

**FROM ACORNS GROW OAKS:  
EXPLORING HOW CHILDHOOD EXPOSURE TO NATURE INFLUENCES ADULT  
BEHAVIOR**

by

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**ABSTRACT**

Employing a community-based participatory research (CBPR) approach, this research project investigates how patrons of a local botanical garden establish a connectedness to nature. Collaborating with the Director of Science Education and Research at Phipps Conservatory and Botanical Gardens, the study examined the role of childhood experiences with plants and nature in the formation of adult participation in nature-based activities using an online anonymous survey. In addition, it examined if nature exposure is associated with perceiving trees and plants as important to physical and psychological health. Participants answered questions about their experiences with plants and nature as a child and as an adult. A link to the survey was sent out via an email from Phipps' Marketing Department to the roughly 11,000 Phipps members. In addition, a link to the survey was posted to Phipps' Facebook and Twitter page. A total of 270 individuals completed the exploratory survey.

Analyses of the data show several statistically significant associations between the nature-based activities Phipps patrons report taking part in before the age of 11 and nature-based activities in which they currently participate. Survey respondents who indicated that they often spent time caring for indoor plants and engaging in active garden experiences in childhood were more likely to report greater levels of interactions with nature as an adult. This association is possibly explained by the fact that active gardening experiences are much more hands-on and create a connection that

lasts over the course of an individual's life. Survey data also indicates that for Phipps' patrons, exposure to nature-based activities before the age of 11 has little influence on perceived physical and psychological health benefits from contact with nature. Respondents who often spend time currently in outdoor places with trees and plants are more likely to perceive health benefits from contact with nature.

Contact with nature has great potential as a public health intervention to address physical and psychological health issues at the individual and community level. In addition, research in this area is critical to support funding for environmental education programs at school and botanical gardens across the country. At the policy level, increasing public awareness of health benefits associated with nature-based activities is also critical to better informing urban development and conservation efforts. Policymakers need to view access to green space and natural areas as a social justice issue.

## TABLE OF CONTENTS

<b>PREFACE.....</b>	<b>X</b>
<b>1.0 INTRODUCTION.....</b>	<b>1</b>
<b>2.0 BACKGROUND .....</b>	<b>3</b>
<b>2.1 PUBLIC HEALTH IMPORTANCE .....</b>	<b>7</b>
<b>2.2 THEORY BEHIND RESEARCH.....</b>	<b>9</b>
<b>2.3 COMMUNITY-BASED PARTICIPATORY RESEARCH APPROACH..</b>	<b>12</b>
<b>3.0 METHODS .....</b>	<b>15</b>
<b>3.1 DEVELOPMENT AND IMPLEMENTATION OF SURVEY .....</b>	<b>15</b>
<b>3.2 DATA COLLECTED.....</b>	<b>17</b>
<b>3.3 STATISTICAL ANALYSIS OF DATA .....</b>	<b>19</b>
<b>4.0 RESULTS .....</b>	<b>21</b>
<b>4.1 EXPOSURE TO NATURE.....</b>	<b>21</b>
<b>4.1.1 Specific Aim 1: Characterize Nature-based Experiences in Adulthood and Childhood.....</b>	<b>22</b>
<b>4.1.2 Specific Aim 2: Association between Childhood and Adulthood Experiences .....</b>	<b>26</b>
<b>4.2 NATURE AND HEALTH.....</b>	<b>28</b>
<b>4.2.3 Specific Aim 3: Perceptions of Engaging with Nature and Relationship to Physical and Psychological Health .....</b>	<b>29</b>
<b>4.2.4 Specific Aim 4: Association between Nature-based Experiences and Perceived Health Benefits.....</b>	<b>32</b>

<b>5.0</b>	<b>DISCUSSION .....</b>	<b>34</b>
<b>5.1</b>	<b>LIMITATIONS.....</b>	<b>37</b>
<b>5.2</b>	<b>DISSEMINATION OF FINDINGS .....</b>	<b>38</b>
<b>5.3</b>	<b>CONCLUSIONS .....</b>	<b>40</b>
	<b>BIBLIOGRAPHY .....</b>	<b>43</b>

## LIST OF TABLES

Table 1. Adult Exposure to Nature .....	22
Table 2. Childhood Exposure to Nature .....	24
Table 3. Frequency of Adult Nature-Based Activities.....	25
Table 4. Frequency of Childhood Nature-Based Activities.....	26
Table 5. Reported P-values from Chi-Squared Test for Association.....	27
Table 6. Reported P-values from Chi-Squared Test for Association.....	33

## LIST OF FIGURES

Figure 1. Perceived Health Benefits from Nature-Based Activities in Adulthood.....	30
Figure 2. Perceived Health Benefits from Nature-Based Activities in Childhood.....	31

## PREFACE

*“If a child is to keep alive his inborn sense of wonder, he needs the companionship of at least one adult who can share it, rediscovering with him the joy, excitement, and mystery of the world we live in.”*

— RACHEL CARSON

*“The future will belong to the nature-smart—those individuals, families, businesses, and political leaders who develop a deeper understanding of the transformative power of the natural world and who balance the virtual with the real. The more high-tech we become, the more nature we need.”*

—RICHARD LOUV

Special thanks to my thesis committee for their help in completing this research project and taking the time to offer their assistance. I am also thankful to Phipps Conservatory and Botanical Gardens for their support during this partnership. Most importantly, a heartfelt thank you to my friends and family for all of their support. So many of you had a hand in introducing me to the joys of playing in the dirt and watching a plant grow.

## 1.0 INTRODUCTION

This study explores the role of childhood experiences with nature in the formation of adult beliefs and behaviors toward nature among patrons of Phipps Conservatory and Botanical Gardens. Data was collected from Phipps patrons regarding this issue using an online anonymous survey distributed via email and social media. Participants answered questions about their experiences with nature as children, before the age of 11, and their current level of interactions with nature as an adult. There were four specific aims that guided the development of this project. The first aim is to characterize the level of engagement that survey respondents have with nature as an adult and in their childhood. Survey questions asked participants to recall the settings, the types of interaction with nature they have experienced, and the frequency of exposures. The second aim is to examine the interaction between childhood experiences and adult experiences through bivariate statistical analysis to determine if there are any significant associations. Comparing the type and frequency of nature-based interactions Phipps patrons report in childhood and adulthood through chi-squared test will establish if there are any significant associations. The third specific aim is to explore Phipps patrons' perceptions of engagement with nature and its relationship to physical and psychological health. To accomplish this aim, survey questions characterizing participants perceived a health benefit from contact with nature were assessed. In addition, respondents were asked to indicate what nature-based activities made them feel the most physically and psychologically well. Lastly, the fourth aim for this research is to determine if there are any

significant associations between the nature-based interactions individuals have and if they perceive a physical or psychological health benefit from contact with nature.

Employing a community-based participatory research (CBPR) approach, this thesis project collaborates with the Director of Science Education and Research at Phipps Conservatory and Botanical Gardens. Located in the Oakland area of Pittsburgh, PA, Phipps is a local greenhouse and botanical garden that focuses on educating community members of all ages about the importance of plants, promoting sustainability, and advancing human and environmental well-being through both action and research. Forging this partnership between Phipps and the Graduate School of Public Health (GSPH) brings expertise and resources of both organizations together to better identify and address public health issues in Pittsburgh. The collaboration created by this CBPR project highlights why exploratory research such as this thesis is important to better understand the variables that influence an individual's connectedness to the natural environment. Contact with the natural world is often ignored as a possible tool to fight against many public health issues such as obesity, psychological health, and community violence. There is great potential for schools of public health and botanical gardens across the country to partner together in efforts to improve health and increase the public's environmental knowledge. As the following section will discuss, contact with nature is a critical aspect to physical and psychological health and can strongly influence community capacity as well.

## 2.0 BACKGROUND

The health benefits experienced by an individual from contact with nature are directly related to the individual's connectedness to nature. Howell, Dopko, Passmore, and Buro (2011) state that there is a significant association between nature connectedness, measures of psychological and social wellbeing, and mindfulness. In the past three decades, research examining the health benefits from contact with nature has grown. Researchers are starting to better understand the mediating factors and provide evidence-based research that establishes that there are positive health benefits associated with interactions with nature (Howell et al., 2011; Mayer & Frantz, 2004; Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009; Wilson, 1984). Such research adds to an increasing body of evidence regarding the psychological, cognitive, physiological, social, and spiritual benefits from contact with the natural environment (Keniger, Gaston, Irvine, & Fuller, 2013; Lohr & Relf, 2000; Tennessen & Cimprich, 1995; Ulrich, 1981, 1984). The combined impacts of these benefits accumulate over the course of an individual's life have the potential to drastically improve overall health. The following section will review some of these studies in order to provide a context for this thesis research.

