If we want children to flourish, to become truly empowered, then let us allow them to love the earth before we ask them to save it.

David Sobel, Beyond Ecophobia

INTRODUCTION

Starting with the first edition of FOSS Middle School, the primary goal was to develop a scientifically literate population with an ever-growing knowledge of the natural world and the interactions and organizational models that govern and explain it. In recent years, it has become clear that we have a larger responsibility to the students we touch with our program. We have to extend classroom learning into the field, into the real world, to bring the science concepts and principles to life. Applying concepts explored in the classroom to another setting is effective for academic achievement (Scott et al., 2005), but it is also important for students’ personal well-being (Coyle, 2010). In the process of validating classroom learning among the schoolyard habitats, students will deepen their understanding by applying their knowledge to new settings and will develop a relationship with their place in nature.

It is our relationship with natural systems that allows us to appreciate the complexity of these systems. In an age when adolescents spend little time outdoors, it is essential to give all students opportunities to become immersed in natural systems, if we expect them to become empowered citizens of Earth.
WHAT DOES FOSS MIDDLE SCHOOL LOOK LIKE OUTDOORS?

Students funnel into class from the chaos of the hall. A few bolt back to their lockers after they notice most of their peers have their winter jackets and hats. Class begins as usual with the focus question for the day’s investigation and an overview of the agenda. There is a heightened focus in the room as students copy the focus question and glue a data sheet into their notebook. They know time wasted now is time lost outdoors.

Students exit the classroom with direction and purpose, eager for fresh air and a change in pace. The band of young scientists reaches the designated home base and forms a circle for a brief review of their purpose before dispersing to collect data and answer questions in their notebooks. The teacher moves about with intention, speaking to a few students at a time. After several more minutes of this work, the teacher calls for attention and gives instructions. A few aren’t listening because they are fully engaged in the content, but their group mates are and will fill them in. Students collect their equipment as instructed and hustle back to form a circle and discuss the experience before heading back indoors.

This scenario could be anywhere in the country with a regular classroom teacher integrating outdoor explorations into his or her instruction. Indeed, FOSS outdoors looks and feels a lot like standard FOSS lessons. Many of the routines you use inside the classroom can be implemented outdoors as well. Success, however, does depend on a few specialized skills and specific preparation to maximize outdoor teaching efficiency.

Expect the enthusiasm, participation, engagement, group discussions, and effort on notebook entries to be heightened during and after an outdoor experience. Even the simplest outdoor activities create a surge of positive energy. It is difficult to determine whether the enthusiasm and commitment students exhibit when doing FOSS outdoors comes from the physical movement needed to get to the outdoor space, from exercising content they already know in a different setting, or simply from the joy of being outdoors and the fresh air. Expect students to be a bit louder and more excited when they are learning in the schoolyard. The enlarged space allows for this expansion in energy level, which benefits some students immensely. All students benefit from applying and extending their science and engineering explorations and content knowledge to the real-world setting of the schoolyard.
GOALS AND OBJECTIVES

The three program goals established 30 years ago still serve FOSS well. They are (1) scientific literacy for all students, (2) instructional efficiency and support for teachers, and (3) systemic reform. This chapter is designed to support teacher instructional efficiency outdoors, exploring management strategies for space, time, materials, and students.

The expansion into the local environment has three objectives that relate to the goals of enhancing student scientific literacy and supporting teachers in encouraging students to reconnect with the natural world.

First, the outdoor activities continue and extend the learning that starts in the classroom, providing more experience with the content and additional opportunities to practice skills and techniques developed in the classroom.

Second, venturing out provides opportunities for students to discover applications and examples of classroom content and concepts. The classroom activities work well for developing sound conceptual science knowledge. That knowledge, however, is constrained by the context in which the concepts are taught. For students to take the next level of ownership of that knowledge, they need to see how it applies and generalizes in the broader context of the world. Enhanced context strategies, such as these, have been identified as the most effective science instructional tools and methods (Scott, 2005).

Third, the outdoor activities connect students with place and nature. On the boundaries of the planned, structured experiences are the intangibles that may spark a new relationship with their place within natural systems. It may start with a multisensory experience in the local environment—wind, cold, sunshine, plants, insects, on and on—and advance to an awareness of the diversity of resources surrounding the school. Only from this foundation can a relationship evolve into a consciousness of place, followed by a flood of questions about the structure, organization, and operation of the local ecosystem. When students bond with nature, they have accepted a precious gift, and we have accomplished something important. It is this foundation with nature that will help students to be prepared to handle the mounting environmental problems of the future (Chawla, 1988).
MANAGING SPACE

FOSS outdoor activities are designed to be successful in diverse open spaces. Bringing students into the fresh air in whatever space you have available will awaken their well-being and stimulate their understanding of science concepts.

Choosing Outdoor Spaces

Whether your school’s landscape is wild, manicured, or asphalt, there are more options for outdoor learning than might initially meet the eye. This section will help you choose the best spaces near your school for the FOSS outdoor lesson.

