NATURE AND OUTDOOR RECREATION AFTER-SCHOOL PROGRAM CURRICULUM

by

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Nature and Outdoor Recreation After-school Program Curriculum

A project submitted in partial fulfillment of the requirements for the degree of Master of Science at George Mason University

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DEDICATION

This is dedicated to my parents who taught me about the beauty and importance of nature from an early age.
ACKNOWLEDGEMENTS

I would like to thank my friends and parents who have given me encouragement and support through this project. I would also like to thank Dr. Brenda Wiggins, Evan Braff, and Dr. James Kozlowski who made this project possible.
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LIST OF ABBREVIATIONS

Attention-deficit/Hyperactivity Disorder .............................................................. ADHD
Body Mass Indexes .................................................................................................. BMI
Moderate to Vigorous Physical Activity ............................................................... MVPA
Science, Technology, Engineering, and Math ...................................................... STEM
Standards of Learning .......................................................................................... SOLs
ABSTRACT

NATURE AND OUTDOOR RECREATION AFTER-SCHOOL PROGRAM CURRICULUM

Cheryl Behrens, M.S.

James Madison University, 2007

Chair: Dr. Brenda Wiggins

The Fairfax County Neighborhood and Community Services supervisors would like to implement a nature education and outdoor recreation curriculum in their community center’s free after-school program. The need for this curriculum is in response to Louv’s (2008) discussion of the Nature Deficit Disorder and America’s rising childhood obesity epidemic. This project examines the benefits of nature and outdoor recreation for elementary school youth. Exposure to nature can lower one’s stress level, improve memory, and create environmental stewardship. Participating in outdoor recreation has been linked to spending more time in moderate to vigorous physical activity (MVPA) and reducing the risk of heart disease and diabetes. Curriculum from other government and private organizations are researched and reviewed. The researcher uses this information to recommend nature and outdoor recreation curriculum and activities that incorporate the Virginia science Standards of Learning (SOLs) and can be implemented in the free after-school program at the third and fourth grade levels.
INTRODUCTION

It is important to motivate the youth of America to become more engaged in nature and active in outdoor recreation. Youth do not get as much physical activity or outdoor time as they should according to many because of video games, the Internet and other technologies. Children between the ages of three and twelve spend 27% of their time watching television and only 1% of their time outdoors (Hofferth & Sandberg, 2000). According to Huhman and Heitzler (2003), 22.6% of children between the ages of nine and thirteen do not participate in any leisure time physical activity. Studies show that when a sedentary lifestyle begins early in life it will worsen throughout childhood and young adult life (LaFontaine, 2008). If youth acquire habits of participation in nature and outdoor recreation early on in their lives, then they may be more likely to have healthier lifestyles later in life. Being outside in nature and participating in outdoor recreation are linked to many physical and mental health benefits.

Theoretical Framework

Three theoretical frameworks will be utilized during the study. The first theoretical framework is Attention Restoration Theory (ART). ART states that interacting with natural environments that are rich with fascinating stimuli, like sunsets; call upon involuntary attention modestly (Kaplan, 1995). Calling upon involuntary attention modestly gives directed-attention mechanisms a chance to replenish. Urban environments
capture attention dramatically and require directed attention in order to overcome that stimulation, like hearing a siren or car alarm. Capturing attention dramatically makes urban environments less restorative. Research shows that after having an interaction with natural environments, even if it only involves viewing nature from a window, one is able to better perform on tasks that depend on directed attention abilities (Berman, Jonides & Kaplan, 2008; Tennessen & Cimprich, 1995). Directed attention is the ability to block or reduce competing stimuli or distractions (Posner & Snyder, 1975; Kaplan & Kaplan, 1982). This ability is important in order to conduct everyday activities like making and carrying out plans, and self-regulating responses and behaviors to meet one’s desired goals (Kaplan & Kaplan, 1982; Lezak, 1982; Tennessen & Cimprich, 1995).

The second framework that will be used in this study is Richard Louv’s Nature-Deficit Disorder (2008). This disorder is not an official diagnosis in the International Classification of Diseases and Related Health Problems but is a label frequently used to describe how children are increasingly deprived of direct contact with nature (Driessnack, 2009). Louv speculates that this deprivation of contact with nature has added to the rising cases of attention-deficit/hyperactivity disorder (ADHD) in children. This study will look for ways to increase children’s contact with nature in order to reduce the effects of nature-deficit disorder.

The third framework is Bandura’s Social-Cognitive Theory. Several studies have used this theory to promote physical activity (Annesi, 2006; Ince, 2008; Nahas, Goldfine, & Collins, 2003). The Social-Cognitive Theory states that environmental influences, personal factors, and attributes of the behavior affect behavior change (Nahas, Goldfine,
& Collins, 2003). The theory goes on to say that in order for the person to change their behavior they must feel confident that they are able to perform the behavior, called self-efficacy. Confidence is created by encouragement from peers or after-school program leaders. Annesi (2006) conducted a study to see if there was a relationship between physical self-efficacy and voluntary physical activity in preadolescents participating in Youth Fit for Life, an after-school physical activity program. He deduced that those participating in the program had experienced an increase in their free-time physical activity. The Social Cognitive Theory will be incorporated into nature education and outdoor physical activity-based curriculums for Fairfax County’s after-school program.

**Problem Statement**

In 2007, the National Recreation and Park Association (NRPA) administered a survey to public park and recreation agencies to uncover how they connected children to the outdoors (Dolesh, 2007). The questions focused on the kinds of nature-based programs, facilities, and parks that the agencies offered to their constituents. Of the agencies they surveyed, one-third responded that they did not have any programming that pertained to nature. They also found that forty percent of the agencies had no nature-based facilities or parks. With the growing amount of research being conducted that shows the benefits of nature interaction and the diminishing access that the youth have to it, it is important to develop a curriculum for after-school programs that engage participants with nature.

Children between the ages of three and twelve spend one percent of their time outdoors (Hofferth & Sandberg, 2000). Also, according to the *National Kids Survey* when
youth are outside they are participating less frequently in outdoor nature-based recreation such as fishing, hiking, and wildlife viewing (Cordell & Green, 2011). This lack of a connection with nature and the outdoors can lead to attention disorders, like ADHD, and stress (Berman, Jonides, & Kaplan, 2008; Louv, 2008; Wells & Evans, 2003). Furthermore, large portions of children in the United States do not partake in a sufficient amount of physical activity (Beets, Beighle, Erwin, & Huberty, 2009). This limited amount of physical activity contributes to obesity, which is becoming a growing problem among Americans. Obesity creates serious health problems such as diabetes and heart disease. It is important to find a way to get the youth of America moving and involved in outdoor physical activities today in order for them to live a healthy lifestyle in the future.

Many researchers and health professionals focus on Physical Education (PE) in schools to promote physical activity but school administrators have been cutting back on the time dedicated to PE. Between 1994 and 2000, daily required PE among middle and junior high schools dropped from 17% to 6.4% (Burgeson, et al., 2001). Since PE is being cut back, after-school programs are becoming a way to promote physical activity (Annesi, 2006; Beets, Beighle, Erwin, & Huberty, 2009; Gutin, Yin, Johnson, & Barbeau, 2008). According to Smith (2007), in 2004 6.6 million youth attended after-school programs. There are a number of reasons for youth attending after-school programs including parents and caretakers having to work when a child is out of school, or children in need of a safe place to stay (Fredricks, Hackett, & Bregman, 2010). A meta-analyses conducted by Beets et al. (2009) found that after-school programs that incorporate a component of physical activity improves the body composition, physical fitness, and
blood lipid profiles of their participants. Given the large numbers of youth participating in these programs, if all after-school programs incorporated outdoor physical activity the obesity epidemic among youth could be confronted. This information helped to create the basis of this project.

**Research Question**

The purpose of this project is to recommend aspects of curriculum for a Fairfax County free after-school program that would promote an appreciation of nature through outdoor recreation and nature education while incorporating the Virginia science Standards of Learning (SOLs). There are two objectives for this project. The first objective is for the participants to become active in the outdoors to promote physical activity in order to fight our country’s obesity epidemic. The second objective is to instill an appreciation of nature within the participants so that as they become adults they realize the importance of taking care of our environment, as well as protecting it. The science SOLs will be included in the after-school program curriculum to reinforce what the after-school program participants are learning about during school and beyond. They will also be included in the curriculum to entice parents to enroll their children into the program. This project will create new knowledge and add to the existing curriculums being used that focus on nature, outdoor recreation, and using the outdoors as a learning lab.

Exciting, interactive and hands-on ways to teach youth about nature by participating in outdoor recreation activities will be investigated. A unique characteristic of the suggested curriculum will be that all the activities can take place on the grounds of
a Fairfax County, Virginia community center and where field trips are not required. The guiding question for this project will be:

**RQ1:** What science SOL based activities are best in exciting youth about nature education and outdoor recreation in after-school programs?

**Key Variables**

The project focuses on three key variables. The first variable is “nature.” This project will examine the benefits that nature has on an individual, why it is important for youth to be exposed to it, and how to incorporate nature education activities into after-school programs. The second variable is “outdoor recreation.” Outdoor recreation is important for youth and its benefits, including the reduction of ADHD symptoms, and stress, along with the improvement of attention and creativity, will be explored throughout this project. The third variable is the “Virginia science SOLs.” The SOLs will be looked for in existing after-school activities and curriculums as well as serve as a foundation for the recommendations for the free after-school program.

**Extent of Study**

The nature and outdoor recreation project has several limitations. One limitation is that other organizations that have similar programs like the one the researcher wishes to recommend for Fairfax County are not willing to share their curriculum. A majority of these organizations charge fees to those that attend their programs in order to make money. This is understandable but is nevertheless a limitation. Another limitation of this project is that all activities will take place on the community center grounds. This
particular after-school program does not charge for youth to attend so there are no finances to pay for transportation to go on field trips to the woods or to the river. This limitation will require the researcher to be creative in her recommendations on how to implement a nature and outdoor recreation program when one’s access to specific nature features are not available.

A delimitation of this project is that it began with a much larger scope. However, in the interest of the evaluator wanting to put forth a quality product, the project was reworked to its present form, which is to make recommendations and provide aspects delimited to nature and outdoor recreation curriculum.

Definitions

• Attention-deficit/hyperactivity disorder (ADHD) is the most common neurobehavioral disorder in childhood (American Academy of Pediatrics, 2000). This disorder results in an unusually high and problematic level of inattention, impulsivity/hyperactivity, or both (Centers for Disease Control and Prevention, 2001).

• After-school programs are considered to be any program that is conducted after regular school hours. The program can be facilitated through the school or organizations like the Young Men's Christian Association (YMCA) or Boys and Girls Club.

• Outdoor recreation has been defined as activities that take place outside the confines of buildings (i.e. the outdoors), can be undertaken without the
existence of any built facility or infrastructure, and may require large areas of land, water and/or air (Outdoors Queensland, 2009).

- Body Mass Indexes (BMI) is calculated by dividing one’s height by the square root of their weight (Centers for Disease Control and Prevention, 2011). One’s BMI helps to determine if he or she is overweight or healthy.

- A Manufacturing Technology Inc. (MTI) accelerometer is a lightweight single channel motion sensor that detects and records time and varying accelerations (Guinhouya, Hurbert, Dupont, & Durocher, 2005). This device is usually worn on a participants’ hip or ankle. Researchers use accelerometers to measure one’s physical activity and will be implemented in this research.

- The Virginia Standards of Learning (SOLs) describe the Virginia “commonwealth’s expectations for student learning and achievement in grades K-12 in English, mathematics, science, history/social science, technology, the fine arts, foreign language, health, physical education and driver education” (Virginia Department of Education, 2012). This project will focus specifically on the third and fourth grade science SOLs. According to the Commonwealth of Virginia Board of Education (2010), the following are the third and fourth grade science subject areas:
  
  - (i) scientific investigation, reasoning, and logic,
  - (ii) force, motion, and energy,
  - (iii) matter, (third grade only)
• (iv) life processes,
• (v) living systems,
• (vi) interrelationships in earth/space systems,
• (vii) earth patterns, cycles, and change,
• (viii) earth resources.
REVIEW OF LITERATURE

An extensive search has been conducted in order to find relevant studies focused on the benefits of outdoor recreation and nature. A number of peer-reviewed articles were found and will be discussed. Although a line of research is available regarding nature and its impact on people (Atchley, Strayer & Atchley, 2012; Berman, Jonides & Kaplan, 2008; Kuo & Taylor, 2000; Wells & Evans, 2003; Wells & Lekies, 2006), there has not been a great deal of research done on the benefits of nature and outdoor recreation in after-school programs. The research identified, however, lends support to Fairfax County personnel’s’ beliefs that they should be promoting nature and outdoor physical activity in after-school programs and a curriculum should be further investigated and implemented.

Focusing on both nature and outdoor physical activity may be a broad scope but this scope is justified by the NRPA’s three pillar of recreation. Recently, the National Recreation and Park Association developed three pillars that essentially summarize the entire recreation field (Beard, 2013). The three pillars are conservation, health and wellness, and social equity. Combining the three pillars will aide in producing a well-rounded recreational product. Conservation is represented in the project by teaching the after-school participants about nature in hopes that they will become stewards of the environment. Health and wellness appears in the project in the form of outdoor physical activity and recreation. Lastly, social equity is part of the project because participants in a
free after-school program ideally should have the same opportunities and advantages as those attending a fee based after-school program. While the research topics may seem broad they are justified.

Five themes will be addressed in the literature review. The first theme provides a background in and the importance of incorporating Virginia’s science SOLs in after-school programs. The second theme is that after-school programs are an excellent venue in which to engage children in outdoor physical activity (Beets, Beighle, Erwin & Huberty, 2009). The third theme is outdoor recreation’s effect on physical activity and how it should be incorporated into after-school programs (Cleland et al., 2008; Dustin, Bricker, Schwab, 2010; Nilsson et al., 2009). The fourth theme is the benefits of physical activity and how evidence suggests that regular physical activity at an early age can reduce the risk of diabetes, heart disease and obesity (Gutin, Yin, Johnson & Barbeau, 2008; Moore, Gao, Bradlee, Cupples, Sundarajan-Ramamurti, Proctor, Hood, Singer & Eillison, 2003). The fifth theme is the benefits of exposure to nature. Nature can reduce stress, components of ADHD, improve memory, and foster creativity according to many (Atchley, Strayer & Atchley, 2012; Berman, Jonides & Kaplan, 2008; Kuo & Taylor, 2004; Wells & Evans, 2003).

Virginia Standards of Learning

It is important to describe the background on Virginia’s SOLs since this project will be incorporating aspects of its science curriculum into the after-school curriculum recommendations. The SOLs were created in response to what Virginia Governor George Allen thought were unwarranted federal interventions in education (Morrill, 2004). In the
spring of 1994, Governor Allen and his appointees selected four local school districts to spearhead the development of new learning standards. The following year, the Virginia Board of Education approved new standards of learning for kindergarten through twelfth grade in English, mathematics, history, science, and social science. The SOLs have been revised multiple times since their inception in 1995.

This project will be focusing on the science SOLs. According to the Commonwealth of Virginia Board of Education (2010), Grade Three and Grade Four have similar subject areas. The eight subject areas are (i) scientific investigation, reasoning, and logic, (ii) force, motion, and energy, (iii) matter, (iv) life processes, (v) living systems, (vi) interrelationships in earth/space systems, (vii) earth patterns, cycles, and change, and (viii) earth resources. Third grade has an additional subject area, which is Matter. What is unique about the third and fourth grade standards is that they essentially have the same subject areas however the lesson plans are geared to focus on different aspects of those areas. This is because third grade SOLs emphasize conducting investigations while the fourth grade SOLs stress the importance of using information, analyzing data, and validating experimental results. An example of these different focuses can be seen within the Life Processes subject area. In third grade the focus is on having the students “investigate and understand that adaptations allow animals to satisfy life needs and respond to the environment” (Board of Education, Commonwealth of Virginia, 2010, pg. 10). For fourth graders, they have the same subject area but focus on investigating and understanding “basic plant anatomy and life processes” (Board of
Education, Commonwealth of Virginia, 2010, pg. 13). Even though the focus areas are slightly different, it would be easy to combine activities for third and fourth graders.

