for children to participate in events that were held in these spaces. The No Child Left Behind act imposes measurable standards on teachers that correlate with standardized testing, which often presents a problem in environmental education because teachers feel pressured to stick to a standardized curriculum and deadlines rather than allowing students freedom to explore and investigate nature. Traditional education also has a tendency to label

equipment which diminishes child freedom to imagine, and it also has the tendency to use imaginary data rather than allowing children to collect their own; “There are lots [of outdoor classrooms] in southern Maryland, northern VA, DC, that are all used for formal learning and have a very structured reason behind it.” Furthermore, outdoor spaces in traditional schools are usually used as a break from school learning activities, rather than a supplement to them.

Those codes contributing to the disconfirming theme of pre-established parks include improperly used parks, education component not included, and research on child preference for natural or plastic.

#### 4.3 SUSTAINABILITY

Issues of sustainability were identified in research surveys and interviews, and supplemented with financial data as in Table 2. The surveys gathered data related to financial costs as well. Based on survey data, with Sandy Point was omitted to avoid skewed analysis, the average cost of nature play space construction in the Piedmont between 2006 and 2013 was \$16,163 per project. In addition to summarizing nature play space characteristics, Table 4 simultaneously provides data related to sustainability of these spaces. Most of the columns in this table can be analyzed along with financial data from Table 2 to identify the ways in which nature play spaces serve as a sustainable way to develop environmental literacy in children. The interview data revealed three emergent codes for the ways in which sustainability is addressed in these spaces. These three main emergent codes are environmental, economic, and social issues of sustainability.

#### *4.3.1 Environmental*

Environmental sub-codes are categorized as immediate, or delayed-onset. Codes to support immediate environmental sustainability include natural materials, repurposed materials, minimal impact, invasive threats, exotic species, local geology, invasive bamboo, natural history, non-durable bamboo, native flora, bamboo eradication, and low-impact construction. The use of natural materials over manufactured ones lessens carbon emissions during construction, all participants alluded to only using natural materials to build these spaces, as that is a defining characteristic of nature play spaces. These environmental codes all relate to the attempt to create and maintain environmental conditions that allow humans and nature to exist symbiotically, and consume a limited amount of natural resources so as to ensure future generations have what they need. Therefore, builders consider the local geology, natural history, and native flora when planning these spaces. They also want to have minimal impact on the land, so low-impact construction techniques are used.

Materials are repurposed as often as possible, whether giving new life to downed trees or old tires. A major recurring theme related to environmental sustainability is the introduction of bamboo in the construction or different nature play space aspects. There was an overall consensus amongst participants that the presence of invasive bamboo was not a positive thing for Maryland, just as the introduction of exotic species should be avoided, but since the presence of bamboo is so prevalent already it may as well be used. Typically, participants cited efforts to eradicate bamboo, then use it for elements such as fencing because of its lack of durability, but not much else.

Delayed-onset codes include longevity, stewardship, environmental services, sealants, planning, environmental literacy, and environmental review. Since longevity refers to the ability of something to have a long existence it is believed to have delayed benefits, and there are many different ways in which these spaces are made to last including their use for community oriented programs, using solid and durable hardwood, constant funding sources like parent-teacher associations or grants, or making minimal repairs and replacements to the space. Stewardship is considered a delayed onset code for environmental sustainability because it involves responsible planning and management of natural resources, and students are more capable of environmentally responsible behaviors when they have the freedom to make choices. The same is true for environmental literacy because the ultimate assessment for students occurs in their last year of high school. Planning, environmental review, and environmental services are also thought of as long-term goals which will pay off in the future with careful thought today.

#### *4.3.2 Economic*

Economic sustainability is addressed by the sub-codes support, government assistance, and longevity. In terms of support, the emergent codes show that economic sustainability of nature play spaces must include funding-planning, school systems, and buy-in. Also included is the code lack of funding, which may make the development of these spaces difficult, but doesn't hinder them completely and is a prominent recurring code in this main theme.

To explain the lack of funding, one participant said, “[There are] funding difficulties, but we received a one-time grant to pilot the program.” This statement provides insight into the way the lack of funding is overcome, and how important

funding-planning is when you receive finite monetary assistance through grants. School systems is an important code in regards to economic sustainability because they provide the best avenue for standardization of nature play spaces in America's educational institution. Luckily, interview data revealed many ways in which schools are currently utilizing their outdoor space; "I think the biggest successes have been with how schools end up adopting different greening practices as part of curriculum and really transform schoolyards into learning areas." And many different stakeholders are continuously advocating for schools to use these spaces, "Well in my opinion to get children access to nature of course put them in public schools." Buy-in is required across a wide range of professional fields in order to achieve economic sustainability because outside financial assistance and consultation is often necessary for long-term success.

#### *4.3.3 Social*

The social aspect of sustainability is shown by the sub-codes community, and schools. In the community, sustainability is achieved by advocacy, engagement, publicity, generational change, connectedness, community involvement, safety, communication, accessibility, self-guided, and parental influence. Most of these codes are self-explanatory but some need further explanation. Connectedness, for example, can be explained with the following statement: "If they're not comfortable in a setting they're never going to relax and have fun. And if they don't have fun, they don't care." Another example of connectedness comes from, "So that way those kids are the ones actually putting in those trees, so they know what goes into it. They like to keep their eyes on it, and stop people from pulling it out." Communication is important to keep with the public, "Advertising is a big thing. We're doing Twitter like crazy to tell people about different

activities and programs and places they can go.” but it’s also important amongst planners and stakeholders, “...better planning, better communications and resources, and involving facilities and administration staff from the beginning...”

In schools, sustainability of nature play spaces is addressed with professional development, career readiness, personnel, child input, professional input, audience range, longevity, partnerships, school curriculum, child involvement, and parental buy-in. Professional development was shown to be a recurring social use which contributes to sustainability because it ensures that teachers are updated on current practices and capable of teaching in these spaces. This is also true of personnel that are needed to maintain and use these spaces. Career readiness is an important social sustainability code to emerge because it suggests that not only will nature play spaces facilitate a child’s connection to nature, but it gives them an opportunity to explore career options related to the environment early on in life. Child input and child involvement refer to the need to include children in the planning and utilization of these spaces. When it comes to audience range, social sustainability is more likely when these spaces can be utilized by a diverse range of people across different age groups.

#### *4.3.4 Disconfirming codes*

I found a number of disconfirming codes related to sustainability of nature play spaces, which were categorized the same as confirming codes, with main emerging themes in environmental, economic, and social sustainability. However, the only sub-code for environmental disconfirming themes is maintenance. Interview codes identify maintenance hazards, tractors, assumed less maintenance, and biodegradation as disconfirming contributions to the sustainability of nature play spaces. Though rare,

interviewees did mention a few examples of maintenance hazards that arise in these spaces and compromise the sustainability such as dangerous locations on slopes, or thorny flora like multiflora rose. Tractors are somewhat of a contradiction to the effort to use minimum impact construction techniques, but were noted as sometimes necessary when installing large elements. Though biodegradation is expected in natural environments, interviewees mentioned instances in which this was brought on by anthropogenic activity in these spaces, which is certainly a disconfirming instance for sustainability.

The economic disconfirming theme lies in funding. Disconfirming codes which contribute to funding difficulties are just two; no nature play space-specific funding, and dollars invested not publicly reported. These elements provide contradictions to the availability of funding and potential for continued funding, and significantly contribute to ways in which nature play spaces aren't economically sustainable.

The social disconfirming sustainability sub-codes include traditional education and public buy-in. Traditional education poses disconfirming instances in the form of sustainability lectures, classroom dittos/worksheets, policy change, and policy implementation. Lectures and worksheets are not only widely used across educational institutions, but were even cited as being used in nature play spaces themselves. Instead of focusing on institutional change in education, some participants suggested change should be made in policy and the way policies are implemented. Public buy-in consists of codes like adults down or kids up approach, short-lived projects, and parental demonstrations. There was one interview in which the participant suggested social sustainability must be done in an adults down or kids up approach rather than putting the

burden on educational institutions. Also, parental demonstrations of how elements in the space work was mentioned as a disconfirming instance because it relies on parental supervision and buy-in rather than being able to sustain on its own. Finally, some short-lived projects were described that contradict the ability of nature play spaces to sustain well into the future.

