Habitat Sweet Habitat Outreach

Bicentennial Nature Center Network

Lower Elementary Curriculum; 45 min-1 hour program
Written By: Aubrey Blue & Ruth Coffey, Cope Environmental Center

Recommended Grades: Lower Elementary (K-1st); can be adapted to other grade levels

Indiana Standards Covered:

Kindergarten:

- **K.1.1:** Use all senses as appropriate to observe, sort and describe objects according to their composition and physical properties, such as size, color and shape. Explain these choices to others and generate questions about the objects.
- **K.1.2:** Identify and explain possible uses for an object based on its properties, and compare these uses with other students' ideas.
- **K.3.1:** Observe and draw physical features of common plants and animals.
- **K.3.2:** Describe and compare living animals in terms of shape, texture of body covering, size, weight, color and the way that they move.

1st Grade:

- **1.1.1:** Use all senses as appropriate to identify the component parts of objects and the materials from which they are made.
- **1.1.2:** Characterize materials as solid or liquid, investigate their properties, record observations and explain the choices to others based on evidence (i.e., physical properties).
- **1.4.1:** Use all senses as appropriate to sort objects as being composed of materials that are naturally occurring, human-made or a combination of the two.

Purpose:

For students to understand habitats, learn the difference between living and non-living things, and recognize the importance of protecting Indiana's habitats using the Children of Indiana Nature Park as a tool.

Overview:

Students will come away from the program with a firm understanding of living vs/ non-living, and they will be able to talk about the composition of a healthy habitat. Students will also learn about the Children of Indiana Nature Park and make connections about ways to protect habitats in Indiana.

Outcomes:

Students will:
1. Discuss observations with others.
2. Recognize that animals (including humans) and plants are living things that grow, reproduce, and that need food, air, space, and water.
3. Differentiate between living and non-living things.
4. Group both living and non-living things according to the characteristics that they share.
5. Identify the ways in which an organism's habitat provides for its basic needs (plants require air, water, nutrients, and light, while animals require food, water, air, and shelter).
6. Explain a habitat.

Materials Needed:

Habitat Charades:

- Small pillow case (this will hold the 5 items/pictures students will be acting out)
- Small plastic bee
- Small stuffed animal (native to your area- i.e. squirrel)
- A fake native plant
- A rock (found on your property)
- Picture of either rain, sun, cloud or wind
- A large poster with the following written on it:
    1. Do you need air?
    2. Do you grow?
    3. Do you eat?
    4. Do you need water?
    5. Do you need a place to live?
    6. Do you have babies?

Indiana's Happenin' Habitats

- Lidded container (clear, plastic shoe box works great) filled with sand
- Lidded container filled with water
- Lidded container filled with forest soil
- Lidded container filled with wetland soil
- Cut-out or picture of cattail with red-winged black bird sitting on it
- Small toy house
- Coffee filter
- Sponge
- Paperclips
- Small fishing pole with magnet attached to end of line
- Thermometer
- Picture of rain or snow
- Leaves of a maple, beech, oak, hickory and/or cottonwood
- Pelts and/or skulls of a few of the following species: fox, deer, raccoons, squirrels or skunks

The Program

Introduction (5 minutes):

*****Interpretation Note: Many parts of this document are written as speech and will appear in a grey box. Please feel free to adapt and change as necessary. It may be helpful to write out exactly what you want to say (at least in the introduction), but this document is really an outline, not a script.**

Introduce yourself, your organization, and the topic of the day: habitats!

(The following wording is the SAME wording as featured in the field trip program. PLEASE ADAPT THIS BASED ON THEIR KNOWLEDGE OF THE CHILDREN'S PARK PROJECT. This should be used the FIRST TIME the children are introduced to the project. If this outreach is performed AFTER the field trip, simply remind the students of the gift and ask if they have their deeds! You might even "autograph" the deeds for them as an important person in their environmental education journey!)

Did you know that YOU have been chosen to receive a special gift? Let me ask you something. What do you think of when you hear the word "park"? Slides? Swings? Playgrounds? Well, we have a NEW way to think about a park. When you hear that word, we want you to think of trees, birds, insects, and presents. Wait, presents?! Yes, presents. The State of Indiana has decided to give you a gift, but it's not one that you unwrap, it's one that you protect, just like a special birthday gift. Indiana created The Children of Indiana Nature Park in Centerville, Indiana in honor of you. It doesn't have swings or slides; instead, it has trees, trails, tracks, and turtles. Indiana thinks you are so important, that each one of you can claim a "deed" for a piece of this land. What's a deed? It means that you are in charge of protecting something special. Your teacher is going to help you claim your deed, and you can learn about your piece of land and all of the ways it is growing and changing by visiting a special website listed on your deed. But how can we protect this land or the land that we live on without learning why it is important? Well, we are going to start today! Today's program is called "Habitat Sweet Habitat!". Once I leave today, you will know why!

Ask students if they have ever heard of the word "habitat". What is a habitat? Can anyone think of some different types of habitats? (Forest, wetland, pond, etc.) Are there living or non-living things in habitats? BOTH! What does a habitat provide for living things? (Food, water, shelter, space and air.) What do we call those things? NEEDS! The children should be able to see that they, too, are part of the living world.

Habitat Charades[1] (15 minutes): *This activity can be done outside in the school yard.* Collect pictures of objects or actual objects from our environment for five of the children to "act out". Have 3 samples of living things (i.e. tree, animal, a child, insect) and 2 samples of non-living things (i.e. water, rock, sun, wind, cloud).

A child picks an object and acts it out. The other children then ask the following questions that are written on a board or represented by images:

- Do you need air?
- Do you grow?
- Do you eat?
- Do you need water?
- Do you need a place to live?
- Do you have babies?

Once all of the questions are asked, have them try and guess what the student is acting out. Then ask them what type of habitat the different things come from (woods, wetlands, tree, etc.).

Now that we know what the students were trying to act out, ask students to determine if it is living or non-living. Is it alive or has it ever been alive? If yes, then it is living. If no, then it is non-living. Let's now sort players into living and non-living groups.

We now know what the students were trying to act out and whether they are living or non-living. Let's think about a few more things!

** What does the living group have in common? Non-living?*

[1] Adapted from: http://learning-in-action.williams.edu/files/UNIT-2-Habitats-and-the-Tree.pdf

** What do the living things need to grow? (Air, water, food, a place to live, and space to move around.)*

** What is a place that provides all these things? A habitat!*

** What is your habitat called (Many different answers could be right! For example, a home/house, community, neighborhood, city, state, farm, etc.)?*

** Do you need air, water, food, space, and shelter? Where do you get your needs?*

** Does any know what habitats are found at The Children of Indiana Nature Park? (Grassland, pine forest, hardwood forest, and a creek!)*

Indiana's Happenin' Habitats (30 minutes): *This activity can be done outside in the school yard.*

So, we have talked about living and non-living things, what living things need to survive, and the place where living things find their needs. What is that place called again? A HABITAT! Let's now focus on a few different habitats found in Indiana!

The Dunes[2]:

(Hold up a clear container of sand) What is this stuff? SAND! (Walk around and allow students to feel this type of soil.) Can anyone tell me which habitat this is from? (Hopefully someone will say "desert"!) Now remember, it is an Indiana habitat! Way up north in Indiana, there is a really cool habitat called the Indiana Dunes. These dunes are located on the southern tip of Lake Michigan. Can anyone guess what type of soil they have there? (Point to the sand.) Sandy soil! Your special piece of land (The Children of Indiana Nature Park) is located in central Indiana near Ohio. Do you think it is part of the Dunes? NO! We won't find much sand there!

The Dunes are home to many special types of plants and animals…let's go over a few of those awesome species!

[2] *http://www.indianadunes.com/assets/indiana-dunes-education-guide.pdf*

1. Lupine

(If you are able to have a potted example of lupine, please use it for this program. Otherwise, just print a picture of it out to hold up.) Hold up the plant or picture of lupine. What would you call this? A plant! It is actually called lupine. What colors does this plant have on it? Do you see any shapes? What does this plant need to survive?

