

*Speaking a Common Language: The Need for Standardization in Scientific Research***Table of Contents**

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## Activity D

### *Speaking a Common Language: The Need for Standardization in Scientific Research*

#### Overview

This activity enables students to develop the ability to compare environmental data that has been collected by research teams studying different habitats and ecosystems. When researchers collect data and compare it to that collected by other researchers it is essential that the data is collected using similar methods and are presented in a similar fashion using similar units. Otherwise it would be as if each research team were speaking a different language to one another. Through this activity students will develop an understanding of the importance of standardized methods of data collection and presentation in order to compare or possibly integrate different data sets. These skills will then be used in the other activities when students perform their own scientific research.

#### Learning Objectives

- ✓ Identify a variety of characteristics representative of diverse (or various) habitats
- ✓ Collect data to characterize a community park habitat
- ✓ Establish uniform data collection techniques

#### Relevance

All human beings and other living organisms play an important role in creating their local ecosystem, as well as our global environment. Likewise, it is Earth's habitable system that sustains life, providing vital nutrients, air and water. So understanding how the Earth system works and changes is vital to our survival. What we know and don't know about its inner-workings is in large part determined by the quality and quantity of data we are able to collect and analyze over time and from many different regions around the world. Without a uniform standard for measurements, the data collected in one place would not be comparable with another. We know that Earth is a changing system and it is important to monitor this system so we avoid surprises that may present a variety of environmental and health risks. For example, the world's population is growing exponentially, with urban areas carrying the greatest burden. Many international science and policy organizations have placed a high priority on creating local, regional and global data sets of environmental characteristics or indicators. In order to do this, we have to be measuring the same quantities and in comparable ways.

## *Teacher Preparations*

1. Gather the materials listed below.
2. You will be using the same park and sites that you used in Activity C to conduct this study.
3. Get appropriate permissions. Make sure both school administrators and parents have provided permission. If it is school policy to have parents sign permission slips, be sure that you have done so well in advance of the activity.
4. Review all the documents in the Student Guide for Activity D on the module web site (<http://icp.giss.nasa.gov/education/modules/carbon/>) to be sure you have downloaded all that you need.
5. Work through the activity yourself in depth before having students try the activity themselves.

## *Materials*

Access to a community park or outside area where you conducted your field study in Activity C. A variety of tools to measure and identify different aspects of a habitat which could include: Cameras (traditional film or digital), Forest and Tree Guide (e.g. Eastern Tree Guide), Clinometers, Thermometer, Anemometer, Graph Paper, Ruler, Three cups, Warm water, Ice, Room temperature water.

## *Period 1 – Developing Data Collection Standards for the Field Study*

### **Methods**

#### **Engagement – Preliminary Activity – Relative Temperature**

1. Students place one finger from their right hand into ice water. While at the same time have students place one finger from their left hand into warm water.
2. Have students hold them there for about three minutes.
3. Next, students place both of these fingers into a third cup of room temperature water.
4. After the activity, ask students describe how each finger feels. Open these results into a class-wide discussion.

From this activity students will find that to one finger (the one originally in ice water) the room temperature water will feel warm while to the other finger (the one originally in warm water) the room temperature water will feel cold. Discuss with students how this is analogous to people looking at the same results and interpreting the results differently. If you live in an area like the Northeastern United States you could discuss how in the middle of winter 60 degrees F seems warm while during the summer 60 degrees F seems cold. From this discussion bring up the need to use quantitative measurements when recording data. Also discuss the importance of using specific units of measurement.

If time permits you can have blindfolded students perform the activity in front of the class. In this case you could have one of the students place their hand in ice water and the other student place their hand in warm water. Then place each student's hand in the room temperature water and have them describe the water to the class. This would also lead to a discussion about the difficulty in relying on qualitative data.

## **Standardizing Data**

Now students will determine the most appropriate way to collect the data for their habitat study within the local park. Students begin by thinking through their initial park study and scientific questions guiding this study. First students will decide what kinds of data it is important for each group to collect. Then students will decide the most appropriate methods to follow in order to collect the data. It is important to stress that all ideas are valid. The aim of this activity is to build class consensus on a park study methodology. When each group collects the same kinds of data using the same methods, then all students within the class can use the data from any site to compare with their own habitat study area. In addition, other researchers can use similar methods in parks in other areas of the country or the world.