## 5

### **Discussion**

The findings reveal trends regarding collective perceptions of nature play space development in the Piedmont region of Maryland, as well as confirming information that was previously known. In reference to the dominant characteristics of outdoor classrooms in the Piedmont, several conclusions can be made. The first is a confirmation that most of these projects in this region are government sponsored. This may be useful to the public knowledge as it shows that state and federal government in Maryland is upholding its responsibility to provide more children with access to experiences in nature by building outdoor areas in which children can play and learn. Also, the average number of children served by privately-sponsored nature play spaces is 12,025 per year, while government sponsored projects are only slightly higher at 17,720 year, although these projects ostensibly represent a larger portion of the data. This is interesting because it suggests that these spaces reach a relatively similar-sized audience whether they are government or private projects. In addition, the total 2010 pre-school enrollment in Maryland was 29,377 children and the total served as reported by survey data was 29,745 over seven years. So theoretically, if all these nature play spaces operated during the entire year of 2010 (which does not apply to five of the reporting organizations that built their spaces

after 2010) they would reach all of the Maryland preschoolers enrolled at public or private institutions. This is assumed true if those Maryland preschoolers were given access to nature play spaces, but many are not.

A second characteristic as defined by the data is the infrequency of major repairs builders make annually. Surveys report that nature play spaces can sustain for a minimum of 12 months without any major repairs, whether private or government contractors build them. Using Irvine Nature Center as an example, because they reported the highest volume of children served annually; approximately 18,000 square feet of land is used seven days per week by at least 95 children per day. This represents the upper range of nature play space use intensity, yet Irvine reports major repairs only once or twice a year with mulch and sand replacement being the most frequent. This example is indicative of long-term economic sustainability because it informs stakeholders of the monetary investment they must first consider before installing a nature play space. By planning in accordance with once yearly major repairs, organizations and individuals may be better able to fund their project long-term.

A third characteristic observed from survey data is the daily use of these spaces by environmental education centers. Jug Bay Wetlands Sanctuary was the only organization to report usage less than five days per week, but it's important to keep in mind that this organization has strict protocol regarding human activity on wetlands such as making a reservation for a group to visit the sanctuary, prohibiting dogs, hunting, boat docking, and fishing, and encouraging visitors to stay on trails or boardwalks. All the other organizations reported using their nature play space a minimum of five days per week, with four of them using the spaces seven days per week. This data provides a strong case

for the standardization of nature play space construction because it shows that they are not under-utilized, and in fact, become important staples of the student's school day. In other regions however, where temperatures can reach extremes, this may not be observed. In the Piedmont region of Maryland, climate conditions allow children to be safely exposed to the natural environment in nearly all weather conditions except those prohibited by State law such as extreme wind, chill, or heat.

The narratives of professionals within the field of nature play space development or application show six characteristics of nature play spaces in the Piedmont. The emergence of the main theme, place-based, supports the influence of David Sobel's research of the benefits of children learning in the context of where they live. Already known about nature play space characteristics is the use of natural materials, but it is interesting to note that those elements contribute to place-based learning just by exposing children to the resources around them. From this, it could be inferred that bringing natural materials into the classroom children with a sense of connectedness to the ecosystem in which they live, though we know experiential learning is also appropriate. Particularly of interest in the Piedmont region, due in part to the rapid urbanization in this region, is the use of preserved areas for nature play spaces. It is interesting to note Maryland land managers' willingness to put nature play spaces in these areas; this finding may suggest that professionals observe no negative impact to the land through installation and use of these projects. The use of repurposed areas supports the notion that space in urbanized areas is becoming limited, and provides a solution to others facing the same circumstances.

Experiential learning has been a staple of environmental education, and its emergence as a second main theme of nature place space characteristics supports the abundant research suggesting that retention rates are greatly increased when using participatory teaching methods (Kolb, 2014). Sub-codes identify the ways in which experiential learning occurs in these spaces; through physical play, real world experience, witnessing ecosystem services, and cognitive functions. These sub-codes assure that the learner is directly in touch with the environment as well as contributing to the cognitive development of the child, which is an added benefit of experiential learning though emphasis is placed on sensory experience and enforced by the first three sub-codes.

The third main theme for research question one, physical location, begins to identify actual requirements for construction. The requirements include compliance, visibility, accessibility, and attractions. The Department of Natural Resources has been successful in reporting the kinds of liability and building compliances for nature play spaces based on David Sobel's play motif so the public can easily conform, and the National Wildlife Federation also provides guidelines for building these spaces based on Robin Moore's landscape design research (DNR, 2012; Moore, 2014). The DNR guidelines report safety advice based on Certified Playground Safety Inspectors Guidelines, and reminds stakeholders that these spaces are subject to the Americans with Disabilities Guidelines as of March 2011. Yet, compliance for nature play spaces is not a big challenge since these spaces do not actually need to meet traditional playground guidelines (CPSC, 2010).

The physical location is more concerned with making the spaces visible and accessible with interesting attraction or features that will entice children to enter the

space. The fourth code describes legislative support in terms of environmental literacy requirements, government responsibility, and funding. These codes are important to find because it provides solid evidence of state and federal support of these projects in Maryland's Piedmont. This theme also eludes to the notion that in the state of Maryland, nature play spaces are an initiative that is mainly funded by the state due to their financial avenues and mandate to facilitate environmental literacy and increase children's access to nature.

Community involvement also emerges as a dominant characteristic of nature play spaces in the Piedmont. Not only does this strengthen the advocacy for building these spaces because they benefit entire communities, but it also provides builders with a foundation on which to initiate these projects. Studies show that community involvement in land naturalization results in better maintenance and usage of the space (Agrawal & Gibson, 1999). If stakeholders are left out of various steps in the planning, staffing, and maintenance of these spaces then the spaces are more likely to be unsuccessful in terms of long-lasting physical presence and social impact. Finally, the data shows that nature play spaces are characterized by significant malleability. This is encouraging because it does not restrict the space to one specific use or age range, and therefore resilient arguments can be made about the benefits of installing these spaces on available land. This characteristic of malleability allows nature play space builders and facilitators to present multiple options to stakeholders regarding budgets, target audience, and development outlets depending on the size of the investment. Those stakeholders wishing to be involved with the nature play space may be more likely to buy-in when informed of the versatility of these spaces for almost any outdoor activity.

Though the characteristics of nature play spaces are vast, the uses are not as diverse as originally expected. Survey data only reveals two types of uses for nature play spaces in the Piedmont of Maryland, but may be partly due to the wording of the question which asked, “What sorts of educational programs do you use this space for?” The way in which the question was phrased may have limited the response of participants to think only of established programs, and exclude anything they do within the space that is not a traditional or well-known use. Even so, the most common survey responses include extended classroom and outreach environmental education. Though not particularly diverse, these uses represent vital societal necessities that are met by the use of these spaces.

Narrative data provide support for these two uses, as well as adding new knowledge. From the interview data, the four main emerging themes are environmental education, eco-psychological development, community benefit, and hindrances to the uses. The first three nature play space use themes listed compliment previously researched positive effects of outdoor environments including things like increased engagement, career readiness, and enriched learning (Neill & Richards, 1998). Eco-psychological development also has a thorough body of research related to it, and it is useful to confirm that nature play spaces are used as a way to foster this in children, because it suggests that the child will development environmentally responsible behaviors which will translate into sustainable populations in the future (Berger & McLeod, 2006). The fact that these areas can be used in a variety of ways not limited to child development in one aspect such as mental or physical, but rather help to create well-rounded children is even further incentive to support increased development of these spaces.

The hindrances to using nature play spaces are important new knowledge to make note of because their emergence in the interview data means stakeholders will encounter these obstacles at one point or another during their project. There are cultural, institutional, financial and parental sub-codes related to the hindrances of use. The seniority of long-established traditional education institutions may always be a challenge for non-traditional environmental education, but these codes inform the public of what to expect when attempting to collaborate with schools. One of the many institutional hindrances to highlight would be the reliance upon volunteers to make these spaces or use them. If not receiving government support, many of the projects use volunteers for construction purposes. Some non-profit agencies even rely solely on voluntary contributions of time, money, and resources. Furthermore, use of private spaces by educators or the general public is completely voluntary. So, for various reasons, one hindrance of particular interest is the reliance on volunteers.

Only one main theme emerged to disconfirm the codes previously described above. The scarcity of disconfirming codes here eludes to the strength of the confirming codes for this research question. To contradict the use of these spaces for environmental education, the theme of traditional education arose. As mentioned when describing the hindrances to nature play space use, traditional education institutions are still widely insistent upon using teaching methods such as standardized testing, or handing out worksheets for students to complete. Due to a lack of teacher training and comfort, it may be difficult to convince school officials to implement the four confirming themes discussed earlier.