The SOLs call for a concentration on various ecosystems, natural events, plant identification, motion, and energy. Ecosystems, natural events and plant identification lend themselves to exploration through various hands-on activities that revolve around nature and the outdoors. Motion and energy can be explored through doing activities outside and through body movement. With these focus areas, the Virginia science SOLs are an excellent resource for planning after-school nature and outdoor recreation curriculum. Since they are an excellent resource, they will be used as a basis for the curriculum and activity recommendations made to the Fairfax County free after-school program. Using the SOLs as a curriculum foundation for this program will not only give the program a sense of structure but will also aide in the program’s social equity. It will aide in the program’s social equity because it will give those individuals that cannot afford a fee based program an advantage in school and on the standardized test.

**After-school Programs**

Properly designed after-school programs provide a safe environment for participants and may shape their attitudes, values, skills, and academic performance (Witt, 2001; Malone, 2007). It has been noted that after-school and out-of-school time (OTS) programs are an excellent way to promote physical activity, increase school attendance, and increase motivation to learn (Beets, Beighle, Erwin & Huberty, 2009; Malone, 2007). Researchers have successfully used this genre of programs to help children become fit by using their time after school for physical activity (Gutin, Yin,
Johnson, and Barbeau, 2008). After-school programs are not only used as a way for children to receive their physical activity but also to foster creativity and critical thinking that are not always addressed during school hours (Malone, 2007).

Traditionally, nature and outdoor programs have been limited to summer camps or weekend activities and rarely addressed during regular school hours. Generally, after-school programs have been overlooked as a valid avenue for these activities mostly due to time, safety, and location issues. However, Lewis contends, “after-school settings in recreational contexts are ideal settings to explore the potential for intentional programming designed to increase youth awareness regarding conceptions of the natural world” (Lewis, 2009, p. 45). Youth need to be exposed to nature and the outdoors at other times besides summer months and weekends. After-school recreation curriculums should be tailored to include nature, despite time and location difficulties. It is imperative that after-school programs are used to their full potential and positively benefit their attendees.

As Fredricks, Hackett, and Bregman (2010) found in their qualitative study, children attend after-school programs for different reasons. These authors conducted interviews with fifty-four elementary and middle school children in Connecticut who participated in Boys and Girls Clubs to find out why they chose to participate in the programs and to learn more about their perceptions of the program’s staff, peers, and activities. A limitation of their study was their participants were all from the same community so they may have had the same perceptions. School children in New Mexico might have different perceptions than school children in Connecticut or Washington due
Youth, they found, attend after-school programs because of the activities of outside play, spending time with friends, opportunities for choice, snacks, and a relaxed atmosphere. Knowing why children choose to participate in after-school programs is useful for program designers who are looking to promote outdoor physical activity and nature. For instance, knowing that children participate in after-school programs because they like to play and be outside, designers can infer that if they create outdoor, nature-based activities they will be well received.

Gutin, Yin, Johnson, and Barbeau (2008) conducted a study examining the effects of a three-year after-school physical activity in Georgia. The intervention was designed to make the after-school program a “fitogenic” environment instead of an “obesogenic” environment. This quantitative study involved eighteen schools divided into two groups. One group received the intervention and the other group served as a control. A total of 617 youth participated in the study. The intervention group participated in a two-hour after-school program offered five days a week for three school years. The first forty minutes of the program were devoted to eating a healthy snack and academic enrichment. The last eighty minutes were used for physical activity. During this time the children participated in an array of activities that focused on improving sport skills, aerobic fitness, flexibility, and strength. Forty minutes of this physical activity block involved vigorous activity. Participants were randomly selected each day to wear heart rate monitors to track the intensity of their workouts. Biological measurements were taken in a mobile laboratory. The measurements included their body fat percent, bone density, fat
mass, and fat-free soft tissue. A participant’s aerobic fitness was measured by their heart rate response to a three-minute bench-stepping task. A limitation of this study is that only a minority of all those who were selected for the intervention group met the attendance requirement. As a result of the low number of children that met the attendance requirement not as much data was collected as the researchers had hoped. The researchers found that the intervention group’s fitness increased and their body fat percent decreased. Height also increased in this group. Since the intervention ran only during the school year the participants were not monitored during the summer. They discovered that the fitness the participants gained during the school year was lost over the summer. This study shows that it is important to be physically active year round. The study also reveals, however, that at least being physically active during after school hours can have benefits.

**Outdoor Recreation’s Effect on Physical Activity**

Outdoor recreation can positively affect one’s health and can be used as a way to encourage youth to participate in physical activity. The opportunity to safely play outside is another reason why children attend after-school programs (Fredricks et al., 2010). By recreating outdoors youth would not only reap the health benefits from being active but would also expose participants to fresh air, another positive effect.

Nilsson et al.’s (2009) quantitative study explored the associations among various activities while objectively assessing time in moderate to vigorous physical activity (MVPA) and sedentary behavior. The activities that the researchers focused on were the mode of transportation to school, outdoor play after school, participation in sport and exercise clubs, and television viewing. They assessed 762 nine-year olds and 565 fifteen-
year olds from across Europe. The participants were all part of the European Youth Heart Study (which may be a limitation to this study) and were randomly selected using a two-stage cluster sample procedure. The participants’ physical activity was measured by using the MTI accelerometer that was worn during all waking hours for four consecutive days, including two weekdays and two weekend days. Other data was collected from computer-based questionnaires that the participants filled out.

The researchers found that nine-year olds participated more frequently in outdoor play, active commuting, and exercise in clubs. Since they participated more in the activities, they were more active at the MVPA levels and spent less time being sedentary than the fifteen-year olds. The researchers also found that outdoor play afterschool among nine-year olds was significantly related to a higher mean percent time in MVPA (n= 762; P<0.01). The study yielded several gender differences too. Boys, in both age groups, were more likely to play outside after school. The researchers’ findings suggest that if after-school programs encouraged outdoor recreation, physical activity in the participants would increase. The findings also suggest that girls need to be motivated to play outside, which is something that after-school programs could promote and this would result in young females’ ultimate health.

Cleland et al. (2008) surveyed 548 children from Melbourne, Australia, to see if there were cross-sectional and prospective associations among the amount of time spent outdoors, objectively measured physical activity, and obesity. They took a quantitative approach, by having the parents complete a survey about their children’s physical activity. The children were measured for their height and weight and were fitted with an
accelerometer. The children were to wear the accelerometer for eight days straight. The conclusions in this Australian study were informative.

The research revealed that out of the older elementary school children, those who spent more time outdoors were more active and had a lower chance of being overweight than children who spent less time outdoors. They also found that for each extra hour of time spent outdoors on weekdays and weekends during the colder months, older girls participated an extra 26.5 min/wk of MVPA and older boys an extra 21.0 min/wk. Lastly, Cleland et al. (2008) found that spending more time outside was a predictor for higher levels of MVPA three years later with older boys. From these results one can see that incorporating outdoor recreation into after-school programs would likely increase the participants’ level of physical activity.

A problem with outdoor recreation is having the facilities for it. In a qualitative study conducted by Goldenberg and others (2010) it was discovered that children want to spend more time outside and that they want to have more access to outdoor recreational activities. Focus groups were held with seventy-two Californian youth in San Diego, Modesto, Livermore, and the Los Angeles metropolitan area. In the focus groups the participants were asked various questions about their opinions on the outdoors and what they like and do not like to do outside. Some examples of the questions were what activities do you do in the outdoors, how much time do you spend outdoors, how important is it for you to increase your time spent outdoors, and what keeps you from participating in outdoor activities. In the groups children might have been embarrassed by their real feelings and answered the questions in a way that would appear to be more
acceptable by the group. Despite these limitations, the findings are still valuable. Since children want more access to outdoor activities, after-school programs should find a way to incorporate the outdoors into their programs according to their data. By doing this, the children would attend the programs more frequently and their level of physical activity would increase (Nilsson et al., 2009), which in turn would make them healthier.

**Benefits of Physical Activity**

Promoting outdoor recreation and physical activity in after-school programs, like the Fairfax County free after-school, may be the best route to take in order to help today’s youth become healthy. There has been an extensive amount of research done on the benefits of physical activity. This section will look at two of these studies that were conducted among children. One study sought to find out if early physical activity could predict the change in body fat throughout ones’ childhood. The other study examined predictors of excess weight gain in elementary schoolchildren. Both of the studies found that physical activity is beneficial to children and that those children that were active had lower gains in body fat. These studies suggest that if physical activity was introduced through outdoor recreation activities in after-school programs the participants would be healthier and that this could result in a decrease in our nation’s obesity epidemic. Incorporating outdoor recreation and physical activity would also support the recreation field’s pillar of health and wellness.

Moore, Gao, Bradlee, Cupples, Sundarajan-Ramamurti, Proctor, Hood, Singer, and Eillison (2003) conducted an eight-year, mixed method, longitudinal study that examined the effects of physical activity on the change in body fat from preschool to
early adolescence. Called the Framingham Children’s Study, the study sought to find out if physical activity has any effect on adiposity rebound in their participants. Adiposity rebound refers to how BMI increases in infancy and then decreases reaching the lowest point in childhood, around the age of six, before increasing again and continuing to increase until early adulthood (Williams, Davie, & Lam, 1999). Participants for this study were grandchildren from the original Framingham Heart Study cohort. The National Heart Institute started the Framingham Heart Study in 1948. The Institute recruited 5,209 men and women between the ages of thirty and sixty-two from the town of Framingham, Massachusetts. “The objective of the Framingham Heart Study was to identify the common factors or characteristics that contribute to CVD [cardiovascular disease] by following its development over a long period of time in a large group of participants who had not yet developed overt symptoms of CVD or suffered a heart attack or stroke” (Framingham Heart Study, 2011). The participants from the original study were contacted and asked to give names and contact information of their grandchildren living in the Framingham area. One hundred and six families were initially enrolled. The researchers gathered their data by having the parents and children annually evaluated. During the evaluation the parents filled out detailed psychosocial questionnaires and provided interviews about their personal activities, eating habits, attitudes, and beliefs. They filled out similar information for their children and examiners interviewed the children as well. Parents and children’s height, weight, and skinfold thickness were measured at these yearly exams. In between the visits, the families filled out multiple sets of diet records and wore an accelerometer for three to five consecutive days, twice a year.
Two limitations of this study are that it was only conducted in one part of the country and that they partially used self-reporting to gather information from the participants. Self-reporting can be unreliable at times because participants can remember in correctly or adjust their reports to portray themselves in a positive light. Longitudinal research, however, can be rich in data.

The results showed that the most active children had lower gains in body fat than children in the low or the middle activity groups. Also, by age eleven, the most active children had lower BMIs and much less subcutaneous fat than the children in lower activity categories. From their findings the researchers concluded that physical activity levels play an important role in the development of obesity for boys and girls. They also concluded that beginning physical activity in preschool might delay the onset of rapidly increasing body fat. Because of these findings, successful strategies for the prevention of obesity should be created to increase the total amount of physical activity that children participate in.

O’Loughlin, Gray-Donald, Paradis, and Meshefedjian (2000) examined predictors of large increases in BMIs in preadolescent children. Their quantitative study took place over two years in ethnically diverse, low-income neighborhoods in Montreal, Canada. The participants were fourth and fifth grade students from sixteen different elementary schools who were already participating in an evaluation of a school-based heart healthy program. Data collection occurred during two visits each year. Height and weight were measured during the first visit. On the second visit, the participants filled out an in-class
questionnaire. The questionnaire contained demographic questions and questions about their level of physical activity and diet.

The researchers discovered that the one-year predictor of the highest change in BMI for boys was due to a baseline BMI at the 90th percentile or more. The one-year predictors for girls were a baseline BMI at the 90th percentile or more, no sports outside of school, and the playing of video games every day. Two-year predictors of change in BMI for boys were a baseline BMI at the 90th percentile or more, no sports outside of school, and being least active. The only two-year predictor for girls was a baseline BMI at the 90th percentile or more. From these findings, O’Loughlin and colleagues suggest that interventions to promote increased physical activity are needed (2000). A limitation of this study pertaining to the current project is that it was done in Canada and not in the United States. Even though the cultures of the two countries might be different, children’s physical make-ups are generally the same.

Benefits of Nature Interaction

Thus far, only the benefits of after-school programs, physical activity, and outdoor physical activity have been explored in this paper. This section will examine the benefits that interacting with nature can have on an individual’s mental health and their future actions. Some of the benefits are a decrease in ADHD symptoms, a reduction in stress, memory improvement, fostering creativity, and becoming a good steward of the environment in the future. This section also supports two of the recreation pillars that justify the scope of this project. The two pillars are health and wellness, and conservation. By the free after-school program providing opportunities for their
participants to be outside in nature they are promoting the health and wellness pillar. Additionally, these opportunities in nature as children could lead to environmental stewardship as adults which would promote the conservation pillar of recreation.

**Improved Attention**

More than two million school aged children are affected by ADHD and are often prescribed medicine with various side effects (Centers for Disease Control and Prevention, 2001). Kuo and Taylor (2000) conducted a study to see if nature could be a natural treatment for some ADHD symptoms. The researchers recruited parents and guardians of children diagnosed with ADHD through websites and newspapers to participate in their survey. The survey was available online for forty-seven days and attracted 528 qualified visitors who filled out at least part of the survey. The researchers used 452 of the surveys for their analysis. In the survey, parents/guardians were asked to rate the "aftereffects" of common after-school and weekend activities. For each activity they needed to indicate the physical and social setting and if the activity resulted in the child’s symptoms being “much worse than usual,” “worse than usual,” “better than usual,” or “much better than usual” for the hour after the activity. The researchers compared and grouped all the activities to see if green outdoor settings reduced the child’s ADHD symptoms using a 2 times 2 (physical setting x social context) ANOVA. A green outdoor setting was defined as “mostly natural area- a park, a farm, or just a green backyard or neighborhood space.” The researchers found that green outdoor activities significantly reduced ADHD symptoms. They also found that only green outdoor activities reduced symptoms regardless of social context. A limitation of this
study is that parents’ self-reporting cannot be entirely reliable because they may have some preconceived assumptions or want nature to be a cure for their child. Regardless of this limitation, these are important findings for developing nature and recreation based after-school curriculum. It does not appear to matter if the after-school participant is alone in nature or if they are in a group with other participants, they will still reap the benefits of having their ADHD symptoms reduced.

Nature is not only beneficial to those with ADHD but to all that come in contact with it. Berman, Jonides, and Kaplan (2008) conducted two experiments to show that looking at nature pictures or walking in nature can improve directed-attention abilities. Their experiments validate attention restoration theory (ART). Thirty-eight University of Michigan students’ moods were assessed using the Positive and Negative Affect Schedule (PANAS). Once their moods were assessed respondents performed backwards digit-span tasks. Then the participants were given a directed-forgetting task in order to suppress information in their short-term memory. This task caused further fatigue in the participants. After the directed-forgetting task, participants were randomly assigned to take a walk on the campus’ arboretum or a walk downtown. When the walk concluded the participants returned to the lab and took part in the backwards digit-span task, the PANAS, and answered questions about their walk. The participants completed the procedure for a second time a week later. The researchers found that when participants walked in nature their performance on the backward digit-span significantly improved. This was not the case after walking downtown.
The second experiment that Berman, Jonides, and Kaplan conducted tested ART using the Attention Network Test (ANT). Their experiment used three different attention functions which are alerting, orienting, and executive attention. Twelve University of Michigan students that were not in the first experiment went through the procedure described in the first experiment and then took the ANT. Next, the participants looked at pictures of either Nova Scotia scenery or city settings in Ann Arbor, Detroit and Chicago. When the participants finished viewing the pictures, the entire procedure was repeated. Like in the first experiment, the participants returned a week later to take part in the procedure again. In experiment two, the researchers found that after viewing pictures of nature, improvements were found in the executive attention portions of the test. Orienting and alerting were not improved because they require less cognitive control. The researchers two experiments prove that even simple and brief interactions with nature can positively affect cognitive control. A similar study conducted by Tennessen and Cimprich (1995) examined college students and the nature views from their dormitories. Their study found that just by having a view of nature from a window improved their direct attention abilities. From these findings, one can infer that if youth have access to nature in after-school programs they may perform better during the day in school and while they are at home doing their homework.

