



DIGGING INTO SOIL

STEM Preschool Teaching Unit

Ages 2.9-5 years

www.massaudubon.org/education

Young children love dirt, mud, and everything in between! Preschoolers are naturally curious about soils, and most young scientists are delighted when they have the opportunity to get dirty.

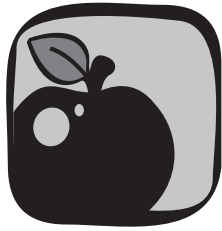
This unit offers six different investigations designed to help young scientists learn about soils:

1. Soil Sense – What is Soil?
2. Soil Science – What is soil made of? Where does it come from?
3. Under My Feet – Who and what lives in soil?
4. Wiggly Worms – What makes a worm a worm?
5. How do people use soil?
6. Construction Site – Engineering with soil

Mass Audubon Philosophy on Early Education.....	1
Brain Building in Progress.....	2
The Nature of Early Childhood Science in the Outdoor Classroom.....	3
Tips for Taking Preschoolers Outdoors.....	4

Digging into Soil

Teaching about Soils.....	5
Investigation Objectives.....	6
Materials.....	8
Teacher’s Corner.....	9
Preschool Interest Areas Planning Form.....	11
Investigation Summaries.....	12
INVESTIGATION 1	
Soil Sense.....	14
INVESTIGATION 2	
Soil Science.....	16
INVESTIGATION 3	
Under my feet: who lives in soil?.....	18
INVESTIGATION 4	
Wiggly Worms.....	20
INVESTIGATION 5	
How do people use soil?.....	22
INVESTIGATION 6	
Construction Site: Engineering with Soil.....	24
Resources.....	26
Teacher’s Bibliography.....	27



What we strive for

At Mass Audubon we strive to create learning experiences that are enriching, innovative, meaningful, and engaging. Our preschool programs support Massachusetts Science, Technology, and Engineering Standards. Our network of wildlife sanctuaries and nature centers located in urban, suburban, and rural communities around the state enable us to develop, evaluate, and sustain nature-based early childhood education programs in all settings. We are fully committed to creating a positive and supportive learning environment that is inclusive, open to all learners, and sensitive to cultural diversity.

Place-based learning

Place-based learning is an educational philosophy that connects learning to what is local to the learner. As children, we develop an understanding of where we are and what this place is like. It might be the child's backyard, local park, beach, forest, or meadow. By learning and understanding your own city, town, or neighborhood, as you grow you have the power and commitment to become an active part of that community.

Play-based learning

Play-based learning in nature takes advantage of a child's innate curiosity in the world around them and, like all play-based learning utilizes discovery as a motivator in learning by supporting children as they choose activities that engage and match their own interests and ideas. Teachers create learning environments that encourage play and exploration in the natural world and even step aside to let a child engage directly with the wonder of nature to guide curriculum. Nature play encourages and provides opportunities for children to construct their own surroundings, design tools and materials, develop give-and-take of social relationships, and solve problems as individuals and part of a team.

Inquiry-based learning

Inquiry-based learning is focused on teamwork, being learner centered, questioning ourselves and the world around us, providing a more focused time-intensive exploration, promoting lifelong learning, communication, and learning as fun.

Embracing the serendipity of outdoor exploration

Nature exploration is dependent upon the weather and other conditions. A class might observe different wildlife than they expected to see. An outdoor lesson can sometimes provide unexpected but enriching teachable moments on a natural history topic that was not planned. Enjoy and celebrate the learning and discovery that nature will offer your classroom.

Brain Building in Progress



Building Young Brains and a More Prosperous Future For All

The Brain Building in Progress campaign is a public/private partnership of the Massachusetts Department of Early Education and Care, United Way of Massachusetts Bay and Merrimack Valley and a growing community of early education and child care providers, academic researchers, business leaders and individuals. Our work is based upon the latest science and research on early childhood development. Our mission is to raise awareness of the critical importance of fostering the cognitive, social and emotional development of young children by emphasizing its future impact on the economic prosperity of everyone in Massachusetts. We welcome the business, education, and policy-making communities, as well as members of the media to be part of this crucial venture. By giving a strong start to our youngest citizens, we create a stronger, more prosperous future for all.

Learn how you can take action for young minds and Massachusetts' future at www.brainbuildinginprogress.org/

The Science Behind Brain Building

When we understand the sequence and process by which brains are built, it's easy to understand why it's a smart investment to start every child out strong. Scientific research shows that early experiences directly shape how the brain develops. According to the Harvard University Center on the Developing Child, Stanford University and other leading researchers:

- In the first few years of life, 700 new neural connections are formed every second.
- Neural connections and the architecture of the developing brain are built through back-and-forth interactions with adults in enriching environments.
- Brain building is disrupted by “toxic stress,” a term that describes chronic stressful conditions rooted in causes such as poverty, neglect, or maternal depression. Toxic stress increases the likelihood of developmental delays.
- Several studies have shown that, as early as 18 months, there are notable disparities in vocabulary between children from language-rich, high interaction homes and those who are not. Recent Stanford research showed that by age two, this equals a six month gap in language processing skills and vocabulary. By increasing interaction, using richer language and child-directed talk, parents can help their child to learn more quickly.



Brain Building can happen anywhere, not just in a formal school or early education programs. Anyone can be a Brain Builder by reading with children, asking lots of open-ended questions or engaging them in play. For fun ideas about how you can turn any moment into a brain building moment, download our activity guides.

The Nature of Early Childhood Science In the Outdoor Classroom



Children have wonderful imaginations and an innate desire to explore through direct experience. Like scientists, children are continuously gaining new knowledge about the world around them through observation, inquiry, and experimentation. Often they do this by asking questions, lots of them. These questions, flowing from experience and observation, are at the heart of early childhood science. Early childhood educators can guide this natural curiosity as well as model skills and attitudes for learning. Teachers, you will have questions too, as you explore the natural world together with your students. Share your questions with children—your willingness to “not know” is actually one of the easiest and most powerful ways that you can model what it means to “practice science” in the early years.

When you are exploring the natural world, science is all around you, but where do you start with a group of young learners? Sometimes it’s best to start with their curiosity and other times you may begin your explorations with activities and tools that help to focus attention and observation. Integrating science exploration in early education can both develop future scientific understanding as well as promote essential learning attitudes and confidence. It also provides a strong foundation for critical thinking and comfort with the practice of science.

Outside the classroom door, the natural world opens up the child’s innate sense of wonder. Here’s an example from a classic:

“That’s funny,” said Pooh (standing by a picket fence). “I dropped it on the other side,” said Pooh, “and it came out on this side! I wonder if it would do it again?” And he went back for some more fir cones.” It’s likely that you recognize this passage from A.A. Milne’s *The House at Pooh Corner*. It embodies what is at the heart of practicing science in the early childhood classroom—that learners observe, question, experiment, ask questions, and inquire, through direct experience of the world around them.

