Interactions with Ecosystems

Getting Started: Nutrient Recycling and Plant Growth

Getting Started — Nutrient Recycling and Plant Growth

Learning Outcomes

Students will be able to:

- identify questions to investigate arising from practical problems and issues (208-2)
- define and delimit questions and problems to facilitate investigation (208-3)
- state a prediction and a hypothesis based on background information or an observed pattern of events (208-5)
- use instruments effectively and accurately for collecting data (209-3)
- organize data, using a format that is appropriate to the task or experiment (209-4)
- compile and display data, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, bar graphs, line graphs, and scatter plots (210-2)
- describe conditions essential to the growth and reproduction of plants and microorganisms in an ecosystem, and relate these conditions to various aspects of the human food supply (304-3)
- describe how matter is recycled in an ecosystems through interactions among plants, animals, fungi, and microorganisms (306-2)

Do and Send

Over the next 30 days, you will be growing plants and observing the effect that nutrient recycling has on them. The plants can be bean, corn, or pea but you must use 10 of the same seeds. You will follow the procedure on pages 270 and 271 of the text *Science & Technology 7.*

Separate the seeds into two groups: control and experimental. The control group will be given only tap water while the experimental group will receive nutrient water. A control group allows you to compare the impact that changing one variable (nutrients) will have on the growth of your plants.

While the plants are growing you are required to collect data and write observations. Record this information daily. Make 15 copies of the data table and observation journal on the next page. Keep an observation journal throughout the 30 days. In this journal make notes on the colour, health, and appearance of each of the 10 plants. You should also make note of anything else that you think is important to the experiment. An example of a journal page has been included to help you.

After collecting the data, analyse it by calculating average heights. Plot a line graph using this information. Copy the line graphs provided on the next page. You may photocopy these graphs. When you have completed the analysis, you need to respond to the "Reflecting" question contained in the blue box on page 271 of your text.

