A Practical Guide to Planning, Constructing, and Using School Courtyards

Maryland State Department of Education
Preparing World-Class Students

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Cover: Beardy the Bearded Dragon lives at Hollywood Elementary School
Bel Pre Elementary School, Montgomery County Public Schools

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Chapter 1 - Purpose

In 1999, the Maryland State Department of Education Division of Instruction, in collaboration with the Division of Business Services, School Facilities Branch published *Conserving and Enhancing the Natural Environment on New and Existing School Sites*. This guide, used by facilities professionals and educators to promote environmental education and greening of school grounds and buildings, provided guidelines and step-by-step plans to create forest, meadow and wetland projects on school grounds. This guide extends that document by including school courtyards as a potential design element.

This publication addresses the use of courtyards in instruction and provides examples of creative instructional strategies from around the state and beyond. Descriptions of materials, treatments of courtyards, safety and security implications, preferred sizes and volume of courtyard spaces, orientation considerations, maintenance strategies and code requirements are addressed as well.

This **School Courtyard Guide** is designed to highlight the importance of providing students with natural environments that support their educational growth and development and to provide a resource for the education community that suggests optimum ways of using natural environments to support instructional practice. This resource:

- offers a variety of successful options for the use of school courtyards for instruction and leisure activities for all age groups;
- enhances awareness of courtyards as a viable component of contemporary schools;
- emphasizes the importance nature plays in the educational growth and development of children;
- encourages architects and designers to incorporate more natural light into learning spaces by integrating school courtyards into their designs for new and renovated schools;
- describes how greening courtyards can lead to Leadership in Energy and Environmental Design (LEED) certification; and
- addresses maintenance issues inherent in a space that is both "inside" and "outside."

Mexico

"Those who contemplate the beauty of the earth find reserves of strength that will endure as long as life lasts. There is something infinitely healing in the repeated re-frains of nature-the assurance that dawn comes after night, and spring after the winter."
- Rachel Carson
conservationist

Introduction

The use of courtyards as a design element is common to residential, office, commercial/retail, and even manufacturing buildings. Courtyards are typically defined as an open space with a building or walls on all four sides. Spaces surrounded on three sides by a building or walls with an open end can also be classified as courtyards. Courtyards were once a viable way to create large school buildings while still providing natural ventilation and light to all classrooms. In the early 20th century, schools were designed as low-slung courtyard buildings to give students light, air and access to open space. (Gutman, 2008, para. 9)

The introduction of the modern conveniences of air conditioning, artificial ventilation and artificial lighting began to overshadow the valuable assets of courtyards in the late 1940's and early 1950's. Courtyards provide not only light for rooms within school buildings, but can also provide restful scenery to alleviate eye fatigue and provide a distinctly different environment for learning. **The recent influx of sustainable design practices and daylighting strategies reinforce the influence courtyards can have on school design and student achievement.**

Maryland public schools have long been a leader in environmental education and in green building design. Over the past decade, school facilities and maintenance personnel have been working closely with administrators and teachers to plan and provide outdoor learning spaces for instructional activities as part of the regular curriculum. Recently, there has been heightened international interest in outdoor learning and environmental education. The National Environmental Education Act of 1990 called attention to how the natural environment could be included in the curriculum at every educational level. The nationwide study *Closing the Achievement Gap: Using the Environment as an Integrating Context (EIC) for Learning* prepared by the State Education and Environment Roundtable, (Liberman, G.A. and Hoody, L.L., 1998, p. 1) has shown that students, who engage in environmental activities as part of the regular curriculum, demonstrate:

- better performance on standardized measures of academic achievement in reading, writing, mathematics, science, and social studies;
- reduced discipline and classroom management problems;
- increased engagement and enthusiasm for learning; and
- greater pride and ownership in accomplishments.

According to the study, EIC-based learning uses a "school's surroundings and community as a framework within which students can construct their own learning, guided by teachers and administrators using proven educational practices." Schools have the unique opportunity to encourage active and healthy lifestyles in children and adolescents by transforming school grounds into natural learning areas and playscapes that offer the physical and psychological benefits of outdoor play and access to green environments. Many authorities believe the window of opportunity for the formation of positive attitudes toward and bonding with the natural environment develops sometime during early and middle childhood and requires regular interaction with nearby nature (White 2004, Cohen & Horm 1993; Wilson 1993; Sobel 1990, 1996 & 2004; Kellert 2002; Phenice & Griffore, 2003). In September 2010, the Maryland State Board of Education adopted new regulations (COMAR 13A.04.17.01 Environmental Education Instructional Programs Grades Pre-kindergarten to 12) that require all Maryland public school systems to provide a comprehensive multidisciplinary environmental education program infused with current curricular offerings. This program is aligned with the Maryland Environmental Literacy Curriculum. In June 2011, the Maryland State Board of Education adopted COMAR 13A.03.02.04 adding Environmental Education as part of the State graduation requirements. Environmental Education goes beyond the nature walk and the traditional study of natural history. By involving students directly in the planning, implementation and maintenance of green spaces, teachers and students realize additional affective benefits.

According to studies (National Environmental Education Foundation, "Benefits of Environmental Education," n.d.) Environmental Education:

- creates enthusiastic students and innovative teacher-leaders;
- helps build critical thinking and relationship skills;
- offers a host of health benefits;
- fosters leadership qualities;
- offers all students equal chances for academic success;

- gets apathetic students excited about learning;
- makes other school subjects rich and relevant;
- helps students become self-directed learners; and
- teaches students to be real-world problem-solvers.

Nature allows for open-ended learning. Nature is always changing, regenerating, and renewing. Robin Moore, a landscape architecture professor at North Carolina State University is quoted in the book *Last Child in the Woods* written by Richard Louv, "Natural settings are essential for healthy child development because they stimulate all the senses and integrate informal play with formal learning." Children have an innate interest in nature. "Interested students are motivated students and motivation is the key ingredient for academic achievement." (National Environmental Education Foundation, "Benefits of Environmental Education" n.d., para. 4)

The Maryland Association for Environmental and Outdoor Education (MAEOE) is an important organization in Maryland. Since 1985, MAEOE, a nonprofit educational association, has served thousands of teachers and students at all grade levels, natural resource managers, nature center staff, and environmental program managers with dynamic training programs, workshops, conferences, awards programs, networking opportunities, publications, and related materials and resources. One illustrious recognition administered by MAEOE is the Maryland Green School Award. The Program has a holistic, integrated approach to authentic learning that incorporates local environmental issue investigation and professional development with environmental best management practices and community stewardship. Both public and private schools of all grade levels and environmental centers are eligible. Nearly 20% of all Maryland schools have earned this honor, according to Mary Rivkin, Associate Professor of Early Education at the University of Maryland, Baltimore County. (Rivkin, M. 2011, p.38). Her article appeared in the book "Schools Going Green," sponsored by The National Association for the Education of Young Children. It provides teachers with tips and strategies to fight "nature deficit disorder" and increase children's connection to the natural world. It is essential to provide children with the tools to address these problems, requiring "three types of environmental education: ***in*** the natural environment, to familiarize children with it; ***about*** the environment, to give children the knowledge; and finally education ***for*** the environment, to give them the skills, dispositions and the courage to solve the increasingly evident environmental problems." (Davis, cited by Rivkin, 2011) MAEOE's program provides this motivation for children to acquire these tools. The application for a Green School must incorporate environmental education:

- ***In*** the natural environment - demonstrating selected conservation best management practices;
- ***About*** the natural environment - combining classroom integration of environmental issue instruction, and professional development for the educators;
- ***For*** the natural environment - through planned celebrations of milestones, and sustained school-community partnerships to enhance environmental learning.

Images from *Native Plants for Wildlife Habitat*
- U.S. Fish and Wildlife Service

The MAEOE website provides steps to complete the application to become a Maryland Green School. The website also includes abundant resources and ideas to employ for the benefit of schoolchildren in outdoor education.

Courtyards are one area of a schoolyard where outdoor educational experiences can occur. Activities that explore weather, seasons, clouds, soil, gardening, plants, and water can all happen in a courtyard setting. Students can work toward the process of qualifying their school as a Maryland Green School within a small outdoor setting such as a courtyard.

Although much of this guide's focus is toward new construction, many of the concepts for the use and treatment of existing courtyards are the same. There are endless options as to what the focus of the courtyard could be. Here are items specific to existing construction to consider.

- Secure the original plans of the building to locate any utility lines that may cross the courtyard.
- Plant trees a minimum of 10'-15' away from the building walls.

Outdoors = Better, more relaxed students

In a September 2008 interview by PlentyMag.com Richard Louv stated "…kids are far more creative in natural play spaces than on a typical flat playground, where it's made of concrete or turf…And in schools that have outdoor classrooms kids tend to do better across the board from social studies to standardized testing...It seems to me that using all of your senses at the same time is the optimum state of learning. When you're sitting in front of a computer screen, or locked in a cubicle called a classroom, you're not using all your senses at the same time. Outdoors, you are."

Another interesting aspect of exposure to the out-of-doors was highlighted by a study sponsored by the Economic and Social Research Council in Great Britain. (Crace, J, 2006, p. 3) More than 10,000 eleven to twelve year old British children were tested in 2006. "The principal finding was that UK children have fallen two to three years behind in cognitive and conceptual development from where they were 15 years ago." Michael Shayer, psychologist stated, "The most likely reasons are the lack of experiential play…and the growth of a videogame, TV culture. Both take away the kind of hands-on play that allows kids to experience how the world works in practice and to make informed judgments about abstract concepts."

Lucy School
Middletown, Maryland

One movement that counteracts the videogame/TV culture is the Waldkindergartens or Forest Kindergartens. This concept (Keller, B. 2006, para. 3) was originated in Denmark in the 1990's as a means to provide inexpensive preschools for children living in poverty. The concept spread to Germany where, as of 2008, there are over 700 sites out of more than 25,000 kindergartens in the country. (De Quetteville, H. 2008, para.7) The basis of the schools is that they are located in nature, forests, and glades and that the three to six year old children spend their days, rain or shine, learning in Nature. Four basic principles sum up Waldkindergarten philosophy.

- Nature, with its vast sources for play, provides space for the emergence of a child's fantasies, curiosity and creativity.
- Direct contact with Nature allows the minds of children to develop a sensitive appreciation for the earth.
- The forest provides an ideal place for children to move freely about, thereby developing trust and gaining self-confidence.
- In free play, above all, but also through daily routines, children gain competence in social relationships and in resolving conflicts. (Keller, B. 2006, pp. 1-2)

These green, natural learning environments contrast sharply with our accepted view of an asphalt playground. Outdoor learning on asphalt limits the engagement to physical activities, while engagement in natural settings stimulates prior knowledge of science or environmental studies as the context of living with nature. The book *Natural Learning* (R.C. Moore and H. H. Wong, 1997) documents the ten-year action-research odyssey that occurred at Washington Elementary School in Berkeley, California. In 1971, the asphalt schoolyard was turned into an Environmental Yard, simply known as the Yard. A quote from the book focuses on one aspect of education: "With loose parts of natural objects and materials to play with, it is almost impossible for a child to feel bored." (R.C. Moore and H. H. Wong, 1997, p. 183) Students were interviewed ten and twenty years after the transformation. Here are some of their memories (R.C. Moore and H. H. Wong, 1997, pp. 182-185).

- "I've learned that you can do a million things here, like collect fossils. There's just so much to do all over the place. It has two ponds and a river. It has dirt and trees and plants and bushes. You can eat in there. You can watch frogs and fish and tadpoles…its neat."
- "It used to be a big, empty place with nothing to do. Now there's a whole bunch of trees and all that stuff…..Now it's more like a forest than a playground."
- "It would just be hot and gray. There wouldn't be any color left. Kids would just sit around doing nothing. People like to look at things. Without the Yard you would just sit there with all the ground around you but nothing in it."
- "We'd fight; we'd get up to mischief and act mean. More fights would give more crimes later. Instead of talking, people would steal stuff from the school to get their revenge."

Courtesy of Lisa Gonzalez
University of Maryland
Extension

Silver Lake Reginal School
Kingston, Massachusetts

Page 252 of the Epilogue to *Natural Learning* states, "As adults, they are now applying the results of their natural learning in social skills, creativity, collaboration, scientific understanding, and love of nature in their families, work environments, and communities."

Fostering Nature Appreciation

Another study, completed closer to home, "Evaluating a Constructivist and Culturally Responsive Approach to Environmental Education for Diverse Audiences." (Stern, M., Powell, R., & Ardoin, N. 2010 pp. 110-122) was published in *The Journal of Environmental Education*. This study compiled information from children attending the NorthBay Adventure Center in Cecil County. This center makes available for middle school students, 5-day residential programs focusing on environmental responsibility, character development and leadership and attitudes toward school. The study shows that the center has achieved success in enhancing these characteristics in its students, as measured three months following the students' experiences. (Stern, M., Powell, R., & Ardoin, N. 2010 p. 117) The students partake in experiential lessons on or near the 97-acre site in northeastern Maryland on the shore of the Chesapeake Bay. The curriculum is based on the model brought forward in 2003 by Hungerford, Volk, Ramsey, Litherland, and Peyton (Stern, M., Powell, R., & Ardoin, N. 2010 p. 112) known as IEEIA, "investigating and evaluating environmental issues and actions." This same model of learning in the outdoors can be experienced in a school courtyard in some small way. With proper planning and preparation, an outdoor courtyard area can be designed to expose students to authentic natural experiences through an environmental education curriculum.

Direct contact with the environment is the best way to foster an appreciation for nature that leads to care and stewardship. Richard Louv (Louv, 2005, p. 2) stated that "For a new generation, nature is more abstraction than reality. Increasingly, nature is something to watch, to consume, to wear, to ignore. Today, kids are aware of the global threats to the environment – but their physical contact, in intimacy with nature is fading." There is an increasing concern about environmental degradation and the loss of earth's natural resources: water, air, land, and living creatures. Without fostering an intimate sense of reverence for the earth, it is hard for students to relate to this potential loss of our natural resources. Habits of good stewardship do not happen spontaneously. Exposure and experience in nature can cultivate an appreciation that lasts into adulthood. To reinforce this nature connection and appreciation, themes can be threaded throughout a courtyard project. Below are three themes promoted by the U.S. Fish and Wildlife Service (*Schoolyard Habitat Project Guide,* 2010, p. 11). These themes and others can be woven throughout a courtyard project to reinforce this nature connection.

- Habitat — A home for a plant or animal, providing basic needs of food, water, shelter and space.

  Plants provide the basic needs for animal life – nuts, seeds, berries, fruit and nectar. Plants also provide shelter and space for nests and to raise young.

  Plants also provide habitat for many insects. Insects are a major food source for many wildlife species.

  Habitat loss is a primary threat to many animal and plant species.

- Watershed — All land is a watershed, as it is an area that drains or sheds its rainwater and springs into a body of water such as a stream, river, lake, or bay.

  Natural habitats like wetlands, meadows, ponds, native plant gardens, and forests help filter and remove pollutants in runoff water. Habitats also act as sponges to trap runoff water, then slowly release the clean filtered water into nearby streams.

