The **SCOOP** on soil
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Check out the Illinois mAGic Kits which are available through your county coordinator. The curriculum in the mAGic kits are multidisciplinary, all-inclusive, and designed to bring agriculture to life in your classroom. To see these lessons and others, check out agintheclassroom.org to see which mAGic Kits are available and how to contact your coordinator.
Scoop on Soil

What is Soil?
One of the most important natural resources is soil. Most life on earth depends upon the soil for food. Plants are rooted in the soil and get nutrients (nourishing substances) from it. Animals also get nutrients from eating the plants that grow in the soil. Soil is home to many organisms such as seeds, spores, insects, and worms. We build sidewalks, roadways, and homes on the soil. Soils also help filter out pollutants that could contaminate our drinking water. Everyone can take an active role in improving and preserving our Earth’s soil.

Soil Particle Size
Try to remember some times when you played in soil. Did it feel soft sometimes and gritty at other times? Soil can feel different from one time to another depending on what’s in it.

Sandy soil is made up of mostly sand. Sandy soil feels gritty and allows water and air to move through it.

Silt feels like flour when dry and is very smooth and soft when moist. Silt particles keep the soil softer and easier to plow than soils with too much clay.

Clay soil has mostly clay, some organic matter, silt, and a little sand. Clay particles are very fine and are the smallest of the three types of soil particles. Clay is sticky when wet and hard like bricks when dry.

Soil Has Three Layers!
Topsoil— Here is where the plants grow. Wind or water erosion can wash away this valuable layer if farmers don’t protect it. In fact, it takes nature over 500 years to replace one inch of soil. Most nutrients, organisms, and roots are in this layer.

Subsoil— This layer is about one foot below the surface. Deeper tree roots and earthworms live here.

Parent Material— This is the bottom layer, about three feet below the surface in the Midwest. It is more compact and often has stones and rocks in it.

Did you know?
The Illinois State Soil is Drummer-Flannagan, a fertile soil that grows our agricultural crops.
Vocabulary

Acidic pH - pH below 7.

Agricultural Revolution - 1750-1900. Time of increased harvests due to new farming practices.

Alkaline pH - pH above 7.

Clay - smallest of the three soil particles. When wet, it feels sticky or greasy; when dry, it is hard and brick-like.

Climate - average weather conditions in an area over a long period of time.

Conservation - preventing unnecessary loss of resources.

Conservation method - a combination of land uses and practices to protect and improve soil productivity and to prevent soil erosion.

Crop rotation - planting a different crop each year for two or more years.

Drought - prolonged period of little or no rain.

Dust Bowl - a time of widespread drought and windblown dust that affected the Southern Plains in the 1930's.

Erosion - the process in which water or wind moves the soil from one location to another.

Fallow - when land is plowed but not seeded.

Fertility - the amount of plant food in soil.

Fertilizer - substance that plants need to grow.

Great Depression - 1929-1940. Period of high unemployment in the U.S.

Green manure - a crop plowed into the soil instead of being harvested. It serves as a source for nutrients.

Groundwater - water within the Earth that supplies wells and springs.

Hexagon - a polygon with six sides. The hexagon is both equilateral (all sides of equal length), and equiangular (all interior angles of equal measure). This makes it a regular polygon.

Legumes - plants which increase nitrogen in the soil, such as clover, alfalfa, soybeans, and peanuts.

Manure - animal droppings rich in nutrients.

Migration - movement of people or animals to another area.

Mineral matter - component of soil that consists of sand, silt, and clay.

