

Developing Outdoor Learning Areas: A Kentucky Guide



A publication of

The Kentucky Environmental Education Council An Agency of the Kentucky Education Cabinet

In cooperation with

The Kentucky Department of Education
Kentucky PRIDE
Kentucky NEED
The Kentucky Division of Water
The Kentucky Division of Energy
The Kentucky Division of Conservation
The Environmental and Public Protection Cabinet
UK Tracy Farmer Center for the Environment
UK Cooperative Extension Service
East Kentucky Science Center
Kentucky Division of Waste Management
Louisville Gas and Electric
Jefferson County Public Schools
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Acknowledgements Page

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Developing Outdoor Learning Areas: A Kentucky Guide



Why Use Outdoor Learning Areas?

There is little doubt that school boards, architects, contractors and teachers would find it ludicrous to build a beautiful new school and then close off half of it before students ever arrive. Not only would it be a waste of money, but also students and teachers would miss the many learning opportunities afforded by those lost facilities. Yet, this exact scenario is played out when a new or remodeled school does not take advantage of its outdoor learning features as learning tools for students. This guide helps school planners, school boards, teachers and parents better understand how outdoor learning sites can enhance learning opportunities for children.

Numerous learning goals in the Academic Expectations, Core Content for Assessment and the Program of Studies focus on the living and nonliving systems that support us and the creatures around us. Often the very best way to study these systems is to see them in action. For example, as any gardener will tell you, the best way to study how plants grow – is to watch them grow - literally making food, fiber, shade and shelter out of sunlight, seeds, water and soil. While the sun provides energy to make plants grow, it also provides energy (usually indirectly) to keep us warm and cool and performs many other functions that we need to live, thrive and learn. Plans for using these special learning areas are best made as a building or renovation is being planned. This makes use of the outdoor space more effective, easier to access for learning, and saves costs in the end.

The Essentials of Outdoor Learning Areas

Listed below are several features that are necessary to make optimal use of outdoor learning areas. Below that are lists of additional features that further enhance these areas.

- ⊕ At least 5% of the school site should be devoted to the outdoor learning area. An ideal outdoor learning area is at least one half acre. For schools with no grounds at all, the surrounding neighborhood can be used as an outdoor learning area.
- ⊕ The area devoted to outdoor learning should have topsoil (suitable for growing plants) at least five inches deep.
- ⊕ A portion of the area devoted to outdoor learning should have direct sunlight at least six hours a day.
- ⊕ The area devoted to outdoor learning should have access to a water source (e.g. hose, pond or cistern) that can be used for watering plants, cleaning tools, running experiments, etc. This source should be within fifty feet of the site. (Note: If using a natural water source, make sure it is tested regularly for safety.)
- ⊕ The area devoted to outdoor learning should be in a safe location away from traffic, construction or other hazards. A quiet area is also helpful, where this is possible.
- ⊕ The area devoted to outdoor learning should have a location (preferably shaded) where students can sit and write or work in groups.

Optional Features for Outdoor Learning Areas

In addition to these required features listed above, a number of other features can be added to the outdoor area that provide outstanding learning opportunities for students. Listed below are some of these features including directions for how to create them and suggestions for how that can be used to enhance learning.

- ⊕ Wildlife Habitat
- ⊕ Weather Station
- ⊕ Birds/Bird Blinds
- ⊕ Wetland
- ⊕ Rocks and Geology
- ⊕ Soils
- ⊕ Historical
- ⊕ Walking Trails
- ⊕ Native Plant Gardens
- ⊕ Greenhouses
- ⊕ Space and Sky
- ⊕ Butterfly Gardens
- ⊕ Energy Use
- ⊕ Solid Waste
- ⊕ Indoor Air Quality
- ⊕ Pest Management
- ⊕ Building Design
- ⊕ Water and Wastewater

Keeping Students Safe Outdoors

As with all learning areas, issues of safety are very important. Often those responsible for students avoid outdoor learning areas because they fear for the safety of children. However, outdoor areas, when designed properly and used appropriately, are no more hazardous than regular classrooms. Of course, common sense and ordinary precautions should be taken. (For example, not having students outdoors for long periods of time without sun protections) but otherwise, students are just as safe outdoors as in. In fact, several studies have shown that discipline problems and horseplay are reduced in outdoor settings because students are highly engaged in their own learning (Lieberman and Hoody, 1996).

Listed below are ideas for making outdoor learning areas as safe as possible.

- ⊕ When designing the area, make sure that it is either away from traffic, construction and “attractive nuisances” or that students are protected from these things by fences or other barriers.
- ⊕ If the area is in a natural state, make sure it is cleared of poison ivy and other hazardous plants, when at all possible.
- ⊕ Provide a list of reasonable and prudent measures to teachers who wish to use the outdoor learning (such as being aware of sun exposure)
- ⊕ Allow students to help plan for their own safety by making lists of possible hazards and how to avoid them.
- ⊕ Make sure that students have assignments to complete in the outdoor learning area that will keep them focused and on task..

A Note on Energy & Archaeology

- ⊕ We have not included a section on energy education in this guide because there is an entire national movement to create more energy efficient schools and schools in which the entire building is used as a laboratory for studying energy efficiency, as well as other conservation techniques. To learn more about ways your school can join in this effort, go to The Kentucky Energy Education Development Project website <http://www.need.org/states/kentucky/> and to the Rebuild America website on energy smart schools at <http://www.rebuild.org/sectors/ess/index.asp>. For even more information, contact the Kentucky Division of Energy at <http://www.energy.ky.gov/programs/education/>.
- ⊕ Archaeology is a very complex endeavor and disturbing archaeological sites is against the law. Having said that, learning how humans have impacted the environment throughout history and prehistory is a very valuable area of study. Teachers wishing to involve students in archaeology can learn more about proper techniques from the Kentucky Director of Project Archaeology, Dr. Gwynn Henderson at aghend@uky.edu

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Optional Features for Outdoor Learning Areas

Air Quality and Weather Stations

Description – A weather station provides students and teachers an area in the outdoor learning area to take scientifically valid measurements, record data, and create maps and graphs about the atmosphere, hydrology, soils and land cover. Anyone interested in a weather station can do an online search for “school weather stations” and find many opportunities that will provide turn-key stations that students can use. For example, the GLOBE program at http://www.globe.gov/globe_flash.html provides teaching/learning systems, and links students with other students and professionals all over the world.