- Biodiversity — Biodiversity refers to the number of different types of living things or the total number of plants and animals in an area. Areas having a high diversity of native plants usually also have a high diversity of animals.

Health, Obesity and Nutrition Issues

Outdoor activity in the natural environment has taken a backseat to television, video games, the computer, and a demanding schoolwork and extracurricular schedule. Children today may be the first generation at risk of having a shorter lifespan than their parents have. (Belluck, P. 2005,) Data from the Institute of Medicine ("Preventing Childhood Obesity: Health in the Balance" 2005, *The Institute of Medicine*) shows that childhood obesity has doubled over the past 30 years for preschoolers and adolescents and more than tripled for children age six to eleven. Chronic conditions such as type-2 diabetes, asthma, attention-deficit disorder and vitamin D deficiency have all increased over the past few decades. Children are spending half as much time outdoors as they did 20 years ago, according to the National Wildlife Federation literature. A Children & Nature Network publication in 2008 stated, "In a typical week, only 6% of children age 9-13 play outside on their own." Nature play and physical activity outside may be an effective strategy against childhood obesity as demonstrated by a three-year cohort study published in the *International Journal of Obesity,* 2008 (Cleland, V, et al. 2008, pp.1685-1693.) Extended nature and outdoor exposure also has been shown to increase children's attention span and to promote psychological health. Introducing outdoor activity to children in an educational setting using courtyards allows more contact with nature and space for physical exercise, effortlessly.

A study (Wells, N.M. & Evans, G.W., 2003, pp. 311-330) reported in 2003 by environmental psychologists from Cornell University stated that "A room with a view of nature can help protect children against stress." Even if the advantage of nature does not manifest itself in this particular way, a view of landscape, trees, and greenery can be beneficial.

School Gardens

Courtyards can be excellent places for flower and vegetable gardens. Vegetable gardens can be a lodestone for all types of activities. Planting a garden, at any age can be a learning experience – especially for those children who do not have direct contact with naturally growing foods. Children who are not exposed to the process of living plants growing before their eyes may not be aware of where certain foods come from. Often children are less likely to try different foods without being exposed to them. A school garden offers ways to encourage experimenting with different foods.

The importance of this issue is illustrated by programs such as the Healthier U.S. School Challenge (HUSSC) Award. Sponsored by the USDA Food and Nutrition Service, the HUSSC Award is a voluntary national certification initiative for schools participating in the National School Lunch Program. It supports First Lady

Courtesy of Lisa Gonzalez
University of Maryland
Extension

"The sun, with all those planets revolving around it and dependent upon it, can still ripen a bunch of grapes as if it had nothing else in the universe to do."

- Galileo
philosopher

Easton High School
Talbot County Public Schools

Michelle Obama's Let's Move! campaign by recognizing schools that are creating healthier school environments by promoting nutrition and physical activity. The courtyard school garden can also play a role in Maryland's Home Grown School Lunch Week program.

The Maryland Agricultural Education Foundation, Inc. (MAEF), a non-profit, non-governmental organization established in 1989, promotes the understanding and appreciation of the importance of agriculture in our daily lives. Agriculture plays a critical role in our lives. It provides an experiential teaching tool for the core curricula of science, social studies, life skills, mathematics, and language arts. Incorporating agriculture into teaching and learning creates the foundation that students, as future citizens, need to make educated decisions regarding food choices and nutrition, community issues, land use planning, and natural resource conservation.

Gardening enhances vegetable consumption.

Courtesy of Lisa Gonzalez
University of Maryland Extension

Raised beds allow access for all children.

Judith A. Resnik Elementary School
Montgomery County Public Schools

With the generous support of many individuals, organizations, businesses and institutions, MAEF continues to build premier educational programs enhancing education and agricultural literacy statewide. One avenue of exposing students to agriculture is through the Urban Youth Garden Grants. One type of grant, the Edible Youth Gardening Project, increases the awareness and appreciation for agriculture in the lives of urban students through gardening and classroom activities that meet MSDE's State Curriculum. This project offers students direct experience with growing, harvesting and preparing fresh foods while learning plant requirements, growing conditions, nutrition and wellness. For more information consult the website shown in the Appendix C.

Sustainability/Being Green

Another contemporary area of public concern is sustainability. Designing buildings and environments that support good "green" design practices addresses that concern. Sustainable/green building design would seem a natural fit for the promotion of the use of outdoor spaces for education. The Leadership in Energy and Environmental Design (LEED) certification for Schools is the premier standard by which sustainable buildings are judged. The Innovation in Design category allows LEED points to be gained by using the school as a teaching tool. Several goals in the rating system support the notion of creating the highest quality learning environments. One of these is in the Indoor Environmental Quality category where points can be obtained by the amount of daylighting and views allowed for the teaching spaces. Points are attained by providing daylight in one of three ways:

- for 75% - 90% of the classrooms;
- 75% of all other regularly occupied spaces; or
- by providing views meeting various criteria to the outdoors for building occupants in 90% of all regularly occupied areas. (Leadership in Energy and Environmental Design, 2009 for Schools, New Construction and Major Renovation)

New schools built in Maryland, receiving State funding shall be high performance schools per the High Performance Buildings Act of 2008. ("Governor O'Malley Signs legislation to Protect Maryland's Environment, Chesapeake Bay"; Help Secure Maryland's Energy Future." 2008. Para. 8) High performance buildings must meet or exceed the current version of the U.S. Green Building Council's LEED Silver Rating or better. The term "high performance" is often used interchangeably with "sustainable" or "green" buildings. The term is not to be confused with a school that has a Green School designation, as discussed earlier. LEED points are awarded for a variety of green practices incorporated into the building design. In order to reach a LEED Silver rating a minimum of 50 points must be earned in various categories.

One architectural method of achieving some of these LEED points is by providing courtyards. Courtyards provide more exterior wall surface and more exterior areas that provide views from the classrooms. Students, instead of being sequestered in an interior block of rooms with no natural light and no views, could enjoy daylight in their classrooms with views to rest their eyes and minds. The application of a courtyard theme could solve daylighting issues and at the same time provide a vital school component like an outdoor environmental learning area with many uses and forms.

The scorecard utilized in evaluating a school building for points toward LEED accreditation can be found in Appendix A. The credit strategies that can be incorporated into the courtyard design to either fully implement the credit goals or to enhance the effort to achieve those goals are highlighted in yellow. The following provides an explanation of some of the main strategies.

Davidsonville
Elementary School
Anne Arundel County
Public Schools

Reviewing the LEED score card

Courtyards provide ways to add points to the LEED scoring.

- Protecting/restoring a habitat can be easily accomplished in courtyards.
- Courtyards can add to open space calculations.
- Some of the requirements of Quality and Quantity of Stormwater can be managed through the use of a courtyard by providing areas for stormwater best management practices (BMP's).
- Courtyards can be designed providing ponds or fountains and/or shade to promote natural convection to occur to alleviate the heat island effect.
- By consciously choosing native plants, points may be gained in the water efficient landscaping category.
- Providing cisterns that collect water from downspouts from the roof can provide water use reduction by capturing the water for later use in irrigation.
- Courtyards are great places for solar arrays and other types of energy creating devices, meeting renewable energy and green power credits.
- Materials reuse – bricks, tires, etc. could add to the quantity requirement of reusing materials to attain a credit.
- Recycled content materials can be used in the courtyard such as Trex decking, patio furniture, picnic tables, and cob construction (see Chapter 3, Exploration and Adventure)
- Using materials that come from less than 500 miles from the site can count toward points for regional materials.
- By virtue of using courtyards, more light is provided to more rooms in the building. This allows classroom lights to be put on sensors, daylight and views are provided to add more points to the LEED calculation.
- The courtyard can be designed to use the building itself as the teaching tool.

Georgian Forest Elementary School
Montgomery County Public Schools
Designed by Hord Coplan Macht, Inc.

Chapter 2 - Courtyards

History

Courtyards have been a long-standing essential component of architecture, especially in semi-arid and arid climates. Historical research confirms that courtyard houses were built as early as 3500 BC in Sumeria. This building form has endured to the present day. One famous city, Pompeii in Italy, exhibits fine examples of early buildings with courtyards as seen above. They were preserved intact by their burial in volcanic ash from the eruption of Mt. Vesuvius in 79 AD.

Traditionally, the elements which define a courtyard are "enclosure," a water feature, and a place which provides a calming and secure environment. The rooms in the outer portion of the building provide a protected, private space within. Due to a cooling effect created by natural convection currents, courtyards are more easily associated with places closer to the equator. However, courtyards have attributes that can be enjoyed everywhere. They have served a practical need in early settlements such as colonial Williamsburg, Virginia. The buildings are built around cisterns and wells for the benefit of all settlement inhabitants. An appropriate design can be found for any environment.

Courtyards are an established component of schools, whether built in the 1920's or designed today. They offer a safe, secure inner zone for a myriad of exterior activities that can be enjoyed by all age ranges. The configuration of courtyard to building allows for light into more rooms in a school. **Nevertheless, commitment and maintenance is vital to the success and longevity of each building's courtyard environment.** Being neither in nor out, maintenance and care is shuffled between building supervisors and yard crews. Custodial and maintenance staff are often not trained nor have an interest in landscaping, plant materials or planting. Most often, their area of expertise and interest is not in landscaping. The maintenance of courtyards is a distinct responsibility outside of custodial and building maintenance. Designating a care-taking group such as an ecology club, student service learning project, Parent-Teacher organization (PTA or PTO) or a school club is most beneficial. These organizations provide a continuity of care and attention. Seeking help from local horticulture, landscape and native plant specialists can also be an alternative. One school district in the state utilizes the local Recreation and Parks Division (Rec and Parks) to provide maintenance. In exchange for public use of the gymnasium and school facilities for Rec and Parks programs, the courtyard habitat is maintained in a professional manner by Rec and Parks employees.

Judith A. Resnik Elementary School
Montgomery County Public Schools

"Study nature, love nature, stay close to nature. It will never fail you."

- Frank Lloyd Wright
architect

Pompeii, Italy

Throughout this manual, it is assumed that the topic is courtyards of new construction. However, many courtyards in school construction are created through additions affixed to existing buildings throughout the years. Successful courtyard design can be accomplished in either new construction or existing construction. The purpose of a courtyard gives inspiration to the design of the courtyard and guides every choice in the design process. Although a courtyard is an integral component of a building, for this manual it will be studied as a distinct object apart from the building itself. **The main purpose of the courtyard will influence the architectural design of the courtyard itself.** These purposes, which include educational themes, will be explored in the next chapter. This influence will affect the orientation, the height and color of the walls, the size, the ground surfaces and how much natural ground cover versus hardscape will be provided. Potential educational themes and purposes for courtyards will be explored in the Chapter 3.

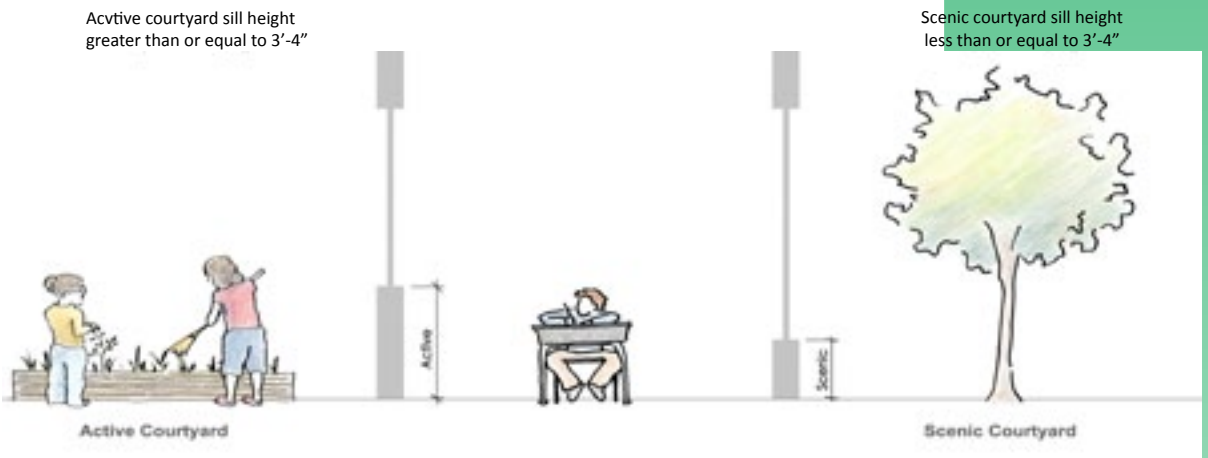
Design

Below is a list of architectural elements to include as the groundwork for a successful school courtyard.

"Take care of the land and the land will take care of you."
- Hugh H. Bennett
conservationist

Elements of Successful Courtyard Design For School Buildings

- Analyze sun angles, building massing and orientation to ensure the most positive impact on the quality of light both into the courtyard and into the adjacent spaces.
- Provide for south light or place the courtyard south of the building as much as possible with appropriate shading.
- Note the direction of prevailing winds and design for protection.
- **When designing a new school building consider the noise levels expected in the courtyard.**
- Consider the access needed by both personnel and equipment to provide regular maintenance. Snow removal should be taken into account.
- Plant native species.
- Before the trees mature, shade may be provided by arbors, pergolas, fabric structures, umbrellas, etc.
- Provide GFIC exterior outlets and frost-proof hose bibs on more than one wall.
- Consider drainage patterns, porosity of the path material and its impact on storm water management. Provide good drainage, not only to collect the water, but also discharge the water to a safe place.
- Where classrooms are adjacent to active courtyards, design the window sills higher to block distractions from inside the classrooms.



- Where classrooms are adjacent to scenic courtyards, design the window sills lower for children of all ages to see out.

LEGEND
*MEANS OF EGRESS

Graphics prepared by Grimm and Parker Architects

- Provide at least two means of egress with doors swinging in the direction of travel, preferably out of the courtyard.
- **Review the functions of the rooms surrounding the courtyard for compatibility with the intended uses and noise levels in the courtyard.**
- Provide the appropriate surfaces for the intensity of foot traffic expected. ***More information is provided on pages 30-35.***

Minimal *Moderate to Heavy Duty* *Heavy duty*

- Create "places" within the courtyard through material changes, elevation changes and landscaping.

Suitland Elementary School
Prince George's County Public Schools

- Design the courtyard and its surrounding uses so they can "be good neighbors" to one another.

- The location of low walls can distinguish a picnic table area for eating and reading from a class gathering area where the low wall acts as seating. Grassy areas and sidewalks reinforce the different activities. Planting boxes and beds can border the entire perimeter of a courtyard.

Planters act as natural dividers between different spaces within a courtyard. Different colored patterns in concrete or floor surface add texture and define pathways and uses.