Before choosing your outdoor study areas, get to know your outdoor options. Look closely at all areas surrounding the school building—even places that students do not normally go. A seemingly uninteresting field may be flourishing with a diversity of different grass species and other small flowering plants when examined more closely. Consider the pile of leaves that blew into a corner of your schoolyard; a crack in the concrete; or the ragged, weedy edge of the field where the lawn mower doesn’t reach. These places provide small animals with what they need—food, shelter, water, and space. Transition zones where vegetation changes from shrubbery to lawn or garden to field can present interesting study sites.

For physical and earth science explorations, look for a variety of surfaces and open areas for daytime astronomy. Rock outcrops, catchment basins, slopes, and drainage paths provide great opportunities to study landforms, local geology, and engineering solutions for heavy water runoff. As you ponder the learning possibilities in and around your schoolyard, consider these characteristics.

Accessibility. You should be able to walk from your classroom to your outdoor site in 2–5 minutes. Check out physical access if you have students whose mobility requires consideration.

Determine which doors are available to access your outdoor site. Make sure you follow your school’s policy for using auxiliary doors during the school day. Do they need to be closed at all times, or can you prop one open? Are they locked from the outside? You may have access to keys that will reduce travel time, or you could send a responsible student ahead to let the rest of the class back in the closest door.

Purpose. Determine the space needs of the activity. Some activities will require open space, such as a field or blacktop. Other activities work better if students have a more diverse landscape with varying environmental conditions (such as temperature, light intensity, and wind).
Managing Space

Size. The space should be large enough for the class to work comfortably but small enough for you to supervise all students easily. Ideally you want to be able to see where your students are at all times, and they need to be close enough to hear you and your attention signal.

Boundaries. For any space you intend to use, make sure you have clearly defined the boundaries before heading outdoors with students. Ideally, the landscape will be helpful—for example, staying between the sidewalk and the tree line. If natural markers are not present, you may need to bring along traffic cones or flags to define limits. Be aware of any hazards, such as traffic, dangerous debris, or skin-irritating plants.

Gaining Administrative Support

If your school does not have a precedent for outdoor learning, approach your administration prepared. Share your purpose and the academic benefits of outdoor learning outlined throughout this chapter. Refer to “Before the First Outing” to prepare your plan for travel, emergency contacts, and parent permission. If you anticipate that it will be necessary to persuade your administration, have statistics ready about how effective outdoor learning can be (see References at the end of this chapter for more information), how little time students currently spend outdoors, and how much screen time they have daily.

Fostering and Maintaining Diversity

For life and environmental science studies, the ideal site will have a variety of living and dead plant matter and a range of environmental conditions. Survey your site to see if it includes places that have been left unmanaged. Even a small wild zone along a fence, behind the maintenance area, or next to an adjacent field can be a valuable resource. It is important for students to see that living things carry on, even in the city, without human assistance.

Enhancing your schoolyard. You may be able to secure a small section of the schoolyard from the school groundskeeper, allowing it to grow wild to compare to the managed school grounds. You can enhance biodiversity and encourage decomposition by letting fallen leaves and/or lawn clippings remain on an area of soil over the winter. This gives worms and other detritivores and decomposers something to eat, which, in turn, provides food for everything else. Make sure all necessary parties are aware of your intentions to leave an area untouched. If you find that you need administrative permission, consider ways to contain and mark the unkempt area so that it clearly represents an intentional project. Student-created signage can be very effective.
Taking FOSS Middle School Outdoors

**Tread lightly.** Your schoolyard study areas will inevitably experience some user impact. It is important to teach students to minimize their environmental footprint. This is a good opportunity to introduce the “leave no trace” philosophy, which, in an effort to preserve an area for recreation, encourages us to leave our site as we found it or better.

Experimentation or collection should maximize learning and minimize impact on the ecosystem being studied. Unless the class is intentionally collecting specimens, nothing natural should be picked up or removed from the area. When observing or collecting living organisms, establish some rules of procedure to promote respect for the activity-site environment. Some students may be accustomed to killing invertebrates on sight. Anticipate this before heading outdoors and explain that it is essential that all organisms be handled in a way that allows them to be returned to the habitat unharmed.

**Weather**

Weather can present great challenges and exceptional experiences. Inclement weather can provide an excellent opportunity to study environmental concepts: water drainage, wind impact, and plant and animal survival adaptations. (There is nothing like being out in a snowstorm to appreciate the value of insulation!) Making extra preparations to study out in the elements has value. If the activity can be undertaken with some assurance of success, try to make it work. Over time, students acclimate to all sorts of weather and will actually look forward to the challenge of going out in difficult weather.

**Clothing.** The right gear at the right time can make all the difference. Train students to come to class “field ready” with whatever clothing will allow them to be comfortable outdoors. Baseball caps stored at school are often essential as sun protection in warmer climates and can work well in a light rain, especially for students who wear glasses. If possible, invest in a set of cheap rain ponchos to make it possible to go out in wet weather. Communicate regularly with students and family members about upcoming outdoor experiences so that students come prepared to work in the outdoor study area.