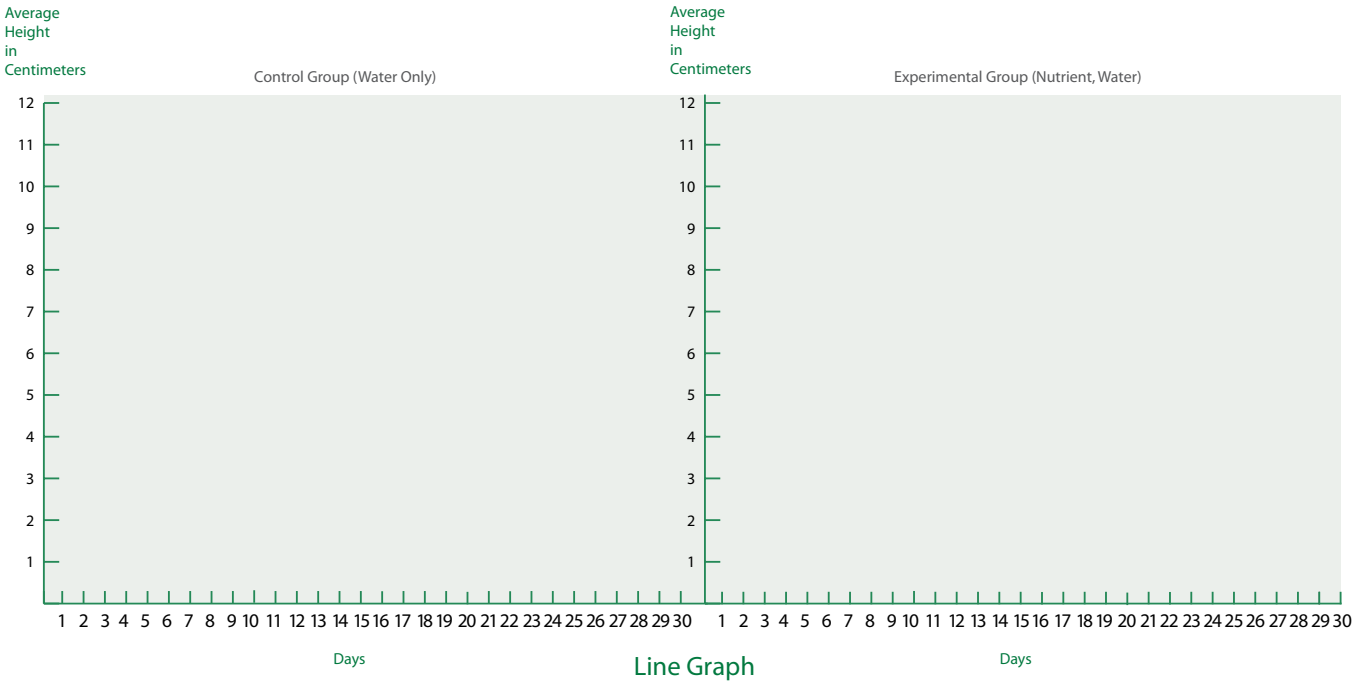
Data Table - Plant Growth

Today's Date _____

Plant Number _____ Control Group ☐ Experimental Group ☐

	Colour (Leaves/Stock)	*Height*	*Circumference*	*Nutrients or Water Amount Added*	*Soil Appearance*	*Room Location and Lighting*	*Room Temperature*
Day 1							

Observation Journal - Write comments detailing any changes you note in the plant or the plants location, room temperature, lighting, or other factors.



Line Graph

Assignment Checklist

Send the following work to your marker:

- ☐ Data Information table (**10** points)
- ☐ Observation journal (**10** points)
- ☐ Calculations of the average heights of the control plants and the experimental plants (**15** points)
- ☐ Line graph showing the average height of the plants plotted against the time in days (**15** points)
- ☐ "Reflecting" response (**10** points)

NOTE: You will need to work on the other lessons in this unit while the plants are growing and you are collecting data. This *Do and Send* activity will be the final assignment for the Interactions Within Ecosystems unit.

Lesson 1 What Do You Know?

Learning Outcomes

Students will be able to:

- identify, delimit, and investigate questions related to a local ecosystem (208-2, 208-3).

Introduction

Read text page 252 to get an overview of this unit.

Do and Send #1

Pages 254 and 255 of *Science and Technology 7* introduce environmental issues facing the planet. After reading each of the issue descriptions, answer the questions contained in that description using what you already know. Do not do any research to answer these questions; the point is to become aware of what you already know and to write your opinions. After you have finished answering the questions contained in each issue description, complete the "Reflecting" exercise text page 254.

Assignment Checklist

Send the following work to your marker:

- ☐ Responses to Environmental Issue 1 (**2** points)
- ☐ Responses to Environmental Issue 2 (**3** points)
- ☐ Responses to Environmental Issue 3 (**3** points)
- ☐ Reflecting exercise (**2** points)

Lesson 2 Discovering Your Backyard

Learning Outcomes

Students will be able to:

- use instruments effectively and accurately to investigate components of an ecosystem (209-3)
- organize and record data collected in an investigation of an ecosystem (209-4)
- describe interactions between biotic and abiotic factors in an ecosystem (306-3)
- identify the roles of producers, consumers, and decomposers in a local ecosystem and describe both their diversity and their interactions (304-2)
- classify organisms as producers, consumers, and decomposers (210-1)

Introduction

To get ready for this activity, read text pages 256-259 and then answer the "Understanding Concepts" and "Making Connections" questions on pages 257 and 259. Compare your answers with those provided in Appendix B, page 110 of this guide.

Do and Send #2

In this investigation you will collect data on the biotic and abiotic factors in your backyard ecosystem. You will observe the living things (biotic factors) and classify them based on how they get energy. Use a thermometer, magnifying glass, and homemade hydrometer to collect information about the non-living things (abiotic factors). Measure temperature and salinity and describe light and moisture levels.

Note: Read the entire procedure and the analysis questions before beginning this investigation.

