LAB 5 Teacher Preparation

Biodiversity and Ecosystems

Purpose

Students will conduct a field investigation to learn about the environment. They will observe biotic and abiotic factors of an ecosystem. Students will use the CBL 2 and a temperature probe to collect data and a graphing calculator to display and analyze data.

Time Requirements

two 45-minute class periods—one for the field investigation and one for data analysis

Advance Preparation

- Select and visit the site. Check for hazards such as debris, poison ivy, steep terrain, or open water. Collect sample data to test the lab.
- Prior to the trip, mark site areas with stakes and letters. Estimate and record the biodiversity level (high, medium, or low) for each site.
- Divide students into groups, assign sites, and assign group members' well-defined responsibilities. Each group should collect data from two sites, each with a different level of biodiversity. Provide clipboards with attached pencils for data collection.
- Plan how you will carry and account for all equipment. Plastic tubs make excellent totes. Tape an index card inside the cover for your inventory. Count items three times—before you leave school, when you are ready to return from the site, and after you return to school.
- Wrap colorful plastic tape on your link cables.
- Precut lengths of string to mark off the square meter (about 4.5 m each).
- Bring extra batteries.
- Reset the memory on the calculators and transfer DataMate.
- Make transparencies of centimeter graph paper. Cut them into 10-cm × 10-cm grids, ten grids for each student group.
- Students can do much of this preparation as an extracurricular activity. Your school's ecology club, honor society, or tech-assistant program has young people that are eager to help. Use PTA volunteers, also.

Safety Information

- Ask students if they have outdoor allergies, such as reactions to bee stings. Take any needed medications along with a first-aid kit and emergency information.
- Review proper attire for fieldwork such as sturdy shoes, socks, pants, and a hat. A fanny pack or small backpack with a water bottle is a good idea. Bug repellent and sunscreen are often needed.
- If available, take along a cell phone.

Teaching Tips

- Observing nature requires patience and practice. Provide students with at least one opportunity before this lab to go outside and quietly observe. Allow them to record their observations in any way they choose—a simple list, a drawing, watercolor, poetry, narrative, etc. Students should be encouraged to share their creations. Differentiate qualitative from quantitative observations and discuss advantages and disadvantages of these two types of data.

Name Date Class

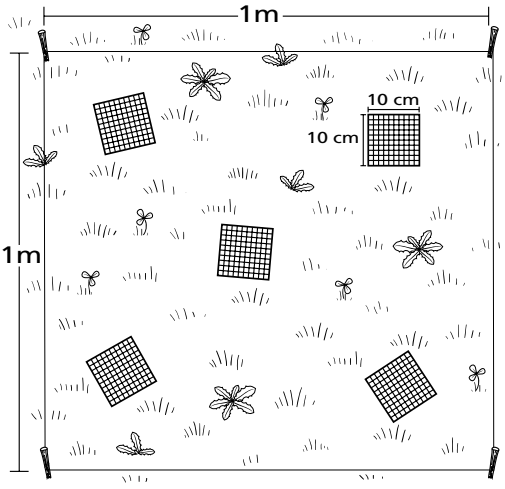
Probeware Activity 5 (continued)

Procedure

Part A: Collecting Plant and Animal Data

1. At your assigned site, measure a one-meter square area and mark it with string and sticks as demonstrated by your teacher.
2. Examine your area carefully. Count the different types of plants. Look for any animals or signs of animal life. Record your observations in **Data Table 1.** You do not need to know the exact name of the plants and animals, but include measurements. A description such as "short (4 cm), thin, yellowish-green grass" is acceptable.
3. Use a trowel to carefully lift out a section of soil. Describe how much effort was needed to remove the soil. Observe the humus layer and record its depth in **Data Table 1.** Replace the soil.
4. Randomly lay five of your 10-cm × 10-cm acetate grids on the ground within your square meter, as shown in **Figure 1.**
5. Using transparency markers, code each small square with a color, number, or symbol to represent the type of plant visible within that square.
6. Repeat steps 1–5 for your second assigned site.

