LC1: Connecting the Parts of the Study Site

Purpose

To help students articulate and integrate their existing knowledge about the air, water, soil, and living things by viewing them as interacting parts of a system

Overview

Students visit a study site, where they observe and recall their existing knowledge of air, water, soil, and living things to make a list of interconnections among the four Earth system components. They make predictions about the effects of a change in a system, inferring ways these changes affect the characteristics of other related components.

Student Outcomes

Students will be able to,

- identify the major components of the Earth system, and give examples from their local study site;
- infer connections among the atmosphere, hydrosphere, biosphere, and pedosphere by describing connections among examples at the study site; and
- predict some ways that changes in one component of the study site might affect the changes in other components.

Science Concepts

Earth and Space Sciences

Weather changes from day to day and over the seasons.

The sun is the major source of energy at Earth's surface.

Solar insolation drives atmospheric and ocean circulation

Each element moves among different reservoirs (biosphere, lithosphere, atmosphere, hydrosphere).

Physical Sciences

Heat is transferred by conduction, convection and radiation.

Heat moves from warmer to colder objects.

Sun is a major source of energy for changes on the Earth's surface.

Energy is conserved.

Life Sciences

Organisms can only survive in environments where their needs are met.

Earth has many different environments that support different combinations of organisms.

Organisms' functions relate to their environment.

Organisms change the environment in which they live.

Humans can change natural environments.

Plants and animals have life cycles.

Ecosystems demonstrate the complementary nature of structure and function.

All organisms must be able to obtain and use resources while living in a constantly changing environment.

All populations living together and the physical factors with which they interact constitute an ecosystem.

Populations of organisms can be categorized by the function they serve in the ecosystem.

Sunlight is the major source of energy for ecosystems.

The number of animals, plants and microorganisms an ecosystem can support depends on the available resources.

Atoms and molecules cycle among the living and non-living components of the ecosystem.

Energy flows through ecosystems in one direction (photosynthesis-herbivores-carnivores-decomposers).

Organisms both cooperate and compete in ecosystems.
The population of an ecosystem is limited by its resources.
Humans can change ecosystem balance.
Energy for life derives mainly from the sun.
Living systems require a continuous input of energy to maintain their chemical and physical organizations.
The interaction of organisms in an ecosystem have evolved together over time.

Scientific Inquiry Abilities

Observing the Earth system
Sharing and comparing observations, predictions, and conclusions
Develop explanations and predictions using evidence.

Time

2-3 45-minute class periods

Level

Middle, Secondary

Materials and Tools

Pencils, pads of paper with stiff backing
Optional: magnifying glasses, trowels, gloves

Preparation

Select and visit a Phenology study site (see the *Biosphere Investigation*).
Prepare students for a trip to study site.
Make copies of *Learning Activity Work Sheets*
Recording Interconnections
Effect of One Component on Another
Identifying Sources for Ideas
Understanding Earth System Concepts
Assessment rubrics for this activity (if you wish to share them with your students)

Prerequisites

None

Crosswalks to Other GLOBE Learning Activities

All of the activities listed below reinforce the concept that components of the Earth system change each other through their interactions. This concept is central to an understanding of systems, and to this activity.

Hydrosphere Investigation: Water Walk

This activity helps students become familiar with the Earth's bodies of water and the differences in characteristics of water. Students learn that the characteristics of bodies of water are closely related to the characteristics of the surrounding land.

Hydrosphere Investigation: The pH Game

Students learn that the level of pH influences the vegetation and wildlife in a site, and is itself influenced by different factors in the rocks and soil, human activities, the atmosphere (precipitation), and amount of water in the landscape.

Hydrosphere Investigation: Macroinvertebrate Discovery

Students investigate the correlations between macroinvertebrates and the water chemistry where those animals live, learning that those two components of the Earth system are related.

Soil (Pedosphere) Investigation: Just Passing Through

Students develop an understanding of some of the relationships between water and soils of different types.

What To Do and How To Do It

Step 1. Select a Study Site for the Earth as a System.

The study site for this activity can be the same as the study site for the GLOBE *Hydrosphere Investigation*, but it does not have to be. Since the system includes air, water, soil, and living things the most appropriate site will have representations of all those components. A site adjacent to a canal, pond, or stream would be a good one. If such a body of water is not available, you can use any site where plants and any kind of animals are living under natural conditions.