Through these four units, you can jump start nature-based science learning and discovery by exploring your school yard or outdoor classroom and focusing on the things that capture children’s attention in any setting—birds, soil, trees, and weather. We encourage you to experiment with methods and activities for using the natural world to create a culture of wonder and scientific thinking in your early childhood education setting.





Ten Tips for Taking Preschoolers Outdoors

1. Start with free play. Playing outdoors, exploring textures and colors, running and jumping, designing and building are all learning activities in and of themselves.
2. Continue with short focused trips outside. A ten-minute walk can yield lots of observations. If possible, ask additional adults to come along for outdoor activities.
3. Be safe. Preview the space to be explored whenever possible. Point out dangers such as broken glass or thorny plants. Make sure everyone has appropriate clothing for the weather and think about a plan in case of emergency.
4. Encourage respect for nature. Tell children that they need to respect plants and animals just like they respect one another. Be a good role model by being gentle with leaves and insects. Before you go out, talk about whether it is okay to pick flowers or collect worms.
5. Focus on one question or phenomenon, such as, “Can you find anything green outside?” or “What sounds do you hear?” Make sure students know what they are looking and listening for before they go outside.
6. Look for things to study in unlikely places. Students can find amazing things looking at brick walls rock outcrops, lawns, broken pavement, and weeds.
7. Encourage a sense of wonder. If you don’t know the names of plants or birds, don’t worry. Just make sure students are observing and using their senses. There are plenty of field guides available if students want to try to identify something.
8. Visit the same spot multiple times over the course of the year. Even in winter, there can be interesting rocks, twigs, birds, and signs of animals to observe.
9. Draw and write. When students record observations, they are more focused and have more to think and talk about when you get back inside.
10. Be flexible. You never know what you might see. If the lesson is about clouds, but a cluster of ladybugs captures children’s attention, be ready to change your plans.





When preschoolers build sand sculptures, create mud pies, and soak the ground with a garden hose, they are learning about soils. These simple explorations of the interaction of soil, water, and air bring up wonderful conversations about how soil is made, how it behaves under different conditions, and the many ways that soil is part of our lives.

Please allow, and even encourage, your students to fully investigate soils. Staying clean should not be anyone's priority. Wearing an apron or an old shirt over their clothing may help some young scientists and their teachers feel more comfortable exploring in these investigations. On a warm day, the most enthusiastic young soil scientists can be cleaned up with a watering can or garden hose.

When a young child learns about soils, he/she is learning that soil is a vital part of our environment and of our daily lives. From the ground up, children learn about how plants, animals, and humans depend on the health of soil. So, dig in – it's time to get your hands dirty.



**Investigation Objectives and Alignment to
Massachusetts Department of Education Pre-K Science, Technology
and Engineering Standards 2013
for 2015-2016 implementation**

Investigation	Children will be able to:	Pre-K STE Learning Standards
<p>#1 Soil Sense: What is soil?</p>	<ul style="list-style-type: none"> • Use their senses to compare and contrast a variety of different soils. • Sort and classify soil samples based on investigation, measuring, and sifting soil. 	<p>PreK-LS1-3. Explain that most animals have five senses they use to gather information about the world around them.</p> <p>PreK-LS-I-4. Use their five senses in their exploration and play to gather information.</p>
<p>#2 Soil Science: What is soil made of? Where does it come from?</p>	<ul style="list-style-type: none"> • Describe the living, nonliving, and once-living components of soil. • Name different components of soil. • Discuss a variety of ways that soil is made. • List some of the effects of water on soil. 	<p>PreK-ESS2-2. Observe and classify nonliving materials, natural and human made, in their local environment.</p> <p>PreK-ESS2-6. Understand the impact of weather on living things.</p> <p>PreK-LS-I-4. Use their five senses in their exploration and play to gather information.</p> <p>PreK-PS-I-4. Recognize through investigations that physical objects and materials can change under different circumstances.</p>
<p>#3 Under My Feet: Who and what lives in soil?</p>	<ul style="list-style-type: none"> • Describe that soil is a habitat for many living things – both plants and animals. • Design and build a model of an underground habitat. • Collect data on soil invertebrates through observation and experimentation. 	<p>PreK-LS-I-4. Use their five senses in their exploration and play to gather information.</p> <p>PreK-LS-2-2. Using evidence from the local environment explain how familiar plants and animals meet their needs where they live.</p>



<p>#4 Wiggly Worms: What makes a worm a worm?</p>	<ul style="list-style-type: none"> • Discuss specialized adaptations of worms for living in the underground habitat. • Design and conduct investigations on how worms move. 	<p>PreK-LSI-1. Compare, using descriptions and drawings, the external body parts of animals and plants and explain functions of some of the observable body parts.</p> <p>PreK-LSI-3. Explain that most animals have five senses they use to gather information about the world around them.</p> <p>PreK-LS-1-4. Use their five senses in their exploration and play to gather information.</p>
<p>#5 How do People Use Soil?</p>	<ul style="list-style-type: none"> • Discuss how plants use the soil in order to grow. • Describe how we eat vegetables that grow above as well as IN the soil. • Design and create a small garden and monitor its growth over time. • Design, create, and monitor a classroom composter. 	<p>PreK-LS-1-2. Recognize that all plants and animals grow and change over time.</p> <p>PreK-ESS3-2. Observe and discuss the impact of people’s activities on the local environment.</p>
<p>#6: Construction Site: Engineering with Soil</p>	<ul style="list-style-type: none"> • Describe and discuss the different uses of soil and mud by animals (including humans). • Design and build objects out of mud. • Discuss the properties of soil, mud, water, and rocks through play, design, and exploration. 	<p>PreK-LS-1-4. Use their five senses in their exploration and play to gather information.</p> <p>PreK-PSI-4. Recognize through investigation that physical objects and materials can change under different circumstances.</p>



Suggested outdoor exploration materials

- String or yarn
- Coffee filters
- Hand lenses
- Popsicle sticks
- Clipboards (can attach pencils with string or velcro)
- Trowels (small shovels)
- Penlight or other small flashlight
- Small plastic containers to hold living things
- White plastic plates to observe samples
- Ziploc bags, various sizes
- Plastic terrariums
- Spray bottles
- Measuring tapes or string
- Disposable or digital camera
- Crayons and markers (fine and thick point)
- Paints
- Clay or playdough
- Collage materials
- Bendable wire or pipe cleaners

Keep it easy!

- Assemble outdoor kits in backpacks to pick up and go as you walk outdoors!
- Families will gladly save and send in recyclables that are both reusable and disposable. Just ask!



DIGGING INTO SOIL

Basic Concepts and Fun Facts



What is soil?