Issues of sustainability may be more difficult to address with the collected interview data, but financial data provides a stronger case for the economic sustainability of nature play spaces. It is best to keep discussion of sustainability on a county-by-county basis because each scenario will yield different results. The beneficial aspect of this research is that it examines nature play spaces in an area of Maryland that is highly developed, and therefore yields interesting and important data that can be adapted for metropolitan areas. In analyzing sustainability issues, principles of economic sustainability should be discussed as well as theoretical concepts.

First, the emerging themes from interviews suggest that there are three main ways in which the sustainability of nature play spaces is addressed. These themes follow the principal of the triple bottom line approach to sustainability in that they address environmental, economic, and social aspects (Norman & MacDonald, 2004). Prior knowledge is confirmed by the sub-code describing environmental sustainability as delayed, but the codes also show immediate ways in which environmental sustainability is achieved. These codes stress the importance of critically thinking about the course of natural resources to build these projects and impacts on the habitat site or surrounding land. Delayed onset describe the typical ways in which we think of environmental sustainability, meaning that we can achieve long-term natural resource procurement by creating generations of people that are conscious of their ecological footprint because we taught them about ecosystem services, and environmental stewardship, and spent time nurturing their environmental literacy in these outdoor spaces. These codes provide important guidelines for builders to adhere to when planning these projects. Conversely, emergent codes also indicate disconfirming instances for environmental sustainability in

the form of maintenance challenges which poses a threat to the economic sustainability of the space too.

Social themes of sustainability include community and schools. The codes to support these themes suggest that the sustainability of nature play spaces in the Piedmont of Maryland is ensured if there is support from the community, and even further the local school systems. Here it is convenient to revisit the concept of autopoiesis because we are thinking of a system in which there is a network of processes of production (ways in which we produce children into environmentally literate adults) that is self-sustained by the actions taking place inside the nature play space. For example, the codes included in sub-codes community and schools describe ways in which the social sustainability of the space creates a positive feedback loop in that actions like training students for career readiness, providing teachers with professional development, advocating and publicizing the space, and establishing partnerships with other agencies will lead to increased community and school support.

It is very important for readers to understand this sustainable aspect of nature play spaces in order to increase chances of success, and these sub-codes can be applied at least regionally rather than being limited to Maryland's Piedmont, if not nationally or universally. This study takes into consideration the theories of economic sustainability and sustainable development when analyzing each county. A sustainable nature play space is able to endure in long-term time frames while still remaining cost effective, and can be validated by dividing the annual total amount to operate the nature play space by the annual estimate of youth served. Percentage of developed land, population growth rates, and financial budgets are considered when evaluating the sustainability of these

spaces. Confirming themes for economic sustainability show that there must be external support for the project, government assistance, and measures taken to ensure longevity such as maintenance plans and pushing for standardization in school systems. However, the disconfirming codes shows that funding is actually not sustainable for these spaces because there does not exist a funding source specifically devoted to these projects and the absence of investment reports makes it slightly difficult to get buy-in from stakeholders because it is not easy to assess the physical space without knowing the amount of money put into it. This is one reason why this particular study is useful in the progression of advocacy for these spaces.

Included in this study because of its importance in the Baltimore Metropolitan Area, Anne Arundel County shows the fastest growing population of the studied counties between 2010 and 2013. It is heavily developed at 51% and receives 8% of the entire state budget, but uses 12% of that budget for education and 5% for health and the environment. The Maryland State Department of Education (MSDE) reported 1,670 pre-school students enrolled in Anne Arundel public schools and cost per student was \$12,330. Jug Bay Wetlands Sanctuary, which is operated by Anne Arundel County's Department of Recreation and Parks allotted \$2,075,000 to a project in 2010. Survey data reveals a total of \$65,000 spent on nature play spaces in 2011 in Anne Arundel County between the Key School and the Annapolis Play and Learn which use their spaces five days a week and serve a combined total of 145 children each year. The Key School repairs their space once a year, and the 15,000 square feet of space at the Play and Learn needs major repairs just once every three years. In 2013, Jug Bay Wetland Sanctuary reports a cost of \$2,180 being spent on their nature play space, which represents only a

0.11% of what was spent to complete a larger scale project there in 2010. Jug Bay's nature play space only calls for major repair once every two years, and serves approximately 1,200 children a year. The combined report of children served by nature play spaces in Anne Arundel County between 2011 and 2013 is 1,345 which represents 80% of the preschoolers enrolled in public institutions in Anne Arundel County in 2010.

If Jug Bay spent \$2,180 to operate their nature play space in 2013, and served 1,200 children that year then they are only spending approximately \$1.82 on each child's yearlong experience in that space. This is in contrast to the \$12,330 reported by MSDE to serve one student in Anne Arundel County public schools for the entire year. This particular estimate, called a unit of service, provides an average quantity that may be useful in estimating financial accessibility and providing a basis for cost comparison (Goldstein, 2006). According to the survey data, the average cost to build a nature play space in Anne Arundel County is \$22,393 and dividing this by the total number of children served leaves an average cost per pupil using a nature play space in this County to be \$16. To summarize, this is the fastest growing County in the Piedmont and it received the second largest portion of state budget, while also showing the highest allotment to education. Whereas public schools in the County require \$12,330 per student, nature play spaces require an estimated \$16 per student. The average size of two of the four nature play spaces reported by Anne Arundel County is 13,150 square feet, making the average cost of development per square foot \$0.31.

The second fastest growing county in this study is Baltimore. This county also received 8% of the state budget and is 47% developed. 26% was spent on education and 18% on health and the environment in 2010. MSDE reported enrollment of 3,613 preschoolers in

Baltimore County public schools in 2010. Survey data showed \$53,000 spent on two nature play space projects in the county in that year. The average cost of Baltimore County nature play spaces was \$26,500. Together, the centers served a total of 36,000 youth annually which greatly surpassed the total preschool enrollment in 2010, suggesting that many nature play spaces in Baltimore County are not limited to children in early education. Both centers report using their space five or more days per week and making repairs once a year. Irvine Nature Center, a non-profit, reported an operating budget of \$2,119,987 for the entire year of 2010, and a total cost of building and operation of the nature play space to be \$50,000. Needing only 2.4% of their total annual budget, and serving 35,000 children each year, Irvine's nature play space needs \$1.43 dollar per child. Sparks Elementary, serving approximately 1,000 children annually, spent \$3,000 to build their space resulting in \$3.00 cost per child. Using the average cost of the two Baltimore County nature play spaces, the average cost per child is \$0.73 compared to \$12,967 reported by Baltimore County public schools. In addition, the average square feet of nature play spaces in Baltimore County is 10,250 square feet which equates to spending \$0.19 per square foot.

Baltimore City is the most urbanized area in the Piedmont with 92% developed land in 2010 and it receiving the most allocation of the state budget in this study with 15% of Maryland's total, though it has not grown much in residents over three years. In 2010, MSDE reported Baltimore City public schools to have 4,874 preschool students enrolled. Carroll Park Children's Garden reports serving a maximum of 800 children per year in a 1,700 square foot area. The garden was created in 2012 and is used seven days a week, costing \$3,000. This means a minimum \$3.75 was spent per child to use this area.

MSDE reported cost per pupil as \$14,183 in 2010. The Baltimore City Public School system spent \$1,372,984 in 2010 while Cylburn Arboretum, an environmental education center in Baltimore City used \$400,000 to operate their non-profit organization. This means the public school system spent \$10.28 per child under 18 that year, while non-profits show approximately \$3 per person under 18 that year (if they were to serve every single person reported). However, MSDE reports the cost per pupil in Baltimore City to be \$14,183 in 2010 because they take many other factors into consideration when calculating that parameter. The cost per square foot is low in nature play space projects, with Carroll Park spending \$0.56 per square foot.

Harford County was reported to be 38% developed in 2010 and received only 1% of the entire state budget of Maryland. Of all the counties in the Piedmont, Harford was included in the areas where the 2010 under 18 age group were represented by 25% of the population, the most that demographic reaches for this study. Also in 2010, there were only 782 pre-school students enrolled in Harford County public schools. Between the two organizations that reported, they serve a total of 2,880 yearly which is well over the enrollment total for preschoolers that year. Based on the survey data, the total number of children served at Rocks State Park and Days Cove greatly exceeds the total of pre-school enrollment. The nature play space at Day's Cove was created in 2006, representing the longest standing in the study still operating nine years later. It is also mentionable that Days Cove is reports the smallest square footage of nature play space, so that could contribute to the ability to maintain the space over time. It is used five days a week, and only reports major repairs once a year. The cost to build was \$15,000 and it serves 2,200 each year, so Days Cove spent approximately \$6.83 on each child. Rocks

State Park spent \$3,095.00 on their 18,000 square foot space that serves 680 children annually, meaning the unit of service for each child is roughly \$4.55. In 2010, with a Parks and Recreation Department budget of \$8,708,415.00, Harford County would have conceptually spent \$144.15 on the education of each child under 18 years old. MSDE reported a cost per pupil in 2010 to be \$11,784. With the average area of nature play spaces reported in Harford County being 1,300 square feet, this shows an average of \$0.14 on each square foot of developed space.