1. Students begin by reviewing the data they collected in Activity C. Students work within their research groups to identify the specific types of data that they feel is important to gather in order to describe their site. As they fill in Data Sheet 1: Standardized Field Study Techniques, they should list the tools needed to collect each type of information. After completing this initial list, the next task is to describe the most appropriate technique for using each tool. Have students pay particular attention to areas they had difficulty with on their first visit to the park. This would also include types of data that they forgot to collect but now believe would be helpful in characterizing their site.
2. Students make suggestions as to the appropriate size of a habitat area to study. Inform students that it cannot be too big because that would make it too difficult to study in one class period. Too small a site is also not appropriate because then they would not be able to collect enough data to characterize the site. The size information should also be placed on Data Sheet 1: Standardized Field Study Techniques.
3. Allow time for students to present their ideas to the class and to discuss them. While it is important to have all groups present, it is essential that the class come up with a consensus on the data collection before the end of this class period. Without the consensus you will have difficulty collecting the data at the park during the next class period.
4. Decide as a group on the common data, tools and collection methods that the class will use in the park study. It may be helpful to disseminate a handout outlining the new methods at the beginning of the next class period. Then, students will have a set of procedures that all groups are following and that the class has decided upon themselves. Since the class came up with the procedures themselves, hopefully they will feel a sense of ownership and understanding of these procedures and therefore will remain "minds-on" during this "hands-on" activity.

## *Period 2 – Park Field Study Observations: Take 2*

### **Engagement – Preliminary Activity – Standardized data**

List five of the different types of data that the groups will be measuring in today's class period on the board. These may include soil temperature, light intensity, tree type, slope, air temperature, plant-life, and animal-life. Have the students write down the tools they plan to use to collect these data. Call on students to review understanding. Also ask students to briefly describe the methods for collecting each type of data. As a final review, students can name each type of data that they plan to collect and classify it as biotic or abiotic.

### **Methods**

1. Students begin this activity by reviewing the list of data to be collected that was put together during the previous class period. You may have to type this out and make copies in order to facilitate the activity.
2. Divide the students into the appropriate number of groups (five has been suggested). It is probably best to keep the same groups that have been working together since the first park study. Changing groups often can be difficult for students that are not used to changing groups frequently. Use your judgment in this group assignment.
3. Remind students that they are responsible for collecting data that includes:
  - ✓ Identifying species of biotic factors
  - ✓ Quantifying biotic populations
  - ✓ Measuring various temperatures to include air, water, soil
  - ✓ Designating study site/mapping site area
  - ✓ Measuring miscellaneous abiotic factors other than temperature
4. Provide the tools that are needed for the study. It is helpful to assign one student to be responsible for the tools. Also, try to avoid having groups share tools. It can be difficult to keep track of all of the tools.
5. Remind students to switch roles for collecting data and recording the data so that each member gets practice at all activities.
6. At the Park Field Study site designate the habitat study area. As students are waiting, they should look over the area themselves.
7. Have students collect the data by placing the information on Data Sheet 2: Data Collected from Your Habitat Field Study Site.
8. Remind students that they need to double check that they have collected all of the data that was required prior to leaving the study site.

## *Period 3 – Preparing a Research Group Presentation*

### **Preliminary Activity – Engagement**

1. Ask students to write down one finding that they think is the most important from their Park Study. Encourage students to keep their findings to ONE interesting piece of information that they feel is most important to describing their site. After students have had a couple of minutes to write down their ideas, call on students to present their answers. Be sure to at least call on ONE member from each group.
2. Introduce the activity to the students. Students will prepare presentations of their findings to a group of “park professionals” responsible for funding research studies. This could be a group of your colleagues or select one member from each student research group to serve on the panel.
3. The student research groups will present their research findings to this group in a series of FIVE-minute presentations. The presentation should focus on the data that was collected on the different sites, as well as their explanation of why it is important to continue monitoring the habitats within the park. The rationale is that by monitoring them, park professionals will be able to understand and assess changes and ultimately, be more informed to protect our parks.
4. Students should be encouraged to look for interrelationships between the different factors. Since interrelationships are mutually dependent, if one of the factors changes through human or natural disturbances, then other factors are likely to change as well.
5. Remind students to include the following information in their presentations:
  - ✓ State the question you were researching and the habitats you are presenting.
  - ✓ Make sure the park professionals understand what you are presenting and how you have worked to make sure it is accurate.
  - ✓ Briefly describe your work in the park.
  - ✓ Present your results to the group.
  - ✓ Discuss the results in the context of your study of the habitat. Make the connections between different conditions obvious to your audience.
  - ✓ State the conclusion of your study as it pertains to the research question: Why do we need to monitor habitats within the park in order to protect them?

Provide student groups with adequate supplies for them to construct the presentation. The specific type of materials will depend on the type of presentation that the students will be giving (PowerPoint, transparent acetates and magic markers, poster board and magic markers)

### **Group Assessment**

As groups are presenting all members of other groups should be filling in Data sheet 3: Park Survey Table. This will allow students to organize all of the data for the entire park. Once this is done have students answer the Individual Assessment Questions. Discuss the answers with the groups.