NCLI

No Child Left Inside Day

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A Guide for Organizing Your Outdoor Earth Science Event

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Introduction

"No Child Left Inside" Day — NCLI Day, for short — originated in 2008 to urge young people outdoors, where they could explore Earth science firsthand. The first NCLI Day was held on Tuesday, Oct. 14, 2008, during Earth Science Week, an annual celebration of the geosciences organized by the American Geological Institute (AGI) since 1998.

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By 2008, the NCLI slogan had become a popular rallying cry among youth organizations, fitness groups, and government agencies interested in promoting outdoor activities. Some wished to promote exercise, some appreciation of nature, and some awareness of recreational opportunities. Working in partnership with the U.S. Geological Survey (USGS), AGI structured the first NCLI Day to promote Earth science education. Teachers led hundreds of students on a short hike from Langston Hughes Middle School in Reston, Va., to a nearby stream and wooded area. At a series of "learning stations" there, AGI and USGS scientists offered demonstrations and conducted discussions on topics such as water chemistry and biological diversity. Students sampled water, observed plant and animal life, and studied the interactions of natural systems in this hands-on exploration of Earth science.

Before the day was over, students expressed what they had learned about Earth science in haikus, enjoyed a picnic lunch, and talked with NBC and NPR journalists who had arrived to cover this extraordinary educational event.

Now NCLI Day is celebrated on the Tuesday of each Earth Science Week. But any day can be NCLI Day! Young people everywhere enjoy experiences that make learning fresh and exciting. Your students will, too. This guide contains all the information you need to begin planning your own NCLI Day. With the help of your colleagues, you can create an event that gets young people excited, shows the community what great things are happening at your school, and genuinely promotes high-quality, hands-on Earth science learning!

Creating Partnerships

To make your NCLI Day celebration all it can be, enlist the help of colleagues and partners in your school system and wider community. Help won't be hard to find when others begin to understand the effort's importance — and its potential benefits.

As someone who is deeply engaged in Earth science, you know how vital the geosciences are to living in today's world. And your neighbors receive daily reminders in the form of news headlines about natural disasters, energy crises, technological advances, employment needs, and global climate controversies.

With your exceptional geoscientific expertise and ties to the community, you're in a perfect position to point out the importance of Earth science. See Why Earth Science? (http://www.agiweb.org/education/WhyEarthScience/Why_Earth_Science.pdf).

More immediately, NCLI Day can bring unique benefits to your school community. This event, as noted above, can excite young people by shaking up their classroom routines and leading them into uncharted territory. Additionally, NCLI Day can show the community a new side of your school, highlighting the nontraditional educational approaches you're undertaking to provide students with high-quality, hands-on experiences in Earth science education.

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Whom should you include on your team? Some recommendations:

- Approach your principal, your school's lead science teacher, and your school district science curriculum supervisor about organizing an NCLI Day celebration. You might even enlist the support of your district superintendent or key school board members. Talk with your fellow science teachers, as well as teachers in other subjects such as math and social studies, about collaborative activities and cross-curricular projects.

- Don't forget to involve partners from outside your school system, such as geoscience faculty from nearby colleges and universities, not to mention informal education entities such as museums, science centers, local geological societies, public parks, geoscience-related employers, and your state geological survey. Representatives from these organizations often are more than happy to spend part of a day promoting awareness among young people. To learn about potential partners in your area, see Earth Science Organizations (http://www.earthsciweek.org/gpn/index.html).

- Welcome parents and guardians to volunteer at the event. In particular, if the number of students included is high, you may be glad to have extra adults on hand to manage students. And as you probably know from previous experience, these folks appreciate being included in their children's education.

- Finally, consider inviting a community leader, such as your district's superintendent or your city's mayor, to participate. Many leaders, and especially elected officials, appreciate such opportunities to interact with constituents and community members. Also, including such leaders in your NCLI Day event can help add cachet and attract media attention. (More on that below, under Media Outreach.)

Enlisting partners is a great way to share the workload. Many of the recommendations above come from AGI's The Pulse of Earth Science: An Advocacy Guide (http://www.agiweb.org/education/statusreports/advocacy/index.html). Feel free to consult this handy resource in maximizing your efforts to garner support for NCLI Day and your other Earth science efforts.

Planning the Event

The trick to organizing a big event like NCLI Day is dividing it up into smaller, more manageable tasks. When you take those tasks one at a time, share the work with partners, and keep the lines of communication open, the job often becomes a lot easier than it originally appeared.

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Here are some step-by-step suggestions:

- Build partnerships with fellow educators, administrators, and relevant community members, as discussed above. These conversations will help you to flesh out details about the size and scope of your event, identify specific components you do or don't want to include, and secure "buy in" from people you'll rely on for key contributions. For example, you need the approval of your principal up front. And you want enthusiastic expressions of commitment from other teachers before making detailed plans.

- Choose a setting for your NCLI Day activities. The ideal location is one on or near your school grounds, where a variety of natural systems and processes can be observed, such as rock formations, a stream or pond, and plant and animal life. But you can find Earth science anywhere, even in an urban setting. The top priority is leading young people outdoors to a location where they can safely observe and interact with Earth systems and processes.

- Plan your NCLI Day educational activities. Cover Earth science topics that are relevant to the selected natural setting, so students see how science relates to their world. Make the most of NCLI Day by conducting investigations or experiments that couldn't or wouldn't ordinarily be done in the classroom, such as testing pond water or taking soil samples. Most importantly, plan activities that enable young people to discover the Earth science behind natural phenomena on their own. (For recommended activities, see Education Stations and Activities.)

- Finally, attend to the details. Will your NCLI Day planning partners share questions and updates via frequent meetings, email, or some other means? Will students conduct activities in the classroom to prepare them ahead of time? Will their parents and guardians need to sign permission forms before the event? Will students travel from class to your NCLI Day location on foot, by bus, or some other way? Will your event feature a speech, presentation, or introductory remarks by a public figure or geoscientist? Will students remain in one large group at your NCLI Day location, or will they split up into smaller groups to explore "education stations" dealing with various topics? Will special equipment or materials be necessary to conduct activities? Will parent volunteers be needed to escort small groups of students from one education station to another? Will special provisions be necessary to ensure student safety (see below)? Will students conduct classroom activities afterward to reinforce NCLI Day lessons? (See Following Up in the Classroom.) Assign roles and responsibilities to your partners, and draw up a schedule to keep preparations on track.

Safety Suggestions

Make sure that these and any other necessary safety guidelines are provided to and followed by students:

- Wear sunscreen outdoors.
- Protect your eyes with dark glasses on sunny days.
- Always wear appropriate footwear and clothing — no flip-flops!
- Take along a first aid kit.
- Pay attention to "No Trespassing" or other warning signs.
- Only use alcohol thermometers, never mercury!
- Stay in a safe place if making outdoor observations.
- Treat living things with care. Some may bite, sting, or be poisonous!
- Take water along, so that you don't become dehydrated.
- Be aware of the weather forecast and any flash flood warnings.
- Have a cell phone and emergency numbers handy.
- Make sure you check yourself for ticks or other pests.
- Be aware of any student allergies, such as a bee venom allergy.
- Avoid areas with poison ivy, poison oak, or poison sumac.