Hollywood Elementary School
St. Mary's County Public Schools

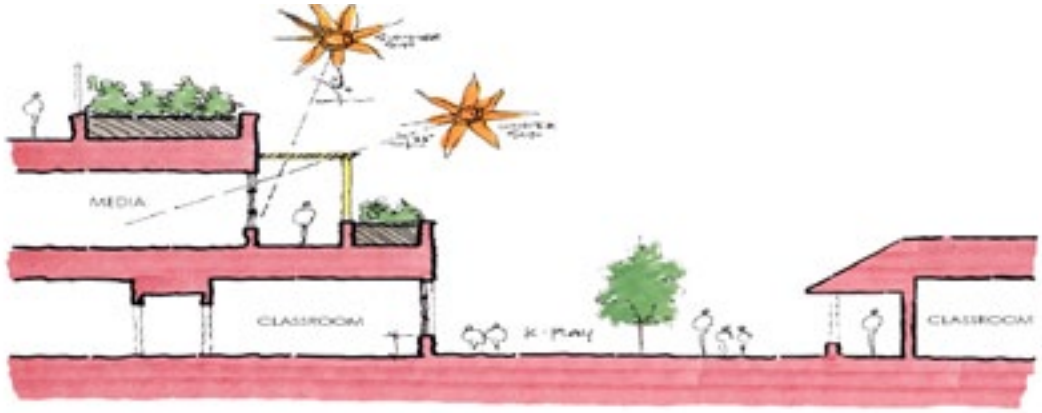
Aberdeen High School
Harford County Public Schools

"Children the world over have a right to a childhood filled with beauty, joy, adventure, and companionship. They will grow toward ecological literacy if the soil they are nurtured in is rich with experience, love, and good examples."

- Alan Dyer
"A Sense of Adventure"

Denver Public School System
Landscapes for Learning

- Create a sense of layering from the enclosed building environment out to the fully exposed courtyard using arbors, pergolas, and architectural items such as semi-enclosed porches.



Graphics prepared by Grimm and Parker Architects

- When designing buildings of multiple stories, try to step the upper floors away from the north side of the courtyard to minimize the amount of shading into the courtyard created by the building.

- Consider integrating some of these features as suggested by the Fish and Wildlife Service in their 2011 Schoolyard Habitat Project Guide:
  Logs: Partially submerged logs in ponds provide a place for turtles and frogs to bask in the sun.
  Brush Piles: Brush piles provide excellent cover for rabbits, chipmunks, small birds and insects. Discarded Christmas trees can be used to create brush piles.
  Nesting Boxes: Nesting boxes for birds, bees, and butterflies are artificial structures that attract a greater variety of wildlife for students to observe.

- Consider strategies to maintain the courtyard in an easy, consistent manner.

Judith A. Resnik Elementary School Montgomery County Public Schools

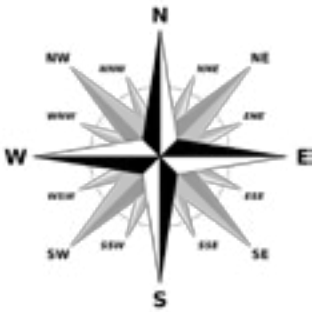
General Courtyard Design

Denver Public School System – Landscapes for Learning

During design it is recommended to perform light and shadow studies to learn how the sun tracks across a courtyard from the winter solstice (data taken on Dec. 21st) to the summer solstice (data taken on June 21st). The resulting diagram will provide a picture of the range of conditions within a courtyard throughout the year. It will provide a good idea of how much sun will enter a courtyard and how much shade would be desirable to provide.

Sun can be one of the most pleasant features or the most bothersome enemy bringing with it heat and glare. Courtyard design, by its basic disposition of being an open-air enclosed space, must take into consideration how the sun affects the floor surfaces and wall surfaces in the courtyard itself. Planning and the study of sun agles is crucial. Factors like the plan orientation concerning the cardinal points, and the amount of wall surface facing east, west and particularly the southern exposure are critical first decisions. Other questions to address are:

- When will the courtyard most likely be used – morning, late morning, for lunch at noon, afternoon or late afternoon?



- For what uses will it be designed?
- How much shade should be provided?
- What types of plantings will be planned?
- Will the courtyard be mostly a hardscape?
- Will the courtyard be devoted to nature and growing plants?

"The best remedy for those who are afraid, lonely or unhappy is to go outside somewhere where they can be quiet, alone with the heavens, nature and God. Because only then does one feel that all is as it should be and that God wishes to see people happy, amidst the simple beauty of nature."

- Anne Frank
author

Orientation

One way of studying the effects of the sun on a courtyard is to study the orientation of the long walls of the courtyard. John S. Reynolds' book *Courtyards, Aesthetic, Social and Thermal Delight,* 2002 provides significant technical data on designing courtyards. The orientation concepts within the book are reinforced by a quote from Ralph L. Knowles – "any **architectural space that is oriented from east to west strengthens our experience of the seasons.**" When the dominant courtyard walls (the longer walls) extend in the east and west direction, one wall is mainly in shade through all seasons. However, the path of the sun is basically the same on both opposing walls, crossing east to west. As the seasons change, the amount of shadow on the wall will change. As the sun rises low in the sky during late winter, the shadows created by the walls of the courtyard will be deeper into the courtyard. As the sun rises higher and higher until the summer solstice, the shadows created by the walls of the courtyard are diminished and more direct sunlight will increase. (Reynolds, J. S. 2002, p. 11)

Long walls oriented E/W
June 21 at 9 a.m.

Long walls oriented E/W
June 21 at noon

Long walls oriented E/W
June 21 at 4 p.m.

North

Long walls oriented E/W
Dec 21 at 9 a.m.

Long walls oriented E/W
Dec 21 at noon

Long walls oriented E/W
Dec 21 at 4 p.m.

Graphics prepared by Grimm and Parker Architects

When the dominant courtyard walls (the longer walls) extend in the **north/ south direction this strengthens our experience of the day.** In the morning, light from the east will cast a shadow that moves quickly down the opposite wall and across the floor, lighting the opposing wall. "Every afternoon, light from the west will cast a shadow that crosses the floor and climbs the opposing wall." - again quoting Ralph L. Knowles. (Reynolds, J. S. 2002, p. 11)

Long walls oriented N/S
June 21 at 9 a.m.

Long walls oriented N/S
June 21 at noon

Long walls oriented N/S
June 21 at 4 p.m.

Graphics prepared by Grimm and Parker Architects

The Solar Shadow Index

The solar shadow index measures the amount of winter sun exposure a courtyard encounters based upon the height of the walls around the courtyard, and the length of walls running in the north/south direction. "The greater the solar shadow index, the deeper the well formed by the courtyard, and the less winter sun reaches the floor or even the north"(sunniest) wall of the courtyard. (Reynolds, J. S. 2002, p. 16)

How to determine the Solar Shadow Index –

Step 1: Determine the height of the courtyard's south wall (w).
Step 2: Determine the width of the courtyard in the North/South direction (x).
Step 3: Divide the height of the wall (w) by the width of the floor (x) in the North/South direction.
w/x =Solar Shadow index (SSI)

The lesser the value of the solar shadow index, the more indicative of light entering the courtyard in winter. This aspect of solar gain is greatly impacted by the orientation of the courtyard in the north/south direction.

Below are two sample courtyard diagrams with different orientations. Both are 25' x 50' with exterior walls of 15'-0" high. North is oriented to the upper left hand corner. Note the differences in the Solar Shadow Index (SSI).

Long walls oriented N/S
December 21 at noon
SSI = w/x = 15/50 = 0.3

Long walls oriented E/W
December 21 at noon
SSI = w/x = 15/25 = 0.6

Graphics prepared by Grimm and Parker Architects

The Solar Shadow index is an indicator of the amount of sun entering the courtyard during the winter. This indicator is most helpful in the design stage using it for comparisons between several different schemes with different courtyard orientations, sizes and wall heights. Note that during the winter months a courtyard with the orientation in the N/S direction gains more sunlight than the same sized courtyard oriented in the E/W direction. This is most evident as shown in the noon-time study diagrams.

Exposure to the Sky

If a courtyard's primary reason were to bring light into the surrounding building, then the primary goal of the design of a courtyard would be to have as much exposure to the sky and sun through all seasons, as much as possible. Several factors affect the success of a courtyard's exposure to the sky and this measurement is called the aspect ratio. (Reynolds, J. S. 2002, p. 16)

The Aspect Ratio

- Determine the Aspect Ratio –

  Step 1: Find the area (A) of the courtyard and the average height of the walls surrounding the courtyard (w).

  Step 2: Square the number representing the height of the walls.

  $(w)^2 = W$

  Step 3: Divide the area of the courtyard by the square of the height of the surrounding walls.

  (A / W = the aspect ratio or AR)

A higher aspect ratio indicates a greater exposure of the courtyard to the sky.

Area = 60' x 60' = 3600
March 21 at 9 a.m.
AR = 60 x 60/15² = 16

Area = 80' x 30' = 2400
March 21 at 9 a.m.
AR = 80 x 30/15² = 10.6

Graphics prepared by Grimm and Parker Architects

Note that although the long walls of courtyard B are in the north/south direction the size of the floor perimeter has a bigger impact on the aspect ratio.

Again, this figure is an index, an indicator of the amount of sun exposure to the courtyard. This indicator is most helpful in the design stage using it for comparisons between several different schemes with different courtyard orientations, sizes and wall heights.

Shading devices

After determining the optimal orientation of the courtyard and considering where to provide shade, the next step would be to consider what type of shade-provider would be used. Shading devices can be broken down into two groups – natural and man-made. Natural is easy – usually trees or some large shrubs are the best way to provide shade. The disadvantage of this technique is that in new construction it takes years for a newly planted tree or shrub to attain a height and size large enough to provide adequate shade. What is the solution, then?

The obvious answer – design the walls around the courtyard to create shading and orient the courtyard for the activities to be taking place in the shaded area. The result should be that there is a shaded area for at least part of the day. In a perfect world, this may be all that is needed. However, most school construction occurs as an addition to existing buildings and courtyards are created as leftover space. They are added wherever it is most convenient for the design of the new construction.

Most likely the easy solution, whether on a temporary or permanent basis, is to consider providing man-made shading devices until natural ones grow into their task.

Man-made shading devices

Architecturally designed structures can provide shade and define space. The materials that can be used are limitless - wood, metal, or fabric are a few common materials. The arrangements of the shading devices can play a dual role in providing a cover for participants in the courtyard and shielding sunlight through the windows into the building. Trellises and arbors built along a wall are a good example of this type of shading device. Deeper arbors and trellis structures should be used to shade the east and west sides of the building. A space of 1'-6" should be left between the building and any vine covered screen in order to allow ventilation and cooling. Large roof overhangs from the main building can also be designed to provide a shaded area within a courtyard. These are most successful on the east and west sides of the building whereas on the north side of the building narrower overhangs allow more light in from the higher sun angle.

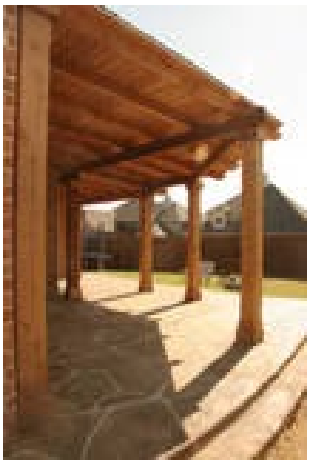
Colorful fabric structures with playful forms may also be integrated into the courtyard design to provide shade. The structures can act as focal points or gathering spaces within the courtyard. Gazebos and small structures can also be built within the courtyard to define different areas of use. Ensure that all structures are accessible, providing either no stairs for entry or an accessible ramp if elevated. A firm, level, stable, slip resistant path must be provided. Another option of planning would be to "set the stage" for future structures to be built by the school children themselves.

The surrounding walls and their orientation play a big part in determining shade areas at certain times during the day. Review the diagrams and concepts discussed under the "Orientation" and "Exposure" sections. Man-made shading devices that are portable – like large umbrellas at tables, can provide flexibility.

Newport Coast Elementary School
Newport Coast, California

Halls Head Middle School
Mandurah, Western Australia

Easton High School
Talbot County Public Schools



Porch

Wood Trellis

Fabric Tensile Structure

Natural shading devices

Strategically placed trees can provide shade. Plantings also improve air quality by filtering pollutants. In order to make the most use of the properties of the different types of trees, place deciduous vines or trees toward the north and evergreen trees to the east and west. The deciduous trees will shed their leaves and allow the winter sun to enter any window openings into the building. Carefully study the canopy of the tree as it will also determine the spread of the roots. If a tree's canopy is 20' in diameter, the roots of the tree will also extend 10' in all directions from the trunk. Planting the tree too close to the building can cause damage to foundations or be a maintenance nuisance should leaves fall on the roof and clog drains. Be aware of and avoid utility and water lines in the area proposed to plant the tree. Always use native species.

Remember that trees and plants can also serve as play or study materials.

Tajimi Junior High School
Japan

William S. Baer School
Baltimore City Public Schools

"Children are born naturalists. They explore the world with all their senses, experiment in the environment, and communicate their discoveries to those around them."
- Audubon Nature Preschool

Spring Ridge Middle School
St. Mary's County Public Schools

Samuel Coleridge Taylor Elementary School
Baltimore City Public Schools

Planning the placement of trees within a courtyard can provide for multiple uses – quiet activities such as reading, or eating under the shade, or more energetic play activities in the open, sunny spaces.

Material selections – Up, Down, and Around

The following photos and suggestions are some ways to treat the components of a courtyard – the ceiling, floor, and walls. Seating examples are also shown.

Courtyard Components: "Up" (the ceiling)

Examples of shading devices:

- Canvas
- Wood trellises, pergolas, or arbors
- Metal canopies
- Roof overhangs
- Tensile fabric structures, tents
- Tree canopies

Vine-covered trellis

Decorative trellis

Wood arbor

Some shade should be provided in all courtyards to protect students from overexposure to the sun and the threat of skin cancer or skin health issues.

"The richness I acheive comes from Nature, the source of my inspiration."

- Claude Monet
artist

"The middle years-roughly six to twelve-is a time of greatly expanded interest, curiosity and capacity for assimilating knowledge and understanding the natural world. Rapid cognitive and intellectual growth occurs, including many critical thinking skills achieved through interaction and coping in the nonhuman environment. Intellectual development at this stage is especially facilitated by direct contact with nearby natural settings, where a world of exploration, imagination and discovery becomes increasingly evident to the child."

- Stephen R. Kellert
Yale University

Fabric tensile structure

Mature trees provide shade for seating.

Roof overhang creates a porch for outdoor activities.

Lucy School
Middletown, Maryland

Vines growing on the arbor creates a meeting space.

Judith A. Resnik Elementary School
Montgomery County Public Schools

Porches provide a place to store boots and start seedlings.

Lucy School
Middletown, Maryland

Fabric tensile structure

William S. Baer Special School
Baltimore City Public Schools

Estimate the amount of traffic expected in the courtyard when selecting the floor surfaces.

