

*Local Connections: Earth Systems in the Local Study Site*

# LC4: Diagramming the Study Site for Others



Welcome

Introduction

Protocols

Learning Activities

Appendix

**Purpose**

To develop the best possible representation of the study site as a system

**Overview**

Working in small groups, students compare and contrast individual diagrams, in terms of the lucidity of their expression of the key components and interconnections in their study sites. Selecting the best of their components and interconnections, the class combines them to produce a summary diagram of their study site.

**Student Outcomes**

Students will be able to:

- Interpret and evaluate diagrams of their local study site in terms of their key components and interconnections;
- Describe and justify their views on what makes an effective diagram of an Earth system.

**Science Concepts***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.

Chemical reactions take place in every part of the environment.

*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).

*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.

**Scientific Inquiry Abilities**

Collaborating to develop a class product

Recognize and analyze alternative explanations.

Communicate results and explanations.



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| <p><b>Time</b><br/>Two 45-minute class periods</p> <p><b>Level</b><br/>Middle, Secondary</p> | <p><b>Materials and Tools</b><br/>Student study site diagrams or sample set from Reynolds Jr. Sr. HS study site</p> <p><b>Preparation</b><br/>None</p> |
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**Crosswalk to Another GLOBE Learning Activity**

**Earth as a System Investigation-Seasons and Phenology: What Can We Learn by Sharing Local Seasonal Markers with Other Schools Around the World?**

Teachers and students share seasonal marker observations, which are the various changes that mark transition points in the annual cycles of seasons. (Examples are the first snowfall, the beginning of monsoon rains, and the summer solstice.) Students compare GLOBE data with the observations they take at their study site. The activity promotes collaborations among GLOBE classes, and helps teachers and students learn how to work with the GLOBE data system and GLOBEMail email.

**What To Do and How To Do It**

**Step 1. Make Student Copies**

If you did not conduct *Activity LC2*, and your students have not created diagrams of their own study site from which to develop a class diagram, make student copies of Figure EA-LC2-1 (in *Activity LC2*), and Figure EA-LC3-1 and EA-LC4-1 (in *Activity LC3*)

Also, copy the two *Work Sheets (Characteristics of an Effective Diagram and Questions to Describe the Study Site)*, and the *Study Site Description Form*. You may also want to copy the *Assessment Rubrics* to share with students.

**Step 2. Revisit or discuss the 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 has emerged with which people attempt to understand changes like these by learning more about ways that parts of the Earth interact to make the whole. The discipline of 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. 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 to others?

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

**Step 3. Organize students into small groups of 3-6 students each, and introduce the activity.**

Distribute the simplified diagrams created by your students if you conducted *Activity LC2*, or if you did not conduct *LC2* distribute copies of the five photographs (Figures EA-L-48 and EA-L-52) and the four simplified diagrams provided for this activity (Figure EA-L-57). Also, distribute the *Characteristics of an Effective Diagram Work Sheet*.

Explain to students that in the course of this activity, they will develop a class diagram of their Earth system study site as a system (showing its four major components, and the interconnections among them), and a short description of the study site. (If your students did not conduct *Activity LC2*

you will create a class diagram for Reynolds Jr. Sr. High School from photographs and diagrams provided by GLOBE). Tell them that a significant skill involved here is collaboration.

**Step 4. If you conducted Activity LC2, give students a few minutes to revise their own diagrams if they wish.**

Students who are working with their own diagrams may have additions or changes to make to them. Students who are working with the diagrams provided by GLOBE can make additions to them that reflect either their existing knowledge of their own study sites or information that they can gather by using the photographs of the hydrology study site and in the four cardinal directions around that site at the Reynolds Jr. Sr. High School study site.

**Step 5. Instruct students to discuss and compare the best features of their diagrams.**

Distribute the *Characteristics of an Effective Diagram Work Sheet*. Tell students that a spokesperson designated by each group will present and describe the best features of that group's diagrams for the whole class. Spokespersons must justify their groups' opinions about these best features on the grounds of either scientific accuracy or the need for clear communication by the diagram. Explain that each spokesperson's presentation will reflect the work of each student in the group.