Education Stations & Activities

Maybe your students can take a short bus ride to a coastal outcrop, a sun-baked mesa, or a snowy forest. Maybe they can walk to a public park just a block off campus. Or maybe they can find a wealth of Earth science right at the edge of the playground.

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Whatever the setting, the specific natural systems and processes available at your location for observation and interaction likely will determine which activities you conduct.

You may choose to set up multiple "education stations" at your location, where a teacher will lead a small group of students in an activity before sending them along to the next education station. Following are 17 educational activities that you are invited to adopt or adapt, as appropriate, for your students.

- Build a Rain Gauge Grades 5-9
- How Can You Test Your Soil Grades 5-9
- Make Your Own Compass Grades 6-8
- Plant an Ozone Monitoring Garden Grades 6-9
- Sky and Cloud Windows Grades 3-8
- Soil Properties Grades 5-10
- Your Own Greenhouse Grades 3-5
- Earthquake on the Playground Grades 7-12
- Dig Into Soil Grades K-4
- Look Up! Observing Weather Grades K-4
- Streams and Water Quality Grades 9-12
- Be a Paleontologist! Grades 3-12
- Find Your Bearing: Mapping Grades 7-12
- Building Geology: Rock and Mineral Hunt Grades 6-12
- The Human Rock Cycle Grades K-5
- Writing Earth Science Grades K-12
- Earth Science Art Grades K-8

To find more Earth science activities, designed for both in and out of the classroom, visit Earth Science Week or order an Earth Science Week Toolkit. Visit AGI Education to learn more about Earth science curricula, professional development, and additional resources.

Build a Rain Gauge

Adapted with permission from the National Oceanic and Atmospheric Administration.

For precipitation to form, particularly over a large area, several ingredients are necessary. First there must be a source of moisture. The primary moisture sources in the United States are the Atlantic and Pacific Oceans as well as the Gulf of Mexico. Winds around high- and low-pressure systems transport this moisture inland.

Once the moisture is in place, clouds still need to form. The most effective way for this to occur is for the air to be lifted. This is accomplished by forcing the air up and over mountains or, more commonly, by forcing air to rise near fronts and low-pressure areas.

Cloud droplets and ice crystals are too small and too light to fall to the ground as precipitation. So there must be processes through which cloud water, or ice, can grow large enough to fall as precipitation. One process is called the collision-and-coalescence or warm-rain process. In this process, collisions occur between cloud droplets of varying size, with their different fall speeds, sticking together or coalescing, forming larger drops.

Grade Level: 5-9

Safety

Keep materials away from your eyes and mouth. Wear sunscreen if outside for an extended period. Wear sunglasses on a sunny day. Be aware of the weather, and check for ticks after returning to the classroom.

Materials

- Straight-sided glass or plastic container, with a diameter of about two inches or less (such as an olive jar)
- Coat hanger or wire bent to make a holding rack
- Measuring spoons: 1 teaspoon and 1/4 teaspoon
- Hammer and nails to secure the rack
- Felt tip marker

Procedure

1. Rain gauges measure the amount of rainfall in cubic inches. So your first task is to make a scale for your container that shows how many cubic inches of water are in the container. One cubic inch of water is about 3 1/4 teaspoons, so you can draw the scale on your container by pouring 3 1/4 teaspoons of water into your container, then drawing a short line at the level of the water. If you look closely, the top of the water will seem to be slightly curved and thickened. Draw your line so that it matches the bottom of the curved surface (which is called a meniscus). This line corresponds to a rainfall of one inch.

2. Add another 3 1/4 teaspoons of water to the container and draw another line. The second line corresponds to a rainfall of two inches.

3. Repeat Step 2 until you have at least five marks on the container. This will be enough for most rain events, but you may want to add another line or two - just in case!

4. Find a location for your rain gauge where there is nothing overhead (such as trees or a building roof) that could direct water into or away from your gauge. The edge of a fence away from buildings is often a good spot. Another possibility is to attach

your rain gauge to a broomstick driven into the ground in an open area. Be sure to record rainfall soon after a rain event to avoid false readings caused by evaporation.

5. Get outside and empty your gauge after each reading, and you are ready for the next rain event!

How Can You Test Your Soil?

Adapted with permission from the Soil Science Society of America.

We walk around on soil all the time, but how often do we think about what's in it? If you have ever looked closely at soil, you probably saw that it is made up of various types of particles and has various materials mixed in with those particles (rocks, twigs, water, air, worms, insects, and much more). Those things you can see.

But did you know that soil also contains things that we can't see and can only measure with chemical tests? These things — acids, bases, nitrates, phosphates, and potassium — are chemicals that affect what types of plants will grow well in the soil. As a citizen scientist, you can use a soil test kit to find out how much of each type of chemical is in your soil.

Grade Level: 5-9

Safety

Keep materials away from your eyes and mouth. Wear sunscreen if outside for an extended period. Wear sunglasses on a sunny day. Be aware of the weather, and check for ticks after returning to the classroom.

Materials

- Soil test kit
- Local soil samples in plastic baggies
- Notebook to record results
- Water supply
- Paper towels
- Plastic gloves

Procedure

1. Get samples of soil from various places in your yard or around your school (with your parents', guardians' or teacher's permission). You don't need much — about half of a small zip-closing plastic baggie of each type will do. When you collect your samples, record in your notebook where you found the soil and what kinds of plants, if any, were growing in it.

2. Put on the plastic gloves. Follow the directions on the soil test kit to test your soil samples. Most kits from garden centers will measure your soil's pH (how acidic or basic your soil is), as well as nitrate, phosphate, and potassium content. Be sure to wash your hands and clean up when you finish.

3. Record the results of the tests in your notebook. Did all the soil samples have the same results for each test? If not, how could you explain that? Ask the people responsible for caring for the places where you got your soil if they are adding anything to the soil. How could what they were adding affect the soil?

4. If your soil test kit has a list of plants that grow best in various soil types, compare this to the types of plants you found growing in your soil. Are these plants likely to do well in this soil? If not, how can you change the soil so that the plants would do well? What would you need to add to it?

Make Your Own Compass

Adapted with permission from the National Oceanic and Atmospheric Administration from Discover Your World with NOAA: An Activity Book.

In ancient times, sailors found their way by observing stars and other celestial bodies — when they were visible through the clouds, that is. Thus, one of the most important improvements to ocean navigation was the invention of the compass.