Visit the Site.

You may wish to visit the site shortly before conducting the activity, to determine the best locations for class discussions and student field work. You'll also need to consider any other aspects of the site. (Is there poison ivy? Will it be wet underfoot? Will students need insect repellent?)

If you are planning to conduct the next activity, *LC2: Representing the Study Site in a Diagram*:

Obtain One or More Photographs of the Study Site.

It is suggested that the teacher or one or more students assigned by the teacher take several photographs of the study site with one in each of the 4 cardinal directions (N, E, S, W). If this is done before beginning the learning activities, there will be time to have the film developed. The photographs should show as many as possible of the four major Earth system components. Students will use copies of the best photographs as a basis for making diagrams of interconnections in *LC2: Representing the Study Site in a Diagram Learning Activity*. If the best photographs do not show all of the important features of the study site, you can instruct students to include it in their annotations and diagrams regardless. It is suggested that for the sake of simplicity in implementation, you not have students work with more than one photograph. Have exposed film and prints made as soon as possible.

If you do not plan to conduct the next activity, *LC2: Representing the Study Site in a Diagram*, you will still need to discuss students' lists of interconnections and the designations they gave them, to bring closure to their work. Refer to Steps 1-4 of *LC2: Representing the Study Site in a Diagram Learning Activity* to do this.

Step 2. Introduce the activity with a discussion of dramatic events or changes that have occurred in your local area.

Ask students to suggest events or changes, such as drought, flood, hurricane, fire, or loss of a particular habitat such as a wetland. Have students describe these events. What changed? What do people understand about it? What don't people understand? What do we still need to find out?

Explain that a new discipline of science – Earth system science has emerged, one in which people attempt to understand changes like these by learning more about ways that parts of the Earth interact to shape the environment. Earth system science integrates all sciences that are concerned with the Earth: geology, hydrology, chemistry, botany and zoology, and meteorology.

People who study the Earth as a system are pioneers in this new discipline, and, as experts on their own local areas, GLOBE students can participate in the pioneering effort. Every area, every site is unique in certain ways. Ask students: How would you apply Earth system science to one of your study sites? How would you communicate the *system* aspect of your study site, its parts and how they interact, to another GLOBE school?

Explain that each one of the activities in the *Local Connections (LC) learning activity series* (a subset of the Exploring the Connections activities)addresses aspects of this question.

Step 3. Describe the study site briefly for students if they're unfamiliar with it, and ask them how they might describe it as a set of parts, or components.

Tell students that in this activity, they will begin to consider how their study site is a system, a set of parts that interact with each other.

If students were to describe their study site (or any site) as a set of parts, or components what would the components be?

Step 4. Help students identify in the study site the four major components that make up the Earth system.

First help students identify these four major components:

1. air (atmosphere) — including precipitation and clouds;
2. water (hydrosphere) — bodies of water such as canals, streams, ponds, lakes, and oceans, as well as groundwater;
3. soil (pedosphere);
4. living things (biosphere) — plants, animals, and other organisms.

Explain that these are the parts, or components, of the study site. Ask students to describe some of the processes that connect them. If students have already learned about the water cycle, the chemical cycle, and the energy cycle, these can be recalled.

Now advise your students that they are going to investigate their study site in terms of these four components and how they connect with each other. Tell them they will make lists of these interconnections. For example, plant parts decay and become part of the soil (an interaction between living things, water, soil and air); water is evaporated from oceans and forms clouds (an interaction between water and air). Ask students to suggest a few examples from one of their GLOBE study sites.

Explain that a change in the characteristics of one of the four components of a system usually results in changes in the characteristics of the other components of the system. For example, if the amount of water in a stream is reduced (water component, or hydrosphere), less erosion occurs (soil component, or pedosphere); less water is available for plant and animal growth (living things component, or biosphere); and less water is available for evaporation (air component, or atmosphere).

Let students know that they are not all required to develop the same lists of interconnections. Different lists will probably reflect different emphases on areas that are of special interest or experience.

Make it clear to students that they do not have to be able to see the interactions to put them on the list. Some of the interactions are ones they will be able to observe while at the study site; others they may remember from collecting GLOBE data, or from another science experience.

Some students may wonder why precipitation is included in the air component, rather than in water. The reason is that water in the air (evaporated water and precipitation) is affected by winds and other forces in the atmosphere, until it has fallen again to Earth.