Background information on lupine: This important plant has dense purple floral spikes. The foliage resembles palm leaves, with seven to ten leaflet segments each. This species is essential to the life cycle of the Karner Blue butterfly, whose larvae feeds on the plant.

2. Karner blue butterfly

Hold up a picture of a Karner blue butterfly. What would you call this? A butterfly! What is a butterfly? An insect! What colors do you see on this butterfly? What are some of the body parts of this butterfly? (Head, thorax, abdomen, wings, antennae, 6 legs, compound eyes, etc.) This is actually called a Karner Blue Butterfly.

Background information on the Karner blue butterfly: It is on the federal endangered species list and makes its home in the dunes. The butterfly's larvae feeds on lupine, a species found in an open oak savanna. When there is fire suppression, the savannas become forests, choke out the lupine and, in turn, prevent the butterflies from feeding. Their current population is one percent of their historic abundance 100 years ago. Prescribed burning conducted by park resource management keeps these savannas open.

3. White-tailed deer

(If you have a deer hide and/or antlers, show them to the class and let them feel them. Otherwise, show a picture.) What is this? A deer! Actually, it's a white-tailed deer! Is it an insect like the Karner Blue Butterfly? No! What is it? A mammal! How does this animal move? It runs really fast! What colors are on a white-tailed deer?

Background information on the white-tailed deer: This is the largest mammal in the area and can be seen regularly in and around Indiana Dunes State Park and the Indiana Dunes National Lakeshore. It keeps a reddish-brown coat in the summer, a grey coat in the winter, and can always be recognized by its distinctive white tail which rises to attention when the deer is alarmed. They are herbivores and like to eat fresh leaves, grasses and sweet, young sprouts.

3. Massasauga rattlesnake

(Show a picture of a massasauga rattlesnake!) What is this? A snake! What is a snake? Is it an insect? A mammal? NO! It is a reptile. How does this awesome snake protect itself?

Background information on the massasauga rattlesnake[3]: The massasauga is a small endangered pit viper found only in northern Indiana in marshy, swampy areas and bogs. It may be found in woodlands and old fields on occasion. It is spotted with dark black or brown blotches on the back and 3 rows of small, dark spots on either side. This "swamp rattler," which eats mice and other snakes, is generally mild-mannered and rarely strikes unless stepped on.

Aren't the Dunes amazing? Let's think about another Indiana habitat.

Wetlands:

Next, hold up the container of wetland soil. Walk around and allow students to feel AND smell this soil. Who can tell me what type of habitat this soil came from? Was it dry or wet? (It should be moist.) What did it smell like? Explain that it was from a wetland. Did you know that there are three wetlands right next door to your Children's Park land?

Background information on wetlands[4]: Indiana was covered with over 5.6 million acres of wetlands in the 1700's. It now only has about 813,000 acres.

What is a wetland? Well, let's figure that out by playing a "fishing" game!

Have your wetland bucket filled with the following different items:

- small plastic container of water (with lid)
- cut-out or picture of cattail with red-winged black bird sitting on it
- small lidded container filled with wetland soil
- small toy house
- coffee filter
- sponge

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[3] *http://www.in.gov/dnr/files/snakes.pdf*

[4] *http://www.in.gov/idem/wetlands/2336.htm*

Each of those items should have something metal stuck to them (i.e. paperclip) so that the mini-fishing pole with the magnet at the end of the fishing line can "grab" the item.

Now have the students go fish! Make sure to go over the meaning to each object that they catch. See information below[5]:

- Water: Areas where water covers the soil or is present either at or near the surface of the soil for part or all of the year, including the growing season for plants.
- Cattail with red-winged blackbird: Wetlands support an array of plants and animals which have adapted to life in saturated or flooded conditions.
- Soil: Wetlands have hydric soils. What is hydric soil?
    1. Consists predominantly of decomposed plant material (peats or mucks).
    2. Has a thick layer of decomposing plant material on the surface.
    3. Has a bluish-gray or gray color below the surface, or the major color of the soil at this depth is dark (brownish black or black) and dull.
    4. Has the odor of rotten eggs.
    5. Is sandy and has a layer of decomposing plant material at the soil surface.
    6. Is sandy and has dark stains or dark streaks of organic material in the upper layer below the soil surface.
- Toy house: wetlands provide homes to many different animals, birds, plants and insects.
- Coffee filter: Wetland plants and soil clean and filter water.
- Sponge: Wetlands absorb flood water and then slowly release the water which protects us from flooding waters!

We are now experts on wetlands. Can anyone name some living things that live in and around wetlands? (Cattails, frogs, turtles, dragonflies, birds, snakes, raccoons, etc.) How can we help protect wetlands? Should we pour our leftover drinks into the water? Would that hurt the plants and critters there? Remember, there is a wetland near our special piece of land. Whatever we do to the wetland can affect our habitats in the Children's

[5] *http://www.ucmp.berkeley.edu/exhibits/biomes/forests.php*

Park. It's important to think about all of the life around us, not just the ones we love!

Ok, now let's explore one more Indiana habitat.

Forests:

Finally, hold up the container of forest soil. Have students feel/smell this soil.

Where did this soil came from? A forest! What are some things that live in forests? What are some insects? Mammals? Birds? Amphibians? Reptiles? Did you know that there is a forest on your Children's Park land! Can anyone tell me what makes a forest a forest?

(Below are some characteristics. Make them easy for kids to understand!)

- Temperature between -25 F and 85 F (Have a thermometer to hold up and point to temperatures).
- Precipitation throughout the year (Hold up a picture of rain/snow).
- Soil is fertile and enriched with leaf litter (Hold soil up again).
- Moderately dense canopy.
- About 3-4 tree species per square kilometer; usually beech, maple, oak, cottonwood, hickory and spring flowering plants (Hold up leaves of a few of these trees.).
- Lastly, animals including: foxes, deer, raccoons, squirrels, and skunks (Hold up 2 or 3 of these pelts/skulls and go over cool characteristics of them). Explain how these animals are able to survive in this habitat.

Honing in on Habitats (8 minutes): *This activity can be done outside.*

Let's review everything we have talked about today! What is a habitat? What do habitats provide? What is the different between living and non-living things? Do habitats have both living and non-living things? What habitats are on the Children's Park land?

Let's review the 3 Indiana habitats we talked about today by playing a matching game! (Hang up a laminated poster-sized paper with the three different sections to represent the habitats listed above. Make sure to have some tape to tape up the laminated cards that students will be placing on the poster.)

You are all going to receive a card with a picture of something on it. There will also be tape

on the back of your card. I am going to choose students (either one at a time, by desk rows or desk groups) to come up to the front to place their card in the right habitat. (This should be done quickly! At the end, go over where the students placed their cards to see if they were right, and if not, where they actually should have placed their card.)

This can also be made into a relay race. The point of this game is to have fun and reinforce the concept of habitats that are common in Indiana!

Closing (2 minutes):

We had so much fun learning about habitats today! Remember that piece of land we talked about? The one that is dedicated in honor of YOU? You are already helping to protect this land by learning about it! Today, you learned that there is a forest on your land, and that wetlands are close by! Are there dunes on your land? NO! Are there LOTS of living and non-living things on your land? YES! Can you help me name some living things that might be there? (Trees, deer, mice, etc.) How about some non-living things? (Rocks, water, air, etc.) I'm glad you are learning so much about your land! The more you know about Indiana's important land, the easier it is for you to help protect it. Thanks for being a conservation hero!

Thank you so much for having me/us come to your classroom!

Indiana Rocks!

Bicentennial Nature Center Network

Middle Elementary Curriculum; 1 hour program
Written By: Aubrey Blue, Cope Environmental Center

Recommended Grades: Middle Elementary (2nd and 3rd); can be adapted to other grade levels

Indiana Standards Covered:

2nd Grade:
Science

- **2.PS.1** - Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

Writing

- **2.W.2.1** - Form letters correctly and space words and sentences properly so that writing can be read easily by another person.