There is some disagreement about who should get credit for this invention. It's pretty clear that the Chinese knew about magnetism as early as 2637 BC, but the first written description of a compass for navigation didn't appear in Europe until 1190. Why did it take so long? After you do this activity, you may have at least one good answer!

Grade Level: 6-8

Safety

Wear sunscreen if outside for an extended period. Wear sunglasses on a sunny day. Taking a first aid kit is a good idea. No flip-flops should be worn outside. Be aware of the weather, and check for ticks after returning to the classroom.

Materials

- Sewing needle about one to two inches long
- Small bar magnet or refrigerator magnet
- Small piece of cork (corks from wine bottles work well, but not the plastic stoppers)
- Small glass or cup of water to float the cork and needle
- Pair of pliers
- Pair of scissors or knife (to cut cork)

Procedure

First, some warnings: Needles, scissors, and knives are sharp — be careful! Also, magnets can damage cards with a magnetic stripe (credit cards, library cards, school IDs, etc), floppy disks, and some electronic devices. Keep magnets away from these things.

1. Rub a magnet over the needle a few times, always in the same direction. This action magnetizes the needle.
2. Cut off a small circle from one end of the cork, about 1/4-inch thick. Lay the circle on a flat surface.
3. Using a pair of pliers, carefully poke the needle into one edge of the circle and force the needle through the cork so that the end comes out the other side. Push the needle far enough through the cork so that about the same amount of needle is sticking out each side of the cork. Be careful not to stick yourself!
4. Fill the cup about half full of water, and put the cork and needle assembly on the surface of the water.
5. Place your "compass" on a flat surface and watch what happens. The needle should point towards the nearest magnetic pole — north or south, depending upon where you live.
6. Try placing a magnet near your compass and watch what happens. How close does the magnet have to be to cause any effects? Try this again with a nail or other steel object. You can see why it's important to keep

metal objects away from compasses on ships!

7. Imagine you are on the deck of a ship tossing back and forth on the open ocean. How well do you think your compass would work? When the cork floats on the water it creates a sort of low friction bearing. This kind of bearing is essential to allow the needle to rotate in response to Earth's magnetic field. But a cup of water probably wouldn't last long on the deck of a rolling ship! The need for a sturdy low-friction bearing was one of the reasons that it took a long time for mariners to use compasses at sea, even though the basic principles had been known for centuries.

   Magnetic fields are areas that contain a force created by moving electrical charges. Earth produces a magnetic field. This field is very weak, but it is sufficient to align magnetized objects —such as your needle — that are free to rotate. By floating the needle on the cork, you allow it to rotate freely so the needle becomes lined up with Earth's magnetic field, and points toward the north or South Pole of the planet.

Plant an Ozone Monitoring Garden

Adapted with permission from NASA Aura Education and Public Outreach.

To measure ozone in the Earth's atmosphere, NASA built the approximately 6,500-pound Aura satellite. The spacecraft carries four high-tech instruments that scan the globe from more than 700 kilometers above the planet.

For students, there is an easy way to investigate ozone in their own neighborhood. It's as simple as growing a few carefully selected plants. Teams of scientists and educators at NASA are showing how this can be done. They have installed ozone-monitoring gardens at several NASA centers.

Ozone, a molecule made up of three oxygen atoms, can be both good and bad, depending on its location. It's good to have ozone high up in the atmosphere - in the stratosphere - where it occurs naturally and protects humans and other living things from the sun's harmful ultraviolet rays. It's bad to have ozone in the lower atmosphere - in the troposphere - where it forms when pollution from cars, factories, and other manmade sources interacts with sunlight.

Too much tropospheric ozone makes air unhealthy for people to breathe. Some plants are also sensitive to ozone, which enters plants through tiny pores in a leaf's outer layer. When exposed to high levels of the gas for extended periods of time, leaves on these sensitive plants develop tiny, colored, evenly spaced spots. The leaves may also turn yellow, and reduced photosynthesis may hinder overall plant growth.

NASA's ozone gardens contain several types of ozone-sensitive plants: cut-leaf coneflower, flowering dogwood, buttonbush, snap beans, soy beans, and milkweed. Students can monitor local ozone by looking in their neighborhoods for ozone-injured plants or establishing similar gardens outside their schools or in their backyards.

Grade Level: 6-9

Safety

Keep materials away from your eyes and mouth. Wear sunscreen if outside for an extended period. Wear sunglasses on a sunny day. Be aware of the weather, and check for ticks after returning to the classroom.

Materials

- Computer with Internet access
- Plants native to your area
- Gardening tools (shovel, etc.)

Procedure

1. First, make observations of ozone injury in your neighborhood. The best observation times for ozone injury are during the summer months (May through September in the northern hemisphere) when sunlight is most intense, and high levels of surface ozone typically occur.

2. Identify plant species. Not every species is sensitive to ozone, and some are more sensitive than others. Even within a species, varieties may differ in their ozone sensitivity.

3. Check this list of ozone-sensitive species for your plant: www.nature.nps.gov/air/Pubs/bioindicators/index.cfm.

4. Carefully examine the bottom (older) leaves on the plant for ozone injury. Ozone injury appears as tiny light-tan to reddish-purple spots or "stippling" on the top surface of the leaf only.

5. If any leaf injury crosses over the veins or veinlets of the leaf, it is due not to exposure to ozone, but to some other cause.

6. Next, prepare to plant your own ozone garden. Determine the size of your garden. How much space do you have? Ozone gardens can range from a single plant in a pot to a yard full of ozone-sensitive species.

7. Select a location where it is permissible to plant your garden. Determine the hours of direct sunlight needed for the species you plan to grow and site your garden accordingly. Locations that are downwind of heavy traffic or other pollution sources are likely to have more ozone than locations that are behind belts of trees or open green spaces. Make sure you have a nearby source of water and somebody to keep the garden watered once or twice a week if you cannot do it yourself.

8. Choose which plants to keep in your garden. Plants that are native to your geographic location will most likely be the most successful. Start by identifying native plants in your area, perhaps by searching the Internet.

9. Plant your garden and watch your plants grow! Start watching for signs of ozone injury as soon as your plants begin to sprout leaves.

10. As growing season progresses, keep a watchful eye on your plants. The recommended minimum observation period is two weeks. The more you check your plants, the more detailed information you will gather on your plants' progression.

    For more, go to http://aura.gsfc.nasa.gov/outreach/ozonegarden.html and http://ozonegarden.larc.nasa.gov.

Sky and Cloud Windows

Adapted with permission from The Weather Channel.

Is today sunny or overcast? Is there wind, rain, or snow? No matter where you live, weather shapes your life. What's happening in the sky can determine how you dress, what you eat, where you spend your time, and when you work—or play.

The science of the sky encompasses Earth and space science (from the solar system to the water cycle), physical science (from heat and energy to motion and forces), and science in personal and social perspectives (from the environment to global climate change).

In this activity, students will conduct experiments or participate in demonstrations to answer questions about sky and weather phenomena. Students also will analyze and present data.

