We All Need Soil!

Purpose

- To introduce students to the importance of soil and why it needs to be studied.
- To help students understand how much soil is available on Earth for human use.
- To help students understand the connection between soil and how it is used by living things.

Overview

Each student will explore three activities that promote understanding of and respect for soil. They will generate responses to the following questions: "What makes up soil?" and "What lives in the soil?" Next the students will watch a demonstration of how much soil there is on Earth that is available for human use. Last they will create their own soil connection sentences.

Student Outcomes

After completing this activity, students will understand the importance of soil science, comprehend the relative amounts of usable soil that exists on Earth, and learn the function of soil as it pertains to animals, plants and humans.

Science Content Standard A: Science as Inquiry
- Science as inquiry

Science Content Standard B: Physical Science
- Properties of objects and materials

Science Content Standard C: Life Science
- The characteristics of organisms
- Organisms and their environments

Science Content Standard D: Earth and Space Science
- Properties of earth materials

Mathematics Standard: Patterns, Functions, and Algebra
- Use mathematical models and analyze change in both real and abstract contexts

Mathematics Standard: Number and Operation
- Understand numbers, ways of representing numbers, relationships among numbers, and number systems

Time

- Part 1: One 30 minute class period
- Part 2: One 30 minute class period
- Part 3: One 45-60 minute class period

Level

Primary (most appropriate for grades K-4)

Materials

Part 1:

- Elementary Globe book: *The Scoop on Soils*
- Chart paper
- Markers

Part 2:

- Apple and small knife (or copies of diagrams on overhead transparency paper)
- *Why Do We Study Soils? Learning Activity* from the GLOBE Web Site (www.globe.gov)

Part 3:

- Chart Paper
- Markers
- Activity Cards from the *We All Need Soil! Student Activity Sheets 1-6*
- Copies of *We All Need Soil! Student Activity Sheet 7* (one per student)

Preparation

- Read the Elementary GLOBE book *The Scoop on Soils* – either read it to the class or have students read it to themselves. The book can be downloaded from www.globe.gov/elementaryglobe.

Part 1:

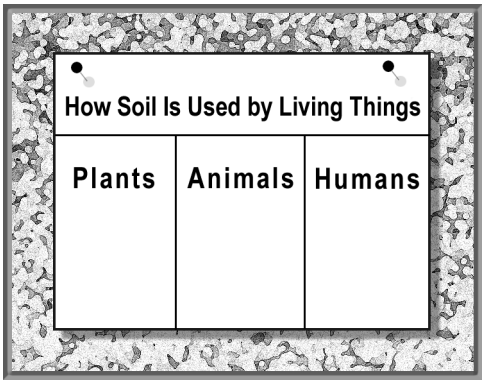
Make two charts with the titles "What makes up soil?" and "What lives in soil?" and place them on a bulletin board.

Part 2:

Download the *Why Do We Study Soil? Learning Activity* from the GLOBE Web Site (www.globe.gov).If it is permitted to use a knife for a demonstration in your classroom, gather the supplies for this activity and do the activity as listed in the *What to Do and How to Do It, Part 2* section below. Otherwise, cut the apple ahead of time or use overhead transparency diagrams copied from the activity.

Part 3:

- Make one chart with the title "How Soil is Used by Living Things" and divide the chart into three sections with the headings: Plants, Animals, Humans and place the chart on a bulletin board.



- Cut and laminate the activity cards.

Teacher's Notes

Soils are one of Earth's essential natural resources, yet they are often taken for granted. Most people do not realize soils are a living, breathing world supporting nearly all terrestrial life. Soils vary greatly from one location to another as a result of many factors, including differences in climate, the parent material of soil, and the location of the soil on the landscape.

Scientists, engineers, farmers, developers, and other professionals consider a particular soil's physical and chemical characteristics, moisture content, and temperature in order to make decisions such as:

- Where is the best place to build a building?
- What types of crops will grow best in a particular field?
- Will the basement of a house flood when it rains?
- What is the quality of the ground water in the area?

Soils exist as natural ecosystems on the surface of the Earth made up of macro and microorganisms, minerals, organic matter, air, and water. Soils are living systems that provide many of the most fundamental functions needed for life. Important functions of soil include:

- Providing the fertile medium in which we grow our food and fiber
- Producing and storing gases such as carbon dioxide
- Storing heat and water
- Providing a home for billions of plants, animals and microorganisms
- Filtering water and wastes
- Providing the source material for construction, medicine, art, makeup, etc.
- Decomposing wastes
- Providing a snapshot of geologic, climatic, biological, and human history

Soil forms very slowly and comprises only about 10% or 11% of Earth's surface. Therefore, it is important to study this essential natural resource and understand how it should be used and conserved properly.