Figure 1



Part B: Collecting Temperature Data

1. Plug the temperature probe into channel 1 of the CBL 2.
2. Turn on the graphing calculator and start DataMate. Press CLEAR to reset the program. The temperature probe should be recognized automatically. If not, turn to page *vi* for instructions on how to set up the probe manually.
3. To investigate the effect of height above the ground on temperature, stand a meterstick in the middle of your sample site. Place the "zero" end on the ground.
4. Put the temperature probe on the ground next to the meterstick. The temperature reading is located in the upper right-hand corner of the calculator screen. Allow enough time for the temperature reading to stabilize. After 30 seconds have passed, record the temperature in **Data Table 3.**
5. Move the probe to the 10-cm mark and repeat the procedure. Measure and record the temperature at each 10-cm increment. Your last reading will be at 100 cm.
6. Repeat steps 1–5 for your second assigned site.
7. After all of your data is collected, select **QUIT.** Follow the directions on the calculator screen.

Cleanup and Disposal

1. Turn off the calculator and disconnect the temperature probe and CBL 2.
2. Return all lab materials to the appropriate location as directed by your teacher.
3. Collect personal belongings and pick up any trash at your site.

Name Date Class

LAB 5 Probeware Activity

Biodiversity and Ecosystems

What lives in your home or on your school lawn? What lives in the wooded areas at the local park? You probably have noticed that some organisms' habitats include both a grassland and a wooded area while other organisms live only in one type of area. In this activity you will play the role of an ecologist in the field. You will observe plant and animal organisms at two different sample sites and collect data using a graphing calculator and a temperature probe.

What You'll Investigate

- What plants and animals live in two ecosystems?
- What is the effect of plant diversity on temperature?

Goals

Observe living organisms in a measured area.
Count the plant types observed using percentages.
Collect temperature data.
Compare the temperature data for two different sites.

Materials

CBL 2 or LabPro unit
TI graphing calculator
link cable
DataMate program
temperature probe
meterstick
string
8 wooden dowels or craft sticks
10 acetate grids (10 cm × 10 cm)
colored transparency markers
trowel
drawing compass
protractor

Safety Precautions

CAUTION: Do not touch or harass animals in the field. Do not eat any fruits, berries, or plant material from the site. Beware of poisonous and thorny plants.

Pre-Lab

1. Predict the type of living organisms you might find in a small plot of lawn.

2. Predict the types of animals you might find in a small plot with more diverse vegetation.

3. List any abiotic factors you could observe at a small site in the field.

4. Describe how you could measure one of the abiotic factors.

Teacher Preparation (continued)

- Familiarize students with how to identify some local plants and insects. Bring along field guides for accurate identification.
- Define humus and show students a soil profile (or a picture of one) so they can see that humus is on top of other soil layers.
- Model laying out a one-meter square, marking it with string and sticks.
- Demonstrate the 10-cm × 10-cm transparency method for counting plant types in the field.
- Ask the math teacher to team with you or have his or her students practice converting from fractions to percentages, calculating averages, and constructing circle graphs.

Extensions

- Investigate Project Globe, an international environmental data effort sponsored by the National Oceanic and Atmospheric Administration (NOAA). This is an opportunity for student data, such as local temperature and land cover descriptions, to be used by scientists worldwide.
- Students are expected to use computers to organize information and to construct tables and graphs. Show students how to use a spreadsheet program with charting capabilities to produce both the circle graph and the scatter plot. Students can produce a lab report using a word processing program and insert their graphs and plots generated with the spreadsheet program.

Pre-Lab Answers

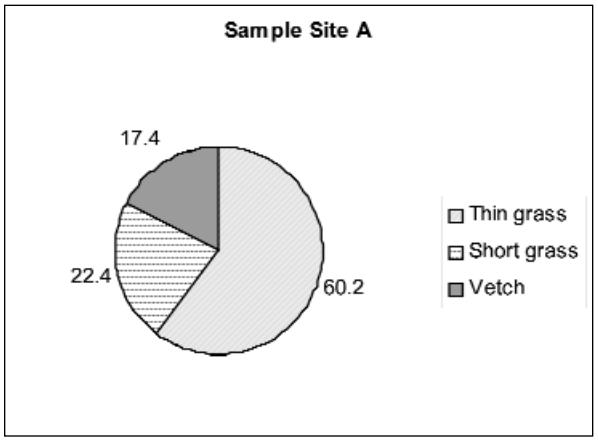
1. Possible answers: various types of grasses, weeds, snails, earthworms, and grub worms