Courtyard Components:"Down" (the floor)

Examples of walking surfaces:

Heavy use walking surfaces

Stone pavers

Stepping stones

Brick pavers

Decorative pavers

Evergreen Elementary School
St. Mary's County Public Schools

Concrete pavers

"I am myself and what is around me; and if I do not save it, it shall not save me."
- Jose Ortega y Gasset
Spanish philosopher

"As children observe, reflect, record and share nature's patterns and rythyms, they are participating in a process that promotes scientific and ecological awareness, problem solving, and creativity."
- Deb Matthews Hensley
early childhood consultant

"Children are born with a sense of wonder and an affinity for Nature. Properly cultivated, these values can mature into ecological literacy, and eventually into sustainable patterns of living."
- Zenobia Barlow
"Confluence of Streams"

Heavy use

Ocean City Elementary School
Worcester County Public Schools

Heavy use

Winton Hills Academy
Cincinnati, Ohio

Concrete (porous and non-porous) – Permeable concrete shown

Concrete with imprints

Porous and non-porous asphalt (non-porous shown)

De-composed granite (DG)

Loose DG walkway

DG with stabilizer

De-composed granite (DG)

Christa McAuliffe Elementary School
Montgomery County Public Schools
Courtesy of Jillian Storms

Elevated wooden walkways and platforms

The Children's School
Stamford, Connecticut

Moderate use walking surfaces

Mulch

Sod

Stepping stones & mulch

Gravel/Pavers/Porous Concrete

Recycled Rubber Tires
(crumb rubber is shown)

Recycled Rubber Tire Surfacing

William S. Baer Special School
Baltimore City Public Schools

Light use walking surfaces

Planting beds with path

Grass

Intertwined grass and path

Select pavers can be imprinted with images and names of native trees and plants in order to teach students valuable information in a very subtle way.

"Let children walk with Nature, let them see the beautiful blendings and communions of death and life, their joyous inseparable unity, as taught in woods and meadows, plains and mountains and streams of our blessed star, and they will learn that death is stingless indeed and as beautiful as life."
- John Muir
naturalist

Courtyard Components: "Around" (the walls)

Examples of wall surfaces:

- Brick
- Concrete block
- Stucco
- Wood siding
- Metal siding
- Exterior Insulating Finish System (EIFS)

Brick masonry and ribbon windows

James M. Bennett High School
Wicomico County Public Schools

Brick masonry and metal siding

St. Michael's Elementary School
Talbot County Public Schools

Wood siding and glazing

Hazelwood School
Glasgow, Scotland

Wide openings/glass bring nature in and learning out.

Matanuska Susitna Career & Technology High School
Wasilla, Alaska

Student painted murals reinforce "a sense of belonging."

Calverton Middle School
Baltimore City Public Schools

Light colored metal wall panels and gridded screen wall

Chung Cheng High School
Singapore

Light colored walls with windows and details like pilasters for definition

Bombeck Family Learning Center
Dayton, Ohio

"Children live an imaginary life, and creating a place where they can have fun in a very free way can motivate them and expand their horizons."
- R. C. Moore & H. C. Wong
"Natural Learning"

Yu Neng Primary
Singapore

"Wall" treatments - Rules of Thumb

- **Light colors are encouraged for the surrounding walls.**
- Trees and vegetation should be maintained at a distance of 10'-15' away from the building to allow ease of maintenance, less impact on tree root structure, less impact on building foundations, and less chance of leaves clogging gutters.

Supergraphics can add a fresh new feeling to an older building.

PS1 – Bergen School Library
Brooklyn, New York

Courtyard Components: Seating

Examples of seating:

- Wooden benches
- Picnic tables of wood, steel, or precast concrete
- Tree stumps or logs
- Large rocks or boulders
- Earth - bermed seating
- Concrete or wood amphitheaters

Leonardtown Elementary School
St. Mary's County Public Schools

Spring Ridge Middle School
St.Mary's County Public Schools

Log Benches in Courtyard
Bremen, Germany
Courtesy of Rolf Grafwallner

Hollywood Elementary School
St. Mary's County Public Schools

Atrium School
Watertown, Massachusetts

Planters with seating

Northwest High School
Baltimore City Public Schools

Multi-level seating

William Farquhar Middle School
Montgomery County Public Schools

Native Plants

Using Native Plants

School facility professionals and grounds managers have begun to incorporate sustainability as part of the school site design concept. An important element of design is the use of native plants to provide shade, reduce energy costs, reduce erosion and run-off, and provide an aesthetically pleasing site for students, staff, and the community. Native plants support a whole ecosystem – insects, thus bats, birds and other animals. Another consideration of grounds-keeping involves ease of maintenance. **The use of native plants in landscaping provides decreased maintenance over time, while satisfying sustainability and aesthetic requirements.** Any planting requires maintenance, but the use of native plant landscapes is usually less costly in maintenance after the first season or two.

According to the National Park Service's website:

> *New plants need watering and monitoring during the first season until they become established. Disturbed soil is prone to invasion by weeds - requiring manual removal (pulling) instead of chemical application. Over time, desired plants spread to fill gaps and natural cycles help with pest control. Garden maintenance is reduced to only minimal seasonal cleanup and occasional weeding or plant management. The savings realized by using little or no chemicals, and less water and gas, can more than make up for initial costs of installing the landscaping. Redefining landscaping goals overall and gradually shifting to using native species provide even greater rewards in terms of environmental quality, landscape sustainability, improved aesthetics, cost savings, and bringing wildlife to the property.*

Native plantings are desirable because they are adapted to this environment, reducing the need for watering, fertilizing, and pesticide applications. By being adapted to the local climatic conditions and soil type they have developed natural defenses to diseases and insects. Native plants attract local animals, providing students with an opportunity to learn about the local ecosystem, while reducing mowing areas, controlling erosion, and eliminating the need to maintain dangerous steep slopes. Of course, native animals enjoy feeding on native plants so care must be taken in selecting plants based on the local fauna.

Health considerations must also be considered. Plants that attract bees should be planted away from open windows. Pesticide applications, which are monitored by Integrated Pest Management (IPM), University of Maryland Extension, can be reduced. IPM, as described on their website "focuses on minimizing economic, environmental, and health risks through innovation and site-specific evaluation of biological, cultural, physical, and chemical tactics.'

One way to begin a project is to replace dead or dying plants with natives. Using a variety of trees on the school grounds provides teachers an opportunity to use the planting as an arboretum, teaching students about local trees, fruits and pollinators. The birds, insects and amphibians that are attracted by the plantings provide additional instructional opportunities. Trees also provide instructional opportunities to collect data on plant growth rate, measurement of canopy, seasonal cycles, and so on. Students can easily be involved in planting

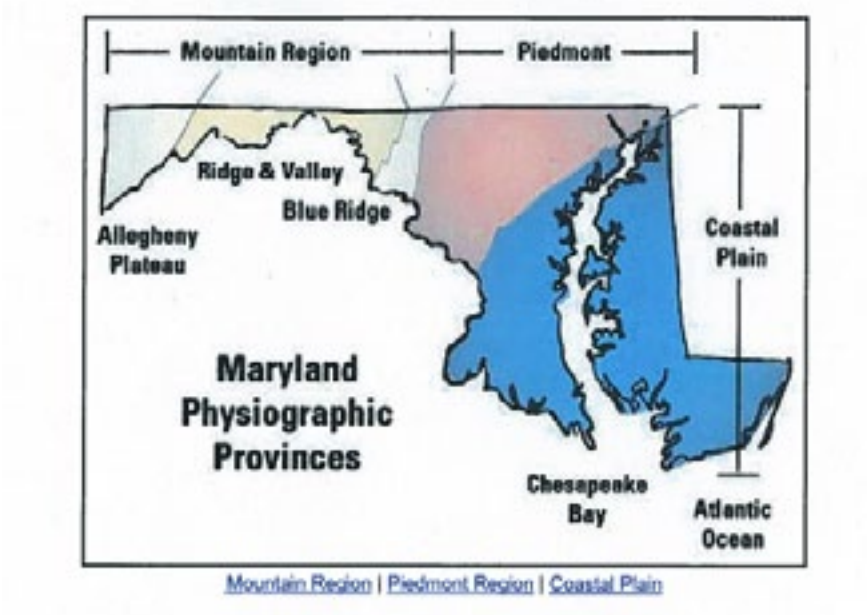
Images from *Native Plants for Wildlife Habitat*
- U.S. Fish and Wildlife Service

"When I go into the garden with a spade, and dig a bed, I feel such an exhilaration and health that I discover that I have been defrauding myself all this time in letting others do for me what I should have done with my own hands."
- Ralph Waldo Emerson
author

and caring for the trees, as well as purchasing them through the Maryland Department of Natural Resources through grants by the Chesapeake Bay Trust or local business partners.

Courtyards, depending on their area and design, may allow for tree plantings. **Grass that requires cutting, can be eliminated in courtyard areas by the use of shrub and perennial plantings areas.** Ideally, teachers, parents, the community and students are involved with facilities personnel to plan and plant the areas. A variety of age-appropriate gardens can be designed to meet different curriculum objectives. Kindergarten students may want to plant an alphabet garden - plants beginning with the letter "A" through "Z". English teachers may have students design a garden based on a book such as the *The Secret Garden*. (Burnett, F.H. 1987) Art teachers can have students design sculptures, garden walks, benches, murals or other features. Adding a water feature to the courtyard with its aquatic plant contingent increases interest and opportunity. For elementary teachers, a native plant butterfly garden allows students to learn about plant parts, life cycles, fruiting and flowering. One topic covered in the state curriculum involves having students identify what plants and animals need to live. Students can help design, plant, and maintain small gardens using these "things needed to live" so that the plants are supplied with water, soil, and light and animals have water, food and nesting areas. As explained in *Bringing Nature Home*, (Tallamy, D. 2007, p. 13) there is an unbreakable link between native plant species and native wildlife. Native insects "will not be able to survive on alien plant species." Designing and providing a sustainable habitat for native species adds to the health of the ecosystem, measured as biodiversity. When native plants disappear, the insects disappear, impoverishing the food source for birds and other animals. Wild creatures survive through a complex web of interconnections. Some require different kinds of food at different stages of their development. In many parts of the world, habitat destruction has been so extensive that local wildlife is in crisis.

A number of excellent resources exist to help guide the development of native plantings in courtyards and on school grounds. The Maryland Native Plant Society website, referenced in Appendix C, is an excellent resource for learning about native plants appropriate for the Coastal Plain, the Piedmont, and the Mountain regions of Maryland. Teachers can apply for grants to plant natives on school grounds as part of the curriculum or for Student Service Learning projects. The National Wildlife Federation (NWF) can certify schoolyards. The NWF website, as referenced in Appendix C has technical information as well as lesson plans for teachers. Grants for student projects are also referenced in Appendix C.



Map of Maryland showing Physiographic regions

Publication by USFWS BayScapes Conservation Landscaping Program

Meadow Mixes for the Mid-Atlantic Region
(*U.S. Fish and Wildlife Service Schoolyard Habitat Project Guide, 2010*)

Dry Soil

Flowers
Butterfly Milkweed (Asclepias tuberosa)
Common Milkweed (Asclepias syriaca)
Heath Aster (Aster ericoides)
Partridge Pea (Cassia fasciculata)
Showy Tick Trefoil (Desmodium canadense)
Wild Lupine (Lupinus perennis)
Wild Bergamot (Monarda fistulosa)
Black-Eyed-Susan (Rudbeckia hirta)
Gray Goldenrod (Solidago nemoralis)
Grasses
Little Bluestem (Andropogon scoparius)
Indian Grass (Sorghastrum nutans)
Canada Wild Rye (Elymus canadensis)

Medium Soil

Flowers
Common Milkweed (Asclepias syriaca)
New England Aster (Aster novae-angliae)
Zig-Zag Aster (Aster prenanthoides)
Flat-Toped White Aster (Aster umbellatus)
Showy Tick Trefoil (Desmodium canadense)
Wild Blue Lupine (Lupinus perennis)
Wild Bergamot (Monarda fistulosa)
Black-Eyed-Susan (Rudbeckia hirta)
Stiff Goldenrod (Solidago rigida)
Hoary Vervain (Verbena stricta)
Grasses
Little Bluestem (Andropogon scoparius)
Canada Wild Rye (Elymus canadensis)
Indian Grass (Sorghastrum nutans)

Wet Soil

Flowers
Swamp Milkweed (Asclepias incarnata)
New York Aster (Aster novi-belgii)
Nodding Bur Marigold (Bidens cernua)
Joe-Pye Weed (Eupatorium dubium)
Spotted Joe-pye Weed (Eupatorium maculatum)
Boneset (Eupatorium perfoliatum)
Rough-Leaved Goldenrod (Solidago patula)
Blue Vervain (Verbena hastata)
Ironweed (Vernonia noveboracensis)
Grasses
Big Bluestem (Andropogan gerardi)
Fox Sedge (Carex vulpinoidea)
Soft Rush (Juncus effusus)
Sensitive Fern (Onoclea sensibilis)
Switch Grass (Panicum virgatum)

Images from *Native Plants for Wildlife Habitat*
- U.S. Fish and Wildlife Service

Universal Design

The *Americans with Disabilities Act* (ADA) of 1990, Title II, prohibits discrimination based on disability in services, programs and activities provided by public entities, including units of State and local government. This law requires schools to make accommodations for or design environments specifically so that persons with disabilities may access the same facilities as persons without disabilities. These standards were updated with the *2010 Standards for Accessible Design* (the 2010 Standards) published by the Department of Justice on September 15, 2010 and can be accessed through the website referenced in Appendix C. All newly constructed or altered State and local government facilities starting construction on or after March 15, 2011 must comply with updated regulations for the ADA.

Below are listed a number of issues to consider when planning your courtyard.

Accessibility Issues

- Coming in and going out -
    - General construction practice is to raise the finish floor of the building 6"-8" above the courtyard, creating a barricade for persons with disabilities.
    - Provide at least one door with an accessible threshold and a short ramp to make up the difference in height of the courtyard "floor" to the school building "floor." The ramp provided should have a slope of no more then 1:12.
- Participation -
    - Plan an area large enough to accommodate a wheelchair on a level surface within a class-sized gathering area.
    - Provide sloped surfaces for access to elevated portions of the courtyard.
- Mobility -
    - All walking/traveling surfaces must be firm, level and slip resistant.
- Seating -
    - Where multiple fixed benches are provided, at least 50% should be accessible, and half of those with armrests.

Learning & Health Issues

Students with special needs can easily be accommodated in outdoor spaces. There are instructional advantages to working with students in outdoor venues.

- Change of venue -
    - Students with learning disabilities have been found to gain confidence, learn well and become more settled through working in the outdoor environment.
- Interactive learning -
    - Uniquely, outdoor learning environments require active participation and engagement. Hands-on learning has been proven beneficial to students with learning disabilities.

- Visual or hearing impaired -
    - Plan a sensory garden addressing all five traditional sensory modes: sight, smell, touch, taste, and sound using paths that are paved with slip resistant material. The path should be smooth, level, and firm.
    - Ensure that paths have clear beginnings and endings.
    - Include wind chimes, water fountains, and other objects that create sounds and vibrations so students can orient themselves easily. A well-designed garden will stimulate all the senses.
    - The garden should provide a journey of colors, textures, sounds, and aromas to arouse the students. Raised planting beds or ponds provide experiences for all students, especially those students with physical disabilities.

