Earth System Play

Purpose

- The play may serve as a "performance assessment" where students have an opportunity to display what they have learned about the Earth as a system in a creative manner.

Overview

The class will brainstorm, write, create, and produce a play in which they represent how all the Earth systems are interconnected. This play can be based on the Elementary GLOBE book *All About Earth: Our World on Stage*.

Student Outcomes

Through this activity, students will demonstrate their knowledge of how the hydrosphere, atmosphere, geosphere and biosphere interact.

Science Content Standard A: Science as Inquiry
- Abilities necessary to do scientific inquiry

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

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

Time

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

Note to teachers: These time frames are estimates. Depending on how involved you and your students want to get with the play, it can take more time than listed above.

Level

Primary (most appropriate for grades K-4)

Materials

Part 1:

- Elementary GLOBE book: *All About Earth: Our World on Stage*
- Chart paper
- Markers

Part 2:

- Miscellaneous materials for creating costumes, props, and backdrop

Part 3:

- Performance space

Preparation

Part 1:

- Read the Elementary GLOBE book *All About Earth: Our World on Stage* – either read it to the class or have students read it to themselves. The book can be downloaded from www.globe.gov/elementaryglobe.

Part 2:

- Gather materials required for creating costumes, props and backdrop.
- Copy the script and distribute to each student in the class.

Part 3:

- Set up backdrop.
- Gather all props.

Teacher's Notes

The Earth as a System

When discussing the Earth, scientists often organize it into five "spheres": the atmosphere, hydrosphere, geosphere, cryosphere, and biosphere. These spheres are connected to each other in a complex web of processes. Instead of focusing on the individual parts of the Earth, Earth system scientists use chemistry, biology, and physics to study the cycles that connect these spheres with each other and with the energy from the Sun, which ultimately drives almost all of these processes. *All About Earth: Our World on Stage* uses terminology that is more age appropriate for K-2 students: air, water, soil, and living things. This book also includes the cryosphere (ice) within the hydrosphere. See Figure 1 below.