Soil is the skin of the earth, capable of supporting plant life and vital to all life on earth. Soil is a mixture of minerals, organic matter, liquid, gases, and micro and macro-organisms. Soil is characterized by layers or horizons – humus, topsoil, subsoil, parent material, etc.

Soil has 4 important functions:

- Medium for plant growth
- Means of water storage, supply, and purification
- Modifier of the atmosphere – absorb and release gases and dust; modify temperature
- Habitat for organisms that decompose and create a habitat for other organisms

Many people confuse the terms soil and dirt. Dirt is what gets on our clothes or under our fingernails. Consider dirt as soil that is out of place – tracked inside by shoes, for example. Also, dirt is soil that has lost the ability to support life – it is “dead.”

How is soil made?

Soil is made from the weathering of parent material by wind and water and the biological action of lichens, mosses, and the addition of organic material. As rocks are broken down into smaller rocks and gravel and/or sediments are deposited by runoff, organisms begin to colonize the accumulated mineral particles and organic matter accumulates. Over time the organic matter breaks down and becomes part of the underlying material and soil develops. Soil formation is an ongoing process dependent on a number of factors:

- Parent material – eroding bedrock, deposited glacial till, river sediments, etc
- Climate – temperature, amounts of water and wind, seasonality
- Topography – slope, directionality
- Biota – plants, animals, microorganisms, humans
- Time – process never stops

What is soil made of?

Soil is made up of three main components – minerals from rocks, organic matter from the remains of plants and animals, and living organisms that reside in the soil. In addition, soil contains air and water in the spaces between the particles.

The proportion of components and the size of the mineral particles (soil texture) are what determine the ability of a soil type to retain nutrients and water. From large to small, soil particles are sand, silt, or clay. Loam is a soil made up of equal amounts of sand and silt with a smaller amount of clay. Loam is the ideal soil for growing most agricultural plants.



How do plants use soil?

Soil supports plant growth by providing:

1. **Anchorage:** root systems extend outward and/or downward through soil to stabilize the plant.
2. **Oxygen:** the spaces among soil particles contain air that provides oxygen to root cells.
3. **Water:** the spaces among soil particles contain water, which is absorbed by the roots and moves up into the rest of the plant.
4. **Temperature modification:** soil insulates the roots from drastic fluctuations in temperature as it maintains a more constant temperature than the air. In New England, this is especially important during winter.
5. **Nutrients:** soil supplies nutrients from both minerals and organic material.

Worms and Soil

A tablespoon of soil has billions of organisms including bacteria, protozoa, fungi, nematodes, insects, crustaceans, arachnids, and earthworms that are all part of a healthy soil ecosystem. The vast majority of these organisms are beneficial to the soil and the plants that grow in it. The most well known and usually the most common by weight are earthworms.

Earthworms are invertebrates. They have circulatory, respiratory, digestive, reproductive, and nervous systems. They have no eyes although they can sense light.

Earthworms tunnel through the soil eating decaying roots and leaves and other soil organisms such as nematodes, protozoa, fungi, etc. They help to aerate the soil and improve water-holding capacity with their tunneling, and they add nutrients to the soil with their castings.

Earthworms breathe through their skin and cannot survive if their skin gets too dry. They mostly stay underground to avoid being dried out by the sun. Worms come to the surface during rainstorms because they can move about safely without drying out, not in order to avoid drowning.

Did you know?

- It is not true that if you cut a worm in half each half will grow into a new worm.
- In order to avoid freezing during the winter, worms migrate deeper into the ground below the frost line. They also may migrate deeper in the summer to avoid drying out.
- The earthworms we have in New England are actually introduced from Europe since our native earthworms were eliminated by the glaciers. Even though earthworms didn't arrive here until European settlers came, they have spread very rapidly throughout the Northeast and Midwest.



PRESCHOOL INTEREST AREAS PLANNING FORM

THEME: DIGGING IN THE DIRT
 (#1-6 indicates the investigation to go to for detailed instructions)

<p>ART</p> <ul style="list-style-type: none"> • Painting with soil/mud/worms (#4, #5) • Soil texture collage • Clay sculptures (#6) • Soil smudges (#1) • Mud sculptures (#6) • Worm sculptures (#4) • Cookie-cutter gardens (#5) 	<p>COOKING</p> <ul style="list-style-type: none"> • Mud pies • Edible dirt (#5) • Window sill garden herbs (#5) • Stone soup (#5) • Where does food grow (#5) 	<p>DISCOVERY/SCIENCE</p> <ul style="list-style-type: none"> • Soil layers in a jar (#1, #2) • Erosion table (#2) • Soil sifting (#1) • Planting with different soils (#5) • Making soil and mud (sand, silt, clay, water) (#1, #2) • Worm study (#4) • Compost bottles (#5) • Worm farm (#4) • Ant farm (#3) • Bug museum (#3) • Bug lab (#3) 	<p>DRAMATIC PLAY</p> <ul style="list-style-type: none"> • Forest/garden restaurant (#5) • Construction zone (#6) • Archeological dig • Underground soil community (#3) • Worm puppets (#4)
<p>ENGINEERING / DESIGN</p> <ul style="list-style-type: none"> • Making mud balls & bricks (#1, #6) • Making mud “sculptures” (#6) • Mud structures with blocks (#6) • Excavators & dirt moving tools (#6) • 3D model/cross section (#2, #3) • Design a bug (#3) 	<p>LITERACY</p> <ul style="list-style-type: none"> • See attached annotated bibliography for multiple selections • Use your local library as a resource 	<p>MATH/NUMERACY</p> <ul style="list-style-type: none"> • Measuring soil, etc (#1, #2) • Weighing soil (#1, #2) • Plant Olympics (#5) • Garden planning (#5) • Measuring worms (#4) 	<p>MUSIC/MOVEMENT</p> <ul style="list-style-type: none"> • Rock Music (#2) • Seed Sprouting (#5) • Mud Sliding (creative movement – i.e. <i>One Duck Stuck</i>) (#2) • Wood turtle stomp (#4) • Move like a worm (#3, #4)
<p>OUTDOORS</p> <ul style="list-style-type: none"> • Tracking in the mud (#5) • Looking for erosion (#2) • Compost (#5) • Soil creatures and homes (#3) • Finding earthworms (#4) • Decomposing logs (#2, #3) • Soil samples and layers (#1, #2) • Coverboards (#3) • Mud kitchen (#2, #6) • Pitfall traps (#3) 	<p>SENSORY</p> <ul style="list-style-type: none"> • Soil samples (#1, #2) • Soil smells (#1) • Sand, silt, clay – soil textures (#1, #2) • Frozen mud balls (#6) 	<p>COMMUNITY CONNECTIONS</p> <ul style="list-style-type: none"> • Stone Soup (#5) • Soil sample from home (#1) • Family lunch from school garden (#5) • Field trip to garden, farm, food pantry – connections between farm and food (#5) 	<p>GAMES/MANIPULATIVES</p> <ul style="list-style-type: none"> • Soil in a can (#1) • Soil bug matching (#3) • X-ray goggles (#3)