Make sure students are equipped with pencils and pads of paper for making lists before leaving for the study site.

Step 5. Distribute the Learning Activity Work Sheet *Recording Interconnections*, take students to the study site, and have them make lists of interconnections among components.

The interconnections should be listed as phrases or short sentences such as, “Water evaporates from the stream,” or “Heat from the soil warms the air.”

Encourage students to explore actively if it will help them think. They can dig small holes, turn over stones, and examine the water, soil, and vegetation with a magnifying glass. They can take time to sit quietly and contemplate the study site as well.

Encourage students to articulate and note as many of their thoughts and ideas as they can. The point of this activity is for students to,

1. recall and articulate their existing knowledge; and
2. think creatively about ecological processes that may take place at the study site.

Creative thinking and speculation based on sound scientific information are among the keys to scientific work. In the homework assignment, students will be asked to evaluate the sources of their ideas about interconnections, in terms of whether they are based on informed speculation, background knowledge, or data.

Instruct your students to consider only the components within the study site. In other words, they should not include the sun itself as part of the study site for this activity, because it is the sun’s energy that enters the site, not the sun itself. However, knowing that the study site receives heat energy from

the sun, they should include heat, as it is transported among study site components. (For example, the soil, warmed by energy from the sun, in turn warms the air above it, a pedosphere - atmosphere interconnection.)

Instruct students to focus on interconnections among the four basic Earth system components, rather than within one of them. For example, a student may want to list one interconnection as insects (living things) consuming plants (living things). Both insects and plants are living things, and so are part of the biosphere, and while insects do indeed consume plants, this is a process that occurs within one component, not between components. An example of an interconnection between components is insects taking oxygen from the air, an interaction that occurs between the biosphere and the atmosphere.

For each interconnection, students should identify the Earth system components that are involved.

Students may ask others what they are looking at and thinking about. Making lists of interconnections can be a cooperative effort.

Students may include photosynthesis in their diagrams. In photosynthesis, plants use energy from sunlight to change carbon dioxide and water into food. So, although the sun itself is outside the boundary of the study site system, photosynthesis can be considered a biosphere – atmosphere interaction.

Advanced students' lists of interconnections will be more sophisticated and complex than middle students' lists. Whatever the students may have learned about the water cycle, the energy cycle, and the biogeochemical cycle can be applied here.

If students need prompting, refer to *Questions about Interconnections Among Components of an Earth System*, in the Teacher Guidelines on the next page.

A *Sample Student List of Interconnections* is also provided.

Step 6. In the classroom, have students discuss and predict the possible effects of changes at the study site.

Upon returning to the classroom, distribute the Learning Activity Work Sheet *Effect of One Component on Another*. Have students speculate about how selected changes might affect the study site. Material is provided on the next page to help you work with students on two possible changes: a rain storm and a dramatic rise in temperature.

Have students focus on effects of interconnections among the four major Earth system components (air, water, soil, and living things). What is important here is for students to realize that a *change in one component of the system can affect the characteristics of other components*. You may choose to have students do this now, or as a homework assignment. If the latter, conduct a class discussion about their predictions during the next class period, after the homework is turned in.

Advanced students can generate their own questions and predictions about ways that changes in one component will affect others.

For tips on helping your students, see Teacher Guidelines, *Questions About Interconnections Among Components of an Earth System*, *Sample Student List of Interconnections*, and *Effects of One Component on Another*.

Step 7: Assign homework.

Two homework assignments, Learning Activity Work Sheets *Identifying Sources for Ideas* and *Understanding Earth System Concepts*, are provided. Distribute copies to students.

The homework assignment *Identifying Sources for Ideas* is intended to help students learn to clarify the sources of their ideas: whether they are based on "hard" data, background information, or scientifically informed speculation. Students are to review their lists of interconnections at home and assign one of the designations that follow to *each* interconnection on the list:

D – To designate an interconnection for which they have data, whether GLOBE student measurements or data obtained by others;

B – To designate an interconnection that they recall from their own backgrounds, i.e. from previous reading or from experience in another course, that they actually could find

and bring to class, given enough time;

S – To designate an interconnection that is scientifically informed speculation.

Tell the students that these designations are described on the work sheet. Make sure that they take home the lists of interconnections that they developed during this activity.