**Stress Reduction**

In 2003, Wells and Evans conducted a study to see if residing near nature and vegetation effectively reduced stress in rural children’s lives. Their participants consisted of 337 children in third through fifth grade from small towns in upstate New York. The
researchers surveyed the naturalness of the participants’ homes, their stressful life events, and their psychological distress. Each participant’s mother filled out a number of surveys (one of them was the Rutter Child Behavior Questionnaire) and was interviewed by one of the researchers. The second researcher examined the participants’ house using the Naturalist scale consisting of four items that rated the amount of nature that was in the home environment. It took into account the view of nature from the windows, the number of live plants indoors, and the composition of the outdoor yard. The second researcher also interviewed the children using the Harter Competency Scale and the Lewis Stressful Life Events Scale. Besides self-reporting from both the children and their mothers, the results could also be different for children living in urban settings since this study looked at rural settings.

Wells and Evans data suggests that having a presence of nearby nature buffers the impact of life stress on children. Some examples of life stress in this study are family relocation, being bullied in school, and experiencing peer pressure. The psychological effects of all these stressors varied depending on the amount of nature the participants had access to. Nature and the outdoors need to play a larger role in after-school program curriculum. As core components of this project’s curriculum, nature and the outdoors would benefit both the physical and mental health of participants.

Creativity

Besides having a positive affect on ones’ memory and stress level, nature can also spark creativity in youths and adults (Atchley, Strayer, & Atchley, 2012; Hart, 1979). Atchley, Strayer and Atchley (2012), conducted a study to see nature’s affects on
creativity. Their study consisted of fifty-six men and women who were participating in four to six day wilderness hikes facilitated by Outward Bound. The average age of the participants was twenty-eight. “Outward Bound is the premier provider of experience-based outdoor leadership programs for youth and adults” (Outward Bound, 2012). Twenty-four of the participants completed a ten-item creativity test the morning before their backpacking trip. The remaining thirty-two participants took the creativity test on the morning of the backpacking trip’s fourth day. All participants were prohibited from using electronic technology during the expeditions. The ten-item creativity test was created using the Remote Associates Test (RAT). This test uses insight, problem solving, and convergent creative reasoning to effectively connect the cues provided through a mediated relationship. The RAT is an untimed test where the participants receive ten sets of three words and they need to come up with a fourth word that ties the three words together. For example, if a participant was given the words SAME/TENNIS/HEAD they might pick MATCH as the fourth word (Atchley, Strayer, & Atchley, 2012). This test is the standard measuring tool for creative thinking and problem solving. A between-participant ANOVA was used to analyze the data. Since age has an effect on one’s cognitive abilities, age was run as a covariate. The researchers found that the pre-hike group answered fewer RAT items (M=4.14) than the in-hike group (M=6.08). These results show that after being immersed in nature for four days, performance on creativity and problem solving tasks increase by fifty percent.

Similarly, in a study conduct by Hart (1979), it was discovered that children are more creative when they are outside in natural environments than in urban environments.
This was seen in the creation of shelters and forts made from discarded materials, fallen branches and other loose parts.

Nature also inspires creativity in the form of children’s art and poetry (Crain, 2001). In 1979, Rogers collected poems that British parents had written down from their two to eight year old children. Of the 220 poems collected, eighty-five percent of them pertained to the natural world. A majority of this eighty-five percent focused on observations that the children had made about nature. From these studies, one can conclude that immersion in nature, even for an hour or two after-school, has a positive effect on the increase of children’s creativity levels. If a nature curriculum were to be implemented in an after-school program the participants’ problem solving and creative thinking abilities would greatly benefit.

**Environmental Stewardship**

The previous articles have focused on the immediate effects of nature exposure but studies have shown that by letting children play in nature it can be beneficial for both the child and the future environment. Wells and Lekies (2006) examined the connections between involvement with nature as a child and adult environmentalism. Their study consisted of 2,004 individuals between the ages of eighteen and ninety living in the 112 most populated areas of the United States. The sample was selected through a combination of listed phone numbers and random-digit dialing. The 108 closed answer questions pertained to how often they participated in nature-related activities before the age of eleven, who they spent their time outside with, and how often they participated in “Wild Nature” and “Domestic Nature.” “Wild Nature” refers to hiking, walking or
playing in natural areas, camping, and fishing while “Domestic Nature” refers to picking flowers or vegetables in a garden, planting trees or plants, and taking care of indoor plants. Participants were also asked questions about their present environmental attitudes and behaviors. Examples of questions in this part of the survey were “do you consider trees to be important to your quality of life” and “have you ever voted for or against a candidate for public office based mainly on their views about the environment?”

The data from the phone surveys were analyzed using structural equation modeling (SEM). The results revealed that participation with “Wild Nature” in childhood had a significant, positive association with both adult environmental attitudes and behaviors. Also, individuals who participated in “Wild Nature” before the age of eleven were more likely to express pro-environment attitudes and to indicate that they engaged in pro-environment behaviors. Meanwhile, individuals who participated in “Domestic Nature” were associated with environmental attitudes but were only marginally associated with environmental behaviors. Interaction with nature on any level creates some aspect of environmental stewardship. Therefore, if children are exposed to nature in after-school programs they will not only receive the immediate benefits but will also develop positive attitudes and behaviors that will influence their actions later on in life.

An example of children being exposed to nature and developing positive attitudes towards it can be seen in Five Rivers MetroParks in Dayton, Ohio. MetroParks developed five nature play sites in different parks throughout their district that encompassed an array of characteristics that were intended to give children the opportunity to establish personal connections with nature (Catchpole & Catchpole, 2012). Five Rivers
MetroParks defined nature play “as an unstructured outdoor experience in a natural environment . . . which cumulatively strengthens an individual’s personal connection to nature” (Catchpole & Catchpole, 2012, p. 14). In these five play sites, children are encouraged to stay off of the trail and to play with the dirt, rocks, running water, and fallen trees. In one of the sites, there was a grapevine that hung from a tree on one side of a creek bank and was able to reach the other side, creating a rope swing. The grapevine was an excellent example of nature play and the children greatly enjoyed. Due to safety reasons it was determined that the grapevine would be cut by park staff. The children that frequented the nature play site began to protest. Each day they posted signs telling the rangers to turn their chainsaws around and that they can’t police every hazard in the woods. At this moment, MetroParks realized that their nature play sites were working by helping youth develop a personal connection with nature and a want to protect it.

Catchpole and Catchpole state that giving youth access and an invitation to play in the woods is creating young conservationists and informed, impassioned stewards of the land. It would be beneficial if this access to nature were introduced in after-school programs.

Summary

This literature review has examined the background of the Virginia SOLs, the benefits of after-school programs, physical activity, outdoor recreation, and access to nature. After-school programs appear to be a valid avenue to expose youth to outdoor physical recreation and nature in order to combat the nation’s obesity issue and nature deficit disorder. Since habits that begin early on in life are often carried into one’s adult
life it is important to give youth the proper tools and knowledge they will need to make them viable citizens (LaFontaine, 2008; Wells & Nancy, 2006). Knowing that physical activity and active recreation is linked to a lower BMI and outdoor recreation is linked to more time spent in MVPA, it seems logical that after-school programs would want to find away to incorporate these activities into their curriculums. Furthermore, the added benefit of outdoor recreation is exposure to nature and the natural world, which has ample benefits. The benefits of exposure to nature are the reduction of ADHD symptoms and stress, and the increase in one’s attention, creativity, and problem solving abilities. If exposure to nature were incorporated into after-school curriculums, the participants would experience better concentration at school and a better emotional state. After-school programs could further aid their participants in school by incorporating the science SOLs into their curriculum. The science SOLs could provide a solid foundation for creating nature and outdoor recreation activities.

After conducting the research for this literature review it was decided to narrow the scope of the project in order to produce a higher quality product. While examining ways to promote physical activity to youth is important, this component was removed from the project and the focus shifted to ways to promote nature education and outdoor recreation. This literature review provides support for Fairfax County to implement an after-school curriculum that focuses on promoting nature education and outdoor recreation and incorporates the science SOLs.
METHODOLOGY

Introduction

The purpose of this project is to recommend aspects of curriculum for a Fairfax County free after-school program that would promote an appreciation of nature through outdoor recreation and physical activity. The recommendations will contain activities that support the third and fourth grade science SOLs. These SOLs are (i) scientific investigation, reasoning, and logic, (ii) force, motion, and energy, (iii) matter (third grade only), (iv) life processes, (v) living systems, (vi) interrelationships in earth/space systems, (vii) earth patterns, cycles, and change, and (viii) earth resources (Commonwealth of Virginia Board of Education, 2010). The two objectives for this project are first for the participants to become active in the outdoors to promote physical activity in order to fight our country’s obesity epidemic and second to instill an appreciation of nature within the participants so that as they become adults they realize the importance of taking care of our environment, as well as, protecting it.

RQ1: What science SOL based activities are best in exciting youth about nature education and outdoor recreation in after-school programs?

Subjects

A wide variety of resources were used to create the necessary information to recommend potential curriculums to the Fairfax County Neighborhood and Community
Services’ after-school program. A number of primary sources were examined such as already existing curriculums and programs from other organizations. Interviews were conducted with individuals who are currently working in after-school programs or at nature centers to obtain best practices and possible curriculum outlines. The interviewees were drawn from a convenience sample. The convenience sample consisted of individuals in Washington DC, the Northern Virginia area, and strategic locations throughout the United States. Texts and articles that have been published in Environmental, Recreation, Health, and Education scholarly journals will also be used to provide recommendations.

**Research Design**

This project used a qualitative approach. Qualitative data is best for examining after-school program activities because this project is interested in exploring participants’ thoughts and feelings about their programs (Henderson & Bialeschki, 2010). The answering of ‘yes’ and ‘no’ questions are not beneficial to this study. While using the qualitative approach, after-school programs were asked open-ended questions about the types of activities they incorporate into their outdoor physical activity and nature curriculums. This approach provided the opportunity to examine and interpret, in words, the curriculum and activities that were found in books and scholarly journals. Lastly, the individuals in charge of the after-school program that will implement the project’s recommendations may have an easier time understanding qualitative data than they would quantitative data. When working with curriculums it is helpful to have words that
explain what should be done instead of trying to decipher the meanings of statistics and tables that attempt to explain how to implement a curriculum.

Interviews and emailed questionnaires to individuals who are currently working in after-school programs or at nature centers were conducted to obtain ideas, best practices, and identify possible curriculum outlines. While reviewing the literature, few relevant existing measures and scales were found. This led to the designing of a new survey that was created with assistance from staff at George Mason University’s Data Services center.

Two processes put forth by Creswell (2009) will be used in order to ensure the validity of the study. The validity check that the researcher will use is a peer briefing. To conduct a peer briefing the researcher will enlist the help of a colleague to review the study and ask questions about it in order to make certain that people who are not familiar with the research will be able to understand it. The next validity check the researcher will conduct is a member check. The member check will take place after the themes have been identified and the data has been analyzed. In a follow up interview, the participants will be shown the findings. The purpose of this interview is to give the participants an opportunity to comment on the findings and to make sure that the researcher understood what was said during the initial interview. This will only occur in the interviews and not the emailed questionnaires. Member checks and the peer briefing will aide in validating the project.

The reliability of the findings is always important so two of Creswell’s (2009) steps were followed to make certain that the study’s findings are reliable. The first step
was to go over the interview transcripts to ensure that they were accurate and that what was said was typed. Last, the definition codes were checked to make sure that they did not change throughout the coding of the themes.

**Data Collection**

The data collection took place during the first half of the Spring 2013 semester. Data were collected by exploring scholarly journals, organization websites, personal interviews, and emailed questionnaires among industry individuals. The industry individuals consisted of an activities director, program director, program administrator, regional supervisor, operations manager, education and outreach manager, recreation program manager, and site coordinator. One individual participated from six different programs and organizations. Two individuals participated from the seventh interviewed program. The interview and questionnaire consisted of ten questions. The interviews lasted about thirty to fifty minutes. The ten questions are related to the participant’s demographics, the program’s promotion of nature education and outdoor recreation, their thoughts on incorporating the SOLs in after-school curriculum, how they create and evaluate their activities, and what advice they have for other after-school programs. The interview and questionnaire began with the participants filling out the Participant Consent Form. No ethical issues were anticipated to arise during the data collection process and none did. No harm was done to the participants because they were asked about their opinions and thoughts on their after-school programs. The George Mason Institutional Review Board (IRB) classified this project as exempt from Institutional Review Board review under category two. The stamped copies of the approved consent and recruitment
documents were used in the research. The informed consent form and survey questions can be found in the appendix.

**Data Analyses**

The grounded comparison technique was used to analyze the interviews. Henderson and Bialeschki (2010) describe the grounded theory as having four stages. First, the interview transcripts and questionnaires were open coded and the major concepts were displayed. The concepts then were integrated into themes. Second, the researcher went back and compared the themes to the data. Third, the themes were delimited and refined. Fourth, examples within the data were found to show how the themes were derived. After this process the interpretation of the findings began. From this interpretation, recommendations were made on curriculum activities that will be seen in the last chapter. In addition to Henderson and Bialeschki’s (2010) text the Mason Data Services staff provided assistance during this period.
FINDINGS

Fourteen organization and programs located in the Washington DC metro area and specific places of interest in the continental United States were contacted via email. If there was no response, follow up emails and phone calls were made. In all, seven programs agreed to participate (response rate = 50%). The programs consisted of a nature camp, several after-school programs conducted in schools, a community center run after-school program, camps, and after-school programs that are part of a fee-based membership gym. Due to schedule conflicts with both the researcher and participants two in person interviews were conducted. The remaining five participants filled out the interview questions in the form of a questionnaire and returned the completed forms via email. While the in person interviews provided more, in depth information, the emailed questionnaires proved to be informative as well. Six of the participants were from the Washington DC metro area and one was located in New Jersey.
Table 1: Participant Demographics (number of respondents). One interview contained two participants from the same program.

<table>
<thead>
<tr>
<th>Title (n=8)</th>
<th>Program in Operation (n=6)</th>
<th>No. of Years with Program (n=8)</th>
<th>Number of Participants (n=7)</th>
<th>Program Facility (n=7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manager (3)</td>
<td>&lt;10 years (2)</td>
<td>&lt;10 years (5)</td>
<td>&lt;50 (2)</td>
<td>School (2)</td>
</tr>
<tr>
<td>Director (2)</td>
<td>11-20 years</td>
<td>11-20 years</td>
<td>51-100 (2)</td>
<td>Gym (2)</td>
</tr>
<tr>
<td>Program Administrator</td>
<td>21-30 years</td>
<td>21-30 years (2)</td>
<td>100 +</td>
<td>Community Center</td>
</tr>
<tr>
<td>Regional Supervisor</td>
<td>30-40 years</td>
<td></td>
<td>500 +</td>
<td>Nature Center</td>
</tr>
<tr>
<td>Coordinator</td>
<td>40 + years</td>
<td></td>
<td>13,000 families (&gt;1 child could be participating)</td>
<td>Satellite Facility</td>
</tr>
</tbody>
</table>

Table 2: Program Number and location of participating programs.

<table>
<thead>
<tr>
<th>Program</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HOA Gym</td>
</tr>
<tr>
<td>2</td>
<td>136 sites at elementary schools / 2 at community centers</td>
</tr>
<tr>
<td>3</td>
<td>School</td>
</tr>
<tr>
<td>4</td>
<td>Community Center</td>
</tr>
<tr>
<td>5</td>
<td>Satellite Facility</td>
</tr>
<tr>
<td>6</td>
<td>Nature Centers</td>
</tr>
<tr>
<td>7</td>
<td>Gym</td>
</tr>
</tbody>
</table>
While reading through the transcripts and questionnaire responses, four themes emerged. The four themes are nature and science, outdoor activities, helping participants succeed in school, and activity creation. As with the Fairfax County free after-school program, the surveyed programs had similar concerns and limitations to their nature and outdoor programming because of the lack of transportation and access to natural surroundings. Despite this limitation many of the programs still provide outdoor recreation and nature education to their participants. The following four sections will explain how they go about meeting this challenge.

Nature & Science

For those programs that had access to nature and transportation, such as buses to natural areas, they were able to expose their participants to stream and watershed studies, environment interaction, astronomy, and habitat exploration. Program Number 1 had a large pond on their property. In order to prevent erosion, boulders baring access to the water’s edge surrounded the entire pond. The Activities Director found a way to still incorporate this resource into their afternoon activities. The Director would take pictures of pond’s inhabitants (i.e. ducks and fish) and the participants would identify them.