Materials Required

- thermometer
- magnifying glass (available at dollar stores if you do not have one)
- garden trowel
- self-sealing plastic bags
- masking tape
- solid-coloured straw
- clay
- water-proof marker
- ruler
- 2 small nails
- a tall clear beverage glass
- salt
- distilled water (available at drug stores and most supermarkets)
- measuring spoons
- pH test strips (commercial or homemade)

Procedure

1. Making a hydrometer:

a) Using the water-proof marker and the ruler, mark off the straw into centimeter and millimeter increments. Number the centimeter mark beginning at zero.
b) Use the clay to completely seal one end of the straw. The seal must be water-tight.
c) Fill a clear glass with 250 mL (1 cup) of distilled water. Place the sealed end of the straw in the glass and observe how far the straw sinks into the water. Record this information in a copy of the table below.
d) Remove the straw and add 2 mL (½ teaspoon) of salt to water in the glass. Stir with a spoon. Be careful – do not spill any of the water. Place the sealed end of the

straw in the glass and observe how far the straw sinks into the water. Record this information in the data table.

e) Remove the straw and add another 2 mL (½ teaspoon) of salt to the water in the glass. Stir with a spoon. Be careful – do not spill any of the water. Place the sealed end of the straw in the glass and observe how far the straw sinks into the water. Record this information in the table.

f) Repeat this procedure until the salt you add will not dissolve when stirred. Continue to record data in the table (Add extra lines to your copy of the table if they are needed). Use the table data to estimate the amount of dissolved solids in the water sample from your backyard.

Photocopy this table.

Data Table - Homemade Hydrometer			
Amount of Salt (mL)	Depth of Straw (cm)	Amount of Salt (mL)	Depth of Straw (cm)
0		12	
2		14	
4		16	
6		18	
8		20	
10		22	

Use this data table to record the salinity of water samples that you collece from your backyard. ***Salinity*** *is the amount of dissolved solids in a liquid. These solids could be salt, minerals, soil particles, or other nutrients.*

2. Observing biotic factors:

Follow the procedure in "Try This - A Field Study" on text page 255. If your yard does not have a shady area, mark off an area to record information about open areas and then find a second area in a nearby wooded area to gather data.

Safety Note: Be sure your parent/guardian knows where you are at all times.

Additional Instructions:

a) Use your magnifying glass to help observe insect life on the ground and on the surface of plants. Include the location where you found the insects and what they were doing when found.

b) Use masking tape, and use a water-proof marker to label the soil samples to indicate the location where the sample was taken. Your sample should be one trowel full. When you get home, empty the contents of each bag onto paper towel and spread the soil into a thin layer. Use the magnifying glass to help make observations about the animals/insects in the soil and any plant matter. Indicate the locations from which you took the soil samples on your map of the open and shady areas.

Answer the questions included in *"Try This - A Field Study"* after you have completed all parts of this investigation.

3. Observing Abiotic Factors:

a) Use the thermometer to determine the temperature in the open area and in the shaded area. Record this information in the observation table.

b) Describe, in a general way, how much moisture there was in both areas.

c) Collect a sample of water from both areas after a rainfall. Use a hydrometer and a hydrometer data table to determine

the salinity of the water. Record this information in your observation table.

d) Determine the pH of the water samples using pH test strips. Record this information in the observation table. To make your own pH test strips, turn to "Making Your Own pH Test Strips" in the Appendix A of this guide.

e) Particle size (texture) has a lot to do with a soil's drainage and nutrient holding capacity. Determine the texture of the soil samples using the descriptions below to help you:

- Sand is the largest particle in the soil. When you rub it, it feels rough. It has sharp edges. Sand does not hold many nutrients.
- Silt is a soil particle whose size is between sand and clay. Silt feels smooth and powdery. When wet it feels smooth but not sticky.
- Clay is the smallest of particles. Clay is smooth when dry and sticky when wet. Soils high in clay content are called heavy soils. Clay can hold a lot of nutrients. It does not let air and water through.

Record the texture of each soil sample in the observation table.

Analysis

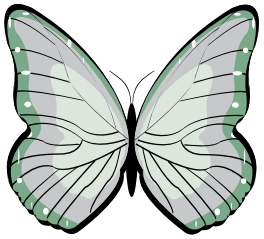
1. From *"Try This - A Field Study"*, text page 255 - Are the shady parts in the study area different from the open areas? Use your observations to support your opinion.
2. From *"Try This - A Field Study"*, page 255 - Speculate on what each of the animals you observed eats. What evidence, that you collected, supports your opinion?
3. From *"Try This - A Field Study"*, page 255 - Make a list of the effects humans have on the living things you observed.
4. Was there a difference between the pH of the water in the open area and the shady area? If so, is the pH different? Explain.
5. Was there a difference in temperature between the open and shady areas? Did this cause a change in the animal and plant life you observed?
6. Salinity and soil texture help determine the types of plants (and therefore animals) that live in an area. Was there any difference in the salinity and soil texture of the areas? Was there a difference in the type and/or number of plants?
7. List the producers (plants) that you identified. List the consumers (animals). Divide your list of consumers into herbivores (plant eaters) and carnivores (animal/insect eaters). List the decomposers (worms, fungi, and the like) that you identified.