## 5.1 FUTURE IMPLICATIONS

This research informs current practices regarding nature play space sustainability in the Piedmont region of Maryland. First, we are provided with a set of guidelines as to the characteristics of these spaces in this region. These emergent themes can and should be considered by all stakeholders when discussing where to build nature play spaces and how to construct them. By following the confirming codes listed, and paying attention to the disconfirming codes, project success is more likely. Especially in the Piedmont of Maryland, those individuals or organizations planning to build or use these spaces are much better off when provided with a set of guidelines adapted from professional narratives regarding their experience with what has worked and what has failed. There are many different resources the general public can use to pull this information together, but a first-hand account of current practices that has been turned into a simple list is a beneficial resource to have when seeking knowledge into nature play spaces.

In terms of the uses of nature play spaces, the first three themes listed basically support current knowledge, and thus can act as leverage for stakeholders trying to

implement the development of utilization of nature play spaces in their area. The interesting and important insight gained by this theme is the emergence of many hindrances that impede upon the use of these spaces. In some respects, it may be more beneficial for prospective nature play space facilitators to be prepared for the things that could go wrong, rather than working from theories of successful techniques. Preparing for the worst is usually an effective strategy when developing any type of protocol, and because there are so many ways in which nature play space use is hindered, it's important for stakeholders to be aware of what they are before initializing projects.

The sustainability implications of nature play spaces are strongly economic, though supported by the other two pillars of environmental and social. Most entities have, or are beginning to grasp, concepts of environmental sustainability in terms of leaving the smallest impact on habitats but some are not aware of the shift towards including economic and social sustainability considerations in their work. The first clear economic observation is that nature play spaces cost less than traditional public school education. In all the economic analyses, nature play spaces cost less than \$0.60 per square foot of space. A greater contribution to this argument lies in the extreme difference of the annual cost per child to use either nature play spaces, or public school institutions. Obviously, nature play spaces do not require as much financial assistance as public schools.

When calculating the cost per pupil, public institutions must take into account the cost of textbooks, meals, administration and instructional salaries, student transportation and services, operational and maintenance costs, and multitude of other factors whereas nature play spaces provide a holistic educational experience using limited outside resources other than instructional and operational wages. So, while public school cost per

pupil for the four Counties described ranges from \$11,000 to \$14,000, nature play space only spend a range of \$1.40 to \$4.50 per child. The data shows that nature play spaces become more economically affordable with increasing numbers of children served. So, if a center plans to build a big nature play space that requires a substantial investment, such as Irvine Nature Center, they can offset the cost by serving a large number of children annually. Essentially, the more children served, the more “bang for your buck”.

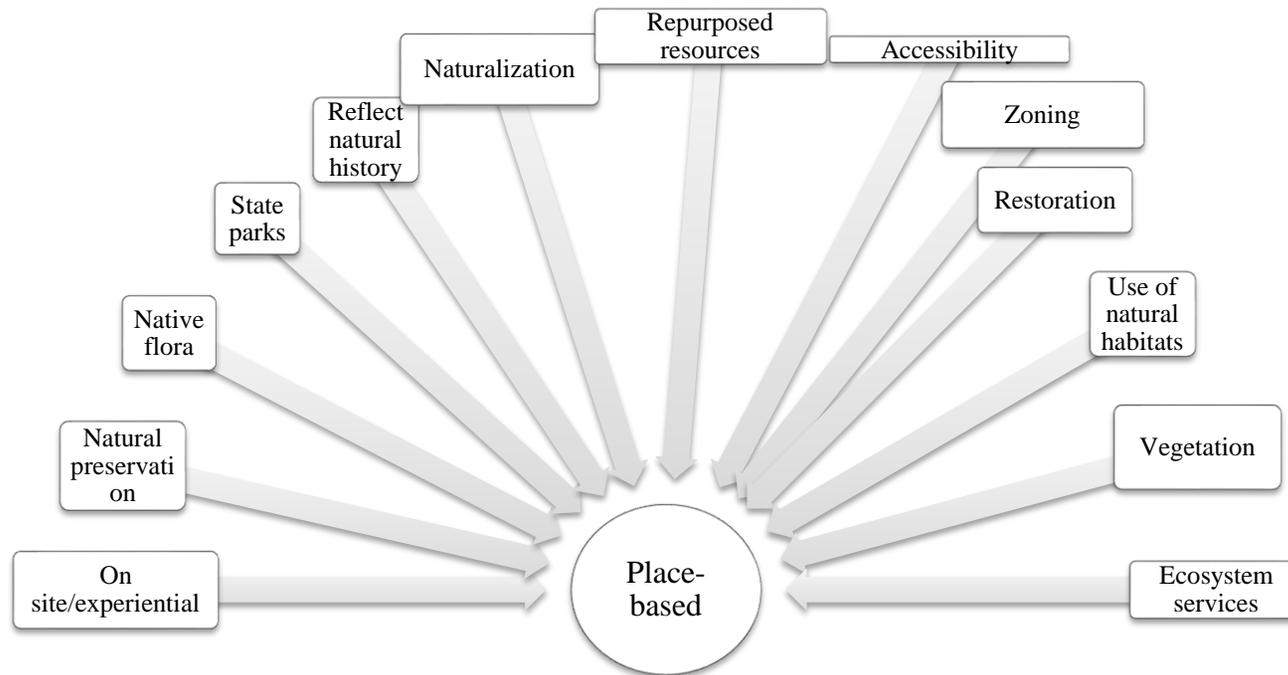
Also noteworthy, is how much of the total State budget is allocated to counties, and how those counties disperse funds to education outlets, including environmental education and nature play spaces. Baltimore City, for example, is the most highly developed area in the Piedmont but is not growing in population very rapidly. It receives the highest allocation of the State budget at 15%, but uses 28% of that allocation towards education whereas Harford County is 38% developed, and only receives 1% of the state budget, yet allocates 29% of that money towards education in their district. In contrast, the County with the most rapid population growth receives 8% of the State budget, but only allocates 12% of that money to education. So even though one would expect to see some kind of trend or systematic distribution of funds, it actually varies across Counties and does not present much insight into financial strategy.

Collectively, nature play spaces in this region reportedly served more youth annually than to total enrollment in public schools. Not only can these spaces be used as extensions to classroom learning, but they can act as a substitute for traditional early education. In other words, public schools exclude a population of children that don't enroll, but those children are not excluded from nature play space utilization so they have an alternative option for early education.

In conclusion, nature play spaces in the Piedmont region of Maryland are sustainable teaching tools as defined by environmental, economic, and social emergent themes, and act as cost-effective methods for creating environmentally literate adults. These data would be most useful to institutions that would benefit from their installment the most. For example, the Young Men's Christian Association, or better known as YMCA, is a worldwide organization with 57 million beneficiaries and a strong presence in Central Maryland. There are even seven preschool locations (six of which are located in the Piedmont region). These centers provide family recreational opportunities and enrichment programs to assist in before or after school supervision. The YMCA is an ideal location for nature play spaces because of the large pool of members, potential for co-location, easy accessibility, and financial affordance. Maryland Green Schools could benefit from the knowledge gained by this research because they have an ideal platform for which to advocate for the development and use of nature play spaces.

Of course, this study also highlights the need for additional research. For instance, Maryland may want to create a database of nature play space project costs in order to provide transparency, but also create a foundation for the assessment of nature play space effectiveness based on return on investment. Also, the data set from which to pull this kind of information should drastically increase. A limitation of this study was the small data set of 10 survey responses and 12 interviews. By further investigating nature play spaces, especially in other physiographic regions of Maryland, these themes can be supported or disputed and results can apply to a wider range of locations.

**Figure 1.** Diagram showing the aggregation of codes into groups with corresponding sub-codes. This diagram gives an example of the codes that were clustered together to create the coding group “Place-based” for research question one. Appendix C was used to assign an all-encompassing code for every individual code of each interview question.



**Figure 2.** Example of the process by which research coding was done in order to thematically analyze survey data. The purple highlighted text corresponds to research question one, meaning characteristics of nature play spaces. Yellow highlights are coding for research question two, or the uses of nature play spaces. And green highlights address sustainability issues. The text encapsulated in ovals are disconfirming codes, or things that somewhat contradict the theme.