Facilitating the Design of the Courtyard

It is helpful to form a committee whose function is to determine the use and purpose of the courtyard. For new construction, typically, a building advisory committee is in place and the courtyard committee could be a subset of that group. For a renovation or revitalization project, a separate committee could spearhead the design of the courtyard. In this particular example, most of the criteria pertain to new construction but can be modified in the process of designing an existing courtyard. **Permission should always be gained from the principal, the superintendent and/or the Board of Education prior to beginning a project within the school's boundaries.**

- The product will be a courtyard in a new building or the revitalization of an old one – an open air space surrounded by walls on at least three sides. The committee has some input in the orientation and size of the courtyard.
- Committee Goal 1: Decide the age range of the users.
    - Consider the best curriculum integration potential for the age of the students.
- Committee Goal 2: Decide the predominant use/subject focus.
    - Hold a brainstorming session to discuss specific activities that could happen in the courtyard. Should the courtyard be more of a free-form play area, designated stations for learning, or have large open spaces for class gatherings?
    - Have a design charette, a focused, sustained activity with a professional planner or architect and all the committee members. Allow at least two hours to discuss and draw up the options.

Suggested Committee Members

Students
Architect
Landscape Architect
Civil Engineer
Teachers, especially those who interact with the predominant use/subject focus
School Administrators
School System ADA Coordinator
Community members
Building and Maintenance Staff
Parents
Community Park and Recreation staff
Other experts as required by the predominant use/subject focus

Goals for the initial meeting should include:

- involving all committee members;
- deciding the focus of the courtyard, curriculum tie-ins and age range of the student-users;
- reviewing data such as building plans, underground utility locations, sun path studies, etc;
- discussing the most important idea the courtyard can impart to the students;
- discussing what features should be added to reinforce the main idea;
- deciding whether the courtyard be “soft”, “hard”, or a mix of the two;
- discussing maintenance and the cost of up-keep and the source of the finances for up-keep; and
- discussing who is responsible for maintenance and plant/material replacement.

Goals for subsequent meetings should include:

- clarifying the focus;
- discussing orientation in terms of the path of the sun, amount of sun; and
- discussing the time of day for use and the amount of shade desired.

Chapter 3 – Uses and Purposes of Courtyards

What is the function of a courtyard?
Why would you want a courtyard?

The following options characterize the elements of courtyards that can be beneficial for students in an educational environment.

- Views and Scenery
- Sensory Stimulation
- Exploration and Adventure
- Organizing and Way-Finding
- Play and Meet Others
- Education
- Gardening
- Special Purpose

Valdelaparra Nursery School
Alcobendas, Spain

School Garden
Courtesy Lisa Gonzalez
University of Maryland Extension

"With loose parts of natural objects and materials to play with, it is almost impossible for a child to feel bored."
- R. C. Moore & H. C. Wong
"Natural Learning"

Views and Scenery

Courtyards can provide a restful green to view or look out on -- for comfort, for relaxation, for contemplation, and for viewing nature.

Bel Pre Elementary School
Montgomery County Public Schools

William Hall Elementary School
Prince George's County Public Schools

The students and teachers in the rooms surrounding the courtyard are provided views and perspectives to the outside. Reading and writing require a short focal length for a student's eyes. The change of focal length from short to long (glancing out the window) allows a rest for the eyes. "It is important to remember that views are 'two-way' – those into the school grounds being as relevant as those from them." (Billmore, B., Brooke, J., Rupert, B., Funnell, K., & Bubb, M., 1999, p.15)

These views are valuable purely for their beauty; from green, natural settings to winter weather watching to landscaped decorative courtyards…

Walt Whitman High School
Montgomery County Public Schools

White River High School
Buckley, Washington

Seasonal effects can be studied easily in courtyards.

Spring Ridge Middle School
St. Mary's County Public Schools

…to ponds…

Roy Lee Walker Elementary School
McKinney, Texas

Chevy Chase Elementary School
Montgomery County Public Schools

Judith A. Resnik Elementary School
Montgomery County Public Schools

Zhangde Primary School
Singapore

… to fountains.

Sensory Stimulation

The environment in a courtyard can awaken sensory perceptions that stimulate awareness of the natural surroundings. Nature itself provides stimuli for all the senses. Sensory stimulation is crucial to the maturity and growth of children. It is imperative for children's senses be fully developed not only through the experience of touch, but also through the visual, olfactory, auditory, and kinesthetic senses. Often just being in natural settings contributes to a child's growth in many ways. **Children need nature for the healthy development of the senses, and therefore, for learning and creativity.** (Louv, R. 2009, p. 54).

Varieties of trees & shrubs
Visual, olfactory stimuli

Bel Pre Elementary School
Montgomery County Public Schools

"He who plants a tree plants hope."
- Lucy Larcom
poet

Musical instruments interwoven with the greenery

William S. Baer School
Baltimore City Public Schools

Courtyards can be designed for auditory and olfactory stimulation, pleasure, and awareness. When designing a courtyard, consider fragrance or pungent smells from plants; predominant wind directions and different textures and colors that complement or contrast to emphasize unique characteristics. Consider the sound the wind may make passing through or by different materials, plants, and trees, or design musical instruments with inventive materials. Creative parents, teachers, and students can make instruments! Alternatively, outdoor musical instruments made of galvanized steel, aluminum, polymer lumber, or PVC pipe can now be bought from commercial vendors.

William S. Baer School
Baltimore City Public Schools

Rock Garden
Tactile, visual stimuli

Bel Pre Elementary School
Montgomery County Public Schools

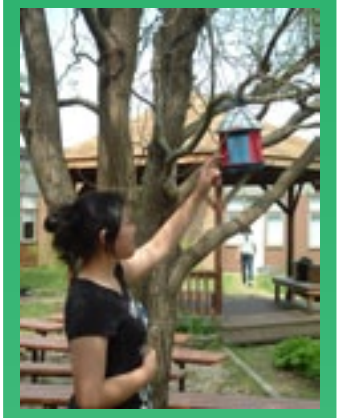
Exploration and Adventure

Courtyards can be designed for exploratory purposes by having curving paths, multiple levels of platforms, or a variety of different graded levels to gain various perspectives. Multiple samples of flora and fauna may also be used. Building structures made of "cob" – a mixture of straw, sand, water, and clay can create exciting spaces to play creatively. Paths arranged in challenging patterns add to the excitement of being in another type of environment. This type of play feeds the imagination. Ordinary objects can become special by changing their scale. To provide another perspective on the world, provide slightly elevated walkways.

Student-made mosaic art adds to the sense of belonging and pride for the students.

Davidsonville Elementary School
Anne Arundel County Public Schools

Buffalo PS90
Courtesy KC Kratt Photography



Spring Ridge Middle School
St. Mary's County Public Schools

Labyrinth at Enchanted Woods

Grass Tunnel

Winterthur Museum, Winterthur, Delaware

Handmade cob structure

Lucy School
Middletown, Maryland

Bird's Nest play house at Enchanted Woods

Winterthur Museum, Winterthur, Delaware

Organizing and Way-finding

Courtyards can be designed to provide sensory cues, focal points or nodes for gathering. Emphasis can be placed on certain areas of the school by designing tree-lined paths or promenades that connect these special areas. Using the same species of a tree or plant can highlight a certain area as a focal point in the courtyard. Sensory cues such as fragrant plants and flowers can guide students along a path. These focal points, nodes and sensory cues help students to orient and find their way around a school building.

Views out to the courtyard from within the school can help orient the students within the building. Focal points within the courtyard can be seen from different corridors or classrooms, thereby providing a sense of location for the students. Awareness of daylighting and sun orientation with visual reminders encourages a sense of security due to familiarity within the building. Sculptures and eye-catching planters may give visual cues as to one's location.

Baltimore City College
Baltimore City Public Schools

Aberdeen High School
Harford County Public Schools
Design and Image by Grimm and Parker Architects

Davidsonville Elementary School
Anne Arundel County Public Schools

Lawrence High School
Lawrence, Massachusetts

Play and Meet Others

Courtyards can provide **a secure play area for kindergarten and primary grades or a gathering space for pre-teens and teens. Courtyards** designed as a play area for early childhood classes can **provide a secure exploration and imaginative-play area.** In early learning and primary settings, the courtyard becomes an extension of the indoor classroom.

Paschalisschool Elementary School & Child Daycare
The Hague

Bombeck Family Learning Center
Dayton, Ohio

The courtyard is also a protected space for children engaging in large-motor skills. In sheltered spaces, provide water features (similar to the aluminum, slanted water channels at the Maryland Science Center's Kids Room), a small stage with seating for performing arts, and a sheltered art studio for pottery or other media.

Evergreen Elementary School
St. Mary's County Public Schools

One key to a successful "play" courtyard is the choice of rooms around the perimeter. Suitable choices are corridors, faculty lounges and workrooms, or group toilet rooms. Even rooms such as art or music can successfully have windows into the courtyard and not compromise the learning going on inside the classroom. Providing a meeting space like the one shown below at The Lucy School, a private school in Frederick County, Maryland offers a great incentive to gather, read, draw, and discuss. Almost anything may be used for seating. Large stones and logs lend to the natural theme of the seating area.

Lucy School
Middletown, Maryland

Bel Pre Elementary School
Montgomery County Public Schools

Tajimi Junior High School
Japan

Hachoresh Elementary School
Israel

Seating can be provided with umbrellas or just left out in the open. Shade is an important component for a successful "play" courtyard, whether natural or man-made.

Plan of Tajimi Junior High School
Japan

Easton High School
Talbot County Public Schools

Calvert Middle School
Calvert County Public Schools
Courtesy of Jillian Storms

Walt Whitman High School
Montgomery County Public Schools

A concrete amphitheater can provide an environment for many activities – gathering, reading, theater activities or an outdoor classroom.

New Biloxi High School
Biloxi, Mississippi

Curriculum Support

Courtyards may be designed **as an environment for teaching.** They can provide a change of pace from teaching inside the school building. Learning outside can support certain curricular subjects such as science and art. A courtyard can also provide a different environment to support a specific curriculum such as a courtyard for a culinary arts program. At Easton High School, the culinary classroom faces onto the courtyard with a door for ease of going in and out of the courtyard. During nice weather, food is prepared in the culinary kitchen and "waiters" bring lunch out to staff seated in the courtyard. Seating areas can be created on a patio of concrete, brick or stone. This area also provides a dining space for students to serve and entertain guests of the program while honing their skills. Well-placed trees offer shade. Benches, seats, amphitheater seating, and tables can be provided to make the environment more conducive to learning, writing notes, making drawings, and doing assignments. See photos below.

One of Easton High School's courtyards in Talbot County serves as an outdoor eating area where the culinary students prepare and serve lunches for staff and dinners for special occasions.

Easton High School
Talbot County Public Schools

This bridge crosses the pond providing easy access.

The reading boat is right outside the media center for ease of supervision.

Mattapeake Elementary School
Queen Anne's County Public Schools

Consider providing an amphitheater to act as a special teaching space. Dispersed seating areas throughout the courtyard allow a single class to go out and read or work on projects in smaller groups.

William Hall Elementary School
Prince George's County Public Schools

Montessori School
Sindlingen, Germany
Courtesy of Rolf Grafwallner

Learning can come easily from experiencing nature. In the above photo of the Montessori School, the stone retaining wall creates raised beds. The trellis on the left allows vines to grow. A tree trunk seat is provided.

This patio, partially shaded by the building overhang, can provide extra learning space outside. Art, reading, and just enjoying nature can be experienced from this area. Notice the grass right outside the patio for free play.

Montessori School of Maui
Maui, Hawaii

Mathematics is another subject that lends itself very easily to exploration in the out-of-doors. Trees, flowers, and other plants can be studied in terms of their proportions, species comparisons, counting, and applying percentages and fractions. Studies of natural objects in regards to the Fibonacci numbers and the golden spiral are popular. Observation and collection of shapes and patterns also encourage practice with geometry. A courtyard also provides endless opportunities to experience measuring, estimating, and approximating.

Gardening

Gardening can help to develop a sense of respect for the natural world. Courtyards may be designed to teach about the living environment – trees, plants, ponds, and creatures. This type of courtyard arouses curiosity, astonishment, surprise, admiration, and respect for the natural environment.

Davidsonville Elementary School
Anne Arundel County Public Schools

Gardening is an easy way to use a courtyard, whether it be through tabletop salad planters or raised beds. Fostering a sense of ownership and care for the environment can be established by having students invest time in the planning, planting and maintenance of a garden. Students and their parents can sign up for a day of weeding, watering, and harvesting over the summer months. Intrigue and curiosity may be raised by using signage to provide specific plant information or to show pride and ownership.

Davidsonville Elementary School
Anne Arundel County Public Schools

Sample Planting Schedule for a Schoolyard Garden: Planting for Harvest During the Schoolyear

by Chrissa Carlson

SPRING GARDEN

Early March

- Start transplants indoors of:

  broccoli
  brussel sprouts
  cabbage
  cauliflower
  collards
  head lettuce

Mid March

- Transplant cabbage outdoors
- Direct seed into garden beds or outdoor containers:

  leaf lettuce
  sweet peas
  radishes
  spinach
  turnips

Early April

- Transplant remaining starts into garden beds or outdoor containers (broccoli, brussel sprouts, cauliflower, collards, head lettuce)
- Direct seed into garden beds or outdoor containers:

  beets
  carrots
  chard
  kale
  mustards
  parsley
  parsnips
  more leaf lettuce
  more peas
  more radishes
  more spinach

Students planting native plants

Folger McKinsey Elementary School
Anne Arundel County Public Schools

Students planting; Senses at work: Olfactory, Kinesthetic, and Visual

The advantages of using raised planting beds

- Raised beds can also be used to avoid the issue of gardening in poor soil.
- Raised beds warm more quickly in spring, allowing you to work the soil and plant earlier.
- Raised beds drain better.

One type of raised planting beds

Easton High School
Talbot County Public Schools

Planting Pod

Judith A. Resnik Elementary School
Montgomery County Public Schools

Raised garden beds

Lucy School
Middletown, Maryland

- The soil in raised beds doesn't get compacted through foot traffic. They are constructed with accessibility in mind.
- It's easy to tailor the soil for your raised bed to the plants you plan to grow there.
- After the initial construction process, raised beds require less maintenance than conventional garden beds.

Another idea for gardening outdoors is the use of a tabletop arrangement. According to the University of Maryland Extension College of Agriculture and Natural Resources website cited in Appendix C "the University of Maryland Salad Table™ is essentially a shallow wooden frame with a large surface area and a mesh bottom that allows water to drain. You can attach legs

SPRING GARDEN
continued

May

- Harvest as plants become ready, may plant another crop of lettuce if desired

June

- Harvest all spring crops, hold a salad party!
- Plant sweet potatoes to harvest in the fall (be sure to water well to get them established before school ends)
- Put remaining beds to rest for the summer (mulch or cover crop)

FALL GARDEN

End of August

- Harvest sweet potatoes
- Transplant fall cropts into outdoor beds or containers:

  broccoli
  head lettuce

- Direct seed into garden beds or outdoor containers:

  kale
  leaf lettuce
  turnips

September-October

- Harvest as plants become ready

Mid-late October

- Plant garlic!
- Put gardens to bed (mulch, cover crop)

of any length you desire or set it on sawhorses or other supports. It is portable, versatile, easy and inexpensive to build, and terrific for gardeners of all ages, sizes, and abilities. The Salad Table™ can be moved to capture sunlight in spring and fall and avoid the sun and high heat of summer. Best of all, you can garden comfortably at waist level and avoid problems with rabbits and groundhogs." Links to directions for constructing a salad table are listed under web resources.