Neutral pH - pH at 7.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>essential nutrient for plant growth.</td>
</tr>
<tr>
<td>Nutrient</td>
<td>substance living things need to carry out their life processes.</td>
</tr>
<tr>
<td>Nutrient management</td>
<td>using the optimum amounts of manure, plant matter, and commercial fertilizer for best yield.</td>
</tr>
<tr>
<td>Organic matter</td>
<td>partially decomposed plant and animal matter.</td>
</tr>
<tr>
<td>Organisms</td>
<td>living things; a living person, plant, or animal.</td>
</tr>
<tr>
<td>Parent material</td>
<td>the bottom soil layer beneath subsoil, also known as the C horizon.</td>
</tr>
<tr>
<td>Pentagon</td>
<td>a polygon with five sides and five angles.</td>
</tr>
<tr>
<td>pH</td>
<td>the measure of the acidity or alkalinity of a substance.</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>essential nutrient for plant growth and root development.</td>
</tr>
<tr>
<td>Pollutant</td>
<td>substance that will negatively affect the environment.</td>
</tr>
<tr>
<td>Potassium</td>
<td>essential nutrient for a healthy plant.</td>
</tr>
<tr>
<td>Rhombus</td>
<td>a figure with four sides of equal length. Opposite sides are parallel.</td>
</tr>
<tr>
<td>Runoff</td>
<td>water that cannot be absorbed by the soil.</td>
</tr>
<tr>
<td>Sand</td>
<td>very tiny rock fragments; largest and heaviest of soil particles; feels gritty.</td>
</tr>
<tr>
<td>Sharecroppers</td>
<td>farmers who pay their landlords a share of their crop as rent.</td>
</tr>
<tr>
<td>Silt</td>
<td>medium-sized soil particles; feels like flour.</td>
</tr>
<tr>
<td>Soil</td>
<td>the outer portion of the earth’s surface. Soil is the foundation of every living thing.</td>
</tr>
<tr>
<td>Soil erosion</td>
<td>the wearing away of soil by wind or water.</td>
</tr>
<tr>
<td>Soil nutrients</td>
<td>minerals necessary for plant growth. Plant food.</td>
</tr>
<tr>
<td>Soil profile</td>
<td>section of Earth several feet deep that shows soil layers.</td>
</tr>
<tr>
<td>Soil texture</td>
<td>the way a soil feels.</td>
</tr>
<tr>
<td>Subsoil</td>
<td>beneath topsoil layer, also known as the B horizon.</td>
</tr>
<tr>
<td>Tilling</td>
<td>mixing plant stems, leaves and crop residue with the soil.</td>
</tr>
<tr>
<td>Topsoil</td>
<td>top layer of soil, also known as the A horizon.</td>
</tr>
<tr>
<td>Trapezoid</td>
<td>a figure that has four sides and exactly one pair of opposite sides parallel.</td>
</tr>
<tr>
<td>Triangle</td>
<td>a three-sided figure.</td>
</tr>
<tr>
<td>Yield</td>
<td>amount harvested in a given area of land.</td>
</tr>
</tbody>
</table>
Say It With Soil

Common Core: CCSS.ELA-Literacy.RI.4.3; RI.4.4; RI.4.5; RF.4.3a; SL.4.1; W.4.2; W.4.6; W.4.7; W.4.8

Next Generation Science Standards:
Interdependent Relationships in Ecosystems: 3-LS4-4
Life Cycles & Traits: 3-LS3-2
Earth’s Systems: 5-ESS3-1

Materials Needed:
- Soil Quotes Handout (Say It With Soil) found on pages 7 & 8.

Directions:
1. Using the provided quotes on the Soil Quotes Handout (Say It With Soil), cut quotes into strips and distribute to students.

2. Students will read the soil quote and write a paragraph about the quote. Some/all of the following questions should be addressed:
   - What does the quote mean to me?
   - What did this quote mean to the author?
   - Under what circumstances did the author write this quote?
   - Has this quote withstood the passage of time? Why or why not?
   - Is this quote appropriate in today’s world? Why or why not?

3. Students can share their writing with the entire class.

Lesson Extender:
Create a Bio Cube about one of the authors of the quotes you read. Use the planning sheets located on pages 9 and 10 to begin. Once the sheet is completed, go to http://www.readwritethink.org/files/resources/interactives/cube_creator/ and fill out your own Bio Cube. A few examples of authors to choose would be: George Washington, Franklin D. Roosevelt, Walt Whitman, etc.

The wealth of Illinois is in her soil and her strength lies in its intelligent development.
Andrew Sloan Draper—President, University of Illinois 1899
Say It With Soil (Soil Quotes Handout)

- Soil, like faith, is the substance of things hoped for, the evidence of things not seen. It is the starting point for all living things that inhabit the earth. -Firman E. Bear; 1986

- I know of no pursuit in which more real and important services can be rendered to any country than by improving its agriculture. -George Washington; July 20, 1794

- The soil is the source of life, creativity, culture and real independence. -David Ben Gurion, Hazon VeDerek; 1950’s

- There are two spiritual dangers in not owning a farm. One is the danger of supposing that breakfast comes from the grocery, and the other that heat comes from the furnace. -Aldo Leopold; 1949

- A nation that destroys its soil, destroys itself. -Franklin D. Roosevelt; 1937

- A conservationist is one who is humbly aware that with each stroke he is writing his signature on the face of the land. -Aldo Leopold; 1949

- When tillage begins, other arts follow. The farmers therefore are the founders of human civilization. -Daniel Webster; 1840

- If in the human economy, a squash in the field is worth more than a bushel of soil, that does not mean that food is more valuable than soil; it means simply that we do not know how to value the soil. In its complexity and its potential longevity, the soil exceeds our comprehension; we do not know how to place a just market value on it, and we will never learn how. Its value is inestimable; we must value it, beyond whatever price we put on it, by respecting it. -Wendell Berry; 1995