While little is known about the mechanism that deliver the psychological benefits of nature, there is growing evidence for the importance of sunlight, fresh air, and access to the outdoors environment either physically or at least visually (Frumkin, 2008; Howell et al., 2011; Howell & Passmore, 2013; Keniger et al., 2013; Loftness & Snyder, 2008; Lohr & Relf, 2000; Tennessen & Cimprich, 1995; Ulrich, 1981, 1984). The Health Council of the Netherlands and Dutch Advisory Council for Research on Spatial Planning (2004) conducted a review of published literature investigating the health benefits of contact with nature. The goal of the Council was to investigate

the current scientific evidence related to how contact with nature improves health and to highlight possible mechanisms for how the benefits translate to improved health. Through the course of their investigation, it was found that the amount of available research investigating the relationship between nature and health is severely lacking in both scale and methodology (Health Council of the Netherlands, 2004). The sample size of most studies is too small to make the results generalizable and rarely do studies utilize the same study design or measure the same variables. Often the definition “nature” is not even the same from one study to another (Cheng & Monroe, 2012; Ewert, Place, & Sibthorp, 2005; Lohr & Pearson-Mims, 2005; Thompson, Aspinall, & Montarzino, 2008).

Despite these limitations, the Council concluded that there is sufficient evidence that interactions with nature improve overall well-being. While minimal direct evidence for a relationship was discovered in the published literature, five indirect mechanisms for how contact with nature can benefit health were put forth. Engagement in nature-based activities (1) aid in recovery from stress and attention fatigue, (2) encourages exercise and increased levels of physical activity, (3) encourages social contact between community members, (4) stimulates psychological and physical development in children, and (5) adds to an individual's personal sense of purpose and social development (Health Council of the Netherlands, 2004). While no direct benefit to health has yet to be established from contact with nature, the indirect benefits are just as important. Spending an hour walking in the woods or tending a garden might have little immediate impact on a person's overall health at that exact moment in time. Yet the benefits of repeating these physical activities over a lifetime can positively impact health by reducing risk factors for chronic diseases.

By stating that the indirect health benefits from contact with nature over the course of years improve health, it raises the question of how and why do individuals incorporate these behaviors

into their daily lives. Current research suggests that individuals who have experiences with nature in their childhood are much more likely to incorporate these interactions into their adult lives and develop positive views toward the environment (Wells & Lekies, 2006). Childhood participation in both wild and domesticated nature before the age of 11 directly influences adult environmental behaviors (Wells & Lekies, 2006). Wells and Lekies (2006) defined “wild nature” as activities taking place in natural areas such as hiking, camping, hunting, or fishing. Domesticated nature is defined as activities such as gardening, planting trees or seeds, and caring for both indoor and outdoor plants. Using data from a national telephone survey, the authors found evidence that interactions with wild and domesticated nature influences environmental behaviors. They also report that interaction with wild nature was shown to have an effect on environmental attitudes (Wells & Lekies, 2006). From these results, it was the authors conclusions that environmental education alone was not sufficient in influencing long term behavior (Wells & Lekies, 2006). Actual hands-on experiences are essential to children’s development and creating a bond with the natural environment.

Ewert et al. (2005) broke up wild and domesticated nature into more specific categories; appreciative recreational activities, mechanized activates, and consumptive activities. Appreciative recreational activates that are activities that can be enjoyed while having little impact on the environment such as hiking and bird-watching. Mechanized activities are recreational activities that use mechanical devices like all-terrain vehicles. Consumptive recreational activates such as fishing or hunting take something away from the environment. Ewert et al. (2005) concluded that outdoor appreciative experiences in childhood were positively related to positive personal values towards the environment. Mechanized activates done in childhood had no correlation with values toward nature, meaning that there was neither a positive or negative

influence on individual attitudes towards environmentalism. Conversely, consumptive experiences were negatively associated with positive values regarding the environment (Ewert et al., 2005). Based on this finding, the authors suggest that simply spending time in nature is not enough for people to develop affinity towards personal stewardship and protecting the environment. Development of these values starts early in childhood through appreciative interactions with nature paired with age appropriate education regarding environmental preservation and sustainability.

Adults who visit green spaces such as parks, forest, or gardens as children are more likely to associate these natural areas with positive, energetic feelings and are more likely to visit natural areas within walking distance of their homes (Thompson et al., 2008). In their study, Thompson et al. (2008) found that making trips to natural areas in childhood is positively correlated with adult confidence to visit these spaces alone. In addition, there was also a correlation with viewing natural settings as a place of emotional and spiritual renewal (Thompson et al., 2008). Thompson et al. (2008) research parallels the work of Asha, Bengston, and Westphal (2012) that the more exposure to nature a person has as a child, the more likely they are to desire nature-based experiences as adults. This relationship is important to investigate because it suggests that adult habits regarding outdoor activity are correlated with patterns of use established in childhood (Asha et al., 2012; Thompson et al., 2008).

There is also research that suggests adults who had a high level of interaction with plants and nature in their childhood are more likely to use mitigation strategies to overcome barriers to participation in nature-based activities (Asha et al., 2012). Childhood participation increases motivation to take part in these activities and empowers adults to overcome any barriers that prevent others without childhood experiences from taking part in the nature-based activities (Asha et al., 2012). A similar relationship has been established regarding adult attitudes toward trees in

urban areas. Lohr and Pearson-Mims (2005) propose that early experiences with nature, such as active gardening, strongly influence adult views toward trees. Active gardening is defined as picking flowers, fruits, or vegetables, planting trees, seeds, or plants, and also as caring for indoor or outdoor plants (Lohr & Pearson-Mims, 2005). Getting children involved in these nature-based behaviors greatly increases the likelihood that they will continue the behavior throughout the course of their lives.

## **2.1 PUBLIC HEALTH IMPORTANCE**

From a public health stand point, this thesis research is important because there is growing evidence that interactions with nature not only improves health at the individual level, but at the community level as well (Largo-Wight, 2011; Maller, Townsend, Pryor, Brown, & St Leger, 2005). As mentioned in earlier sections, limited research is available on the mechanisms behind the relationship between nature and health. Nevertheless, there is sufficient evidence-based research to conclude that interactions with nature improve well-being (Maller et al., 2005). Previous studies provide evidence that simply being exposed to natural views and indoor plants have been shown to reduce recovery rates after surgery (Dijkstra, Pieterse, & Pruyn, 2008; Ulrich, 1981, 1984), improve concentration and emotional stability (Adachi, Rohde, & Kendle, 2000; Tennessen & Cimprich, 1995), and reduce stress and increase job satisfaction in office settings (Fjeld, Veiersted, Sandvik, Riise, & Levy, 1998; Kaplan & Kaplan, 1989; Lohr, Pearson-Mims, & Goodwin, 1996; Smith, Tucker, & Pitt, 2011). Being physically in a natural environment has been strongly linked to even greater individual health benefits stemming from decreased stress levels and increased physical activate (Howell et al., 2011; Maller et al., 2005; Mayer et al., 2009).

Contact with nature is beneficial at the community level well. Community gardens are an excellent approach to increase community capacity because they naturally bring people together to socialize who might not normally intermingle. This interaction potentially allows for an exchange of ideas between community members and stakeholders, increasing social capital (Lewis, 1990, 1992). Other research has shown that this increased community capacity from gardening has been shown to reduce violence and graffiti in low socioeconomic status communities while increasing positive attitudes among community members about themselves and the community as a whole (Lewis, 1990, 1992, 1996).

Another study of how contact with nature can impact community health was conducted by Wells (2000). Examining changes in children's directed attention capacity, the author stresses the significant influence that housing environments have on the well-being of children. This influence is especially strong for those in low-income urban areas. Tracking families that moved from low quality to high quality housing, Wells (2000) found that changes in the overall housing quality were not significantly correlated with changes in attention capacity of children. However, changes in the naturalness of the home were a statistically significant predictors of postmove attentional capacity (Wells, 2000). The naturalness of homes was based on a 10 items scale evaluating factors such as views out different windows and the condition of the yard. Since there is support of a connection between the naturalness of children's housing environment and their well-being, this evidence-based research can be used to support public health interventions to preserve existing trees and green spaces when neighborhoods are constructed in addition to encouraging community tree-planting activities (Wells, 2000).