Speaking and Listening

- **2.SL.1** - Listen actively and adjust the use of spoken language (e.g., conventions, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
- **2.SL.2.1** - Participate in collaborative conversations about grade-appropriate topics and texts with peers and adults in small and larger groups.
- **2.SL.2.3** - Listen to others, take one's turn in respectful ways, and speak one at a time about the topics and text under discussion.
- **2.SL.3.2** - Ask and answer questions about what a speaker says to clarify comprehension, gather information, or deepen understanding of a topic or issue.

Geography

- **2.3.2** - Locate the equator and the poles on a globe and identify the local community, state and the United States on maps.

3rd Grade:
Science

- **3.ESS.3** - Observe the detailed characteristics of rocks and minerals. Identify and classify rocks as being composed of different combinations of minerals.

Writing

- **3.W.2.1** - Write legibly in print or cursive, leaving space between letters in a word, words, in a sentence, and words and the edges of the paper.

Speaking and Listening

- **3.SL.1** - Listen actively and adjust the use of spoken language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
- **3.SL.2.1** - Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) on grade-appropriate topics and texts, building on others' ideas and expressing personal ideas clearly.
- **3.SL.2.5** - Explain personal ideas and understanding in reference to the discussion.
- **3.SL.3.2** - Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.

Geography

- **3.3.13** - Identify and describe how human systems and physical systems have impacted the local environment. Example: List examples of changes in land use in the local community.

Purpose:

To connect the students to an important Indiana natural resource. To help students understand why the study of geology is an important step in understanding land conservation. To introduce students to the concept of land conservation using the Children of Indiana Nature Park as a tool.

Overview:

Students will learn about the geology of Indiana, the difference between rock types, the way these rocks "shape" our everyday lives, and how important this resource is to Indiana.

Outcomes:

Students will:

1. Identify what state we live in and where it is located.
2. Explain the three major rock types: metamorphic, igneous and sedimentary.
3. Discuss limestone and explain one way to identify this rock.
4. Relate limestone and its uses to our everyday life.
5. Create lists.
6. Become better stewards of the land through an understanding of its building blocks.

Materials Needed:

Crayon Rock Cycle:

- Wax crayons – at least two different colors
- Source of very hot water (we use a plug-in electric kettle)
- Aluminum foil
- Container to hold hot water
- Simple scrapping device (i.e. a plastic knife)

Rock Cycle Song:

- A poster with the words written out on it

Testing for Limestone:*

- 5 rock collections, 10 stones each (one in each collection MUST be limestone!) (http://www.hometrainingtools.com/rock-study-kit)
- 5 glass measuring cups
- Vinegar (each measuring cup will be filled with ½ cup vinegar)

My Home:

- Flip chart paper
- Non-permanent markers (one for each group and yourself)
- Informational facts listed at the end of this curriculum

*When scheduling this program, ask the teacher to have their students sitting in 5 groups for your program. As soon as you arrive, place the "Testing for Limestone" materials out with each group.

The Program

Welcome/Introduction (5 minutes):

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Introduce yourself and your organization. Introduce yourself, your organization, and the topic of the day: rocks!

(The following wording is the SAME wording as featured in the field trip program. PLEASE ADAPT THIS BASED ON THEIR KNOWLEDGE OF THE CHILDREN'S PARK PROJECT. This should be used the FIRST TIME the children are introduced to the project. If this outreach is performed AFTER the field trip, simply remind the students of the gift and ask if they have their deeds! You might even "autograph" the deeds for them as an important person in their environmental education journey!)

Did you know that YOU have been chosen to receive a special gift? Let me ask you something. What do you think of when you hear the word "park"? Slides? Swings? Playgrounds? Well, we have a NEW way to think about a park. When you hear that word, we want you to think of trees, birds, insects, and presents. Wait, presents?! Yes, presents. The State of Indiana has decided to give you a gift, but it's not one that you unwrap, it's one that you protect, just like a special birthday gift. Indiana created The Children of Indiana Nature Park in Centerville, Indiana in honor of you. It doesn't have swings or slides; instead, it has trees, trails, tracks, and turtles. Indiana thinks you are so important, that each one of you can claim a "deed" for a piece of this land. What's a deed? It means that you are in charge of protecting something special. Your teacher is going to help you claim your deed, and you can learn about your piece of land and all of the ways it is growing and changing by visiting a special website listed on your deed. But how can we protect this land or the land that we live on without learning why it is important? Well, we are going to start today! Today's program is called "Indiana Rocks!". Once I leave today, you will know why!

Begin your program by getting out the crayon shavings and foil. Does anyone know why I have these crayon shavings and the foil? How in the world does it relate to land, and more specifically, rocks? (This is to demonstrate how rocks are formed and to help show how long it takes for these rocks to be formed.) Well, let me show you!

Crayon Rock Cycle[1]:

To make a "sedimentary crayon":

1. You need to make small particle sized sediments out of your crayons. These can be scraped from new crayons (this represents the weathering of a rock). Scrape crayons with knife.
2. Gather a pile of sediments collected from various scraped crayons (several different colors).
3. Pressing down on this pile will allow the particles to stick together.
    a. Encasing the sediments between sheets of paper, foil, etc. will help keep the sediments together.
    b. Using a utensil or stepping on the sheets will help this process along, too.
4. Your coherent bunch of crayon sediments is now representative of a sedimentary rock.

To make an "igneous crayon":

1. Place a small pile of sedimentary crayons (since you already have these available) into piece of aluminum foil.
2. Float this crayon containing foil on hot water.
3. Watch as the heat from the water transfers to the foil and to the crayons. The crayons should start to melt.
4. The crayons should be allowed to melt until a smooth liquid forms.
5. Carefully remove molten crayon wax and let cool. Your totally melted and cooled crayons are now representative of igneous rocks *(The flowing, liquid crayon represents magma flow.).*

To make a "metamorphic crayon":

1. Place a small pile of sedimentary or igneous crayons into piece of aluminum foil.
2. Float this foil on hot water.
3. Watch as the heat from the water transfers to the foil and to the crayons. The crayons should start to melt.
4. Remove the foil when the crayon wax is soft to the touch and then compress it again (this represents both heat and pressure).
5. Let your crayons cool.
6. Your partially melted and cooled crayons are now representative of metamorphic rocks.

Summary: Igneous rocks are formed when magma (or molten rocks) have cooled down and become solid. Sedimentary rocks are formed by the accumulation of other eroded substances. Metamorphic rocks are formed when rocks change their original shape and form due to intense heat or pressure.

[1] Adapted from: http://www.exo.net/~emuller/activities/Crayon-Rock-Cycle.pdf

Do you think these rock formations happen overnight? No! It takes thousands of years! So, if we use up lots and lots of rock (such as limestone), can we "grow" or make more overnight?

Think about plastic. Most plastic is made out of oil. Did you know that? Oil is like rock in that it has been around for a very, very long time. We can't produce it as much as we want. We use plastic for some very important things that even help save people's lives. But, we also use it for unimportant things that people just throw away (have the children brainstorm things that are disposable plastic). We shouldn't treat plastic that way and we shouldn't treat rocks that way either!

In this program, we are going to talk about all of the cool things that are made from rocks. I want you to continue thinking about why it is important to take care of this awesome resource and habitat.

Rocks of Indiana (15 minutes):

What am I holding? (You should be holding a globe.) A globe! Let's go over the basics of a globe. Where are the North and South Poles? What about the equator? In which country do we live? (Have a student point to the United States.) Here is the MOST important question: in which state do we live, and where is it located? (Have another student point to Indiana.) Right, Indiana! If possible, use a pen to show where the Children of Indiana Nature Park is located, too (Centerville, IN- directly east of Indianapolis on the Ohio border). Let's think about the layers of the earth at the Park. Can you name some things that might be growing on the land? (Trees, plants, grass, etc.) What is below these growing things? (Soil!) What is below THAT? (Rock!) Right! Today, we are going to be talking about Indiana and one of its special rocks. Sometimes we forget to protect the parts of the environment that we can't see! Rocks are one of these important things!