The Salad Table™

Courtesy of University of Maryland Extension
College of Agriculture and Natural Resources website

Good resources for planning a garden and integrating nutrition education are made available through Johns Hopkins for a Livable Future; University of Maryland Extension, College of Agriculture and Natural Resources; Johns Hopkins Bloomberg School of Public Health; National Gardening Association; the Maryland Department of Agriculture; and the United States Department of Agriculture.

Suitland Elementary School
Prince George's County Public Schools

Sustainable living practices can be integrated into the curriculum by providing rainwater cisterns. The runoff from roof drain pipes can be used for watering the gardens!

A tilled garden plot and a shaded study space

Chevy Chase Elementary School
Montgomery County Public Schools

"What is a weed? A plant whose virtues have not yet been discovered."
- Ralph Waldo Emerson
author

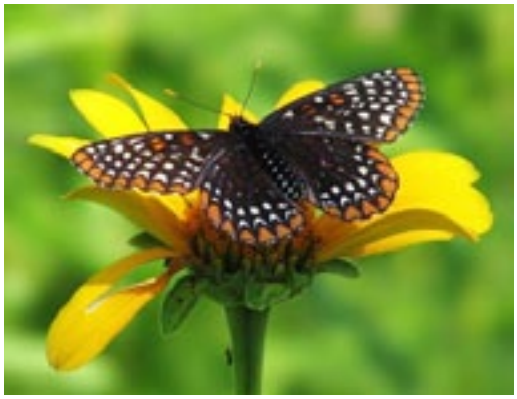
Other types of gardens are a butterfly/insect garden, an herb garden, a berry patch, or a sensory garden including plants that are selected for their aromatic, textural, visual, and edible qualities.

"Teaching children about the natural world should be seen as one of the most important events in their lives."
- Thomas Berry
"The Dream of the Earth"

Courtesy of Nature Conservancy

Berry patch

Butterflies and Butterfly gardens



Herb gardens

There was a child went forth everyday,

And the first object he look'ed upon, that object he became.

And that object became part of him for the day or a certain part of the day, Or for many years or stretching cycles of years.

- Walt Whitman
poet

"The goal of life is living in agreement with Nature."

- Zeno
Greek philosopher

Chapter 4 - Courtyard Themes

Courtyards provide a versatile setting for many curriculum connections. The following themes may provide ideas about the purpose and focus for your courtyard. The diagrams and text on pages 70-73 are courtesy of the book *Designing Outdoor Environments for Children* (Tai, L., Haque, M., McLellan, G., and Knight. E., 2006). Children's gardens can be designed to be any size, shape, or theme. As you read about these various gardens take note of the many theme gardens that make a space special. Below is a chart listing a range of ideas for theme gardens. Elaborate on this list by asking your children or classes about their interests, background and hobbies, and work with them to design their own theme garden.

Pizza garden	Wildlife habitat garden	Herb garden	Fall garden	Bee hive garden	Moonlight garden
Cut flower garden	Ethnobotany garden	Container garden	Winter garden	Xeriscape Garden	Annual garden
Rainbow garden	Memorial garden	Rooftop garden	Alpine garden	Carolina Fence garden	White garden
Storybook garden	Edible garden	Plants for pets garden	Bog garden	Organic garden	Artist's garden
Water garden	Heritage garden	Plants for crafts garden	Vegetable garden	Wetland garden	Sculpture garden
Bird garden	Tea garden	Spring garden	Rainbow garden	Rain garden	Vertical garden
Butterfly garden	Ethnic garden	Summer garden	Native plant garden	Desert garden	Sunken garden

Courtesy of Designing Outdoor Environments for Children, p. 96

Develop your child's idea for a theme garden by asking them to research the topic. They will discover interesting facts about plants, fascinating folklore, and relationships between plants, animals, and mankind as they pursue a theme.

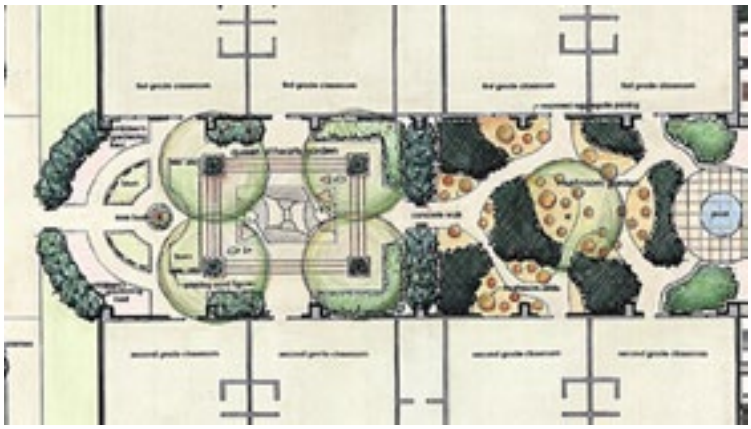
A series of theme gardens can insure peaks of interest throughout the year. For example, a Garden for the Seasons might have distinct sub gardens that feature spring flowers, summer vegetables, fall fruit, and winter form. A wildlife habitat garden can be designed to attract hummingbirds in the summer and chickadees in the winter.

Literature and Reading

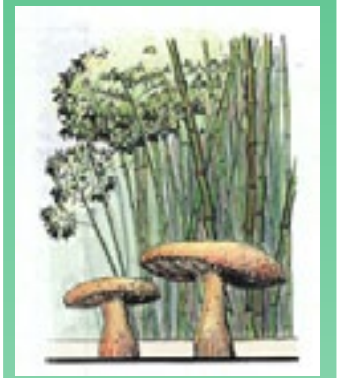
Literature inspired courtyards are courtyards which are designed to recreate the atmosphere and environment of a novel or book that the children read at a certain age level. These can also be designed as a comfortable place to read.

"Storybook designs are a powerful way to connect landscape spaces to literature. Children love to read storybooks and then design gardens featuring elements from the story. The American Horticultural Society (AHS) partnered with the Junior Master Gardener program in 2005 to create the 'Growing Good Kids – Excellence in Children's Literature' award program. Honoring outstanding children's gardening and nature books, the award recognizes books that are exceptionally effective at helping children understand and appreciate gardening and the natural environment. Themed books published during the last 100 years were evaluated by a selection committee consisting of both children and adults to identify a one-time 'Classics' category. The forty books receiving this distinction can be found with a synopsis on the AHS website at: http://www.k2demo.com/jmg/index.k2?did=11777&sectionID=10398 "
(Tai, et al., 2006)

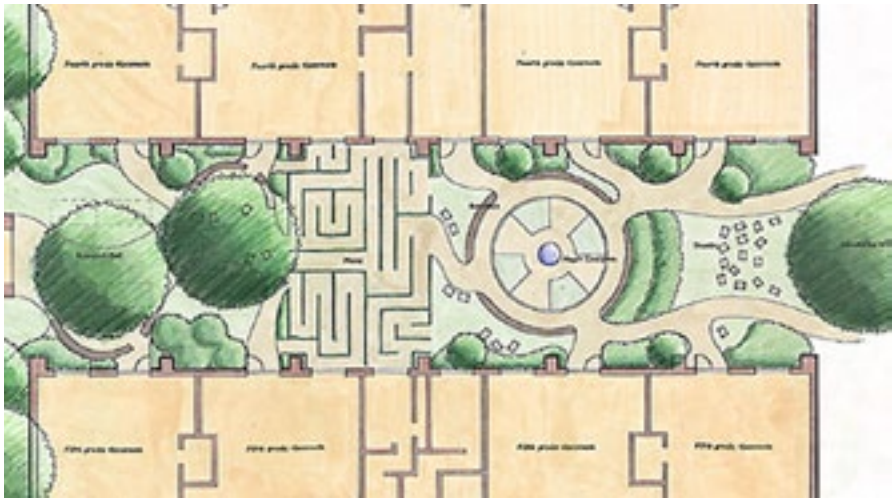
The Peter Rabbit Garden



The Alice in Wonderland Garden



Mushroom Seating

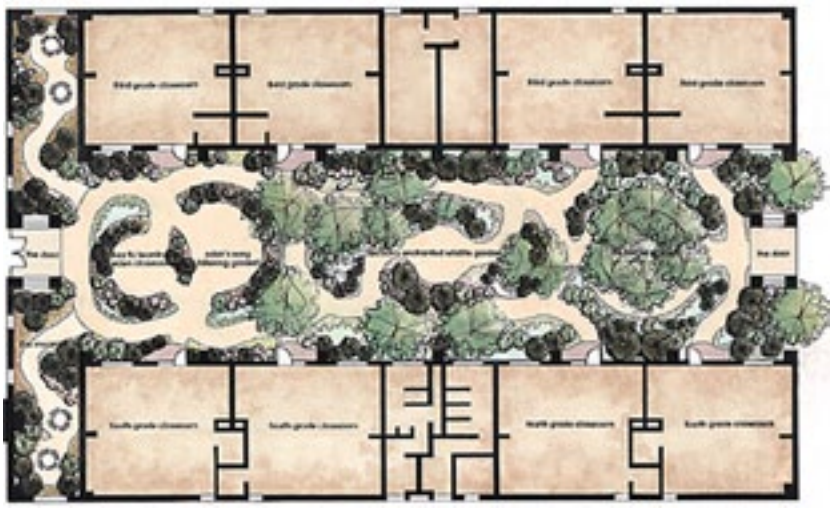


The Harry Potter series books were used for inspiration in designing this courtyard with the help of the fourth and fifth graders. (Tai, et al., 2006)

Plan of Harry Potter Garden

Clemson Elementary School
Clemson, South Carolina

"When designs for a new elementary school were being drawn up in Clemson, South Carolina, four courtyards were selected to become storybook gardens. The school librarian, teachers, and parents worked with the children to select their favorite story with a strong outdoor theme. They then invited Clemson University landscape architecture students to assist with the development of designs…" Two of the storybook gardens are shown on these pages. (Tai, et al., 2006)



The *Secret Garden* (Burnett, F. H., 1987) inspired this courtyard chosen by the third and fourth grade students at Clemson Elementary School. The themes of discovery, growing, healing, and magic from the story are interpreted into the major garden areas in the courtyard.

Plan of the Secret Garden

Clemson Elementary School
Clemson, South Carolina

Pizza garden, part of the Harry Potter Garden

Clemson Elementary School
Clemson, South Carolina

Many theme gardens revolve around food. Pizza gardens are popular with children, and they provide opportunities for children to grow their own pizza toppings in a garden shaped like a pizza pie. Tomatoes, onions, peppers, parsley, oregano, garlic, and basil are all easy to grow and fun to harvest from triangular shaped beds.

Sketch of the walled garden in the Secret Garden

Clemson Elementary School
Clemson, South Carolina

The Secret Garden theme was chosen by the third and fourth graders. The design incorporates storybook elements including: 1) the hidden garden door, 2) an area representing the moor with native grasses and wildflowers, 3) Dickon's enchanted wildlife garden with plants to attract birds and butterflies, 4) The secret garden with footprint impressions of the special robin in the pavement. The footprints lead to an impression of the key, so children can discover the key to the gate. Full of spring bulbs, this garden is designed to inspire Dickon's love of nature in school children.

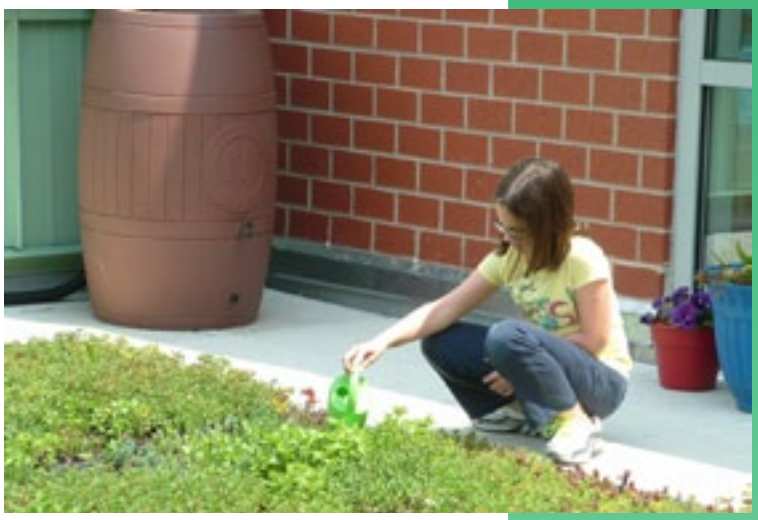
Hollywood Elementary School
St. Mary's Public Schools

Science

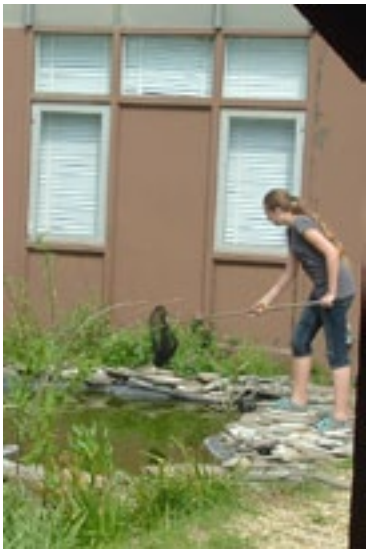
Science-oriented courtyards can be designed to foster interest in the growth of the natural habitat. Establishing a butterfly community by planting butterfly bushes, building birdhouses for specific native bird species and planting native species are several ways to utilize a courtyard effectively. Flower gardens and/or vegetable gardens can be prepared, designed and planted by the students. Learning comes through direct observation and documentation. Valuable first hand experiences help children gain real world knowledge through experiments conducted right at the site.

College Gardens Elementary School
Montgomery County Public Schools

Spring Ridge Middle School
St. Mary's County Public Schools



Evergreen Elementary School
St. Mary's County Public Schools



Spring Ridge Middle School
St. Mary's County Public Schools

Evergreen Elementary School
St. Mary's County Public Schools

At Evergreen Elementary School in Maryland, a green roof with various native plants allows for easy access for the students through the second floor science classroom. Cisterns collect water from the upper library roof for gardening. A wind turbine is also mounted on the second floor. It generates power that can be monitored within the science classroom. Solar panels are also mounted on the roof of the library to generate more energy.

Courtyards can provide a habitat for many creatures, including Beardey – the Bearded Dragon that lives part of the school day out in the enclosed courtyard. Classes come to visit him and watch his movements through the courtyard.

Hollywood Elementary School
St. Mary's County Public Schools

School gardens

Courtesy of Lisa Gonzalez
University of Maryland Extension

Yu Neng Primary School
Singapore

Children love water because water offers a sensory experience like no other element – natural or man-made. It provides a tactile sensation for hands to splash and swirl in. Visually, the rhythm and the motion of water are mesmerizing and the sound of rushing water brings a soothing feeling.

Have you ever stroked a velvety Lamb's ear? Sniffed a spicy Pink? Heard the clatter of Golden-rain tree pods in the wind?