Remind students that their ability to work together as a group is an important part of the experience. They must listen to each others' work and ideas constructively, and reach consensus out of full participation by all members of the group. Encourage students to evaluate their teammates' diagrams carefully, to ask questions about aspects that are unclear, and to offer constructive criticism. Help them to be aware that although they may reach consensus about the appearance and characteristics of a good diagram, the styles and approaches of different students will vary. This in itself is a valuable lesson for students. The same phenomena can be represented in ways that are different, yet equally valid if they are based on accurate information.

Instruct students that in the course of the group's work, each student should make notes on what she or he considers to be the characteristics of an effective diagram.

**Step 6. Have each group's spokesperson present and describe the best features of that group's diagrams to the whole class.**

Diagrams being discussed can be passed around, or redrawn on the blackboard.

Let students know that during this time, they can modify their individual lists of the characteristics of an effective diagram, as they review the diagrams of others and participate in the class critiques.

Have one or two students keep track of the best diagram features that are identified by the class, making notes and sketching on the blackboard, as the presentations and discussions proceed.

**Step 7. Help the class to reach consensus on what should be in the class diagram and how it should look.**

The class must reach consensus on the best diagram to represent their ideas about interconnections at their study site. As features of the class diagram take shape, a student (or students) designated by the teacher can sketch the diagram on the blackboard.

**Step 8: Distribute the Questions to Describe the Study Site Work Sheet. Have students develop a list of the questions, the answers to which they think will describe their study site.**

Explain to students that in addition to the class diagram of the study site, they will create a description of it.

A *Study Site Description Form* is provided, but before introducing it to students, have them suggest what information should be included in such a form. What would you want to tell other students about your study site, so that they would understand it as a system as fully as possible?

Reinforce the students' awareness that this is important work, because they are the experts on their study site. Nobody knows it as well as they do.



Illustrative student responses:

- Is the area in a temperate, tropical, or polar climate?
- What is the range of temperatures throughout the year?
- What are the seasons, and when do they occur?
- How much rain and snow does the site get, and when does it fall?
- How often are there storms?
- How cloudy is it throughout the year?
- What species of plants, animals, and other organisms live here?
- How does the vegetation change over the year?
- How do animal populations change over the year? Do some animals migrate from or into the area during different seasons?
- Is the soil sandy, sticky, or hard? Is it wet or dry?
- Is the site in an urban, suburban, or rural area?
- How far is the site from an ocean or other large body of water? Does this body of water lie to the north, south, east, or west of the site? What is unique or special about this site?

**Step 9. Designate one of the students to draw the final version of the class diagram on a piece of paper.**

Using either the Reynolds diagrams or their own, produce a class compilation of the best features of the individual diagrams.

Sample class diagrams from different climatic regions (one of which is the Reynolds Jr. Sr. High School site) appear in Figure EA-LC5-1 in *LC5: Comparing the Study Site to One in Another Learning Activity*.

**Step 10. Distribute copies of the Study Site Description Form, and have students discuss and evaluate the questions on it.**

Ask students to compare the questions on the form with the questions they suggested. Why are these particular questions on the form? Select a few and ask the students, Why might this information be helpful for understanding another school's study site as an Earth system?

It is perfectly acceptable to add questions to the *Study Site Description Form*, if students can explain how those additions will help others to understand their study site as a unique place and as a system.

Allow students to revise their own lists of questions if they wish. Explain that you will be collecting their lists at the end of the activity.

**Step 11. Guide students in completing the Study Site Description Form, with descriptions of unique or special features of the study site.**

Students should complete this form as a class, using their own lists of questions to help point out any special aspects or features of their study site that distinguish it from other sites.

**Step 12: If you plan to conduct the next activity, Activity LC 5, prepare students for it.**

Explain that in the next activity, students will compare a diagram and description of an Earth system study site from another study site with their own in terms of both science content and style.