Soil is composed of minerals of different sizes (sand, silt and clay). The combination of these materials

in a particular soil determine how much water a soil will hold, how easily water passes through the soil, and what happens to the soil as it dries. Soil with too much clay may crack as it dries, as demonstrated by ground with huge cracks or the cracking at the top of a mud puddle when larger, heavier particles have settled to the bottom. Soil with too much sand may not hold together well or be strong enough to use as a building material. Soil has been used as a building material for thousands of years and is still one of our most important building materials. In dry regions houses built of adobe bricks last hundreds of years. Concrete and bricks are common everywhere. Whether you are making concrete or adobe blocks, it is essential to understand the importance of having the right elements in your soil mix.

Soil can be characterized by its structure, color, consistence, texture, and abundance of roots, rocks, and carbonates. These characteristics allow scientists to interpret how the ecosystem functions and make recommendations for soil use that have a minimal impact on the ecosystem. For example, soil characterization data can help determine whether a garden should be planted or a school should be built. Soil characterization data can help scientists predict the likelihood of flooding and drought. It can also help them to determine the types of vegetation and land use best suited to a location.

What To Do and How To Do It

Part 1:

1. Place the two charts titled "What Makes Up Soil?" and "What Lives In Soil?" on the bulletin board.
2. As a large group, have the students report their ideas, and record their thoughts on the charts.
3. After all ideas have been recorded, review the students' findings with the whole group.

Part 2:

Optional: This section is a good follow-up to Part 1.

1. After students have discussed what soil is made of and what lives in the soil, have them remain in the large group for the this activity.
2. Demonstrate *Part 3* of the *Why Do We Study Soil? Learning Activity (How much soil is there on Earth?)* with your students.
3. Note to teachers: adjust the discussion you have with the students during this activity depending on their grade level and amount of content knowledge.

Part 3:

1. Gather students into a large group and fill out the chart "How Soil is Used by Living Things." As students report their ideas, record them on the chart. Complete each section (plants, animals, and humans) separately and compare them at the end of the session. Discuss with the students the connections between how each group uses soil to survive. *Note: "Humans" are listed in a separate column than "Animals" - make sure students realize that humans are animals but are discussed separately because they often use soil in different ways than other animals do.*
2. Demonstrate for the class the following "soil connection" process. Lay all of the cards out in their groups so the students can see all of them. Review all of the cards with the students so they are familiar with the pictures and the vocabulary. Start the process by speaking out loud about what your connection would be. Then collect a card from each pile. Place the items on a table or the floor and lay them out in a sequence that leads to the connection. See Figure 1 below.

GROUP 1 (plants/animals) **+ GROUP 2** (action) **+ SOIL = FOOD/HOME**

Rabbit + Dig + Soil = Burrow (Home)

"The rabbit digs in the soil to make a burrow for its home."

OR

Seeds + Plant + Soil = Plants (Food)

"Seeds planted in the ground grow in the soil to become food."

Figure 1: Soil connection samples.

3. Divide the class into four to five groups. Give each group a set of cards. Explain to the students that they are going to make "soil connections." As a small group, they need to decide what their connection will be and gather all the materials to complete the connection. Have each group designate a runner to collect the materials.
4. After all of the small groups have arranged their connections, have them share their soil connection with the rest of the class. Then have the runners return the materials to the appropriate places and repeat the process to make a new connection. Continue this process as time allows.
5. Provide a copy of the recording sheet from the *We All Need Soil! Student Activity Sheet 7* for each student so the students can document their connections. The students will first illustrate the connection in the boxes under the appropriate boxes and then write the connection using words. Younger students can illustrate the connection and then dictate their thoughts to an adult.
6. See Figure 2 below for a list of potential soil connections. Teachers and students may come up with many other possibilities. Note that these connections focus on how animals and plants use soil and some of their needs (water, sun, food chain) have been left out.