-Robin C. Moore
Plants for Play

Lucy School
Middletown, Maryland

Judith A. Resnik Elementary School
Montgomery County Public Schools

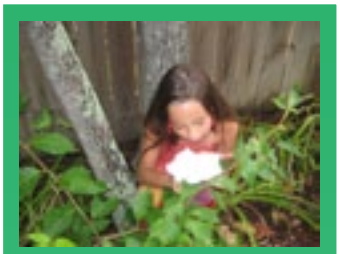
Water sources or ponds are an age-old element of courtyards and can provide a rich introduction to aquatic life and plants. The design of the pond can include small waterfalls, miniature rivers and differing depths as exemplified by the stone pond at the Lucy School shown above. Ponds offer a rich resource to study science. The experiences that may be found in a small pond can be phenomenal. Millions of organisms can be found in a cup filled with pond water. Children can learn about animals that live in the water and what part they play in the ecosystem.

Easton High School
Talbot County Public Schools

Bel Pre Elementary School
Montgomery County Public Schools

Weather stations and sundials can contribute to studying weather, seasons and time. The courtyard itself can be used as a time-clock – documenting the path of the shadows across the south facing wall through different seasons. Another type of science related activity can occur in the courtyard with a sun oven. Utilizing the sun's rays and the reflective properties of the oven flaps, items can be cooked outside without using electricity or any fuel source other than the sun! Below is an example of a sun oven utilized at Lucy School.

Art, Design and Drama



The courtyard can feature art created by the students or can be a place for making art. The courtyard can be arranged for students to sketch, draw, or paint. Art gifts from graduating classes can also be displayed leaving a legacy of their time at the school.

Easton High School
Talbot County Public Schools

Davidsonville Elementary School
Anne Arundel County Public Schools

Davidsonville Elementary School
Anne Arundel County Public Schools

Mosaic wall murals were designed and installed by the students with help from an artist in residence.

Hollywood Elementary School
St. Mary's County Public Schools

Outdoor amphitheaters or sloping bermed seating areas can be provided to act not only as a class gathering space, but also as a performance stage area.

Canberra Primary School
Singapore

Yoch-de-He Preparatory School
Brooks, California

A retractable canvas sunscreen provides cover and defines the "theater" for the performing arts curriculum.

This scored concrete pad area allows a simple space for self expression and creativity.

Judith A. Resnik Elementary School
Montgomery County Public Schools

Special Purpose Courtyards

Career and Technology

Easton High School
Talbot County Public Schools

This courtyard supports the culinary arts program at a high school on the Eastern Shore in Maryland by providing a space for the students to prepare and serve meals for special occasions, or for staff lunches. In good weather, it is used for evening events, special weekend occasions and during school day lunches.

Davidsonville Elementary School
Anne Arundel County Public Schools

Memorial courtyards

These courtyards provide pleasant places to remember an individual or acknowledge a contributor. Donor bricks can be engraved with family names. Trees and plants can be planted to honor a loved one, a special teacher or a special fellow student.

Chapter 5 – The Use of the Courtyard

Facilitating the Use of the Courtyard

The following are suggestions to more easily integrate the use of the courtyard into everyday school life:

- Provide a guide to the courtyard. The guide can list what items are within the courtyard, art work and a map showing the layout. ***(See Appendix B for maps of gardens)***
- Provide staff development training on the what's, how's and why's in the courtyard. This is a key activity to help familiarize the staff with all attributes of the courtyard. This diminishes staff hesitancy to use the space and provide motivation and ideas to augment the curriculum.
- Consider providing a faucet outside to facilitate watering plants and wash-up. A hard surface such as a concrete slab at the faucet prevents muddy situations.
- Consider the following nine paired dimensions as tools to consider what to include in outside play environments: (Stine, S., 1997, pp. 24-40)

Accessible/Inaccessible

- Promote independence and participation through the accessibility of materials. Raised plant beds or a raised pond may be more easily accessible to children of all ages and invite global use.
- Regulate activities and choices by physical distance or placement. For example, a small mound or a bridge to climb or a deck to be under invite exploration of different types of areas and from different viewpoints.

Active/Passive

- Provide different environments to allow children to decide whether they want to engage in vigorous activity or quiet contemplation.
- Larger, open spaces promote movement while smaller spaces lead to a more quiet activity.

Challenge/Risk and Repetition/Security

- Provide environments designed to allow for varied physical abilities. This allows for the exploration and testing of physical skills.
- Provide environments that allow risk-taking and challenges. Personal competence, confidence and limitations are learned.
- Environments that support repetition allow for a child to build competence through eliminating the challenge by acquiring the skill.
- Predictable security allows risk-taking within the limits of safety to build self-confidence.

Hard/Soft

- Provide exploration through a variety of textures, surfaces – mud, grass, water, concrete, stones, etc.

Natural/People-Built

- Expose children to growing plants and animals to reinforce life processes; allow for pieces and parts of built objects to be dismantled and re-assembled to provide exploration and processing activities.

William W. Hall Academy
Prince George's County
Public Schools

Buffalo PS-90
Courtesy of KC Kratt
Photography

Joseph Hess Elementary
School
Hammond, Indiana

Davidsonville Elementary School
Anne Arundel Public Schools

Open/Closed

- Provide for open-ended activities that lack a particular goal or defined end product, allowing children to make their own choices from a variety of alternatives. Exploration and discovery are learned.
- Also provide for close-ended activities that provide feedback such as ball games with rules. The activity demonstrates whether the child has successfully completed, correctly solved or produced a product. Accomplishment and closure are learned.

Permanence/Change

- Design landmarks to convey permanence and a special place. Way-finding is important to developing minds and healthy independence.
- Provide opportunities for change within the courtyard to allow experimentation to augment growth and creative problem solving.

Private/Public

- Provide different areas within the courtyard that promote solitude as well as social activity. Identity and security are strongly linked to a child's ability to preserve their own privacy.
- Providing group activity space helps children understand their place as individuals within the whole.

Simple/Complex

- Provide areas within the courtyard that have one obvious use – a simple environment. A bench for reading or tables for drawing may be provided.
- Provide an area within the courtyard that allows for manipulation or for a child to change the environment – a complex environment. Flower gardens are one example that allow the child to interact with the nature by planting, weeding, tilling, etc.

Facilitating the Use of the Courtyard with Controversial Design Elements

Each item placed in the courtyard has both pros and cons. Some of these items are more controversial than others. Listed on page 88, are some of the more common "troublesome" elements with a general suggestion on possible solutions.

CompoSpin 50 gallon by CompostBins.com

Hollywood Elementary School
St. Mary's County Public Schools

Courtesy of USDA School Garden

"To exist as a nation, to prosper as a state, and to live as a people, we must have trees."
- Theodore Roosevelt
president

Sensitive Topics
Recommendations /Solutions

Item	Pros	Cons	Solution
Ponds	Great resource, Versatile	Potential drowning Attracting mosquitoes	Provide a raised pond Fish or frogs control insects
Maintenance	Provides longevity of materials, protects investment	Time-consuming, costly, not an easy job, should not be imposed on school building supervisors and custodial staff	Engage a volunteer group, a local landscaping business, a parent/teacher association or arrange an agreement with the local recreation and park program. Creating an environmental club is another option.
Maintenance costs	Necessary evil	Often considered in hind-sight	Consider the investment of time and money needed to maintain the courtyard during the design phase
Pressure treated wood building materials ; old railroad ties (Chromated copper arsenate)*	Easily obtained	Contains hazardous chemicals and compounds	Substitute with painted wood, cedar, redwood, wood/recycled materials composite, High Density Polyethylene (HDPE), rubber lumber or virgin vinyl products
Composting	A sustainable habit to learn, good science lesson	Can draw the attention of un-wanted creatures – rodents, etc.	Recommended distance to compost - 50'-0" or more from the school; or purchase a self-contained composter, see photos below.
Flowers and Plants	Provide aromatic and visual stimulation	Attracting bees	Locate flowering plants away from operable windows.
Bees	Pollinators	Some children may be allergic	Locate flowering plants away from operable windows.
Brush Piles	Provides habitat for small animals such as rabbits.	Tempting to pranksters to build a fire	
Trees	Provide shade, host to many insects including butterflies & moths. Trees also provide play items – pine cones, leaves, etc.	Planted too closely to the building root structures may damage foundations; roots may also interfere with pavers, concrete, any walking surface.	Carefully design tree locations – should be a minimum of 10'-15' away from buildings. Large rooted trees should be planted away from walks.
Gardens	Cycle of life experience. Fosters pride and accomplishment	Possibility of rodents	Maintain a clean environment, use self-contained composers or compost at least 50' away from the school.

*Pressure treated wood was often used in creating edging, play structures and box planting. This type of wood product was treated with Chromated Copper Arsenate (CCA) and contained arsenic, a known carcinogen. CCA has been demonstrated to continue to leach into the surrounding soil for years after installation. This material may get on children's hands, and could be ingested by the child putting their hands into their mouth. CCA could also leach into the ground producing another source of contamination – the soil.

For existing installations with wood products with CCA, these products can be successfully treated, painted or sealed to prevent the chemicals from leaching out of the wood. The Maryland Department of the Environment cautions the use of pressure treated wood and emphasizes appropriate safety precautions and proper handling. Restrictions do apply in Maryland in terms of CCA contact with waterways.

Proper handling techniques are washing hands thoroughly after touching, especially prior to eating and drinking and always ensuring that food does not come into direct contact with any treated wood. CCA treated wood should never be burned. Wear goggles and a dust mask when cutting and sawing. Do not use this material for mulch and do not use it where it may come into direct contact with drinking water.

The Environmental Protection Agency (EPA) does not believe there is any reason to remove or replace CCA-treated structures including decks and playground equipment. The EPA is not recommending surrounding soils be removed or replaced.

The industry agreed to stop using this chemical as a treatment for wood as of December 2003. **There are several other arsenic-free wood pressure treatment alternatives to CCA.** Substitutes include painted wood, cedar, redwood, wood/recycled materials composite, High Density Polyethylene (HDPE), rubber lumber or virgin vinyl products.

Tumbleweed Composter

Self contained composters; children "roll" the ball (seen on page 87) or turn the canister to activate composting and introduce air into the container.

Outcomes and Effects

Increased use of the courtyard as an architectural feature may:

- expose more children to nature;
- bring more light into more school rooms;
- heighten awareness of the beauty and delicate balance nature plays in man's existence;
- encourage more children to take an interest in the state of the environment as adults;
- enhance character development and leadership;
- improve children's attitudes toward school and learning;
- provide a space to exercise in a secure, carefree zone; and
- experience a more flexible cross curricular atmosphere for learning.

Courtesy of Sheri D. Thomas

These are but a few of the many appealing outcomes generated by a simple integration of an educational outlook with a design element.

LEED 2009 for Schools New Construction and Major Renovations Project Checklist

Sustainable Sites - 24 Possible Points

Prerequisite 1	Construction Activity Pollution Prevention	Required
Prerequisite 2	Environmental Site Assessment	Required
Credit 1	Site Selection	1
Credit 2	Development Density and Community Connectivity	4
Credit 3	Brownfield Redevelopment	1
Credit 4.1	Alternative Transportation—Public Transportation Access	4
Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	2
Credit 4.4	Alternative Transportation—Parking Capacity	2
Credit 5.1	Site Development—Protect or Restore Habitat	1
Credit 5.2	Site Development—Maximize Open Space	1
Credit 6.1	Stormwater Design—Quantity Control	1
Credit 6.2	Stormwater Design—Quality Control	1
Credit 7.1	Heat Island Effect—Nonroof	1
Credit 7.2	Heat Island Effect—Roof	1
Credit 8	Light Pollution Reduction	1
Credit 9	Site Master Plan	1
Credit 10	Joint Use of Facilities	1

Water Efficiency - 11 Possible Points

Prerequisite 1	Water Use Reduction	Required
Credit 1	Water Efficient Landscaping	2-4
Credit 2	Innovative Wastewater Technologies	2
Credit 3	Water Use Reduction	2-4
Credit 4	Process Water Use Reduction	1

Energy and Atmosphere - 33 Possible Points

Prerequisite 1	Fundamental Commissioning of Building Energy Systems	Required
Prerequisite 2	Minimum Energy Performance	Required
Prerequisite 3	Fundamental Refrigerant Management	Required
Credit 1	Optimize Energy Performance	1–19
Credit 2	On-site Renewable Energy	1–7
Credit 3	Enhanced Commissioning	2
Credit 4	Enhanced Refrigerant Management	1
Credit 5	Measurement and Verification	2
Credit 6	Green Power	2

Materials and Resources - 13 Possible Points

Prerequisite 1	Storage and Collection of Recyclables	Required
Credit 1.1	Building Reuse—Maintain Existing Walls, Floors and Roof	1-2
Credit 1.2	Building Reuse—Maintain Existing Interior Nonstructural Elements	1
Credit 2	Construction Waste Management	1-2
Credit 3	Materials Reuse	1-2
Credit 4	Recycled Content	1-2
Credit 5	Regional Materials	1-2
Credit 6	Rapidly Renewable Materials	1
Credit 7	Certified Wood	1

Indoor Environmental Quality - 19 Possible Points

Prerequisite 1	Minimum Indoor Air Quality Performance	Required
Prerequisite 2	Environmental Tobacco Smoke (ETS) Control	Required
Prerequisite 3	Minimum Acoustical Performance	Required
Credit 1	Outdoor Air Delivery Monitoring	1
Credit 2	Increased Ventilation	1
Credit 3.1	Construction Indoor Air Quality Management Plan—During Construction	1
Credit 3.2	Construction Indoor Air Quality Management Plan—Before Occupancy	1
Credit 4	Low-Emitting Materials	1-4
Credit 5	Indoor Chemical and Pollutant Source Control	1
Credit 6.1	Controllability of Systems—Lighting	1
Credit 6.2	Controllability of Systems—Thermal Comfort	1
Credit 7.1	Thermal Comfort—Design	1
Credit 7.2	Thermal Comfort—Verification	1
Credit 8.1	Daylight and Views—Daylight	1-3
Credit 8.2	Daylight and Views—Views	1
Credit 9	Enhanced Acoustical Performance	1
Credit 10	Mold Prevention	1

Innovation in Design - 6 Possible Points

Credit 1	Innovation in Design	1-4
Credit 2	LEED Accredited Professional	1
Credit 3	The School as a Teaching Tool	1

Regional Priority - 4 Possible Points

Credit 1	Regional Priority	1-4

LEED 2009 for Schools New Construction and Major Renovations

100 base points; 6 possible Innovation in Design and 4 Regional Priority points

Certified	**40–49 points**
Silver	**50–59 points**
Gold	**60–79 points**
Platinum	**80 points and above**

U.S. Fish and Wildlife Service - Schoolyard Habitat Project Guide
Building bird houses augments the math, english, science and art curriculum.