**Step 13. Have students complete the Diagramming and Describing the Study Site for Others: Student Reflection Log Work Sheet.**

### **Student Assessment**

Three *Work Sheets* can be used for assessment of student learning:

- Characteristics of an Effective Diagram;*
- Questions to Describe the Study Site;*
- Student Self-reflection Log: Diagramming the Study Site for Others*

Students' collaboration skills can also be assessed.

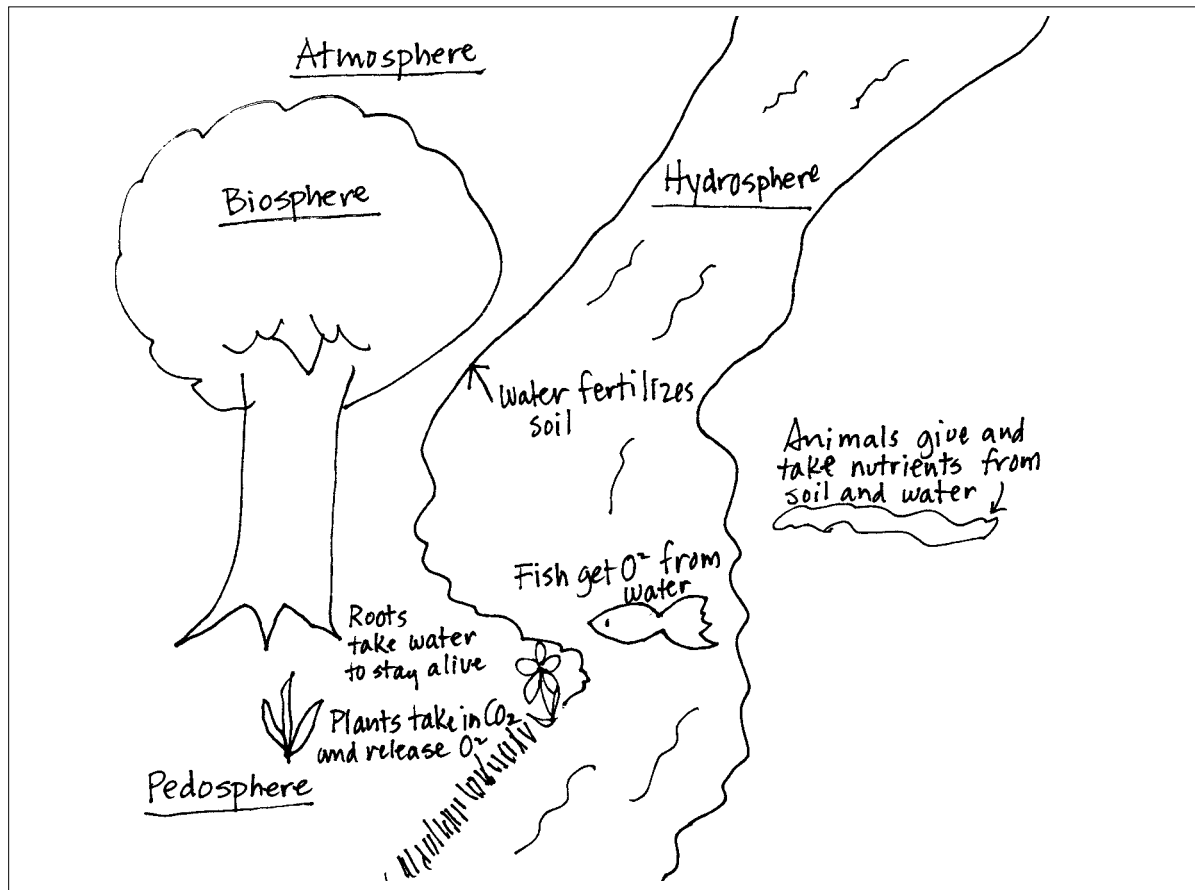
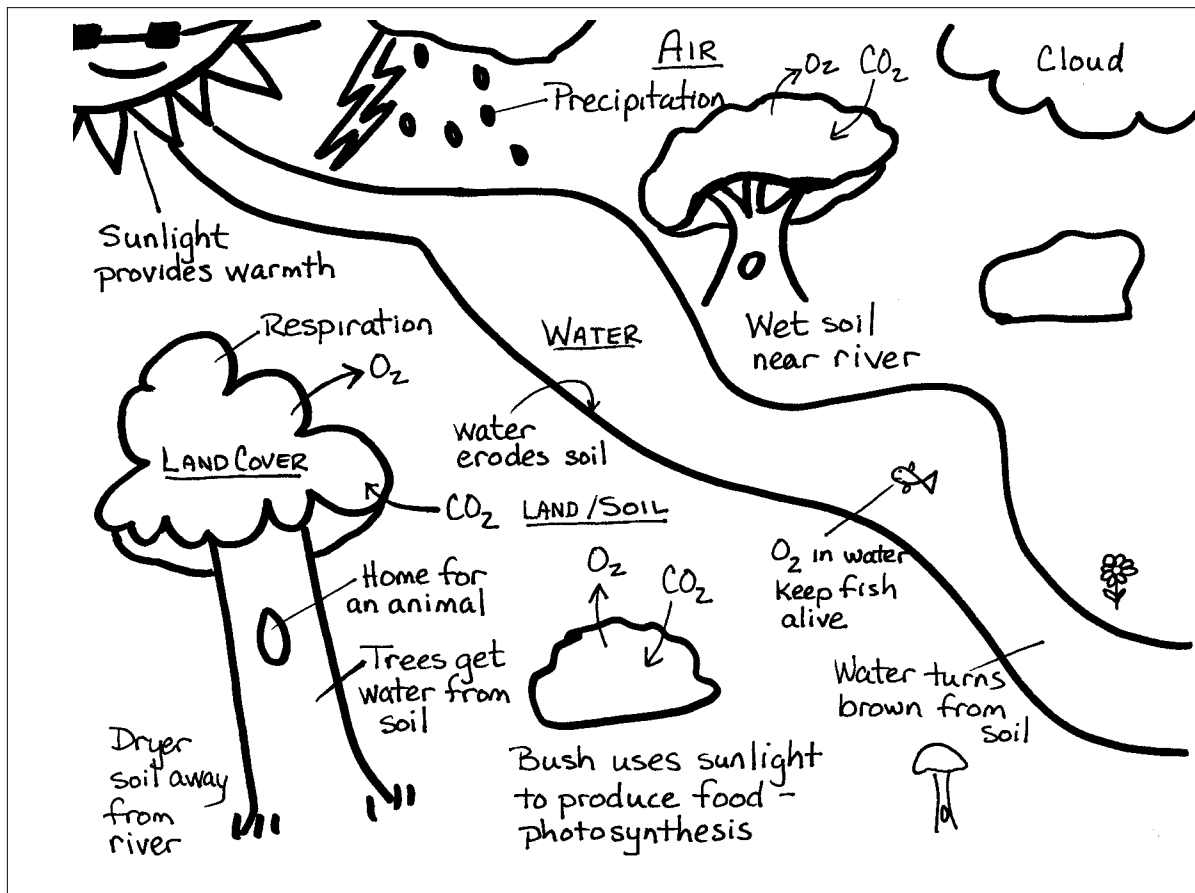
Assessment rubrics for the first two *Work Sheets* and for the collaboration skills are provided.