Maller et al. (2005) brings support to the idea that contact with nature has vast potential to be used as a public health intervention to promote healthier communities. Because of the well-

documented health benefits, contact with nature should be included as a population health strategy. Parks and green spaces should be thought of as an essential health resource in the prevention of disease in urban populations (Maller et al., 2005). All biological life is connected through an interrelated ecosystem on which that very life depends. There is a flaw in trying to focus on improving community health without considering how to improve the natural environment (Maller et al., 2005). Human beings evolved in a natural environment and therefore the natural environment must be part of public health initiatives.

This approach to human health and well-being is ideal because focusing on ‘contact with nature’ approaches environmental, social, and health issues from a socio-ecological theoretical perspective (Maller et al., 2005). In public health, social and economic inequities are commonly discussed as strong social determinates of health in communities. Maller et al. (2005) states that with additional research, perhaps “ecological inequity” has the potential to be recognized as another important component to consider when addressing population health issues. Maller et al. (2005) goes so far as to state that having access to nature needs to be seen as a social justice issue similar to access to health care.

## **2.2 THEORY BEHIND RESEARCH**

Much of the current research regarding the physical and mental health benefits from contact with the natural environment stems from Wilson’s (1984) biophilia hypothesis. The concept of biophilia centers on the fact that over the course of human evolution, hominins survival depended on access to natural resources. As such, there was an extreme selection pressure towards humans developing an affinity to nature, thereby ensuring access to these vital resources (Howell &

Passmore, 2013). These evolutionary forces shaped human mental development and as a result, psychological health is closely linked to people's relationship with nature (Howell et al., 2011). The biophilia hypothesis has a growing body of evidence in support of its explanation of the relationship between nature connectedness and mental wellbeing (Kahn Jr., 1999; Kaplan & Kaplan, 1989; Ulrich, 1993).

Attention Restoration Theory also plays a role in explaining how individuals benefit from contact with nature and plants (Kaplan & Kaplan, 1989; Raanaas, Evensen, Rich, Sjostrom, & Patil, 2011). This theoretical view states that with the growing demands society has for people's direct attention from long work hours and technology, our limited attention resources can become fatigued (Raanaas et al., 2011). Before a person can effectively mentally function effectively again, their attention capacity must be restored. Referred to as "soft fascination", the natural environment, and even pictures of nature, offers stimulation that does not demand direct attention, allowing restoration and stress levels to be reduced (Kaplan & Kaplan, 1989; Raanaas et al., 2011).

Published literature also suggests that self-efficacy and observational learning are critical in the development of positive attitudes and behaviors towards interacting with nature and plants. These constructs pull heavily from Social Cognitive Theory (SCT) along with the theory's core emphasis on the influence that interactions between individuals and their environment play in health behavior (Bandura, 2004; McAlister, Perry, & Parcel, 2008). It is only through knowledge and awareness about health risks that people can incorporate healthy behavioral changes into their lives (Bandura, 2004). Furthermore, while many health behavior theories center on the idea that individual behavior is influenced by environmental factors, SCT stress that individuals and groups have the agency to impact their environment (McAlister et al., 2008). Knowledge of health risks is not enough to encourage behavioral changes. Individuals must have the perceived self-efficacy

that they can successfully preform the healthy behavior (Bandura, 2004). When it comes to encouraging individuals to interact with nature in order to experience positive health benefits, people must first be aware of the benefits in addition to having the confidence that they can actually make time to take a walk alone in a local park, have the skills to go camping, or the knowledge to care for both indoor and outdoor plants.

The social-ecological model plays a major role in this research as well. While the previously discussed health behavior theories focus on individuals, the social ecological model takes the ability of external factors to influence health behavior into consideration. An individual's physical and mental health are affected by elements beyond those that directly impact the person's daily life. Behavior is influenced by internal and external factors at the individual, interpersonal, organizational, community, and policy level (Sallis, Owen, & Fisher, 2008). When addressing public health issues, treating the direct cause of disease at the individual level might be the fastest and cheapest way to approach an issue. However, it is often more effective, and has a greater impact on the community as a whole, to implement an intervention at the community or policy level where the intervention will impact a greater number of individuals. In regards to contact with nature and the natural environment, interventions that encourage and foster a connection to nature can be implemented at all levels of the social ecological model, making it an ideal framework for intervention research.

The survey being conducted in partnership with Phipps is based on the concept that it is that this self-efficacy towards nature and plants that is most successfully established during childhood through personal experiences with the natural world and through observational learning. By having positive experiences as a child, individuals are much more likely to be motivated to involve nature into their adult lives, receive the positive health benefits associated with these

interactions, and develop pro-environmentalism values. As a result of being more highly motivated, these individuals are also more likely to overcome any potential barriers to healthy behaviors (Bandura, 2004).

### **2.3 COMMUNITY-BASED PARTICIPATORY RESEARCH APPROACH**

One unique aspect of this thesis research was its foundation in CBPR. The topic of investigation, method of data collection, and interpretation of results was done in partnership with stakeholders. Phipps first made contact with the Department of Behavioral and Community Health Sciences (BCHS) in the Graduate School of Public Health (GSPH) regarding a possible research partnership in early 2013. The organization was interested in engaging an academic partner in their efforts to research nature and health. Since BCHS focuses on applying behavioral and social science theories, methods, and concepts to prevent illness and improve individual and community health, the collaboration seemed ideal.

As a graduate student in the Community-Based Participatory Research and Practice (CBPRP) certificate program at GSPH with an interest in gardens and community health, I was asked if I would be willing to be involved with the research project and help facilitate the relationship between Phipps and BCHS. When the partnership first began, there were no defined project goals. In accordance with a CBPR approach, neither Phipps nor BCHS came to the table with an idea of what specific health issue the partnership would address. During the first several collaboration meetings, we discussed what each stakeholder was looking to gain from the partnership. As a graduate student in BCHS, I needed the research to be public health related and also ensure that it fulfilled the requirements for both my CBPRP certificate and MPH thesis. From Phipps's

perspective, the organization wanted a research project focused on the benefits gained from interacting with plants. Phipps also required that the research project benefited the local Pittsburgh community. Throughout this brainstorming process, all stakeholders were excited about the potential relationship that could develop between the two institutions and future research collaborations.

Given these discussed parameters, we worked together to come up with several possible opinions for areas of investigation. At first there was discussion about a possible partnership with Community Human Services to conduct and evaluate a photovoice program with their community. The photovoice program, which had been conducted at Phipps with school children before, uses photography and science education to foster a connection to nature. The second possible research project was to evaluate the effectiveness of the same photovoice program conducted during one of Phipps' workshops with local school children. However, due to time and funding constraints, we were not able to follow through with either project.

Another research idea steamed from wanting to understand how the Center for Sustainable Landscaping (CSL) building impacts Phipps' employees' health. One of the greenest buildings in the country, the CSL was built using sustainable architecture and design. In addition to using sustainable construction materials and having indoor plants intentionally incorporated in the office spaces, it generating all of its own energy and treats and reuses all water captured on site. Because of the CSL's potential ability to influence other construction projects and architects interested in biophilic design, Phipps then suggested shifting the project to exploring the benefits of indoor plants on mental and physical health. Biophilic design centers on the concept that indoor plants help to improve indoor air quality and also improve psychological health. Phipps suggested that this topic was very relevant to helping the organization support and justify construction of the CSL. In addition, it would be a good topic for a health communication campaign encouraging individuals who visit

Phipps to incorporate indoor plants into their homes. However, when a literature reviews was conducted, it was revealed that there is very little generalizable scientific evidence that indoor plants reduce indoor air pollutions (Aini Jasmin, Noorizan, Suhardi, Murad, & Ina, 2012; American Lung Association, Environmental Protection Agency, Consumer Product Safety Commission, & American Medical Association, 1994; Bringslimark, Hartig, & Patil, 2009; Kim et al., 2011). While the influence on mental health was more substantiated, Phipps felt uncomfortable designing an educational campaign without strong evidence-based research. As a result of this development, the partnership had to change direction once again.

After discussing our options and conducting an additional literature review, we finally decided to explore the relationship between childhood and adult experiences with nature through the use of an online survey. Using Phipps already existing sampling frame, the survey asked about childhood exposure to nature, adult exposure to nature, and how adults are engaging the next generation with nature. Phipps thought that an exploratory survey was ideal to develop an understanding of how and why their patrons interact with the natural environment. This organic and ever evolving approach to selecting a topic for research is very important for CBPR and is something that this project did very well. There was a very open exchange of knowledge and opinions of how to proceed in order to fulfill everyone's needs while also making the most effective and efficient use of everyone's skills, resources, and time. Other botanical gardens across the country could benefit from this model of utilizing community partners to expand their research and outreach efforts.