- We know more about the movement of celestial bodies than about the soil underfoot. - Leonardo DaVinci; 1500’s

- Essentially, all life depends upon the soil...There can be no life without soil and no soil without life: they have evolved together. -Charles E. Kellogg; 1938

- ..the Latin name for man, homo, derived from humus, the stuff of life in the soil. -Dr. Daniel Hillel; late 1900’s
I saw all the people hustling early in the morning to go into the factories and the stores and the office buildings, to do their job, to get their check. But ultimately it’s not office buildings or jobs that give us our checks. It’s the soil. The soil is what gives us the real income that supports us all. -Ed Begley; late 1900’s

Plowed ground smells of earthworms and empires. -Justin Isherwood; 1990

Soil erosion is as old as agriculture. It began when the first heavy rain struck the first furrow turned by a crude implement of tillage in the hands of prehistoric man. It has been going on ever since, wherever man’s culture of the earth has bared the soil to rain and wind. -Hugh H. Bennett and W.C. Lowdermilk; 1930’s

We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect. -Aldo Leopold; 1949

I bequeath myself to the dirt, to grow from the grass I love; If you want me again, look for me under your boot soles. -Walt Whitman; 1855

We are part of the earth and it is part of us...What befalls the earth befalls all the sons of the earth. -Chief Seattle; 1854

Each soil has had its own history. Like a river, a mountain, a forest, or any natural thing, its present condition is due to the influences of many things and events of the past. -Charles Kellogg; 1956

Nature has endowed the earth with glorious wonders and vast resources that man may use for his own ends. Regardless of our tastes or our way of living, there are none that present more variations to tax our imagination than the soil, and certainly none so important to our ancestors, to ourselves, and to our children. -Charles Kellogg; 1956

Man and man’s earth are unexhausted and undiscovered. Wake and listen! Verily, the earth shall yet be a source of recovery. Remain faithful to the earth, with the power of your virtue. Let your gift-giving love and your knowledge serve the meaning of the earth. -Friedrich Nietzsche; 1870’s –1880’s

A cloak of loose, soft material, held to the earth’s hard surface by gravity, is all that lies between life and lifelessness. -Wallace H. Fuller; 1975

I cannot conceive of the time when knowledge of soils will be complete. Our expectation is that our successors will build on what has been done, as we are building on the work of our predecessors. -R.S. Smith; 1928

Soils are developed; they are not merely an accumulation of debris resulting from decay of rock and organic materials...In other words, a soil is an entity – an object in nature which has characteristics that distinguish it from all other objects in nature. -C.E. Millar & L.M. Turk; 1943

We spend our lives hurrying away from the real, as though it were deadly to us. “It must be somewhere up there on the horizon,” we think. And all the time it is in the soil, right beneath our feet. -William Bryant Logan; 1996
Bio Cube Planning Sheet

Use this planning sheet to prepare for the online Bio Cube interactive by filling in the information for each side of the cube. Because space on the cube is limited, you will need to briefly summarize your information.

<table>
<thead>
<tr>
<th>Side</th>
<th>Prompt</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Person’s Name, Time Period, and Place</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Personal Background</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Personality Traits</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Significance</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Obstacles</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Important Quote</td>
<td></td>
</tr>
</tbody>
</table>

CREATE YOUR OWN CUBE

Fold along the dotted lines, making sure that your cut along the outside edges of your cube. Then, tape the outside layers of the cube together to make a cube. 

A 3D model in the classroom

Cube created by:
Text Features

Common Core: CCSS.ELA-Literacy.RI.1.5; RI.2.5; RI.3.5

Suggested Reading Materials:
- Soil Ag Mag
- Textbooks
- Magazine Articles
- Webpages

Background Information:
Authors include text features to help the reader better understand what they have read. Text features provide information that may not be written in the text itself. They can be found in textbooks, magazine articles, newspapers, reports, web pages, and other forms of nonfiction text.

Directions:
1. Using one of the suggested reading materials, the students will look for all of the different text features listed below.

   - Bold
   - Graphs
   - Maps
   - Illustrations
   - Diagrams
   - Clipart
   - All Caps
   - Color
   - Italics
   - Underline
   - Highlight
   - Borders
   - Headings
   - Table of Contents
   - Insets and Sidebars
   - Bullets
   - Numbering
   - Photos
   - Asterisks
   - Stars
   - Timelines
   - Glossary
   - Captions
   - Labels
   - Index

Lesson Extender:
Check out the link below for more teaching tools for text features.


Adapted from Barat Education Foundation
Reader Marks

Common Core: CCSS.ELA-Literacy.W.5.7; W.5.8

Suggested Reading Materials:
Soil Ag Mag

Directions:

1. After reading the passage from A Handful of Dirt and the Soil Ag Mag, review the questions given and annotate the passage by using Readers Marks.