INVESTIGATION SUMMARIES

THEME: DIGGING INTO SOILS

(#1-6 indicates the investigation to go to for detailed instructions)

<p>Big Ideas</p>	<p>Investigation #1 Soil Sense: What is soil?</p>	<p>Investigation #2 Soil Science: What is soil made of? Where does it come from?</p>	<p>Investigation #3 Under My Feet: Who and what lives in soil?</p>
<p>LARGE GROUP LEARNING</p>	<ul style="list-style-type: none"> • Do a KWL chart or concept map about soil. • Generate a list of soil words – mud, soil, sand, gravel, dirt. • Soil sense: have a few different soil samples to feel, smell, talk about. • Soil in a jar 	<ul style="list-style-type: none"> • Compare and contrast different soil samples. • Observe a decomposing log; discuss living, nonliving, “was living” • What is soil made of? Can we make soil? • Make soil in a can. • Soil layers jar. • Make rock dust. 	<ul style="list-style-type: none"> • Who and what lives underground – roots, bugs, amphibians, mammals, etc. ? • Soil critter movement • X-ray goggles to look into the soil • Soil bug match-up • Bug museum • Ant farm • Make a 3D underground model
<p>SMALL GROUP LEARNING</p>	<ul style="list-style-type: none"> • Sort/classify different soil samples. • Soil smudges or rubbings. • Weigh and sift soil. • Investigate mud. 	<ul style="list-style-type: none"> • Soil making table • Paint pan erosion • Erosion table experiments • Soil sifting (sieves, coffee filters, etc.) 	<ul style="list-style-type: none"> • Design a bug • Decomposing log terrarium • Bring in soil and look for organisms. • Soil Safari • Bug lab
<p>OUTDOOR LEARNING</p>	<ul style="list-style-type: none"> • Go for a soil walk to experience different types of soil in your schoolyard or neighborhood – gather samples along the way. • Try a walk on different weather days to notice variations in soil texture, smell, etc. 	<ul style="list-style-type: none"> • Search for erosion outside – streams with silt and mud; ravines from heavy rains, etc. • Find things “turning into soil”: leaves, logs, rocks, etc. • Dig soil pits in different locations: forest, garden, field. 	<ul style="list-style-type: none"> • Animal homes in soil – animal holes, worm castings, ant hills. • Coverboards • Pitfall traps



INVESTIGATION SUMMARIES

BIG IDEAS	Investigation #4 Wiggly Worms	Investigation #5 How do People Use Soil?	Investigation #6 Construction Site: Engineering with Soil
LARGE GROUP LEARNING	<ul style="list-style-type: none"> • What is a worm? • Compare and contrast worms and caterpillars. • Watch a worm! • Move like a worm • Worm Concept Map 	<ul style="list-style-type: none"> • Discuss all the ways that people use soil. • Bring a bag full of veggies – which grew in the soil? What grows in above the soil and what grows in the soil? • Seed sprouting • Read the book and make <i>Stone Soup</i> 	<ul style="list-style-type: none"> • What can we make with soil? • Show pictures of people around the world who build with dirt or mud. • Animals that use mud or soil – birds make nests out of mud; beavers use mud in their dams; ants and termites use soil, sand, or mud. • Who likes to play in the mud? People, animals...
SMALL GROUP LEARNING	<ul style="list-style-type: none"> • My worm is... • Measuring worms • Worm puppets • Worm sculpture • Paint with worms • Worm Farm 	<ul style="list-style-type: none"> • Sow seeds; make a window sill garden; plant in eggshells; cookie-cutter gardens • Plant Olympics • Compost 2 liter bottles • Paint with mud/clay • Forest/garden restaurant • Start a compost pile 	<ul style="list-style-type: none"> • Construction projects with dirt/mud • Make a construction site of different materials – use tools/toys to move through different materials – soil, sand, mud, etc.
OUTDOOR LEARNING	<ul style="list-style-type: none"> • Worm Expedition: search for worms outside in all sorts of weather. • Worm charming 	<ul style="list-style-type: none"> • Plan and plant a garden • Edible school yard garden • Family picnic • Farm or restaurant field trip 	<ul style="list-style-type: none"> • Mud Kitchen • Make mud pies, mud balls • Frozen mud balls • Making and building with bricks made of mud



Soil Sense

What is Soil?

How does it feel?

How does smell?

LARGE GROUP LEARNING ACTIVITIES

What is Soil? Most children have some experience playing in the dirt, mud, or sand. Take some time as an introduction to learn what your students know about soil. What do they think it is made of? Do they think it is alive or dead? Use a KWL chart as students describe their own experiences with soil (or dirt!).

What do we KNOW ?	What do we WANT to know?	What did we LEARN ?
Soil makes plants grow.	Where does soil come from?	
Soil is muddy.	Is soil the same as dirt?	

Soils in a Jar: Show the students 3 or more jars full of soil. Collect soil from three different locations so that your samples look different in color and texture. Collect soil samples by digging down several inches below the surface with a garden trowel. You could collect soil from a yard, garden, forest, riverbank, compost pile, or worm bin. To be certain that your samples do not contain any toxic or dangerous materials, it is best to avoid vacant lots or roadsides. Ask the students what is in the jars. What is soil? Why is it important? What do they notice about the different soil samples? Ask them to describe what is different and what is the same.

Soil Sense: While sitting in a circle, give each student a white paper plate. Place a large spoonful of soil on each student's plate, one sample at a time. For each sample, ask the students to smell the soil and describe what it smells like. Ask them to take a pinch of soil and rub it between their fingers and describe what it feels like. Have them put some soil in their hand and squeeze it: is it wet or dry, soft or firm; does it stick together or fall apart? Go through each soil sample and explore the same properties one by one. Talk about the many different characteristics of soil – color, texture, moisture, etc.

Soil Words: Generate a list of soil words: soil, dirt, muck, mud, dust, loam. Assemble a list of descriptive words about soil based on the students' experience with the soil samples.

Read a Soil Story – suggested books are in the resources section

Sing: Dirt Made My Lunch by The Banana Slug String Band
www.songsforteaching.com/bananaslugstringband/dirtmademylunch



OUTDOOR LEARNING ACTIVITIES

Community Connection: Ask children to bring in soil samples from home in Ziploc bags. Transfer the samples to baby food or jelly jars. These samples can be looked at as a large group or can be placed in your science discovery area for additional small group learning. See activities related to soil samples in Investigation #3.

SMALL GROUP LEARNING ACTIVITIES

Sorting Soil: Have different soil types and soil samples for children to sort and classify. Have examples of sand, silt, clay, gravel, mud, compost, forest soil, potting soil. Invite them to sort the soil in different ways.