Others may choose a more informal route and build a weather station with a simple windsock, anemometer (to measure wind velocity), rain gauge, sundial, and thermometer. The area could also be used for observation of cloud cover, seasonal changes, etc. Simply by attaching double sided tape to a post, air quality can be monitored. An evergreen shelter belt between a road and a school can help reduce highway noise and dust problems if it is at least 30 feet wide.

Size – A four feet by four feet area is large enough for small student groups to record information in the outdoor learning area weather station.

Location – The weather station should be close enough to the building for easy access during inclement weather, yet in a clear area not affected by overhangs, shadows, or wind blocks. The sundial needs to be in a sunny area.



Materials Needed – A windsock, sundial, thermometer, anemometer, soil thermometer and rain gauge are the basics in the weather station. Several 4 inch by 4 inch wooden posts for mounting equipment and a 4 sided, ventilated cube for shading the thermometer are needed. Make the posts the appropriate height for comfortable observation by your student population. The cube may be constructed from a 4 feet wooden house shutter. Native plants can add interest to the weather station. If a conifer windbreak is being installed, conifers indigenous to your area are necessary.

Labor Needed – Labor is needed to dig a hole for the pole and build the shading box. Plants and trees will need to be planted.

Technical Assistance – The National Weather Service (<http://www.nws.noaa.gov/>) and area television web sites are helpful in sharing and comparing data.

EPA has several activity guides to help teach about air quality issues.

See <http://www.epa.gov/teachers/curriculumair.htm>

The Kentucky Division of Air Quality also has information and educational materials and programs about Kentucky's air quality. See

<http://www.air.ky.gov/>

Maintenance – During freezing weather, be sure to remove the rain gauge to prevent cracking. Check the windsock periodically for replacement.

Challenges – Vandalism can occur with since the equipment that can be easily broken or removed. Locating near visible windows helps during school hours and locating the weather station near the rear of the building and away from play areas may be helpful. Mowing crews may complain of the posts as obstacles to go around when mowing. Inviting them to help plan the station may help with this.

Optional Features for Outdoor Learning Areas

Birds and Bird Blinds

Description – Providing sanctuaries and feeding stations for birds on the school grounds can enhance opportunities for the community to view wildlife in a natural setting and aid in the conservation of native species. From a simple feeding station outside of school windows to bird blinds in larger settings, bird watching provides experiences where students can practice observation, inquiry-based investigations, and data collection.

Size – Bird sanctuaries can be as small as a simple feeder hanging in a tree or as large as a natural area on the school grounds.

Location – The feeding and viewing stations should be close enough to the building for easy access, yet away from the hustle and bustle of human activity.



Materials Needed – Providing the four basic needs of wildlife (food, water, shelter, and space) will help guarantee success. Attention should be given to providing shelter and protection for the birds against predators through native plantings. Select plants that bear fruit at different times of the year. Plants and shrubs that bear fruit supply sources of food throughout the year. Trees with fruit or nuts also supply seasonal foods and shelter for the birds. Contact your local nursery for plants, shrubs, and trees appropriate for your area. Provide additional food and shelter by building or purchasing feeders and houses.

Make or buy birdhouses specifically designed for the species of bird you want to attract. The size of the hole is most critical to prevent the eggs and young from being destroyed by other birds or wildlife. Add a shallow

birdbath or a shallow dish as a source of water if there is not a natural source nearby.

To facilitate observation, a bird blind can be constructed to allow small groups to watch from concealment. An approach path can be designed so that people cannot be seen when they enter the blind. This screened path can be constructed by creating a dense hedge on both sides of the approach path, by entering the blind through a ravine, or through an existing dense thicket. A basic basket weave wall with removable boards for viewing may be used to create the blind. Tree stumps of varying heights may be set vertically behind the blind for viewers to sit on while observing. Blinds can be very complex, with one-way glass, etc. However, remember, a blind is simply a place where people can watch wildlife without being seen! Use your imagination and materials at hand to build a blind.

Labor Needed – Plant flowers, shrubs, and trees. Install posts for mounting feeders and houses if there is no natural outlet for mounting them. Labor for building a bird blind may be needed.

Technical Assistance – Local Conservation Districts, Cooperative Extension Offices, the Kentucky Department for Fish and Wildlife Resources and the USDA Natural Resources Conservation Service can provide literature, lists of plants to attract different species, plans for houses and feeders, etc. to guide the construction process. For contact information in your county go to <http://weba.ky.gov/genericsearch/LicenseSearch.asp?AGY=17>. Also see <http://www.audubon.org/> for more information on birds and feeders

Maintenance – Filling feeders and water containers weekly and cleaning out nesting boxes yearly keep birds visiting the area.

Challenges – Use of feeders may attract species you do not want, such as squirrels, starlings, and crows. The placement, type of feeders you choose, and type of food you supply can help deter unwanted species. Seed hulls and bird droppings under the feeders can be unsightly and affect plantings below. The ongoing expense of purchasing seeds for the feeders and the ongoing process of filling feeders and watering stations can be challenging.

Optional Features for Outdoor Learning Areas

Butterfly Garden

Description – A butterfly garden consists of plants that attract butterflies and their larvae. Students grow and maintain specific types of plants. They have an opportunity to observe the interactions of plants and butterflies by exploring habitats, adaptations, and life cycles in a natural setting.

Size – Butterfly gardens may range from a one-acre plot of land to a five foot by one foot strip near a walkway. They may even be in a window box.

Location – Butterfly gardens may be placed in a large, open, sunny area. The area chosen needs to allow for sweet and/or sticky plant juices, overripe fruits, and the probability of bees for pollination. Any sunny walkway, entryway or courtyard provides areas for butterfly gardens.



Materials Needed – Rich, well-drained soil, plants for attracting butterflies, plants for feeding butterfly larvae, a water tray with rocks for the butterflies to stand in the water to drink, optional butterfly houses for decoration. You may need mulch in newly planted areas. Ideal plants include butterfly bushes, purple cone flowers, lavender, coreopsis, goldenrod and black-eyed susans.