**Wind.** A stiff breeze can fling your materials into disarray or send notebooks flying. If you anticipate wind, discuss ways to keep materials from blowing away (such as using natural paperweights or taping down nonliving specimens). If there is a protected area where you and your class can take shelter briefly, the activity can continue. You may have to chase down a couple of notebook sheets before students become accustomed to securing papers and other light materials.

**NOTE**

Remember to never release classroom animals into schoolyard environments, unless they were collected from that space.

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Safety and Comfort

Be prepared for the unexpected. Insect stings (ants, bees, wasps, mosquitoes) can be alarmingly painful, particularly if the student has never been stung. Although extremely unlikely in a schoolyard, have a plan developed with students in advance as to how to retreat with purpose if someone accidentally disturbs a nest. Be sure you know who is allergic and who has never been stung before.

Skin-irritating plants (poison oak, poison ivy, poison sumac, nettles) can certainly put a damper on a field trip. Take a moment and get to know your local irritants and toxic plants. The rule “leaves of three, let it be” works only for poison ivy and poison oak. Poison sumac has 7–13 leaves on a branch. Stinging nettle feels much like being stung by a jellyfish and can be startling for students who have never experienced it. Often, the irritation subsides within a few minutes; do not treat rashes with bleach or rubbing alcohol.

Lyme disease is a treatable bacterial infection carried by deer ticks. It is present throughout the country, particularly in eastern and midwestern states. It is possible to get sick without finding a tick bite. If you or your students experience flu-like symptoms that are severe enough to see a doctor, make sure that the doctor is aware of any outdoor exposure.

If you are out and about in tick country, use insect repellent and tuck pant legs into socks. Take a few minutes at the end of the trip to pair up and look for obvious ticks on clothing and on the neck and shoulders of a partner.
MANAGING TIME

When to Teach

When you start a new course, anticipate when you might go outdoors, and schedule the time. The At a Glance chart for each investigation can help with this planning.

**Time of year.** If possible, plan the time of year when you will teach a particular course. In northern states, early fall or late spring are the best seasons for exploring life, while late fall through early spring is better in most southern states. Depending on when you start and anticipate ending a particular course, plan your strategy for when to collect outdoor data. You can also plan your outdoor excursions around disruptions to the regular schedule, such as days before or after school vacations or district testing.

**Time of day.** Consider the time of day you teach your various classes. It can be interesting to compare results between morning and afternoon sections of your classes.

**Specific times.** Nature is not always predictable. Some activities require a sunny or rainy day, and insects are active only above particular temperature thresholds. It can be tricky to move on without completing specific observations or experiments. Be creative. You may need to proceed with the course and return to the weather-dependent activities another day.

**Stay flexible.** If you are studying the Diversity of Life Course, for example, be prepared to dash out on a warm day to survey organisms. If you are studying the Earth History Course, consider taking advantage of a rainy day to observe water flowing over the school landscape. One of the delights of outdoor education is going out when nature is putting on a show.
Managing Time

Instructional Time
A typical middle school outdoor activity might require 20–40 minutes outside, or an extension activity might require multiple class periods. Only part of the time budgeted for outdoor learning is actually spent interacting with the schoolyard weather, terrain, plants, and animals. The rest is management.

Indoor preparation. Teach students to come to class field ready with any clothes they will need from their lockers to be comfortable outdoors. Keep your indoor introduction concise. Consider having students glue sheets into notebooks before leaving the classroom.

Travel time. You should be able to walk from your classroom to your outdoor site in 2–5 minutes. Consider the shortest path to and from your site. If your return trip involves a locked door, acquire keys in advance or send a responsible student ahead to let the rest of the class back in the closest door.

Instructions. Outdoors, have students form a circle. It will take 2–4 minutes to review rules, set the boundaries for the activity, review the challenge, and distribute materials.

Investigation time. Students break into pairs or groups to engage in the outdoor investigation. This might be as short as 8–10 minutes or as long as 20–30 minutes.

Wrap-up. Students reform their class circle to share and discuss their discoveries for several minutes. It is important to make time for the closing discussion.

Classroom follow-up. Frequently, students bring artifacts back to class to display in a classroom museum or to set up for further observation, such as rock collections or animals for the terrarium. If time is tight, follow up on the experience the next class day.
MANAGING MATERIALS

When students step onto the schoolyard, they are field scientists. In the field, there is no lab station to set up materials. The field equipment must be minimal, portable, and durable so that it can be easily and safely transported from the classroom and back.

Field Equipment

Activities will require no additional equipment beyond what is listed in Guiding the Investigation. In some cases, however, additional equipment can make your work outdoors easier. For example, seat pads can simply be several sheets of newspaper covered with a plastic bag. A 4 L zip bag can act as a good protective cover for notebooks in the field while holding specific materials needed for the activity of the day and a writing tool, and can even act as a seating pad on wetter days. Note that pens and pencils each have drawbacks: pencil points break, and pen ink freezes in extremely cold weather.

Your basic teacher’s outdoor equipment kit should include a few backup student materials and some items for helping with management.