2. Compare annotations with a partner and then determine what evidence to write down for your reasoning.

3. Individually write a paragraph using evidence from the readings to answer one of the following questions:
   - Why is soil the most important natural resource to our everyday life?
   - How do fertilizers help the plants grow?
   - How do farmers help keep the soil healthy?

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A Handful of Dirt

By Raymond Bial

Without soil there would be no life on Earth. We eat vegetables and fruit, as well as animals that feed on the grasses and grains grown in the soil. We make clothes from cotton, wool, and many other products that trace their roots back to the soil. Soil is as essential as the elements of water and air and as the energy of the sun.

Soil is made up of organic and inorganic living and nonliving ingredients. The inorganic minerals found in soil—clay, silt and sand—began as rocks that have been worn down by wind and water over thousands of years. Rocks break apart when water collects in their cracks, then freezes and expands. Streams and rivers also wear down rocks, just as the ocean waves over time grind large stones into grains of sand on the beach.

Adapted from Gina Wickstead
Digging In The Dirt

Common Core:  CCSS.ELA-Literacy.SL.1.1; SL.1.6; W.1.3
              CCSS.Math.Content.1.MD.A.2

Next Generation Science Standards:
From Molecules to Organisms: Structures and Processes: 1-LS1-1

Suggested Reading Materials:
Soil Ag Mag

Directions:
1. Using the Soil Ag Mag, work in small groups to make a Soil Sam. The students will first discuss the steps they went through to make their Soil Sam and will make a list of the steps. If you, the teacher, hear the students use words such as first, next, last, or later, try to bring that up in discussion because they will be writing those words later in the lesson.

2. Next, explain that they will be writing a paragraph about the steps it took to create Soil Sam. Once the paragraph is complete, the group of students will evaluate each other’s paragraph and make changes where they feel are necessary.

3. Once that is completed, you will explain there is some criteria that each paragraph needs to contain. Ask the students if they used words such as first, next, and last. Discuss what a topic sentence should contain and if they included one. As a whole class, come up with an example of a well written topic sentence.

4. The next three sentences must begin with first, next and then. Have the students come up with three sentences with guided help if needed.

5. Last, the students will write a closing sentence. Work as a class to come up with an example of a closing sentence to make sure they are on the right track.

6. Once the paragraphs are completed, the students will share with the whole class and evaluate each other. The teacher will evaluate the first student to show the other students what it means to evaluate their peers.

Adapted from Regan Aymett
Diary of a Worm

Common Core: CCSS.ELA-Literacy.RL.1.3; RL.1.7; SL.1.1; SL.1.4; SL.1.6

Suggested Reading Materials:
Diary of a Worm by Doreen Cronin ISBN-13: 9780060001506

Materials Needed:
- Worksheet on page 15
- Pencil

Directions:
1. Read Aloud and Discussion of the Story
   - Partner up students up before beginning the read aloud and have them sit next to their partner.
   - Assign them numbers (1 & 2).
   - The teacher will begin reading the story and stop part way through to have a class discussion.
   - The teacher will say, “We’ve learned a bit about Worm so far. Let’s talk about him. How can we describe him?” Person 1 is the speaker, while person 2 is the listener. Ask your partner what they think and what their evidence is. Have a group discussion. This is very important because using effective questioning techniques can challenge your students to think deeper. Ask other questions like, “What do you think about what (s)he just said? Do you agree or disagree? Why?”
   - Then the teacher will say, “There are 2 parents in the story. How can we describe them?” Partner 1 will now be the listener, while partner 2 is the speaker. Then, come together as a class and discuss the students’ answers.

2. Guided Practice (We Do)
   - Using the worksheet on page 15, the students will write all the main characters’ names in column 1, write a describing word or two about the character in the second column, and draw a picture that matches the describing words in the last column.
   - Next, they will complete a Venn Diagram with their partner. They will compare and contrast Worm and his best friend Spider. They will fill the outside circles with how the two are different, and the inside circle with how they are similar.
   - Once they are finished with both the worksheet and the venn diagram, the class will have a discussion. Ask questions such as, “What did we learn about the characters in the story? How are Worm and Spider alike? How are they different?” The students will turn in both assignments.