Assignment Checklist

Send the following work to your marker:

- ☐ Observation Table (**15** points)
- ☐ Analysis Responses (**15** points)

Lesson 3 Classifying Living Things



Learning Outcomes

Students will be able to:

- distinguish between the following scientific terms: consumer, decomposer, producer, ecosystem, habitat, photosynthesis (109-12)
- explain how biological classification takes into account the diversity of life on Earth, using the terms producer, consumer, and decomposer (304-1)
- explain that observations and identification of similar characteristics enables classification in an ecosystem (109-1)

Introduction

All sciences classify their objects. Chemists use the periodic table of the elements, astronomers categorize celestial bodies as planets, stars, and moons while doctors organize illnesses into groups. Biologists use classification systems to help them make predictions and testable hypotheses about new species by comparing new species to organisms that have already been classified according to their characteristics. You read about the organization of life on pages 258 and 259 of your text. The ability to interpret and construct classification systems is a basic and important skill for students of science.

Within ecosystems, organisms are classified as producers, consumers, and decomposers. Read text pages 266 and 267 of *Science and Technology 7* to refresh your memory of these organisms.

Do and Send #3

1-5 Read text pages 262 and 263 then answer the "Understanding Concepts" and "Making Connections" questions from page 263.

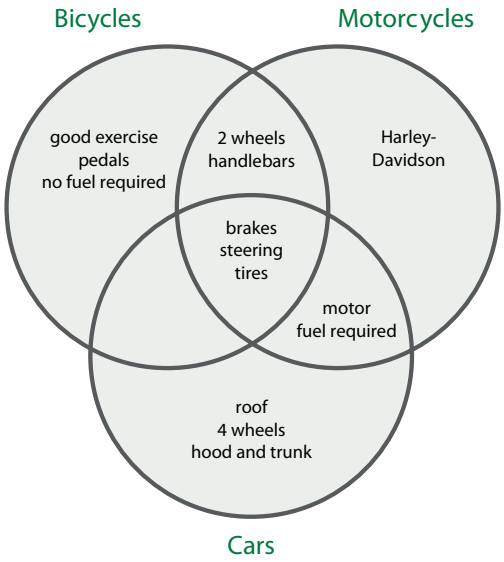
6. Create four food chains using organisms from the compost heap food web on text page 267.
7. Complete a Venn diagram to distinguish between *producers*, *consumers*, and *decomposers*. A sample Venn diagram comparing bicycles, motorcycles, and cars has been provided to refresh your memory of this technique. This sample is on the next page.
8. Use the form on the next page to compare and contrast the terms "*habitat*" and "*ecosystem*". You may use a dictionary to help you with the definition of *habitat* and *ecosystem*.

Assignment Checklist

Send the following work to your marker:

- ☐ Answers to A Landfill Ecosystem questions from page 263 (**10** points)
- ☐ Four food chains (**4** points)
- ☐ Venn diagram (**10** points)
- ☐ Compare and contrast (**6** points)

