

NATURE LAB SUMMER CAMP: *Protect Land and Water*

Experiential Project Concept:

A diversity of organisms in a garden is important.

Grade Levels: 3-8

Essential Question:

- How does a garden function as an ecosystem?



Introduction:

By identifying and counting the animals in a specific habitat, scientists monitor species populations to determine if **stressors** - like drought or competition from other species or pollution - are threatening a species.

It's this kind of scientific field work that enables scientists to identify endangered species, like the Giant Panda in China and the Island Fox in California, and take steps to protect them. Scientists often get data from volunteers when they conduct a species census. Every day there are more and more people serving as "citizen scientists" or ordinary people who collect data to help scientists with research.

In this activity, you will collect data in order to determine the diversity of organisms in a garden in your home or neighborhood and to understand how a garden functions as an ecosystem.

Conduct a Species Census

1. You are about to gather data on animals in a garden by conducting a species census. This will require you to **look very closely** and carefully at every part of the garden, to **take notes** on the different garden inhabitants that you see, and **count** how many of each inhabitant you find. (*Warning: If you are allergic to bee stings, please refrain from this activity*)
2. The tables at the end of this packet will serve as data collection sheets when you go outside. We will transfer these data to the website when the survey has concluded. Each part of the table is explained in detail below:

- a. **Organism:** Write in the **common name** of the animal you observe. If you don't know the name, leave this space blank and take a photo of the animal and/or write notes about it in the notes section. You can use a numbered card to hold up in the photo and write the number in the notes section so when you look the photo later, you know which photo corresponds with which notes. After the survey is over, use a field guide to identify the animal.
- b. **Quantity:** Keep a count for each different animal. For example, if you see an earthworm, make one hash mark; then, if you see another earthworm, make another hash mark. Do not count the same animal twice. Some animals, like ants, are hard to count. If you can't count all of the animals, you can estimate and write something like "greater than 50" or "greater than 100".
- c. **Type:** Use the code at the bottom of the chart to identify the type of animal you have observed. These are the same types listed on the website. Write the corresponding code number on the table.
- d. **Where Observed:** Describe where you observed the animal. Try to include both the general location and exactly where the animal was when you saw it. For example:
 - In the tomato patch, crawling on a stem
 - On a maple tree, sitting on the bark
 - In the squash patch, on the underside of a leaf
- e. **Role:** Some animals play a special role in the garden's ecology. Use the code at the bottom of the chart when you observe an animal that plays one of these roles:
 - Pollinators are animals that spread pollen by flying from flower to flower or by crawling into and out of different flowers. Many pollinators are insects, but many birds, such as hummingbirds, can pollinate plants as well.
 - Decomposers usually found in or on the soil, are animals that feed on and help break down decayed organic matter. They play an integral role in the health and productivity of the garden. Worms are an example of decomposers in the garden.
 - Invasive species are non-native organisms that are usually introduced to an ecosystem or habitat from an external source and can play a harmful role in the ecology of the garden. Invasive species can be plants or animals and may disrupt an ecosystem by dominating a region or particular habitat because of the loss of natural controls (predators or other factors in an ecosystem that keep populations of species in check). When introduced to a new ecosystem or non-native habitat, an invasive species can quickly multiply and dominate, negatively impacting native species, because their population is no longer controlled by predators or other factors.
 - Pests also play a harmful role in the garden ecology, but mainly from the gardener's point of view. Aphids and scale insects, for example, which feed on plant sap, can be considered pests when they become so numerous that they weaken or kill a plant. Moles, which burrow through the soil and feed on earthworms, may be considered pests if their burrows disturb plant roots and slow their growth. Gardeners need to be aware of pests like these, so they can protect their plants, and students can categorize an animal as a pest if it seems to be damaging a plant.

- f. **Notes:** Use this space to describe organisms you need to identify later and to take notes on animal behaviors — both how the animal interacts with the garden environment (for example, flying from flower to flower on a specific plant, hiding under a leaf, perching on a garden sign) and how it interacts with other animals (for example, attacking or eating another animal, running to hide from another animal). Evaluate how the animal’s behavior fits into the garden ecology and what role the animal plays.
- g. **Examples of Field Guides for Use in Identification:**
- **All About Birds** (<http://www.allaboutbirds.org/Page.aspx?pid=1189>)
 - **BugGuide** (<http://bugguide.net/node/view/15740>)
 - **eNature.com** (www.enature.com)

COLLECTING DATA IN THE GARDEN

1. Go to your assigned location in the garden. Decide with your family member what measurement of land you will use (i.e- square foot). Make sure you bring the necessary measuring tools.
2. Do not interfere with the animals you observe. No poking, teasing, grabbing, or swatting. Show care for the garden and its inhabitants and try to have the least possible impact on what you are observing so as not to interfere with the data.
3. You will have 30 minutes to collect data in the garden habitat.
4. Keep a detailed and complete record of what you observe – the more consistent and detailed you are in the data you collect, the more scientifically accurate and meaningful the information. If you collect data in a consistent way, you can then compare these data across time periods and to other data you have collected about your garden.
5. Record data on the “Garden” data sheet.
6. After each observation period, you can use the field guides to look up any organisms you couldn’t identify. Don’t forget to use the numbered card in your photograph of the animal so it’s easier to identify later.

COLLECTING DATA OUTSIDE OF THE GARDEN

1. To assess biodiversity in the garden, conduct a test species census using the same method that you used in the garden, in another natural area in your neighborhood. This location could be a lawn or bed of shrubbery where the plant life is less varied.
2. You will have 10 minutes to conduct this survey. Record data on the “Other Location” data sheet.