Adapted from Valerie Gresser
<table>
<thead>
<tr>
<th>Character</th>
<th>Describing words</th>
<th>Picture to match describing words</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spider</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daddy &amp; Mom</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lego Garden Array

Common Core:
CCSS.ELA-Literacy.RI.3.1; RI.3.10
CCSS.Math.Content.3.OA.A.1

Suggested Reading Materials:

Directions:
1. Begin by reading the book, One Hundred Ants.
2. Discuss, as a class, what an array is and how the book shows many different arrays.
3. The ants decided that 2 lines of 50 would get them there sooner than 1 line of 100. After moving to the 2 lines of 50, they decided that 4 lines of 25 would get them there even sooner so they moved into those lines. Next, they moved into 5 lines of 20, and then lastly 10 lines of 10.
4. Using manipulatives (legos), have the students make all the different arrays that were mentioned in the story.
   • 1 X 100
   • 2 X 50
   • 4 X 25
   • 5 X 20
   • 10 X 10
5. Once they have made the different arrays, let the students work together to make different arrays with different numbers. The students can build with legos to create a garden of sweet corn or a field of dent corn. How many rows of corn would they plant in their field or garden?
6. Have a few students show some arrays they created.

Lesson Extender:
Have the students plant seeds in the school garden and decide as a class what array you want to use in the garden. Read through the Specialty Crop Ag Mag for ideas of what to plant in the garden that is easily grown in Illinois. Have the class vote on which specialty crops to plant and take care of.

Adapted from Jennifer Valentine
Making Connections

Common Core: CCSS.ELA-Literacy.RL/RI.K.1; RL/RI.1.1; RL/RI.2.1; RL/RI.3.1; RL/RI.4.1

Materials Needed:
- Soil Pictures
- State song located on page 18
- Paper and pencil

Directions:
- Have the students read the official Illinois State Song and choose pictures of soil that relate to each line of the song.
- Use the discussion questions to guide the classroom discussion.

Discussion Questions: Make personal connections
- How does this image make you feel? Why do you think it makes you feel that way?
- What would you be thinking, feeling, or doing if you were in this image (imagine you are a person or a thing)?
- What did you notice that sparked your curiosity?

Adapted from Barat Education Foundation
Illinois State Song

Written by Charlie H. Chamberlein
Composed by Archibald Johnston

By thy rivers gently flowing, Illinois, Illinois,
O'er thy prairies verdant growing, Illinois, Illinois,
Comes an echo on the breeze.
Rustling through the leafy trees, and its mellow tones are these, Illinois, Illinois,
And its mellow tones are these, Illinois.
Eighteen-eighteen saw your founding, Illinois, Illinois,
And your progress is unbounding, Illinois, Illinois,
Pioneers once cleared the lands,
Where great industries now stand. World renown you do command, Illinois, Illinois,
World renown you do command, Illinois.
From a wilderness of prairies, Illinois, Illinois,
Straight thy way and never varies, Illinois, Illinois,
Till upon the inland sea,
Stands thy great commercial tree, turning all the world to thee, Illinois, Illinois,
Turning all the world to thee, Illinois.
When you heard your country calling, Illinois, Illinois,
Where the shot and shell were falling, Illinois, Illinois,
When the Southern host withdrew,
Pitting Gray against the Blue, there were none more brave than you, Illinois, Illinois,
There were none more brave than you, Illinois.
Not without thy wondrous story, Illinois, Illinois,
Can be writ the nation's glory, Illinois, Illinois,
On the record of thy years,
Abraham Lincoln's name appears, Grant and Logan, and our tears, Illinois, Illinois,
Grant and Logan, and our tears, Illinois.
Let us pledge in final chorus, Illinois, Illinois
That in struggles still before us, Illinois, Illinois
To our heroes we'll be true,
As their vision we pursue. In abiding love for you, Illinois, Illinois.
In abiding love for you, Illinois.
Garbage Helps Our Garden Grow!

Common Core: CCSS.ELA-Literacy.RI.3.10

Next Generation Science Standards:
Structure, Function, and Information Processing: 4-LS1.A

Suggested Reading Materials:
Garbage Helps Our Garden Grow: A Compost Story by Linda Glaser

Materials Needed:
- One empty and clean water bottle for mini composter
- Soil (can be dug from school grounds or potting soil)
- A handful of food scraps such as orange peels or lettuce leaves chopped into small pieces
- Ruler
- Scissors
- Masking tape

Directions:
1. Explain to the students that they will be able to view composting in the classroom on a small scale. Show students the materials collected.
2. Using scissors and following the diagram, cut off the top two inches (below the mouth) of the bottle. Save this portion for later.
3. Place 1” of soil in the bottom of the bottle. Do not compact the soil.
4. Place food scraps on top of the soil and cover with another 1” of soil.
5. Using scissors carefully poke 5-7 air holes in the top (cut off) portion of the bottle.
6. Use masking tape to secure the two sections of the bottle, being careful not to cover the air holes with tape.
7. Place the bottle in a sunny place that is not too hot or too cold.
8. Over the next 1-2 weeks, shake the bottle once daily to mix the soil and food scraps, being careful not to spill. This represents the turning that would ordinarily occur in a backyard compost pile and allows air and moisture to circulate through the soil and scraps.
9. Discuss with the students what they observe each week. Is the food decomposing? Why or why not?
   - What would happen if the bottle were not shaken?
   - What would happen if there were no air holes in the bottle?
   - Why was the soil added?