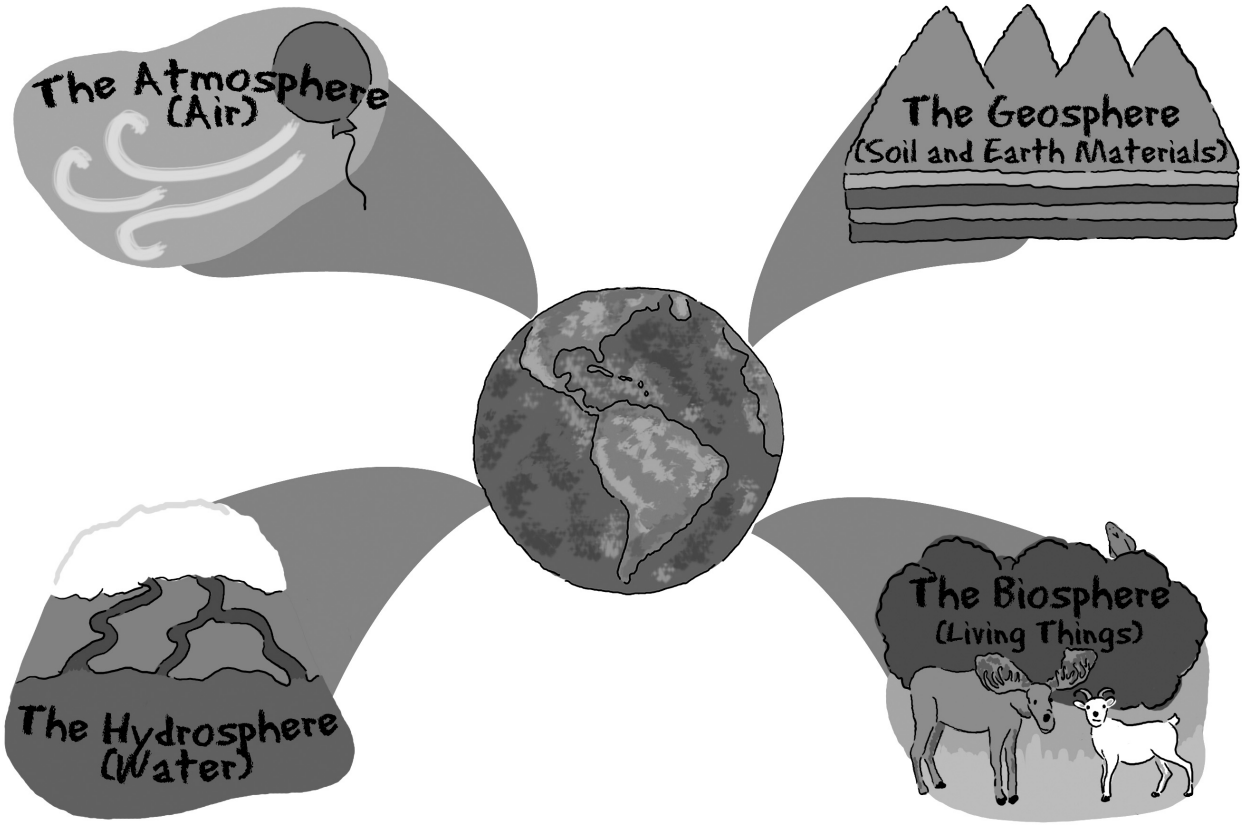


Figure 1: Earth System.

The Atmosphere (Air)
The atmosphere consists of the gases in the air. It provides the oxygen animals breathe and carries off the carbon dioxide they exhale. The atmosphere filters out most harmful forms of sunlight and traps outgoing heat from Earth's surface. The atmosphere transports heat from the equator to the poles, making the whole planet more livable. It also carries the moisture evaporated from lakes and oceans over land, where it can condense and fall in different forms of precipitation.

The Hydrosphere (Water)
The oceans, inland water bodies, ground water, and ice sheets (cryosphere), comprise the hydrosphere. (Note: *All About Earth: Our World on Stage* does not discuss the cryosphere specifically. Instead, "ice" is included in discussions about "water.")

The hydrosphere includes water that is on or close to the surface of Earth wherever it is found. This includes water in the oceans, lakes, streams, ponds, underground, ice sheets, glaciers, icebergs, snow, sleet, hail, clouds, and fog. Water continually circulates between Earth's surface and atmosphere in what is called the hydrologic cycle or water cycle.

The Geosphere (Soil and other Earth Materials)
The geosphere includes the entiresolid surface of the Earth: soil, rock, sand, ocean floor and continents. Soil is a precious natural resource and so deeply affects every part of each ecosystem that it is often called the "great integrator." For example, soil holds nutrients and water for plants and animals. Soil filters and cleans water that passes through it. It can change the chemistry of water and impact the amount that recharges the groundwater or returns to the atmosphere to form rain. The foods we eat and most of the materials we use for paper, buildings, and clothing are dependent on soil. Soil plays an important role in the amount and types of gases in the atmosphere. It stores and transfers heat, affects the temperature of the atmosphere, and controls the activities of plants and other organisms living in the soil.

Biosphere (Living Things)
The biosphere includes all of the living things on Earth, including plants, animals, and microorganisms.

For more information on the Earth system, see the *GLOBE Teacher's Guide* (www.globe.gov).

What To Do and How To Do It

Part 1: Discussion and Brainstorming

1. Having read the Elementary GLOBE book *All About Earth: Our World on Stage*, introduce the idea to the students that they will produce a play, just like the students in the book did. Explain that they will be brainstorming and creating a script that shows how the different Earth systems interact and how all of the components are important.
2. Brainstorm all the Earth system components they think should feature in the play.
3. Ask for volunteers to play each component, or assign roles to students. See below (Part 2, Number 2) for ideas of how to include all of your students in the play even though the book focused on five students.