Soil Smudges: Using the different soil samples begin an artistic exploration of soil by simply smudging it. Take a pinch of soil with fingers and rub it on a white sheet of paper without adding water. This process helps children feel the texture of different soils and notice the different color rubbings the varied soil samples make. Try creating a picture by just using soil smudges!

Soil and Water = Mud: Add water to different soil samples and try to make mud. Do some soil samples make better mud than others? Document which soil samples make the best mud for later when you make mud bricks in Investigation #8.

The Weight of Soil: Weigh the soil before and after you add water. What happens to the soil when you add water? Put the soil in a small strainer over a cup. Does the water pass through some samples but not another? Which soils retain the most water?

Sifting Soil: Sift soil over a white dishpan or bucket using household strainers or colanders. Use strainers with different-sized holes. Try using the strainers in sequence from large holes to small holes. What falls through and what gets stuck in each strainer? What ends up falling through all the holes?

Soil Walk: Go for a soil walk to experience different types of soil in your school yard or neighborhood. With trowels and Ziploc bags or small jars collect samples to bring back to the classroom. Try to collect soil from a few different locations to get different soil types – hard-packed area, under trees, sandy area, gravel area, etc. As you collect your samples, notice:

- Is it hard or easy to dig?
- If it's hard, how can you loosen it?
- Is the soil wet or dry?
- Is it wetter or drier as you dig deeper?
- What does the soil feel like? Smell like?
- Do you see anything besides soil in your sample? Seeds, leaves, bugs?

Label your soil samples. You can even bring a map along with you and make a number on the map where you collected each sample that corresponds with your container.

Soil in any Weather: Take walks on different weather days to notice the differences in smell, texture, color, moisture. On a wet, muddy day, read *One Duck Stuck* and then go for a soil walk.

Get Stuck in the Muck: Read *One Duck Stuck*, then head outside in your rain boots and find muck to get stuck in. What does it feel like when we get stuck in the muck? Does it make a sound when you pull a boot out of the muck? Do you need help from friends when you get stuck in the muck? No muck in your school yard – make some muck! See Investigation #8.



Soil Science

What is soil made of?

Where does it come from?

Where does it go?

LARGE GROUP LEARNING ACTIVITIES

Soil Science: In large group, review your soil samples from Investigation #1. Compare and contrast different soil samples with a sorting chart. How are the textures, color, and moisture content the same or different? Did students find any living things in their soil? If so, try to describe and/or draw them.

A Slice of Earth: Make a “cross section” drawing of soil—what did students find as they explored soil. What do we find in the top layers? What do we find as we dig deeper? Draw a model for what a cross section of soil looks like. Make a 3-D model under a circular table of a cross section of soil.

Living, Nonliving, Once Living: Bring in a decomposing log. You can put it in a terrarium for close observation. Gather around the log – observe and discuss what is happening to the log.

Soil in a Can: What is soil made of? Try making soil! Fill an old coffee can with soil ingredients—leaves, sticks, “starter dirt”, etc. Put on the lid and see if you can make soil.

Rock Music (Inside or Outside): Find a variety of different kinds of rocks. What happens when you grind them together? When you bang them to make “rock music”, do you make dust? These small particles of rock are the nonliving “ingredients” of soil!

Soil Layers in a Jar: Using your soil samples from Investigation #1 or new samples, add water to different soil samples in an old mayonnaise (or similarly shaped) jar. Make sure the cap is securely fastened. Shape the jar with water and let the soil settle. What happens as the soil settles? Let it sit overnight. Do you see different layers? Do you notice anything floating at the top?

SMALL GROUP LEARNING ACTIVITIES

Recipe for Making Soil: Materials – buckets of sand, silt, clay, rocks, potting soil (dark like humus layer), fake bugs and worms (made by students with found objects or art supplies), apron, chef hat. Set up a kitchen area for making soil. Who makes soil in nature? Let children experiment with different soil ingredients to make soil. Can they do it?

Have students rub 2 rocks together, to simulate weathering, over a paper plate. Give them dead leaves and have them crush them up as finely as they can, to simulate decomposition, over the same plate. What else do they need to add to make soil?



Erosion “Tables”: Fill roller paint pans with packed-down soil. Use a finger or small stick to make furrows in different patterns – make line (III) or channel (VVV) or stream (SSS) shapes in the pan. Add water slowly at the top of the pan and observe the flow of water. Which patterns allow the water to travel the fastest, the slowest? Which patterns cause the most erosion? What happens when you increase the slope of your pan? Try adding some blocks under the top of the pan to make your “hill” steeper. How do these changes modify the way the water flows?

More Experiments with your Erosion Table

- Add objects to your Erosion Table: sticks, rocks, grass, etc.
- Have water drip out of cups with different-sized holes drilled in the bottom. Balance cup or cups at the top to simulate water flowing down a hill.
- Experiment with different types of soil.
- Use a “shower” watering can to simulate rainfall.
- Other ideas that the kids come up with!

Messing Around with Soil: With several soil samples from a variety of sources and locations (garden soil, potting soil, forest soil samples, yard samples, sand, silt, clay), set up a small soil lab in the classroom. Materials include, but are not limited to, spoons, popsicle sticks, sieves (with different-sized holes), white trays or plates, magnifying glasses, tweezers, white and black construction paper. To contain the mess, you can have students work on baking sheets.

Examine the soil samples using the provided materials. Students can sift soil onto the different colors of paper. Observe the soil with magnifiers. Use tweezers to pick out soil treasures to explore under magnification. Document what students are curious about and note their questions about soil on a question board.

OUTDOOR LEARNING ACTIVITIES

Lens on the Litter: Using paper plates with the center cut out; have pairs of student sit down to explore the forest floor. Let them know they will be exploring all of the things on top of the soil

– what we call the leaf litter. Have them collect examples of what they find on a large piece of white cardboard, make drawings, and note any living things they find in the litter (worms, critters, etc.)

Erosion Walk: Find examples of erosion by taking a walk. Where do you see water that has made a “stream”? Do you see trails of soil that traveled downhill during a heavy rain?

Soil Layers Pit: In the forest or garden, dig a small soil pit. Dig down layer by layer – litter, duff, humus, inorganic material. Notice the different layers of soil. Can you dig down far enough to get to mostly “inorganic” or “non-living material”? Place a sample of each “layer” on a white paper plate to examine more closely. Use a soil chart to notice the differences between the different layers – color, texture, moisture, living organisms.

Turning into Soil: Find things that are “turning into soil” – leaves, logs, snags, rocks, etc. Can you make dust when you scrape two rocks together? Search for logs that are decomposing – how are they breaking down? Are any living things helping them to break down? What’s happening to the logs as they break down or decompose?



Under My Feet:

Who lives in the soil?