Labor Needed – Amend the soil to be well drained and rich in organic matter for optimum growth. Depending on the size of butterfly garden created, sow seeds and/or install plants attractive to butterflies and their larvae. Mulch where necessary.

Technical Assistance – University of Kentucky Cooperative Extension offices may help with the design and choice of plants for your butterfly garden. Also check with local nurseries who may be willing to donate plants. See

<http://www.uky.edu/Agriculture/Entomology/entfacts/misc/ef006.htm>

for details on how to create a butterfly garden in Kentucky.

Maintenance – Weeding and replacing mulch, as needed.

Challenges – Butterfly Gardens are one of the easiest gardens to maintain. However, remember that flowers that attract butterflies also attract bees. Obtain allergy information and have sting remedies available in safety kits. A Butterfly Garden may be kept in a raised bed to provide for wheel chair access.

Resources

- <http://udel.edu/~lynneb/butterfly/>
- <http://www.naba.org/pubs/bgh.html>
- **American Museum of Natural History Butterfly Conservatory**
<http://www.amnh.org/exhibitions/butterflies/garden.html>
- **The Smithsonian Butterfly Garden**
<http://www.amnh.org/exhibitions/butterflies/garden.html>
<http://www.dnr.state.mn.us/gardens/butterfly/index.html>

Optional Features for Outdoor Learning Areas

Environmental History

Description – Environmental history is the historical interaction between the natural world and humans. It provides an opportunity for the school community to experience hands-on history. Environmental history can be seen in such things as architecture and building materials, the placement of bridges and roads, artifacts of human settlements, patterns of stone walls, or changing patterns of land use over time. Retaining large and significant trees in an outdoor learning area can preserve an important piece of history and serve as a guide to other historical events in the community. The history of our trees can lead us to discover patterns of settlement, economic conditions, technological change, political events, and changes in attitudes toward the natural environment over time. When construction and renovation call for the removal of trees from the land, we are removing part of history. However, by preserving cross-sections of these trees, a timeline of that history can be retained and explored. **Size** – Preserve and maintain cross sections from the smallest to the largest trees with the idea of documenting environmental and community history. Depending on the size of a cross-section removed from a tree, create an easily accessible area 12 feet by 10 feet for comfortable observation by a class of students.

Location – Whether an urban or a rural area, the history is already there, in every location.



Materials Needed – Aerial view maps are often available from the physical plant office of your local school board. The Library of Congress web site (www.loc.gov) often contains aerial maps that give past information on settlement, land use patterns, and the historic location of natural resources. Large equipment may be needed to cut and move the tree cross-section to a display.

Labor Needed – Gather historical photographs of the site from community members, previous property owners, etc. Take a tree inventory of the site by labeling and numbering trees on an aerial map. Note the condition of the tree and any evidence of human activity that affected the shape. Measure and record the circumference of the tree 1.3 meters from the ground. Try to find out why the tree was planted. Was it for aesthetic, economic, or ecological reasons? Correlate the tree inventory with an inventory of historic maps of houses from earlier days, and pictures of the area through various periods in history. Cut cross-sections from significant trees being removed and prepare a place on site for the display. Take photographs before, during, and after construction to create a photo archive of the area.

Technical Assistance – Contact the Kentucky Heritage Council or visit their website at (<http://www.state.ky.us/agencies/khc/khchome.htm>). Contact the Kentucky Division of Forestry to learn more about each species of tree and its historical uses. See <http://www.forestry.ky.gov/>. Still more information can be found at local museums and area historical societies.

Application – The subject of environmental history provides many opportunities for standards based teaching and learning.

- Students can perform research, including toponomy (the study of place names) to find the history of their town.
- Students can increase environmental history studies through tracking the harvesting of trees during early settlement, by examining over-cutting during the industrial age, by considering regeneration during wars, and by investigating protection of trees during post-war and contemporary eras.
- Students walk through local historical districts, visit parks and common areas, research in cemeteries, and learn about historic landmarks to further their environmental history studies and increase map skills.
- Students continue measuring and documenting for the tree inventory.

- Cultural objectives may be met when students study the history of the people that planted and protected the trees on the site. Whether planted for aesthetic, economic, or ecological reasons, the trees provide students the opportunity to chart the intention and impact of people on their environment.
- Communication and writing skills are enhanced as students gather oral histories and present research.
- Correlating historical architecture with other events in your community's history provides the student opportunities to develop timelines and enhance visual arts.

Maintenance – Visit trees on the property regularly to assure their health and continue historical documentation.

Challenges – Searching through land titles to find previous owners and researching the history of the area are time consuming and often require the services of a person who know how to do historical searches. Allow students to be as involved with this process as possible and rely on local historical societies for assistance. Check for fallen branches, wind damage, disease, etc. to maintain a safe environment for student research.

Other websites to learn about historic trees.

- <http://www.heritage.ky.gov>
- <http://home.earthlink.net/~jeffkrueger/links.html>
- <http://www.smithsonianmag.si.edu/smithsonian/issues96/oct96/bigtrees.html>
- <http://www.acf.org/>
- <http://www.historictrees.org/>
- <http://www.silentwitnesses.org/>

Optional Features for Outdoor Learning Areas

Greenhouses

Description – In areas with four seasons, a greenhouse can provide opportunities to continue working in the environment during inclement weather. When you place an ecosystem within glass or plastic walls, it becomes a metaphor for the earth and how it works. It provides students an opportunity to extend gardening techniques, pest management, and inquiry based science activities into the winter months. Propagating plants, preparing seedlings, storing tender perennials, picking fresh salads in winter, and enjoying colorful bouquets of flowers on a cold, dreary day are just a few activities that are possible when there is a greenhouse on school grounds.

Size – Greenhouses are available in many styles and sizes. A typical school greenhouse, 16 feet by 30 feet, allows a class to work comfortably inside. Smaller, more budget conscious greenhouses are available and will hold small groups of students.

Location – Greenhouses perform best in an open area with plenty of sunshine and ventilation. They should be near sources of water and electricity.