### **3.0 METHODS**

To explore the formation of Phipps patrons' connection to nature, an online survey was created to explore what nature-based activities they participated in before the age of 11 and those activities patrons take part in now as an adult. The survey also asked participants about the level of importance that contact with trees and plants plays in their physical and psychological well-being. In addition, Phipps patrons were asked about what nature-based activities produced feelings of physical and psychological well-being during childhood and adulthood. For this thesis research, the specific community of interest was defined as all individuals who have expressed an interest in Phipps, whether that is through having a membership or by following Phipps on the social media websites Facebook and Twitter.

#### **3.1 DEVELOPMENT AND IMPLEMENTATION OF SURVEY**

Questions for this exploratory survey were based on those used by Lohr and Pearson-Mims (2002) in their nation-wide phone survey examining the influence childhood experiences with the environment have on adult perceptions and interactions with nature. Additionally, questions were added to examine individuals' motivations and constraints to participating in nature-based activities. These questions were first used by Asha et al. (2012) in a study examining similar variables. When crafting the Phipps survey, only questions relevant to this research project were used from the previous studies. Changes were made to several questions to make them more applicable to Phipps patrons. Using Survey Monkey and the resources of GSPH to set up the

survey, a link to the survey was sent out via a newsletter from Phipps' Marketing Department to the roughly 11,000 members of Phipps Conservatory and Botanical Gardens on December 10<sup>th</sup>, 2013. In addition to distributing the survey through e-mail, the link along with a brief description was also posted on the Phipps' Facebook page and Twitter page. The decision to use social media was made as an attempt to increase the visibility of the survey and increase responses. Phipps Marketing Department reposted the link to Facebook and Twitter once a week while the survey was open as another attempt to increase the response rate.

The survey was designed to be optional and no identifiable information was asked to keep the results anonymous. Since the survey was available for the general public via social media, to ensure participants were age 18 or older. The first question of the survey asked for the participant to indicate if they were at least 18 years old and asked the participant to give informed consent to be part of the research study. If patrons indicated that they were under 18 or did not want to give consent, then Survey Monkey would direct them to the end and they were not allowed to complete the survey. As an incentive to take and finish the survey, the consent question also informed participants that once they completed the survey, they had the opportunity to enter their name into a raffle for a free one-year family membership to Phipps. To ensure that individual answers were not linked to the personal information entered for the membership raffle, a link to a different Survey Monkey page was posted at the end of the Phipps survey. Participants then manually copied and pasted the new website address into their internet browser. The survey was closed January 13<sup>th</sup>, 2014.

### 3.2 DATA COLLECTED

While the Phipps survey collected data on multiple factors regarding interactions with nature, not all data are reported in analysis. This thesis only focuses on a portion of the overall data due to time constraints. Through collaboration with Phipps, we decided to only concentrate on questions that would address the association between childhood and adulthood exposure to nature. To help facilitate this analysis, four specific aims were established. These aims were to (1) characterize the engagement the Phipps patrons have with nature as an adults and in their childhood, (2) examine the interaction between childhood experiences and adult experiences through bivariate statistical analysis, (3) characterize the nature-based activities that make Phipps patrons feel the most physically and psychologically well, and (4) examine the interaction between contact with nature and perceived physical or psychological health benefit through bivariate statistical analysis.

The first set of questions analyzed examined varying exposures Phipps' patrons have with indoor and outdoor nature. Distinguishing between indoors and outdoors is important because it can help to establish where people are spending the majority of their time when encountering nature. In addition, examining exposure through the classifications of indoor and outdoor nature can aid in determining if there are any significant associations between childhood indoor or outdoor nature-based activities and adulthood participation in nature-based activities. The data for this comparison is based on a survey question asking respondents to state how often they spent time in outdoor and indoor places with plants and trees as an adult and before the age of 11 using the following responses: "never", "rarely", "occasionally", "often". In the directions for the survey, "occasionally" was defined as "perhaps up to a dozen times" and "often" defined as "clearly more than a dozen times". As another way to measure exposure to indoor and outdoor

nature, survey participants indicated the extent to which they agreed or disagreed with the several statements using the following scale: “strongly disagree”, “somewhat disagree”, “somewhat agree”, or “strongly agree”. These statements were “I try to make outdoor recreation a priority”, “I enjoy caring for outdoor plants”, “I make it a priority to have houseplants in my home”, and “I enjoy caring for indoor plants”. Phipps patrons were also questioned about the frequency with which they take part in nature-based activities both as an adult and in their childhood before the age of 11. The activities listed in the Phipps survey were camping, hunting or fishing, going to the beach, bird watching, picking flowers, fruit or vegetables from a garden, planting trees, seeds, or plants, taking care of indoor plants, taking care of outdoor plants, and visiting or playing in local parks. Participants indicated the frequency of participation in these nature-based activities using the frequencies of never, rarely, occasionally, and often.

Phipps patrons were also asked about the positive physical and psychological health benefits they perceive from contact with all types of nature. First, the survey asked participants to indicate how strongly they agreed or disagreed with these statements: “Trees and plants are important to your physical well-being” and “Trees and plants are important to your psychological well-being”. Once again, directions specified for those taking the survey to indicate whether they strongly disagree, somewhat disagree, somewhat agree, or strongly agree with the statements. In addition, given the same list of nature-based activities from earlier, survey respondents were asked to rank the nature-based activities that made them feel the most physically well and psychologically well both before the age of 11 and as an adult. Survey instructions told respondents to rank up to three activities, with number one being the activity that produced the most feelings of well-being.

### 3.3 STATISTICAL ANALYSIS OF DATA

SPSS Statistics software was used to address the second and fourth specific aim of this research. During the analysis, no variables were controlled for due to extreme bias in the sample. To determine if there were any significant associations, dichotomous variables for an individual's exposure to indoor and outdoor nature as a child and as an adult were created. This frequency data was reported in the survey from participants as never, rarely, occasionally, or often. To perform a chi-squared test for association, the values of never, rarely, and occasionally were grouped together and assigned the value of 0. "Often" was kept separate and assigned the value 1. If there was missing data for an individual, their data were not included in the analysis. Crosstabulation was then conducted to determine if there were any statistically significant associations between the reported exposure in childhood and adulthood of Phipps patrons.

In addition to the setting of exposure, it is important to explore possible associations between the type of reported nature-based activities done before the age of 11 and activities done later in the Phipps patrons lives. To accomplish this measure, we employed the classification system used by Lohr and Pearson-Mims (2005). The nine nature-based activities included in the survey were divided into "active gardening" and "passive interactions with plants". Four activities were grouped into active gardening: picking flowers, fruits, or vegetables, planting trees, seeds, or plants, caring for indoor plants, and caring for outdoor plants. Passive interactions with plants included the five activities of camping, hunting or fishing, bird watching, going to the beach, and visiting or playing in local parks.

In order to perform a chi-squared test for association between active and passive interactions with nature, once again dichotomous variables were created. The variables never, rarely, occasionally and often were assigned the values of one through four respectively. Summing

the assigned values for describing how often the person did each “active gardening” nature-based activity, we created a new variable for each Phipps patron that completed the survey. This “active gardening” variable was then divided by four, which gave an average for each respondent. Averages between one and three were group together and transformed into a new variable with the value of zero. Averages between 3.01 and four were transformed and assigned the value of one to create a dichotomous pair that could be compared to the indoor and outdoor exposure data. The same process was done to create a variable for nature-based activities grouped into the category of passive interactions with plants.

It is possible to compare how contact with nature is associated with perceived health benefits for the fourth specific aim using the dichotomous data for childhood and adulthood nature-based experiences from specific aim two. Variables for a chi-squared test were based on responses to two questions inquiring about physical and psychological health. Phipps patrons were instructed to indicate if they strongly disagreed, somewhat disagreed, somewhat agreed, and strongly agreed to the statements that “Trees and plants are important to your physical health” and “Trees and plants are important to your psychological health”. Similar to earlier analysis for aim two, strongly disagreed, somewhat disagreed, somewhat agreed were group together and assigned the variable value of zero. Strongly agree was given the assigned value of one to create the dichotomous variables that could be compared to the dichotomous data for childhood and adulthood nature-based experiences.