Sample of Venn Diagram



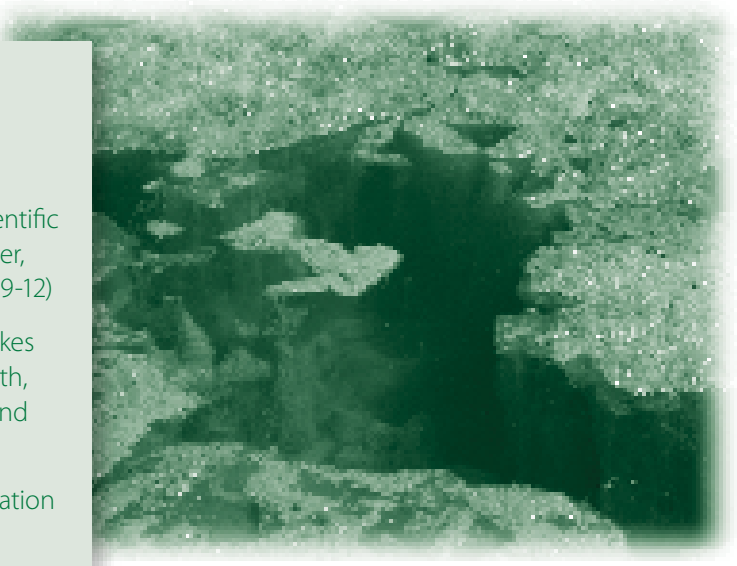
Compare and Contrast

COMPARE	How are *habitats* and *ecosystems* **alike?**

CONTRAST	How are *habitats* and *ecosystems* **different?**

Write a statement to compare and contrast the two terms.

Lesson 4 Microbes in Ecosystems



Learning Outcomes

Students will be able to:

- distinguish between the following scientific terms: consumer, decomposer, producer, ecosystem, habitat, photosynthesis (109-12)
- explain how biological classification takes into account the diversity of life on Earth, using the terms producer, consumer, and decomposer (304-1)
- explain that observations and identification of similar characteristics enables classification in an ecosystem (109-1)
- provide examples of how knowledge of microorganisms has resulted in the development of food production and preservation techniques (111-1)

Introduction

What do mosquitoes, cold viruses, and bread mould have in common? They are organisms humans would happily live without. Yet, they have a purpose in daily life. In Do and Send assignment 4, read about other organisms that we may not like that play a role in the health of humans and the planet.

Do and Send #4

Read *"Microbes in Ecosystems"* on pages 268 and 269 of *Science and Technology 7* to complete "Understanding Concepts", "Making Connections", and "Reflecting" on page 269.

Assignment Checklist

Send the following work to your marker:

- ☐ Understanding Concepts #1-3 (**9** points)
- ☐ Making Connections #4 (**6** points)
- ☐ Reflecting (**5** points)

Lesson 5 Food Webs

Learning Outcomes

Students will be able to:

- demonstrate the importance of choosing words that are scientifically appropriate by using these words in context: niche, habitat, population, community, ecosystem (109-13)
- prepare a chart that describes how energy is supplied to, and how it flows through, a food web (210-2, 306-1)
- apply the concept of a food web as a tool for interpreting the structure and interactions of a natural system (111-6)

Introduction

Food chains show the flow of energy through organisms from producers to herbivores to carnivores and on to other carnivores. A food chain is a simple way to look at an ecosystems. The feeding relationships within an ecosystem usually involve many food chains that overlap one another. When food chains overlap, they become a food web.

These definitions help you to understand organisms within an ecosystem:

Niche - the role an organism plays within a community.

Habitat - the place where an organism lives is called its habitat.

Population - is a group of organisms of the same species that live in the same area at the same time.

Community - is composed of all of the populations that live and interact with each other in a particular area.

Ecosystem - is a community of organisms interacting with each other and with abiotic factors in their environment.

Do and Send #5

Cut out the cards on the next page. Use them to complete these questions.

1. List each of the organisms and describe its (a) niche and (b) habitat.
2. These organisms form a community. What abiotic factors does this community interact with?
3. Use the feeding information on each card to arrange the cards into a food chain. You must make 5 chains. Use each organism at least once.
4. Use the cards to create a food web. Draw the food web on looseleaf. Connect the organisms so that energy flows from the food to the consumer.

Assignment Checklist

Send the following work to your marker:

- ☐ List of organisms' niches and habitats (10 points)
- ☐ Abiotic factors for the community (5 points)
- ☐ Five food chains using the cards (5 points)
- ☐ Food web of the 10 organism cards (10 points)

Organism Cards

Owl

- eats mice, squirrels, bats, skunks, birds, rabbits, rats, snakes

Frog

- eats small insects such as bugs, flies, mosquitoes, and spiders

Water Snake

- eats tadpoles, fish, frogs, and insects

Porcupine

- eats leaves, twigs, bark, and most other plant life

Grasshopper

- eats any plant life

Worm

- break down dead and decaying materials on and in the soil for food

Sheep

- eats any plant life

Bacteria / Fungi

- break down dead and decaying materials

Grass

- uses photosynthesis to convert energy from the sun into sugar
- absorbs nutrients from soil and water