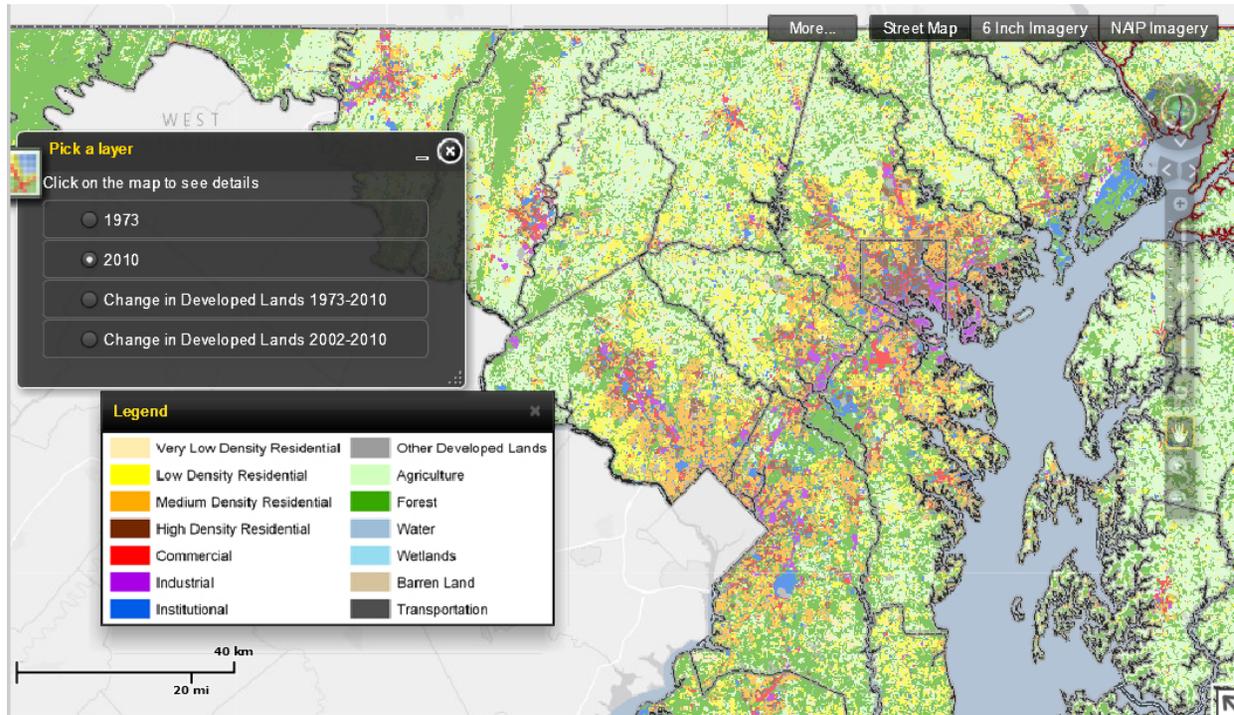
Question: What are some of your success stories?

Answer: "It's easy to talk about a resource like Turkey Point light house, but to actually get someone there makes them truly appreciate it. And without that we don't have them as an advocate to protect our resources. Immersion makes it real for people. There's a program called Junior Rangers with several levels geared towards 7-12 year olds. It invites pre-registered kids to the park on numerous days, and they learn how the environment and people are connected. We offered one program this summer called "Be the Playground Engineer" to get them thinking of park development, and introduced the idea of sustainability. We get to talking about nature play spaces and sustainability in that all the metal structures can be made of natural materials."

**Figure 3.** 2012 NASA satellite image of North American city lights at night. Credit: Image by Craig Mayhew and Robert Simmon, NASA Goddard Space Flight Center.



**Figure 4.** 2010 Maryland Land use as reported by the Maryland Department of Planning.



**Table 1.** Focal research questions of study with complementary data collection techniques and analysis.

<b>Research Question</b>	<b>Data Collection</b>	<b>Data Analysis</b>
What are the characteristics of outdoor classrooms in the Piedmont region of Maryland?	Literature review of current research. Surveys of environmental education centers within the Piedmont region, mixed with professional interviews.	Comparative analysis (cost effectiveness, yield of educational value, minimization of outside resource input).
What are the predominant uses of outdoor classrooms in the Maryland Piedmont? Are these uses the same for the general public?	Interviews with land managers, informal educators, K-12 teachers, nature play experts, and government representatives.	Thematic analysis using emergent categorical coding.
How are sustainability issues addressed in outdoor classrooms of the Piedmont region in Maryland?	Interviews with private and government agencies.	Financial analysis, and thematic analysis using emergent categorical coding.

**Table 2.** Summary of populations, financial data, and land use data of seven Piedmont counties and one Atlantic Coastal Plain province. The data was retrieved from U.S. Census and Department of Planning reports for 2010, 2013, and 2015.

County	Total Population (2013)	Total population (2010)	Population under 18 (2010)	Percent developed (2010)	Total budget (2015)	Education allocation (2015)	Health and Environmental allocation (2015)
Baltimore county	823,015	805,029	176,750	47	290,536,500	74,218,000	52,695,000
Baltimore City	622,104	620,961	133,560	92	552,250,000	158,990,000	203,201,000
Anne Arundel	555,743	537,656	125,061	51	306,107,763	36,486,000	14,421,279
Howard	304,580	287,085	74,664	51	64,198,333	21,538,000	0
Harford	249,215	244,826	60,410	38	43,822,500	12,791,000	3,355,000
Frederick	241,409	233,385	59,044	24	46,990,929	22,004,726	575,000
Carroll	167,564	167,134	41,237	29	18,449,304	3,915,000	3,920,000
Cecil	101,913	101,108	25,355	13	16,726,861	8,195,000	325,000

**Table 3.** Summary of survey responses from ten government sponsored nature play spaces within the Maryland Piedmont region regarding physical size, financial cost, serving capacity, frequency of use, and major repair projections.

<b>Name of Organization</b>	<b>County</b>	<b>Area of nature play space (sq. ft.)</b>	<b>Year and cost of area construction (year, USD)</b>	<b># children served annually</b>	<b>Usage (# days per week)</b>	<b>Frequency of major repairs</b>
Key School	Anne Arundel	ND	2011, 25,000	75	5	Annually
Jug Bay Wetlands Sanctuary	Anne Arundel	10,800	2013, 2,180	1,200	3	Every 2 years
Play and Learn	Anne Arundel	15,500	2011, 40,000	70	5	Every 3 years
Sandy Point State Park	Anne Arundel	8,712,000	Est. 1952, ND	12,770	7	Annually
Carroll Park Children's Garden	Baltimore	1,700	2012, 3,000	600-800	7	Every 1-2 years
Sparks Elementary	Baltimore	2,500	2010, 3,000	1,000	5	Annually
Irvine Nature Center	Baltimore	18,000	2010, 50,000	35,000	7	Every 1-2 years
Rocks State Park	Harford	100	2012, 3,095	680	7	Annually
Days Cove	Harford	2,500	2006, 15,000	2,200	5	Annually
High Knob	Frederick	800	2010, 4,200	200-300	5	Annually

**Table 4.** A matrix of comparative analysis between government and privately sponsored nature play spaces which reported surveys.

<b>Nature play space</b>	<b>Area more or less than 1,000 sq. ft.</b>	<b>Cost more or less than \$3,001.00 USD</b>	<b>Project completed before or after 2010</b>	<b>Serves more or less than 500 youth annually</b>	<b>Used more or less than 5 days/week</b>
Rocks State Park	-	+	+	+	+
High Knob	-	+	-	-	+
Carroll Park	+	-	+	+	+
Children's Garden					
Days Cove	+	+	-	+	+
Jug Bay	+	-	+	+	-
Wetlands Sanctuary					
Play and Learn	+	+	+	-	+
Sandy Point State Park	+	ND	-	+	+
Privately- sponsored					
Sparks Elementary	+	-	-	+	+
Irvine Nature Center	+	+	-	+	+
Key School	ND	+	+	-	+

**Table 5.** Summary of survey responses from ten nature play spaces within the Maryland Piedmont region regarding the main physical attractions of the space, its educational uses, man-made learning structures, and biggest maintenance challenges arranged by smallest to largest annual serving.