[2]Has anyone ever heard of bedrock? What is bedrock? And no, the bedrock we are talking about is not Fred Flintstone's home town! Anyone have any guesses? Well, bedrock is the hard, solid rock beneath surface materials such as soil and gravel. Bedrock is also found under sand and other sediments on the ocean floor. Bedrock is "consolidated" rock, meaning it is solid and bound together tightly. Overlying material is often "unconsolidated" rock, which is made up of loose particles.

[2] Taken from: http://education.nationalgeographic.org/encyclopedia/bedrock/

Does anyone remember the 3 major types of rocks we just discussed? Here is a quick little song to remember the three major types of rocks: metamorphic, igneous, & sedimentary.

Rock Cycle Song[3]

(Sing to the tune of "Row, Row, Row Your Boat")
SEDIMENTARY rock
Has been formed in layers
Often found near water sources
With fossils from decayers.

Then there's IGNEOUS rock
Here since Earth was born
Molten lava, cooled and hardened
That's how it is formed.

These two types of rocks
Can also be transformed
With pressure, heat and chemicals
METAMORPHIC they'll become.

[4]*The entire bedrock surface of Indiana consists of sedimentary rocks. Indiana's major kinds of sedimentary rocks are limestone, dolomite, shale, sandstone and siltstone.*

Today, we are going to focus on just one of those rocks…LIMESTONE! Limestone is by definition a rock that contains at least 50% calcium carbonate in the form of calcite by weight. All limestones contain at least a few percent other materials. These can be small particles of quartz, feldspar, clay minerals, pyrite, siderite and other minerals. It can also contain large nodules of chert, pyrite or siderite. One type of limestone even has fossils in it!

Interpreter's Note: The following list is not intended to be read to the students. It is, instead, meant to be used as a reference to help children better understand this valuable natural resource. Simply choose a few from this list! (It can even be made into a game or quiz!)

Random facts about Limestone *(See end of program for more limestone information.)*:[5]

[3] Taken from: http://cmase.uark.edu/teacher/workshops/GEMS-lessons/Rock_Cycle_Song.pdf
[4] Taken from: http://earthsciences.iupui.edu/indiana-geography-and-geology-facts
[5] Taken from: https://igs.indiana.edu/MineralResources/Limestone.cfm and

- Nearly 2.7 million cubic feet of Indiana Limestone is quarried each year.
- Although a relatively small industry, the Indiana Limestone industry generates about $26 million annually in revenue.
- Indiana Limestone can be quarried and milled with greater efficiency, in terms of energy consumed, than most competing building materials.
- The Indiana Limestone industry employs stone cutters and carvers whose skills in working limestone into complex shapes and into art forms remain world class.
- Indiana Limestone has stood the test of time in structures all over the world where its strength, beauty, and durability have made it the material of choice in many older load-bearing structures as well as cladding stone in the modern context.

Examples include:

- The Pentagon: Located in Arlington, Virginia, the Pentagon serves as headquarters to the United States Department of Defense. On September 11, 2001 a hijacked plane crashed into the western side of the building. The reconstruction used Indiana Limestone fabricated by Bybee Stone Company in Ellettsville, Indiana. It was rededicated one year later on September 11, 2002.
- Lincoln Memorial: Look for Indiana limestone on the interior walls and columns of the Lincoln Memorial, dedicated in 1922 to honor Abraham Lincoln, the 16th president. Indiana limestone and other materials are representative of different regions of the United States.
- Empire State Building: Named after New York's state nickname, the "Empire State," and completed in 1931, the once-tallest building in the world is made of Indiana Limestone and remains one of the tallest and most impressive buildings in New York City.
- Monument Circle: The Indiana State Soldiers and Sailors Monument stands in the center of Indianapolis at almost 285 feet, just 15 ft. shorter than the Statue of Liberty. The monument was completed in 1889 to honor veterans from the Hoosier state and was among the first dedicated to common soldiers.

Can you believe how many neat things are built using limestone? Sounds like we need to make sure we protect this important resource, huh? But how do we protect something underground? When we need rocks for building materials, we usually dig it out of the ground. But what happens if we dig too much out of the ground? What happens to the soil, plants, and animals that were living on top of that rock? One way to protect this resource is to reuse the materials we already have, learn to use different types materials, be careful when removing the material

http://www.visitbloomington.com/limestone/around-the-world/

to ensure we don't harm other ecosystems, and work hard to ensure that SOME of the material stays in the ground!

[6]Testing for Limestone (20 minutes):

Believe it or not, there is a really easy way to test rocks to see if they are limestone (or at least contain calcium carbonate which is limestone's main ingredient). Other carbonate rocks include: marble, chalk, travertine, and dolostone (dolomite).

We are going to use vinegar to test our rocks to figure out which one is limestone! (The following should have been placed at the tables with the 5 groups: rock collections (http://www.hometrainingtools.com/rock-study-kit) and vinegar already poured in the glass measuring cup.)

Explain to students that in order to do this experiment, one person in each group will need to place "their" rock in the vinegar to see if it fizzes and wait until you, the interpreter, tell them to take it out and switch to another person's rock. Each person will get a chance to test "their" rock. The experiment is simple: which ever one fizzes is the limestone! (There should only be one sample of limestone per group. Make sure that no other rock reacts to the vinegar (or contains calcium carbonate!).

Once everyone has finished, explain that the reason it fizzes is because vinegar, an acid, dissolves bits of a material called calcium carbonate in the limestone. This releases carbon dioxide, a gas that rises to the surface as a stream of bubbles. Rocks that don't contain calcium carbonate won't fizz.

Who, in each group, had the limestone? Raise your rock! (Make sure they are correct!)

Importance of Limestone (15 minutes):

Why ELSE is limestone important? Well first off, it is the state stone of Indiana (Salem Limestone). Who lives in Indiana? We do! Indiana has been a state for 200 years. Has this limestone been here that long? Yes! Even longer! Around 300 million years! (Write that number on a chalkboard or smartboard so students can see how big that number really is!) But there are MANY more reasons we should love, appreciate and protect limestone!

[6] Adapted from: http://kids.nationalgeographic.com/kids/activities/funscience/rock-on/

My Home:
Students should still be in their groups. Hand-out one sheet of flip chart paper and a marker to each group. Have students work together to make a list of all of the different parts of their house (i.e. roof, walls, paint, window, window frame, door, carpet, tile, pipes, cement foundation, etc.). Have one person in each group be the recorder who writes everything down. Explain that this person needs to be able to spell well and write legibly. Give groups around 5 minutes to do this part.

Next, explain to the groups that they are now going to record different things that people might do in their morning routine (i.e. take a shower, go to the bathroom, brush teeth, eat breakfast, get dressed, drive to work/school, etc.). Give them around 5 minutes to make this list, too.

Once everyone is done, go over the answers. Have each group read 5 things on their list aloud. Write everyone's answer on your own flip chart. Make sure to write "HOUSE" at the top of the house list and "MORNING ROUTINE" at the top of the routine list.

Once you have made the main list, go over how limestone is related to each item on the list (if it is). Please see limestone fact sheets at the end of this program so that you know how to do this (These lists should be studied before the program. Print out the sheets if you need a "cheat sheet").

Closing (5 minutes):

After what we talked about today, how many of you now see the importance of not only rocks in general, but limestone in particular? I hope every one of you!

Let's review! What are the three main types of rocks? Sedimentary, metamorphic and igneous. What type of rock is Indiana's bedrock made of? Sedimentary rock! What is one type of sedimentary rock that Indiana has in its bedrock? Limestone! Finally, what are some items that are made from limestone?

Do you remember that limestone is one of the rocks underneath your piece of land at the Children of Indiana Nature Park? It is supporting the soil, trees, plants and animals that call this special piece of land home. Limestone (and other rocks) are also habitat for all kinds of critters. Can you think of a mammal that sometimes makes its home in caves? Bats! This important resource is something worth protecting! Can everybody now see WHY Indiana's state rock/stone is limestone? It is so important to our environment and state! Thanks for learning to be a ROCKin' conservationist today!

