Coastal zone

Waste Not

Decomposers play an important role in food webs, but their influence on the planet does not stop there. Throughout this unit, students have become familiar with examples of decomposers, and they have learned that, in their quest to obtain energy, decomposers ensure that nothing in nature is wasted.

Students have also gained understanding of how decomposers return nutrients to all ecosystems, where they help complete the cycles and processes on which all ecosystems depend. Human communities also depend this ability to "recycle" nutrients to help manage their waste streams.

Lesson 4 introduces students to the wastewater treatment system and the involvement of organisms such as plankton and bacteria in waste management. Class discussion enables students to recognize that, whether on land or in a body of water, decomposers are present and necessary to all ecosystems and that humans rely on the health of those ecosystems to ensure that their communities stay healthy.

Learning Objective

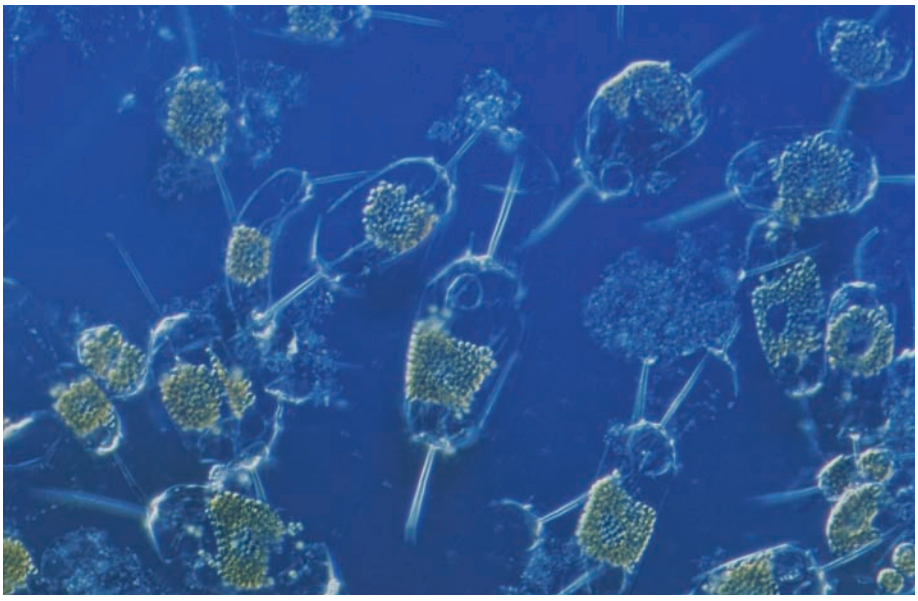
Provide examples of human practices that directly depend on the cycles and processes involving decomposers in terrestrial, freshwater, coastal, and marine ecosystems (e.g., their role in food production and waste management).

Describe the dependence of human practices on the cycles and processes that occur in terrestrial, freshwater, coastal, and marine ecosystems (e.g., the role of decomposers in: food production through soil formation and fertility; waste management through the decay of waste products).

Background

There is no such thing as "waste" in a natural system. All living things need nutrients and energy to live, and everything in a natural system is a source of nutrients or energy (or both) for some organism in the system. As an animal processes food, the body absorbs some nutrients and excretes others. The excretions are still of value, particularly to decomposers that like their food "preprocessed."

While still in the intestines, bacteria go to work on what will eventually be excrement. As they feed, they release carbon, nitrogen, and oxygen from the matter that passes through the digestive tract. The body's cells absorb and use some of these chemicals; the body discharges the rest.



Phytoplankton

"Waste" that has left the body of the animal continues to feed the bacteria present. Other decomposers now join those decomposers, and the "feast" continues. Eventually the decomposers process all of the matter in the excrement, cycling it back into the surrounding environment.

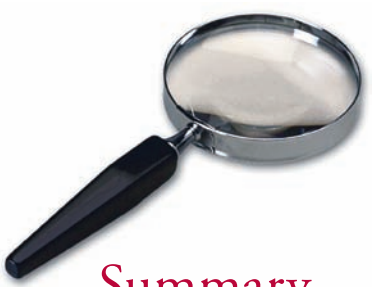
Human communities make great effort to carry away and contain bodily wastes. The bacteria that decompose waste are helpful to humans in our intestines but can be harmful to our health if allowed to infect other parts of our bodies. Humans build complex sewage and wastewater treatment systems that work to keep our communities healthy. But these systems depend wholly upon bacteria and other decomposers continuing to work on the "waste" they collect.

For many communities in California, the ocean is the final step in a city's wastewater treatment process. The "waste" that goes down our drains and toilets travels first to a treatment facility, where bacteria are encouraged to continue decomposing the dissolved organic matter in the wastewater. Then the system pumps the wastewater into a natural body of water, such as the ocean. Bacteria and plankton in the ocean use the nutrients in the remaining organic matter, releasing the nutrients into the surrounding marine ecosystem.

Key Vocabulary

Waste management: The system of collecting, transporting, and processing waste created by humans.

Toolbox



Summary of Activities

Students interpret a diagram showing a wastewater management system. They discuss the presence of particular organisms that help decompose matter in the system. Students answer questions about the waste management system and humans' dependence on decomposers to make the system work.

Instructional Support

See Extensions & Unit Resources, page 30.

Prerequisite Knowledge

Students should have:

- completed previous lessons.

Advanced Preparation

Gather and prepare Materials Needed:

- **My Decomposition Book**

Gather and prepare Visual Aids:

- Prepare transparencies.

Add to Word Wall.