Program Number 2 did not have access to busing but took excellent advantage of the resources around them and their ability to walk. This program is in walking distance to a small Italian restaurant. The Site Director contacted the restaurant owner and gained permission for the participants to create an herb garden on the restaurant’s property that could be used in restaurant’s kitchen. The participants were responsible to plant, weed, water, and care for the herbs. This exposed the participants to the physical activity of
walking and the science of how to keep a garden while making a connection to the
community and nature. Other programs have also embraced gardening as a way to
connect youth with nature and have created flower gardens on their facility grounds. Not
only does gardening help connect children with nature it is also helping them prepare for
the SOL test. Standard 3.7 is to “investigate and understand the major components of soil
and its importance to plants and animals including humans” (Board of Education,
Commonwealth of Virginia, 2010, pg. 10). One of the key concepts of this subject area
includes learning how soil provides the support and nutrients necessary for plant growth.
Gardening is a perfect way to hands-on way to learn about this key concept.

Programs that are unable to transport their participants to natural areas or do not
have natural space on their facility grounds proved to be creative in finding ways to bring
nature to their participants. Program Number 1 was unable to go out and explore natural
habitats so they made habitats out of kits and then went outside, captured insects, and
placed them into their self-made habitats. While the insects were in the habitats the
participants studied and identified them. This activity incorporates several of the science
SOLs. Two examples of the SOLs in this activity are terrestrial ecosystems (3.6b) and
habitats and niches (4.5d). The terrestrial ecosystems SOL applies because creating a
habitat is a small sector of the larger ecosystem. By doing this activity, the participants
can see how habitats relate to one another and create a larger system. The habitats and
niches SOL applies since the participants are created habitats and learning what is
involved in supporting an insect. Depending on the insect caught, the animal life cycle
SOL (3.8b) may apply as well. This would only apply if the insect happened to go
through a metamorphosis while in captivity or die. The participants should work toward creating viable habitats for their insects to prevent death and so that they learn exactly what insects need to live and thrive.

Another example of bringing the outdoors to non-transportable participants is buying butterflies and ladybugs. After the program bought these insects, they watched them hatch and grow. During the time the insects were in captivity participants studied their life cycles. The insects were later released. Watching and learning about the life cycle of butterflies and ladybugs directly correlates with SOL 3.8b, which is Earth Patterns, Cycles, and Change’s key concept animal life cycles. Butterflies are excellent examples of animals that go through a life cycle because they do it over a short period of time so the participants will be able to watch all of the stages.

Table 3: Tallied responses to the question Does your program offer science and environment activities? Please describe these activities.

<table>
<thead>
<tr>
<th>Responses (number of repeated response)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gardening (2)</td>
</tr>
<tr>
<td>Butterfly gardens</td>
</tr>
<tr>
<td>Watershed studies (2)</td>
</tr>
<tr>
<td>Biomes (2)</td>
</tr>
<tr>
<td>Nature crafts</td>
</tr>
<tr>
<td>Hatching butterflies</td>
</tr>
<tr>
<td>Hatching ladybugs</td>
</tr>
<tr>
<td>Interactive games</td>
</tr>
<tr>
<td>Photography</td>
</tr>
<tr>
<td>Plant identification</td>
</tr>
<tr>
<td>Habitats</td>
</tr>
<tr>
<td>Plastic bottle rockets</td>
</tr>
<tr>
<td>CO2 balloons</td>
</tr>
<tr>
<td>Experimental learning</td>
</tr>
<tr>
<td>Observing and interacting with environment</td>
</tr>
<tr>
<td>Engineering camps</td>
</tr>
<tr>
<td>Collaborate with other organizations that offer these</td>
</tr>
<tr>
<td>STEM activities</td>
</tr>
</tbody>
</table>
Two staffers programs have created ways to integrate nature and science education with physical activity. Program Number 6 created a caterpillar camouflage game:

We play a caterpillar game that helps students see the effect of camouflage on the survivability of caterpillars. The game uses colored tooth picks, 10 of each color strewn about a yard-like area. The students pretend they are birds and search for the caterpillars. The result is that green, yellow, and brown toothpicks are not found while blue, red, and orange ones are.

This game shows how important camouflage is to the survival of caterpillars and other species. The easier it is to blend in with one’s surroundings, the more difficult it is for predators to find them. The animals or insects can camouflage themselves the best, theoretically live longer. The activity encompasses the Life Process key concept on physical adaptations (3.4b), Living Systems key concept of predator and prey (3.5c) and plant and animal adaptations (4.5a). The physical adaptation is the ability to camouflage one’s self. Program Number 1 created a food chain tag game. To play the game you need to divide your participants into two groups.

You say you all are the rabbits [to one group of participants] and you all are the foxes [to the other group of participants]. And then there are rabbits that can hide in a hole. So you can put a spot on the floor that is a hole. And you can say that you need to make it to the rabbit hole before the foxes get you.
If the fox tags a rabbit before they reach the rabbit hole they are out. In a real life situation where they are really foxes and rabbits, if the rabbit did not make it to the hole before they are ‘tagged’ by the fox they would not be out they would be dead. This ties into nature and science education because it teaches about the food chain and how bigger animals eat smaller animals. This also relates to SOL 4.5c which is Living Systems key concept of the flow of energy through food webs. Similar to the camouflage game, this teaches the participants about nature and science in a hands-on, fun way.

Other nature and science activities that appeared in the interviews and transcripts were activities focused on Science, Technology, Engineering, Mathematics (STEM), recycled art projects, plastic bottle rockets, and bottle bio-domes. Also, Program Number 2 has four program curriculum themes and they rotate every year.

One year our focus will be on culture. So we’ll look at cultures from the different perspectives of all the different SOLs. For instance, if you’re doing health and fitness, a center may be looking at South America or Argentina. Well what do they do there for health and fitness? What kind of activities and sports do they do? And then we’d replicate those activities. Literature, what are the popular kids books or authors there? So culture is one year, the arts is another, which is what we are currently on... Another year we have the natural world and then we do science and technology.

This leaves an entire after-school program year dedicated to the natural world and another year entirely devoted to science and technology. All of these yearly themes are taken from the perspective of how can they do each one of these individually while
incorporating the SOLs. Program Number 2 emphasized how they support and align with what the schools are doing but in a fun and hands-on way.

**Outdoor Activities**

All seven of the participating programs offer outdoor time to their participants.

Program Number 2 stated that since they are licensed by the State of Virginia, they are required to provide at least 30 minutes of outdoor time per day, weather permitting.

Program Number 3 stated the same requirement for their New Jersey based program. The Department of Social Services, Commonwealth of Virginia’s Standards for Licensed Child Day Centers (2012) states that toddlers, preschoolers, and school age children in childcare centers, such as after-school programs, must have outdoor activities if the weather and air quality allow for it. The amount of time children must be outside depends on the program’s hour of operations. Children must be outside for “thirty minutes per day or session if the center operates between three and five hours per day per session” (The Department of Social Services, Commonwealth of Virginia, 2012, pg. 44). The licensing requirements don’t explicitly state what activities must be done during this time; just that outdoor time must be provided. The activities that take place during this outdoor time can be found in the table below. It is also important to note that when the participating programs were asked what activities their children like the most, the majority replied with activities that took place outdoors.

Like nature and science activities, there needs to be the distinction between what the programs with transportation or access to the outdoors are able to offer and what the programs without this ability are able to offer. Programs with access to transportation and
the outdoors are able to offer their participants the opportunities to hike, fish, canoe, horseback ride, mountain bike, and partake in ropes courses. Some of the activities listed in the Nature and Science section can also be categorized under this section as well. These activities would include gardening, habitat exploration, and astronomy.

Programs that are unable to transport or have access to natural outdoor settings still offered plenty of outdoor activities. These activities included a variety of noncompetitive team sports (soccer, football, flag football, basketball, lacrosse), skateboarding, tennis, playground activities, free independent play, scavenger hunts, and exercise activities. One program even has access to an outdoor high ropes course that their participants can use. Program Number 5 stated that third to fifth graders favorite activities are sport games played at a less competitive level then they would for a regular sports team. Sports like tennis, soccer, and baseball could tie into the fourth grade SOL area of force, motion, and energy. The fourth grade area of force, motion, and energy has key concepts that focus on the definition of motion (4.2a), how change in motion is related to force and mass (4.2b), and how friction is a force that opposes motion (4.2c). These key concepts can be explored through kicking and hitting balls in a sports’ setting. Despite the research that has been found on the benefits of nature play, none of the participating programs mentioned it in the questionnaires or interviews.
Table 4: Tallied responses to the question Describe the outdoor activities that your program offers.
Responses (number of repeated response)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hikes and scenic walks</td>
<td>4</td>
</tr>
<tr>
<td>Sports</td>
<td>3</td>
</tr>
<tr>
<td>Playground and free play</td>
<td>3</td>
</tr>
<tr>
<td>Gardening</td>
<td>2</td>
</tr>
<tr>
<td>Structured games</td>
<td>2</td>
</tr>
<tr>
<td>Nature education programs</td>
<td>2</td>
</tr>
<tr>
<td>Scavenger hunts</td>
<td>2</td>
</tr>
<tr>
<td>Interactive games</td>
<td></td>
</tr>
<tr>
<td>Exercise activities</td>
<td></td>
</tr>
<tr>
<td>Fishing</td>
<td></td>
</tr>
<tr>
<td>Canoeing</td>
<td></td>
</tr>
<tr>
<td>Clean up projects</td>
<td></td>
</tr>
</tbody>
</table>

Many of the programs mentioned the importance of incorporating physical activity into their outdoor time. Program Number 1 dedicates half of their time to physical activity because

\[\ldots \text{they are cutting back on PE in the schools. Kindergarteners don’t get it at all. They don’t get it at all because they are only half day out here. So they don’t get any exercise all day.}\]

To incorporate physical activity into their outdoor time, Program Number 1 has their participants play a wide range of sports and even has an outdoor and indoor swimming pool. Program Number 3 stated:

\[\text{Our participants generally enjoy the active games and outdoor time the best. We know they enjoy these activities because they are always asking to go to the gym or outside. It is very important for them to get their physical needs met after a long day of school.}\]

It is possible for participants to receive this outdoor physical activity time while still
learning. Some of the activities mentioned in the Nature and Science section involve physical activity and outdoor recreation. These activities would include gardening and the food chain tag game.

**Helping Participants Succeed in School**

In addition to the nature and science activities, some of the programs go further to help their participants succeed in school. Participating programs were asked what their thoughts were on after-school programs incorporating the SOLs (or standardized test material) into their curriculums. Six of the programs responded to the question. Five of these programs felt positive towards incorporating the SOLs into after-school programs and one felt negative towards it. Surprisingly, some of the programs that felt positive towards incorporating the SOLs into their programs don’t specifically design their programs around them or incorporate them at all. Program Number 7 seemed to capture the general consensus when they stated “Great idea – as long as children are still receiving a recreation aspect of the after-school program.” It is important to have a balanced scale and to make sure that the participants are learning but also have plenty of time for play and to be children. Playing would be considered the recreation aspect that Program Number 7 refers to. Program Number 4 felt that they should provide homework help to their participants but that their staff was not trained to work with SOLs.
Table 5: Tallied responses to the question *Can you explain to me an activity from your program that helps your participants do better in school?*

<table>
<thead>
<tr>
<th>Responses (number of repeated response)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework (4)</td>
</tr>
<tr>
<td>Math and Science activities (3)</td>
</tr>
<tr>
<td>Life skills (2)</td>
</tr>
<tr>
<td>Journaling</td>
</tr>
<tr>
<td>SOL activities</td>
</tr>
<tr>
<td>Physical activity</td>
</tr>
</tbody>
</table>

Program Number 2 bases their entire after-school curriculum off of the SOLs. To help the parents to understand what their children will be doing they create ‘highlight sheets’ that are posted on the facilities’ bulletin boards.

*We put a highlight sheet on the board that highlights activities, it doesn’t tell you [what] all the activities are but it is geared toward the SOLs… So it shows what we are doing, what it ties into, what we support… Also it tells them all the integrating of what is already going on in the schools. It makes the connection for them. Otherwise, how would you know what the bottle gardens fall under? It might be obvious that it’s science but maybe they’re doing some writing with it so that would fall into literature and they wouldn’t know if they just read “we’re going to make bottle gardens.”*

They went on to say that “we are finding that what we do helps them [the children] do better in school.” It’s important to note that even though the SOLs are a major part of Program Number 2’s after-school curriculum, they are also very big on their participants picking the direction that they take each day and want to make sure that they are having
run. While they interpret the SOLs for their parents, they “very much hide” their SOLs from the participants.

Program Number 2 was the most vocal about mirroring what the schools were doing in their after-school program but some of the other programs are working to help their participants in other ways. Five of the seven programs offer their participants time to do their homework. Some even assist their participants if they have questions about the homework. One program offers their participants a computer club that has games to help with mathematic skills.

Other ways that the interviewed and surveyed programs help their participants do better in school is by teaching components of overall life skills. One program discussed how they teach the “skills the kids need to get where they need to go.” The program does this by offering opportunities for the participants to think critically. When the participants ask questions the staff members are instructed not to give them the answer but to walk them through the thought process that would help them figure it out for themselves. Another program specifically mentioned that they help their participants improve in school by offering opportunities where “they are required to listen, observe, be patient, team work, etc.” They also provide opportunities for leadership and understanding of different perspectives. These opportunities are provided through their various sports programs and camps and a high ropes course. While these skills do not directly help children pass Virginia’s standardized testing, it can be argued that these particular skills are more important than the ability to pass a standardized academic test.
Missing SOL Areas
While a great amount of data was found on how after-school programs are incorporating the SOLs and helping their participants succeed in school it is important to note that not all science SOLs’ subject areas were found in the activities offered by the participating programs. No activities were found that focused on

- scientific investigation, reasoning, and logic,
- force, motion, and energy for third graders,
- matter,
- earth resources for third graders,
- interrelationships in earth/space systems for fourth grade key concepts focusing on weather, and
- earth patterns, cycles, and change for 3.8 key concepts focusing on season and day cycles, and fourth grade key concepts focusing on the solar system.

It is possible that the programs do include these missing areas and that the interview and questionnaire question of “Does your program offer science and environment activities?” did not invite participants to go in depth about areas related to weather and the solar system. However, there is some evidence to suggest that the framing of the question is not to be entirely at fault for the lack of data on activities for these subject areas. When Program Number 6 was asked what activities they would add to their program if they had unlimited resources they stated that they would add more astronomy activities. This statement suggests that astronomy and perhaps solar system activities are too expensive.
It might also suggest that field trips to a planetarium may be required to fully teach these subject areas. It is also possible that some of these areas are not explored in after-school programs because they may be too difficult to do in a fun and hands-on way. After being in a classroom all day children most likely are not going to want to do their homework and then an activity where they identify independent and dependent variables (4.1f), learn about the historical contributions in understanding electricity (4.3f), the order of the planets in the solar system (4.7b), the purpose and function of simple machines (3.2a), and how to chronologically sequence natural events (3.1d). Regardless of the reason for these deficits, research in the future should focus on discovering ways to teach these subject areas to give the program participants a well-rounded science experience.

Currently, the subject areas that are most thoroughly addressed in program activities are:

- life processes for third and fourth graders,
- living systems for third and fourth graders,
- interrelationships in earth/space systems for third graders,
- earth patterns, cycles, and change key concepts 3.9, and
- earth resources for fourth graders.
Figure 1: Pie Chart showing the percentage of activities and curriculums for the 3rd grade science SOL subject areas.
Activity Creation

The fourth and final theme is dedicated to how these programs create and find the programs that they use in their after-school programs. A popular response to the question “how do you come up with the activities that you do in your programs” was the National Wildlife Federation (NWF). NWF offers workshops and two of them are called Project WET and Project WILD. These workshops come with books that list fun, educational, outdoor activities that different age groups can do. One program states “what was nice about it is that it recommends an activity and for K-1st you want to do this, for 2nd-3rd you want to do this. So it had all the different adaptations of the same activities in there.” It is beneficial to have activities that can be adapted for a range of skill and knowledge levels.
This way a program staffer does not need to create entirely different activities for all the participants’ skill levels. Having one activity that can be geared for the different individual age and skill levels of the participants can save precious staff planning time. Other programs used resources like Science Bob, Oriental Trading Post, Zoom Kids, Links to Learning, and STEM activities for ideas. A majority of these resources are located on the internet. A list of these websites can be found in the appendix.