- Extra pencils, pens, hand lenses, vials, etc.
- Attention signal (chime, whistle, or cowbell)
- Basic first-aid kit (bandages, peroxide, insect repellent, etc.)
- Phone with list of direct contacts in administration
- Class list with summary of appropriate health information

Transporting Materials

Getting materials to and from the outdoor site is a shared responsibility. Students will carry their personal equipment, and class materials can be distributed among students or tackled by you. When students carry something to the outdoor site, it reminds them that they are heading out with academic purpose.

Some teachers prefer to package the field equipment into a canvas bag or milk crate to transport to the outdoor home base. Other teachers use a cart to transport the equipment. After teaching a few outdoor activities, you will discover what works best for you.
**Creating Outdoor Tools**

A **sturdy writing surface** is essential for science in the schoolyard. Students should be adding information from outdoor investigations to their science notebooks. In inclement weather, you may decide to leave notebooks indoors and bring out paper that can be glued into notebooks later.

A serviceable clipboard can be made from a piece of cardboard and a binder clip. Use a paper cutter to cut sturdy cardboard slightly larger than a sheet of notebook paper. Place a medium-size binder clip at the top and a large elastic band around the bottom (to keep the paper from flapping up).

A **group writing surface** is important sometimes. You can use blue painter’s tape to attach a sheet of chart paper temporarily to a wall, or attach it to a chain-link fence with binder clips or clothespins. On windy days, attach all four corners. You can also tape chart paper to a large piece of cardboard and use it anywhere. Large portable whiteboards can also be very effective outdoors.

**Hand lenses** may disappear when students place them on the ground to perform a task. Run bright-colored string or yarn through holes in the lenses.
MANAGING STUDENTS

Going outdoors regularly is the best way to develop a productive working relationship with students in the outdoors. When students realize that going outdoors to learn is a recurring extension of their indoor learning, you will be surprised at how quickly they adapt to their expanded, enriched classroom.

Before the First Outing

It is always important to let the school administration know that you and your students will periodically be out of the classroom. If you are planning to leave the school grounds, remember to file a flight plan describing your itinerary, anticipated time of return, and contact partners in case a student has to come in early.

Inform interested parties. At the beginning of the school year, send a letter home, letting families know that learning will extend to the schoolyard. Create a permission slip for general outings throughout the year and have guardians include contact information and specific student health concerns. Consider keeping one set in the office and another set in a zip bag with your teacher toolkit in case of emergency.

Tell students at the beginning of the year that they will be going outdoors during science class. Remember to let them know a day in advance that they will be going outdoors so they can plan to come to class field ready. Your class can go out in any weather if students are dressed appropriately. A consistent system of reminders and clothing preparation will train students to be prepared.

Ground rules. Creating consistent, considerate rules of engagement is important. Learning is enhanced and behavior problems are largely averted by routines that students participate in and understand.

Discuss and create a class contract of what constitutes proper behavior for outdoor learning, and post it by the FOSS Outdoor Safety poster. Articulate rules with positive language, avoiding words like don’t. Include a version of each of the following points in your contract:

- Outdoor science is still science class. Therefore all rules from our classroom still apply.
- Remain inside the boundaries and stay on task.
- Keep silent and inconspicuous near other classes.
- Leave the outdoor environment as you found it or better.
- Respect living organisms and return them unharmed.
Managing Students

First Outing
Your first trip to the schoolyard may be a bit chaotic. At first, students may be distracted or lapse into social mode. A few precautions will minimize disruptive behaviors.

**Start strong indoors.** Begin class with the day’s focus question and clear tasks for student work. Have materials ready for transport. A mild first day has less repercussions for students that are not field ready.

**The path of egress.** Make sure administration has approved your optimal travel path. If a door locks from outside, get the key or send a responsible student ahead to let the class in the closest door.

**Orientation activity (optional).** Consider an optional orientation activity for your first outing. The stated goal might be a site tour to inventory the resources on hand. Your primary agenda, however, is to dissipate the energy generated by the novelty of going outdoors during class time. Focus on preparing your transition to the outdoors, moving out in a purposeful and orderly fashion, and arriving at your predetermined home base, a destination that you will always go to first. Form a circle, a process you will use time and again. Conduct your chosen orientation activity and end with a closing circle before returning to the classroom.

**Challenging students.** Sometimes the class will be inattentive or unresponsive. At such times, it is appropriate to direct students back to the classroom. Breaking the contract has consequences, and students need to understand that the opportunity to learn outdoors is a privilege. They will remember that day.

In rare instances, you may have an individual student who is not able to comply with the rules. Interestingly, this is probably not the student who you anticipated would have difficulty. Often, students who have difficulty with attention and performance in traditional classroom seated work shine and take on leadership roles outdoors. In the case of the noncompliant student, it may be necessary to ask him or her to quietly sit out the activity or stay with you as you visit groups. If the behavior persists, you may be obliged to send the student to an office support indoors to allow the rest of the class to continue. Be sure to give this student a chance to redeem himself or herself the next time you go outdoors.