## **4.0 RESULTS**

A total of 270 individuals started the online survey, however not everyone that started the survey answered each individual question. Of those participants that completed the demographic information, 77% reported that they were Pennsylvania residents and 23% indicated they live in another state. Of the 236 that reported their ethnic background 98% identified as white or European ancestry. Four respondents identified as Hispanic or Latino, two as Asian American or Pacific Islander, one as Native American, one as black or African American, and two identified as multi-ethnic or other. The sample contained a large number of women with 86% indicating that they were female. The age of the participants ranged from 20 to 88 with the average age being 46 years old. Respondents were also asked to report their highest level of education. Of those that answered, 72% of the 238 individuals reported they had a four year college degree or higher. Almost 30% of the participants held master degrees and 8% held doctoral degrees from graduate or professional programs. In addition, 65% reported that they made \$50,000 or more in annual household income. Nearly 25% of those that took the survey had an annual household income of \$100,000 or greater. Lastly, of the 238 that answered the question, 31% of the respondents were currently Phipps members, 60% were not members, and 9% had been members in the past but did not currently have a membership.

### **4.1 EXPOSURE TO NATURE**

In the following section the results related to each of the first and second specific aims guiding this research are discussed. These aims were to (1) characterize the engagement the Phipps

patrons have with nature as an adults and in their childhood, (2) examine the interaction between childhood experiences and adult experiences through bivariate statistical analysis.

#### 4.1.1 Specific Aim 1: Characterize Nature-based Experiences in Adulthood and Childhood

##### *Indoor and Outdoor Nature Experiences: Adulthood*

When asked about the amount of time spent in outdoor places with trees and plants as an adult, the vast majority of Phipps patrons indicated that they did so on a regular basis (Table 1). Nearly 80% of participants marked that they often spend time in outdoor spaces with trees and plants. Only a total of 3% of the sample said they that either rarely or never spend time interacting with outdoor nature. Furthermore, 60% (162) of respondents strongly agreed and 31% (84) somewhat agreed with the statement “I try to make outdoor recreation a priority” while roughly 9% (23) indicated that that they strongly or somewhat disagreed. There was a similar distribution of responses for the statement “I enjoy caring for outdoor plants” with 54% (146) stating that they strongly agreed, 33% (89) somewhat agreed, and 13% (34) either somewhat or strongly disagreeing.

**Table 1. Adult Exposure to Nature**

	<b>Never</b>	<b>Rarely</b>	<b>Occasionally</b>	<b>Often</b>
<b>Spend time in outdoor places with trees and plants?</b>	1 (0.4%)	6 (2%)	19% (52)	78% (211)
<b>Spend time in indoor place caring for plant life?</b>	23 (9%)	20% (54)	35% (94)	37% (99)

For the survey question asking patrons about the amount of time spent in indoor places caring for plant life, only 35% and 37% responded that they did so occasionally or often, respectively. In addition, one in ten stated that they never spent time caring for indoor plant life while 20% said they did so rarely. When asked to what extent participants agreed or disagreed with the statement “I make it a priority to have houseplants in my home”, 48% strongly agreed, 28% somewhat agreed, 17% somewhat disagreed, and 7% strongly disagreed. For the statement “I enjoy caring for indoor plants” 45% strongly agreed, 34% somewhat agreed, 15% somewhat disagreed, and 7% strongly disagreed.

#### *Indoor and Outdoor Nature Experiences: Childhood*

As part of the survey Phipps patrons were also asked to report on how frequently there were exposed to indoor and outdoor nature before the age of 11. Childhood exposure to indoor and outdoor nature differed slightly from adult exposure (Table 2). Of the 246 patrons that answered the survey question, 87% indicated that they often spent time in outdoor places during their childhood. A total of 12% marked that they spent time outdoors either rarely or occasionally before the age of 11 and only one person indicated that they never did so. When asked about frequency of spending time in indoor places caring for plant life, only one in ten stated they often did so as a child. In addition, over half indicated that they never or rarely took care of indoor plants in their childhood and roughly a third of patrons reported they did do occasionally as a child.

**Table 2. Childhood Exposure to Nature**

	<b>Never</b>	<b>Rarely</b>	<b>Occasionally</b>	<b>Often</b>
<b>Spend time in outdoor places with trees and plants?</b>	1 (0.4%)	2.8% (7)	9.3% (23)	87.4% (215)
<b>Spend time in indoor place caring for plant life?</b>	23.3% (57)	38.4% (94)	27.8% (68)	10.6% (26)

*Types of Nature-based Activities: Adulthood*

The most frequent nature-based activity was taking care of outdoor plants with 56% (Table 3). Roughly half of the sample stated they often plant trees, seeds or plants or pick flowers, fruits, or vegetables from a garden. Visiting or playing in local parks was another popular nature-based activity with 43% marking that do so on a regular basis. Furthermore, 44% reported that they often take care of indoor plants. Going to the beach and camping were the activities with the highest response for activities done “rarely” or “occasionally”. The least popular nature-based activity among Phipps patrons was hunting or fish, with 53% indicating that they had never participated in either.

**Table 3. Frequency of Adult Nature-Based Activities**

<b>Active Gardening</b>	<b>Never</b>		<b>Rarely</b>		<b>Occasionally</b>		<b>Often</b>	
Picking flowers, fruits, or vegetables from a garden	17	(6%)	46	(17%)	78	(29%)	129	(48%)
Planting trees, seeds, or plants	16	(6%)	42	(16%)	74	(28%)	137	(51%)
Taking care of indoor plants	30	(11%)	42	(16%)	80	(30%)	118	(44%)
Taking care of outdoor plants	13	(5%)	32	(12%)	74	(27%)	151	(56%)

<b>Passive Interactions with Plants</b>	<b>Never</b>		<b>Rarely</b>		<b>Occasionally</b>		<b>Often</b>	
Camping	75	(28%)	83	(31%)	83	(31%)	28	(10%)
Hunting or fishing	144	(53%)	76	(28%)	34	(13%)	16	(6%)
Going to the beach	16	(6%)	79	(29%)	129	(48%)	46	(17%)
Bird watching	51	(19%)	59	(22%)	77	(29%)	83	(31%)
Visiting or playing in local parks	9	(3%)	36	(13%)	108	(40%)	116	(43%)

*Types of Nature-based Activities: Childhood*

Over a third of the 246 participants reported that they never went hunting or fishing or bird watching in their early childhood (Table 4). In addition, over half of the survey respondents answered that they either never or rarely took care of indoor plants before the age of 11. One in three marked that they occasionally went camping or to the beach as in their childhood. Other nature-based activities Phipps patrons indicated they did often in childhood were planting trees, seeds, or plants (37%), taking care of outdoor plants (37%), and visiting local parks (48%).

**Table 4. Frequency of Childhood Nature-Based Activities**

<b>Active Gardening</b>	<b>Never</b>		<b>Rarely</b>		<b>Occasionally</b>		<b>Often</b>	
Picking flowers, fruits, or vegetables from a garden	22	(9%)	32	(13%)	82	(33%)	109	(44%)
Planting trees, seeds, or plants	25	(10%)	55	(23%)	74	(30%)	89	(37%)
Taking care of indoor plants	56	(23%)	80	(33%)	70	(29%)	39	(16%)
Taking care of outdoor plants	33	(13%)	48	(20%)	73	(30%)	91	(37%)

<b>Passive Interactions with Plants</b>	<b>Never</b>		<b>Rarely</b>		<b>Occasionally</b>		<b>Often</b>	
Camping	72	(30%)	54	(22%)	73	(30%)	45	(18%)
Hunting or fishing	94	(38%)	61	(25%)	58	(24%)	32	(13%)
Going to the beach	48	(20%)	67	(27%)	82	(33%)	48	(20%)
Bird watching	93	(38%)	55	(23%)	66	(27%)	29	(12%)
Visiting or playing in local parks	13	(5%)	42	(17%)	72	(29%)	118	(48%)

#### **4.1.2 Specific Aim 2: Association between Childhood and Adulthood Experiences**

There was a statistically significant association ( $p = 0.002$ ) between Phipps patrons that reported often spending time in outdoor places with trees and plants in childhood and those that spend time outdoor currently (Table 5). In addition, there is a statically significant association ( $p = 0.002$ ) between those that spend time in indoor places caring for plants in their childhood and those patrons that indicated that they care for indoor plants as an adult. However, there was not a significant association between Phipps patrons that reported that they spent time outdoors with trees and plants as a child and those that spend time caring for indoor plants as an adult ( $p = 0.559$ ) or those that care for houseplants in childhood and those that spend time outdoors now that they are older ( $p = 0.218$ ).