Bird House Specifications

Species	Preferred Habitat	Width (in)	Height (in)	Entrance Size (in)	Entrance Ht. Above Floor (in)	Height of House (ft)	Special Tips
Barn Owl	Open canopy woodlands or edges of bottom thick woodlots	22	18	10" sq.	centered	in building	2" of woodchips on bottom
Barred Owl	old growth, wetland forests	12	24	7	12	20-30	3" of woodchips on bottom a perch should be close but not blocking entrance
Brown-headed nuthatch	pine woodlands	4	10	1 ¼	7	10-25	outer material should be pine bark
White-breasted nuthatch	deciduous woodlands	4	10	1 ¼	7	6-25	outer material should be bark
Carolina wren	woodlands with thick underbrush	4	8	1 ½	1-6	6-10	house can be hung from limb or house eave
Carolina chickadee	all woodlands	4	8	1 1/8	6	4-10	place house in area with 1/2 sunlight
Common Flicker	all woodlands	7	24	2 ½	18	8-20	fill house tightly with sawdust, outer material should be bark
Downy woodpecker	all woodlands	4	10	1 ¼	7	8-25	fill house tightly with sawdust, outer material should be bark
Eastern bluebird	open fields and golf courses	5	9	1 ½	5	4-8	place house in open area facing and about 10' away from a bush or along a wire fence
Eastern screech owl	woodland edges	8	16	3	10	15-30	3" of woodchips on bottom
Great crested flycatcher	all woodlands	6	10	2	6	8-20	place house in shade
Hairy woodpecker	all woodlands	6	15	1 ½	10	12-25	fill house tightly with sawdust, outer material should be bark
Pileated woodpecker	old growth woodlands	11	24	4	18	20-30	2" thick boards, fill tightly with sawdust, outer material should be bark
Prothonotary warbler	swamps and along rivers	4	8	1 ¼	6	2-12	place house next to or over water
Purple martin	open fields, yards and golf courses	6	6	2 ½	1	10-20	must have several compartments, place house on pole at least 25' from trees, other tall structures
Red-bellied woodpecker	all woodlands	7	15	2	10	20-40	fill tightly with sawdust, outer material should be bark
Red-headed woodpecker	open canopy woodlands and edges	6	15	2	10	20-40	fill tightly with sawdust, outer material should be bark
Southeastern American kestrel	open areas and edges of woodlots	9	16	3	11	15-30	2" of woodchips on bottom
Tufted titmouse	all woodlands and edges	4	10	1 ¼	7	4-15	place house in shade
Wood duck or Hooded merganser	bottomland hardwoods and wetlands	10	24	4x3 horiz. oval	20	4-6 over water 15-25 over land	4" of woodchips on bottom 18"x3" strip of hardware cloth on inside below entrance

BUTTERFLY DRY-SUN

Scale: ½ inch = 1 foot

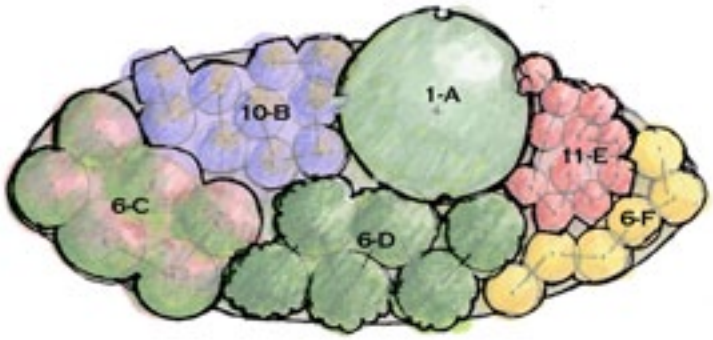
PLANT LIST

Symbol	Quantity	Size	Common Name	Latin Name
A	2	1-gallon	Joe-Pye Weed	Eupatorium dubium 'Little Joe'
B		seed	Fennel	Foeniculum vulgare
C		seed	Parsley	Petrselinum crispum
D	4	1-gallon	Beebalm	Monarda didyma
			OR Wild bergamot	Monarda bradburiana
E	3	1-gallon	New-England Aster	Aster novae-angliae
F	3	1-gallon	Threadleaf Coreopsis	Coreopsis verticillata
G	2	1-gallon	Black-eyed Susan	Rudbeckia hirta
H	3	1-gallon	Purple Coneflower	Echinacea purpurea
I		seed	Butterfly Weed	Asclepias tuberosa

Butterfly Gardens -

Montgomery County Public Schools

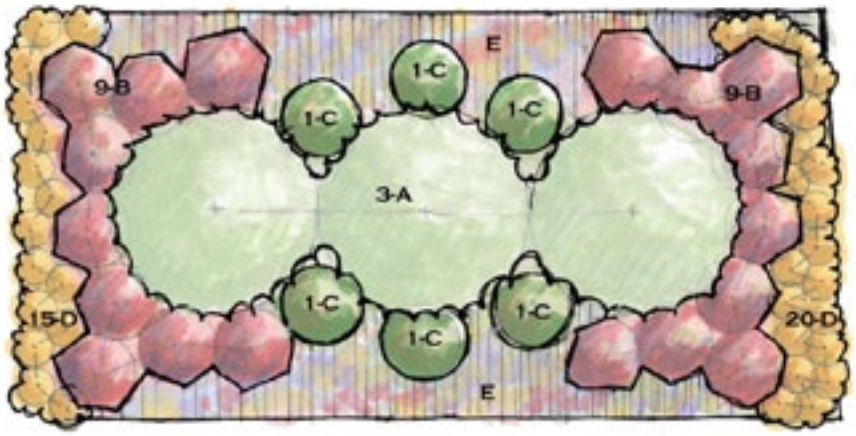
http://www.montgomeryschoolsmd.org/curriculum/outdoored/



PLANT CHOICE	DESIGN VALUE
A - *Chionanthus virginicus* (Fringe Tree) or *Viburnum nudum* (Wild Raisin)	Tallest/Structural element in garden (8-12')
B - *Aster novae-angliae* (New England Aster) 2'o.c. *	Medium coarse texture, white spring flowers, yellow fall color
C - *Vaccinum angustifolium* (Blueberry), 3' o.c.	Medium Tall perennial, billowing fall color (lavendar), butterflies
D - *Kalmia latifolia* (Mountain Laurel), 3' o.c.	Medium height (3-5'), year round color interest, fruit
E - *Iris versicolor* (Blueflag Iris), 12" o.c.	Year round interest, color mass in spring (white)
F - *Solidago* 'Golden Fleece', 2' o.c. or *Rudbeckia fulgida* 'Goldsturm' (Black Eyed Susan)	Spring color mass, interesting texture
	Fall yellow mass of color, compliments Fringe Tree and Aster, butterflies
	Summer and early fall flowers if the summer flowers are cut

note: o.c. = on center
* also listed as *Symphyotrichum novae-angliae*

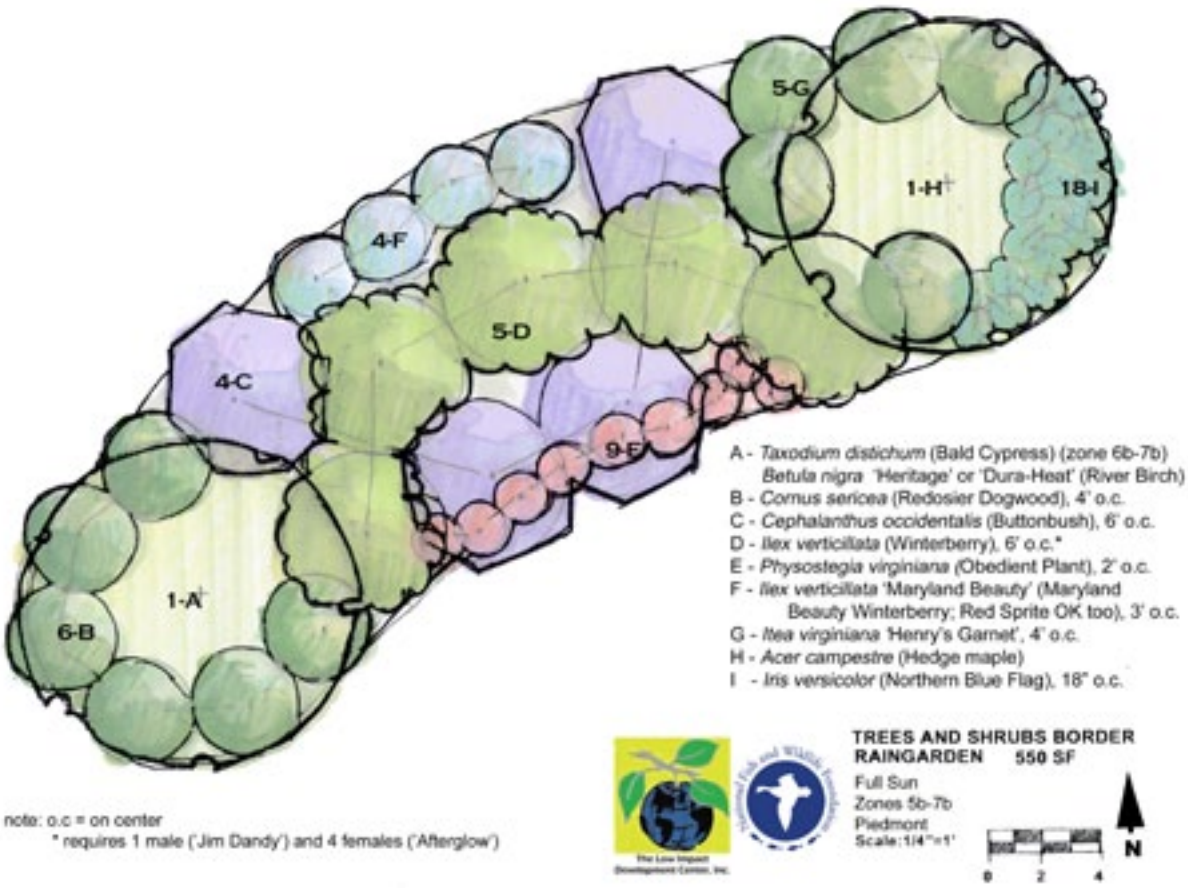
LOW MAINTENANCE RAINGARDEN
DEER RESISTANT
200 SF
Full Sun
Piedmont
Zones 5a-7b
Scale: 1/4"=1'
N
0 2 4



A - *Ilex opaca* (American Holly), 8' o.c.
B - *Vaccinum corymbosum* (Highbush Blueberry), 3' o.c.
C - *Rhododendron viscosum* (Swamp Azalea), or *Cornus sericea* (Redosier Dogwood), or *Ilex glabra nana* (Dwarf Inkberry)
D - *Hemerocallis hybrids* (Hybrid daylilies *e.g.* 'Happy Returns'), 12" o.c. or *Phlox subulata* (Thrift), 12" o.c.
E - Wildflower Mix, 85 SF; sample mix:
- 50% *Rudbeckia hirta* (Black-Eyed Susan)
- 20% *Echinacea purpurea* (Purple Coneflower),
- 20% *Liatrus spicata* (Blazing-Star),
- 10% *Asclepias tuberosa* (Butterfly Weed)

If using plants (vs. seed) for wildflowers, space 18" o.c. (19 -*Rudbeckia*, 8 - *Echinacea*, 8- *Liatrus*, 4 - *Asclepias*) <seeding is lower cost but higher maintenance option due to need for nurturing seedlings>
note: o.c. = on center

FOR THE BIRDS RAINGARDEN
450 SF
Full Sun-Pt. Shade
All zones
Scale: 1/4"=1'
N
0 2 4


5-G
1-H+
18-I
4-F
5-D
4-C
9-F
1-A+
6-B
A - Taxodium distichum (Bald Cypress) (zone 6b-7b)
Betula nigra 'Heritage' or 'Dura-Heat' (River Birch)
B - Cornus sericea (Redosier Dogwood), 4' o.c.
C - Cephalanthus occidentalis (Buttonbush), 6' o.c.
D - Ilex verticillata (Winterberry), 6' o.c.*
E - Physostegia virginiana (Obedient Plant), 2' o.c.
F - Ilex verticillata 'Maryland Beauty' (Maryland Beauty Winterberry; Red Sprite OK too), 3' o.c.
G - Itea virginiana 'Henry's Garnet', 4' o.c.
H - Acer campestre (Hedge maple)
I - Iris versicolor (Northern Blue Flag), 18" o.c.
TREES AND SHRUBS BORDER
RAINGARDEN 550 SF
Full Sun
Zones 5b-7b
Piedmont
Scale: 1/4"=1'
0 2 4
N
note: o.c = on center
* requires 1 male ('Jim Dandy') and 4 females ('Afterglow')

Appendix C – References

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http://www.nwf.org/At-School.aspx

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http://www.ada.gov/2010ADAstandards_index.htm.

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http://web4.audubon.org/bird/at_home/PlantNativeSpecies.html

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http://www.dnr.state.md.us/

- Maryland Department of Natural Resources
Landscaping with Native Plants
http://dnr.maryland.gov/naturalresource/spring2005/landscaping.asp

- Maryland's Forest Conservancy District Boards
http://www.marylandforestryboards.org/

- Maryland Integrated Pest Management
  College of Agriculture and Natural Resources
  http://www.mdipm.umd.edu/

- Maryland Native Plant Society
  http://www.mdflora.org/

- Maryland Cooperative Extension Offices
  http://extension.umd.edu/

- National Arbor Day Foundation
  http://www.arborday.org/

- National Clearinghouse for Educational Facilities
  http://www.edfacilities.org/rl/landscape.cfm

- National Park Service
  http://www.nps.gov/

- National Wildlife Federation
  http://www.nwf.org/At-School.aspx
  NWF - Schoolyard Habitat Program
  http://www.nwf.org/Get-Outside/Outdoor-Activities/Garden-for-Wildlife/Schoolyard-Habitats.aspx

- Native Plants for Wildlife Habitat and Conservation Landscaping:
  Chesapeake Bay Watershed
  http://www.nps.gov/plants/pubs/chesapeake/toc.htm

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  http://www.treetures.com/TreTrust.htm

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  Also includes activities, programs and volunteer opportunities.

Chapter 5

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Miscellaneous Information

Grants for student projects and Resources:

- Community Tree Planting Program
  1120 G Street, NW
  S-770
  Washington, DC 20005

- Cheasapeake Bay Trust
  http://cbtrust.org

- Multiple grant sources
  http://www.fxbrowne.com/html/newsletter%20grants.htm

- "Make Your World Better" Grant Program
  http://www.conservationgrants.com/education.htm

- Roots and Shoots Intergenerational School Garden Program
  306 Overhill Drive
  Lexington, VA 24450
  540-463-6454

Distributors/Centers:

- Largest North American distributor of resources for school gardening:
  Let's Get Growing
  1900 Commercial Way
  Santa Cruz, CA 95065
  800-408-1868
  www.letsgetgrowing.com

- The Center for EE
  Antioch New England Graduate School
  40 Avon Street, Keene NH 03431

- EE-Link
  http://eelink.net/pages/EE-Link+Introduction
  Gathers lists of organizations, grants, classroom resources for environmental education EE-Link is funded by the North American Association for Environmental Education (NAAEE)

- Environmental Protection Agency
  http://www.epa.gov/enviroed/
  This site taps into the EPA Grants Program for Env. Ed projects, Env. Ed Training, Studies and Fellowships, Educational resources for Portal Sites, Partnerships and Advisory Groups

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