Materials Needed – A gravel floor is recommended for greenhouses. Greenhouse kits are available on line when you type “greenhouse kits” into

any Internet search engine. You may choose glass, polycarbonate, or plastic styles. Keep in mind fire resistance, hail resistance, guaranteed life span, and energy efficiency when you are choosing. Make sure you have ventilating fans whether manually or thermostatically controlled, to provide needed air circulation. Depending on the your area and climate, you may need heaters for mid-winter success. Supplies of running water will need to be in or near the greenhouse. Electricity will also be needed. Obtain lumber for building wooden shelves and work areas. Mount a thermometer inside the greenhouse for monitoring temperature. Occasionally, local law enforcement agencies have confiscated greenhouses they will give to schools.

Labor Needed – Labor is needed to prepare the floor of the greenhouse and spread the gravel, put together the kit, and build wooden shelves and work areas.

Technical Assistance – Many local nurseries operate their own greenhouses and can share expertise. Your local Soil and Conservation District and Cooperative Extension Offices may also be of assistance. See <http://weba.ky.gov/genericsearch/LicenseSearch.asp?AGY=17> for offices near you.

Maintenance – If you have chosen a greenhouse with a plastic cover, they often need to be recovered in 5 to 10 years. During extended vacations, a schedule for watering and checking heat and ventilation needs to be maintained.

Challenges – Pest management in the greenhouse often becomes a problem. With student allergies and sensitivities, care should be taken before considering the use of any sprays or chemical products in this contained place. Organic gardening and natural pest controls are strongly encouraged.

Optional Features for Outdoor Learning Areas

Natural and Constructed Wetlands

Description – Check to see if natural streams, ponds, or other bodies of water exist on the school site. These features may support student observations of wildlife, habitat, water testing, and aquatic population studies. They may be utilized with minimal support. The constructed wetland is designed for small sites where natural wetlands do not exist or their location is too far from the main school building for convenient access by classes. The wetland is designed to support hydrophytic vegetation and provide a study area that simulates real wetland conditions.

Size – The approximate size of a small constructed wetland is 8 feet by 12 feet. It should be deep enough not to freeze except in extremely cold weather. The wetland should have shelves of various depths in the water to accommodate medium and deep-water plants and fish; shallow water for edge plants, drinking water for small mammals and close up observation of aquatic life for the students.

Location – The location of the constructed wetland should be within a hose length of water. Priority should be given to areas with mostly open sun and some shade. If a pump, filter, or water feature is to be used, the wetland will need to be near an electrical outlet.



Materials Needed – 20 mil PVC liner, sand, rocks or creek stones for the edges of the liner, 4 inch diameter corrugated flexible drainage tubing with holes, silt loam or other good topsoil, mulch, hydrophytic plants, and a re-circulating pump.

Labor Needed – Heavy equipment or labor to dig a hole the dimensions of the wetland and labor using shovels and rakes.

Technical Assistance – Design information is available through local Soil Conservation Districts and the USDA Natural Resources Conservation Service. See

<http://weba.ky.gov/genericsearch/LicenseSearch.asp?AGY=17> for offices near you. For an excellent guide to creating vernal ponds (wetland that exist only when it rains) by Tom Biebighauser, see <http://www.southernregion.fs.fed.us/boone/vernal.pdf>.

Maintenance – Periodic thinning and weeding of plants and addition of water during dry periods will maintain the wetland. Fall removal of leaves and debris is recommended. Change filters and store re-circulating pumps for the winter months. Lower sensitive plants to the bottom of the pond during the cooler seasons. Return them to their shelves in the spring. Plants that cannot survive the winter should be removed in the fall and replaced in the spring.

Challenges – Overcoming the misconceptions of wetland habitats as mosquito infested areas, harbors for snakes, liability concerns, and keeping the wetland from becoming overgrown with algae is difficult. A system utilizing wetland plants, fish, and other balancing techniques should keep the wetland clear. Circulating the water should control mosquitoes and snakes are rarely visitors to these sites. The depth of the wetland is normally less than two and one-half feet, which should be manageable, with appropriate supervision.

Optional Features for Outdoor Learning Areas

Pest Management

Description – An ideal outdoor learning area would allow students to experience first hand all aspects of modern pest management. Pest management principles play a part in every step of plant production, from choosing appropriate plants, to pest monitoring, to pest control decision-making, to harvesting techniques.

Size – Any size plot associated with commercial or cosmetic plantings is appropriate. Miniaturized versions may be used for demonstrations.

Location – Any area where garden, crop, or landscape plants are growing, such as flowerbeds, gardens, field crops, or orchards.



Materials and Techniques Needed – Plant disease and pest-resistant species, spacing plants appropriately. Select plants that bloom and bear fruit at different times of the year. Have available gardening tools and supplies, soil testing equipment, and pest identification guides,

Labor Needed – Normal gardening labor. Clean up plant litter and remove weeds before they go to seed. Water and add nutrients properly to increase plant vigor.

Technical Assistance – *IPM for the Outdoor Learning Area*, available through the University of Kentucky IPM Program, see <http://www.uky.edu/Agriculture/IPM/ipm.htm>

Maintenance – An outdoor learning area would require all the maintenance of a normal garden, flowerbed, or similar environment, plus the additional monitoring and maintenance associated with proper pest management.

Challenges – Because changes in pest populations and other conditions need to be monitored continually, an outdoor learning area should be accessible for frequent visits during the growing season. These changes offer an excellent learning opportunity for students.

Optional Features for Outdoor Learning Areas

Rocks and Geology

Description – Rock and geological gardens and outcrops provide opportunities for students to identify sedimentary, metamorphic, and igneous rocks and their properties. When excavating for a new school, rocks can be collected for use in the garden, school landscaping, or features in a walking trail. Natural materials (rocks in place of bricks or cinder blocks) may be vertically stacked to build walls or fences to simulate stratification. (See safety issues below under “challenges”.)

Size – The size depends on the existing area at the proposed location. If a rock outcrop already exists, the school may utilize the outcrop as a learning area for students, teachers, and the community. Schools without existing outcrops can design a rock garden with landscaping timbers. 4 feet by 8 feet is a good size in which an average sized group of students and a teachers can observe.

Location – The rock garden should be within comfortable walking distance, but away from school windows. If rock garden plants will be added, the garden should be in a sunny or semi shady spot.