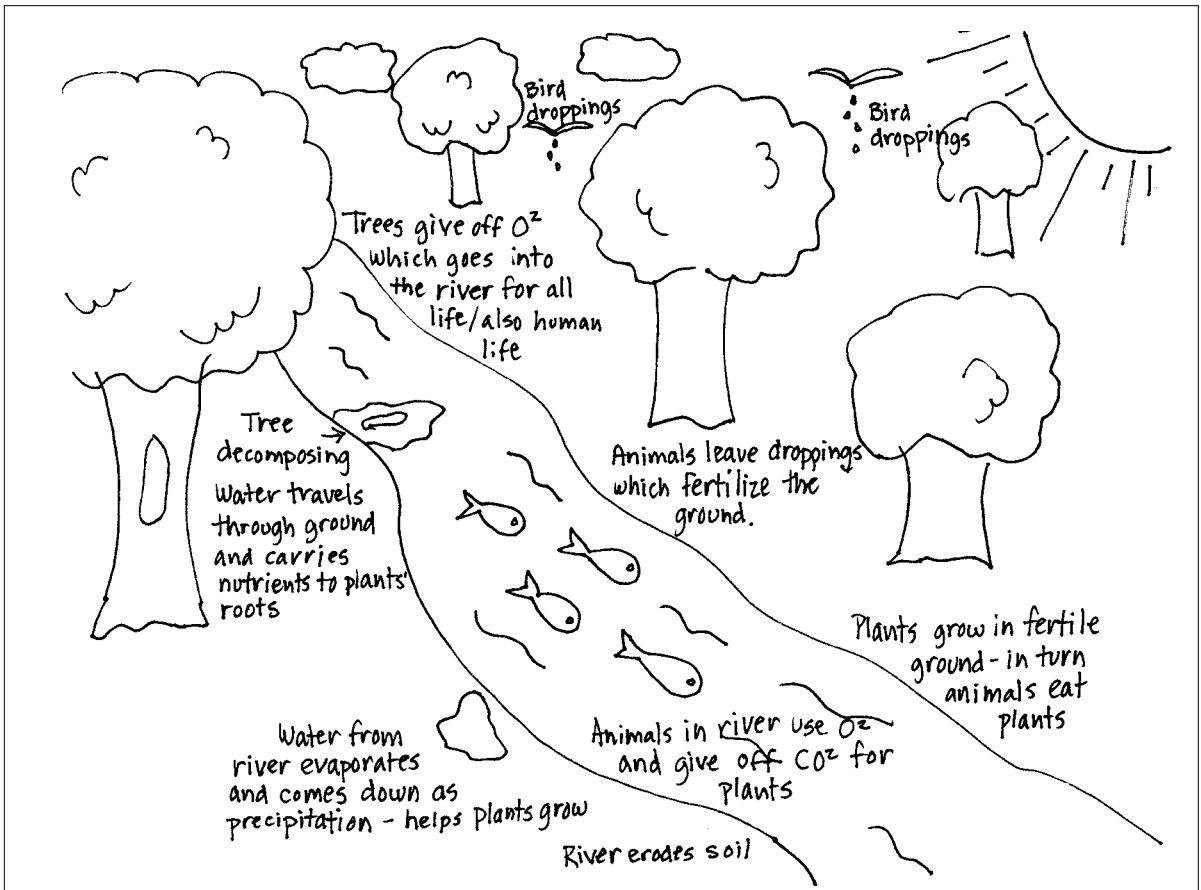
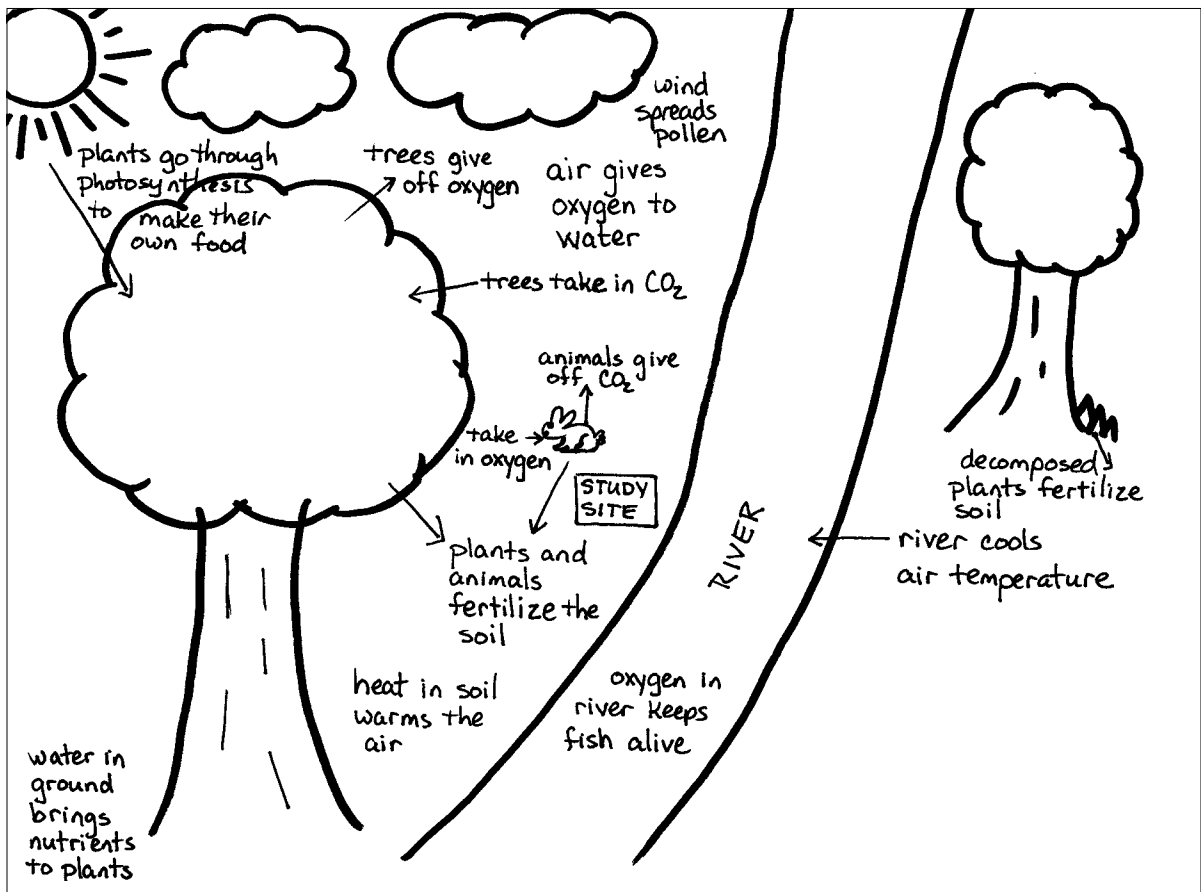
### **Further Investigations**