Adapted from Wake County Environmental Services, Solid Waste Management Division
A Worm’s World

Common Core: CCSS.ELA-Literacy.3.10

Next Generation Science Standards:  Structure, Function, and Information Processing: 4-LS1.A

Suggested Reading Materials:
Earthworms by Elaine Pascoe ISBN: 9781567111774

Materials Needed:
- 1 gallon plastic jug
- Plastic plates
- Gravel
- Bedding mixture
- Earthworms
- Protection Pledge
- Chopped fruit and veggie scraps

Vocabulary:
Humus- A brown or black organic substance consisting of partially or fully decayed vegetable or animal matter that provides nutrients for plants and increases the ability of soil to retain water.

Castings- A solid deposited by earthworms that is packed with minerals and nutrients that plants need.

Vermiculture- A way of composting using earthworms to speed up the process.

Compost- A mixture of decayed matter and once living things or their products and used for fertilizing and conditioning land.

Background Information:
Earthworms live in warm, moist soil throughout the world. Earthworms can be found in many different sizes. The smallest earthworm can be only one millimeter long and the longest can be eleven feet long! Earthworms are great recyclers because they take food scraps and other decaying matter in the soil and turn it into nutrients for plants. Whether it is humus (dead plant material) or food scraps, earthworms will eat all kinds of things that are soft to chew. This earthworm “food” is digested and then excreted back into the soil in a nutrient-rich matter. These nutrients are great for the soil and enable the plants to grow. Earthworms also dig through soil and mix it up. Particles called sand, silt, and clay make up most of the mineral content of soils. As earthworms dig, they loosen up the soil and mix different types of soil so plants have a better environment to grow in. Earthworms also provide air passages for soil, which help plants grow. Other organisms found in soil include plant roots, insects, and small mammals. Earthworms live wherever they find enough food and moisture in the soil and wherever temperatures are not too extreme. The only places where worms do not live at all are deserts (too dry) and areas where the ground is frozen all or much of the time (too cold). Earthworms are constantly burrowing and tunneling into the earth. As they go, they gobble up dirt and debris. They grind this mixture into mush and break down the debris. Then they leave behind a new solid (called castings) that is packed with minerals and nutrients that plants need.
Many small types of earthworms live right at the surface of the soil. These worms feed mainly on crumbling leaves and other plant debris. Larger types, 3 to 6 inches long, live deeper in the soil, usually within the first foot or so. They tunnel along, constantly making new burrows and filling in their old tunnels with castings as they go. Night crawlers and some related types of earthworms live deeper in the ground. These worms, which can be 12 inches long, make permanent burrows. Their homes are narrow tunnels that go straight down into the earth as deep as 6 feet. Because of where these creatures live, their physical features are quite different from other animals. A worm’s body is divided into rings, or segment (perhaps as many as several hundred) which are called annuli. Underneath a worm’s skin are two layers of muscles—one running lengthwise and one running around the worm. When the muscles that run around the worm contract, its body stretches out long and thin. When the lengthwise muscles contract, the worm draws its body up short. By contracting first one set and then the other, the worm inches through the soil. A coat of slimy mucus, produced by the worm’s skin, helps it glide along. Sunlight can kill a worm. Worms are very sensitive to the ultraviolet radiation in sunlight—the same radiation that gives us a sunburn. They will move away from white or bluish light, although they do not seem to mind dim or red light. Earthworms are also sensitive to temperature and touch. They also do not have ears. They “hear” by sensing vibrations in the soil.

Directions:

1. Order worms. There are several sites on the internet. Be sure to compare prices.
2. Request that each student bring in a 1-gallon plastic milk jug.
3. Cut the top from a clean, clear plastic gallon jug. (You will want to do this for the students.)
4. Poke holes for drainage in the bottom of the jug. Make sure you have a plastic plate under the jug to collect excess water.
5. Add 1 inch of gravel for drainage. If you provide shredded newspapers and carefully watch the moisture content in the worm jug, you can omit the gravel.
6. Poke holes in a plastic lid or plate and place over the gravel.
7. Add 1 inch of bedding mixture (peat moss, grass clippings, vacuum cleaner bag, debris, leaves, dryer lint, shredded newspaper, etc.) on top of the plate.
8. Add a few earthworms.
9. Sprinkle some food scraps on top of the worms.
10. Cover with more bedding material. Sprinkle with water. DO NOT SOAK!
11. Cover the jug with dark paper to screen out light and encourage the worms to burrow next to the edges.
12. Put the jug in a cool place. Sprinkle with water and add food as needed.
13. Observe daily. Record what you see in a daily log.