Activity		Application of limestone
Hot water switches on		
water is stored in dams made of concrete		limestone is used in cement and as aggregate to make concrete
water		hardness is adjusted and purity improved by adding lime
water is transported in	metal pipes (iron or copper)	limestone is used as a flux to remove impurities when refining metals
	concrete pipes	see above
	plastic pipes	limestone is used as a non-reactive filler to extend expensive resins in plastics
water is heated by electricity	produced from coal	lime is used to remove (neutralise) polluting sulfur dioxide emissions from coal-fired power station gases
		limestone used in coal mines to prevent explosions (keeps dust down and doesn't transmit sparks)
	produced from oil / nuclear sources	lime used in refining processes (for oil and uranium)
Alarm clock rings		
plastics / metals		see above
Look out of window		
glass		glass is made of sand (silica), limestone and soda ash (sodium carbonate), which is itself made from limestone and salt
lead (leaded lights)		limestone removes sulfur (as calcium sulfate) from lead ore (lead sulfide) and acts as a neutraliser for the flue gas, which contains sulfur dioxide
Step onto carpet		
carpet backing		limestone is used as a filler to extend latex (expensive) and bulk it out

Go to the bathroom	
wash basin / wall tiles (*ie* ceramics)	ceramics are made from clays, sand and small amounts of limestone (*eg* in glazes)
Stand on	
rubber mat	limestone used as a filler to extend rubber (expensive)
Clean teeth	
toothpaste	fine limestone is used as a mild abrasive and also helps develop / maintain teeth which are made up of calcium compounds
Use the lavatory	
lavatory pan (ceramic material)	see above
waste water	treated with limestone before being recycled or returned to river / sea
Take a bath	
bath iron	see above
bath enamel	enamel contains limestone
soap	lime is used in soap making
Clean bath	
bath cleaner	contains fine limestone as a mild abrasive
Get dressed	
clothes	lime is used in preparing cotton and wool; dyes and washing powders use limestone
Go downstairs	
paint	limestone is used in pigment-making and as a filler in extending expensive pigments, polymers, resins, *etc*
	limestone is used in treating acid waste from making white titanium pigments

	vinyl floor in kitchen has limestone filler
Make a cup of tea	
cup / saucer / teapot	ceramics, metals, hot water (see above)
milk	cows have dietary calcium supplement derived from limestone
sugar	lime is used to raise pH, causing impurities to separate out for removal; carbon dioxide (also from limestone) is then used to remove the lime by reforming calcium carbonate (limestone)
Make toast	
wheat	limestone is used by farmers to neutralise soil
bread	limestone is added to flour to maintain our calcium levels (to reduce risk of the bone disease rickets)
Cook	
eggs	limestone is used in poultry grit
bacon	limestone is used in pig feed to provide essential calcium
salt	salt is made easier to pour by adding fine limestone
Take indigestion tablet	
indigestion tablet	contains limestone filler / extender and calcium salts (derived from limestone) as active ingredients (limestone is also used as a filler in many pharmaceuticals)
Clean up	
surface cleaners	contain limestone filler
unblock plug hole	caustic soda (sodium hydroxide) made from lime, salt and ammonia
Pick up mail	
brochures	paper contains limestone filler and also provides a smooth coating
Make phone call	

copper wire	limestone is used as a flux and to lubricate wire-drawing process
optical fiber	is high grade glass (see above)
Pick up school bag	
leather	tanning process uses calcium hydroxide (made from lime) to remove hairs and to plump up hides
pencils	limestone filler in the pencil 'lead'
paper	see above
typing corrector	limestone filler / extender / opacifier
adhesive	limestone filler and lime in processing
Blu-tack	limestone filler / extender

Taken from: http://www.rsc.org/Education/Teachers/Resources/jesei/limeston/home.htm

Ways in Which Limestone Contributes to our Lives:[7]

Building our Homes and Cities: Limestone is one of the key ingredients in making cement, the powder that binds rock and water to make concrete. To make cement requires a nearby limestone deposit. Reliable and nearby sources of limestone, and consequently cement, make it possible to build and grow in a sustainable manner.

Improving our Farming: The calcium in limestone provides an important feed supplement for cattle and poultry to help produce milk, eggs, and meat products. It is also applied to soils to reduce acidity and improve crop yields.

Making Glass: Limestone is essential to glass-making, including windows, bottles, windshields, and the fiberglass insulating your home.

Cleaning our Air: Electric power plants rely on local supplies of limestone to keep plants clean and reduce air emissions. It is the scrubbing agent that removes sulfur dioxide, mercury and other gases from smokestacks.

Adding Nutrients: High quality limestone is a source of calcium in foods and vitamins. Foods where limestone adds calcium include breads, granola bars, cereal, infant formula, pasta, pet food, tofu, yogurt, graham crackers, baking mixes, waffles...the uses grow daily. It also has many uses in making antacids and medicine tablets.

Affordable Roofs: Asphalt roof shingles are the most economic roofing product available today, and limestone is a key ingredient. Limestone in roofing reduces the use of asphalt, adds fire resistance, and lowers cost

Cleaning Our Water: Limestone is used as a filter to purify drinking water and neutralize lakes subject to acid rain. It is also used to treat bio-solids in sewage, as well as industrial sludges and petroleum wastes. It does this by controlling the growth of pathogens in bio-solids and converting sludges into usable products.

Bringing Paper to Life: The many qualities of limestone improve paper by adding brightness, opaqueness, smoothness, strength, and dryness, as well as making environmentally friendlier paper products, such as non-acidic papers. It is essential in the making of graphic papers, paperboard for milk cartons and juice containers, magazines, annual reports, and pizza boxes.

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[7] Taken from: http://www.calcima.org/pdf/CalCIMA_Limestone.pdf

Durable Paints: A paint product is about 20-30% limestone. Limestone provides durability, color, sheen, gloss, non-toxicity, weather resistance, and low abrasiveness. It is an important reason why paints can be made to adhere to such varying surfaces as walls, appliances, furniture, children's bikes and wagons, cars, bridges, and ships.

Everyday Products: Probably every day you are using a product that is stronger, more durable, warps less, dampens sound better, and less costly because of limestone. These are only a few of the applications: window frames, fences, home siding, PVC pipes, computer keyboards, automotive dials, car upholstery, electric wires, TV cables, automotive gaskets, clear packaging and food wrap, car exteriors and interiors, trash and garbage bags, large garbage cans, food containers, bathroom cleaners, shoe polish, and diaper film.

Joining and Sealing: Our Lives Limestone seals the gaps in our homes and cars to prevent moisture and gas seepage, and dampen sound. Adherents and sealants composed of limestone can be found under auto bodies, in insulated glass windows, between steel and glass in buildings, and between pre-cast concrete panels. They are commonly known as putty, caulk, joint compound, epoxy, urethane, silicone, acrylic, and vinyl acetate.

A Staple of Construction: Don't look now, but you may well be standing on carpeting, tile, or vinyl flooring made of limestone compounds. It is probably in the stucco on your home's exterior, in the tape sealing your home's sheet rock, the concrete and masonry work in your home, the lining of your swimming pool or spa, in shower stalls and in bathroom sinks, and throughout your home in pipe conduit, grout, and mortar!

“I’m Diggin’ It!” Soil Outreach

Bicentennial Nature Center Network

Upper Elementary Curriculum; 45 mins- 1 hour program
Written By: Mary Jones, Cope Environmental Center

Recommended Grades: Upper Elementary (4th-5th); can be adapted to other grade levels

Indiana Standards Covered:

Geography:

- ***4.3.5*** - Explain how glaciers shaped Indiana’s landscape and environment.
- ***4.3.6*** - Describe Indiana’s landforms (lithosphere*), water features (hydrosphere*), and plants and animals (biosphere*).
  * lithosphere: the soil and rock that form Earth’s surface
  * hydrosphere: all the water on Earth’s surface, including the hydrologic cycle (precipitation, evaporation, and condensation)
  * biosphere: all plants and animals

Science:

- ***4.2.1*** - Demonstrate and describe how smaller rocks come from the breakage and weathering of larger rocks in a process that occurs over a long period of time.
- ***4.2.2*** - Describe how wind, water and glacial ice shape and reshape earth’s land surface by eroding rock and soil in some areas and depositing them in other areas in a process that occurs over a long period of time.
- ***4.2.4*** - Investigate earth materials that serve as natural resources and gather data to determine which ones are limited by supply.
- ***4.2.5*** - Describe methods that humans currently use to extend the use of natural resources.
- ***4.2.6*** - Describe ways in which humans have changed the natural environment. Explain if these changes have been detrimental or beneficial.
- ***5.3.1*** - Observe and classify common Indiana organisms as producers, consumers, decomposers, predator and prey based on their relationships and interactions with other organisms in their ecosystem.
- ***5.3.2*** - Investigate the action of different decomposers and compare their role in an ecosystem with that of producers and consumers.