#### **Systems through the Seasons**

Using photographs of the site (or sites like it) taken in other seasons, ask students to describe how interconnections among Earth system components might be different at those times. How will temperature changes affect interconnections?

Figure EA-LC4-1: Four Sample Simplified Diagrams of the Reynolds Jr. Sr. High School Hydrology Study Site





# Characteristics of an Effective Diagram

## Work Sheet-1

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Respond to Questions 1 and 2 below *before* you work to determine best features of your diagrams in small groups.

1. What do you like about the diagrams made by the other students in your group, or, if you used diagrams provided by GLOBE, what do you like about those diagrams? Why?

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2. What do you consider to be the characteristics of an effective diagram?  
Think about the diagram as a way of communicating concepts about the study site as a system, in other words, as a set of components that interconnect.

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### **Tips for Choosing the Best Features of Several Diagrams**

Your task is to decide as a group which diagram features and characteristics to recommend to your class, so that the class can make the best possible single diagram to represent your study site as a system, to other GLOBE schools.

Your teacher has given you some diagrams — either diagrams made by students in your class, or diagrams drawn by other students for the GLOBE teacher's guide), as examples to help you. Here are some tips on how to accomplish your task.

*For students who did not make their own diagrams in Activity LC2 and are using the sample student diagrams provided by GLOBE: Take heed.* These 4 sample diagrams are based on student work, and they are not perfect! They can be improved upon. They will probably not represent your own study site as completely and accurately as you want. The major components may not be labeled, which is a requirement for the class diagram. They may not include all of the interconnections you might think should be on the class diagram, so you may want to add some.

