Green Ecology

Principle of Plant Biology #12

Plants live and adapt to a wide variety of environments. Plants provide diverse habitats for birds, insects, and other wildlife in ecosystems.

When you look at a group of people, do they all look the same to you? Of course not! We are very good at using small differences to tell people apart. With a little practice, you can have a similar experience when you look at plants. We often look at natural ecosystems as big green blurs in the landscape. Nevertheless, ecosystems contain a diverse array of organisms with unique adaptations. Just as with knowing people, getting to know the plants around you can be very enjoyable and interesting.

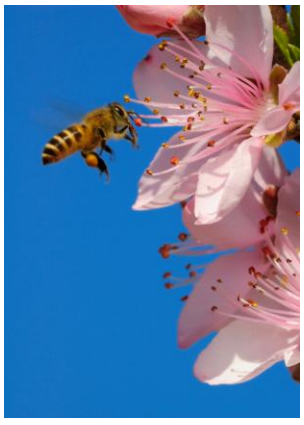
Plants are the foundation of Earth's ecosystems. Because they take in sunlight and create sugar, they are considered the primary producers of ecosystems and the foundation of food webs. They also provide habitat for animals and other organisms. There are around 350,000 species of plants, each one of which harbors a diversity of other organisms.

Humans are also dependent on plants in natural ecosystems. Amazingly, plants in natural ecosystems supply us food, clean our water, produce oxygen to breathe, buffer coastal communities from storms, supply building materials and medicines, etc., and they do it all for free. Can you imagine how much it would cost to perform all of these "ecosystem services" without plants? Plants are "green" in more way than one.

Many of Earth's natural ecosystems are being degraded as humans impact more and more of the planet. The biggest threats to biodiversity include habitat destruction, pollution, invasive species, overharvesting, and climate change. To combat these pressures and preserve biodiversity, scientists are studying the impacts of human practices on ecosystems. Likewise, people throughout society are thinking more about how to live sustainably. Natural ecosystems are among our most valuable assets. We destroy them at our peril.

In the following experiment, you will compare the biodiversity within different ecosystems to better understand your local ecology.

Real-world Connection:
Earth's diverse array of ecosystems contain around 350,000 species of plants, each one of which provides habitat for a variety of other organisms.



Activity: Measuring Biodiversity

Procedure:

1. Find at least two different natural ecosystems. They might be totally different (i.e. forest vs. field) or they might be different in a more subtle way (i.e. edge of a forest vs. interior of a forest).

2. Which ecosystem do you think holds more biodiversity? Write your hypothesis below.

3. Create two plots in each ecosystem. Use a tape measure to ensure that the plots are all the same size, and mark the borders of the plots with flags (or another type of marker). Your instructor may suggest a size for your plots depending on the type of ecosystem and the time that is available. Also, it may be easier to complete Steps 4 and 5 for one plot before moving on to the next.

4. Count the number of plant species in each plot. If you have field guides available, try to figure out the name of each species.

		# of plant species
Ecosystem 1	Plot 1	
	Plot 2	
Ecosystem 2	Plot 3	
	Plot 4	

5. Count the number of species of another type of organism (i.e. insects, fungi, birds, worms, etc.).

		# of _____ species
Ecosystem 1	Plot 1	
	Plot 2	
Ecosystem 2	Plot 3	
	Plot 4	

6. Which ecosystem has more biodiversity? Why might this be the case?

7. What other observations can you make regarding patterns of biodiversity within the plots? For example, how were different species distributed within each ecosystem?

Student-Designed Experiments

Using the methods you learned in the activity above and the "Guide for Student Experimentation" below, design and carry out your own inquiry. Question topics you might consider include how young ecosystems differ from those that are well-established, how ecosystems differ from season to season, how human activities alter ecosystems, etc.

Guide for Student Experimentation

Guidelines for Achieving Great Experiments

1. Ask a very specific, testable question.
2. Test a control for comparison (a group that does not receive the experimental treatment).
3. Use a sample size large enough to allow firm conclusions.
4. To understand a whole population, obtain a random sample of that population to avoid bias.
5. Replicate each part of the experiment (at least 3 times).
6. Hold all variables constant between trials except the variable being tested.
7. Collect quantitative data whenever possible.
8. Measure using metric units.
9. Gather data carefully and accurately.
10. Be objective and honest.

Introduction

Question:

Hypothesis:

Materials and Methods

Independent variable:

Dependent variable:

Experimental constants:

Control:

Protocol:

Results

Data collected:

Other observations:

Graph(s):

Discussion

Interpretation of data:

Conclusions:

Teacher's Guide to "Green Ecology"

Links to National Science Education Standards

Grades 5-8:

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry
- Diversity and adaptations of organisms
- Science and technology in society

Grades 9-12:

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry
- Matter, energy, and organization in living systems
- Science and technology in local, national, and global challenges

Materials

Per group:

- Tape measure
- Flags
- Rope (for marking plot boundaries)

Teaching hints

1. **Field guides:** Field guides corresponding to your local ecosystems are not essential, but will add depth to the activity.

2. **Safety:** Be sure to point out hazards that are specific to your local environment (i.e. poison ivy, falling hazards, etc.)

3. **Successful student-designed experiments**:
   - Emphasize the "Guidelines for Achieving Great Experiments."
   - Before students design experiments, tell them how much time they will have.
   - Allow students to present their experiments and lead a short discussion about each one. Encourage other students to ask questions.

Acknowledgements

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