2. Possible answers: rabbits, birds, squirrels, and snakes

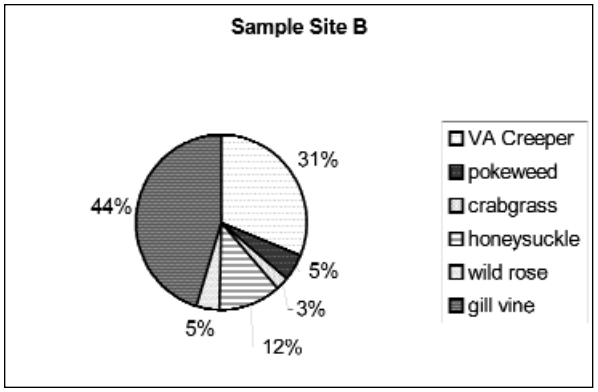
3. Possible answers: temperature, soil pH, humidity, wind speed, and barometric pressure

4. Possible answers: use a tool such as a thermometer, a pH meter, or wind speed indicator

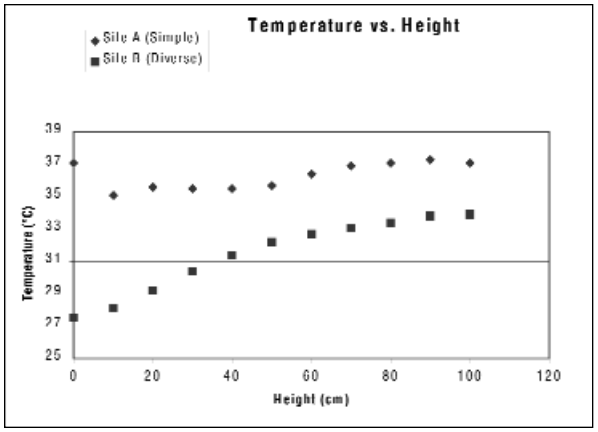
A sample circle graph of a site with a low level of biodiversity is shown below.



A sample circle graph of a site with a high level of biodiversity is shown below.



A sample graph of temperature versus height above ground is shown below.



Name Date Class

Probeware Activity 5 (continued)

Data Table 1: Soil Conditions and Organisms

	Site A	Site B
Plants found	*1. short (4 cm), thin yellowish green grass* *2. taller (10 cm), thick dark green grass* *3. vetch with tiny pink flowers*	*1. Virginia creeper* *2. pokeweed* *3. crabgrass* *4. honeysuckle* *5. wild rose* *6. gill o' the ground*
Animals/Animal signs found	*1. tiny white hopper* *2. two ant hills, no ants visible*	*1. worms* *2. honey bees* *3. beetle* *4. pill bugs* *5. bird in overhanging tree*
Depth of humus (cm)	*0.5*	*12*
Ease of penetrating ground	*hard to dig in*	*very easy, like soft butter*

Data Table 2A: Plant Analysis at Site A

Plant Type	Number of Squares out of 100					Total (of 500)	Percent (%)
	Grid 1	Grid 2	Grid 3	Grid 4	Grid 5		
1. thin grass	*58*	*62*	*65*	*56*	*60*	*301*	*60.2*
2. short grass	*25*	*20*	*30*	*19*	*18*	*112*	*22.4*
3. vetch	*17*	*18*	*5*	*25*	*22*	*87*	*17.4*

Data Table 2B: Plant Analysis at Site B

Plant Type	Number of Squares out of 100					Total (of 500)	Percent (%)
	Grid 1	Grid 2	Grid 3	Grid 4	Grid 5		
1. Virginia creeper	*35*	*25*	*26*	*37*	*33*	*156*	*31.2*
2. pokeweed	*0*	*0*	*0*	*0*	*24*	*24*	*4.8*
3. crabgrass	*10*	*0*	*0*	*3*	*0*	*13*	*2.6*
4. honeysuckle	*0*	*10*	*12*	*20*	*16*	*58*	*11.6*
5. wild rose	*8*	*5*	*10*	*0*	*0*	*23*	*4.6*
6. gill o' the ground	*47*	*60*	*52*	*40*	*27*	*226*	*45.2*

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