LARGE GROUP LEARNING ACTIVITIES

Who Lives Underground? Discuss as a group all of the animals that live underground. Create a felt or magnet board so that you can talk about how some animals (mammals, amphibian, insects, other critters) live underground and some just visit. See resources for an example of a magnetic board that demonstrates the underground habitat.

Soil Critter Movements: How do all of the critters that live underground move? Wriggle like a worm, walk like a beetle, stride like a centipede, dig like a mole, etc.

Soil Bug Matchup: Introduce new soil critters to students by playing a large group game of soil bug matchup. Create pairs of flash cards of soil animals – ground beetles, earthworms, pillbugs, moles, salamanders, etc. Ask students to note the different characteristics of the “bugs” and match up into pairs. Have them invent a name for their bug that describes it.

Bug Museum: Each child chooses a soil bug that he/she finds especially interesting and puts it in a bug box (old baby food jars with holes poked in the top work well). They share their bug with other students by describing it and talking about what they find interesting about their bug. Note: You can also purchase bug boxes commercially.

Please Note: It is important to always model safe capture and release whenever handling living organisms. This starts with ensuring that there are no substances on your hands that might harm the animals – particularly bug spray or sunscreen. With thin-skinned soil organisms such as worms, it is even good to have some dirt and/or moisture on your hands to help keep them from drying out while you look at them. Be careful and gentle at all times. Return all organisms to the area where they were found.

Ant Farm: Bring an ant farm into the classroom. Have student observe any behavior in the classroom and compare to the ants you find and study during outdoor explorations.

X-Ray Goggles: Make X-ray goggles out of old paper towel tubes and aluminium foil and have children decorate them. Use your X-ray goggles to imagine what is living under the ground. What would it be like to see underground? What kind of things would be under our feet – tree roots, worms, moles, voles, millipedes?

Building a 3-D Model of Soil and Its Inhabitants: Using your imagination and information from non-fiction literature, design and build a 3-D model of the underground habitat. A circular table works well – include tree roots, worms, centipedes, pillbugs, and all of the organisms you have found during your soil explorations.

Read: *Dirt: The Scoop on Soil* by Natalie Rosinsky



SMALL GROUP LEARNING ACTIVITIES

Design a Bug: Once you have studied different bugs that live underground, ask students to design and build their own soil bugs. They need to think about how it moves through the soil, what it eats, and what might eat it...unless it's a top underground predator!

Buggy Logs: Make an underground terrarium. Be sure to include a decomposing log that may host a diversity of different organisms. Dissect the decomposing log to search for millipedes, pillbugs, ants, and other critters. Make a chart of what you find!

Soil Safari: Shake soil samples through a kitchen sieve onto a white sheet of paper. What do you find? What was living in the soil that you didn't see before you sifted the soil?

OUTDOOR LEARNING ACTIVITIES

Ant Hill & Worm Castings Hunt: Look for these helpful animals on your walk. Talk about how they recycle and move soil around—they're nature's bulldozers!

Coverboards: Put a 2-foot square piece of plywood on the ground in your school yard or within walking distance of your school. Visit the coverboards regularly to see who is living underneath. Mark your coverboards so people who happen upon them know that you are studying what lives in the soil. Compare 2 different study locations.

Animal Homes: Search for underground animal homes – can you find any holes where a small mammal might reside? Imagine where animals might go while they are underground.

Resources: *Life in a Bucket of Soil* by Alvin and Virginia Silverstein



Wiggly Worms

LARGE GROUP LEARNING ACTIVITIES

What is a worm? What makes a worm a worm? With the children, start a KWL chart about worms. What do children already know about worms; what do they want to know about worms? Add additional “want-to-know” items based on the activities that you have planned.

Have on hand a big stuffed worm or a blown-up picture of a worm. Worms are invertebrates – that means no backbone. Have children feel their spine and ask them if they have a backbone? What would happen if they didn’t? They might move like a worm! Worms usually lack appendages or legs. There is an exception, but most of the worms that you will observe do not have appendages. That inchworm you see dangling from the trees in spring is actually not a worm; it’s a caterpillar. It has legs. But the word “worm” is often used to describe other things beside animals that are actually worms. Most interesting, different species of worms live in different habitats. We can find worms underground, in ponds, and even in the ocean.

Watch a Worm: The best way to generate more questions about worms is to observe them. Each child will need a white paper plate, a damp paper towel, a magnifying glass, and a worm or two. Have a spray bottle filled with water on hand too. First make sure that all the children’s hands are clean and clear of any soap, bug spray, or lotion. Explain that any of these products could harm the worm. Dampen the paper towels and hand them to the children. Share that the paper towel is also to help protect the worm from drying out. Ask the children where worms normally live? Do they remember from their explorations of soil what it felt like underground? Was it moist or dry?

Give each child a worm to observe. Ask each student to observe the worm silently – just with his/her eyes for one minute. After one minute, have them share all of their thoughts about the worm as well as all of their questions. Document their thoughts and questions on a chart. You may also invite the children to touch the worm after they have settled into observation. Demonstrate how to touch the worm carefully. This involves touching the worm with one or two fingers. Do not stroke or pet the worm because this can be very damaging to its skin. Our skin is like sandpaper to a worm – you wouldn’t want someone rubbing your arm with sandpaper even if he/she was trying to be gentle.

Ask the children to notice the characteristics of their worm:

- The shape and/or pattern of its body from one end to the other
- Color
- Movement
- Can they find the head and the tail? (see diagram)

Look for:

- Does it have a mouth?
- Does it have eyes and ears?



Have children carefully measure their worms – are they all the same length? Record the length of their worms on their observation page.

Worm Concept Map: Make a Worm Concept Map based on what children notice or know about worms after an initial observations.

Wriggle Like a Worm: Have the kids move like worms to get their own wiggles out before you move onto the next activity! Explain how worms move by contracting and releasing their muscles – or squeezing and stretching. Have kids squeeze and stretch (or wriggle) in unison across the floor!

Read: *Wiggling Worms at Work* by Wendy Pfeffer and Steve Jenkins

SMALL GROUP LEARNING ACTIVITIES

My Worm is... Have all children finish the sentence, “My worm is...” Make a worksheet with room for a drawing with their completed “My Worm is...” Ask them to make an observation drawing of a worm, noting the characteristics that they learned in their worm observations.

Read: *Diary of a Worm* by Doreen Cronin
Have children make a Venn diagram of a worm’s life and their life – how are they the same? How are they different?

Measure Your Worm: Create a “How Long is your Worm” chart with data from your worm observation. Create measuring units with different children’s worms. “That book is three of Brendan’s worms.”

Worm Puppets: Make worm puppets out of old socks and decorate. Have a worm puppet show.

Worm Sculptures: Make worms out of a variety of different art materials: Pipe Cleaners, egg cartons, string cheerios strung on pipe cleaners, pasta worm necklaces, etc.