Purpose:

For students to appreciate the complexity of soil, understand how long it takes soil to form, and recognize the importance of soil conservation using the Children of Indiana Nature Park as a tool.

Overview:

After distinguishing between dirt and soil, students will dive into the microcosm of the soil as an ecosystem and point of intersection for the hydrosphere, lithosphere, and biosphere. Students will then learn about the deep history of their local soils through exploration of the soil horizons and the effects of glaciation. Finally, students will see first-hand how wind and water cause soil erosion, discuss why soil needs to be conserved, and brainstorm methods of soil protection.

Outcomes:

Students will:

1. Realize the complex ecosystem of the soil.
2. Understand the long processes of soil formation.
3. Explain how humans can protect soil from erosion.
4. Articulate why Indiana soils are important to conserve.

Vocabulary Words[1]:

- ***Soil*:** The collective term for the natural bodies of earthly material that cover much of the Earth's surface; a complex combination of mineral and organic material.
- ***Hydrosphere***: All the water on Earth's surface, including the hydrologic cycle: precipitation, evaporation, and condensation.
- ***Lithosphere***: All rock on Earth's surface.
- ***Biosphere***: All life on Earth's surface.
- ***Ecosystem***: Short for ecological system, an eco-system includes all living organisms in a specific area and how they interact with one another. (Adapted from geography4kids.com)
- ***Food Chain***: A series of plant or animal species in a community, each of which is related to the next as a source of food; also called a food web.
- ***Producers***: Organisms that produce their own food, usually through photosynthesis. They are at the beginning of any food chain that starts with the sun. (Adapted from geography4kids.com)

[1] *Taken from Dig In! Hands-On Soil Investigations by National Science Teachers Association, Indiana State Standards, and other sources as noted.*

- ***Consumers***: Organisms that must eat other organisms (whether producer or consumer) to gain energy.
- ***Decomposers***: Organisms that break down nutrients in dead material and return nutrients to the soil such as bacteria and fungi. (geography4kids.com)
- ***Parent Material***: Solid rock that underlies the soil; also called bedrock.
- ***Topsoil***: The upper, outermost layer of soil, usually the top 2-8 inches. It has the highest concentration of organic matter and microorganisms and is where most of Earth's biological activity occurs.
- ***Subsoil***: The layer of soil found between the topsoil and parent material that may contain sand, silt, and clay but is devoid of organic materials found at the surface.
- ***Glacier***: A dense body of ice on that is constantly moving (or flowing) due to its weight.
- ***Soil Erosion***: Soil erosion occurs when soil is removed through the action of wind and water at a greater rate than it is formed. (National Department of Agriculture)

Materials Needed:

Drawing the Soil and Spheres of Influence:

- Giant paper or Post-It pad
- Easel
- Thick markers (black, brown, blue, green, and red)

Measuring Soil's Source:

- Step stool
- Measuring tape with paper grass on the end, a black dot at 80" and a blue dot at 8"
- Mason jars with topsoil, subsoil 1 (loamy) and subsoil 2 (gravelly sand)
- Slab of limestone (or appropriate parent material)

An Edible History of Soil:

- Saltine crackers (enough for every child to have one)
- Bucket(s) to collect waste

Blown Away:

- Three aluminum cake pans representing three different soil conditions
    - "Plowed Field": filled with soil
    - "Crop Residue": filled with soil and grass strewn on top
    - "Meadow": soil with firmly rooted grass
- 3 clear trash bags (one marked for each of the above)
- Hair dryer
- Extension cord, if needed

Soil: The Apple of Our Eye:

- Apple
- Knife
- Cutting board, ifneeded

The Program

Welcome/Introduction (10 Minutes):

*****Interpretation Note: Many parts of this document are written as speech and will appear in a grey box. Please feel free to adapt and change as necessary. It may be helpful to write out exactly what you want to say (at least in the introduction), but this document is really an outline, not a script.**

Introduce yourself, your organization, and the topic of the day: soil!

(The following wording is the SAME wording as featured in the field trip program. PLEASE ADAPT THIS BASED ON THEIR KNOWLEDGE OF THE CHILDREN'S PARK PROJECT. This should be used the FIRST TIME the children are introduced to the project. If this outreach is performed AFTER the field trip, simply remind the students of the gift and ask if they have their deeds! You might even "autograph" the deeds for them as an important person in their environmental education journey!)

Did you know that YOU have been chosen to receive a special gift? Let me ask you something. What do you think of when you hear the word "park"? Slides? Swings? Playgrounds? Well, we have a NEW way to think about a park. When you hear that word, we want you to think of trees, birds, insects, and presents. Wait, presents?! Yes, presents. The State of Indiana has decided to give you a gift, but it's not one that you unwrap, it's one that you protect, just like a special birthday gift. Indiana created The Children of Indiana Nature Park in Centerville, Indiana in honor of you. It doesn't have swings or slides; instead, it has trees, trails, tracks, and turtles. Indiana thinks you are so important, that each one of you can claim a "deed" for a piece of this land. What's a deed? It means that you are in charge of protecting something special. Your teacher is going to help you claim your deed, and you can learn about your piece of land and all of the ways it is growing and changing by visiting a special website listed on your deed. But how can we protect this land or the land that we live on without learning why it is important? Well, we are going to start today! Today's program is called "I'm Diggin' It!". Once I leave today, you will know why!

Dirt vs. Soil (5 minutes):

*Now, before we get started, I want to make one thing clear: **soil** is NOT dirt! Everyone take a look at your shoes. If you've been playing outside, you probably have what I would call "dirt" on your shoes. Who thinks they have a good example of dirt to share? Call on a volunteer and have them stand by you and hold up their shoe for the class to see. Where do you walk/play, and where did the dirt come from? (The school yard, backyard, etc.) THAT is soil! Have the child sit down. So, before we move on…today we are talking about **soil** NOT what? **(DIRT!)***

Drawing the Soil (10 minutes):

*See Appendix II for full diagram of activity.

So that dirt, which we found on "Zoe's" shoes, came from SOIL somewhere. Maybe it was her backyard or the school yard or the park. Up here I have a very basic picture of soil- let's say it's from a backyard. How many of you have ever dug in the yard? If you have, you know that there are a lot of things missing from this picture. Raising your hand, who can tell me something that's missing?

Call on a student. Let them draw their idea on the paper with the black marker. Help the students think of different things from each different sphere as they continue to add to the diagram.

Possible examples for each sphere:

- Lithosphere: rocks, pebbles, fossils
- Hydrosphere: water from rain
- Biosphere: roots, seeds, spiders, worms, ants, small mammals (moles), something rotting/decomposing (banana peel, apple core), mushrooms

Spheres of Influence (5 minutes):

*See Appendix II for full diagram of activity

Now let's group some of the things that are going on in this soil. First, let's group all the rocks. Circle or color in all rocks and pebbles in brown. Let's call this the ***lithosphere.***

Write lithosphere in brown at the top of the page. Have them repeat "lithosphere" making a motion like their holding a rock.

Now let's circle any water (use blue). Let's call this the ***hydrosphere*** *(make a motion like a river flowing).*

Finally, let's circle all the living things (use green- have the kids help find them all). We'll call this the ***biosphere*** *(make a motion like something growing). Now in the biosphere there's even more going on. Right now we have an ant and a spider. How do they relate to one another? Are they friends or is one food for the other? What else do we have drawn that's food for something else?*

Draw arrows between organisms to show the food chain in red. For example: seed → ant→ spider→ small mammal.