Check out these websites for more information on composting and vermiculture:
http://web.extension.illinois.edu/state/newsdetail.cfm?NewsID=12684
http://www.epa.state.il.us/kids/fun-stuff/wormbin.html

Utah Ag in the Classroom
Fun with Soil

Common Core:
CCSS.ELA-Literacy.SL.4.1; RI.4.3

Next Generation Science Standards:
Structure, Function, and Information Processing: 4-LS1.A

Suggested Reading Materials:
Soil Ag Mag
The Amazing Dirt Book by Paulette Bourgeois ISBN: 0201550962

Materials Needed (per student):
- 1 large piece graham cracker
- 1 rounded T chocolate frosting OR vanilla frosting
- 1 strip blue gel frosting
- 1 tsp green sugar crystals
- 1 gummy worm sweet or sour
- Food coloring (to use with the vanilla frosting)

Directions:
1. First, choose five states to concentrate on for this activity. Break the students into groups of five and allow the small groups time to research a specific state’s soil. Have the groups make a small list of important facts about the soil.
2. Give each individual a graham cracker. Have the students bite the edges of the graham cracker to match the outline of the state assigned to them.
3. Have the students spread chocolate frosting on their graham cracker. The students can also use vanilla frosting and add food coloring to match the state’s soil they researched. Have a class discussion about the importance of soil and about the five different soils.

- Soil is one of the most important natural resources. Most life on earth depends upon the soil for food. Everyone must take an active role in improving and preserving Earth’s soil. It can take, on average, 500 years to form one inch of topsoil. Topsoil is where the plants grow. If farmers don’t protect this layer, wind or water erosion can wash away this valuable layer. Most nutrients, organisms, and roots are in this layer.
4. Sprinkle green sugar on your graham cracker.
- Living plants are rooted in the soil and get nutrients from it. Animals also get nutrients from eating the plants grown in the soil.
5. Squeeze a small strip or small circle of blue gel frosting on your graham cracker.
- Rain/water is needed for the plants to grow. Use a strip of blue gel frosting to create one of the main rivers in the state given to you or a small circle to show a main lake.
6. Lastly, add a gummy worm.
- Earth worms take care of the soil. They help to increase the amount of air and water that get into the soil. They break down organic matter into things that plants can use.

Adapted from Nancy Brown, Elkhart County SWCD, Indiana
Soil Slurry

Common Core:
CCSS.ELA-Literacy.RI.4.3; RI.4.4; RI.4.5; RF.4.3a; SL.4.1; W.4.2
CCSS.Math.Content.4.MD.A.2; 4.MD.B.4

Next Generation Science Standards:
Structure & Properties of Matter: 5-PS1-1; 5-PS1-2; 5-PS1-3; 5-PS1-4

Materials Needed:
- 2 quart jars with lids
- Masking tape, to label jars
- Dishwashing liquid
- Plastic rulers
- Science Lesson 2 Student Worksheet - Soil Slurry Data Table
- Dry soil sample from garden, flowerbed or field
- Soil sample from roadside, gravel pit or housing development, completely dry

* Samples for Soil Slurry are taken from the topsoil. Topsoil is the upper, outermost layer of soil, usually the top 2 to 8 inches. It has the highest concentration of organic matter and microorganisms and is where most of the Earth's biological soil activity occurs.

Directions:
1. Before the experiment, in small groups, work together to come up with a hypothesis of what you think will happen to the soil when the dishwashing liquid is added.
2. Make sure that all dried soil clumps are crushed and that any rocks, roots and litter are removed from the samples.
3. Label the two jars using the masking tape.
4. Fill the first jar ¼ full of soil sample A.
5. Fill the second jar ¼ full of soil sample B.
6. Add water to the jars until they are about ½ full.
7. Add 1 teaspoon of dishwashing liquid to each jar.
8. Making sure the lids are on securely, shake them hard for about 3 minutes. Continue shaking until the particles have separated from each other.
9. Set the jars on a table. Observe them closely for 5 minutes. (The sand should settle to the bottom in approximately 1 minute.)
10. Measure any layers and record the data.
11. Observe the jars after 30 minutes. (The silt will settle out in 30 – 60 minutes.)
12. Measure any layers and record the data.
13. Observe the jars after 24 hours. (The clay will take about 1 day to settle.)
14. Measure any layers and record the data.
15. Observe the jars after 48 hours. (The final sample should have a layer of sand on bottom, followed by silt, with the clay at the top. Any floating material should be considered organic matter.)
16. Measure any layers. Students will record data on the Science Lesson 2 Student Worksheet - Soil Slurry Data Table.
17. Once all the information is recorded on your data sheet, write a paragraph explaining exactly what happened. Include ways that you could change the experiment and what you think would happen with the changes.
Soil Slurry Data Table
Student Worksheet