The homework assignment *Understanding Earth System Concepts* is a student self-reflection log. Students are asked to write about what they are learning, what may be confusing them, and what they would like to learn more about.

If you plan to conduct the next activity, LC2: Representing the Study Site in a Diagram, go to Step 8.

Step 8. Wrap up this activity.

Explain to students that during the next activity they will discuss their lists of interconnections, and they will begin making diagrams of the study site. Explain that student lists of interconnections will be collected for assessment after the next activity and returned to them later.

If students wrote in class about predictions of changes to the study site, those should also be collected for assessment.

Student Assessment

Four Work Sheets can be used for assessment:

- *Recording Interconnections*
- *Effect of One Component on Another*
- Homework Assignments-*Identifying Sources for Ideas*, *Understanding Earth System Concepts*

Concepts and skills that students display during this activity will be further developed if you plan to conductthe *Local Connections* activities (Representing the Study Site in a Diagram, Using Graphs to Show Connections, Diagramming the Study Site for Others, and Comparing the Study Site to One in Another Region). Assessment at this early stage will provide benchmarks against which to measure student progress later on.

Rubrics for assessment of the first two work sheets and the homework assignment, *Identifying Sources for Ideas* are provided. Homework Assignment, *Understanding Earth System Concepts* is a self- assessment. Student self-reflection logs play a special role, as students may be more comfortable describing confusion they feel or other problems they're having that they would not feel free to bring up with the whole class. You can use this information to help shape the next stage of your teaching with these activities.

Further Investigations

Earth System Component Chemistry

It has been said that each Earth system component — atmosphere, hydrosphere, pedosphere, and biosphere — is made of the others, in varying percentages. In other words, the air contains water, soil, and living things; the soil contains air, water, and living things; the water contains air, soil, and living things; and living things contain air, water, and parts of the soil. Discuss with students. Is this true? How or how not?

Teacher Guidelines

Questions about Interconnections Among Components of an Earth System

If students need prompting, you can ask them questions such as these.

Atmosphere–Hydrosphere Interconnection

- How does the presence of a stream, pond, lake, or ocean affect the air temperature nearby? (hydrosphere – atmosphere)
- How does a rainstorm affect rivers and streams?

Atmosphere–Lithosphere (Pedosphere) Interconnection

- Does the amount of moisture in the soil change? How? (atmosphere – pedosphere)
- How does the presence of large areas of rocks or asphalt affect the air temperature nearby? (Rocks are part of the lithosphere which is distinct from the soil, which is the pedosphere. Asphalt is man-made but is made up of natural materials. You can call this lithosphere – atmosphere interaction or more simply surface – atmosphere interaction)

Atmosphere–Biosphere Interconnection

- What do plants, animals, and other organisms obtain from the air? What is transported from each of those groups of organisms into the air? (biosphere –atmosphere)
- Where does heat in the soil and in the air come from? Did you know that the sun mainly warms the air only indirectly? (The soil is warmed by the sun, which heats the air, and not the other way around.) (pedosphere – atmosphere)

Hydrosphere–Lithosphere Interconnection

- Is moisture present in the soil? How does it get there? (hydrosphere – pedosphere)

Hydrosphere–Biosphere Interconnection

- How does water get from the stream (or pond, lake, canal, or ocean) to the trees? (hydrosphere – biosphere)
- How does the presence of a stream (or pond, lake, canal, or ocean) affect plants and animals? What are differences among species that live in it, species that live adjacent to it, and species that live 20 meters or more away from it? (hydrosphere – biosphere)

Biosphere–Lithosphere (Pedosphere) Interconnection

- How do leaves become part of the soil? (biosphere – pedosphere)
- Does water carry soil? When and how? (biosphere – pedosphere)
- How do plants affect the soil? (biosphere – pedosphere)
- How do animals affect the soil? Remember, there are animals living in the soil as well as on its surface. (biosphere – pedosphere)
- How do bacteria and other microorganisms affect the soil? How are they affected by the soil? (biosphere – pedosphere)

Sample Student List of Interconnections

Atmosphere–Hydrosphere Interconnection

- Water evaporates from the stream into the air. (hydrosphere – atmosphere)
- Gases move between the atmosphere and the water.
- Rain and snow from the atmosphere goes into the surface water.

Atmosphere–Lithosphere (Pedosphere) Interconnection

- Rain and snow from the atmosphere goes into the soil.
- Gases from volcanoes go into the atmosphere.