Rabbit + Dig + Soil = Burrow (Home)

Worm + Dig + Soil = Tunnels (Home)

Mole + Dig + Soil = Burrow (Home)

Seeds + Plant + Soil = Plants (Food)

Ants + Dig + Soil = Ant Colony (Home)

Prairie Dog + Dig + Soil = Burrow (Home)

Termites + Dig + Soil = Termite Nest (Home)

Chipmunk + Dig + Soil = Burrow (Home)

Figure 2: List of soil connections.

7. Once students have completed making their soil connections, add in Humans as an additional part of the equation. Use the Human cards from Group 3. See Figure 3 below for an example.

GROUP 3 + GROUP 2 + GROUP 1 + SOIL =FOOD/HOME

Human + Plant + Corn Kernels + Soil = Corn Crop (Food)
"A human takes corn kernels and plants them in soil to grow corn for food."

Human + Mix + Water + Soil (Clay) =Bricks for House (Home)
"A human mixes water and clay (soil) to make bricks to use when building a home."

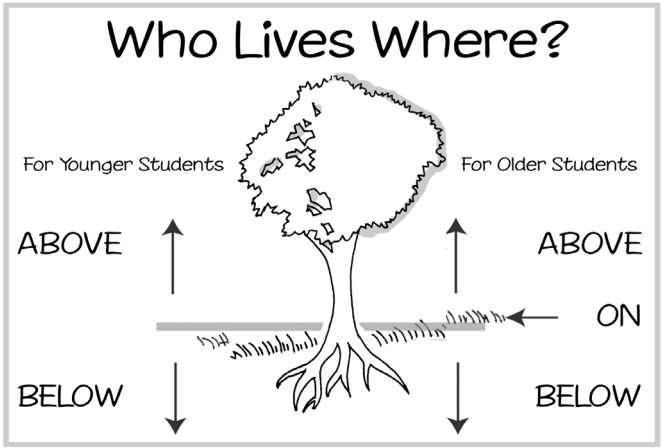
Figure 3: Human/Soil connections.

Adaptations for Younger and Older Students

(See the "Who Lives Where?" diagram below)

Younger students: Discuss with the students which animals live above the ground and which live below the ground. Next, have the students illustrate a scene with soil and a tree. Then they can draw or cut out and glue on animals that live above and below the ground.

Older students: Discuss with the students which animals live above the ground, on the ground, and below the ground. Next, have the students illustrate a scene with soil and a tree. Then they can draw or cut out and glue on animals that live above, on, and below the ground.



Further Investigations

- **Soil Comparison:** Find out which kind of soil is best for growing plants. Gather the following materials: four clear plastic cups, potting soil, sand, soil from an outside garden site, clay, large bean seeds, and water. Have students fill each cup three-fourths full with one of the four different types of soil. Plant 2-3 bean seeds in each cup. Instruct students to plant the seeds closer to the side of the cup for better viewing as the seeds grow. Add a measured amount of water to each cup. Allow time for the seeds to grow. Have students predict what they think will happen for each cup of soil on a chart and save the chart for a future discussion when the experiment is completed. Have students make their own recording sheet by drawing the four cups of soil and then record what happens in each cup.

We All Need Soil! Student Activity Sheet 1

Teachers: Cut out the cards on all of the activity sheets and laminate if possible. Then use the cards for Part 3 of *We All Need Soil!* with your students.