*What do we call this? **(Food chain!)** Who's at the top of this chain? What happens when they die? Talk about **producers (plants)** vs. **consumers (animal)** vs. **decomposers** in the context of the soil.*

*As you can see soil is WAY more interesting than dirt. It has many kinds of living things and gives them food, water, and shelter. That means soil isn't dirt, it's a teeny tiny **ecosystem**!*

Soil is a very important part of the Children of Indiana Nature Park. Your piece of land, even if it's a spot right in the middle of a trail, has a whole world underneath it supported by soil. If we don't take care of the soil, what could happen? Could trees grow on your land? Would critters survive? Let's learn more about soil so that we can be great caretakers of the land in Indiana.

Besides various forms of life, soil also has water and rock. In fact, the soil is the ONLY place on earth where these three spheres (biosphere, hydrosphere, and lithosphere) all come together in the same place!

Measuring Soil's Source (5 minutes):

*So where does that soil come from? What we just drew was the **topsoil**. (Show mason jar of top soil.) Topsoil is the stuff at the very surface. Because the topsoil is so close to the living things in the biosphere, it is rich in nutrients from decaying plants and animals. But this soil began as something quite different. To find out where soil starts forming we have to go much deeper! To show you just how deep, I need two more volunteers.*

Have one volunteer stand and hold the measuring tape. Have paper grass glued on the tip of measuring tape to show that it is ground-level. The other volunteer must pull down on the tape until the black dot is visible to the audience (marked at 80 inches). Make sure your step stool is in easy reach for them to use…they'll need it!

*If you dug down about this deep (actually even a bit deeper!) in East Central Indiana, you will hit bed rock or the **parent material** of the soil. Show a slab of limestone. The parent in this part of the state is mainly limestone and shale. It's called the "parent material" because it is the base of our soil. So at the surface we have the rich topsoil and far down we have where it came from- the parent material.*

Draw attention to the blue dot, marked at 8" that represents the end of the topsoil.

*Between the two, we have a mixture of both called the **subsoil**. Instead of being fine like the topsoil, the subsoil is rockier and has bigger chunks of the parent material. The closer the subsoil*

is to the topsoil, the more it looks like topsoil. The closer it is to the parent material, the more it looks like the parent material.

Show mason jars with two subsoil examples, one close to the top and one close to the bottom. Thank the volunteers and have them sit down.

An Edible History of Soil (10 minutes):

*To show you how **THIS** (hold up the limestone slab) turns into **THIS** (hold up the topsoil jar), I have something I want to give to everyone.*

Pass out one saltine to every child. If there is a big group, call on volunteers to help pass them out. Tell the kids to hold it carefully, and not to eat it! Wait until everyone has a saltine.

*Right now everyone has a saltine cracker. This cracker represents the **parent material** of a soil, almost like our slab of limestone. Now over time, a LONG time, hundreds of years, something is happening to our parent material. Even though it is very far down, whenever it rains, water trickles down over it. If the water freezes, it can crack some of the rock.*

(Have the kids break their cracker once.) Pressure can also crack the rock.

(Have the kids crack their cracker again.) This happens over and over.

(Have the kids crack their cracker one more time.) After a LONG time, again, thousands of years, some of the bedrock has broken apart and moved into the subsoil.

*(Hold up the gravel subsoil jar.) This process of breaking from pressure and water continues in the **subsoil**.*

(Have the kids gently crush their small pieces. Make a comparison to the loam subsoil jar.) As the rock moves upwards as it gets smaller, it is also broken down from living things like the roots of plants.

*(Have the kids pulverize what is left of their cracker. Have them open their hand gently to observe. Afterwards, have them hold their hand closed and keep it closed.) Eventually, what was once part of a massive rock has become tiny rock particles closer to the surface. Here, they meet matter from decomposing plants and form the rich **topsoil**.*

Glaciers (5 min):

How long do you think it takes to form 1 inch of topsoil, knowing all that has to happen? ***500-1000 years!***[2] *Now wait, let's get out our measuring tape. According to this, we have about 8 inches of rich top soil and we would have to go down over 80 inches to hit parent material! That's A LOT of good soil! In other parts of the country, for example, out west, you would be lucky to have a couple of inches of topsoil and, if you dug down, you would hit solid rock way before 80 inches. The reason Indiana has so much good soil is that the soil around here took a shortcut when it was formed. Around 21,000 years ago, there was ice over about half of Indiana! In fact, it was a huge* ***glacier****, like the ice caps on the north and south poles with ice a MILE thick!*[3] *In fact, the glaciers of the last major ice age crept to about Brookville, IN just south of your special piece of Children's Park land. That ice acted like a big bulldozer. As it moved south during the ice age, it scraped the earth, grinding everything it picked up. This sped of the process of turning big pieces of rock into soil. When the glaciers melted at the end of the ice age, they left behind a lot of the ground up debris they were carrying, giving us lots of rich soil!*

Blown Away (5 min):[4]

Even though Indiana had the glaciers as a short-cut, it still took a VERY LONG time to form our soils. Unfortunately, it takes much less time to lose our soil if we don't take care of it. How do you think we could lose our soil? (Take responses.) The biggest factors are wind blowing soil away and water washing it away. Unprotected soils are especially at risk for being lost quickly. We call this ***soil erosion*** *when soils are being lost faster than new soil can form to replace it. Let me show you.*

Here I have soil as you might see when driving in Indiana. Show cake pan with loose soil. This represents a plowed field with just soil. It has no protection. Show cake pan with loose soil and grass sprinkled on top. This represents a plowed field with some crop residue left. How many of you have ever driven by a corn field in the fall and seen the dried stalks from the summer's crops? Soil like this has some protection. Show cake pan with grass. And this represents a meadow. It has a lot of protection.

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[2] "How Long Does It Take for Soils to Form?" Soil Matters, Get the Scoop! August 29, 2013. Accessed February 16, 2015. https://soilsmatter.wordpress.com/2013/08/29/soil-formation.

[3] "Wisconsin Glaciation." Wikipedia. October 24, 2014. Accessed February 16, 2015. http://en.wikipedia.org/wiki/Wisconsin_glaciation.

[4] adapted from Dig In!: Hands-On Soil Investigations by National Science Teacher Association

Choose two volunteers. Have one hold the pan at an angle (representing a field with some slope) and the other hold the clear garbage bag under it. Blow the hair dryer over the "Plowed Field" for 30 seconds. The kids can help you count. Switch bags and repeat for the "Crop Residue" and "Meadow". Hold up the clear trash bags for the students to compare how much was lost in each.

So which pan had the most erosion? Why? What did that pan represent? Which pan had the least erosion? Why? What did that represent? After this experiment, how can we help keep our precious top soil? (Plant trees, make sure soil has plant cover, etc)

Soil: The Apple of Our Eye (Remaining time minus 5 min.): [5]

So we've talked about how soils are like mini-ecosystems, how they form, and how they get eroded away, but why is soil important? Who has an idea? (Get some ideas from raised hands.) I'm thinking of something we need to do every day, something we should do three times a day…FOOD! Who can tell me what you had for breakfast/lunch today? (Explain how all food, even processed food like Pop-Tarts, comes from plants or animals that depend on the soil.) A lot of the food we eat comes from crops like corn and wheat, which can only grow on certain soils. Although the earth is a big place, there are only a few places on it, like Indiana, that can grow crops well. (Take out your apple.)