In addition to using the internet to find curriculums and activities, a popular resource for activity creation was the programs’ own staff. Several of the programs’ staff worked together to create activities or they attended meetings and conferences that revolved around activity creation. Program Number 4 has each staff member research one activity per week and the program keeps notebooks of all of their activities. Program Number 3 stated that their staff consists of trained teachers so they are able to “plan many valuable, enriching activities on their own.” Program Number 7 has a less formal method of activity creation. They stated that they used trial and error in order to create their activities. From this information it appears that activities can be created from both formal and informal channels through measurable objectives with benefits-based outcomes.

<table>
<thead>
<tr>
<th>Table 6: Tallied responses to the question How do you come up with the activities that you do in your program.</th>
<th>Responses (number of repeated response)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff knowledge</td>
<td>7</td>
</tr>
<tr>
<td>Internet</td>
<td>4</td>
</tr>
<tr>
<td>Curriculum packets</td>
<td>3</td>
</tr>
<tr>
<td>SOLs</td>
<td></td>
</tr>
<tr>
<td>Children’s interests</td>
<td></td>
</tr>
<tr>
<td>Trial and error</td>
<td></td>
</tr>
</tbody>
</table>
CONCLUSIONS AND RECOMMENDATIONS

Conclusion
This project has discussed the Virginia science SOLs, and after-school programs and reviewed the importance of physical activity, outdoor recreation, and interacting with nature. It has also discovered science SOL based curriculums and activities that can be accomplished in an after-school setting. The scope of this project is justified by Lewis’ (2009) dissertation and NRPA’s three pillars of recreation. After-school programs creating a solid curriculum incorporating nature education is justified by Lewis when he states that “after-school settings in recreational contexts are ideal settings to explore the potential for intentional programming designed to increase youth awareness regarding conceptions of the natural world” (Lewis, 2009, p. 45). Additional support for the project’s scope comes from the three pillars of recreation that the National Recreation and Park Association has put forth. The three pillars are conservation, health and wellness, and social equity. Conservation is represented in the project by teaching the after-school participants about nature in hopes that they will become stewards of the environment. Health and wellness is supported in the project in the form of outdoor physical activity and recreation. Many studies have shown the benefits of being physically activity and recreating outdoors. Lastly, social equity is addressed in the project by giving the participants of a free after-school program the same opportunities and advantages as those attending fee based after-school programs.
The science SOL based curriculums and activities were uncovered by conducting interviews and collecting questionnaires from seven programs that work with youth outside of school. The interviews and questionnaires asked questions relating to the outdoors, the science and nature activities their program offers, how they feel about incorporating the SOLs into their curriculums, how they create their program activities, and what activities their participants enjoy the most. The grounded theory method steps described by Henderson and Bialeschki (2010) were used to analyze the collected data. During the analysis process four themes emerged. The four themes that emerged are nature and science, outdoor activities, helping participants in school, and activity creation. The Findings chapter of this project contains the descriptions of after-school activities that revolve around nature and science and the outdoors. A majority of these activities directly relate to the science SOLs and participation in the activities could greatly benefit the participants’ mental and physical health. The Findings chapter also discusses how five of the SOL subject areas are well represented in the discovered activities and how there are subject areas that are greatly underrepresented.

From the findings discovered and discussed in the previous chapter, conclusions are drawn and recommendations for after-school curriculums that focus on nature education and outdoor recreation are revealed. The curriculum recommendations are categorized into two sections. The first section provides recommendations for science and nature activities while the second section focuses on outdoor recreation activities. Like the previous chapter, some of these areas overlap. The activities that can be considered both nature and science, and outdoor recreation will be addressed in the outdoor
recreation section. This chapter will conclude with recommendations for action that the Fairfax County free after-school program should take and suggestions for future research that should be conducted in order to assist in creating excellent science SOL based nature education and outdoor recreation curriculums for after-school programs.

Nature and Science Activities

According to Program Number 2, having a curriculum in an after-school program is very important. Without a curriculum or a set plan the program “would just be floating out there.” Some organizations say, “‘We are going to do after-school’ and then they just play games or they are going to do homework.” They provide no learning outcomes based on the objectives of each activity. This particular program can boast the fact that they introduce their participants “to things that they might not have been introduced to before and they have that option of not staying with it but to give them that opportunity and that’s huge.” It is not being recommended that the Fairfax County Free After-School Program becomes an exact replica of Program Number 2; but rather support a plan where the children benefit from measurable objectives. Through a thorough literature review and interviewing after-school programs, several already existing curriculum programs materialized. While these programs have a startup cost, there is evidence that suggests the cost is worth it. Wise Kids Outdoors is a curriculum program that was highlighted in NRPA’s Parks and Recreation magazine (Stolar, 2009). It was also studied in a University of Minnesota’s doctoral dissertation (Lewis, 2009). Wise Kids Outdoors is an after-school and/or summer recreation program that introduces youth to the natural world in three phases (Stolar, 2009). The curriculum was created by the SaJai Foundation in
such a way that each session focuses on a Learn-Do-Explore format. First, children learn about environmental stewardship, nature, and wellness. Next, they do activities related to the three areas. Finally, they go exploring and investigate the nature and environment around them. The Wise Kids Outdoor Program Small Site Kit is $500 but includes everything the after-school program would need. The kit includes 30 mission notebooks (one for each participant), three training guides (for program leaders), one training CD, one marketing CD, access to the online survey tool, thirty backpacks for the children, one leader backpack, thirty magnify glasses, two compasses, two program posters, seeds, and a storage box (SaJai Foundation, 2012). The study conducted in Minnesota identified through evaluation that the children greatly enjoyed this curriculum, made them excited, and they became enthusiastic about the outdoors (Lewis, 2009). Hopefully the participants in the free after-school program will also encounter these feelings toward the outdoors.

Another nature and science curriculum option is Project WET. Two of participating programs stated that they use this curriculum guide. Part of the Project WET Foundation focuses on providing training workshops on diverse water topics such as watersheds, water quality, and water conservation (ProjectWET.org, 2013). Through sixty-four water related activities, their curriculum teaches about water by using hands-on, investigative techniques. The program is written for kindergarten through twelfth graders and adjusts each activity to the participants learning level. Project WET would directly support the SOLs’ Earth Patterns, Cycles and Change for third graders and Earth Resources for fourth graders. All five of third grade’s 3.9 key concept areas are directly
related to water sources, cycles, and conservation and a fourth grade Earth Resources key concepts is watersheds and water resources (4.9a). Additionally, this program’s focus on water conservation ties directly to NRPA’s recreation pillar of conservation.

Project WET’s curriculum and activity guides are included with the cost of attending the training workshop. The training workshops are run by local organizations. According to Suzie Gilley, who is the Wildlife Education Coordinator and Project WILD State Coordinator with the Virginia Department of Game and Inland Fisheries, those wanting to attend either the WET or WILD workshops must register using the WET, WILD, Underground & Learning Tree Workshop Request Form [http://www.surveymonkey.com/s/Projectworkshoprequestform]. Once an individual fills out the form they are placed on a waiting list to be notified when workshops are available within an hour’s drive of their location (S. Gilley, personal communication, May 28, 2013). The surveyed programs mentioned that these workshops are usually held at the World Wildlife Federation headquarters, which is located in Reston, Virginia. It is recommended that one of the staff members from the free after-school program attends and then comes back to train the rest of the staff.

Another well-known nature and science curriculum is called Project WILD. This curriculum is also used by two of the interviewed programs. Project WILD has several different curriculum and activity guides that are backed by established educational practices and theories (Council for Environmental Education, 2013). Their main philosophy is to teach their participants how to think and not what to think (Council for Environmental Education, 2013). There are times in school when children are taught
what to think, and they memorize facts in order to recite them back to the educator. This does not happen with Project WILD. Through interactive activities participants come up with their own conclusions and thoughts on the material instead of being directly told the information. On one of the completed questionnaires a participating program indicated that if they have unlimited resources they would want more life skills programs. Since Project WILD teaches their participants how to think this could be one way to go about achieving this particular life skill. The curriculum is similar to Project WET except it focuses on wildlife and the environment, not just water. By the free after-school program using this program they would aide their participants in passing their science SOLs. This curriculum supports the Living Systems SOL subject area for both third and fourth graders and the Life Processes SOL subject area for third graders. Like Project WET, a staff member for Fairfax County would need to fill out the online questionnaire to take the workshop and receive the course materials.

Since these are recommendations for a free after-school program, it would be understandable if Fairfax County did not wish to purchase turnkey curriculums or pay for educational training workshops. It is also understandable if they wish to do focus groups or gauge the interest of their participants before investing time and energy into a full curriculum. If the County is not ready to implement a full curriculum due to the previously mentioned reasons in addition to the high turnover and the inconsistency of participants’ attendance, there are still beneficial programs for day to day basis that would benefit participants by mirroring the science SOLs that were identified earlier. The World Wildlife Federation has numerous lesson plans posted on their website that cover a
wide range of topics and age groups. The lesson plans can be found at
of the lesson plans tie directly into the third and fourth grade SOLs. As discussed earlier,
the SOLs for this age group include life processes, plant identification, and ecosystems.
The NWF has free lesson plans for teaching about the Butterfly Life Cycle to third and
fourth graders, tree identification to third to sixth graders, and eleven lesson plans on
arctic and watershed ecosystems (National Wildlife Federation, 2013a). Depending on
the lesson plan, they can be done in one to two hours. Each plan lays out the length of
time, supplies needed, and age group.

A hands-on, interactive, and fun way to teach program participants about life
processes can be done by buying butterfly larva and watching them grow. Butterfly
garden kits can be purchased for as little as $19.99 over the internet (Insect Lore, 2013).
The kits include a mesh habitat, five live caterpillars, a feeding pipe, and an instruction
manual. Actually having live caterpillars and watching them go through metamorphosis
would be an exciting way to teach youth about life processes. This could also be used in
conjunction with NWF’s lesson plans on butterfly life cycles.

There is other nature and science activities that can be done that do not involve a
formal curriculum at all. Along with lesson plans, the NWF has an extensive activity
finder on their website. There are ranges of activities featured on this site that include
everything from culinary activities to arts and crafts. An example of an educational nature
and science activity is making a soda bottle terrarium (National Wildlife Federation,
2013b). On this site they also have instructions on how to make a bottle bio-dome, bird
feeders, and birdbaths. A majority of the activities can be done at a low cost. It does not matter about the amount of money that is spent on the activities but rather that the after-school program simply provides some sort of opportunity for their participants to explore nature and science in a fun and hands on way.

Outdoor Recreation Activities
A theme throughout the participant interviews and questionnaires was how the children enjoyed going outside. There are a number of ways that were discovered to incorporate outdoor recreation into after-school programs. For the health reasons
explored earlier in this paper it is important to include outdoor recreation into the after-school curriculums. Outdoor recreation also supports the health and wellness pillar of the recreation field. It is strongly recommended that the Wise Kids Outdoors curriculum is used to establish an outdoor recreation curriculum but if that proves to not be an option there are a plethora of other activities. Since the free after-school program participants are unable to take field trips to nature, the program should bring nature to the participants. Planting a garden, by planting trees, and by creating a nature playscape, can do this. The programs that were interviewed recommend gardening as a way to introduce youth to nature and outdoor recreation. A garden should be established on the community center grounds. The youth participants can create the garden space, plant the seeds, and care for the plants as they grow. This would teach the program participants about interrelationships in earth (key concepts 3.7a-b), plant life cycles (3.8c), life processes (4.4a-d), earth resources (4.9c), nature, and responsibility while incorporating moderate physical activity. It is recommended that flowers be planted that specifically attract butterflies. If these types of flowers were planted it would tie into the nature and science section where the program purchases and grows butterflies. If there are butterfly enticing flowers in the garden the butterflies may stay around the center’s grounds once the after-school program participants release them.

In addition to planting gardens, the program should plant trees. NWF offers tree-planting kits that include seeds, activity guides, a tree planting instruction guide, and recognition patches (National Wildlife Federation, 2013d). This activity would tie together both nature and science with outdoor recreation. The activity guides help to
incorporate learning with playing in the dirt. This would also assist the participants with the SOLs that focus on basic plant anatomy (4.4a). A small group tree planting kit costs $45 but this kit is worth the price (National Wildlife Federation, 2013d). When the after-school program orders the kit, they will receive ten seeds that are specific to their region which will cut down on the time that the after-school program staff will have to dedicate to researching what trees are native to the center’s particular area.

Creating a nature playscape is also an excellent way to help connect children with the outdoors and promote outdoor recreation. The community center can create a nature playscape by placing an assortment of large rocks and trees on a corner of the property. This would give the program participants the opportunity to play with something other than plastic playground equipment.

Another way to encourage outdoor recreation in the free after-school program is through geocaching. Research indicates that incorporating technology into outdoor activities is an effective way to get youth excited and involved (Cordell & Green, 2011; Harmon, 2008). Geocaching is a way to combine both technology and the outdoors by using global positioning system (GPS) units to find treasure (caches) (Harmon, 2008). Harmon (2008) explains that the basic rule of geocaching is to ‘take something, leave something.’ Cachers leave (and take) pins, pictures, and toys. Along with the treasure is a logbook where the cachers can write down and sign in when they found the cache. GPS units can cost roughly $100 but this is the only purchase that needs to be made for this activity (Harmon, 2008). If the $100 price tag for a GPS unit is too costly, there is an application that can be downloaded to smartphones like the iPhone and Android
NWF’s Activity Finder has detailed instructions on how to go geocaching and how to create one’s own geocaches and trails.

If the free after-school program would like a more turnkey geocache trail system, the NWF has a program called Ranger Rick’s Geocache Trail (National Wildlife Federation, 2013c). This program would give the free after-school program the materials, logbooks, treasure maps, and educational guides to create their own geocache trail on the community center’s property. Prices depend on the number of caches that are being purchased and range from $75-$150 (National Wildlife Federation, 2013c). Being part of the Ranger Rick Geocache Trail network would allow for other community members to get involved and use the trail. It would also give them recognition on Ranger Rick’s website. This prepackaged kit would be an excellent avenue to take if the after-school program wishes to have an instant geocache trail. This is a convenient and suitable avenue to take but it is recommended that the after-school program participants create their own caches without purchasing this kit. It would help the program participants become more involved and the caches would be unique and not something that can be found at other community sites. Creating their own geocache trail would still give the community center recognition because the coordinates could be posted on geocaching.com. While geocaching itself is not directly related to the SOLs steps can be made to incorporate them into this activity. For instance, science questions relating to the SOLs can be stored in the caches that they have to answer before finding the next cache.

Besides geocaching there are other outdoor recreation activities that can be done in an after-school program setting. There are an abundance of activities that can be done
outdoors that take less time than geocaching, gardening, and tree planting. Scavenger hunts are popular outdoor activities that emerged from both the interviews with after-school programs and review of literature (Frost, 2010; National Wildlife Federation, 2013b). They are excellent ways to make the participants explore the community center’s property and be exposed to the outdoors. There are also tag games that combine physical activity, outdoor recreation, and knowledge of nature and science. These activities were found from LIVESTRONG.com and Outdoor-Nature-Child.com. A description and rules of the games are included in appendix. These two websites contain references that the after-school program staff can refer to when they are creating their weekly activities. Another activity that combines both outdoor recreation and nature is Bird Themed Yoga Poses (National Wildlife Federation, 2013e). This combines both the knowledge of birds and the discipline and strength to do yoga. A description of this activity can be found in the appendix as well.

**Recommendations for Action**

The previous section has discussed curriculums and activities that the Fairfax County free after-school program should do with their participants. In order for these curriculums and activities to become part of the program it is essential that the program’s staff are made aware of and on board with the County’s desire to incorporate science SOL based nature education and outdoor recreation curriculums and activities into the current program. One or two program staffers should be appointed to lead this charge and to make sure that nature education and outdoor recreation activities are included in the weekly activities. Ideally, these leads would be fulltime staff members so that turn over is
not as likely as it may be with part-time staff members. The more stable the staff leads are the better follow through there will be with incorporating these activities into the after-school program. As the staff leads they should register and attend the Project WET and WILD workshops. These workshops will give them the resources they need to successfully move this initiative forward. After attending the Project WET and WILD workshops it would be beneficial for the staff leads to take an outdoor or wilderness safety course. Such a course would provide vital information that the program will need in order to keep the staff and the program participants safe while outdoors. The staff leads should also familiarize themselves with the list of websites provided in the appendix. This list contains links to a majority of the activities mentioned in the conclusion section. Two lesson plans that directly support the third and fourth grade science SOLs are also included in the appendix. These teaching materials would be an excellent starting point for the program to begin incorporating the SOLs into their activities.