**Table 5. Reported P-values from Chi-Squared Test for Association**

	Spend time in outdoor places with trees and plants as an adult	Spend time in indoor places caring for plant life as an adult	Participation in passive interactions with plants as an adult	Participation in active gardening experiences as an adult
Spend time in outdoor places with trees and plants as a child	<b>0.002*</b>	0.559	0.806	<b>0.009*</b>
Spend time in indoor places caring for plant life as a child	0.218	<b>0.002*</b>	<b>0.044*</b>	<b>0.022*</b>
Participation in passive interactions with plants as a child	<b>0.025*</b>	0.471	<b>0.001*</b>	0.281
Participation in active gardening experiences as a child	<b>&lt; 0.000*</b>	<b>0.012*</b>	0.654	<b>&lt; 0.000*</b>

\* Denotes significant association at the 0.05 level

Bivariate statistical analysis was also done to determine if reported frequencies of active gardening and passive interactions with plants in childhood influences adult behavior (Table 5). Chi-squared tests determined there is a statistically significant association between ( $p < 0.000$ ) Phipps' patrons who reported often taking part in active gardening activities before the age of 11 and those who reported that they often participate in active gardening activities as an adult. In addition, there is a statistically significant association ( $p = 0.001$ ) between those who took part in passive interaction with plants in their childhood and patrons who indicated they do the same as adults. There was not an association between Phipps' patrons who reported active gardening experiences as a child and those with passive interactions as an adult ( $p = 0.654$ ) or those who had

passive interactions in childhood and those with reported active gardening now that they are older ( $p = 0.281$ ).

To further explore the relationship between childhood behavior and adult behavior, bivariate analysis was also done to examine if there is a significant association between Phipps patrons' childhood exposure to indoor nature, outdoor nature, active gardening, and passive interactions with plants to current behavior (Table 5). Using a chi-squared test, it was determined that there is a statistically significant association ( $p = 0.009$ ) between those patrons who indicated that they often experienced outdoor nature before the age of 11 and those who reported that they often take part in active gardening activities as an adult. There was a similarly significant association between survey participants who indicated they often spent time with indoor plants before the age of 11 and respondents that take part in both active gardening as an adult ( $p = 0.022$ ) and passive interactions with plants ( $p = 0.044$ ). In addition, there was found to be a statistically significant association ( $p = 0.025$ ) between Phipps' patrons who often took part in passive interactions with plants before the age of 11 and those who spend time outdoors with plants. Lastly, there was also a significant association found between survey participants that indicated they often took part in active gardening experiences before age 11 and those that indicated that they spend time outdoors with tree and plants as an adult ( $p < 0.000$ ) and patrons that spend time indoors caring for plants as an adult ( $p = 0.012$ ).

## **4.2 NATURE AND HEALTH**

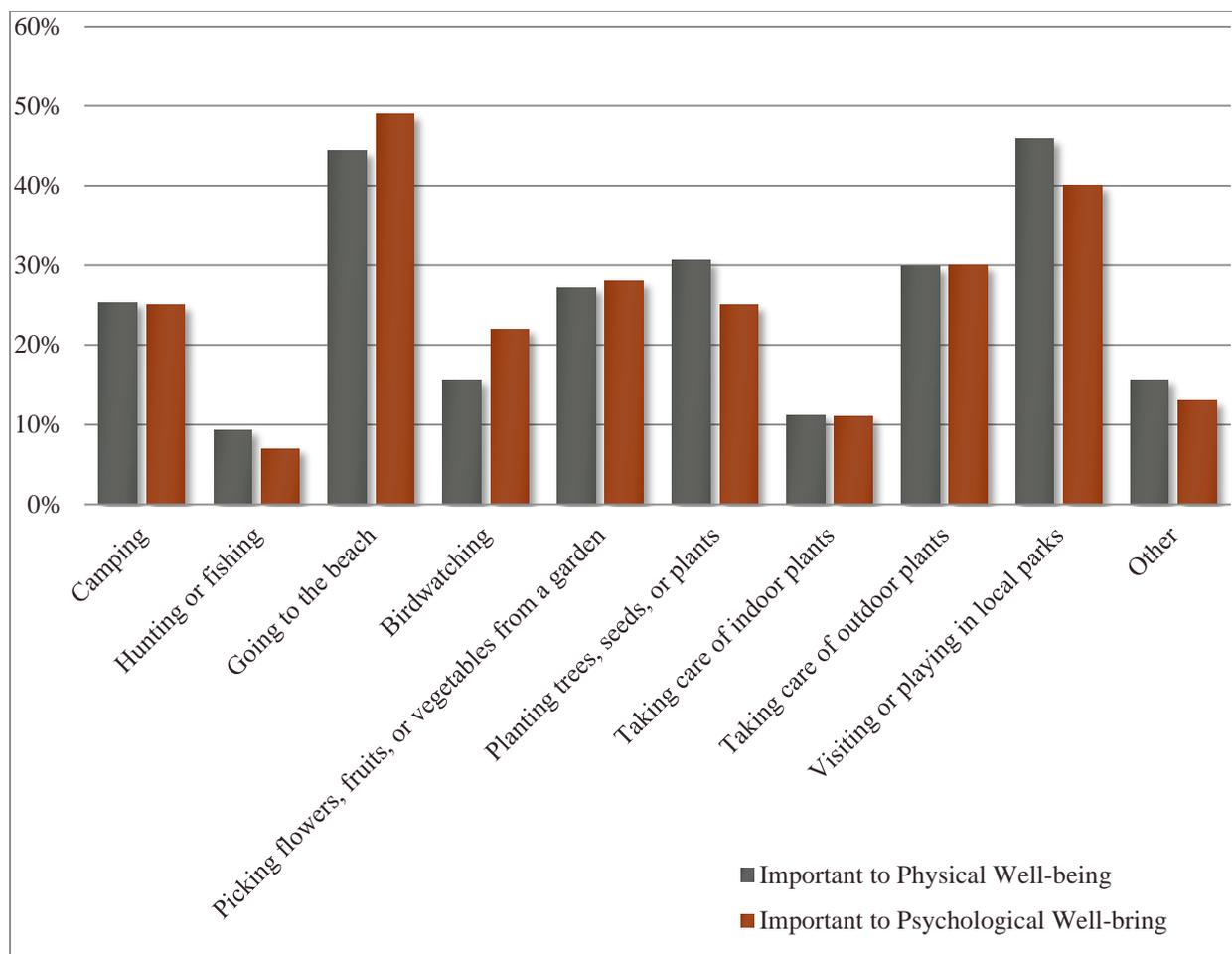
Phipps patrons overwhelmingly reported they perceive a health benefit from contact with the natural environment. When asked to what extent they agreed with given statements, 80%

strongly agreed with the statement that “Trees and plants are important to physical health” and 89% strongly agreed with the statement that “Trees and plants are important to psychological health”. In addition, 81% stated that they strongly agree that trees and plants in cities help them to feel calmer. The following section will review the data for specific aim three and four. These aims were to (3) characterize the nature-based activities that make Phipps patrons feel the most physically and psychologically well, and (4) examine the interaction between contact with nature and perceived physical or psychological health benefit through bivariate statistical analysis.

#### **4.2.3 Specific Aim 3: Perceptions of Engaging with Nature and Relationship to Physical and Psychological Health**

##### *Contact with Nature and Perceived Physical Well-being: Adulthood*

Of the activities listed in the survey, the most popular nature-based activity that made Phipps patrons feel physically well was visiting or playing in a local park, with a little under half of the sample including it in their top three rankings (Figure 1). Going to the beach was the next popular choice with 44% of the participants including it in their top three ranking of nature-based activities that make them feel physically well. Over a third of the participants included planting trees, seeds, or plants and taking care of outdoors plants. The nature-based activities that were least often included in individuals ranking of activities that make them feel physically well were taking care of indoor plants as well as hunting or fishing with only 11% and 9% of the sample including these respectively.