- Make notes on what you like about these diagrams. You can record your ideas in different ways:  
You can make a list of the features and characteristics you want to recommend to the class;  
You can have one of the group sketch a new diagram; or,  
If these diagrams are copies and not original work by classmates, you can highlight or circle what you like directly on them.
- Decide how you want to recommend that your class represent the 4 components of the system on the diagram.  
How do you want to represent the biosphere? Do you want to use a tree, or a bird, or both?  
How do you want to represent the atmosphere? Do you want a cloud?  
How do you want to represent the hydrosphere? A stream, or a lake, or a canal?  
How do you want to represent the pedosphere?
- Decide which interconnections among components you want to recommend for the class diagram. Which are the most important?
- Decide about the style of the diagram. Do you prefer simple, or complex? Are there particular kinds of arrows that you want?



Respond to Questions 3 and 4 below *after* you work to develop a diagram as a whole class.

3. For students who developed their own diagrams of the study site in *Activity LC2*: If you were drawing your own individual diagram of the study site as a system all over again, what (if anything) would you change? Why?

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4. What (if anything) would you now add to or delete from your list of the characteristics of an effective diagram, in Question No. 2, above?

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# Study Site Description Form

Today's Date: \_\_\_\_\_ Season Depicted in Class Diagram: \_\_\_\_\_

## **1. School Identification**

1. School Name: \_\_\_\_\_

2. School Address: \_\_\_\_\_  
\_\_\_\_\_

3. Teacher Name: \_\_\_\_\_

4. Class Identification: \_\_\_\_\_

(Note: Since a school may do this activity over a number of years with multiple classes, it is possible that there will be multiple diagrams for the same study site on the GLOBE web site. Therefore, please include here the name of the teacher who guided the development of the class diagram, and any other distinguishing notes about the class):

## **2. Study Site Location**

5. Latitude: \_\_\_\_\_

6. Longitude: \_\_\_\_\_

7. Elevation (in meters): \_\_\_\_\_

8. Is your study site in the interior of a continent (more than 200 km from the coast)?  Yes  No

9. Would you describe your site as urban, suburban, or rural? Please check one:

- Urban (city environment, much of the land surface covered with concrete or other man-made material)
- Suburban (many man-made structures separated by areas of open land, i.e. land not covered with man-made materials)
- Rural (farmland, mainly open land with few man-made structures)

## **3. Climate**

10. Please check one:

- Polar and subpolar (located between 60° latitude and the pole)
- Mid-latitude (located between 30° and 60° latitude)
- Tropical and subtropical (located between 30° latitude and the equator)

11. What is the average precipitation your area gets in a year? Please give your response in cm. (You can get this information from an atlas, your local library, local civil engineer, or local government) \_\_\_\_\_ cm

12. Are there months of the year when your area usually gets more precipitation than during other months?  Yes  No

If yes, during what months does your area usually get more precipitation?

\_\_\_\_\_

**4. Weather**

13. Does your weather usually come from one particular compass direction during the season represented in your diagram of the study site as an Earth system? \_\_\_Yes \_\_\_No

If yes, what *general* direction (N, E, S, or W)? \_\_\_\_\_

**5. Water**

14. Does your study site include part of a body of water, or is it within 100 m of one? \_\_\_Yes \_\_\_No

If yes, please indicate what type of water body it is by checking one below

If no, please go to Question 18.

- Stream
- Canal
- River
- Pond
- Lake
- Bay
- Ocean
- Reservoir
- Irrigation ditch
- None

15. If your study site includes all or part of a body of water, what is its name?

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16. How much of the study site area is covered by your body of water?

Please check one. \_\_\_ A lot (more than 30%) \_\_\_Some (10-30%) \_\_\_ A little (1-10%) \_\_\_ None

17. Does your water body have water present all year, or just some fraction of the year?

Please check one. \_\_\_100% \_\_\_75%-99% \_\_\_ 50%-74% \_\_\_ less than 50%

18. Is your study site within 100 km of a very large lake (larger than about 5000 sq km), or a sea or an ocean? \_\_\_ Yes \_\_\_ No

If yes, in what compass direction is that lake, sea or ocean from your study

**6. Soil**

19. Which of the three traits below best describes your soil? Please check one. (If you are unsure, you may wish to read over the classification of soils in the *Soil Investigation*.)