Atmosphere–Biosphere Interconnection

- Animals inhale oxygen from the air, and exhale carbon dioxide. (biosphere – atmosphere)
- Plants take in carbon dioxide and let out oxygen. (biosphere – atmosphere)
- Microorganisms take some gases from the air, and some gases are transported from microorganisms to the air. For example, some bacteria take nitrogen from the air. (biosphere –







atmosphere)

- Aquatic animals breathe dissolved oxygen in the water. (biosphere – atmosphere)
- Heat from the surface warms the air. (pedosphere – atmosphere)
- Heat in the air warms animals, plants, and microorganisms. (atmosphere – biosphere)
- The amount of water in the site helps determine which species of plants and animals live there. (hydrosphere – biosphere

Hydrosphere–Lithosphere (Pedosphere) Interconnection

- Rain and snow drop water onto the ground. Some of it flows away, and some of it seeps into the ground. (hydrosphere – pedosphere)
- Earthworms consume parts of the soil. (biosphere – pedosphere)
- Rain wears away little bits of rock. These become part of the soil. (hydrosphere – lithosphere – pedosphere)
- Rain beats down on soil near the stream, and some of it carries soil away (erosion). (pedosphere – hydrosphere)

Hydrosphere–Biosphere Interconnection

- Trees take in water through their roots. (biosphere – hydrosphere)
- Water evaporates from leaves of trees and other plants. (biosphere – hydrosphere)
- Animals breathe out some water. (biosphere – hydrosphere)
- Animals drink water. (biosphere – hydrosphere)

Biosphere–Lithosphere (Pedosphere) Interconnection

- Waves wear away pieces of shells and break shells up into bits. These become part of the soil (sand). (biosphere – pedosphere)
- Soil erosion makes the water more turbid, which reduces the depth to which sunlight can penetrate the water. This diminishes the ability of plants to carry out photosynthesis, thus affecting their ability to grow. (pedosphere – biosphere)
- Plants take nutrients from the soil. When they die, they put nutrients into the soil. (biosphere – pedosphere)

Effects of One Component on Another

Select two or more of these questions, ask students to make predictions, and discuss the predictions as a class.

Change No. 1: Rain storm

Guiding Questions

- How would a change in water level affect plants and animals at the site?

  (The amount of available water is a determining factor in which species of plants, animals, and microorganisms can live at a given place.)
- How might heavy precipitation affect soil moisture levels?

  (Soil moisture levels will rise following heavy precipitation. Once the soil is saturated, remaining moisture will not be absorbed, but will run off the site.)
- How might the storm affect erosion?

  (The impact of rain drops and runoff cause soil erosion where vegetation does not protect the soil.)
- What happens to the flow of water in a stream or river during rain storms? What effects might that have on plants and animals in the water? What effects might it have on the soil at the bottom of the stream (or pond, lake, canal, or ocean)?

  (The flow of water increases during rain storms. If a storm drops a lot of water on the site, the flow will be great, and may cause physical distress to plants and animals in the water, possibly even removing them from the site. It will disturb sediments at the bottom of a stream, which will cause turbidity to increase, lowering the rate of plant photosynthesis.)
- If rain storms are frequent and regular at the study site over a number of years, how might that affect interconnections among components?

  (Such rain storms will scour the bottom of a stream or canal, and

plants or seeds living near it may be removed. Soil throughout the site will be saturated, and species of plants, animals, and microorganisms that cannot tolerate saturated soil will be replaced by species that can tolerate it. Temperatures overall may change, and that too may affect which species live at the study site.)

- How might long periods with large amounts of cloud cover affect vegetation?

  (Temperatures may change, and the rate of photosynthesis will decrease. Plant and animal species that require long hours of full sun will be replaced by species that flourish with less sunlight.)

Change No. 2: Dramatic Rise in Temperature

Guiding Questions

- What would happen to the components at the study site if the temperature rose dramatically for an extended period, in a prolonged heat wave?
- What changes in evaporation rates could be expected?
- How might that affect the soil?
- How might it affect living things?
- How might it affect the water?

  (Evaporation rates would increase, resulting in a drier site, although this could be complicated by changes in precipitation. Plant, animal, and microorganism species that could not tolerate higher temperatures would be replaced by species that could. If there were few plants that could tolerate the higher temperatures, the soil might become exposed, and soil erosion by both wind and water would increase. The hydrologic cycle would become more vigorous, meaning that there would be more evaporation and more precipitation, and therefore more water moving through the cycle faster.)