Occasionally, a student may be uneasy working outdoors or feel it is not safe for a variety of reasons. Be sensitive to this, but know that with routine and regular outings, students will feel more comfortable, and outdoor behaviors will improve.
Routines are good for management. They impose a measure of self-monitoring because they represent behaviors that are already known and have been practiced. If one person transgresses during a routine, other students are able to intervene to help you with student management. Here are a few routines that may work for you.

**Transition behavior.** Be explicit about how you want students to walk through the hallways and into the schoolyard. Repeat if necessary. By consistently showing students that poor travel behavior limits their time outdoors, they will follow your directions.

**Home base.** Establish a destination in the schoolyard, ideally where all outdoor activities will begin and end. Students should walk directly there after leaving the building. Choose a place that is level, protected from the elements, and, if possible, away from distractions like classroom windows and excess ambient noise.

**Circle up.** When students arrive at home base, they should form a large circle—everyone in a single ring. This is an effective way to maintain eye contact with all students while you give instructions or share findings. Take a position in the circle where you are facing the Sun. This way, you will know that students won’t be distracted by having the Sun’s glare in their eyes. If possible, place yourself next to those students whose focus might benefit from your proximity.

Techniques for forming a circle vary. To speed up the formation of a circle, try the tried-and-true countdown from ten or five, with the objective that everyone is in a proper circle by zero. Just make sure they know the signal to regroup before you let them go.

**Note:** For large groups, or when you want the circle very tight to look closely at something in the center, you can have two layers, with the inner circle kneeling or sitting and the outer circle standing.

**Attention signal.** Adopt a uniform signal for attention. It is essential that students respond to the attention signal immediately. You may choose the same method you use in the classroom or, if this is not appropriate for the outdoors, try one of these: a chime, bell, whistle, or other singular and loud sound.

Students can quickly learn additional signals for actions like regrouping at home base, pausing to look at the teacher, moving to the next task, and so on. Using these signals can be very helpful when the class is spread out.
**Focus question.** Inquiry-based activities are guided by a question. This pedagogical routine should extend into the schoolyard, too. Students need to know why they are engaged in the outdoor investigation. They should expect to write the focus question in their notebooks at the outset of the investigation and produce an answer by the end of the investigation.

**Boundaries.** Setting boundaries allows students freedom within a defined space. Because different activities may require different locations, it is always important to be explicit about where students are allowed to travel during the outdoor activity before you leave the introductory circle.

**Buddy system.** You may want to institute a buddy system, particularly if you leave the schoolyard. When participants are paired off, tell them that each individual is responsible at all times for the whereabouts and safety of his or her buddy. You may decide to number the pairs in order to count off and account for everyone quickly.

**Considerations for Students with Disabilities**

FOSS evolved from pioneering work done in the 1970s with students with physical disabilities. The legacy of that work is that FOSS investigations incorporate multisensory methods, not only to accommodate students with physical and learning disabilities, but also to maximize information gathering for all students. Strategies that provide opportunities to learn for students with disabilities turn out to be good strategies for all students.

All students benefit from opportunities to experience the natural world outdoors. For students with disabilities, consider how to make the schoolyard accessible and safe so that they can work with a degree of independence. This requires planning to make sure that the student, his or her family, and staff involved in the student’s school experience are informed and have input into the process.

Whenever a student with a disability is successful in a full-inclusion classroom, there is a behind-the-scenes collaborative effort of caring educators who work together to support the student with just the right amount of scaffolding. Before teaching the first outdoor activity, contact the special education teachers in charge of each student’s individualized education program (IEP), and have them review the planned outdoor experiences. Discuss modifications that will accommodate and support each student. Encourage the special educators to join the class for the outdoor activity.
**Attention and language-based disabilities.** Students with attention and behavioral issues often thrive when they are engaged in science outdoors. A fenced area will help you to both keep track of students and provide a sense of safety. Having students work with partners (buddies) allows them to look after each other. Provide short, structured opportunities for students to participate in outdoor activities in a clearly defined space, and expand the boundaries and time expectations as students earn your trust and confidence. Many educators have found great success with treating the outdoor activity as a reward for excellent behavior indoors.

Consider students’ communication requirements, and plan to bring specialty devices outdoors with you. These might be as simple as picture cue cards to help enhance your message or an electronic communication device such as a tablet.

**Physical disabilities and visual impairments.** In the Preparation Details for each outdoor activity, we ask you to decide where the outdoor activity should be taught. You may find that certain locations are better than others for the purposes of developing science concepts and meeting the physical needs of students with disabilities. Get to know your schoolyard well, and try to experience it as your students do.

One side of most schoolyards is typically a parking lot, and the other three sides have spaces accessible to students for work and play. If you have a student with a physical disability, you need to consider whether the terrain provides for good mobility for the student. Often, schoolyards are handicapped accessible because they are covered in asphalt. For many of the FOSS outdoor activities, an asphalt area is appropriate. When you want to use a greener location, make sure wheelchairs or crutches will work on these new surfaces. If the surface will be a mobility challenge, see whether a paraprofessional or an educational assistant is available to help the student. If not, consider whether a classmate can help. If that is not an option, then consider working at a transition zone where the grass meets the asphalt.