<b>Name of Organization</b>	<b>Main Physical Attractions</b>	<b>Educational uses</b>	<b>Physical Structures for Learning</b>	<b>Maintenance Challenges</b>
Play and Learn	Tree stump circle	Science activities/observation, story time	Gathering area, live willow tunnel, stage, large climbing log, sensory plants, butterfly garden, berry bushes	Drainage, grounds crew communications/understanding (mowing over plants)
Key School	Outdoor recess	Interdisciplinary activities/projects	Music area with stage, building areas with shelves, tiered stage, shed with props, gardens, swings	Facilities crew to do maintenance, annual sand and mulch renewal
High Knob	Log walk, log balance beam	Nature programs, meeting area	Walking trails with signage, nearby nature center	Balancing log repairs/corrections
Rocks State Park	Giant bird's nest, stump jump, hollow tree trunk crawl	Self-guided	Gathering area. Creativity stage	Fallen debris, restock mulch, bamboo repairs
Carroll Park Children's Garden	Large network of adjacent logs	Used by adjacent schools for outdoor exploration programs	Gathering area, garden, physical challenges	Keeping safety surfacing in place, plants worn/stolen/vandalized, large logs moved around, Prevent grass growing over edging
Sparks Elementary	Garden, native plants, trees, fire pit, trails, waterfront, wildlife	Campfires, Leave No Trace, Scales and Tails, Projects	Gathering area, garden, fire pit, picnic tables	Wood replacement, mowing grounds, tree maintenance, weeding garden

		WET/WILD/Learning Tree games		
Jug Bay Wetlands Sanctuary	Willow tunnel, canoe, stump jump, balancing log, sand pit, vine hut, art table, musical instruments	Family visits, lunch breaks, pre-school programs	Musical instruments, willow tunnel, stump jump, balancing log,	Musical instrument repair, survival of native shrubs
Days Cove	Garden, native plants, trees, patio/picnic tables, bamboo hut, log path, trails, waterfront	Campfires, canoeing, Leave No Trace, Scales and Tails, Owl Prowl, Projects WET/WILD/Learning Tree games	Gathering area, garden, bamboo logs, picnic tables, fireplace	Wood replacement, patio stones, mowing, tree maintenance, weeding gardens
Sandy Point State Park	Open water access to Chesapeake Bay	Junior Rangers, interpretive programs, school based curriculum programs	Beach, trails, picnic shelters	Trail maintenance, aging infrastructure (60+ yrs), restroom renovation
Irvine Nature Center	Music and movement area with stage and instruments, log jumpers, hollow tree trunk crawl, climbing logs, building area with loose parts, digging area, sandbox, rain barrel, pollinator garden, slate art easels	Summer camp, parent/child programs, Nature Preschool, nature birthday parties, impromptu play, model for annual Nature Preschool Conference	Gathering area with arbor, reflection area with garden, vegetable garden, greenhouse, stone wall for building, logs, trees, shrubs	Foot traffic, safety monitoring, mulch renewal twice a year, sand renewal, replenish loose parts, planting costs, new seeds, hand tools/ materials renewal, staff time

**Table 6.** Abbreviated summary of recurring survey responses from ten nature play spaces within the Maryland Piedmont region regarding the main physical attractions of the space, its educational uses, man-made learning structures, and biggest maintenance challenges.

Survey question	Most common responses
What are the main attractions?	Gardens Logs Trees Shrubs Sand Huts
What sorts of educational programs do you use this space for?	Extended classroom Outreach environmental education
What physical structures/areas are present for learning?	Native flora Gathering area
What maintenance challenges do you face?	Loose parts repair Safety monitoring Grounds keeping

**Table 7.** Emergent categorical coding of twelve interview transcripts to serve as qualitative data for addressing research questions.

<b>Research Question</b>	<b>Emergent Codes</b>	<b>Sub-codes</b>
What are the characteristics of outdoor classrooms in the Piedmont region of Maryland?	<ol style="list-style-type: none"> <li>1. Place-based</li> <li>2. Experiential</li> <li>3. Physical location</li> <li>4. Legislative support</li> <li>5. Community involvement</li> <li>6. Malleability</li> </ol>	<ol style="list-style-type: none"> <li>1. a. Natural – On site/experiential, reflect natural history, native flora, State parks, use of natural habitats, vegetation, ecosystem services               <ol style="list-style-type: none"> <li>b. Repurposed areas – Naturalization, professional development, repurpose materials, restoration, repurposed resources, natural objects                   <ol style="list-style-type: none"> <li>c. Preserved areas – State parks, natural preservation, conservation</li> </ol> </li> </ol> </li> <li>2. a. Physical play – Environmental education, communication, tunnel, interactive               <ol style="list-style-type: none"> <li>b. Real world experience – Live sampling, immersion, wilderness, making connections</li> <li>c. Ecosystem services – previous research</li> <li>d. Cognitive development – Structured learning, unstructured learning, cognitive exploration, imagination skills</li> </ol> </li> <li>3. a. Compliance – zoning, minimal permitting, liability one pagers, National standards, safety, NWF guidelines, soft surface requirement               <ol style="list-style-type: none"> <li>b. Visibility – Co-location, signage, boundaries, large elements</li> <li>c. Accessibility – Anthropogenic changes, semi-public spaces, community open-space land</li> <li>d. Attractions – Campground, non-permanent structures, attention-grabbing, fun,</li> </ol> </li> <li>4. a. Government responsibility – Gov’t policy, State responsibility, State legislation, Gov’t installation, State initiatives, environmental literacy</li> </ol>

		<ul style="list-style-type: none"> <li>b. Funding – Grant funding, Gov’t funded,</li> <li>5. a. Planning – Public buy-in, parental buy-in</li> <li>    b. Staffing – Staff turnover, teachers, staff availability</li> <li>    c. Maintenance – Community effort, grounds maintenance</li> <li>6. a. Cost – Monetary reporting, minimal cost</li> <li>    b. Age range – All inclusive</li> <li>    c. Schools – Curriculum, sub-segments of outdoor classrooms, professional development</li> <li>    d. Other – Public vs. private sector differences, versatility, reading, formal, development span, more commonly built from scratch, vacant lot</li> </ul>
<p>What are the predominant uses of outdoor classrooms in the Maryland Piedmont? Are these uses the same for the general public?</p>	<ul style="list-style-type: none"> <li>1. Environmental education</li> <li>2. Eco-psychological development</li> <li>3. Community benefit</li> <li>4. Hindrances</li> </ul>	<ul style="list-style-type: none"> <li>1. a. School programs – Facilitating, child engagement, school curriculum, age specific, early education, Common Core</li> <li>    b. Professional development – Career readiness, research contribution, technical support</li> <li>    c. Experiential - Environmental education, make connections, on site/experiential, self-guided, outdoor learning, hands on, camp programs</li> <li>    d. Other – Public use, recreation, college level environmental education, formal, multi-purpose, gov’t policy, enriched learning, stewardship, physical development</li> <li>2. a. Immediate – Free play, build confidence, creative thinking, native fauna, educational play</li> <li>    b. Delayed-onset – Environmental literacy standards, lifestyle changes, long-term stewardship, create bonds</li> </ul>

		<p>3. a. Families – Family experiences, family influence, memory making, parental inclusion          b. Neighborhoods – Public use, public activities engagement, technical support, community engagement, public awareness          4. a. Institutional – Resources lectures, academic preparation, programmatic approach, public school structure, learning objectives, pre-determined, caretaker comfort level, staff turnover, volunteer reliance, small steps, placement restrictions, untrained teachers          b. Cultural – Lack of appreciation, indoor societal phenomenon, biphobia, fear of the boogeyman, metal and plastic replacements, old idea, limited urban access to green space, awareness of resources          c. Financial – Inspection, funding lobbying, summertime absence, consultants, low budget, court binding documents for manufactured equipment, yearly application, asphalt removal, heavy maintenance, time constraints, long process, time commitment, natural deterioration          d. Parental – Child reassurance, learned fear of nature, parental supervision, parental pre-existing ideas of outdoor play benefits, parent planning sessions,</p>
<p>How are sustainability issues addressed in outdoor classrooms of the Piedmont region in Maryland?</p>	<ol style="list-style-type: none"> <li>1. Environmental</li> <li>2. Economic</li> <li>3. Social</li> </ol>	<p>1. a. Immediate – Natural materials, repurpose materials, minimal impact, invasive threats, exotic species, local geology, invasive bamboo, natural history, non-durable bamboo, native flora, bamboo eradication, low-impact construction</p>

		<ul style="list-style-type: none"> <li>b. Delayed onset – Longevity, stewardship, environmental services, sealants, planning, environmental literacy, environmental review</li> <li>2. a. Support – Funding-planning, school systems, buy-in             <ul style="list-style-type: none"> <li>b. Government assistance – Installation, Gov’t policy, Gov’t funding, free labor, technical support, State parks</li> <li>c. Longevity – Maintenance, school curriculum, standardization, maintenance plan, communication</li> </ul> </li> <li>3. a. Community – Advocacy, engagement, publicity, use, generational change, connectedness, community involvement, safety, communication, accessibility, self-guided, parental influence             <ul style="list-style-type: none"> <li>b. Schools - Professional development, career readiness, personnel, child input, professional input, audience range, longevity, partnerships, school curriculum, child involvement, parental buy-in</li> </ul> </li> </ul>
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**Table 8.** Emergent categorical coding of twelve interview transcripts to serve as qualitative data for addressing research questions. This table depicts the disconfirming instances that appeared in the data.