DATA ANALYSIS

Discuss the following questions:

1. Identify the species that are observed most frequently in the garden. Suggest reasons why we have seen these species so repeatedly.
2. Use your observation notes to investigate the relationship between animals and the plants in the garden.
 - Are certain types of animals almost always seen on or near certain types of plants?
 - Are some species most frequently seen on or near certain parts of plants (leaf, stem, root, flower, etc.)?
 - Are there animals that you observed only when plants are flowering or only when they have produced a fruit or vegetable?
 - What other patterns did you notice?
3. Compare the number of different species you observed at the second, non-garden site with the numbers you have observed in the garden. What did you notice? Use data to support your answer.
4. Complete the environmental “zones” chart below. Use your observation notes to determine whether certain species are found in a specific zone and list them under the appropriate heading in the table.

Environmental Zone Species Comparison		
Shady	vs.	Sunny
Moist	vs.	Dry

Elevated areas (tree leaves, branches)	vs.	Lower areas (soil, ground)

EVALUATION QUESTIONS

Using the data we have collected as a class, answer the questions below:

1. Based on your habitat survey what can you conclude about the diversity of your school garden? Be sure to use data from your survey in your answer.

2. Use your observation notes to describe how the variety of animals and plants in the garden each contribute to the different ecological functions (e.g. water filtration, food production, carbon cycling, and soil health). Describe the ecological functions of at LEAST three things in your garden.

3. Imagine a scenario in which a pest or disease or severe weather conditions (stressors) weaken or kill the plants in a non-diverse habitat such as a field of corn, an orange grove, or a rose garden (*monocultures*). What might happen in these ecosystems?

4. Describe one way to increase biodiversity in a garden habitat.

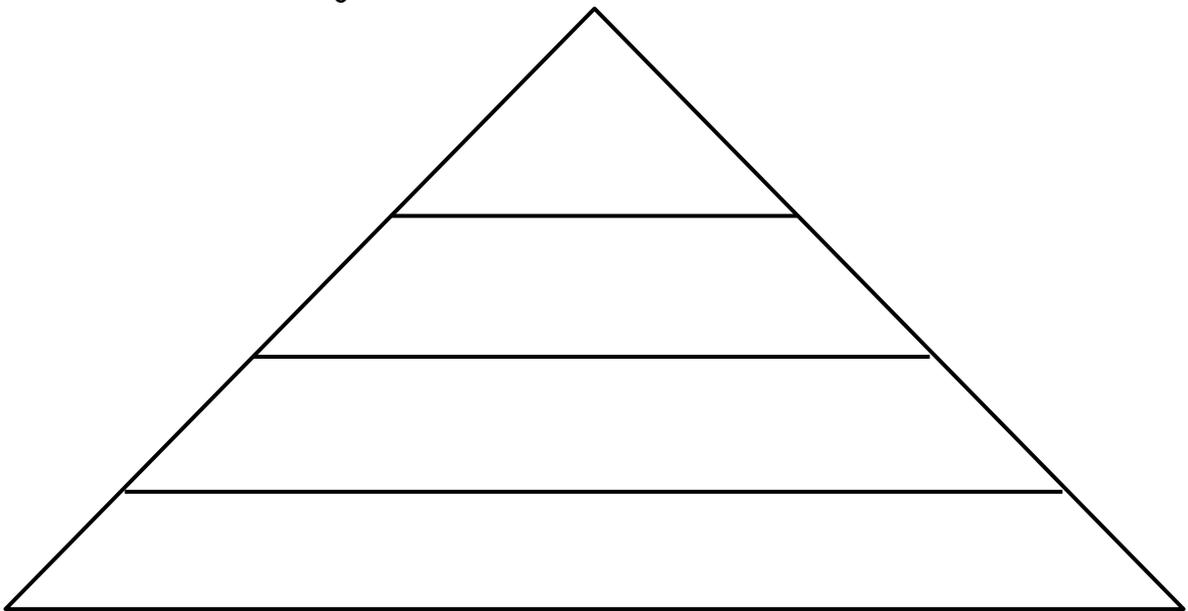
5. Give examples of a producer, a primary consumer, and a secondary consumer in the ecology of a garden habitat.

- Producer:

- Primary Consumer:

- Secondary Consumer:

6. Use your data to create an ecological pyramid depicting the animal and plant life in the garden habitat. An ecological pyramid diagrams energy transfer through an ecosystem, from the producers (plants) at the bottom of the pyramid up through primary consumers (herbivores), secondary consumers (omnivores), and tertiary consumers (carnivores), showing how the amount of available energy and (usually) the number of organisms decreases at each stage.



7. Describe the role of pollinators in a garden habitat.

8. Predict what might happen if all of the pollinators in an ecosystem were wiped out by disease.

9. How does biodiversity at every level strengthen the ecological pyramid and the vitality of the ecosystem?

GARDEN - Habitat Data Collection Sheet

Use this sheet to record your observations of animals in the garden.

Organism – Common Name	Qty	Organism Type	Where Observed	Role	Notes

- Organism Type Code:**
- | | | |
|--------------|------------------------|--------------------|
| 1. Amphibian | 6. Dragonfly | 11. Slug |
| 2. Arachnid | 7. Grasshopper/cricket | 12. Worm |
| 3. Bee | 8. Mammal | 13. Other insect |
| 4. Beetle | 9. Moth/butterfly | 14. Other organism |
| 5. Bird | 10. Reptile | |

- Role Code:**
- a. Pollinator
 - b. Decomposer
 - c. Invasive species
 - d. Pest