Grade Level: 3-8

Safety

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Materials

- 8 1/2" x 11" poster board
- Paint chips of a variety of sky colors
- Safety scissors and glue
- Notebook and pen
- Digital camera and printer (optional)

Procedure

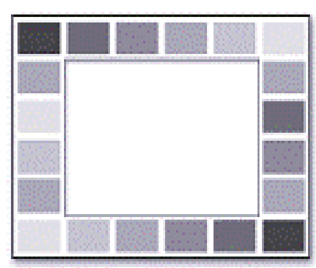
1. Fold the poster board in half lengthwise and cut out a center rectangle, leaving about a 2-inch frame.

2. Cut apart paint chips in shades of dark to light blue and white to dark gray. Glue these chips around both sides of the frame (see illustration).

3. Go outside for "Sky Checks." Use the frames as references when you look up at the sky. (Remember: Always look away from the sun!) These sky and cloud windows will focus your sky observations and help you determine and keep track of sky and cloud colors and changes.

4. Every time you do a Sky Check, write down your observations in your notebook. Be sure to include the date and time for each Sky Check, the amount of cloud cover, the types of clouds, amount of wind, and any precipitation.

5. If you have a digital camera, you can take a picture of the sky through your frame. Download these onto your computer and be sure to put the date and time when you took each picture. Taking pictures is just another way of collecting and recording your sky observations.



Soil Properties

Adapted with permission from Kristen Lucke, Views of the National Parks, National Park Service.

"Soil porosity" refers to the amount of pore, or open space between soil particles. Pore spaces may be formed due to the movement of roots, worms, and insects; expanding gases trapped within these spaces by groundwater; and/or the dissolution of the soil parent material. Soil texture can also affect soil porosity

There are three main soil textures: sand, silt, and clay. Sand particles have diameters between .05 and 2.0 mm (visible to the naked eye) and are gritty to the touch. Silt is smooth and slippery to the touch when wet, and individual particles are between .002 and .05 mm in size (much smaller than those of sand). Clay is less than .002 mm in size and is sticky when wet. The differences in the size and shape of sand, silt, and clay influence the way the soil particles fit together, and thus their porosity.

Soil porosity is important for many reasons. A primary reason is that soil pores contain the groundwater that many of us drink. Another important aspect of soil porosity concerns the oxygen found within these pore spaces. All plants need oxygen for respiration, so a well-aerated soil is important for growing crops. Compaction by construction equipment or our feet can decrease soil porosity and negatively impact the ability of soil to provide oxygen and water.

Grade Level: 5-10

Safety

Keep materials away from your eyes and mouth. Wear sunscreen if outside for an extended period. Wear sunglasses on a sunny day. Be aware of the weather, and check for ticks after returning to the classroom.

Materials

- 3 100ml graduated cylinders per group (or a measuring cup and two clear plastic bottles)
- Fine, playground-style sand and coarse, aquarium-style gravel
- Blank piece of paper and something to write on
- Pencil or pen
- Ruler
- Metal spoon or gardening spade

Procedure

1. Divide into small groups. On a piece of paper, make a data table like the one below for each group.

Soil particle type	Volume of Water used (ml)
gravel	
sand	

2. With each group taking 3 graduated cylinders, fill one cylinder with 100ml of sand, one with 100ml of gravel, and one 100ml of water.

3. Pour the water slowly into the gravel and stop when the water just covers the top of the gravel. Record the amount of water used in each data table. Refill the cylinder of water to 100ml.

4. Repeat step 4 with the sand and record the amount of water used in the data table.

5. Discuss the experiment: Which substance has more pore space: gravel or sand? How did you make this decision?

6. Before leaving the classroom, though, refill two of the graduated cylinders with 100ml of water. You will also need paper, pens, and pencils to record observations. Draw the data table below for each group.

7. Find a place outside where it is permissible to collect small soil samples and have each group choose a survey area.

8. Record observations of this survey area. Look at the types of plants growing in the soil, evidence of wildlife, etc. Is the soil in the shade or in direct sunlight? Sketch what you see.

9. Once survey area observations have been made, obtain a small sample of soil to determine its texture. Is the soil wet or dry? If it's wet, does it feel gritty (sand), smooth and slippery (silt), or sticky (clay)? Can you see and measure individual particles? Record all of your texture observations.

10. Now have each group fill its empty graduated cylinder with 50ml of soil. Pour water from one graduated cylinder into the soil until water just covers the top. Record the volume of water used in the data table next to Survey Area #1.

11. Pick a new survey area (if possible, with different vegetation). Repeat steps 3 through 5, and record the volume of water used in the data table next to Survey Area #2.

12. Return to the classroom and discuss your results: Was there a difference in soil porosity? Were there similarities? For the soil samples with similar porosities, did they have the same soil textures? Do you think these soils provide adequate water and air for plants? What types of plants live in these soils? Do factors such as sunlight or soil texture seem to affect the porosity of the soil?

Survey area	**Volume of Water used (ml)**
# 1	
# 2	

For more, visit www.nature.nps.gov/views.

Your Own Greenhouse

Adapted with permission from ARM and the U.S. Department of Energy.

As far back as ancient Greek and Roman times, people built structures that created an indoor environment suited to growing plants throughout the year. This enabled the gardener to establish a measure of control over growing conditions and extend the growth period into the colder seasons of the year. In this manner, the gardener was better able to provide fresh fruits and vegetables when needed. Today these structures, called greenhouses, are usually made of glass or plastic, but they still allow us to maintain year-round greenery.

There are similarities between a greenhouse and the Earth's atmosphere. During the day, the sun's rays shine on the Earth. Gases in the Earth's atmosphere trap some of this energy created by the sun and help warm the planet. Without this "greenhouse effect," the Earth would be too cold for life as we know it. But if the amount of greenhouse gases in the atmosphere increases, then more energy will be trapped, and the Earth will get warmer and warmer.

The way that heated air behaves in a greenhouse is also different in some ways from heated air in the Earth's atmosphere. For example, once the air in a greenhouse is heated, it has no way to escape. The Earth's atmosphere is more complicated, as you can see in the illustration that shows the different ways solar energy interacts with the atmosphere.

Climate scientists around the world study greenhouse gases and the ways they affect global climate. By making your own small greenhouse in this activity, you can recreate the greenhouse effect and measure its effect on temperature.

Grade Level: 3-5

Safety

Keep materials away from your eyes and mouth. Wear sunscreen if outside for an extended period. Wear sunglasses on a sunny day. Be aware of the weather, and check for ticks after returning to the classroom.

Materials

- Two identical empty plastic bottles (one with cap)
- Two identical alcohol thermometers
- Safety scissors
- Tape

Procedure

1. Make a hole near the top of the first plastic bottle and insert one thermometer.

2. Use tape to hold the thermometer in place and prevent any air from escaping through the hole.

3. Cut the second plastic bottle in half, as shown in the figure.

4. Place the second thermometer in the bottom half of the second plastic bottle.
5. Make sure that the same amount of sunlight reaches both thermometers.