Research Question	Emergent Codes	Sub-codes
What are the characteristics of outdoor classrooms in the Piedmont region of Maryland?	<ol style="list-style-type: none"> <li>1. Time/space constraints</li> <li>2. Financial challenges</li> </ol>	<ol style="list-style-type: none"> <li>1. a. Limited space – Non-conductive habitats, inadequate campus space, Home Owner’s Association,</li> <li>2. a. Maintenance – Traditional playgrounds, fragile elements, trail work, most advocacy for replacement               <ol style="list-style-type: none"> <li>b. Funding – Lack of support, pet project, jurisdictional permitting,</li> </ol> </li> </ol>
What are the predominant uses of outdoor classrooms in the Maryland Piedmont? Are these uses the same for the general public?	<ol style="list-style-type: none"> <li>1. Traditional education</li> </ol>	<ol style="list-style-type: none"> <li>1. a. Indoor lectures – Pre-registration, No Child Left Behind, standardized testing, equipment labeling, imaginary data, activities break,               <ol style="list-style-type: none"> <li>b. Pre-established parks –Improperly used parks, education component not included, research on child preference for natural or plastic</li> </ol> </li> </ol>
How are sustainability issues addressed in outdoor classrooms of the Piedmont region in Maryland?	<ol style="list-style-type: none"> <li>1. Environmental</li> <li>2. Economic</li> <li>3. Social</li> </ol>	<ol style="list-style-type: none"> <li>1. a. Maintenance – maintenance hazards, tractors, assumed less maintenance, biodegradation</li> <li>2. a. Funding – No nature play space-specific funding, dollars invested not publicly reported</li> <li>3. a. Traditional education – Sustainability lectures, classroom dittos/worksheets, policy change, policy implementation               <ol style="list-style-type: none"> <li>b. Public buy-in – Adults down or kids up approach, short-lived projects, parental demonstrations,</li> </ol> </li> </ol>

## APPENDICES

### Appendix A

Exemption letter from Institutional Review Board of Towson University.



#### EXEMPTION NUMBER: 14-X168

To: Victoria Brusafarro  
 From: Institutional Review Board for the Protection of Human  
 Subjects, Stacy Spaulding, Member *(NS)*  
 Date: Friday, August 01, 2014  
 RE: Application for Approval of Research Involving the Use of  
 Human Participants

Office of Sponsored Programs  
 & Research

Towson University  
 8000 York Road  
 Towson, MD 21286-2001  
 T: 410 704 4238  
 F: 410 704 4494  
[www.towson.edu/sopr](http://www.towson.edu/sopr)

Thank you for submitting an application for approval of the research titled,  
*Sustainable Development of Nature Play Spaces in Maryland's Piedmont  
 Region*

to the Institutional Review Board for the Protection of Human Participants  
 (IRB) at Towson University.

Your research is exempt from general Human Participants requirements  
 according to 45 CFR 46.101(b)(2). No further review of this project is  
 required from year to year provided it does not deviate from the submitted  
 research design.

If you substantially change your research project or your survey  
 instrument, please notify the Board immediately.

We wish you every success in your research project.

CC: Amy-Crauth-Nare  
 File

## Appendix B.

## Nature play space survey.

**YOUR OUTDOOR CLASSROOM: SURVEY**

1. When was your outdoor classroom built?

---

What was the final cost of construction? \$\_\_\_\_\_

2. Approximately how many youth are served annually?

---

3. Approximately how big is your outdoor classroom?

---

4. What sorts of educational programs do you use this space for?

---

What are the main attractions?

---

**(It may be easy to circle answers on your organization's program calendar.)**

5. Approximately how many days out of the week is the outdoor classroom used?

---

6. What physical structures/areas are present for learning? (Gathering area, garden...)

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---

7. What maintenance challenges do you face?

---

8. What resources did you use for funding and accreditation?

---

9. At what frequency do you expect to make major repairs to your outdoor classroom?

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**Thank you very much for taking the time to assist me  
in my thesis research! If you have any questions or  
concerns, please feel free to contact me.**

**- Rose Brusafferro**

**(443) 379-7058**



## Appendix C

Nature play space interview.

**MARYLAND PIEDMONT OUTDOOR CLASSROOMS:  
SEMI-STRUCTURED INTERVIEWS**

1. How long and in what ways have you been involved with outdoor classrooms?

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2. What are some of your success stories? \_\_\_\_\_

3. Do you have any stories of failed nature play space projects?

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4. What methods have been effective in implementing the use of outdoor classrooms?

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5. How are these classrooms created and maintained in sustainable ways?

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6. **Approximately how many new projects are proposed each year?**

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7. **What are the permit requirements for building these classrooms?**

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8. **Approximately how much money has been distributed to these projects through grants?**

---

9. **Are there any particular building materials that are frequently used in these projects?**

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10. **Do you know which building materials are the most eco-friendly, and durable?**

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**Thank you very much for taking the time to assist me  
in my thesis research! If you have any questions or  
concerns, please feel free to contact me.**

**- Rose Brusafferro**

**(443) 379-7058**



## Appendix D

Table of all emergent codes, both confirming and disconfirming.

	Confirming			Disconfirming		
Interviewee	Code 1: Characteristics	Code 2: Uses	Code 3: Sustainability	Code 1: Characteristics	Code 2: Uses	Code 3: Sustainability
JT	On site/ experiential Campground Use of natural habitats Preservation and conservation Natural preservation Repurpose resources Professional development Minimal permitting Public vs. private sector differences Funding	Environmental education Public use Experiential learning Facilitating Make connections On site/ experiential Child engagement Make connections Professional development Career readiness Public buy-in Facilitating Self-guided Recreation Child engagement School curriculum	<u>Environmental</u> Natural Low-impact Longevity Repurpose Minimal impact Invasive threats  <u>Economic</u> Longevity Funding- planning, installation, maintenance  <u>Social</u> Advocacy Volunteers Community engagement-	Non-conductive habitats Traditional playground	Pre-registration Classroom planning	Sustainability lectures Maintenance hazards

		<p><u>Hindrances to use</u>                  Reassurance                  Resources lectures                  Lack of appreciation                  Learned fear of nature                  Inspection                  Parental supervision                  Funding lobbying                  Indoor societal phenomenon                  Public buy-in                  Biophobia</p>	<p>publicity, use, maintenance                  Personnel- plan and deliver programs</p>			
KM	<p>On site/                  experiential                  Live sampling                  Structured learning                  Unstructured learning                  Cognitive exploration                  Imaginary skills                  Time frame/planned                  Experiential</p>	<p>College level environmental education                  Environmental literacy standards                  Age-specific                  Make connections                  Formal                  Self-guided                  Free play                  Immersion                  School curriculum                  Experiential</p>	<p><u>Environmental</u>                  Exotic invasive species    <u>Economic</u>                  Lack of funding                  Career                  Readiness                  Professional development                  Stewardship                  Sealants</p>		<p>No Child Left Behind                  Standardized testing</p>	<p>Classroom dittos/worksheets                  Adults down or kids up approach                  Policy change                  Policy implementation</p>

	<p>Experiential Physical play Commitment Permits Use of natural habitats Experiential Native Flora</p>	<p>Multi-purpose Family experiences Public use</p> <p><u>Hindrances to use</u> Fear of the boogeyman Academic preparation Summertime absence Consultants Parental pre-existing ideas of outdoor play benefits Programmatic approach Public school structure Learning objectives pre-determined</p>	<p><u>Social</u> School curriculum Generational change Government policy Stewardship School systems Standardization</p>			
SO	<p>State parks Safety standards</p>	<p>Revitalize Accessibility</p>	<p><u>Environmental</u> Longevity</p>	Lack of support		Training volunteers