Part 2: Play Preparation

1. How to do the play:
   Ideally, you and your students will construct all elements of the play together from scratch. However, here are a few options to get you started. You and your students could probably come up with several more!
   (a) Students act out the words of the Earth System song while it is being sung by a chorus of their classmates.
   (b) Just as Anita, Ono and their friends argue about who is the most important Earth system component in the book *All About Earth: Our World on Stage* (pp. 25-26), your students argue about their importance in the course of the play. They can perform the closing lines from the book: "We are air, water, soil, plants,

animals, and the Sun. We all need each other. Together we make up a system called Earth!" The students can end their performance by singing the song together.

(c) Students act out their parts while you, as narrator, read the script. Students may have short speaking parts at various points in the narrative.

(d) As the different Earth system components take center stage, students representing parts of the components act out their possible interactions (e.g., Rabbit nibbles Grass, Soil supports Flower, Chipmunk drinks Water, Rain falls on Soil etc.). Other possible actions include Rain making sprinkling motions with hands, Tree dropping handfuls of paper leaves, Plant "growing" from a crouching position.

2. Who are the characters?

Air
Water
Soil
Sun
Plants
Animals

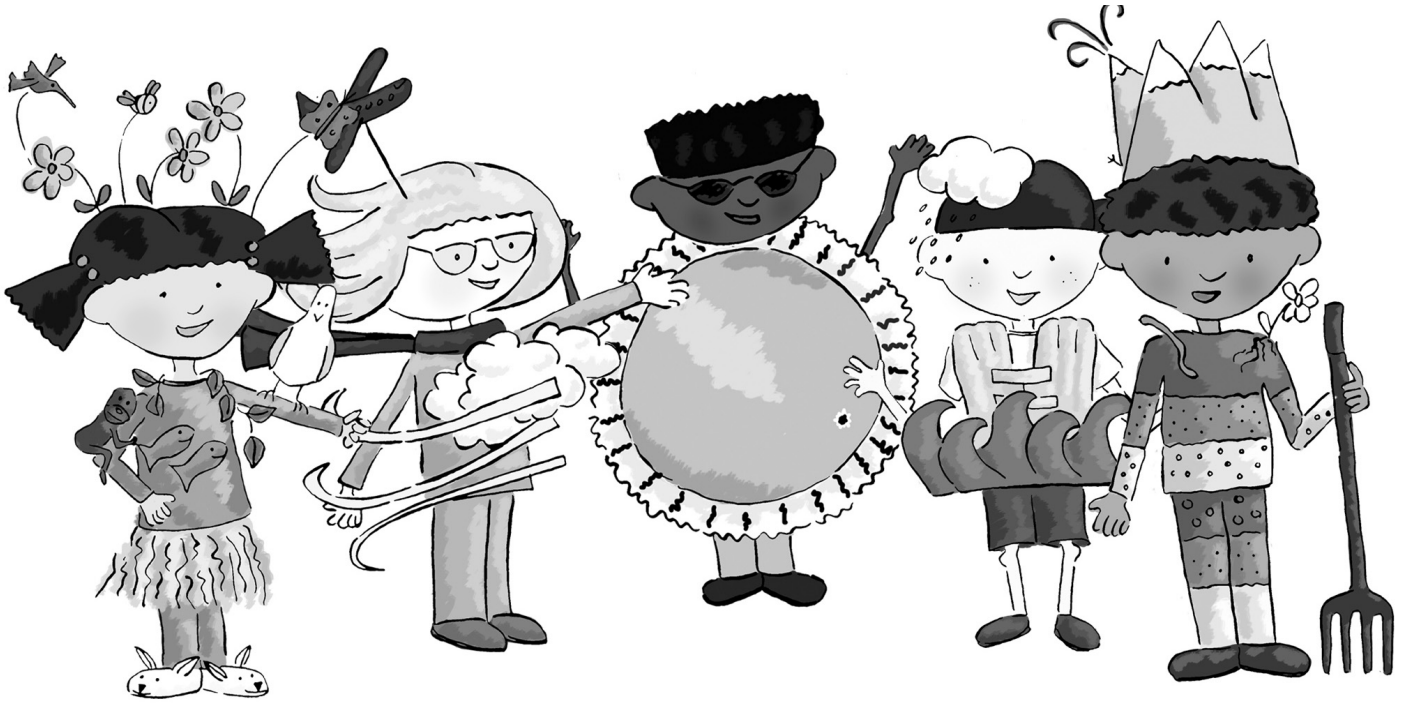
The play can also include Arrow Carriers (who illustrate the connections among earth system components) and an Earth Chorus to sing the song. Some students might not be interested in acting out parts in the play, so these roles would suit them. Other students could spend their time creating props and the backdrop for the play.