Materials Needed – Use a variety of rocks from sedimentary, metamorphic, and igneous rock groups. The rocks should include examples of sediments, minerals, and fossils. Install landscaping fabric under the rock garden and fill with pea gravel before placing rocks. This will help control weeds. Rock garden plants (available at local nurseries) are optional.

Labor Needed – Rock collecting during excavation, labor to build boxes, heavy equipment or labor to move large rocks.

Technical Assistance –

Kentucky Geological Survey www.uky.edu/KGS/home.htm

Falls of the Ohio (near Louisville, KY), <http://www.falloftheohio.org/>

The Web's Topographic Map, www.topozone.com,

Kentucky Minerals, <http://minerals.usgs.gov/minerals/pubs/state/ky.html>,

Mammoth Cave National Park, <http://www.nps.gov/maca/>

American Cave and Karst Museum, <http://www.cavern.org/>

Devonian Botanic Garden,

<http://www.discoveredmonton.com/devonian/getgro87.html>

North American Rock Garden Society, <http://www.nargs.org/>

Maintenance – Pick up fallen rocks and check for degradation of existing rock surfaces. Check for stray weeds.

Challenges – Safety may be a liability issue if the rock outcrop has a cliff or drop off. Students need to wear hard soled shoes. Smaller rocks that may be picked up and are close to school windows may result in vandalism. Bigger samples are best. Animals may get into the sand in the dig site. Removable, light covers may be made of decking material to cover the sand, yet allow drainage. Please note that rock walls should be added to an outdoor learning area with caution since unstable walls may fall on children and since they create excellent habitat for snakes and other creatures that some teachers and parents may find undesirable around children.

Optional Features for Outdoor Learning Areas

Sky and Space

Description – Leave open grassy areas in the outdoor learning area to provide places for students to observe space and sky. Classes can gather to study cloud formation, cardinal directions, daily movement of the sun, shadow patterns, stars, constellations, planets, eclipses, moon phase observations and other astronomy related subjects. Provide a mounting pad containing a sundial, a stake for shadow studies, and a telescope mount to enhance the area.

Size – A typical size for the open area would be a 24 feet by 30 feet area, though a larger area would allow students to sit back comfortably when viewing for extended periods of time.

Location – An open viewing area, away from buildings and sources of light provides the best setting for observations. If available, a horizon-to-horizon view works best for stargazing. If lights are located near the site, be sure they can be manually turned off.



Materials Needed – Anyone can observe the sky without equipment. All you need is room to look and curiosity! However, to further enhance the site a telescope, concrete, pipe, steel cap, lugs, compass, and sundial are needed for this project. Portable back rests for each student may be helpful for night viewing

Labor Needed – Labor is needed to build the concrete mounting pad and telescope mount. If a telescope will be mounted for nighttime viewing, a simple telescope mount may be made from a 6-inch diameter schedule 40 steel pipe, filled with concrete. The height would depend on the size and type of telescope to be used. Extend the steel post 30 inches below grade level for stabilization. Add a steel cap welded to the post containing mounting lugs for the telescope's equatorial mount, size, type, and location of lugs to match the equatorial base. An 8 feet by 8 feet square, 6-inch thick concrete pad one inch above grade should be constructed around the pole. The pole may be used during the daytime for shadow studies. A sundial may be added. Use a compass for correct positioning.

- Technical Assistance – Many on-line activities are available to enhance Sky and Space Science studies. NASA web sites such as (<http://www.nasa.gov/home/index.html>) and (<http://education.nasa.gov/>) are always a plus. In Kentucky contact the East Kentucky Science Center at <http://www.wedosience.org/> . In addition nearby colleges often have telescopes and even planetariums.

Maintenance – No maintenance is needed for the project, other than keeping the area mowed and clear of debris.

Challenges – When walking around at night, flashlights with red cellophane over the lenses are a must for safety reasons. A protective, soft covering, such as a rubber ball with a slit in it could be placed over the pipe when not in use in case someone falls on it.

Resources

- DarkSky - A Web Tool for Stargazing
<http://proxima.astro.virginia.edu/ida/darksky>
- Earth and Sky Homepage
www.earthsky.com
- Heavens Above
www.heavens-above.com

- Starchart Map Server
www.polaris.net/services/starchart
- Your Sky
www.fourmilab.to/yoursky
- Reading the Skies
www.people.virginia.edu/~tgt3e/skies
- J Track Satellite Tracking
<http://liftoff.msfc.nasa.gov/realtime/jtrack>
- Astrophotography
www.astropix.com/INDEX.HTM
- Sunrise, Sunset & Local Time
www.sunrisesunset.com/default.asp
- US EPA Sunwise School Program
<http://www.epa.gov/sunwise>
- Comets and meteor showers
<http://comets.amsmeteors.org>
- Find Your Longitude
<http://www.pbs.org/wgbh/nova/longitude/findgame.html>
- Light Pollution
<http://www.lightpollution.it/worldatlas/pages/fig1.htm>
- How to view a solar eclipse
www.exploratorium.edu/eclipse/how/html

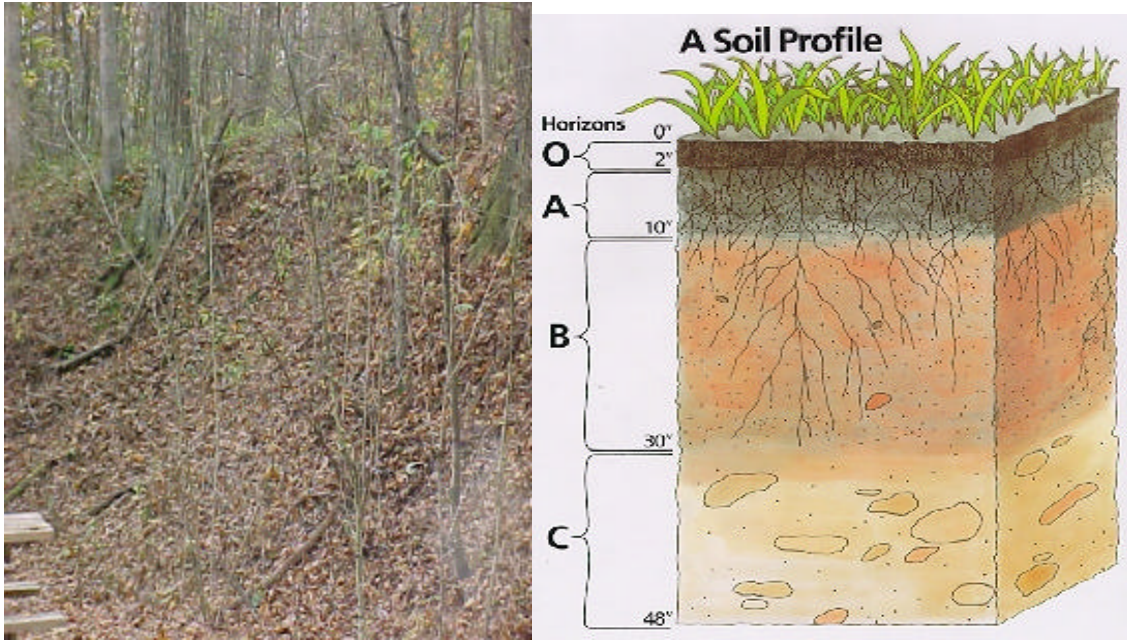
Optional Features for Outdoor Learning Areas