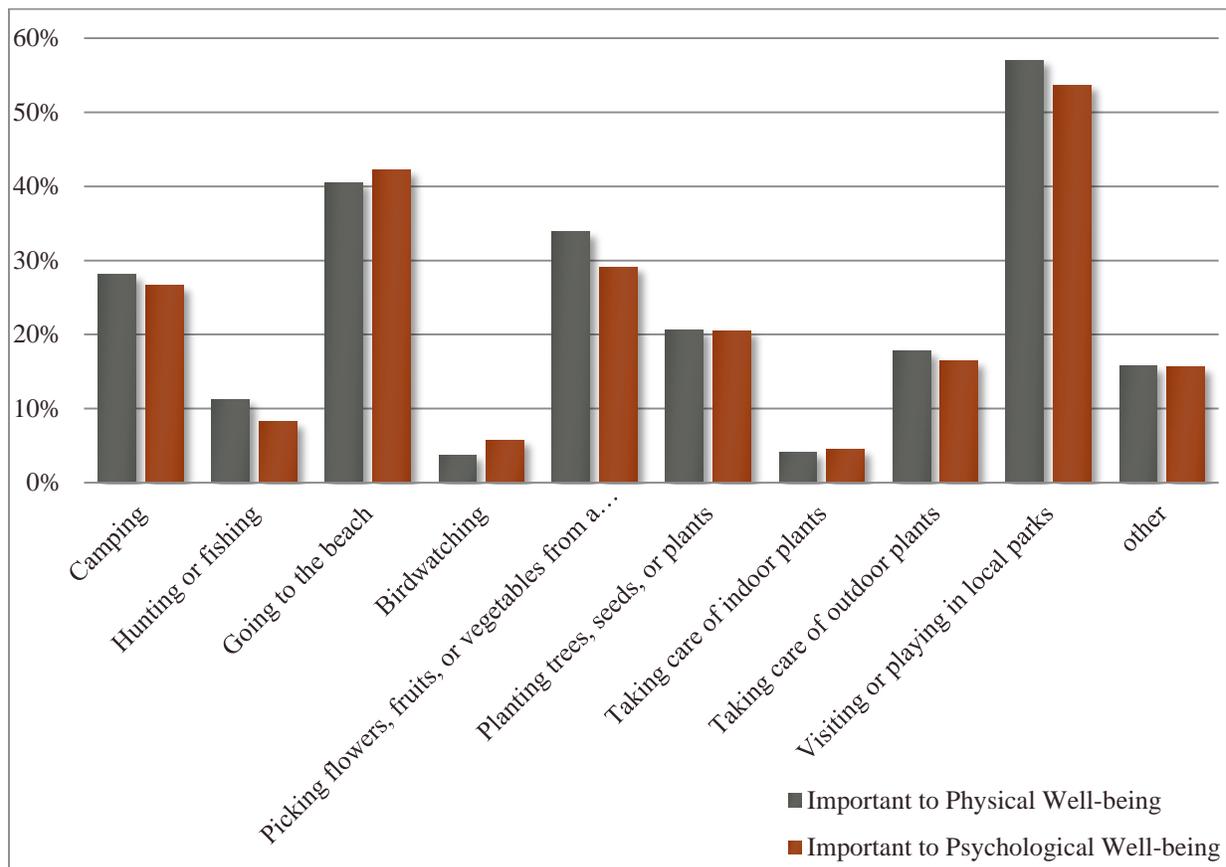
**Figure 1. Perceived Health Benefits from Nature-Based Activities in Adulthood**

*Contact with Nature and Perceived Psychological Well-being: Adulthood*

The rankings for what makes patrons feel psychologically well closely mirror the rank for what they indicated makes them feel the most physically well (Figure 1). When asked to rank what activities that made them feel the most psychologically well, half of the survey respondents included going to the beach in their rankings. Two fifths of the sample included visiting or playing in a local park. The nature-based activities that were included the least often in the top three ranking by respondents were hunting or fishing (7%) and taking care of indoor plants (11%).

### Contact with Nature and Perceived Physical Well-being: Childhood

Visiting or playing in local parks was the activity that made individuals feel the most physically well before the age of 11 years old with 57% including in their rank of nature-based activities (Figure 2). Following a similar pattern as with the adults, going to the beach was the next most popular activities to feel physically well, with 40% and 38% respectively. Roughly one third stated that camping, planting tree, seeds, or plants, and picking flowers, fruit, or vegetables from a garden made them feel physically well. Bird watching and taking care of indoor plant were the nature-based activities that patrons included in their rankings the least, each only being included in the top three rankings of 4% of the participants.



**Figure 2. Perceived Health Benefits from Nature-Based Activities in Childhood**

### *Contact with Nature and Perceived Psychological Well-being: Childhood*

The nature-based activities that made Phipps patrons feel psychologically well in childhood closely reflected activities respondents indicated giving them feelings of physical well-being (Figure 2). When Phipps patrons were asked to rank the top three nature-based activities that made them feel psychologically well, visiting or playing in local parks was included in the top three the most with 54% of individuals. Roughly 42% of survey respondents included going to the beach in their ranking. Hunting or fishing (8%), bird watching (6%), and taking care of indoor plants (5%) were the activities least often included in the top three rankings of Phipps patrons.

#### **4.2.4 Specific Aim 4: Association between Nature-based Experiences and Perceived Health Benefits**

Chi-squared tests were done to measure the association between perceived physical and psychological health benefits from contact with nature and exposure. These exposures included spending time outdoors with trees and plants, spending time indoors caring for plants, participating in active gardening, and taking part in passive interactions with plants as an adult and before the age of 11. The same analysis was done with adult exposures to the same interactions (Table 6). There was a statistically significant association ( $p = 0.049$ ) between Phipps' patrons who indicated they had passive interaction with plants before the age of 11 and those that perceive physical health benefits from contact with nature. There was also found to be an association ( $p = 0.029$ ) between survey participants that reported taking part in active gardening activities as an adult and those that reported they agreed that "Trees and plants are important to their physical well-being". Lastly, there was a statistically significant association between Phipps patrons that indicated on the survey that they often spend time outdoors with plants and those that indicated trees and plants are

important to their physical well-being ( $p = 0.009$ ) and trees and plants are important to psychological well-being ( $p < 0.000$ ).

**Table 6. Reported P-values from Chi-Squared Test for Association**

	Trees and plants are important to physical well-being	Trees and plants are important to psychological well-being
Spend time in outdoor places with trees and plants as a child	0.133	0.11
Spend time in indoor places caring for plant life as a child	0.115	0.058
Participation in active gardening experiences as a child	0.053	0.157
Participation in passive interactions with plants as a child	<b>0.049*</b>	0.206
Spend time in outdoor places with trees and plants as an adult	<b>0.009*</b>	<b>&lt; 0.000*</b>
Spend time in indoor places caring for plant life as an adult	0.114	0.363
Participation in active gardening experiences as an adult	<b>0.029*</b>	0.113
Participation in passive interactions with plants as an adult	0.081	0.417

\* Denotes significant association at the 0.05 level

## 5.0 DISCUSSION

This exploratory survey of Phipps patrons reveals several significant associations between reported contact with nature they experienced before the age of 11 and how they currently interact with nature. If survey participants who reported taking part in certain nature-based activity before age 11, they are more likely to report that they participate in that activity as an adult. Participants who indicated they spent time outdoors with trees and plants in their childhood were more likely to indicate they spent time in the same type of environmental setting as an adult. The same association was found for patrons reporting spending time caring for indoor plants, active gardening, and passive interactions with plants. Phipps patrons reporting often spending time in outdoor places with trees and plants before the age of 11 were also likely to report active gardening as an adult. Phipps patrons who reported passive interaction with plants before the age 11 were also significantly associated with reporting they spend time outdoors with trees and plants as an adult.

Based on these results, it appears that often spending time in indoor places caring for plant life and taking part in active gardening experiences before the age of 11 seems to have the greatest influence on adult nature-based behavior. Phipps patrons who indicated they often spend time caring for indoor plants were associated with indicating they care for indoor plants, have passive experiences with plants, and take part in active gardening as an adult. Those that reported having active gardening experiences early in life were associated with indicating that they spend time outdoors with trees and plants, spend time caring for indoor plants, and take part in active gardening experiences as an adult. This interpretation of how nature-based activities are incorporated into individuals' daily lives aligns with the constructs of SCT discussed earlier.

Having the self-efficacy to take part in nature-based activities as an adult stems from observational learning and the mastery of necessary skills to successfully to engage with nature early in childhood.

The interpretation that Phipps patrons who taking part in nature-based activities as a child are more likely to participate in them as an adult reflects conclusions from studies conducted (Asha et al., 2012; Lohr & Pearson-Mims, 2002, 2005; Thompson et al., 2008; Wells & Lekies, 2006). As this connection that starts in childhood develops over time, it then influences adult behavior leading to a greater likelihood of living a nature-centered life. The data from Phipps patrons suggests that there is something yet to be measured factor about childhood active gardening experiences in that influences adult behavior more so than only spending time outdoors or participation in passive interactions with plants. While likely a contributing factor, the setting of the childhood interaction with nature (i.e. indoors or outdoors) is not sufficient for a lifelong connection to nature to take root. The variable that impacts behavior the most is the nature-based activity in which the child takes part. Data from the Phipps survey suggest that it is when children have the chance to have truly hands-on learn experiences regarding nature and plants that they develop an appreciation for nature-based activities. Caring for indoor plants and active gardening are much more interactive experiences than being outside or playing in the park. Having the chance to get their hands dirty, ask questions about their local environment, and develop an appreciation for how our daily lives impact and are impacted by nature that individuals establish a connection to the natural world around them. As this connection grows and develops over an individual's life, then they are much more likely to engage in nature-based activities that strongly benefit their physical and psychological health.