Recording Interconnections

Work Sheet-1

Name:_____ Class: _____ Date:_____

Instructions

Look around your study site. Analyze and describe it in this way:

1. Identify some examples of the four major components: living things, water, soil, and air. (Air includes hot and cold air, wind, clouds, and precipitation.) (The components are also known as: biosphere, hydrosphere, pedosphere, and atmosphere.)
2. Identify and record connections among these components by: making observations; recalling and integrating your existing knowledge about them; and speculating carefully about the connections that might be taking place.

Record answers on next page or on a separate piece of paper, and attach it to this *Work Sheet*.

Tips, Questions, and Comments to Get You Thinking

- Write down your observations as short phrases. *Use verbs.* Example: Leaves fall, decompose, and become part of the soil.
- Write down as many interconnections as you can think of. Be as specific as you can. You can even use general quantities, such as “a little,” “some,” or “a lot”.
- Work with other students if you wish. But before you add anything to your list, make sure you understand it *and agree with it!*
- Examples of questions you might consider:

  What happens in the soil that changes the characteristics of the living things at the site? What happens in the water that changes the characteristics of the air?

  What moves from one study site component to the other?
- It may help your thinking to compare this place to others. What’s happening at this site that doesn’t happen somewhere else? How is this one different? What about soil characteristics? Different kinds of plants? Less water, or more?
- Recall ideas from other courses you have taken. Think about biology, chemistry, Earth science, ecology, geography, meteorology, and physics.
- After you’ve made an initial list, look it over. *Be sure you have described examples at the study site for each of the 4 components.* Is each of them acting upon *each* of the other three in at least two or three ways?

An excellent list of interconnections will be long; it will involve all of the components; it will be specific; it will bring in your knowledge from previous studies in other classes as well as this one; and it will show that you are thinking deeply and carefully about your study site.

Examples of Four Major Components	
Atmosphere	Hydrosphere
Pedosphere	Biosphere

Connections Among Components	
Atmosphere–Hydrosphere Interconnection	Atmosphere–Lithosphere (Pedosphere) Interconnection
Atmosphere–Biosphere Interconnection	Hydrosphere–Lithosphere Interconnection
Hydrosphere–Biosphere Interconnection	Biosphere–Lithosphere(Pedosphere) Interconnection

Effects of One Component on Another

Work Sheet-2

Name:_____ Class: _____ Date:_____

Instructions

Choose three or more of the questions below, and on the back of this sheet or on a separate piece of paper, describe your predictions of ways that a change in the characteristics of one component of the study site might affect the characteristics of other components.

Be as specific as you can. For example, if someone planted a tree at the site, the ground beneath it would be shaded; the temperature of that soil would decrease, and the soil moisture level would increase.

It is not necessary to respond to all of these questions. **What is important here is for you to demonstrate your understanding of how a change in the characteristics of one component of the study site may result in changes to the characteristics of other components.** All aspects of the site are connected.

Indicate on this sheet which questions you are addressing, and attach your responses to the questions to this page before turning it in.

Change No. 1: Rain Storm

- How would a change in water level affect plants and animals at the site?
- How might heavy precipitation affect soil moisture levels?
- How might the storm affect erosion?
- What happens to the flow of water in a stream or river during rain storms? What effects might that have on plants and animals in the water? What effects might it have on the soil at the bottom of the stream (or pond, lake, canal, or ocean)?
- If rain storms are frequent and regular at the study site over a number of years, how might that affect interconnections among components?
- How might long periods with large amounts of cloud cover affect vegetation?

Change No. 2: Dramatic Rise in Temperature

- What would happen to the components at the study site if the temperature rose dramatically for an extended period, in a prolonged heat wave?
- What changes in evaporation rates could be expected?
- How might that affect the soil?
- How might it affect living things?
- How might it affect the water?

Ask Your Own Questions

Ask some of your own questions about changes here, and predict the effects of those changes to other components of the study site. Your questions can have to do with any aspects of the study site, not just rain storm events or climate. Ask yourself, “What if…?” and take it from there. For example:

- What if no birds flew into the study site?
- What if twice as many birds flew into the study site as do now?
- What if no people ever came again?