A staff meeting should be held to minimize any pushback from the staff about incorporating the SOLs into the curriculum. The meeting should explain the new outdoor and nature curriculum initiative and explain the importance of the SOLs to the program. Incorporating the SOLs into the program does not only assist participants with their school tests. It also opens the door to more state funding and strengthens the relationship between the program, schools, and parents. If the area schools know that the free after-school program incorporates the SOLs into their activities they will be more likely to market and recommend the program to their students and parents. Also, parents will be
more likely to send their children to the program if they know that there is educational value in the activities that are being done.

In addition to the leads attending the workshops and familiarizing themselves with the material in the appendix of this paper, the leads should arrange for the necessary materials to be ordered. Necessary materials include the curriculum, a GPS unit (or downloading the mobile application to supported devices), butterfly larva, tree planting kit, flower seeds, and gardening tools. Having these materials already on hand will excite the program participants and give the staff the encouragement they need to follow through with creating nature education and outdoor recreation activities.

Along with the program staff becoming involved so too should the community centers as a whole. The Fairfax County Neighborhood and Community Services supervisors should examine what facilities they hold their free after-school programs in. Location and accessibility for participants should be taken into consideration when assigning programs to facilities but also the facility should be able to provide the necessary resources for the program. The free after-school program that will be charged with incorporating this new curriculum and activities should be placed in a facility that has outdoor space available and in walking distance to a park or natural area. Having outdoor space available to program participants will provide the opportunity for gardening, geocaching, nature play, and attention renewal. The community centers should also be willing to let the program participants dig up some of their land to create gardens. By taking these outlined steps the free after-school program will build a solid foundation and a suitable environment for these curriculums and activities.
Future Research

The research conducted in this project discovered science SOL based nature education and outdoor recreation activities and curriculum that can take place at a free after-school. These activities and curriculum have the potential to positively impact youth who cannot afford to pay for a fee based after-school program. By participating in fun, hands-on science SOL activities the youth will have a better chance of digesting the material and this may result in them doing better on Virginia standardized tests. Also, having a safe, clean, and outdoor environment will help to decrease the youth’s stress levels and improve their attention abilities. This outdoor environment may also encourage the youth to become physically active, which will reduce their risk of becoming obese.

While the scope of the study is large, the scope is justified by NRPA’s three pillars of recreation, which are conservation, health and wellness, and social equity. While many activities were found that supported the science SOL key concepts there were some concepts that were under represented. Further research should be conducted in order to find activities conducive to after-school programs that pertain to astronomy, the solar system, weather, and the effects of human activity on the environment. In the future it would also be beneficial to have a longitudinal study conducted to see if the recommendations made in this project where implemented and resulted in positive effects on the program participants’ school grades and overall health. Additionally, a quantitative study should be conducted to see if the free after-school programs’ participants are enjoying the new activities. This study could create a survey using Likert scale style questions and be administered to the program participants with the approval of their parents. The project discussed in this paper has added to the recreation field’s knowledge.
base of after-school programs and their activities and curriculums. It would be beneficial for this field if further research on this topic were conducted.
APPENDIX A

INFORMED CONSENT FORM

RESEARCH PROCEDURES

This research is being conducted to examine how nature and outdoor recreation are promoted in after-school programs. If you agree to participate, you will be asked to answer sixteen questions about your program. The interview will take no more than thirty minutes. The completed survey will be kept secure in a locked drawer in the researcher’s office. The researcher and her advisor will be the only ones that have access to the surveys. The surveys will be destroyed after the thesis projected has been completed.

RISKS
There are no foreseeable risks for participating in this research.

BENEFITS
There are no benefits to you as a participant other than to further research in how to promote nature and outdoor recreation to children.

PARTICIPATION
Your participation is voluntary, and you may withdraw from the study at any time and for any reason. If you decide not to participate or if you withdraw from the study, there is no penalty or loss of benefits to which you are otherwise entitled. There are no costs to you or any other party.

CONTACT
This research is being conducted by Cheryl Behrens with the Sports and Recreation Studies Master’s Program in the School of Recreation, Health, and Tourism at George Mason University. She may be reached at (908) 797-1522 for questions or to report a research-related problem. You can also contact her committee chair, Dr. Brenda Wiggins at (703) 993-2068. You may contact the George Mason University Office of Research Subject Protections at (703) 993-4121 if you have questions or comments regarding your rights as a participant in the research.

This research has been reviewed according to George Mason University procedures governing your participation in this research.

CONSENT
I have read this form and agree to participate in this study.

________________________  _____________________
Name      Date
APPENDIX B

Directions: Please type in your answers to the questions below.

Demographics:
What is your title?
How long has your afterschool program been operating?
How many years have you been with this program?

Program Information:
- What is the age range?
- How many participants do you have?
- Is the program held in a school or in a separate facility?
- What kind of format or schedule does the program follow?

Outdoor Recreation:
Are the children in your program able to go outside? If so, what type of outdoor activities do you offer?

Nature and Natural Environment:
Does your program offer science and environment activities? If yes, please describe these activities.

SOLs:
Now I’d like to ask some questions about Virginia’s Standards of Learning. What are your thoughts on after-school programs incorporating the SOLs into the curriculum?
Can you explain to me an activity from your program that helps your participants do better in school?

Next, can you describe the activities that your participants enjoy the most and explain how you know that they enjoy these activities.

How do you come up with the activities that you do in your programs?

Explain the types of challenges that the program faces and what your suggestions are on how to minimize these challenges.

If you had unlimited resources, what types of activities or topic areas would you add to your program?

What advice do you have for starting a new after-school program?

Thank you very much for your time. Please return this form to Cheryl.Behrens@gmail.com
Summary
Students create an arctic food web to understand the feeding connections and social relationships between tundra plants and animals.

Grade Level: 3-4; K-2; 5-8

Time: one to three class periods.

Subjects: science, creative arts, physical education

Skills: analysis, comparison, construction, critical thinking

Learning Objectives:
Students will be able to:
✓ Explain the relationships between several arctic plants and animals.
✓ Identify a number of arctic plants and animals and their role in arctic food chains.

Materials:
✓ One rag, bandana or cloth for each student, using three different colors for the class.
✓ Arctic Species cards (included)

Background
The arctic is home to plants and animals adapted to take advantage of its unique climate. On the following pages are examples of plants (producers), herbivores (primary consumers, plant-eaters), omnivores (eat both plant and animal matter), and carnivores (primarily meat-eaters). Your students will use these relationships to create their own food chains and food webs in this activity. Your class can learn more about the plants and animals of the arctic ecosystem by reading Arctic Summer by Downs Matthew (1993; New York: Simon & Schuster).

Sample food chains:

1. With your class, review or introduce the terms producer, herbivore, omnivore and carnivore. Explain that they will begin by examining some arctic food chains to learn about the feeding connections of tundra species, and will ultimately construct an arctic food web. Ask your students, What is the main source of energy for all living things? (the sun) How does the energy get from one organism to another? (through food chains) Discuss the role of decomposers in recycling nutrients.

2. To practice making food chains, organize your students into small groups. To practice, distribute the Arctic Species cards for them to line up
in logical feeding order, making one or more food chains. Ask students to look at each other’s food chains and identify any problems. How does each food chain start? Where does it end? How does it recycle? Help students identify links in the chain they may have forgotten, such as starting with the sun or including decomposers, etc.

3. Collect the square cards then re-distribute an assortment of them to the class, one for each student. Distribute only one card, then attach it to the front of their shirt using masking tape. To illustrate the concept of the food web, move the students to an open area. Have students circulate around the area and join hands with other students forming natural arctic food chains. Students should join fingers when it is necessary to accommodate more than one other student onto that end of their chain. In the case of an herbivore, for example, one hand should be dedicated to producers, and the other hand dedicated to omnivores.

4. Once they have completed their food web, have them stop and look around. They will likely be well interconnected. Ask, How are you all connected? Why is it important that there are so many links? How would removing one species from the web impact other species? What would happen if we removed caribou from the web? Before letting go of one another, choose only one individual, such as a caribou or a mosquito, and explain to the students that there has been an environmental disaster, causing the extinction of the caribou. With all other students remaining in place, remove the caribou from the group. Next, ask any students who were connected to the caribou and relying on it for food, to leave the group. Explain that if the caribou (for example) are no longer eating the lichen, lichen populations could grow out of control. When this happens, habitat occupied by other plant species may be overtaken. To demonstrate, remove a “moss” or “grass” from the web. Any student who is relying on moss for its food source should then leave the group. Continue in this fashion for as long as is reasonable, then have the students evaluate the web that remains. This exercise should serve to illustrate the complexities of the relationships between organisms in any ecosystem.

www.nwf.org
**Modifications for Younger Students (K-2)**

Have students pick Arctic Species cards from a bag or box and color them in. Then select student volunteers to hold up their card. Ask them, *What does this animal eat? What eats it?* Assist students to identify another student with a card that is predator or prey of their animal. Have them stand next to this new animal. After several rounds of moving students around to stand next to predators and prey, point out to students that all these animals and plants are interconnected. *What does that mean? What would happen if one disappeared?*

**Modifications for Older Students (5-8)**

☑ Have students work in small groups to make their own Arctic species cards and food webs based on the plants and animals provided, or they can research several

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**Extensions**

☑ Research real-life situations in which a pollutant moved through a food chain or web. Discuss with the students the fact that pollutants are sometimes initially taken in by one organism, but may have serious consequences to an organism further along the chain. Examples would be the use of the pesticide DDT, or fallout from the Chernobyl nuclear power plant accident. *How did this pollutant affect the food web?*

☑ Which Arctic species can also be found in your region? Have students research and report their findings to the class, including the food webs to which they belong.

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**Assessment**

☑ Have students research the predator/prey interactions of their chosen Arctic species (from Activity 2) and create a food web highlighting that species. Alternatively, have students create a food web for local species or a species found on their schoolyard. Students can then create a predator-prey mini-drama, and present their creation to the class.
Worksheet 5

Arctic Species Cards

Plankton

Tundra Swan

Arctic poppy

Blueberry Bush

Purple Saxifrage

Lichen
Snow Goose

Grizzly Bear

Snowshoe Hare

Ptarmigan

King Crab

Salmon
APPENDIX D

BUTTERFLY LIFE CYCLE

Summary
Students identify life cycle stages of butterflies. Other students learn about the life cycle of the Karner blue butterfly. This activity is designed to help students understand the life cycle of butterflies.

Grade Levels: K-2, 3-4
Time: 45 minutes - 1 hour
Subjects: biology, science, art
Skills: construction, synthesis

Learning Objectives:
Students will be able to:
- Identify the stages in a butterfly life cycle.
- Discuss some of the habitat requirements of butterflies in their area and look for ways to provide them.
- Name several factors that make the Karner blue butterfly susceptible to endangerment at each stage in its life cycle (Grades 3-4).

Materials:
- Construction paper
- Scissors
- Glue or tape
- Pencils and paper
- Markers or pipe cleaners
- Copies of the Butterfly Life Cycle activity sheet
- Copies of the Butterfly Threats activity sheet (Grades 3-4)
- Nature journals (optional)

Background
The life cycle of the Karner blue butterfly is similar to that of many other butterflies, and can be used as an example of butterfly life history and the kinds of habitat threats butterflies face. Karner blue caterpillars feed only on wild lupine (Lupinus perennis) plant leaves. Wild lupine grows within the oak savanna and pine barrens ecosystems that range from Maine to Florida and west to Minnesota, but Karner blues live only on the lupine of New Hampshire, New York, Michigan, Wisconsin, Indiana, Ohio, Minnesota, and possibly Illinois and Ontario.

Two generations of Karner blue butterflies are born every year. In mid-April, the first set of caterpillars hatch from eggs that were laid the previous summer. In mid-May the caterpillars pupate and form chrysalises, and adult butterflies emerge approximately two weeks later in late May or early June. Unlike caterpillars, adult butterflies feed on a variety of flowering plants that produce nectar such as dewberry, goldfinch, New Jersey tea as well as wild lupine and many others.

In June, the newly emerged butterflies mate and the females lay their eggs on or around wild lupine plants. The female adult butterflies from this first generation die after laying their eggs and the males die soon after that. The eggs take a week to hatch, and the emergent caterpillars feed for three weeks exclusively on the lupine before pupating and emerging as butterflies in July.

Members of the second generation of Karner blues mate soon after emerging in July, and the females lay the eggs that will hatch the following April. The females from the second generation lay their eggs on plant stems, on the grass at the base of the lupine, or on the lupine pads or stems.

The second-generation female Karner blues die after depositing their eggs, and the males from this generation die by the end of August or early September. These eggs are left on and around the wild lupine for the winter. If the eggs survive the winter, they will hatch the following spring and become the first generation of the next year's Karner blues.
Like many other butterflies, the Karner blue butterfly faces many human-caused and natural threats during its different life cycle stages, including the following:

**Fire suppression.** A history of stopping or preventing naturally occurring fires has led to woodland and forest succession, which closes the forest canopy and blocks out light that lupine and other sun-loving plants need to survive. This has caused a loss of suitable Karner blue butterfly habitat and a decrease in populations of wild lupine, which depend on fire to eliminate tree cover and open up the canopy in order to obtain the sunlight they need for growth. This human action has the greatest impact on caterpillars because they are solely dependent on lupine for food, but it also reduces populations of nectar plants used by adults. Fire suppression does not affect all butterflies.

**Urban/suburban development.** The continual sprawl of construction for housing and shopping centers has wiped out much of the butterfly's habitat throughout its range.

**Lack of snow and snowpack during winter.** Eggs are laid in the fall and may have to survive harsh winter temperatures before hatching in the spring. Winter snows protect eggs from dehydration and provide insulation from freezing temperatures through the coldest part of the year. If the weather during the winter is mild or dry and there is not enough snow or if the snowpack melts too quickly, the Karner blue eggs may not be sufficiently insulated to survive until spring.

**Mowing.** Natural meadows are a crucial part of Karner blue habitat, providing food, water, cover, and places to lay eggs. Mowing for lawns decreases both lupine and nectar plants, food for larvae and adults, causing the greatest threat when the eggs are overwintering, the caterpillars are feeding, and the chrysalides have formed. Seasonally mown natural meadows, however, can emulate the effects of fire and are used as a management strategy for Karner blues.

**Procedure**

1. Ask your class what they know about butterflies. Do they know the link between caterpillars and butterflies? (There are lots of cute stories and puppets on this theme! Hold up a picture of a caterpillar, and then a butterfly. Ask, Do you know how these two animals are alike? Tell students that they are actually the same animal, even though they look very different. This animal changes (metamorphoses) over its life cycle. Ask, What does that mean?)

2. Review each stage of a butterfly’s life: egg, caterpillar, chrysalis, butterfly. What is the animal’s main activity in each stage? (Egg: growing and developing. Caterpillar: eating, chrysalis: changing form. Butterfly: eating and reproducing.) Show pictures of each stage or have students follow along using the Butterfly Life Cycle activity sheet.

3. Tell students they are going to make their own butterflies. To make the butterfly wings, have students cut four wing shapes out of construction paper. If desired, provide wing stencils made from cardboard for students to use. With older students, you can discuss that the wings are symmetrical. (Ask, What does that mean?)

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**Preparation**

Gather a list and pictures of local butterflies and the plants they need to eat and rest on, or have your students do this. For help, try www.etsu.edu, where you can search by area for local species, and the Northern Prairie Wildlife Research Center’s Butterflies of North America site www.npwrc.usgs.gov/resource/distr/lepid/bflyusa/bflyusa.htm where you can also search by state.
4. It is time to assemble butterflies! Give each student a pipe cleaner or piece of construction paper to use as the butterfly's body. With their four wings, have students glue on tape two wings to each side of the body. If desired, have students decorate their butterflies like one of the local species, such as a monarch or zebra swallowtail. Provide pictures as examples. Have students label their butterflies' species on the back. If they wish, students can create antennae for their butterflies out of pipe cleaners.