1. Tell the kids to imagine the planet Earth as an apple. The skin of the apple is the crust of the earth. The core of the apple is the core of the earth.
2. Ask the kids if they know how much of the planet is land. Cut the apple into fourths; only ¼ of the earth is land. Set aside the rest.
3. Cut the land section in half. Half of the land on Earth contains mountains, deserts, or covered in ice and is not livable. Set this aside.
4. Cut the section representing habitable earth into fourths. Set aside three. They represent areas that are too rocky, infertile, hot, or urban to grow food.
5. All that is left is 1/32 of the apple. Carefully remove the skin.
6. The skin represents all the soil (crust of the earth) that we have to feed all the world's people! ***Did you know that we have over 7 billion people to feed in this world? What would happen if we didn't take care of Indiana's soil? We produce LOTS of food for the world. They are counting on us to be responsible!*

[5] Taken from *Dig In!: Hands-On Soil Investigations* by National Science Teacher Association

7. Cut the skin in half. In the last 150 years, ½ of the topsoil on the planet has been lost[6].

*Full original activity in Appendix III. Step 7 has been added.

Because there is so little soil on our planet that is fertile for growing food for everyone, it is important that those of us who are lucky to live on that soil to know how to take care of it!

Closing (5 mins):

Thank you for letting me come in today and talk about soil! Ask review questions.

- *Who can name something that lives in the soil's ecosystem?*
- *What does a decomposer do?*
- *What do we call the materials where soils come from?*
- *How long does it take for 1 inch of soil to form?*
- *Why do we have such rich soil in this part of Indiana?*
- *What is one way soil can erode?*
- *What can we do to help protect our soils?*
- *Why are soils important?*

Isn't it cool that your special piece of land at the Children's Park is located in Indiana where we have such incredible soil? It's you turn to help us take care of Indiana's special land. Think of some things you can do to protect your own backyard and the soil near you (We talked about lots of ideas today such as planting trees!). You'll be a conservation hero!

[6] "Soil Erosion & Degradation." World Wide Fund for Nature. Accessed February 16, 2015. http://www.worldwildlife.org/threats/soil-erosion-and-degradation.

APPENDIX I

Customizing the Curriculum

To find out more about your local soils, you can create a map specifically to your region using Web Soil Survey from United States Department of Agriculture (USDA). Directions to use the tool and the access link can be found here: http://websoilsurvey.nrcs.usda.gov/app/

I used this site to identify a specific soil found on Cope Environmental Center's property in "Measuring Soil's Source". Soil horizon lengths in the program as is are based on Miami, Gravelly Substratum. Description below.

Description of Miami, Gravelly Substratum

Setting

- *Landform:* Moraines, till plains, outwash plains, stream terraces
- *Landform position (two-dimensional):* Backslope, shoulder
- *Landform position (three-dimensional):* Side slope
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Parent material:* Loess over loamy till over sandy and gravelly outwash

Typical profile

- *A - 0 to 8 inches:* silt loam
- *B - 8 to 36 inches:* clay loam
- *C1 - 36 to 60 inches:* loam
- *2C2 - 60 to 80 inches:* stratified coarse sand to very gravelly sand

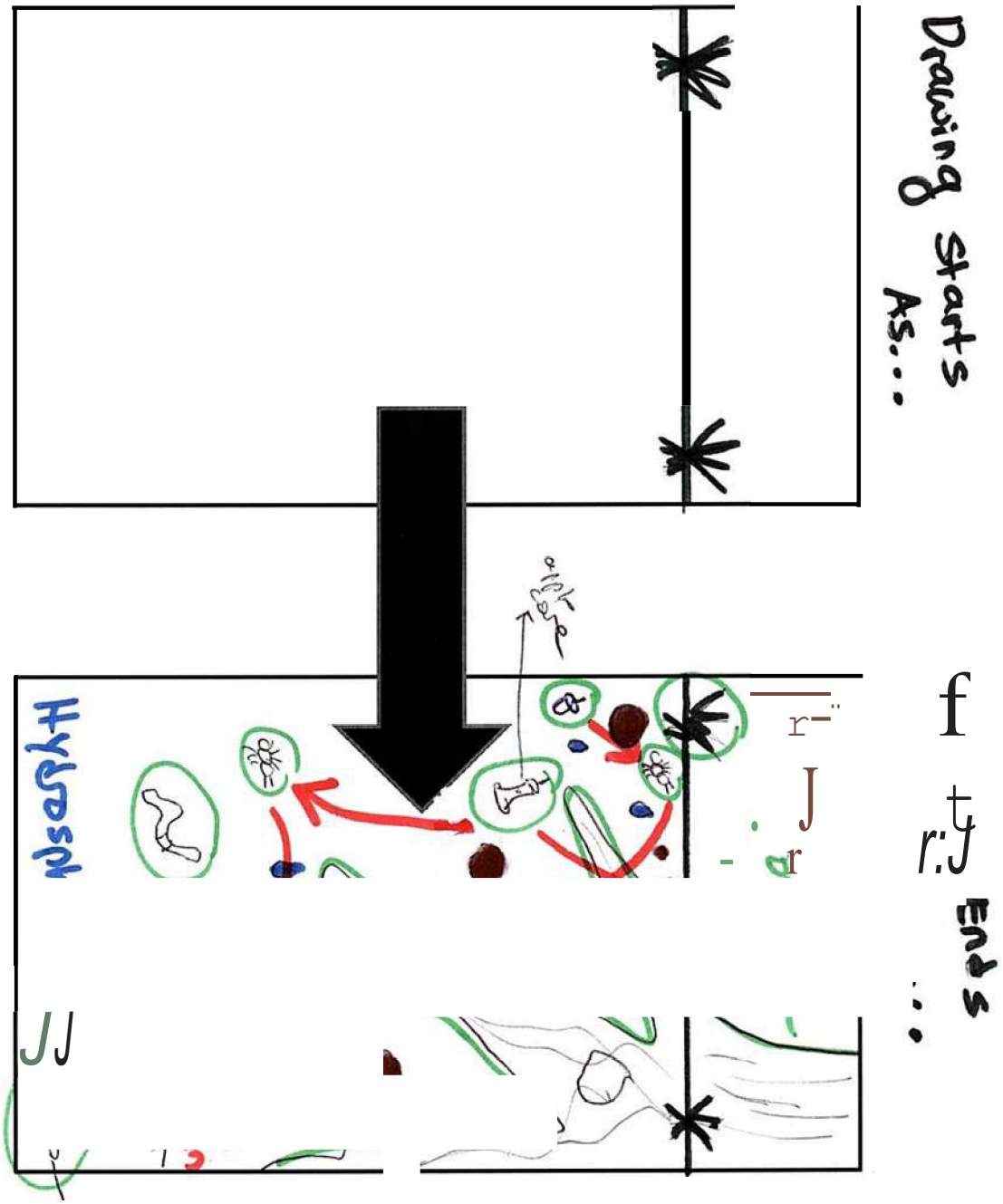
To find the bedrock specific to your region (needed for "Measuring Soil's Source" and "An Edible History of Soil") visit http://igs.indiana.edu/Bedrock/.

To learn more about the extent of the glaciers and how they may have affected your region, check out http://igs.indiana.edu/Surficial/IndBoundries.cfm

More Indiana specific resources on soil can be found here: http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/in/soils/?cid=nrcs144p2_031079

APPENDIX II

Diagram for "Drawing the Soil" and "Spheres of Influence"

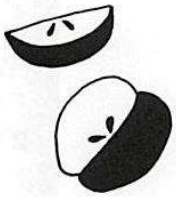


APPENDIX III

Diagram for "Apple of my Eye"

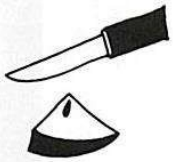
Figure 5.1. Only a small portion of land is capable of producing food.

1 Imagine the Earth as an apple.



2 Cut it into fourths. Only one part is land—the rest is water. Set aside the three sections that represent water.

3 Cut the land section in half. One part represents land that is mountains, deserts, or covered with ice. Set this part aside.



4 Cut the other livable area into fourths. Three of these are too rocky, wet, hot, infertile, or covered with roads and cities to grow food. Set these three aside.

5 There is now only $^{1}/_{32}$ of a slice of apple remaining. Peel the skin from this tiny piece.

6 The skin represents the soil on which the food is grown that must feed all the people on Earth.

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III*: Other Resources for Users*

http://www.soils4teachers.org/lessons-and-activities