A student with a visual impairment should make a scouting trip to the outdoor site with a mobility instructor to get the lay of the land and to learn where things are located. If the student becomes familiar with and knows how to navigate his or her outdoor surroundings, it will allow for more independence. Even so, during the actual outdoor activity, the student may need someone to quietly describe the terrain ahead and may need a fellow student’s arm for balance and security.

If a student struggles with gross motor coordination, uneven ground may present a challenge. Just as you would in the classroom, begin by offering more support, and slowly pull back on this assistance as
students become more comfortable with their stamina, security, and endurance with regular outdoor activities.

**Sensory sensitivity.** For a student with tactile-sensitivity issues, make it clear that he or she may, for example, observe as a classmate digs in the soil to collect a sample. Over time, this student may feel better able to participate by using gloves or by washing his or her hands as soon as the digging is complete. Knowing where each student falls on the continuum of a disability will help you decide when to refrain from asking a student to fully participate, when to allow him or her to just observe, and when to give a gentle nudge and expect more active participation.

For students with sensory disorders, the outdoors is often a calming space. Consider where the quietest place in the schoolyard is, and use this more often if you have students with sensitivity to noise.

No matter what the disability, educators have found success taking students outdoors. With planning, communication with the student and the special education team, and a little extra effort, you, too, can provide a rich, safe outdoor learning experience for all your students.
FOSS OUTDOORS OPTIONS

In each FOSS middle school course, you will find embedded opportunities to take students outside. If you are interested in additional opportunities to take your classroom outdoors, you can find extensions on FOSSweb that link to outdoor activities related to specific investigations.

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**TEACHING STRATEGIES**

In the beginning, you may find some students are hesitant to get dirty. Some students may be resistant to handling bugs or even just sitting on the grass. After a few outings, these issues often fade away. With patience, persistence, and support, students’ resistance may be overcome entirely. If you suspect that your students may be reluctant to work outdoors, structure your first few activities to be low-stress activities.

**Set the tone.** Many teaching strategies that are effective in the classroom work outdoors, too. For example, at the circle, instead of instinctively talking louder (because it is noisy outdoors), kneel down and speak in a loud whisper so that students need to focus to hear you. If students are speaking, put up your silent signal, and wait for silence. The educator’s voice sets the tone for the activity outdoors just as it does in an indoor classroom.

**Take a position.** Position yourself in group circles so you have the Sun in your face and students don’t need to squint. You can choose positions next to those students whose focus might benefit from your proximity.

**Meet the challenge.** Students who struggle with behavior problems often respond well outdoors when given responsibility. Let the active student carry equipment or take the position at the front of the line to lead the class outdoors. For many students, this is all it takes to get them off on the right foot for the outdoor activity.

Students who have the greatest difficulty focusing or learning indoors are often the leaders outdoors. In fact, you may find that distracted or unmotivated students indoors thrive so much on outdoor learning that they will take the initiative to focus the entire class in order to get outside faster.
Taking FOSS Middle School Outdoors

SCIENCE NOTEBOOKS OUTDOORS

Using FOSS notebooks outdoors can help keep students on task and organized when they are more dispersed in the field and unable to reference teacher notes on a classroom board. Using notebooks outdoors also reminds students that they are conducting scientific investigations just as they would be in the classroom.

Here are some tips for taking notebooks outdoors.

- Students should add notes to their notebooks and glue in pages before heading outdoors. Review these notes at home base before beginning the activity.
- Protect notebooks from dirt and water. Depending on the activity, you might decide to consolidate all notebooks into a crate for easy transport or storage while outdoors. This technique is particularly useful when the ground is moist, when the activity is messy, or when students need to have their hands free for a part of the activity. In addition, 4 L zip bags are excellent for protecting notebooks from the elements as well as containing other supplies, like writing tools.

In addition to the ideas and suggestions included in the Science Notebooks in Middle School chapter, consider the following modifications for each notebook component used during your outdoor investigation.

Focusing the investigation. The focus question and procedures normally remain on the classroom board during an indoor investigation. Adding these elements to notebooks before going outside helps keep students more independent and efficient.

Data acquisition and organization. Make sure students understand what data is being collected and how the data should be displayed before they disperse. Predesigned data sheets can help expedite and focus teamwork.

Making sense of data. Regroup and check in with all the groups before they analyze their data to answer the focus question. You may want to consolidate group data as a class. If possible, discuss data before going back inside, so that discrepancies between groups can be explored and reconciled in the setting where the data were collected.

Next-step strategies. Always consider how reflective strategies can help move student understanding forward. For example, encourage students to add a line of learning beneath their notes and add new information from the closing-circle discussion.

Full Option Science System
EXTENDING BEYOND FOSS OUTDOOR ACTIVITIES

There is no literary or online replacement for students’ participating in long-term weather study, observations of Moon phases, exploring erosion on the schoolyard landscape, or observing living local organisms in their natural habitats. In this digital age, it is essential to explicitly engage students in collecting data from direct personal experience.