Title Cards

Group 1
Plants, animals, and other things

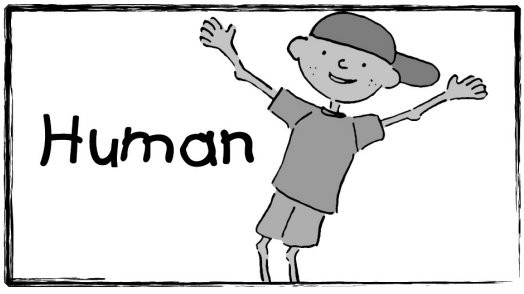
Group 2
Actions

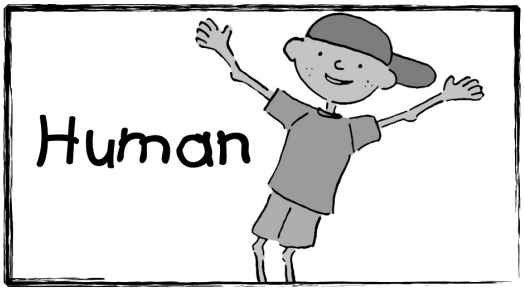
Group 3
Humans

Soil

Home/Food

Group 3

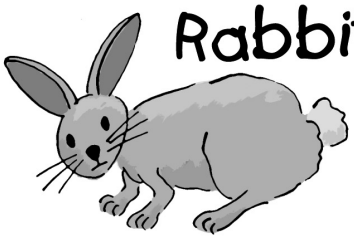




We All Need Soil! Student Activity Sheet 2

Group 1 Cards

Rabbit



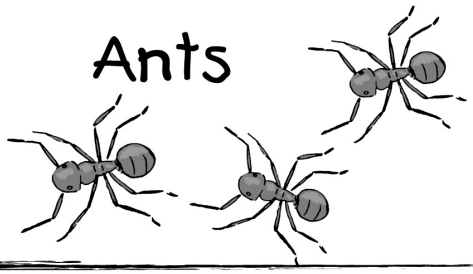
Corn

Worm

Prairie Dog

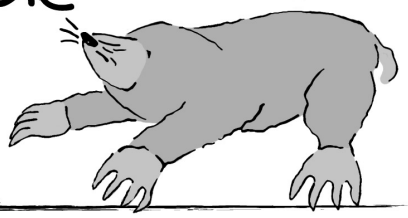
Chipmunk

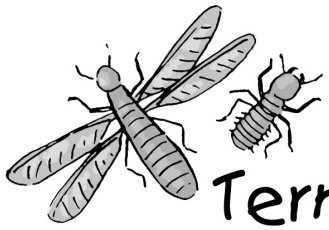
Ants



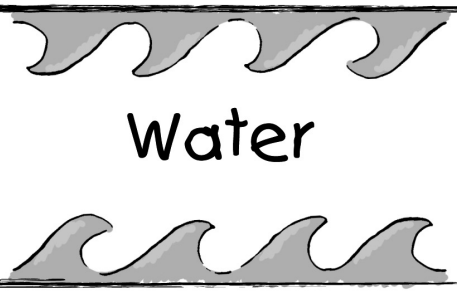
Seeds

Mole





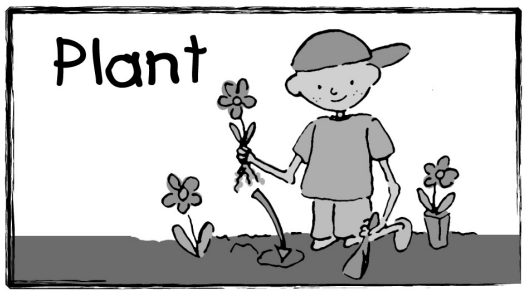
Termites

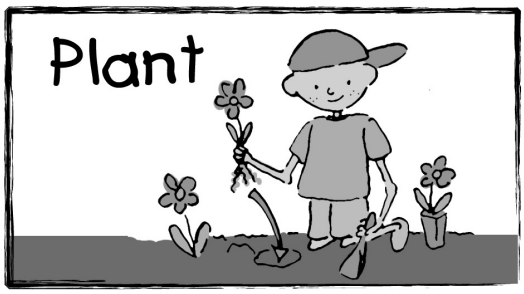


Water

We All Need Soil! Student Activity Sheet 3

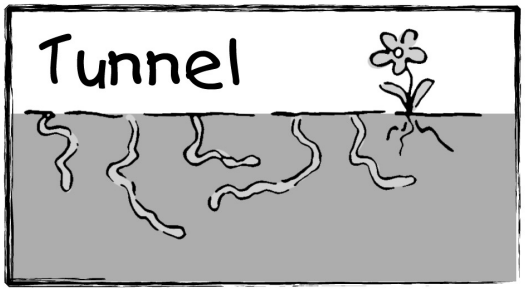
Group 2 Cards

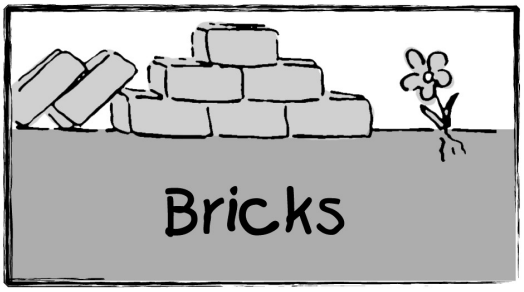


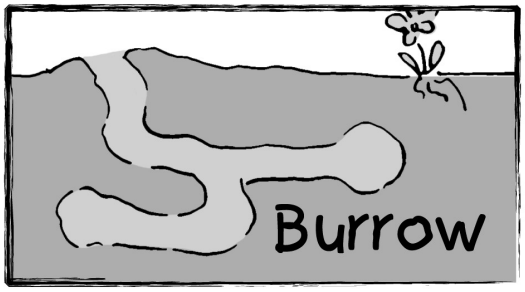


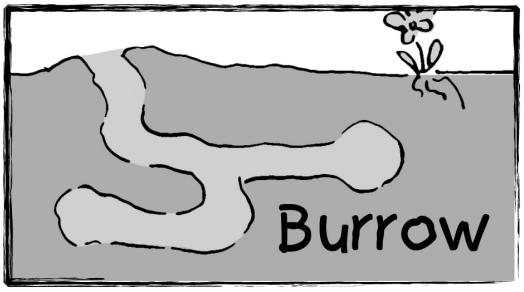
We All Need Soil! Student Activity Sheet 4