Soils

Description – All things in the outdoor learning area begin with soil. Assuring the site is well prepared with topsoil with adequate sublayers during the building phase will save much time and effort later. However, if adding an outdoor learning area to an existing school site, topsoil can be added. Your local Conservation District or Natural Resource Conservation Service offices are excellent sources for help with this feature. See <http://weba.ky.gov/genericsearch/LicenseSearch.asp?AGY=17> to search for an office in your county. It is also important that all sites have a soil test in several areas of the school grounds. Without a soil test, you could be applying too much, too little, or not enough nutrients to sustain your green space and its accompanying wildlife. Survey for areas in need of erosion control. It is crucial to check for erosion on the school grounds so valuable topsoil will not be lost. Native grasses provide excellent erosion control. Soil profiles and composting sites can enhance student and community learning, as well as provide areas for study of this essential resource.

Size – Soil profiles (pits) need to be at least six feet deep to show examples of humus, root, clay, and rock layers. (See “Challenges” below for safety issues related to soil profiles.) See also <http://www.liverpool.k12.ny.us/standards/lstandards/curriculum/sci/g3sci/soillayers.html> and <http://ltpwww.gsfc.nasa.gov/globe/>

Location – Walking the school property and surveying with soil conservation issues in mind will help you decide on the location of diverse learning stations. While large equipment is available, scooping into an existing bank during the construction phase can save time and labor later. That exposed area can provide an excellent example of a soil profile and its components. Having diverse areas with differing soil attributes preserved needs only the addition of student soil probes, soil thermometers, and pH testing kits to produce many opportunities to extend student learning. Since all schools are built on soil, these areas exist at every site.



Materials Needed – Commercial soil test kits are available at nurseries and lawn and garden suppliers. Plants to aid in erosion control may be necessary.

Labor Needed – If large equipment can be used for sculpting the soil profile, labor needs are greatly reduced. If no equipment is available, the profile must be shoveled by hand.

Technical Assistance – Your local conservation district or Natural Resource Conservation Service Offices can provide expertise, materials for investigations, and ideas for learning stations. See <http://weba.ky.gov/genericsearch/LicenseSearch.asp?AGY=17> for an office in your county.

Maintenance – Checking of school grounds for areas of erosion and testing of soil for adding nutrients may be necessary.

Challenges – When soil profiles are done on steep banks, it is important to keep students off the top for safety reasons. You should also take care that soil profile sites are stable. No student should be near a soil profile site until an expert has checked it for stability. This should be done periodically, especially after periods of heavy rain.

Optional Features for Outdoor Learning Areas

Solid Wastes and Composting

Description – Through effective solid waste management, schools can greatly reduce their contribution to local landfills. On the inside, schools can recycle and reuse paper, metal, and other materials to reduce their impact on forests and waterways. On the outside, schools can provide receptacles for disposing of litter appropriately, install recycling centers from local landfill operations, and compost schoolyard waste. Compost piles return humus for outside gardens and greenhouses and reduce solid waste.

Size – A compost pile needs to be at least two square yards in size, or may have several bins for sorting by decomposition.

Location – Locate waste receptacles near heavily traveled areas and playgrounds. Recycling centers should be located for easy access by vehicles. Compost piles should be located in a sunny area that has easy access to gardens and landscaping. Containers for gathering cafeteria scraps should be located close to kitchen exit doors.



Materials Needed – Composting can be done in a trench, in a commercial barrel, or in homemade areas set aside with cinder blocks or fencing. Most anything that was once growing is fair game for composting. However, meat and meat products as well as dog and cat manure should not go into compost areas. Cafeteria vegetable and fruit scraps and fresh yard waste are high in nitrogen. Dried leaves and twigs are high in carbon. Grass clippings, straw, livestock manure, sawdust, shredded paper, and coffee grounds may be safely added to make compost. Microorganisms are the workhorses. As a compost pile heats up, microorganisms break it down, and it turns to rich soil. A pitchfork for turning, a shovel for gathering humus, and a wheelbarrow for distributing the humus to appropriate areas in the landscape are tools for basic composting.

Labor Needed –Install a commercial composter or section off a portion of the schoolyard with cinder blocks or fencing. Purchase and place attractive cans or barrels for disposing of litter. Arrange for the local landfill operation to install a recycling container. Earthworms will do most of the labor in the compost pile!

Technical Assistance – Contact your local landfill for supplying the recycling center. Area soil and conservation districts and solid waste management offices are available for planning and implementing the project. See <http://weba.ky.gov/genericsearch/LicenseSearch.asp?AGY=17> for offices in your county.

Maintenance – Composting of grass clippings and dry leaves can be done with no maintenance, if you are short on time, or you have little yard waste. Once the style of composter is created for your application, the compost will need to be turned every two weeks or so. Compost piles get thirsty during dry seasons. You may need to water the compost to keep it moist and during particularly dry periods, you may need to cover it with a tarp.

Challenges – Compost piles may have a strong odor. Avoid the use of diseased plants, meat scraps, and dog or cat manure that may carry disease. Trouble shooting tips:

- If the compost pile does not heat up, check the moisture and add more green material.
- If the compost pile begins to smell bad, poke air holes with a rake or garden tool handle and turn the pile.