Paint with Worms: Paint with rubber worms you buy at a fish tackle store.

Make a Worm Farm: This is a great resource for making a simple worm farm in a recycled soda bottle. <http://letkidscreate.blogspot.com/2012/04/making-worm-farm.html>

Read: *Garden Wigglers; Earthworms in Your Backyard* by Nancy Loewen

OUTDOOR LEARNING ACTIVITIES

Worm Expedition: Go for a walk outside to look for worms. Where might you find them? If you have a garden, dig in the dirt to look for worms. Try a walk in all sorts of weather – do you find more worms on different weather days? Why or why not? Where do you find them?

Wood Turtle Stomp: Wood turtles stomp their feet and sometimes thump their shells against the ground to attract worms. The vibrations bring the worms to the surface and the turtle then eats the worms.

The turtle rapidly taps one front foot against the ground (about once per second) while rocking back and forth. The turtle then switches and taps with the other front foot, and sometimes also thumps its bottom shell against the ground. Children can actually draw worms to the surface doing the same kind of tapping or stomping.

Read: *An Earthworm’s Life* by John Himmelman or *Wiggle and Waggle* by Caroline Arnold



How Do People Use Soil

LARGE GROUP LEARNING ACTIVITIES

Soil in Our Lives: Discuss all of the ways that people use soil – for growing food, for building things, for playing.

Where Does Our Food Come From? During circle time, introduce the concept of where food comes from and how fruits and vegetables grow. Prepare a bag of foods that grow in the soil. Pull out one at a time and ask the children to sort them based on whether the part we eat grows in the soil or above the soil. It's fun to have a large piece of chart paper that represents the areas above and below the soil.

Read: *Stone Soup*. Have each child bring a designated ingredient to school. Teacher provides the “stone.” Together, prepare and share soup as a class.

Seed Sprouting: In a large group, ask children to scrunch up tinfoil as a seed planted in the soil. Have one child be the rain and “sprinkle” the other children. Have a second child act as the sun to shed light. Encourage the children to slowly begin to push up through the dirt, sprouting and reaching toward the sunlight.

SMALL GROUP LEARNING ACTIVITIES

Sowing Seeds: Start an edible indoor garden. Begin with small pots and soil. Provide various vegetables and herb seeds. Have them observe the seeds. Provide pictures or the packet for each seed to see if they can make predictions regarding which seed can produce each fruit, vegetable, or herb. Designate a chart for what the plant will need each day and who will be responsible. Use an observation journal to keep track of the plant's growth. Some different variables can also be introduced. Plant the seeds in different containers – small pots, eggshells, cleaned out jack-be-little pumpkins, etc. Use seeds that don't sprout to start a compost pile.

Tray/Cookie-Cutter Gardens: Fill a small planting tray with soil. Using stencils or cookie cutters, set one into the soil and fill it with fast-sprouting edible seeds. Seeds will sprout in the shape of the stencil. Try vegetable shapes!

Windowsill Herb Garden: Provide planting pots, soil, and edible herb seeds such as basil, oregano, chives, and cilantro. Have children plant seeds, water them, and place pots in a sunny windowsill. Use the herbs for cooking.

Plant Olympics: Set up various events for children to participate in. For example, start 4 seeds at the same time and document which sprouts first. Or, plant 4 fast-sprouting seeds (scarlet runner beans) each in its own pot. Measure each one as it grows and chart which grows the tallest.



OUTDOOR LEARNING ACTIVITIES

Garden Plot Planning: Have children measure out a garden plot. Estimate and measure how much space will be needed between each seed and each row.

Edible School Yard Garden: Designate an area in your school yard that can be turned into a garden. Once the soil is reasonably prepared, provide the children with tools to work the soil, divide the rows, and create space for plants and new seeds. Whatever has survived from your indoor garden can be transplanted here in spring.

Family Picnic: Prepare recipes from your edible herb gardens and ask families to come for a picnic. Combine this with stone soup day!

Field Trip: Visit a local farm or restaurant. Invite a farmer or chef or local grocer to talk about crops and vegetables that are grown in the soil.

Forest/Garden Restaurant: Indoors or outdoors, set up a small table and chairs. Add cookware and “vegetables” that are grown in the soil. Add chef hats, aprons, and “menus” along with note pads and pencils for taking orders.

Mud Painting: Provide various tools (pine branches, bark, etc.) and different surfaces (paper, textured paper, fabrics). Have children mix soil and water to make mud paint of desired consistency and texture.

Edible Dirt: Chocolate pudding, chocolate cake crumbs, oreo cookie crumbs, gummy worms. A healthier alternative would be to use yogurt and dried fruit. Mix up your own edible dirt or mud!

Read: *Mud Pies and Other Recipes* by Marjorie Winslow

Make Compost Bottles: Materials – 2-liter soda bottle, soil, leaves, newspaper, vegetable peels, etc. The clear soda bottle is perfect for keeping an eye on the changes that are happening within your compost, and it’s a great way to reuse something that would have otherwise ended up in the trash.

Cut the top off the soda bottle and rinse it out well. Remove the label so that you can see inside the whole bottle. Start with a layer of soil on the bottom and alternate between soil and compostable material – leaves, food waste, etc. Make sure your bottle is moist but not wet. Cover the top of the bottle to keep out flies and keep moisture in but make small holes in the cover. It’s important that your bottle can get air since good compost needs oxygen!

Start a Compost Pile: Compost can have lots of different ingredients. Brown waste, green waste, food waste! You can even compost with worms to speed things up.

Super Easy Food Waste Compost
www.gardenguides.com/126540-compost-preschool-classroom.html

Read: *Compost Stew* by Mary McKenna Siddals



Construction Site: Engineering with Soil

LARGE GROUP LEARNING ACTIVITIES

Shelters of Mud: Introduce children to pictures of structures made from mud (adobe) and the people who create and use them around the world. Ask the children what they think can be made out of mud. Pose the questions prompting who else might make a home or shelter using mud. Have a bird nest with a mud base available for the children to investigate. Continue a discussion regarding other animals such as beavers that build and live in mud and stick shelters.

SMALL GROUP LEARNING ACTIVITIES

Construction: On a sensory table provide children with construction materials such as sticks, stones, wood and other scraps, mud, clay, soil, and straw. You might also include mud bricks and small construction vehicles. Ask them to create structures for people and animals.

Clay Sculptures: Combine clay with different natural materials such as shells, feathers, sticks, cones, leaves. Encourage children to mold and press objects into clay. Sand may be added for interest, texture, and experimentation.

Mud Sculptures: Mix various types of soil together with water. A strainer can be provided to mix ingredients and sieve out pebbles, sticks, leaves, etc. When mud is smooth, children can roll, drip, and drop mud into sculptures.