6. Record the temperature values from both thermometers after 10 minutes or so.

7. Take the temperature records again after another 10 minutes.

8. Repeat the procedure at different times during the day or during different weather conditions.

9. Discuss: Do both thermometers always record the same temperature? If the answer is “no” for the previous question, which one is higher? Can you explain why these two temperature records are not the same? What effect do different times of day or different weather conditions have on the temperature records? Can you give a similar example that demonstrates the greenhouse effect in our daily life?

For more activities and information about climate science, along with lesson plans and resources for teachers, visit http://education.arm.gov.

Earthquake on the Playground

Adapted with permission from L.W. Braile and S.J. Braile and the Incorporated Research Institutions for Seismology (IRIS).

While seismologists conduct much of their research indoors at a computer, going outside to collect data is a vital aspect of their work, as in the activity below. Seismologists travel to some of the most remote places on Earth to install seismographs far away from the vibrations of human civilization. Here they can record the high-quality data necessary for them to conduct their research, including locating earthquakes.

Grade Level: 7-12

Safety

Drawing compasses have sharp points, so make sure students use them properly. P-wave students should jog at a steady pace and should not sprint. Wear appropriate footwear and clothing — no flip-flops!

Materials

- 3 stopwatches
- Graph paper and pencils
- Meter stick/tape measure
- Drawing compasses
- Object, such as a cone, to mark the epicenter

Procedure

1. Outside with your classmates, simulate P and S waves by jogging (to model the faster "primary waves") and walking (to model the slower "secondary waves"). Practice jogging and walking at a constant velocity to ensure consistency.

2. Decide which of you will serve as station timers. To determine the velocity of student P and S waves, station timers (students using stopwatches) measure the time it takes to jog and walk to a point at a distance of 10, 20, and 30 meters from the source. In other words, time how long it takes students, traveling a straight path, to arrive at the timers. To improve the accuracy of the P and S wave velocity measurements, complete several trials and take the average. Write down your findings.

3. Compute average travel times for the student P and S waves at various distances, and graph the data as a travel-time curve (http://www.earthsciweek.org/ncli/edact/Playground_TimeCurve.pdf). By plotting how long it takes seismic waves to travel various distances, you're modeling the way scientists create travel-time curves. You will need this curve for later in the activity.

4. Next, mark the corners of a 30-meter square space as well as the "epicenter," the place within that square that will be the source of student P and S waves. Create "seismic stations," where students with stopwatches stand at three corners of the square. See a diagram of this set-up (http://www.earthsciweek.org/ncli/edact/Playground_Set-Up.pdf).

5. Work together to assemble six student P and S waves at the epicenter marker, with S waves standing back-to-back and their associated P waves standing directly in front of each of them, each facing one of three seismic stations. Until the earthquake occurs, they represent stored potential energy in rocks.

6. Representing an earthquake, P-wave students jog outward from the epicenter toward the seismic stations. Start the stopwatches when the students start jogging, and stop them when they reach the seismic stations. Record the times. S-wave students walk outward from the epicenter toward the seismic stations. Start the stopwatches when the students start walking, and stop them when they reach the seismic stations. Record these times. Next, subtract the S-wave time from the P-wave time (S-P times) and record the time differences between P and S wave arrivals.

7. Use this measurement along with the travel time curves they created earlier to calculate the distance from each station to the epicenter, then combine all three distances to locate the epicenter by triangulation. Using the example travel-time curve online, if the S-P travel time is 0.5 seconds from a particular seismic station, then the distance from the station to the epicenter should be 10 meters. Find the distance to the other two seismic stations and record your findings. To triangulate the epicenter, use the graph found here (http://www.earthsciweek.org/ncli/edact/Playground_Graph.pdf). Put the point of the drawing compass on the first station and, using the scale, measure out the distance to the epicenter and draw a circle. Repeat this for the other two stations. Where the circles meet is the epicenter of the earthquake. See an example (http://highered.mcgraw-hill.com/sites/dl/free/0073135151/90798/16_08.swf).

8. Once you've calculated the location of the playground earthquake, compare your result with the actual epicenter in the 30-meter-square space. Discuss possible reasons for any inaccuracies in determining the actual earthquake location.

For a longer version of the activity including pictures of the setup, see http://web.ics.purdue.edu/~braile/edumod/walkrun/walkrun.htm.

Dig Into Soil

Adapted with permission from Wendy Greenberg, Soil Science Society of America.

Soil scientists often examine soils and record soil data outside. Soil is not just topsoil; it includes other horizons (soil layers) underneath the topsoil. So soil scientists use shovels or soil augers to get samples of many soil horizons. They record soil colors, textures, and types of living organisms for various soil horizons. They also record the location, vegetation, and topography of each soil. All this data helps soil scientists, farmers, builders, and others understand soils better in order to use land appropriately.

Grade Level: K-4

Safety

Only an adult should handle the large shovel. Students should take caution if digging with trowels because some trowels have sharp points. Washing hands after this activity is a good idea. Living things may bite, sting, or be poisonous, so be careful. Always check for ticks. Do not wear flip-flops outside. It is a good idea to take along a first aid kit.

Materials

- Shovel with long straight blade
- Measuring tape or ruler and meter stick
- Data sheet and pencil
- Water spray bottle
- Trowels (for those not using shovel)
- Plastic sandwich bags, markers, and newspaper for desks (if bringing samples inside)

Procedure

1. Working in groups, find a place outside to dig a small pit. Be sure to get permission!
2. Observe and write down information about the site:

   Location. What building or road is it near? Whose property is it on?

   Vegetation. What types of plants are growing or have grown there?

   Topography. What is the general shape of the land (flat, hilly, etc.)?
3. Make a table on your data sheet that looks like this:

Horizon	Depth	Color	Texture	Living Organisms
Topsoil				
Subsoil				

4. Before you start digging, measure out a square plot of land, a meter in length on each side. Observe and make note of everything in that square, including plants, debris, types and abundance of living organisms, how much sunlight there is, and so on. Discuss your observations.
5. Dig carefully until you reach the subsoil. How do you know when you reach the subsoil? Something about the soil will change, most likely the color, and maybe also the texture. Dig into the subsoil for a sample of that, too. (The term "subsoil" is used here to mean any soil beneath the topsoil. Technically, what is under the topsoil may not be subsoil.)

6. Measure how deep the topsoil is, and write it down in the Depth column of the table. Be sure to write down the units (centimeters or inches). Then measure how deep the pit is, and write down that depth for the subsoil.

7. Get a good handful of topsoil. (If bringing samples inside, place topsoil in a plastic bag and label it.) Evaluate and write down these properties:

   Color. Use words like dark brown, light brown, yellowish brown, or reddish brown. Some soil might also be black, gray, yellow, or orange.