- If the compost is slow to break down, chop and shred larger pieces.
- Kentucky Division of Waste Management Education Resources
<http://www.waste.ky.gov/educat/>
- Kentucky Division of Waste Management Fact Sheets
<http://www.waste.ky.gov/factsheets/>

Optional Features for Outdoor Learning Areas

Walking Trail

Description – A walking trail provides an environment for students, teachers, and the community to explore the characteristics and interactions among native plants and organisms. Opportunities for exploring ecosystems, life cycles, investigating habitats and adaptations, comparing and analyzing soil types, and growing and maintaining different kinds of plants abound. Walking trails may be self-guiding with interpretive panels and exhibits at various learning stations along the path or without interpretive signs, they may simply be areas for discovery.. Walking trails may also double as exercise trails for both students and the local community

Size – A typical walking time to walk a trail would be 20 to 45 minutes (one to three miles). The size depends on the area, the age/grade of the walker, and what is to be observed.

Location – The walking trail may be located anywhere that is suitable for walking and has a diversity of native plants, animals, and other organisms. Make sure that the trail is located in a safe area. A successful trail is easily accessible and attractive in its layout. Incorporate wheel chair access into the trail design. Creating trails is an excellent way to connect your school with your local neighborhood since both the school and the local residents will benefit from the trail.



Materials Needed –The material on the walkway may be gravel, mulch, or simply mowed grass. However, you may need a harder surface if your trail is

to be wheelchair accessible. Benches or picnic tables along the way can provide a resting spot for walkers with special needs, and a place to gather for group discussions. Native plants may be supplemented in strategic areas along the trail. Once the trail is established, it is a matter of accessing the existing natural areas and adding learning stations to them (See other ideas in this booklet: Butterfly Gardens, Soils, Wetlands, Wildlife Habitats, Birds, etc.). If there are wetlands, allow students to get a closer look at flora and fauna by building suitable bridges and walkways. Signage, markers, and/or guides are optional.

Labor Needed – Setting up a walking trail begins with the labor needed to carve the trail itself. A small trail can be made the same width as a mower. Heavy equipment may be needed to clear larger trails. Building picnic tables and/or benches and creating appropriate signage will also require labor.

Technical Assistance – The Kentucky Department of Fish and Wildlife (<http://www.kdfwr.state.ky.us/>) will donate up to 20 native plants. Contact state and local park staff (<http://www.kystateparks.com/>) near you for advice on where and how to locate trails.

Maintenance – Check the trail on a regular basis for fallen trees and other obstructions. Remove poison ivy, poison oak, invasive plant species, etc. when possible. Ask adults who use the trail to help with maintenance.

Challenges – Make sure all students have appropriate shoes for walking, a permission form listing any allergies, and access to a safety kit that includes insect repellent and treatment for stings/bites. Railings or line leading ropes may need to be installed for safety issues in various areas along the trail. The recent popularity of four wheelers has caused some to install lockable gates at the beginning and end of trails.

Optional Features for Outdoor Learning Areas

Wastewater Treatment

Description –Students can learn about wastewater treatment by using the runoff from the school parking lot or roof to fill a rain garden. A rain garden is essentially a small wetland that is planted with flowering plants selected for their ability to have wet roots and obtain nutrients from the runoff. The rain garden allows storm water to percolate through the soil and enter the aquifer partially cleansed of contaminants. Rain gardens do not have standing water for more than a short period of time after a storm event.

Size – Rain Gardens may be as small as 3 feet in diameter and no more than a few inches deep. The drainage area (parking lot, lawn, street) from which the storm water is draining will determine the size of the garden.

Location – The Rain Garden should be located on the downhill slope of a drainage area that carries storm water.



Materials Needed – At most sites, the landscape generally has naturally sloping areas. Many bog and swamp plants will thrive in these areas. See your local nursery for suggestions.

Labor Needed – Preparing soil, sculpting soil so that runoff from parking areas drains into the rain garden.

Technical Assistance – Area Sanitation District offices and Solid Waste Management Services can help with the design of this area and follow-up field trips for students to see the entire wastewater process. See <http://www.infinetivity.com/~stack/rain/> for details of how to build a rain garden as well as answers to commonly asked questions.

Maintenance – It may be necessary to add water during extreme drought. Occasional replacement of plants and removal of debris or excess soil is recommended.

Challenges – Safety precautions for handling wastewater should be followed. There may be some concern over mosquitoes. Some areas are not large enough for all students to gather around the Rain Garden.

Optional Features for Outdoor Learning Areas

Wildlife Habitat

Description – Wildlife viewing can be achieved by providing food, water, shelter, and space to the species native to your area. Survey the grounds to find what is already on site. There may be trees, brush piles, snags, and other naturally occurring habitats just waiting for you to preserve them. Birds, hummingbirds, butterflies, bees, bats, and squirrels are easily attracted to native plantings and feeding stations. Reptiles and amphibians may be provided cover and nesting areas by including brush and rock piles on the edge of a small pond. Deer, turkeys, and pheasants may be attracted to feeding plots. Having these opportunities for observation, inquiry, and investigation can enhance learning for students.

Size – A small suburban lot may not attract as many wildlife species as a 5-acre lot, but by landscaping that space with wildlife in mind, you can provide optimum habitat per square foot of space.

Location – Locate your wildlife habitat within easy access of the school building, away from high traffic areas. Empty lots behind buildings, away from play areas are ideal sites for wildlife habitats. The most important key here is to make sure there is plenty of cover. A food plot, bird feeders, or salt block with no nearby place for wildlife to hide serves little purpose.



Materials Needed – Basic to all wildlife viewing areas are trees, shrubs, and other plants to provide shelter and food for wildlife. The types of plants you use for food and cover will determine the wildlife species attracted to your schoolyard. Include conifers to provide good winter cover and summer

nesting cover. Consider native species first. It is crucial to plant a variety of species and select plants that flower and bear fruit at different times of the year. Logs, rocks, and other in-water structures provide drinking and basking habitat for turtles, butterflies, and songbirds. Dead or dying trees and fallen trees can be homes for woodpeckers and other small animals. These snags (dead trees) should be at least 6 inches in diameter and 15 feet tall. A larger snag is preferred.