5. Ask students, What do butterflies need to survive? Have you seen any butterflies in your schoolyard or in your own backyard? Show students several pictures of the local butterflies and the plants these butterflies need to survive. Do we have these in our schoolyard? Let's go find out!

6. For Grades 3-4: Take students outside for a butterfly plant hunt. As a group, search for the plants you identified. Alternatively, divide students into groups and have each group look for one specific plant. Depending on the time of year, students can also look for butterflies and draw what they see in a nature journal or on a sheet of paper.

For Grades K-2: Have students look for butterflies on the school grounds and draw what they see on a piece of paper or in a nature journal. An alternative is to cut out squares of construction paper of different colors. Hand out one or more (depending on the level of the students) squares of several different colors to each student. Take students out to the schoolyard or other outdoor area and have them look for butterflies or flowers that have their color in it. If possible, have them look for butterflies or flowers that have more than one of their colors. Ask students to observe these animals/plants carefully and draw them when they return to class.

7. When you return to the classroom, examine your results. Make a list (or simple sketches) of the plants and/or butterflies you found. Could you add any plants to make the schoolyard a better place for butterflies? Consider planting or starting a butterfly garden as part of a Schoolyard Habitats® site. Visit www.nwtf.org/schoolyardhabitats for more information on Schoolyard Habitats.

Modifications for Older Students (Grades 3-4)

1. Explain that the students will be learning about the Karner blue butterfly, an endangered species of butterfly in the northeastern United States. They should brainstorm problems the butterfly might face at each stage of its life cycle. What might a caterpillar need for food and cover that is different from what an adult butterfly might need?

2. Give each student a copy of the Butterfly Threats activity sheet. Have them cut out each of the Threat and Life Cycle Stage cards.

3. Students should pair each stage of the butterfly life cycle with a logical threat at that stage. Note that students will come up with multiple pairings. Sample pairs include: fire suppression; caterpillars or butterfly; development; all four stages; snow; eggs, wintering; all four stages. Discuss with the class how and why they decided to pair each life cycle stage and threat. If needed, students can play a second round to try other pairings.

Extensions

✓ For Grades K-2: Musical butterflies. Write the words: egg, caterpillar, chrysalis, butterfly on plain paper (eight times each, for a total of 32 pieces of paper). You can do this activity with any group size; just change the numbers, making sure you have an even number of each life cycle stage. Shuffle the pages randomly and place them in a circle in a large open area, either on the ground or on chairs.
Have students pick a place to sit/stand and then begin to play music as the students move around the circle. When the music stops, all students should stop where they are and pick up the nearest piece of paper. Which life cycle stage are they? Ask all students to strike a pose as if they were a butterfly in that stage (e.g., eggs get into a ball on the ground, etc.). Then, tell them to move about and act their life stage for a few moments. What does a chrysalis do? What does a caterpillar do? Now turn on the music and repeat a couple times, allowing students to try the different stages.

✔ If you have found good pictures of local butterflies and their host plants, make them into cards and tape them to a board or easel paper. Have students play a matching/memory game to match up the butterflies with their respective host plants!

**Assessment**

✔ Have students design a poster depicting the different stages of a butterfly life cycle. Older students can indicate on the poster what kinds of conservation threats butterflies face at each stage.
WORKSHEET
BUTTERFLY LIFE CYCLE

1. EGG
2. CATERPILLAR
3. CHRYSLIS
4. BUTTERFLY
### BUTTERFLY THREATS

**Directions:** Cut out the cards below. Match each threat with a life cycle stage. Some stages may match with more than one threat.

<table>
<thead>
<tr>
<th>Stage One: Egg</th>
<th>Threat: Fire Suppression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity: growing and developing</td>
<td>Loss of habitat and decrease in populations of wild lupine due to stopping or preventing naturally occurring fires. These fires prevent the closing of the forest canopy which blocks out the sun that lupine and other sun-loving plants need to survive.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Threat: Urban/Suburban Development</th>
<th>Stage Three: Chrysalis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butterfly habitat loss due to the sprawl of construction of shopping malls and housing for people.</td>
<td>Activity: changing form</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Threat: Lack of snow/snowpack during winter</th>
<th>Stage Four: Butterfly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snow acts as an insulator for one stage of the butterfly life cycle. Without enough snow, will not be insulated enough to survive freezing temperatures.</td>
<td>Activity: eating and reproducing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage Two: Caterpillar</th>
<th>Threat: Mowing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity: eating</td>
<td>Natural meadows provide food, water, cover, and places to raise young. Mowing decreases lupine and nectar plants.</td>
</tr>
</tbody>
</table>
Summary

Students study the role of butterflies in pollination.

Grade Levels: 3-8

Time: several class periods spread out over several weeks.

Subjects: science

Skills: observation, prediction, description, research

Learning Objectives:
Students will be able to:
✓ Describe the process of pollination.
✓ Identify butterfly roles in pollination.
✓ Name several different kinds of butterflies.

Materials:
✓ Notebooks
✓ Pencils
✓ Cut flowers
✓ Photos of flowers and butterflies
✓ Magnifying glasses

Background

Animals play a key role in the reproduction of many flowering plants. Bees, butterflies, hummingbirds, bats, wasps, moths, beetles and others visit flowers in search of food. In the process, animals pollinate the flowers, bringing reproductive cells (pollen) from one plant to another. When animals visit multiple plants of the same species, they transfer pollen from plant to plant. This movement of pollen is called pollination. Pollination leads to fertilization, the development of new seeds, and, in some plants, fruit. The young seeds (either contained in fruit or not) may be carried by wind, water, or animals to a new location where, if all goes well, they will grow into new plants and start this process all over again.

How does the process of pollination work? Flowers contain a plant's reproductive parts, including the male stamen and the female pistil (see diagram, pg. 12). The structure of the flower forces the male anther, holding pollen grains, to brush up against the pollinating species while it is looking for its food, the nectar. The female pistil includes the ovary, which contains eggs or ova, style, and stigma; the stigma is sticky and collects pollen from the bodies of animal visitors. When pollen grains fertilize an ovum, a new seed begins to develop.

Since plants are rooted in one place, they need help transferring pollen to other flowers of the same species. Some flowers rely on wind to carry pollen grains, while others use water. As you might imagine, lots of pollen carried by wind or water never actually reaches flowers of the same species. Animal pollinators, however, give plants an advantage, since they deliver pollen directly to the flower. While collecting nectar from the base of a flower, butterflies brush against pollen from the flower's anther. The butterfly ends up carrying a load of pollen on its body. At the next flower the butterfly visits, some of that pollen reaches the female reproductive parts while the butterfly feeds. This direct contact is what makes butterflies and other nectar-feeding animals great pollinators. The pollination relationship is mutually beneficial to flower and animal—one gets food while the other receives help with reproduction.

Over time, flowers have developed adaptations to ensure that the most suitable pollinator for their species will visit and return often to feed. In fact, flowers' fragrances, bright colors, nourishing nectar and pollen and varied shapes are considered adaptations to attract certain pollinators. For example, the bright colors of flower petals are thought to help flowers stand out against a green background. The shape of
the flower also plays a role in determining the kind of pollinator that can feed from the flower. Butterflies must have a perch to land on while feeding, while hummingbirds can hover near flowers while feeding. Pollinators are also well adapted to ensure that they will have access to flower nectar.

Animal adaptations associated with pollination include sense of smell, color preferences, beak shape (in birds), and tongue length. A butterfly's "tongue," or proboscis, is very effective at reaching nectar at the base of flowers because it is long (compared to the butterfly's body) and also very flexible. When not in use, the butterfly proboscis is coiled up. When the butterfly needs to feed on nectar, it will uncoil its proboscis to sip the nectar at the base of the flower.

Pollinators play a critical role in both agricultural and natural systems. Many of the plants that produce the food we eat depend on pollinators — from apples to watermelon. In fact, scientists estimate that every third bite of food humans eat is made possible by the act of pollination. Pollinators are also key to maintaining ecosystem health and biodiversity. Healthy pollinator populations ensure that many plants that help clean our air and water and serve as food and cover for wildlife can reproduce, which in turn sustain our ecosystem functions and a diversity of life.

This activity will allow students to engage in their own student-directed investigation of the relationship between butterflies and their nectar plants.

**Procedure**

1. Ask students what they know about butterflies and pollination. *How do butterflies help to pollinate flowering plants? What does this mean?*

2. Provide students with several photographs/drawings of butterflies and flowers, including real cut flowers if you have them available. Divide your class into smaller groups and give each group the same materials. Give students time to explore their materials and to jot down questions they have about butterflies and pollination. Ask them to think about how the flowers are shaped, and then guess what kind of body shape, tongue, etc. would be best for pollinating a particular flower structure.

3. Next, take students outside to observe butterfly/plant interactions in your schoolyard or near-by outside area. Students should bring their notebooks outside with them. Have each student spend about 10 minutes quietly observing on their own and writing questions about their observations. They should write down additional questions that occur to them as they observe. If they don’t see any butterflies, have them list possible reasons why.

4. Have students get together in their groups and spend another few minutes observing and writing down questions together.

**Butterfly Observation Tips:**

1. Wear comfortable clothing without bright colors, since these may startle butterflies. Greys and browns are good colors to wear while butterfly watching.

2. Most butterflies spend the majority of their time in the sun. Butterfly watching is likely to be most rewarding during midday on a sunny, warm day without much wind.

3. Look for butterflies on or near nectar-producing flowers.

4. Take binoculars and butterfly field guides with you to help you identify the different species of butterflies you encounter.
5. When you return to the classroom, have students write their questions on large strips of paper and give them to you. Look at the questions and sort them by category, determined by the questions themselves, and then post around the room in the categories you have determined. This will give you a chance to eliminate questions that are either inappropriate, irrelevant, or will be impossible to actually investigate given the time and materials and level of students you have available. While you are doing this, students can either take a break, draw illustrations of the butterflies they saw, or focus on something else.

6. Ask students to spend a few minutes wandering through the room, looking at the questions, and picking one they are most interested in studying. Have students form small groups based on which questions they pick.

7. In their groups, ask students to develop an investigation plan for how they will answer their question of choice. What materials do they need? How much time do they need? What are the steps in their investigation? Have them lay out their investigation plans in as much detail as possible. Check in with each group to provide them with assistance or make lists of materials they will need.

8. If you have time, have students carry out their investigations over the time needed to complete them. Assist them as necessary, when they appear stuck, but encourage them to explore as much as possible. Allow students to conduct their investigations into butterfly/plant interactions.

9. Have student groups give presentations on their conclusions, sharing the information they collected through their investigations.

Note: Read the options below for alternative activities.

Option 1: If your time is limited or you are working with younger students and you want to conduct a more structured observation activity, provide students with the Pollination Partners activity sheet, and have them make observations over several class periods.

Option 2: For classes with limited outdoor access, complete Steps 1 and 2 above. After the overview of pollination, have students research locally occurring butterflies (try www.crescent.com) and the host and nectar plants the butterflies would need. Have students draw the host and nectar plants along with the butterflies and create a butterfly habitat mural on a piece of butcher paper or a bulletin board. Plants and butterflies can also be created out of art materials such as tissue paper, cotton balls, and fabric scraps. Older students can write a schoolyard butterfly habitat proposal that outlines where on the school grounds a site could go, what native plants they are interested in planting, and what butterfly species the site would attract. The proposal could also include how classes could use the site, what benefits it would provide the school and community, and fundraising ideas. For additional information on creating a Schoolyard Habitats site, visit www.nwf.org/schoolyardhabitats.

Extensions

✓ Have students think about where their investigations led them, and what kind of follow-up they would like to do. Have them design these follow-up investigations and conduct them if time allows.

✓ Explain to students that some butterflies are endangered because the plants they depend on as hosts for the caterpillars are being decimated due to habitat destruction. Have students conduct research to find out if there are any endangered butterflies in your area, and explore the factors leading to their endangerment.
Have students research the characteristics of flowers that attract butterflies (e.g., How have flowers adapted to make butterfly pollinations possible? How are these flowers different from those pollinated by bats, hummingbirds, bees, etc.?) Can you tell by looking at a flower how it is pollinated?) Then, in small groups have students design an “ideal” flower for a butterfly on large poster-size paper, pointing out those qualities that are especially suited for butterflies. (You may choose to have some students research and design flowers pollinated by other animals, so that students can see the different adaptations.)

**Assessment**

Student presentations can serve as excellent assessments of their work. Develop an evaluation rubric with students prior to their presentations, determining what criteria should be used to assess them.
WORKSHEET  

POLLINATION PARTNERS

Name: ____________________________  
Date: ____________________________  
Time: ____________________________  
General weather conditions: ____________________________  
Location of plant I will be observing: ____________________________  
Name of plant: ____________________________  
Sketch it: ____________________________  

Hypothesis: When I observe a butterfly, I will see: ____________________________  
Observation: Number of times I saw a butterfly on my plant: ____________________________  
Same kind or different species? List the species if you know the names: ____________________________  

What did the butterfly do while on the plant? Watch carefully: ____________________________  

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Where did the butterfly go next? ____________________________  
Sketch your butterflies: ____________________________  

Conclusions:  
Was your hypothesis supported by your observations or not? ____________________________  
What other questions do you have about butterflies and plant interactions? ____________________________  

Butterfly Activity Guide | 13  
www.aza.org
# The Great Butterfly Migration

## Activity 3

### Summary

Students trace butterfly migration routes.

### Grade Level: 5-8

Time: 1 class period

Subjects: science, geography

Skills: research, predicting, communicating

### Learning Objectives:

Students will be able to:

✓ Define the term migration.
✓ Explain how and why some animals migrate.
✓ Trace North American butterfly migration routes.

### Materials:

✓ Copies of blank maps of North America
✓ Research sources (internet or reference books)

### Background

Approximately 13 species of North American butterflies migrate north in early spring and south in late summer. Most of these migrations go unnoticed, but they are truly spectacular considering the small size of the butterflies and the tremendous distances they travel.

These annual migrations rank high on the list of amazing insect accomplishments. Consider that the monarch butterfly can migrate 4,500 km from eastern Canada to their wintering sites in Mexico. For an animal with a body of about 3 cm (0.02 m), flying a distance of 4,500 km is about 150,000,000 body lengths for a monarch butterfly. An equivalent feat for a 1.8 m (6 ft) tall person would be 270,000 km or about 11 times around the earth. Each year hundreds of millions of butterflies make their way across North America. This is a truly amazing feat!

This activity will allow your students to examine several butterfly migration routes.

### Procedure

1. Ask students what they know about migration. What is it? Which animals do they know of that migrate? (Examples: whales, many songbirds, zebras, butterflies, caribou, whooping cranes, hummingbirds, manatees.) Make a list on the board.

2. If students do not mention it themselves, point out that several species of butterflies migrate very long distances. How is this possible? Why would they want to do that? Make a list of reasons on the board. Be sure to touch on: temperature, climate, food sources, and habitat conditions.

3. Give students blank maps of North America (on pg. 16), and a choice of migratory butterflies. (Common buckeye, red admiral, painted lady, mourning cloak, monarch, Gulf Fritillary, question mark, cloudless giant sulphur, pipevine swallowtail, dwarf yellow, Mexican yellow, sleepy orange, and long-tailed skippers.) Have students conduct research on their butterfly of choice to determine where this species spends its summer and winter, and map out its approximate route along the way. Students should mark these routes on their maps.

4. Ask students, What threats do these animals face on their migrations? What threats would migratory insects face that might...
5. Have students study the migratory routes they mapped out and research some of the locations through which their butterfly species travels. Are there any major cities along these routes? Areas of large human populations? Large agricultural areas? Have students mark these places on their maps as well.

What challenges do the butterflies face along their migratory routes?

Have students conduct research and prepare posters showing their butterfly routes and the challenges faced on these routes as they attempt to meet all their habitat needs for food, water, cover, and places to raise young. Are any of these butterflies considered endangered? Why might that be?

6. Ask each small group of students to give a poster presentation, explaining their findings to the class.

Note: To participate in an actual migration-monitoring project, visit The Journey North, wwwlearner.org/north where students can report their sightings and communicate with other students nationwide. You may also want to visit www.monarchwatch.org for more information on tracking butterfly migrations.