   Texture. Spray water on the soil to help you feel the texture. Pick sandy, clayey, or loamy. Sandy soil feels gritty and does not stick together well. Clayey soil is sticky. Loamy soil is between sandy and clayey. (Loam is not related to amount of organic matter).

   Living organisms. Did you find any worms, ants, or other organisms? Don't forget plant roots and seeds.

8. Get a good handful of subsoil. (If bringing samples inside, place subsoil in a labeled bag.) Write down subsoil color, texture, and living organisms as you did for topsoil.

9. Discuss: How is topsoil different from subsoil? Which has more organic matter? (Hint: Which one has a darker color?) Which one has more living organisms? How well do you think topsoil and subsoil hold water? How easy to you think it is for air, water, and plant roots to move through topsoil and subsoil? Does this soil get wet for a long time? (Hint: If the subsoil is gray, it probably stays wet for a long time.) What do you think would be different if you dug somewhere else? Were the organisms you found before digging the same as the organisms within the soil? Why do you think they are the same or different?

Look Up! Observing Weather

Adapted with permission from The Weather Channel and the National Oceanographic and Atmospheric Administration (NOAA).

Weather is a very important part of everyday life. Every morning we look at the weather report to decide on what clothes to wear and how early we should leave for school or work. To get a better idea of how meteorologists (scientists who study weather) make weather predictions, students will begin their own weather journals and make rain gauges. Meteorologists use tools and techniques like these to understand *climate,* patterns of weather over large areas and long periods of time.

Grade Level: K-4

Safety

Glass jars may be used in place of plastic jars, but be careful that the glass jar is not over a hard surface. Only an adult should handle the hammer and nails. Wear sunscreen if outdoors for an extended period of time. Wear eye protection such as sunglasses when looking at the sky, and *never* look directly at the sun. If using a thermometer, only use an alcohol thermometer, never mercury. No flip-flops should be worn outside.

Materials

- Pencils
- Notebook with lined paper
- Straight-sided plastic container, with a diameter of about 2 inches or less (such as an olive or peanut butter jar).
- Coat hanger or wire bent to make a holding rack
- Measuring spoons: 1 tablespoon (which equals 3 teaspoons) and ¼ teaspoon
- Hammer and nails, or duct tape to secure the rack
- Felt-tip marker
- Container of at least a liter of water

Procedure

1. Working in groups and using the notebook, record observations about clouds, temperature, atmospheric moisture, wind, and precipitation. An example could be: *Wispy clouds high in the sky (cirrus clouds). Temperature feels between 50 and 60 degrees Fahrenheit (or measure degrees Celsius). Atmospheric moisture is low and there is no current precipitation. Mostly sunny with wind from the NW at 5 miles per hour.*

2. If desired, continue this weather journal for a week, a month, or a semester. At the end of the observations, note any weather patterns or irregularities. Perhaps there was a hurricane, or maybe it was unseasonably warm for that time of year. Try to explain these occurrences. What does the weather say about the climate?

3. Rain gauges measure the amount of rainfall in cubic inches. So the first task is to make a scale for the container that shows how many cubic inches of water are in the container. One cubic inch of water is about 3 ¼ teaspoons (the same as one tablespoon and ¼ teaspoon), so pour 1 tablespoon and ¼ teaspoon of water into the container. Then, draw a short line at the level of the water. Looking closely, the top of the water will seem to be slightly curved and thickened. Draw your line so that it matches the bottom of the curved surface (which is called a meniscus). This line corresponds to a rainfall of an inch.

4. Add another tablespoon and ¼ teaspoon of water to the container and draw another line. The second line corresponds to a rainfall of 2 inches.

5. Repeat step 4 until there are at least five marks on the container. This will be enough for most rain events, but adding another line or two is a safe bet.

6. Find a location to hang the rain gauge where there is nothing overhead (such as trees or a building roof) that could direct water into or away from the gauge. The edge of a fence far from buildings is often a good spot. Another possibility is to attach your rain gauge to a broomstick driven into the ground in an open area. Be sure to record rainfall soon after a rain event to avoid false readings caused by evaporation.

7. Get outside and empty the gauge after each reading. Discuss: How much time must pass before you observe a pattern? What do you think are some other ways scientists directly study weather to understand climate?

Streams and Water Quality

Hydrogeologists and environmental scientists often study streams and lakes to determine the quality of the water. Water quality depends on several factors including sediment load and pH (level of acidity). Water quality in these environments is important, because this is where many people get their drinking water. In this activity, students will measure stream velocity, sediment load, and pH.

Grade Level: 9-12

Safety

Make sure students aren't too close to the water, so they won't fall in. Take special care after a rainfall, when the banks can be muddy and slippery, and the water may be moving more quickly than normal. Be aware of weather and flash flood warnings. Make sure that your stick or other floating object is handled with care so as not to cause injury from a sharp point or edge. Bring a first aid kit.

Materials

- Stopwatch
- Measuring tape/meter stick
- A stick or other floating object that can be discarded after experiment
- pH paper and corresponding color chart
- Paper and pencil
- Calculator

For the Teacher

Prior to conducting this activity, particularly step 6, the teacher should determine the cross-sectional area of the stream. Measure the stream's width with a measuring tape, and find average depth with a meter stick. Cross-Sectional Area = Average Depth x Width.

Procedure

1. Travel to a local stream, preferably a place where it is easy to stand on the bank. With the measuring tape or meter stick, measure out 2 meters parallel to the stream.

2. Have a student stand at one end of the measuring tape upstream (Point A) and another student stand at the other end downstream (Point B). Hand the student at Point B a stopwatch.

3. Hand a third student a stick or floating object that is large enough to be easily seen.

4. To measure the velocity of the stream, the student with the stick drops it in the stream about 2 feet beyond where the student at Point A is standing. When the front end of the stick reaches the measuring tape at Point A, then that student says "Go," and the student at Point B starts timing. When the front end of the stick reaches the end of the measuring tape at Point B, the student at Point B stops timing. Record the time on the stopwatch.

5. To calculate the velocity, the equation is Velocity = Distance/Time. So in this case, Velocity = 2 meters/X seconds, where X is the time on the stopwatch. (For example, if the time on your stopwatch is 2 seconds, then the Velocity = 2 meters/2 seconds, or 1 meter per second.)

6. After finding the velocity of the stream, calculate discharge, the amount of water flowing past a certain point per second.

7. An important indicator of what organisms live in the stream, discharge also influences a stream's ability to dilute chemical pollutants. To determine discharge, use your measurement for the stream's cross-sectional area, which is expressed in meters squared, as indicated above. So the equation for discharge (Q) is Q = Cross-sectional area (A) x Velocity (V). (For example, if A is $10m^2$ and V is 1m/s, then Q is $10m^3/s$ or 10 cubic meters per second.)