<table>
<thead>
<tr>
<th></th>
<th>Sample A</th>
<th>Sample B</th>
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<tbody>
<tr>
<td># of layers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5 minutes)</td>
<td></td>
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<tr>
<td>Layer Measurements</td>
<td></td>
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<tr>
<td>(5 minutes)</td>
<td></td>
<td></td>
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<tr>
<td># of layers</td>
<td></td>
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<tr>
<td>(30 minutes)</td>
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<tr>
<td>Layer Measurements</td>
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<td>(30 minutes)</td>
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<tr>
<td># of layers</td>
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<td>(24 hours)</td>
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<tr>
<td>Layer Measurements</td>
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<td>(24 hours)</td>
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<td># of layers</td>
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<tr>
<td>(48 hours)</td>
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<tr>
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<tr>
<td>(48 hours)</td>
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</tbody>
</table>
Growing Grass in a CD Case!

Common Core:
CCSS.Math.Content.4.MD.A.2

Next Generation Science Standards:
Matter and Energy in Organisms and Ecosystems: 5-PS3-1; 5-LS1-1
Structure Function and Information Processing: 4-LS1-1.A; 4-LS1-2

Suggested Reading Materials:
Soil by Melissa Stewart ISBN: 1403400962
Soil Ag Mag

Materials Needed:
- House plant soil
- CD case (the original 1/4" thick ones)
- Grass seeds
- Rubberband
- Paint markers
- Stickers

Directions:
1. After reading, What Do Roots Do?, you will start the experiment! Start with just a couple spoonful's of house plant soil soaked in enough water to get it really wet. Hand squeeze it and spread it out in the bottom of an open CD case (the original 1/4" thick ones).
2. Spread about a teaspoon of grass seeds near the top edge. Close the case, wrap with a rubber band to keep shut, and set in a window.
3. Prepare a graph to record the growth on a daily basis once the seeds begin to sprout.
4. You should observe fuzzy little seeds in 2 or 3 days, and the grass a few days after that. The soil stays wet for a long time, but if it appears to be dry, the lid can carefully be lifted and water sprinkled inside.
5. Paint markers can be used for drawing tiny little lady bugs or lady bug stickers can also be used.
6. Based on your observations, write a paragraph explaining what happened.

Adapted from Kathy Barbro
Mini Soil Ag Mag

Common Core:
CCSS.ELA-Literacy.RI.1.2; W.1.2

Suggested Reading:

Materials Needed:
- Soil Ag Mag
- 11 x 17 paper (enough for 1 per student)
- Scissors
- Pencil and Crayons

Instructions:
1. Using the Ag Mag, ask students what other elements are missing from this magazine—table of contents, index, and a glossary.

2. Each student will be given an Ag Mag. Explain that they are going to use the information from the Ag Mag to create a Mini Ag Mag. Students can draw pictures and write 1 or 2 sentences to describe the topics they chose. The more advanced literacy groups will write in paragraph form and add pictures to their project.

3. Review the criteria with students. Provide students with a sample of what you are looking for. The directions on how to make your Mini Ag Mag are found on page 27.

4. Allow students time to work on their Mini Ag Mag throughout the week during their free time.

5. When the students have completed their Mini Ag Mags, they can read a book quietly.

<table>
<thead>
<tr>
<th>Criteria for Mini Ag Mag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Cover</td>
</tr>
<tr>
<td>Title—capitalized; Include author &amp; illustrator</td>
</tr>
<tr>
<td>Table of Contents</td>
</tr>
<tr>
<td>Topics with page numbers</td>
</tr>
<tr>
<td>Topics</td>
</tr>
<tr>
<td>4 topics; one topic per page; Use correct capitalization &amp; punctuation; Include illustration</td>
</tr>
<tr>
<td>Glossary</td>
</tr>
<tr>
<td>Words used that reader may not understand</td>
</tr>
<tr>
<td>Index</td>
</tr>
<tr>
<td>Key words and what page to find them on</td>
</tr>
</tbody>
</table>

Adapted from Karrie Perrin
1. Fold paper in half.

2. Fold the paper in half again.

3. Fold

4. Unfold the paper until it looks like this and only cut on the solid line.

5. Open the paper all the way. Fold the paper in half, as shown.

6. Hold both sides and push toward the center. Finish folding.

7. You should be able to see the Mini Ag Mag! You can glue the inside pages together, and start writing!
Illinois Agriculture in the Classroom

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www.agintheclassroom.org

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