Assessment

✓ Have students write creative “breaking news” newspaper stories about their migratory butterflies’ arrival, departure, or journey through their key locations, including challenges they face along the way and what they are looking forward to at each location.

Extension

✓ Create a large outline map of North America on the ground in a large outdoor area. Using reference sheets you provide, have students create large-scale models of migratory butterfly species out of construction paper and assorted craft materials. Provide student groups with butterfly migration map outlines. (Visit www.monarchwatch.org/tagmig/index.htm for monarchs. Other species require more in-depth research and you may need to draw up the map yourself after some research.) Have students trace identified migration routes by walking over the approximate route, demonstrating to others where the butterflies go in spring and fall.

If possible, have a couple of students stand still in key locations to show where major cities are located in North America. Ask students volunteers to explain where these butterflies will find food, water, cover, and place for their young along their migration routes.
Worksheet
North America Map

Directions:
Mark the migration route of your chosen butterfly on the map. Mark any major cities, large agriculture areas, and other important landmarks along the butterfly’s route.
ACTION PROJECTS CONTINUED

Project 2: Growing and Transplanting Host Plants

Suggested Age Group: K-8

Since 1999, NWF’s *Keep the Wild Alive* campaign has been working with grade school students in Concord, New Hampshire to help the endangered Karner blue butterfly. Working with the New Hampshire Fish and Game Department (NHFG), students grow wild lupine (*Lupinus polyphyllus*), the host plant of the endangered Karner blue butterfly, in their classrooms during the winter and then transplant the seedlings to U.S. Fish and Wildlife Service (USFWS) conservation land during spring. This is an especially effective tool in teaching the close relationship between plants and animals and transferring the knowledge gained to a natural, habitat-wide context. This creative project can be replicated in many areas where imperiled butterflies are found, as long as the project is implemented in partnership with the appropriate national, state or local partner charged with conserving threatened and endangered species. In fact, AZA member Roger Williams Park Zoo began working with NWF, NHFG, USFWS and other partners on the New Hampshire project in 2002. NWF can provide contact information for local resource agencies and educational resources to interested classrooms. Contact: (202) 797-6892 or wildlive@nwf.org for additional information. AZA can provide contact information for accredited zoos and aquariums working with butterflies and host plant conservation. Contact: (301) 562-0777 for additional details.

Project 3: Restoration of Butterfly Habitat

Suggested Age Group: Middle and High School

Classrooms and youth service programs can participate in a restoration event hosted by refuges, land trusts, or other organizations overseeing imperiled butterfly recovery, including many AZA institutions. Many endangered butterfly habitats managed by the Fish and Wildlife Service and other resource agencies need help implementing habitat management plans. For butterflies, often the most effective habitat restoration method is the most simple: removal of invasive exotic plants. This activity does not require much expertise and is suitable for almost all ages. It also teaches a valuable lesson on the benefits of native species versus invasive exotics and can advance students’ understanding of the intimate relationship between butterflies and plants. NWF’s *Keep the Wild Alive* campaign and AZA can help participants identify a local partner to help design a restoration project and host the event, as well as assist educators in preparing students before they participate in the event. Contact: (202) 797-6892 or wildlive@nwf.org for additional information from NWF or (301) 562-0777 for information from AZA.
BUTTERFLY CONSERVATION NEWS

The American Zoo and Aquarium Association (AZA) and the National Wildlife Federation (NWF) have joined forces with the U.S. Fish and Wildlife Service (FWS) and other partners, including the Xerces Society to promote the recovery of imperiled North American butterfly populations. One of our many goals is to raise public awareness about the ecological role of butterflies and the need to preserve them and their habitats through an exciting project called the Butterfly Conservation Initiative.

The aim of the Butterfly Conservation Initiative (BPCI) is to bring together the energy and expertise of a wide range of individuals and organizations committed to community conservation. Through the BPCI, gardeners, school groups, entomology experts and citizen scientists can all come together to help make a difference in our communities.

For more information, contact the NWF’s Keep the Wild Alive campaign at (202)797-6892 or the American Zoo and Aquarium Association at (501)362-0777.

ACTION REPORTS

Singing the Karner Blues at the Toledo Zoo

For over ten years, scientists and volunteers at the Toledo Zoo have been working hard to reintroduce the tiny Karner blue butterfly to the Oak Opening habitats in the Toledo area. Before the Zoo team started on this project, this endangered insect was extinct in Ohio. Karner blues depend on the oak savanna habitat, much of which has been lost to development and is no longer available to Karner blue butterflies. To help with this problem, staff from the Toledo Zoo have been working with the Ohio Department of Natural Resources, U.S. Fish and Wildlife Service biologists, and land managers from the Nature Conservancy to restore Karner blue habitat near the Zoo.

Earning a Gold Medal for Silverspot Conservation at the Oregon Zoo

In the Pacific Northwest, biologists at the Oregon Zoo are working hard to recover the Oregon silverspot butterfly and its host plant, the western blue violet. Together with the Nature Conservancy, the U.S. Fish and Wildlife Service, Washington State Department of Fish and Wildlife, and Seattle’s Woodland Park Zoo, Oregon Zoo staff are raising silverspots in captivity for release into the wild. The recovery team is also working to restore butterfly habitat so the released silverspots have enough nectar to eat and good places to lay eggs. The Zoo and its partners are now working to protect the endangered Fender's blue butterfly as well.

AZA-Accredited Zoos and Aquariums With Butterfly Exhibits and/or Gardens

www.aza.org
Did you know that in addition to being fun places to see bears and penguins, lots of AZA-accredited zoos and aquariums also have butterfly exhibits and special gardens designed to attract butterflies and other pollinators?

Visit your local AZA-accredited zoo or aquarium to see what they're doing to help butterflies in their own backyards and all over the world!

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### Alignment with National Science Education Standards

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The mission of the National Wildlife Federation® is to educate, inspire, and assist individuals and organizations of diverse cultures to conserve wildlife and other natural resources and to protect the Earth's environment in order to achieve a peaceful, equitable, and sustainable future.

As America's largest member-supported conservation group, NWF leads grassroots efforts to safeguard wildlife, wild places and the natural resources on which we all depend.

The National Wildlife Federation has been a leader in environmental education for nearly 65 years. From our Schoolyard Habitats® program and teacher workshops to Ranger Rick™ magazine and our award-winning television shows and films, NWF's dynamic education efforts reach out to help people discover, experience and connect with the wild in our world.

For more about NWF's education programs, visit us at www.nwf.org.

The National Wildlife Federation's Keep the Wild Alive™ program is an ambitious endangered species campaign that aims to build support for endangered species, educate the public in species conservation efforts, and move several imperiled species closer to recovery.

For more information about the Keep the Wild Alive campaign, or to learn about simple actions you can take to help endangered species, please visit the Keep the Wild Alive website at www.nwf.org/keepthewildalive or call (202) 797-6800.

Founded in 1924, the American Association of Zoological Parks and Aquariums, now known as the American Zoo and Aquarium Association (AZA), is a nonprofit organization dedicated to the advancement of zoos and aquariums in the areas of conservation, education, science, and recreation. AZA's vision is to work cooperatively to save and protect the wonders of the living natural world.

The AZA and its accredited zoo and aquarium members constantly strive to maintain the highest standards in wildlife care and conservation. To demonstrate this commitment, AZA members participate in over 700 cooperative conservation and management programs. Through these programs, AZA assists its members in managing their captive populations and conducting and overseeing zoo and aquarium-based and field-based conservation, research and education projects. Since 1991, AZA's Conservation Endowment Fund has awarded over $2 million to support 146 projects benefiting wildlife worldwide.

AZA-accredited zoos and aquariums draw over 134 million visitors each year. With their inestimable commitment to conservation education in living classrooms, AZA zoos and aquariums teach more than 12 million people annually. More than nine million students enjoy on-site education programs at our member institutions each year — over three and a half million receive them free of charge.

We are proud of our dedication to conservation and science and conservation education. In 2000 alone, AZA members supported over 2,700 conservation and associated scientific and educational projects in 86 countries worldwide. In the same year, over 58,000 volunteers contributed over 5 million hours to support AZA member zoos and aquariums. Through projects like the Butterfly Conservation Initiative and other local efforts, AZA institutions are becoming community conservation centers. Contact your local accredited zoo or aquarium to find out how you can get involved. Visit www.aza.org or call (301) 562.0777 to learn more.
Stretch and Balance with Bird-Themed Yoga Poses

Get inspired to do yoga out in the fresh air with these bird-themed poses.

Materials
- A small object such as a pine cone - something to focus your eyes while balancing
- Yoga mat or towel (optional)

Steps

Try yoga outside with your kids.

Doing yoga outside can add a whole new dimension to the experience. You get some vitamin D and connect with nature while relaxing and stretching your body.

Stretching and focusing exercises are also a great option for parents who want to bond with their children. Even the most active child can find a moment of peace doing yoga with an attentive adult.

Many yoga poses are kid-friendly and they particularly like poses where they pretend to be like an animal. You can really make it fun by play-acting with them. Here are three bird-themed yoga poses that your family might enjoy.

Practice your balance with flamingo pose.
- To do the flamingo pose, start by standing up straight and tall.
- Then take one foot and slowly step it back behind you.
- Put out your arms straight out from your shoulders like flamingo wings. You can hold them still or flap them gently. Holding them still is easier.
- Slowly tip your body forward so that all your weight is on your front foot. Your back foot slowly rises from the ground. It does not need to rise very high off the ground.
- Hold the pose while you breathe in and out deeply through your nose.
- Children may find balancing like this difficult. Teach them to pick a spot on the ground about 10 feet away and focus their eyes on it. You can even have a "focus
object" such as a pine cone for them to fix their eyes on.

- Also, at first, they can just keep their big toe on the ground. The number one goal is to hold still, and not tip side-to-side or forward and back.
- After holding the pose for a comfortable length of time, slowly adjust your weight back to two feet, and then pull in your back foot so you are standing tall again. Switch feet and do the balance on the other side.

**Stretch your inner thigh with crow pose.**

- Start by standing straight and tall on both feet.
- Lift your arms so they extend straight out from your shoulders. Bend your hands at the wrists so the fingers point down to the ground. They should hang loosely from the wrist, not a rigid bend.
- Bend one of your knees and stand that foot on tippy-toes. Turn the knee out from your body.
- Hold the pose for a comfortable amount of time with breathing through your nose.
- Your child may have some challenges holding still. Again offering them a "focus object" such as a pinecone can help them relax.
- After some time, bring your arms down and knee in. Then switch to the other side.

**Stretch up tall with stork pose.**

- Begin this pose by standing straight and tall.
- Lift one knee up. The toes can stay on the ground, or you can bring them higher on your calf.
- My daughter tended to lift her knee but her foot then bent behind her. This is not correct. Put your toes either on the ground, or on your calf.
- Bring your hands together at your chest in a type of prayer pose. Your elbows should stick straight out like stork wings.
- Slowly raise your hands above your head with your hands still together. You can close your eyes during this pose, but it might be challenging to keep your balance. It is more important to be smooth and relaxed than to lift your foot high off the ground or close your eyes.
- Hold the pose for a comfortable amount of time while breathing through your nose.
- Slowly bring your arms and leg down until you are standing tall again.
- Switch to the other foot.
Cuddle with "egg pose."
During the photo shoot for this activity, my son invented a yoga pose which he called "egg pose." It involved mommy curling into a ball like an egg and having the kids pile on! It was a fun pose.

Curling up into a ball and relaxing is actually very close to a real yoga pose called "child pose." Child pose is a great way to end any yoga session, to allow the participants to center themselves and listen to their breath. Our version was just a bit more raucous.

Encouraging your child to have fun with yoga is key to making a successful outdoor experience. So encourage them to invent their own yoga poses and let us know what they come up with in the comment field below!

Outdoor Games

Litter Race
The litter race environmental game helps clean up the outdoor location where you are playing—a park, school playground or neighborhood works well. The children collect litter in teams, wearing gloves as protection. Instruct kids to avoid sharp items. Trash picking tools also protect the kids. The goal is to collect the most litter. If you’re collecting a large amount of litter, you will likely have to estimate or weigh the bags of trash. For smaller cleanup efforts, count the pieces of litter collected by each team. The team that collects the most litter is the winner. The environment also wins since this game removes litter from the area. Discuss the importance of cleaning up your own trash instead of throwing it on the ground, including the impacts of trash left outdoors.

Another way to play the game is to sort out the recyclable items from the other trash. This game works well indoors, with the kids sorting through trash collected around the home or school. The team that finds the most recyclable items is the winner. Show the kids how many items were able to stay out of trash as a result of sorting out the recyclables. This helps reduce the amount of trash sent to the landfill by sending at least part of it to the recycling plant.

Nature Balance
Nature Balance is a variation of tag that teaches kids about the balance of nature, according to the Sanborn Western Camps. The kids break up into three groups: bobcats, grass and mice. A visible marker, such as a different color ribbon, helps the kids identify one another. The mice try to tag the grass since mice eat grass. The bobcats tag mice, since bobcats eat mice. The grass players tag the bobcats because bobcats provide nutrients to the grass when they die. If a player is tagged, he becomes the next species in the chain. For example, if a bobcat is tagged, he becomes grass. Stop the game
periodically to determine the balance of each species. This leads to a discussion about how balance impacts real plants and animals. If there are too many mice and not enough grass, the mice have more competition for the grass that is available.

In this nature activity, hawks birds present a fun challenge to the children.

When a bird hawk is hunting, the birds that survive are the ones that are most aware of danger. At a young age either they learn to scatter into the trees or back into the nest, or they become lunch for a bird of prey.

This is a fast moving game that children love. It is a good one to play with large groups, although it can also be used with groups as small as four or five.

Working with the 6 to 9 year olds at Spruce Pine Montessori School, we shaped it to a version that we liked, giving our hawks and birds a lot of freedom to interchange.

Start the game with one or two hawks. Everyone else is a baby bird. The bird’s “nest,” or safe place, is a bandana or other object placed on the ground. Make as many nests as necessary so that the birds are not too crowded.

The game begins when the baby birds leave the nest to find food. Then the hawks began to fly around the birds. When they raise their “wings” (arms) they begin the hunt.

When the baby birds see the hawks hunting they must get back to their nest or be killed (tagged) by the hawk. Once in the nest they must practice being still and quiet. If the hawk sees movement or hears noise, it can tag the bird and the bird dies.

“Dead” birds become hawks in the next round so that no one has to sit out.

If a hawk does not catch a bird in three rounds, then it “dies” and becomes a baby bird.

Helpful hints:
1. Hawks are not allowed to touch the birds in order to make them move.
2. Hawks are not allowed to hover over a bird. They must continue to fly.
3. Baby birds must leave the nest if hawks are not hunting.
4. Limit each round to 30 to 60 seconds.

APPENDIX H

Relevant Websites

Project WET:
http://projectwet.org/

Project WILD:
http://www.projectwild.org/

Project WET and Project WILD Workshop Request Form:
http://www.surveymonkey.com/s/Projectworkshoprequestform

Saja Foundation’s Wise Kids Outdoor:
http://sajaifoundation.org/programs/wise-kids-outdoors

National Wildlife Federation Lesson Plans:

National Wildlife Federation’s Activity Finder:
http://www.nwf.org/Activity-Finder/Search.aspx

National Wildlife Tree Kits:

Butterfly Garden ordering site:
http://www.insectlore.com/live-butterfly-kits/butterfly-garden

Ranger Rick Geocaching:

Create your own geocaching:
http://www.nwf.org/~/link.aspx?_id=8F689AEA754F4F508732DF9A8C7BD9A4&_z=z

LIVESTRONG.com Environmental Outdoor Games:

Outdoor-Nature-Child.com Outdoor Games:
REFERENCES


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CURRICULUM VITAE

Cheryl Behrens graduated from Voorhees High School, Glen Gardner, New Jersey, in 2003. She received her Bachelor of Arts from James Madison University in 2007. Upon graduating she worked for a women’s business association for a year and then joined AmeriCorps, National Civilian Community Corps (NCCC). While serving in NCCC, she worked for the 2009 Special Olympics World Winter Games in Boise, Idaho; the San Joaquin River Parkway and Conservation Trust in Fresno, California; Green Light New Orleans; and Campfire USA in Lake Charles, Louisiana. After completing her term of service with NCCC, she returned to the Washington DC area to work for the American Statistical Association and to pursue her Master’s at George Mason University.