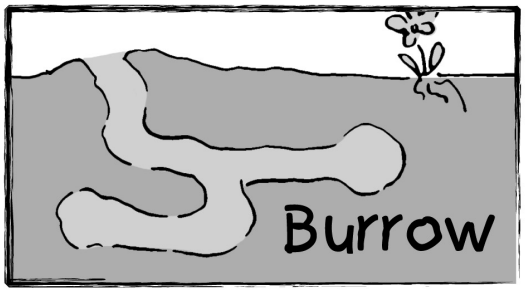
Home/Food Cards

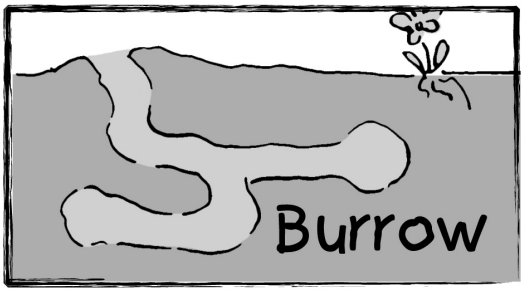


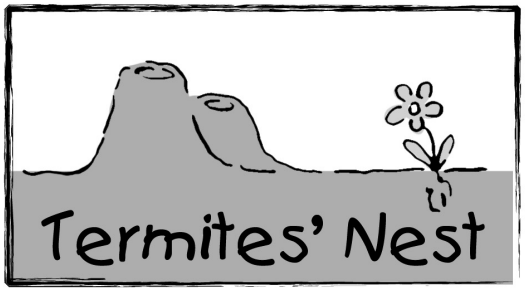


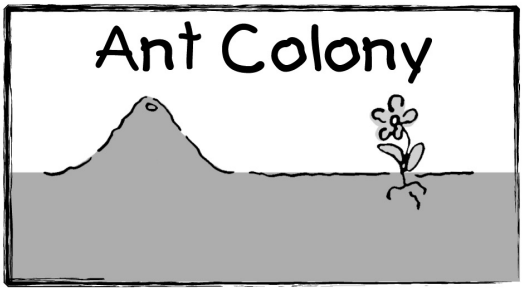


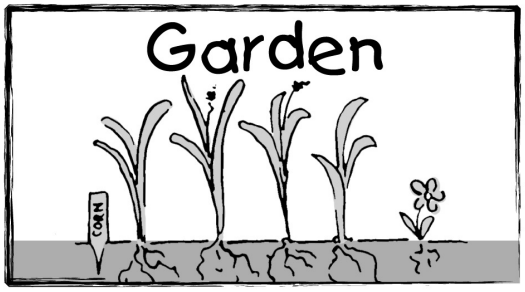


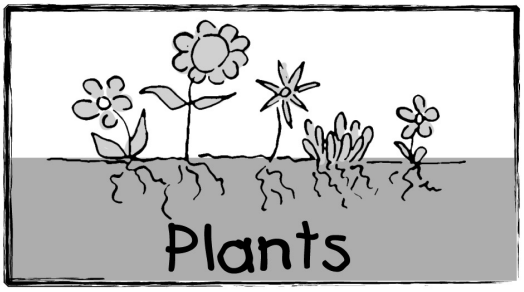






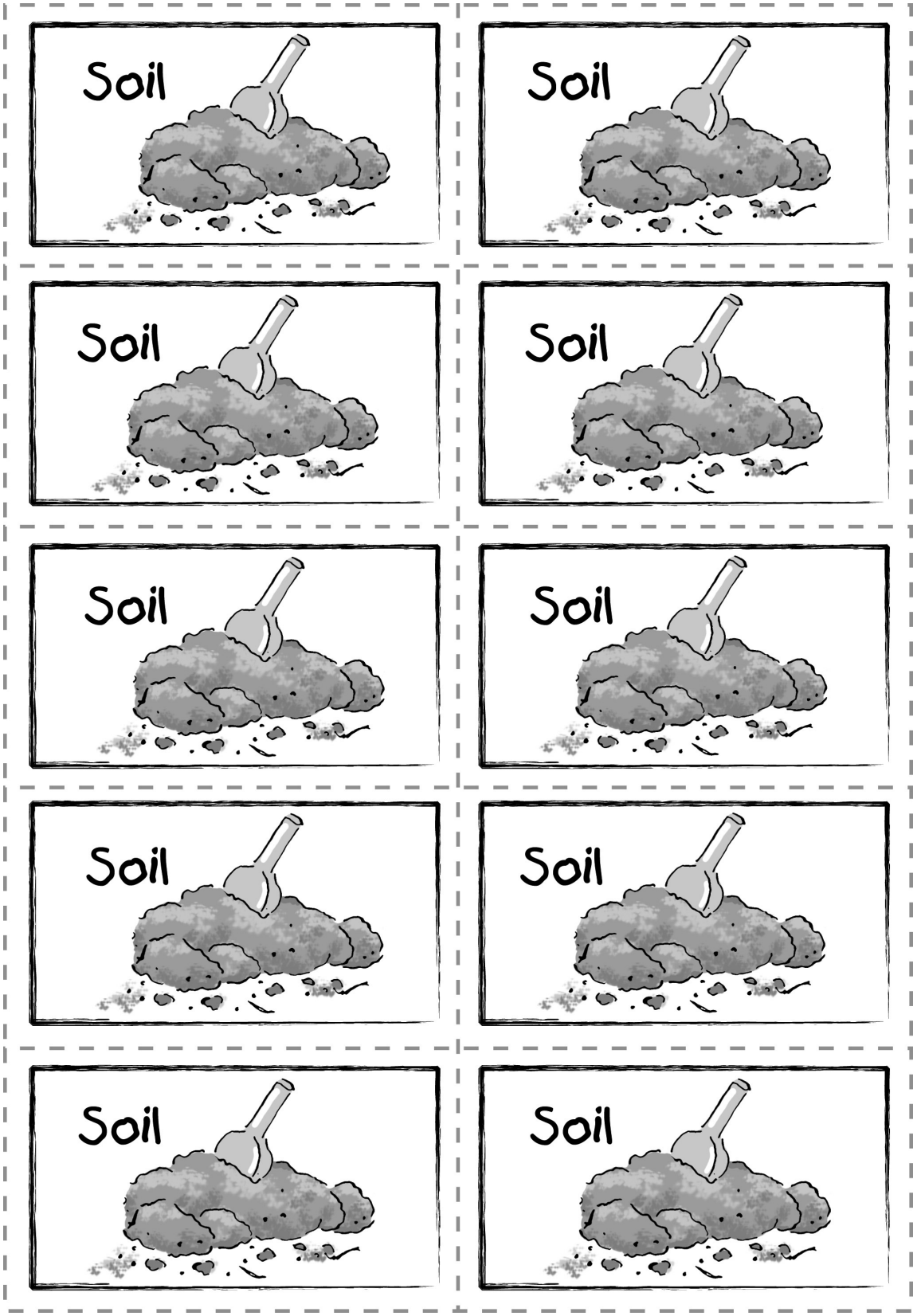






We All Need Soil! Student Activity Sheet 5

Soil Cards



We All Need Soil! Student Activity Sheet 6

+/= Cards

+	+	+	=
+	+	+	=
+	+	+	=
+	+	+	=
+	+	+	=
+	+	+	=
+	+	=	=
+	+	=	=

Elementary GLOBE

The Scoop on Soils

NAME:______________________________

We All Need Soil! Student Activity Sheet 7

Draw the parts of the soil connection in the boxes.

Item from Group 1 (Plants and Animals) + Item from Group 2 (Actions) + Soil = Type of Home/Food

Write your soil connection in a sentence.