8. If there is time left, find the pH of the stream using pH paper and a color chart. Simply take a piece of pH paper, dip the end of it into the stream for a few seconds and pull it out to see if there is a color change. Then use the pH paper color chart key to determine how acidic or basic the water is.

9. Discuss how the velocity, discharge, and pH of the stream might affect the biology of the stream and the quality of the water as a source of drinking water for humans. Why is the stream acidic? Why not? Could there be human or animal contamination? Does the stream's velocity affect which animals you see in the stream? Are there fish or insects? How many and how big? Discuss the biodiversity of the stream. Are there many different types of organisms or a lot of the same kind of organism?

Be a Paleontologist!

A paleontologist is like a private investigator, searching for clues and evidence of past life. These clues, preserved in sediments or rocks, are called fossils. In this activity, students are asked to think like private investigators working on a case: Where is paleontological evidence of past life likely to be discovered?

Grade Level: 3-12

Safety

Wear sunscreen if outside for an extended period. Wear sunglasses on a sunny day. If near a stream, take care: Do not get too close to the water, and be aware of flash flood warnings and fast-moving water. Watch the weather, and check for ticks after returning to the classroom.

Materials

- None

Procedure

1. Take a short walk outside and consider the landscape. If you were a paleontologist, in which of the environments nearby would you expect an animal or plant fossil to be preserved?

2. Think about how fossils are preserved. Are they preserved in places where sediments are deposited or where sediments are eroded? Would a fossil be preserved on a basketball court? Why or why not? Would a fossil be preserved in a muddy area near a stream or lake? Why or why not?

3. What types of rocks would have fossils in them? Would igneous and metamorphic rocks contain fossils? Would sedimentary rocks? Why?

Find Your Bearing: Mapping

Geologists, cartographers (map makers), and surveyors use compasses to make maps and determine where they are. Hikers use compasses to find their bearing in the wilderness in hopes that they won't get lost. Sailors used to use compasses to find their way across the ocean and explore new territories.

Many people now often use a Global Positioning System (GPS), but it is important to know how to use a compass because there are still many applications of compasses — and not everyone can afford a GPS. Mapping is also a very important tool for Earth scientists. Maps can show everything from roads and buildings to the rock layers beneath the surface of the Earth. In this exercise, students will make a map of the school's campus.

Grade Level: 7-12

Safety

Wear sunscreen if outside for an extended period. Wear sunglasses on a sunny day. Taking a first aid kit is a good idea. No flip-flops should be worn outside. Be aware of the weather, and check for ticks after returning to the classroom.

Materials

- Compass or several compasses (Nothing too fancy, just a simple plastic compass will do. However, it's best to have a compass with azimuth readings instead of quadrants. An azimuth compass goes from 0 to 360 degrees. A quadrant compass has four quadrants of 0-90 degrees each.)
- A handout with predetermined bearings, a starting point, and paces between 4-6 bearings for each student. See samples (http://www.earthsciweek.org/ncli/edact/BearingSamples.pdf).
- A site marker or prize for the end of the exercise
- Sheets of standard 8.5"x 11" white paper for each student
- Pencils

For the Teacher

Prior to conducting the activity, the teacher should create a handout of predetermined bearings and paces between bearings. Give a copy of the handout to each student, along with a pencil and a plain sheet of 8.5"x 11" white paper. Show students how to use a compass to get bearings. A bearing is simply a direction in degrees on a compass. For example, 0 degrees is due north, 180 degrees is due south, 90 degrees is due east, and 270 degrees is due west. Any bearing between 0 and 90 degrees is a northeasterly direction, and so on. Ask for volunteers to use the compasses.

Procedure

1. Use your compass to determine the direction you must walk the number of paces specified on the handout. For example, if the first bearing from a designated starting point is 75 degrees and 25 paces, hold the compass at eye level and turn in place until the north arrow is pointing to 75 degrees. Then walk in a straight line for 25 paces along that bearing. Continue to the next step.

2. After you complete the exercise and reach your final destination, draw a map of the school campus. Create the map in such detail that a new student would be able to easily find his or her way around. Items to include are buildings, trees, tables,

blacktops, playing fields, and surrounding roads. Also important maps components are scale, legend, a north arrow, and the title of the map.

3. Use your compass skills to make your map more accurate in scale and more realistic. For example, you can turn paces into actual measurements. Maybe your pace is 0.3 meters, or about 1 foot. If you walk 102 paces along a wall of the school holding your compass at a bearing of 90 degrees, you could determine that 102 paces x 0.3 meters = 30.6 meters. Therefore, your map must include a line representing a wall that is 30.6 meters long, or about 100 feet, running from east to west (because the bearing is 90 degrees).

Building Geology: Rock and Mineral Hunt

Observation is a vital part of the scientific process, especially in Earth science. Before Earth scientists make hypotheses and theories, they observe the rocks around them for answers to questions, such as: What rock types are present? How old might they be? What do fossils and rocks tell me about the depositional environment? Was there active volcanism or faulting in this area? Students will use their observational skills to examine rocks they find on the exterior of the school building and on the ground on the campus.

Grade Level: 6-12

Safety

Wear sunscreen if outside for an extended period. Wear sunglasses on a sunny day. Taking a first aid kit is a good idea. No flip-flops should be worn outside. Be aware of the weather, and check for ticks after returning to the classroom. Washing hands after this activity is recommended to remove unwanted minerals such as lead.

Materials

- Geologic map of the collection area

Procedure

1. Take five minutes to find examples of sedimentary, igneous, and metamorphic rocks in the area around the school.

2. Discuss the rocks that your class collected and the minerals in the rocks. Can you identify any common minerals, such as quartz or feldspar?

3. Examine the geologic map of the area and discuss why you found these particular rocks and why you didn't find other types of rocks.

4. Now walk around the school and examine the materials used to make the building. Discuss: Is the school made of brick, limestone, granite, or some other material? Do you see igneous, metamorphic, or sedimentary rock? Is the building composed of human-made material? Where do the building's rocks come from? Are they found in a local quarry, or are they imported from far away? Do other buildings nearby have similar rocks? Are there fossils in the rocks? If so, what kind?

The Human Rock Cycle

Students, like adults, have various learning styles. Some of us learn best by talking and listening, others by reading. Many of us, including young students, learn best by doing — by moving, exploring, touching, and feeling. Acting out geologic processes can be a powerful way of building understanding.

Grade Level: K-5

Safety

Wear sunscreen if outside for an extended period. Wear sunglasses on a sunny day. Taking a first aid kit is a good idea. No flip-flops should be worn outside. Be aware of the weather, and check for ticks after returning to the classroom. Also, no rough play.

Materials

- None

For the Teacher

Prior to conducting the activity, the teacher should divide students into groups of about three or four. Assign each group, in secret, a rock type — igneous, sedimentary, or metamorphic — and tell them to discuss privately their strategy for acting out the group's assigned rock type. No talking with members of other groups!