OUTDOOR LEARNING ACTIVITIES

Mud Tracking: On a rainy day, take children outdoors for a mud walk. Have them notice what it feels like to walk in the mud as opposed to a dry patch of firm soil on a path. Draw attention to footprints and tracks. Look for other tracks along the way.

Mud Balls, Bricks, and Pies: Play with mud and experiment to make a variety of objects. Playing with mud is the perfect sensory activity. For bricks, offer water and soil in separate bins and allow children to mix together. Add straw to some of the mixture and leave the rest aside. Provide various containers for children to fill with the different batches of mud mixtures. Ice cube trays and half-pint milk containers work well. Allow bricks to dry completely then pop them out for building.

Make mud balls and put them in the freezer.

What happens when mud freezes?

- From soil to mud and back to soil – let students experiment with how they can change the properties of soil and mud.
- Make a mud mountain and pour water on top to create erosion.



- Create a safe place to make a “mud walk.” Make a path of mud and have children feel the mud squish between their toes!

Design and Create Mud Kitchen: Create an outdoor space that has a sense of enclosure but is not separated from the rest of the play yard. Add work surfaces and shelving. Introduce an interesting selection of pots, pans, jugs, buckets, and utensils. Have an available source of soil and water nearby. A hose is a great addition for cleanup time. Different soil types and plant materials to add will keep the cooking interesting.



CHILDREN'S BIBLIOGRAPHY

RESOURCES: SOILS

Title	Author	Description
<i>One Duck Stuck</i>	Phyllis Root Jane Chapman	A fun book to read aloud about a duck that gets stuck in the muck. Something children can relate to while exploring a muddy day!
<i>The Piggy in the Puddle</i>	Charlotte Pomerantz, James Marshall	A story in-verse about a piggy that loves to be in the mud.
<i>Dirt: The Scoop on Soil</i>	Natalie Rosinsky	Nature, uses, and importance of soil. Spanish Version available.
<i>Dirt: Jump into Science</i>	Steve Tomecek Nancy Woodman	A fun and fact-filled picture book about soil and the things that live in it.
<i>Wiggling Worms at Work</i>	Wendy Pfeffer Steve Jenkins	Learn about the work of worms in the soil. They're busy!
<i>Diary of a Worm</i>	Doreen Cronin	A charming story about a small worm in a big world.
<i>Compost Stew</i>	Mary McKenna Siddals	An easy how-to book about making a compost pile as well as other ways young children can care for the Earth.
<i>An Earthworm's Life</i>	John Himmelman	Beautifully illustrated book about the life cycle of an earthworm.
<i>Garden Wigglers: Earthworms in Your Backyard</i>	Nancy Loewen	Characteristics, biology, and anatomy of earthworms.
<i>Wiggle and Waggle</i>	Caroline Arnold	Two worm friends dig in the dirt, work hard, and sing songs.
<i>Mud Pies and Other Recipes</i>	Marjorie Winslow	A make-believe cookbook using items from nature.
<i>Stone Soup</i>	Marcia Brown	Three hungry soldiers make a feast from stones...or do they?



Tools for Learning	Where to Find	Description
Soil Sifters	Home Depot, Garden Store, Amazon	Colanders or homemade screen sieves can also be used.
Trowels, Spoons, Jars, Tweezers, etc.	Garden/Hardware, or Grocery Store	Great tools for exploring soil. These household items can be requested as donations or as loaners for the unit.

TEACHER'S BIBLIOGRAPHY

Title	Author	Description
<i>Discovering Nature with Young Children</i>	Ingrid Chaloufour Karen Worth	This explores the wide-ranging elements that make up the natural world around us. The curriculum replaces simple fact-feeding practices with the development of long-term scientific reasoning.
<i>Hands-On Nature: Information and Activities for Exploring the Environment with Children</i>	Jenepher Lingelbach	Grouped around five themes (Adaptations, Habitats, Cycles, Designs of Nature, and Earth and Sky), fact-filled essays introduce each subject, followed by field-tested, experiential activities that engage students in learning about the natural world.
<i>Nature's Playground</i>	Fiona Danks	Children will learn how to build a den from branches, make twig boats to sail across a pond, and voyage through the backyard to find tiny insects and creatures.
<i>Mudpies to Magnets: A Preschool Science Curriculum</i>	Robert Williams Robert Rockwell Elizabeth Sherwood	224 hands-on science experiments and ideas with step-by-step instructions delight and amaze children as they experience nature, the human body, electricity, floating and sinking, and more.
<i>More Mudpies to Magnets: A Preschool Science Curriculum</i>	Robert Williams Robert Rockwell Elizabeth Sherwood	Develop the natural scientist in every child with 260 hands-on science activities and ideas.
<i>Small Wonders: Nature Education for Young Children</i>	Linda Garrett Hannah Thomas	Introduces children ages three through kindergarten to the natural world in a special hands-on way.



Growing Up Wild	Thorsten Milse	To observe young animals in their natural surroundings is a special event. Wildlife photographer Thorsten Milse has captured them for us – young cheetahs at play in the Namibia, downy penguins in the Antarctic, lumbering polar bear cubs in Canada, curious mini-kangaroos in the Australia, and shy tiger cubs in the jungles of India. And lets not forget the entertaining young gorillas in the rain forests of Rwanda!
SOIL: Get the Inside Scoop	David Lindbo	Get to know different types of soil and meet scientists who study it. For children and teachers.
Microlife that Lives in Soil	Steve Parker	A close-up look at the microlife that lives in soil.
The World Beneath our Feet: A Guide to Life in the Soil	James Nardi	This book uncovers a secret world full of life just under our feet. A good reference book for studying life in the soil.
Life in a Bucket of Soil	Virginia Silverstein	Another great reference for curious minds about the creatures that live in soil – what they eat, how they move, and their “niche” in the soil habitat.
Healthy Food from Healthy Soils	Elizabeth Patten and Kathy Lyons	A teacher resource for where our food comes from, how its grown, and how it turns back into soil.
www.soils4kids.org/home		Background/Resource
www.preschooleducation.com/sgarden.html		Background/Resource
http://urbanext.illinois.edu/soil/songs/songs.htm		Soil Songs

Mud Pie Song

Sung to the tune of: “Sing A Song of Sixpence”

Sing a song of mud pie,
The best in all the land.
Mix it till it’s mushy,
Squeeze it in your hand.
Put it in a pie tin,
Leave it in the sun.
Wait about an hour,
Then you’ll know it’s done!

Planting Time

Sung to the tune of: “Row, Row, Row Your Boat”
Dig, dig, dig the earth (make digging motion)
Then we plant our seeds (pretend to drop seeds, cover them with soil, and pat the soil firm)
A gentle rain (flutter fingers down)
And bright sunshine (circle arms above head)
Will help our flowers grow. (crouch down and then slowly stretch up tall with arms overhead)