Occasionally, you may stumble upon a serendipitous opportunity. At special moments like these, when wildlife visits or the weather suddenly changes, our job as educators is to signal students to stop and quietly appreciate the suspension of time, without words. Inviting students to be quiet and present in the moment can give them a gift for a lifetime.

It is not uncommon for educators to experience the powerful effect of the outdoors on student learning. If you find yourself searching for additional outdoor learning opportunities, consider the ones below.

Move activities outdoors. Whatever the subject, students will have more room outdoors to be creative with some activities, and you can worry less about mess or loud conversations. You must still consider how to transport materials, where students will sit, how they will return their project to the classroom, and how to clean up the outdoor space. The additional space can allow for isolated reflection and writing in notebooks at pivotal moments in the course.

Use the outdoors for extensions. Applying what students have learned in the classroom and putting that knowledge to work outdoors is an effective way to solidify their understanding. It is also an effective way to reinforce learning and informally assess whether students understand the concepts.

There is great value in repeating indoor activities outdoors. If students are studying milkweed bugs, explore the schoolyard for insects and compare them. Compare classroom plant roots to various weeds from the schoolyard. Do patterns of erosion and deposition in stream tables translate to the school grounds? This is also a great opportunity for homework extensions through backyard or neighborhood explorations.

Connect learning to your place. Indoor work can also make powerful place-based connections. For example, in the Populations and Ecosystems Course, students explore the ecology of places across the United States by studying different ecocenarios. Enhance student understanding by creating an ecocenario for your place. Similarly, create your own geocenario at the end of the Earth History Course. Whenever possible, help students explicitly connect classroom concepts to their place in the world.

Taking FOSS Middle School Outdoors

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NOTE

Most states have an Environmental Literacy Plan, and some states, districts, or schools have a strong push for helping students become environmentally literate. You can find additional regional resources on FOSSweb.
Find solitude. Use your outdoor space for silent independent work time. Just as in the classroom, the outdoor space can be a workspace with activities going on. At times the outdoor space is more of a sanctuary for independent observation and notebook writing. It can be a place for special classroom rituals, awakening awareness of the beauty of nature. Sometimes it can just be a place to be silent for a minute to awaken the senses and refocus students’ energy.

Silent solo-spot project. Consider allowing each student to choose a personal spot in your outdoor space that they will return to throughout the year. Spots ideally should be at least 2 meters from other students. The basic guidelines are to stay silent and remain in your spot until you hear the signal. Activities for solo-spot time will vary in relevance to classroom work. Journaling about the surroundings is a good starter activity. A solo sit could begin or end an outdoor activity or be the main purpose for venturing outdoors.

Finding time to allow students to have personal time in nature can have a surprising influence on student motivation and academic achievement beyond the project, as well as being beneficial for you. Consider having separate notebooks for students’ journaling in their spot. Maintaining silence can be challenging at first for students and teachers, but ultimately may result in the most memorable experience of the year and a potentially life-long connection to the space.

Enhance biodiversity. Modify your schoolyard by adding natural materials, such as logs, rocks, or paving stones. There are many responsible ways to attract wildlife to your class windows with feeders for birds, squirrels, hummingbirds, or butterflies, as well as many great programs for monitoring these animals. Consider involving students in the design and implementation of projects (perhaps through an after-school club).

Schoolyard modifications require administrative participation and the support of the school custodian. Marking the area with professional or student-created signage can further benefit the enhanced site. If your schoolyard habitat needs your intervention to cultivate biodiversity, understand that it can take a couple of years to get established. Areas completely surrounded by blacktop or concrete can become filled with living things if provided with food, shelter, and water.
Establish long-term studies. The possibilities for long-term studies are endless, ranging from weather monitoring to seasonal population variation. It can be as simple as adopting an observation location and visiting it monthly to monitor various aspects of change over time. Seek questions that could be used to study your local site and inform future site improvement.

Outdoor Biology Instructional Strategies (OBIS). OBIS is an outdoor instructional program that offers young people fun and challenging opportunities to investigate ecological relationships in their local environment, to investigate biology, and to increase their environmental awareness. You can access OBIS activity guides online through www.outdoorbiology.com.

Create a schoolyard field guide. Have students collect a leaf sample from every kind of plant they can find. Consolidate similar samples to determine how many different kinds of plants were collected. To preserve your samples, take digital photos or press leaves. Then comes the arduous task of identifying your plants using online and print guides. The final product could be useful for other classes and educating the general public.

Schoolyard gardens. Planting a garden in raised beds or improved soil is an ambitious option for increasing the biodiversity of your schoolyard. Consider carefully, especially with an edible garden, the timing of the school year. In most parts of the country, the growing season is during summer vacation. Even if you can get a summer program involved, we suggest starting with indigenous plants that bloom or mature in spring and fall and require little maintenance. “Rain gardens” involve native plants and use the landscape for natural sustenance. Often, parents or local garden organizations are willing to help maintain gardens during the summer months.