Procedure

1. Quietly discuss with members of your group some creative ways to act out the rock cycle. How is your rock type formed? How does it age? How is it used by people? What does this look like?
2. One group at a time, make your dramatic presentation. You can make noises if appropriate, but no talking!
3. Once each group's presentation is over, allow observers to guess which rock type was being acted out. What evidence suggests one rock type rather than another?
4. After all groups have presented, discuss the rock cycle. How do the rock types differ? What do the processes that create them tell you about their age, location, composition, potential uses, and other characteristics?

Writing Earth Science

Earth science is more than measurements, maps, charts, and graphs. The language of geoscience, full of unique poetry, offers another avenue to understanding. Offer students a chance to flex their writing muscles in the context of Earth science.

Grade Level: K-12

Safety

Wear sunscreen if outside for an extended period. Wear sunglasses on a sunny day. Be aware of the weather, and check for ticks after returning to the classroom.

Materials

- Lined paper, preferably in a hardback notebook
- Pen or pencil

Procedure

1. Find a comfortable spot outdoors, whether far from school or right outside your classroom, and observe the natural world. Can you see earth — and is there anything living in it? Can you hear moving water? Can you feel a dry breeze?

2. Write a poem describing the natural world where you are. Include as many sensory details as possible. What can you see in the sky, feel in the ground, smell on the earth, taste in the air, hear all around?

3. Connect these observations with what you've learned about Earth science in the classroom. What is the history of this landscape? How did these landforms and organisms come to be? Where and when will the story of these natural materials, forces, and processes continue?

4. If time permits, use your first draft as a starting point for further investigation and research. Maybe study the local geology or search the Web for information on the history of industry in the area. Write a second draft, adding depth to your first impressions with these new understandings.

Earth Science Art

Half the fun of Earth science is experiencing the aesthetic beauty of the natural world. Our appreciation of nature can be enhanced by understanding the geoscience that underpins natural systems and processes. In this activity, students are invited to integrate scientific understanding with artistic expression.

Grade Level: K-8

Safety

Keep art materials away from your eyes and mouth. Wear sunscreen if outside for an extended period. Wear sunglasses on a sunny day. Be aware of the weather, and check for ticks after returning to the classroom.

Materials

- Selected art materials, such as sculpting clay, colored pencils or pens, paints and paintbrushes, paper, etc.

Procedure

1. Find a place outdoors to work. Collect your art materials, and pick a subject for your artwork. Which part of the scenery will you work on?

2. Before beginning your picture or sculpture, talk about what you see and what you plan to create. Why did you pick that part of the outdoors? Does it look exciting or interesting?

3. Talk about what you've learned in Earth science about what is around you outside. Why does the look like it does? Is it flat or hilly, bare or green with plants, worn away by water or ruffled by wind?

4. Maybe you've chosen to focus on a rocky outcrop, a stand of trees, or an area with lots of birds. How does what you know about Earth science help you understand what you see? Do you see rock layers you might not have noticed before? What kinds of trees and birds do you see?

5. Draw, paint, sculpt — create! Practice your observation skills by putting lots of details into your artwork so that another geoscientist who has never seen this area before would be able to find and recognize it using only your art as a guide. When you're finished, hang your art in the school for others to see!

Media Outreach

Building a team to make the most of your NCLI Day celebration, as discussed earlier, is vital. Think of local news media representatives as part of your team. Not only can these reporters and editors help shine a glowing spotlight on your efforts, but they also can help spread the content of your educational activities to the wider community, where parents and other citizens also can learn about Earth science.

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Remember, Earth science is big news. Topics like energy, the environment, natural hazards, and climate change routinely dominate the headlines. You can take advantage of journalists' inherent interest in geoscience to promote awareness of NCLI Day activities. Here are five effective strategies:

- Plan your NCLI Day as a truly extraordinary event. In addition to conducting investigations and experiments, invite a prominent geoscientist to talk with students, give awards to volunteers, recognize geoscience enthusiasts who have made a difference, or host a ceremony or a feast.

- Prepare a press release to alert the media about your NCLI Day event. Answer important questions, such as who, what, where, when, and why. Include important information and quotes from key players. Provide contact information for follow-up. Print the release on your school letterhead and fax it to editors and reporters at least three days before the event. See the Oct. 7, 2008 press release that AGI issued in advance of the first NCLI Day (http://www.agiweb.org/outreach/2008news.html).

- Be persistent in pitching your story to local news organizations. Besides noting the "hook" of NCLI Day, show how your activities address issues that are urgent, timely, and relevant to the community. Write a brief, compelling query letter to the appropriate editor at each media outlet. Follow up with a phone call or an e-mail.

- Write letters to the editor for print in local newspapers and magazines. You might respond to a recent geoscience-related article with a letter to the editor. If possible, schedule a meeting with the editorial board. Or instead of a letter, perhaps write an opinion editorial, or "op-ed," to cite concerns and recommend solutions.

- Use available Earth Science Week materials in promoting awareness of NCLI Day as a key component of Earth Science Week. In the Earth Science Week Toolkit and on the event website are print and electronic materials — poster, calendar, logo, and more — that you can use to "brand" your activity. Link your local activity to the larger national celebration to emphasize its significance.

Media coverage can be good for your school, your students, and your career. It lets the community see the high-quality learning experiences that your school is providing to students. It also gives your students a taste of high-profile recognition for the work they're doing. And, not least of all, it shines a spotlight on the innovative efforts you personally are undertaking as an educator.

Following Up in the Classroom

Too often, a special experience comes and goes — and is soon forgotten. Follow-up activities can help reinforce what young people learn on NCLI Day:

- Celebrate your students' work at school and throughout the wider community. Connect your NCLI Day experiences with the broader worldwide celebration of Earth Science Week. Send your photos from NCLI Day, along with signed permission forms, to be posted on the Earth Science Week Photo Gallery (http://www.earthsciweek.org/whatsgoingon/gallery/photos.html).

- Have students work individually or in groups to document their NCLI Day experiences and what they learned. Consider ways they can extend the day's lessons with additional research or activities. They might conclude by writing reports, designing PowerPoints, or giving presentations.

- Take advantage of this opportunity to explore cross-curricular connections. Once again, collaborate with teachers of other subjects to find ways that students can draw on their NCLI Day experiences to practice or deepen what they are learning n English/language arts, mathematics, social studies, or other classes.

- Finally, invite students to talk candidly about their NCLI Day experiences. What did they learn? Which parts of the day did they most appreciate and enjoy? Where did the experience fall short of expectations or potential? How could your school team make next year's NCLI Day event even better?

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For most educators, NCLI Day offers a special opportunity to teach Earth science in a novel way. Take what worked best in your NCLI Day event and build on it. And have a great NCLI Day next year!

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