	<p>Liability one                      pagers                      Public buy-in                      Gov't policy                      Compliance                      Previous                      research                      National                      standards                      Differing                      expectations                      Community                      effort                      Vegetation                      Staff turnover                      Co-location                      Signage                      Boundaries                      Versatility                      State                      responsibility                      Safety                      Anthropogenic                      changes                      State legislation                      Reflect natural                      history                      Signage</p>	<p>Play                      Experiential                      State and national                      guidelines                      updated                      Family influence</p> <p><u>Hindrances to Use</u>                      Low budget                      Caretaker comfort                      level</p>	<p>Repurpose                      resources                      Natural                      resources                      Local geology                      Environmental                      services</p> <p><u>Economic</u>                      Free labor                      Gov't funding</p> <p><u>Social</u>                      Staff turnover                      Professional                      development                      Technical                      support                      Safety                      State gov't                      Gov't funding                      Economic                      Natural                      Natural</p>			<p>No NPS-specific                      funding</p>
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MR	Private sector State gov't Teachers Schools Use of natural habitats NWF guidelines Semi-public spaces	Outdoor learning Lifestyle changes Long-term stewardship Early education Research contribution  <u>Hindrances to Use</u> Metal and plastic replacements Old idea Court-binding requirements for manufactured equipment	<u>Environmental</u> Invasive bamboo Natural history Native flora Natural resources Sealant Research Enviro. literacy  <u>Economic</u> Gov't funding  <u>Social</u> Connectedness Professional input Professional development Community involvement School curriculum Community involvement Accessibility Audience range Enviro. literacy		Education component not included	
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<p>GM</p>	<p>Naturalization Grant funding Ecosystem services Grant funding Staffing availability Gov't funding School curriculum</p>	<p>Outdoor learning Outdoor exposure Professional development Make connections  <u>Hindrances to Use</u> Staff turnover Yearly application</p>	<p><u>Environmental</u> Naturalization Ecosystem services Enviro. literacy  <u>Economic</u> Gov't grants  <u>Social</u> School curriculum School curriculum</p>		<p>Growing Healthy Schools</p>	
<p>VR</p>	<p>Gov't installation Gov't funded Extended classroom Hands-on Gov't funded Repurpose Naturalization Improvements Repurpose Natural Objects Play Experiential</p>	<p>Gov't programs Community programs Technical Assistance Environmental ed. Versatility Community Schools Outdoor learning Experiential Exciting Experiential School curriculum</p>	<p><u>Environmental</u> Repurpose materials Low maintenance Low-impact Ecosystem service  <u>Economic</u> Maintenance plan Low maintenance</p>	<p>Inadequate campus space Pet project Jurisdictional permitting</p>	<p>Improperly used parks</p>	<p>Dollars invested not publicly reported</p>

	<p>Accessible Reading Formal Schools Repurpose Monetary reporting Naturalization Natural</p>	<p>Reading Nature play Experiential School curriculum School grounds improvement School curriculum Natural resources Connectedness Outdoor chalkboard</p> <p><u>Hindrances to Use</u> Staff turnover Limited urban access to green spaces Asphalt removal Heavy maintenance Parent planning sessions</p>	<p>Gov't funding Ecosystem services Longevity Protocol</p> <p><u>Social</u> Community involvement Inclusive Connectedness Community involvement Ownership Connectedness Communication Buy-in Safety</p>			
AH	<p>Experiential Immersion Wilderness Accessible Funding Buy-in</p>	<p>Outdoor learning Environmental ed. Experiential Build confidence Natural history Experiential</p>	<p><u>Environmental</u> Stewardship Low-impact Natural material Invasive bamboo</p>			Temporary elements

	<p>Safety          Anthropogenic changes          Communication          Co-locate          Development span          Staffing          Versatility          Non-permanent structures</p>	<p>Public activities engagement          Professional development          Technical support          Camp programs</p> <p><u>Hindrances to Use</u>          Time constraints          Long process          Biophobia          Volunteer reliance</p>	<p><u>Economic</u>          Maintenance plan          Co-locate          Gov't funding          Gov't grants          Gov't labor</p> <p><u>Social</u>          Connectedness          Longevity          Community involvement          Teacher training          Partnerships          Community involvement          Safety</p>			
JD	<p>Environmental literacy requirement          Experiential          Environmental ed.          School curriculum          Improvements</p>	<p>School curriculum          Gov't policy          Community engagement          Connectedness          Technical support          Environmental ed.          Outdoor learning          Make connections</p>	<p><u>Environmental</u>          Natural objects          Longevity</p> <p><u>Economic</u>          Maintenance plan          Buy-in</p>			Short-lived projects

	<p>Versatility Increasing popularity Enviro. literacy School buy-in Play</p>	<p>Natural history Self-interest School curriculum Hands-on Professional development</p> <p><u>Hindrances to Use</u> Small steps</p>	<p><u>Social</u> School curriculum Partnerships Longevity Communication Accessibility Child input Child involvement Communication School curriculum Planning Sealants Safety Maintenance plan</p>			
SM	<p>Gov't funding Community involvement Accessibility Attention-grabbing Signage Versatility Visibility</p>	<p>Professional development Construction Repurpose Creative thinking Safety Memory making Parental inclusion Experiential</p>	<p><u>Environmental</u> Longevity Natural Objects Low-impact Natural resources Sealants Non-durable bamboo</p>	<p>Fragile elements Trail work</p>	<p>Equipment labeling</p>	<p>Tractors No NPS-specific funding</p>

	<p>Boundaries  Natural elements  Large elements  Safety  Anthropogenic changes  Community involvement  Private sector  Safety  More commonly built from scratch  Soft surface requirement</p>	<p>Accessibility  <u>Hindrances to Use</u>  Time commitment  Placement restrictions</p>	<p>Environmental review  Bamboo eradication    <u>Economic</u>  Gov't funding  Pay-off  Grant funding  State parks  Private sector    <u>Social</u>  State parks  Self-guided  Parental influence  Parental buy-in  Longevity</p>			
KW	<p>Experiential  Parental buy-in  Liability  Communication  Accessibility  Teachers  Making connections</p>	<p>Outdoor learning  Repurpose  Environmental ed.  Environmental lit.  Common Core  Enriched learning  Experiential</p>	<p><u>Environmental</u>  Low-impact  Longevity  Research    <u>Economic</u>  Maintenance plan</p>	Homeowner's Association	Imaginary data	Assume less maintenance

	<p>Natural elements          Accessibility          Community engagement          Natural elements          Staffing availability          Natural elements          Ecosystem services          Zoning          Grant funding          Gov't funding          Natural          Vacant lot          Community open space land</p>	<p>Instructor supervision          Experiential          Outdoor learning          School curriculum          Community engagement          Outdoor learning</p> <p><u>Hindrances to Use</u>          Resource awareness          Few structures          Untrained teachers</p>	<p>Gov't partnerships          Gov't funding          Planning</p> <p><u>Social</u>          School curriculum          Experiential connections          Child involvement          Community involvement          Professional development          Community involvement          All-inclusive          Communication          Parental buy-in          Schools</p>			
JK	<p>Visible boundary          Play          Natural history          Natural          Wood-burned</p>	<p>Family engagement          All-inclusive          Play          Make connections          Physical play</p>	<p><u>Environmental</u>          Longevity          Low-impact          Repurpose materials</p>		<p>Activities break          Parental demonstrations</p>	

	<p>Natural elements          Native flora          Tunnel          Permanent structures          Co-locate          Gov't funded          Interactive          Fun          All-inclusive          Versatility          Accessibility          Public buy-in          State initiatives          Community involvement          Anthropogenic changes          Minimal cost          Grant funded</p>	<p>Experiential          Environmental ed.          Make connections          Physical play          Native fauna          Families          Environmental ed.          Educational play</p> <p><u>Hindrances to Use</u>          Natural deterioration</p>	<p>Naturally occurring          Sealant          Natural materials</p> <p><u>Economic</u>          Gov't programs          State gov't programs</p> <p><u>Social</u>          Gov't programs          Make connections          Partnerships          Community involvement          Staff involvement          Family engagement          All-inclusive          Safety</p>			
KW	<p>Gov't funding          Improvements          Improvements          Versatility</p>	<p>Stewardship          Naturalization          School curriculum</p>	<p><u>Environmental</u>          Ecosystem services          Longevity</p>	<p>Most advocacy for replacement</p>	<p>Research on child preference for natural or plastic</p>	

	<p>Natural materials          Grounds maintenance          All-inclusive          Signage          Co-locate          Repurpose          School curriculum          Liability          Improvements          Restoration          Grounds maintenance          Native flora          Sub-segments of outdoor classrooms</p>	<p>Professional development          Early education          Physical development          Create bonds          Accessibility          Community involvement          Public awareness          Experiential          Make connections    <u>Hindrances to Use</u>          Biodegradation</p>	<p><u>Economic</u>          Maintenance plan          Gov't funding    <u>Social</u>          Longevity          Communication          Signage          All-inclusive</p>			
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## CURRICULUM VITA

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