The result from the survey would also seem to indicate that, among Phipps patrons, childhood exposure to nature has little to do with patrons perceiving physical and psychological health benefits from interacting with the natural environment. A weak association existed between respondents who reported that trees and plants were important to their physical well-being and two exposures variables. These two variables were patrons who participated in passive interactions with plants before the age of 11 and those who participated in active gardening as an adult. However, the strongest association was between Phipps patrons who strongly agreed with the statements that trees and plants were important to their physical and psychological well-being was with those that indicated often spending time in outdoor places with trees and plants as an adult. This lack of an association with childhood experiences can possibly be explained by the fact that, when Phipps patrons were remembering their childhood, they were not remembering perceived health benefits. Interacting with nature was viewed as a fun activity. An appreciation of the health benefits from living an active nature-centered life come later as health becomes larger part of a persons education.

With the evidence that interactions with nature are a critical part of a persons development, the question then become how can contact with nature be increased. In a review of current literature examining evidence-based ways to incorporate contact with nature at an individual and community level, Largo-Wight (2011) has several recommendations for how the field of public health can work to increase outdoor, indoor, and indirect contact with nature. Contact with outdoor nature is possibly the most important in regard to health because of the immersive experience of being outside (Mayer et al., 2009). Outside, people can engage nature with all of their senses. To increase contact with outdoor nature, Largo-Wight (2011) suggests constructing green spaces that feature seating areas so visitors can observe flowers, trees, plants, and other natural elements. Building

therapeutic gardens that focus on recovery and stress-reduction in healthcare facilities, incorporate wooded parks and green spaces in urban communities, and encouraging individuals to advocate for preservation of wilderness are all methods to increase outdoor nature contact.

Interacting with plants indoors is just as important to a person's psychological well-being as contact with outdoor tree and plants (Bringslimark et al., 2009; Dijkstra et al., 2008). According to Largo-Wight (2011), public health interventions aiming to increase indoor contact with nature should center around encouraging people to have indoors pets, caring for indoors potted plants, letting in bright natural light, incorporating windows with outdoor views in office buildings and homes, and letting outdoor air and sounds indoors. Lastly, methods to increase indirect contact with nature includes displaying nature photography and painting, listening to recorded nature sounds, watching shows or videos of natural environments (Largo-Wight, 2011).

## **5.1 LIMITATIONS**

One of the major limitations of this research project is recall bias. Phipps patrons that took the survey might not be remembering the actual frequency and settings in which they were exposed to nature-based activities in their childhood. In addition, there is recall bias because those that took the survey might be projecting their current level of nature exposure onto their childhood. Someone that is highly active in nature as an adult might report higher levels of contact with nature in their childhood than they actually experienced.

Another limitation of the data is due to the demographics of the average Phipps patron. The results are not very generalizable to the general population of Pittsburgh because those that took the survey were predominantly older white women. However, for those individuals with an interest

in Phipps, there results have more external validity. While the demographic of the sample population in this survey are very different from general population of Pittsburgh, the purpose of this study to explore how Phipps members and those interested in Phipps develop a connection to nature arose from a CBPR approach. Keeping this community in mind, this survey successfully captured a sample from this population when demographic data are compared to other demographic data collected in previous surveys of the Phipps membership (M. Steinwald, personal communication, February 17, 2014). Conducted in 2012, the demographic data from the survey revealed that 95% of Phipps members identified as white or Caucasian, 75% are female, an average age of 55, over 85% having at least a college degree, and 55% reporting an annual household income of over \$75,000.

## **5.2 DISSEMINATION OF FINDINGS**

There are several stakeholders to which these research findings should be summarized and disseminated. First, the Phipps' patrons that actually took the survey should be informed of the results. As participants in the research, these individuals have a right learn about the findings and how their responses were used. By seeing how their participation in research facilitates investigations into public health issues, they might be encouraged to participate in other future studies. Dissemination could easily occur to those that took the survey by using the same methods utilized to send out the survey by Phipps Marketing Department. A brief summary of the findings could be sent out via e-mail to Phipps member as well as being posted to Phipps Facebook and Twitter page. However, when writing up the results for the community, it is important to

contextualize the results and convey the proper meaning of the data in common language that is easy to comprehend

Secondly, the result should be shared with Phipps' leadership. While the research was done in coordination with the Director of Science Education and Research, I want to share the findings with the rest of the staff in the department. In addition, to foster continued collaboration between the GSPH and Phipps, the executive director should be made aware of the results as well. Sharing the results of the data analysis will be complicated by the fact that the Director of Science Education and Research that was my partner during the research is no longer employed by Phipps. However, as a major partner in the creation of the project and providing access to their membership, there is an ethical obligation to share the results with Phipps. By sharing with Phipps, the management might have ideas of how to spread knowledge for the study to policy makers in local government, different nonprofits in Pittsburgh, and schools in the area.

The knowledge should be shared with GSPH students and faculty. Sharing the results with other public health researchers is important because it can open the door to further partnerships and research opportunities. Researcher with other backgrounds might be able to offer different insight in how to interpret results and also offer suggestion on improving the study design for future investigations. Lastly, if the appropriate academic journal can be identified, the results from this thesis should be published to add to the general knowledge of how individuals establish a connection to their natural environment.

### 5.3 CONCLUSIONS

In regards to private policy, this study has positive implications for Phipps. It stresses the importance of continued support for their education programs and can be used to justify expanding Phipps programs to reach low-income families that are unable to attend current programs. As demonstrated from the demographics of Phipps patrons, Phipps is currently not being very effective in reaching a diverse audience. The origination should partner with community stakeholders and develop innovative methods to expand their membership, making it more representative of the various communities that comprise Pittsburgh.

This research project has several implications for public policy as well. Findings from this and similar studies can be utilized to support the development and funding of nature-based educational programs in schools. Policy encouraging children to take part in nature-based activities early in life can help individuals develop healthy habits that will follow them through out the adult lives. Furthermore, research on how people develop a connection to nature also has policy implications in the area of urban planning. As mentioned in the earlier discussion of the social ecological theoretical model, a range of outside factors affects physical and psychological health. Understanding why people interact with nature can provide guidance for city planners and developers regarding how to best include green spaces and access to nature when developing urban communities (Cheng & Monroe, 2012). Lastly, there are environmental policy implications as well. This research can be added to the long list of research justifying the need for strong environmental protection legislation. It is not just about protecting the environment, but protecting public health.

There are several areas from future research to improve support for the trends highlighted by this exploratory survey of Phipps patrons. Incorporating the voice of the target community would

improve the process of selecting a research topic. For this particular research project, the community of interest was defined as all individuals whom have expressed an interest in Phipps, whether that is through having a membership or by following on social media. However, the opinions of the defined community were missing when we were designing the research project. To move beyond community-engaged research into the realm of CBPR, the community needs to be incorporated in all aspect of the research process.

One possible way to accomplish this higher level of engagement is through focus groups exploring health concerns of the community. It is possible that Phipps' patrons have no interest in mental and physical health benefits from interacting with nature, and instead, are more worried about access to safe green spaces in their neighborhood. Conducting a needs assessment with the community of interest would better inform Phipps' about current health concerns and improve participation in the research. Looking back on this current research project, small focus groups also could have been conducted to better tailor the survey questions and answer choices to our target population. The online survey was created using questions from other published surveys that examined similar research questions. Since those questions were designed with other communities in mind, the questions asked and answer choices given might have not been relevant for Phipps patrons and followers.

Moving forward public health research should investigate how active gardening experiences can be utilized as a novice method for addressing individual and community health. Future research should also explore the possibility of creating a prospective cohort study conducted at Phipps to further investigate how childhood nature-based experiences impact behavior later in life. This study design would eliminate recall bias and help to identify what specific nature-based interactions are influencing behavior later in life. A cohort study design could also explore

modifying factors such as frequency of nature exposure, if whom the child has the nature experiences with matters (i.e. teacher, parent, friends, siblings, or alone), and the role of socioeconomic factors.

While there are several limitations in the research presented here that reduces the external validity of the results, the findings are no less important. The evidence from this thesis that active gardening experiences before the age of 11 was associated with increased levels of nature-based activity as an adult among Phipps patrons adds to the growing body of literature highlighting the importance connectedness to nature plays in physical and psychological health. Promoting meaningful interactions with nature is no longer simply an environmental or educational problem, but quickly becoming an area ripe for public health research. Botanical gardens and other environmental protection organizations need to become more aware of the research that can be accomplished through collaboration with public health researchers. Through community-engaged research centered on increasing a community's contact with nature, novel approaches can be developed to address community health issues by limiting the disconnect between humans and the environment around them.

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