The play in the book has only five characters. However, this is not enough for the more typical elementary classroom where most children want to take part. Here are some ideas for creating additional parts:

Water can be further divided into its components (Rain, Snow, Ice, Hail, Sleet, Clouds), as can Soil or the Lithosphere (sand, compost, gravel, stones), Animals (Bird, Deer, Cougar, Mouse, Fox, Wolf, Rabbit, Squirrel, Chipmunk, Skunk, Possum, Raccoon) and Plants (Grass, Flower, Shrub, Tree) and other living things (Mushroom, Bacterium).

3. Costumes and Props

Costumes can be as simple or elaborate as time and money afford and student schedules and curriculum needs dictate. Students may dress in their regular clothes in colors appropriate for their



roles (e.g., white for Air, blue for Water, green for Plant, brown for Soil), they may make simple tunics in these colors, wear headbands made out of construction paper, or they may have Halloween costumes that represent some of the characters, especially the animal ones. Alternatively, students can simply carry small signs stating which Earth system components they represent.

Creating masks, props, and backdrops can be wonderful art activities. Young children love to wear masks, especially ones they have created and decorated themselves. Children can make their own masks for their costumes if they are appropriate for your school setting.

Props can include leaves, raindrops, clouds, etc. Backdrops can represent the biome in which the school is located (e.g., a desert biome in Tucson, AZ or a forest biome in Madison, WI) or a large image of the Earth. Have the whole class work on a backdrop as a collaborative art project and display it in the classroom afterwards. If your school has an art teacher, this activity would be a nice way to integrate art classes.

Remember to have the students create large arrows to represent "flow" or connections between Earth system components. Arrows connecting the Sun to the Earth system components should be "one-way" arrows because the Sun is not affected by Earth in any significant way; arrows connecting Earth system components to each other should be "two-way." See the illustrations in *All About Earth: Our World on Stage* for examples for how to use the different arrows.

Part 3: It's Showtime!

Once costumes, backdrop, and props have all been created, students have learned their lines, and the basic choreography has been worked out, it's time to stage the show. Have students create posters advertising their play around the school (keep in mind school policy) and design a flyer to send to other classrooms and/or home to families. Reserve a time slot at a school assembly if appropriate.

Adaptations for Younger and Older Students

The suggestions in the "What To Do and How To Do It" section present ideas that are appropriate for younger/older students. In addition, older students may want to put on the play for younger students. Younger students can perform a scaled-down version of the play, or they can act out only the song if the play seems like too much.

Further Investigations

- **Expand upon the Earth System song:** Students may write additional verses of their own for the song.
- E**arth System Riddles:** Divide the students into five groups (perhaps using the characters from the play as group leaders). Tell each group what part they are, but don't announce the groups to the rest of the class. Then have the students write a riddle that describes their part in the Earth system. Once they have written their riddle onto chart paper, they share it with the rest of the class so the class can guess what that group represents. For example, a water riddle might be: "I can be seen in more than one form. I help plants and animals survive. My form changes depending on whether I am warm or cold. What am I?"
- **Write/Perform Other Plays:** Read other trade books that look at specific spheres (the water cycle, the geosphere, etc.) with your class. Then write a new play based on that specific sphere.

The "Earth System Play Learning Activity" was developed in collaboration with Harold McWilliams and Gillian Puttick from TERC, Cambridge, MA.