Oak Tree

- uses photosynthesis to convert energy from the sun into sugar
- absorbs nutrients from soil and water

Lesson 6 Other Ways of Looking at Energy Flow

Learning Outcomes

Students will be able to:

- identify the strengths and weaknesses of a diagram showing the flow of energy in an ecosystem (210-3)
- describe how matter is recycled in an ecosystem through interactions among plants, animals, fungi, and microorganisms (306-2)
- identify and evaluate potential applications of the recycling of matter in an ecosystem (210-12)
- describe conditions essential to the growth and reproduction of plants and reproduction of plants and micro-organisms in an ecosystem, and relate these conditions to various aspects of the human food supply - air, light, temperature, moisture (304-3)

Introduction

Food chains and food webs are two ways to show the flow of energy through ecosystems. Another representation is the ecological pyramid. Read pages 274 and 275 of *Science and Technology 7* to become familiar with ecological pyramids. Complete "Understanding Concepts", "Making Connections", and "Reflecting" on page 275. Compare your answers with those provided in Appendix B of this guide.

Do and Send #6

1. Read "The Water Cycle" on pages 278 and 279. Complete "Understanding Concepts" #1-4 and "Making Connections" #5-6 on text page 279.
2. Read pages 286 and 287. Complete "Understanding Concepts" #1-2 and "Making Connections" #3-4 on text page 287.

Assignment Checklist

Send the following work to your marker:

- ☐ Understanding Concepts #1-4, page 279 (**6** points)
- ☐ Making Connections #5-6, page 279 (**4** points)
- ☐ Understanding Concepts #1-2, page 287 (**2** points)
- ☐ Making Connections #3-4, page 287 (**8** points)

Lesson 7 The Cycling of Matter

Learning Outcomes

Students will be able to:

- describe how matter is recycled in an ecosystem through interactions among plants, animals, fungi, and microorganisms (306-2)

Introduction

In Lesson 6 you learned how water cycles through nature. This assignment deals with the cycling of carbon through an ecosystem.

Do and Send #7

Read pages 290 - 293, then complete "Understanding Concepts" #1-5, "Making Connections" #6, and "Exploring" #7 on page 293. In order to complete "Exploring" you will need to research to construct a display. Be sure to keep a list of your sources of information to identify which information came from which source. Your display needs to fit on legal-size paper.

Assignment Checklist

Send the following work to your marker:

- ☐ Understanding Concepts #1-5 (10 points)
- ☐ Making Connections #6 (10 points)
- ☐ Exploring #7 (10 points)

Lesson 8 Ecological Succession

Learning Outcomes

Students will be able to:

- identify signs of ecological succession in a local ecosystem (306-4)
- predict what an ecosystem will look like in the future on the basis of the characteristics of the area and the long-term changes (succession) observed in the site (208-5)

Introduction

Ecological succession is the process of change in the structure of an ecological community over time. Within a community species may become less abundant over time, or they may vanish from the ecosystem. At the same time, other species within the community may become more abundant, or new species may enter the community from adjacent ecosystems. This observed change in an ecological community over time is "ecological succession".

Do and Send #7

Comple the case study on Succession for this assignment. Read pages 296 - 299 and then complete "Understanding Concepts" #1-3 and "Making Connections" #6 on page 299.

Assignment Checklist

Send the following work to your marker:

- ☐ Understanding Concepts #1-5 (10 points)
- ☐ Making Connections #6 (10 points)
- ☐ Exploring #7 (10 points)

The Food Chain Mystery

In the mid-1990's the Royal Society for the Protection of Birds noticed a rapid fall in the South Asian vulture flock. The Society's alarm increased after learning the flocks millions of birds number only a few thousand at the turn of the century. The Society examined the eight vulture species in the region to hopefully discover the source of the decline. For years the near extinction was a scientific who-done-it. By 2000 the American Peregrine Fund began to use it resources to research the enigma. In early 2004 the Peregrine Fund's research solved the mystery.

The Peregrine Fund researchers learned South Asian farmers treated their cattle with a drug to combat inflammation. They observed that cattle treated with the drug did not always recover and those that died shortly after a treatment were left for the vultures. A single tainted carcass was fed on by many vultures. Each vulture required only a single feeding to be poisoned by the same drug. The Fund reported the findings to government to hopefully start the process of rebuilding the flocks.