Local and regional resources. Looking for resources in your area for field trips or experts in your area related to a specific course? Check for a database of resources on FOSSweb.
ADOLESCENTS IN NATURE

E.O. Wilson (1929–), renowned entomologist and advocate for global biodiversity, reflects upon his childhood inspiration: “Hands-on experience at the critical time, not systematic knowledge, is what counts in the making of a naturalist. Better to be an untutored savage for a while, not to know the names or anatomical detail. Better to spend long stretches of time just searching and dreaming” (Wilson, 1994). The magic in the free, unstructured exploration of Dr. Wilson’s youth that influenced his career in conservation biology is missing from the experience of an average modern American adolescent. The good news is this: educators who integrate their local environment into their teaching practice can spark an enduring relationship with the natural world, cultivate empowered citizens and motivated students, and enhance long-term academic performance.

Children today often enter adolescence lacking a positive relationship with the natural world. In the last three decades, an attitudinal survey measured a steady decline in environmental concerns and awareness by high school students (Wray-Lake et al., 2010). David Sobel (1949–), who has been studying children’s relationships with nature since the 1980s, labeled this phenomenon ecophobia—a fear of ecological problems and the natural world. There are multiple social factors that influence this disconnect from nature, including parental overprotection (Louv, 2008); the indoor draw of electronic media, with which American children spend an average of 7.5 hours a day (Coyle, 2010); and the more recent well-intentioned “look but don’t touch” preservationist approach to the outdoor experience (Sobel, 2012).

What happens in childhood to propel certain remarkable individuals to grow up with strong ecological values and to pursue social action? An analysis of multiple studies determined that environmentalists attribute their social commitment to a combination of “many hours spent outdoors in a keenly remembered wild or semi-wild place in childhood or adolescence, and an adult who taught respect for nature” (Chawla, 1988). Another study, involving 2,000 adults between the ages of 18 and 90 who live in urban areas, found that wild nature experiences during childhood directly correlate with adult environmental values and behavior (Wells and Lekies, 2006). If we truly want to create active citizens, it begins with regular outdoor exploration.
Research has also shown that using the schoolyard is an effective way to enhance student learning. When students are exposed to their environment as an integrating context of learning, they become enthusiastic and self-motivated and, typically, academically outperform their peers who have not had these learning opportunities (Liebermann and Hoody, 1998). In addition, they are able to stay focused and engaged in outdoor assignments longer and are more focused when they return to their indoor class work (Louv, 2008).

Texas A&M University, in conjunction with the Texas Education Agency, conducted a meta-analysis of the research in order to identify and rank effective instructional methods for science education and to define how best to improve student achievement. The highest ranked teaching strategy was enhanced context strategies, which included taking meaningful field trips and using the schoolyard for activities (Scott et al., 2005).

In addition, students’ attitudes toward learning are influenced by simple outdoor experiences. In one study (Shaw and Mills, 1981), students who experienced outdoor instruction reported that they enjoyed school more and felt more supported and trusted by their teacher than they had prior to the outdoor experiences. These pretest/posttest differences were more pronounced for students who had been identified as being “uninvolved” in the classroom activities. Also, this student perception had a lasting effect that carried over to the regular classroom activities weeks later.

As children start to discover the “self” of adolescence and are connected to their place in the natural world, they are more inclined to want to create positive change (Sobel, 1996). In a world of overwhelming exposure to negative and abstract environmental problems like climate change and human overpopulation, it is essential to focus students toward tangible productivity at the local level. This includes improving the school grounds, managing school recycling programs, contributing data to citizen science projects, mentoring younger students outdoors, and volunteering with a local conservation project. FOSS outdoor activities will help you focus on age-appropriate environmental topics and enable meaningful and personal connections between students and their local environment.

“If we prematurely ask children to deal with problems beyond their understanding and control, then I think we cut them off from the possible sources of their strength” (Sobel, 1996). E.O. Wilson was not initially inspired by the destruction of the rain forests of Brazil, but by
catching lizards and insects in his backyard. By focusing on inquiry and direct experience in the local environment instead of seemingly insurmountable problems, students will make positive, empowering, lifelong connections to nature. Educators have an opportunity to act as guides and activate for students the sense of wonder and curiosity possible only in the natural world, while simultaneously academically enriching their instruction, simply by including the outdoors as part of classroom teaching.
REFERENCES


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The FOSS Outdoors initiative began through a collaboration with the Boston Schoolyard Initiative (BSI). In 2004, BSI began developing an approach to teaching science that routinely takes elementary school students into the schoolyard to test, apply, and explore core science concepts and skills. As part of this project, BSI developed Science in the Schoolyard Guides for 12 K–6 FOSS Second Edition modules and a companion Science in the Schoolyard DVD. Many of the behavior management strategies listed here were gleaned from innovative Boston Public School teachers. We thank each of them for their contributions to this initiative and hope they know that the ripples of their work extend far beyond the city limits of Boston, MA, to reach many more students across the country and throughout the world.

In partnership with the city of Boston, BSI designed and built K–8 schoolyards across the city that provide a rich environment for teaching, learning, and play. For more information on BSI, Science in the Schoolyard, or BSI’s Outdoor Writer’s Workshop professional development program and materials, see www.schoolyards.org.