Rocks may need to be submerged on the north end of ponds. Terrace the rock pile up to the edge to attract frogs, toads, turtles, skinks, and snakes. Create den sites by placing a 12-15 foot diameter, 5 feet high brush pile in a sheltered area along the edges of fields and woods. You may include nesting houses for bats and birds. Leave food plots of corn, millet, or other grains in a specific area, purchase commercial feeders, or make the simple gravity feeder pictured above. Use a 4-inch diameter PVC pipe approximately 3 feet tall. Cap it and cut a small notch at the bottom of the pipe for gravity feeding. Mount the feeder on a post or platform. Enhance the area by pouring a concrete pad near your viewing area and making permanent imprints of the tracks of local wildlife.

Labor Needed – Labor is needed to build and install houses and feeders, establish brush and rock piles, plant appropriate native species, and pour the concrete pad.

Technical Assistance – Check with nurseries, area conservation districts, and cooperative extension agents on what grows best in your area. Contact your local fish and wildlife agency for information on wildlife and assistance in making the imprints of wildlife tracks. Make arrangements to have the agent on site during the pouring of the concrete pad so that imprints can be made before the concrete hardens. See (<http://weba.ky.gov/genericsearch/LicenseSearch.asp?AGY=17>) for how to contact these offices in your county.

Maintenance – Checking that feeders remain full and providing water in watering areas during dry weather will keep wildlife visiting the area.

Challenges – The best single thing you can do for wildlife is minimize the use of chemicals. There may be visitors to feeders that do damage, such as raccoons damaging bird feeders

APPENDIX:

STATEWIDE OUTDOOR CLASSROOM RESOURCES

Community Farm Alliance

Address : 311 Wilkinson Blvd.

Frankfort, KY 40601

Phone : (502) 223-3655

KY Division of Conservation

Address : 663 Teton Trail

Frankfort, KY 40601

Phone : (502) 564-3080

KY Division of Water

Address : 14 Reilly Road

Frankfort, KY 40601

Phone : (502) 564-3410

Ag and Environment in the Classroom

Address : PO Box 814

Frankfort, KY 40601

Phone : (502) 564-4696

Food, Land and People

Address : PO Box 814

Frankfort, KY 40601

Phone : (502) 564-4696

Kentucky Division of Air Quality

Address : 803 Schenkel Lane

Frankfort, KY 40601

Phone : (502) 573-3382

KY Heritage Council

Address : 300 Washington Street

Frankfort, KY 40601

Phone : (502) 564-7005

Kentucky Down Under**Address :** PO Box 189

Horse Cave, KY 42749

Phone : (502) 786-2634**American Cave Association****Address :** PO Box 409

Horse Cave, KY 42749

Phone : (502) 786-1466**Mammoth Cave National Park****Description :** Guided Tours, Nature Trails and Activities**Address :** Mammoth Cave, KY 42259**Phone :** (502) 758-2328**Kentucky Coal Council****Address :** PO Box 11578

Lexington, KY 40576-1578

Phone : (606) 246-2500**PCEDAR, Inc****Address :** PO Box 3536

Pikeville, KY 41502

KY Dept. for Surface Mining**Description :** Occasional Presentations and Tours on Coal Mines in KY**Address :** #2 Hudson Hollow Road

Frankfort, KY 40601

Phone : (502) 564-6940**KY Division of Conservation****Address :** 663 Teton Trail

Frankfort, KY 40601

Phone : (502) 564-3080**KY Dept. of Fish and Wildlife Resources****Address :** #1 Game Farm Road

Frankfort, KY 40601

Phone : (502) 564-3400**Nature Conservancy****Description :** Presentations**Address :** 642 W. Main Street

Lexington, KY 40508

Phone : (606) 259-9655

KY. State Nature Preserve Commission

Address : 801 Schenkel Lane
Frankfort, KY 40601
Phone : (502) 573-2886

KY Division of Energy

Address : 663 Teton Trail
Frankfort, KY 40601
Phone : (502) 564-7192

Project NEED

Address : PO Box 176055
Covington, KY 41017
Phone : (606) 578-0312

SWAT,JR Program

Address : 663 Teton Trail
Frankfort, KY 40601
Phone : (502) 564-7192

KY Coal Council

Address : PO Box 11578
Lexington, KY 40576-1578
Phone : (606) 246-2500

KY Division of Forestry

Address : 627 Comanche Trail
Frankfort, KY 40601
Phone : (502) 564-4496

Project Learning Tree

Address : #1 Game Farm Road
Frankfort, KY 40601
Phone : (502) 564-3400

Daniel Boone National Forest (EDIT)

Address : 1700 Bypass Road
Winchester, KY 40391
Phone: (859)-745-3100

KY Geological Survey

Address : UK--228 Mines and Minerals Bldg.
Lexington, KY 40506
Phone : (606) 257-5500

KY Division of Water

Address : 14 Reilly Road

Frankfort, KY 40601

Phone : (502) 564-3410

KY Division of Waste Management

Address : 14 Reilly Road

Frankfort, KY 40601

Phone : (502) 564-6716

KY Dept. of Transportation

Address : State Office Bldg., 10th Floor

Frankfort, KY 40601

Phone : (502) 564-4890

KY State Nature Preserves Commission

Address : 801 Schenkel Lane

Frankfort, KY 40601

Phone : (502) 573-2886

American Planning Association-KY

Address : 2332 Royal Plaza

Ft. Mitchell, KY 41017

Phone : (606) 331-8980

KY Division of Waste Management

Address : 14 Reilly Road

Frankfort, KY 40601

Phone : (502) 564-6716

Southern Appalachian Recycling

Phone : (606) 884-7385

KY Geological Survey

Address : UK 228 Mining/Minerals Resource Bldg.

Lexington, KY 40508

Phone : (606) 257-5500

Project WET

Address : North Central 4-H Center, 260 Camp Drive
Carlisle, KY 40311

Phone : (606) 289-5308

Project WILD

Address : #1 Game Farm Road
Frankfort, KY 40601

Phone : (502) 564-3400

KY Dept. of Parks

Address : Capital Plaza Tower
Frankfort, KY 40601

Phone : (502) 564-2172

Website Resources

<http://greenschools.schoolsgogreen.org/guidelines.shtml>