Sandy (gritty)    Clayey (slippery when wet)    Rocky (rough)

**7. Land Cover/Biology**

20. Describe the land cover. (If you have already collected this information using the *Land Cover/ Biology Protocol*, please enter it here.) Please indicate approximately what percentage of the land is

\_\_\_\_\_ bare (rocks, sand or other soil with no vegetation)

\_\_\_\_\_ paved

\_\_\_\_\_ covered with buildings

\_\_\_\_\_ covered by grass, trees, and/or shrubs

If you wish, provide more information about the land cover at your study site here:

21. What animals live at the study site? Note: You may use whatever knowledge you have of the animals, or use any evidence of animals you may have observed at the study site.

22. Please describe here anything that is special or unusual about your study site:

# Diagramming and Describing the Study Site for Others

## Work Sheet-3: Student Self-reflection Log

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Your responses to the questions below are intended to help your teacher become aware of what you're thinking and what you need help understanding. *You will not be graded on these responses.*

1. What have you learned about what makes the most effective diagram of your study site, that you feel confident about?

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2. What are you having trouble understanding about diagramming, or about your study site as a system?

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3. What would you like to know more about?

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| <b>Assessment Rubric: LC4: Diagramming the Study Site for Others</b> |   |  |  |  |
|--|---|--|--|--|
| <b>Collaborating to Develop a Class Diagram</b>                      |   |  |  |  |
|  | 4   | 3  | 2  | 1  |
| <b>Collaborates</b><br><br>to the ideas of others                    | Always participates fully; actively listens, suggests ideas, and responds<br><br>ideas of others<br>ideas of others | Usually participates fully; listens, suggests ideas, and responds constructively | Sometimes participates; listens and responds constructively to the | Rarely or never participates constructively to the |



| <b>Assessment Rubric: LC4: Diagramming the Study Site for Others</b>         |  |   |   |  |
|--|--|---|---|--|
| <b>Characteristics of an Effective Diagram</b>                               |  |   |   |  |
|  | <b>4</b>   | <b>3</b>  | <b>2</b>  | <b>1</b>   |
| <b>Description of Effective Diagram</b>                                      | Fully describes, explains, and justifies opinions, on the basis of scientific accuracy, completeness, and clarity of communication   | Adequately describes, explains, and justifies opinions, on the basis of scientific accuracy, completeness, and clarity of communication | Partially describes, explains, and justifies opinions, on the basis of scientific accuracy, completeness, or clarity of communication | Inadequately or incompletely describes and justifies opinions  |
| <b>Revisions to Own Diagram and to Characteristics of Effective Diagrams</b> | Fully describes and justifies revisions  | Adequately describes and justifies revisions  | Partially describes and justifies revisions   | Inadequately or incompletely describes and justifies revisions |
| <b>Qualities Desired in Classmates for Collaboration</b>                     | Describes several appropriate qualities, such as willingness to fully engage in the task, ability to contribute constructive ideas, and making constructive responses to the ideas of others | Adequately describes some appropriate qualities   | Partially describes some appropriate qualities  | Inadequately or incompletely describes appropriate qualities   |

| <b>Assessment Rubric: LC4: Diagramming the Study Site for Others</b>                                |  |  |   |  |
|---|--|--|---|--|
| <b>Questions to Describe the Study Site</b>   |  |  |   |  |
|   | 4  | 3  | 2   | 1  |
| <b>Questions to Describe the Study Site</b>   | Suggests scientifically appropriate questions that fully and elaborately study site                        | Suggests scientifically appropriate questions that cover some aspects of study site  | Suggests a few scientifically appropriate questions that cover few aspects of study site                              | Suggests no questions, or suggests scientifically inappropriate questions that inadequately cover the study site                         |
| <b>Learning from Discussion and Comparison of Student Questions and Study Site Description Form</b> | Demonstrates mastery of science concepts and careful thought about best means of describing the study site | Demonstrates satisfactory understanding of science concepts and adequate thought about best means of describing the study site | Demonstrates partial understanding of science concepts and some thought about best means of describing the study site | Demonstrates superficial understanding of science concepts, and needs to think more deeply about best means of describing the study site |