Identifying Sources for Ideas

Work Sheet-3:
Homework Assignment

Name:_____ Class: _____Date:_____

Assignment 1

For each interconnection on the list you made during this activity, identify what kind of source you used for the idea. (See below.)

Review your list of interconnections. Make any additions or changes that you wish. Make sure you have involved and correctly identified the four major components of the study site as a system: atmosphere (air and precipitation), hydrosphere (water), biosphere (living things), and pedosphere (soil).

Now review the list again, with particular consideration for where you got your ideas. Write one of the designations below next to each interconnection on the list:

D – Your concept is based on data. Use “D” to designate an interconnection for which you have or have seen data, whether it is data collected by your class, another GLOBE school, or others

B – Your source is background information. Use “B” to designate an interconnection that you have recalled from previous reading or experience in another course, at home, or elsewhere, and that you could actually find and bring to class, given enough time. There may be data somewhere to substantiate this, but you either have not seen it or you do not have easy access to it.

S – Your source is speculation. Use “S” to designate an interconnection that is scientifically informed speculation on your part. This is your opinion based on what you have learned over time but you can not point to a particular source of data or other information to support it. (Creative speculation — when based on authoritative background information and data — is one of the keys to excellent scientific work.)

As you write the letter designation (D, B, or S), put a small circle around it, so that it will be clear and legible to others.

Understanding Earth System Concepts

Work Sheet-4:
Homework Assignment

Name:_____ Class: _____ Date:_____

Assignment 2

Take a few minutes to consider and write about what you are learning. If you need more space use the back of this paper, or attach additional sheets.

1. Give several examples of connections you detected in this activity. What are you confident about? What are you confused about? Are you stuck anywhere?

   _____
   _____
   _____
   _____
   _____

2. Were you able to identify examples of the Earth system components at your study site? What did you learn? What are you confused about? Please explain.

   _____
   _____
   _____
   _____
   _____

3. Were you able to predict changes in the study site? Did you understand what was being discussed? Please explain.

   _____
   _____
   _____
   _____
   _____

4. Do you see that a change in the characteristics of one of the system components usually results in changes in the characteristics of the other components? Would you be able to give examples of this readily if someone asked you? Give examples.

   _____
   _____
   _____
   _____
   _____

Assessment Rubric: *Local Connections 1: Connecting the Parts of the Study Site*

Recording Interconnections Among Components of the Study Site				
	4	**3**	**2**	**1**
Study Site Components Included	Includes and correctly identifies all 4 major components	Includes and correctly identifies 3 major components	Includes and correctly identifies 2 major components	Incompletely and/or incorrectly includes and identifies major components
Interconnections Proposed	Specifically describes 4 or more scientifically appropriate inter-connections for each component of site	Describes 3 scientifically appropriate inter-connections for each component of site	Describes 2 or fewer interconnections for each component of site; some are not scientifically appropriate	Describes no scientifically appropriate interconnections
Clarity of Descriptions	Uses short phrases withverbs to indicate interconnections, and writes very clearly	Uses short phrases withverbs to indicate interconnections; most are written clearly	Uses unclear phrases to indicate most interconnections	Uses unintelligible phrases

Assessment Rubric: *Local Connections 1: Connecting the Parts of the Study Site*

Predicting Ways that a Change in the Characteristics of One Component of the Study Site May Affect the Characteristics of Other Components				
	4	**3**	**2**	**1**
Predictions Made	Responds to 3 or more questions, generates 2 or more new questions	Responds to 2 questions, generates 1 new question	Responds to 1 or 2 questions, does not generate any new questions	Does not respond to questions; does not generate any new questions
Predictions Based on Sound Scientific Principles	Bases all predictions on sound scientific principles; shows careful thought about interconnectedness of system components	Bases most predictions on sound scientific principles; shows somethought about interconnectedness of system components	Bases predictions on questionable concepts; shows little thought about interconnectedness of system components	Makes no predictions; reflects little thought about interconnectedness of system components

Assessment Rubric: *Local Connections 1: Connecting the Parts of the Study Site*

Designating Information Sources for Interconnections				
	4	**3**	**2**	**1**
Information Source Designations (D, B, S)	Identifies all information sources accurately and thoughtfully	Identifies most information sources accurately and thoughtfully	Identifies some information sources accurately and or thoughtfully	Identifies few or no information sources accurately