Materials Needed

A-V equipment:

- Overhead or LCD projector, screen

Class supplies:

- Colored pencils (optional), pencils, transparency markers

Visual Aids

Transparencies:

- **Wastewater Treatment Plant**, Visual Aid #9
- **Wastewater Management System**, Visual Aid #10

Duration

Preparation Time
15 min.

Instructional Time
50 min.

Safety Notes

None

Activity Masters in the Supporting Materials (SM)

No Activity Masters are required for this lesson.

Procedures

Vocabulary Development

Use the **Unit Dictionary** and the **Vocabulary Word Wall Cards** to introduce new words to students as appropriate. These documents are provided separately.

Step 1

Distribute students' copies of ***My Decomposition Book***. Instruct students to turn to pages 7 and 9, where they drew diagrams of food webs and decomposers in forest and marine ecosystems.

Ask students, "Where do you see waste in your diagrams?" (*The earthworm castings in the forest; the bird waste on the rock by the tide pool; the dead fish in the tide pool; the fallen leaf on the forest floor.*) "Are these things really waste?" (*No, bacteria or other decomposers feed on the waste, so it is not really "waste."*) "Do you think all waste is useful to some other living thing?" (*Yes, since the waste still contains nutrients, a decomposer can feed on it.*)

Step 2

Point out the new Key Vocabulary term and definition on the word list and have students locate "waste management" on page 10 of ***My Decomposition Book***. Have students read the definition aloud and copy it onto the correct space on page 2. Ask students to name parts of the waste management system that they know. (*Answers will vary but may include recyclables, recycling bins, trash, trash cans, garbage collection, sewer, landfill, dump, and sewage treatment plant.*)

Ask students if they think decomposers break down the "waste" in their community and recycle the nutrients back into the environment. (*Answers will vary.*) Tell students that the waste management system in their community works very hard to make sure that these nutrients are recycled; such systems rely on decomposers to help do this.

Step 3

Display the **Wastewater Treatment Plant** (Visual Aid #9) on the overhead or LCD projector. Tell students that their community has a place like this to help manage the safe decomposition of waste and the cycling of nutrients. These places are "wastewater treatment plants." Explain that many people in their community work in the waste management system, and some work at the wastewater treatment plant. Tell students that decomposers work at these plants too, and that humans could not do their jobs without them.

Step 4

Have students turn to page 10 in ***My Decomposition Book*** and examine the diagram on the page. Place the transparency of the **Wastewater Management System** (Visual Aid #10) on the overhead or LCD projector and walk students through the process using this sequence:

- First, pipes called sewer lines carry away the wastewater created in your home. (Have students find the sewer lines on their copy of the diagram.)
- The sewer lines from each house come together at certain points and the pipes carrying the wastewater get bigger. These large pipes take the wastewater into the wastewater treatment plant. (Have students locate where the sewer lines from the houses come together to form the community sewer line.)
- At the plant, the wastewater goes into a big tank, where it becomes very still. When this happens, anything that is solid sinks to the bottom of the tank. What goes to the bottom of the tank is taken out and put in a special container called a "sludge digester." (Have students locate the settling tanks and the digester in the diagram.)
- The wastewater at the top of the settling tank is drained into big pools called "basins," where air is pumped through the wastewater and chemicals are sometimes added. (Have students locate the aeration basins on the diagram.)
- Then, the wastewater is pumped out of the basins and into a lake, river, or the ocean. (Have students locate the outlet that drains into the larger body of water on the diagram).

Step 5

Ask students to think about where decomposers work in this system. Using a transparency marker, mark the following places in the system shown on the transparency of the **Wastewater Management System**, while students do the same on the diagram on page 10 in their copies of ***My Decomposition Book.*** Explain the following as you mark the diagram:

- Bacteria are everywhere, so decomposers are already breaking down the waste in your home. They travel through the sewer lines in the wastewater, decomposing the waste on the way. (Put a mark on the sewer line coming from the house.)
- In the stillness of the settling tanks at the wastewater treatment plant, the bacteria reproduce and grow, continuing to break down the matter in the water. (Put a mark on the settling tank.)
- In the sludge digester, the people working at the plant help the bacteria to grow. They make the environment in the digester just right for the bacteria to grow and feed like crazy! (Put a mark on the sludge digester.)
- The wastewater that goes into the pools and then into the lake, river, or ocean still has some living bacteria. These bacteria continue to feed on the matter that is contained in the water. Bacteria in the lakes and rivers, or bacteria and plankton in the ocean release the rest of the nutrients back into the environment. (Put a mark on the large body of water.)

Step 6

Ask students, "What would happen if there were no decomposers in this system?" (*The "waste" would not get broken down and would pile up. Nutrients would not be released back into the environment.*) Point out that now they know what happens to the nutrients that made it to the lake, river, or ocean in the wastewater, but what do they think happens to the nutrients in the sludge digester? (*Answers will vary, but may include the idea that the nutrients are probably used somewhere.)* Tell the class that they will learn about those nutrients in the next lesson.

Step 7

Ask students to answer the questions on pages 11–13 in ***My Decomposition Book.*** When they are done, collect students' work to use in assessment.

Lesson Assessment

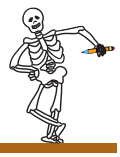
Description

Lesson 4 teaches students that decomposers are essential components of human waste management systems, specifically wastewater treatment systems. Students document decomposers' presence in the system on page 10 in ***My Decomposition Book*** and then answer questions requiring them to describe the dependence of human practices on the decomposition process and nutrient cycle.

Suggested Scoring

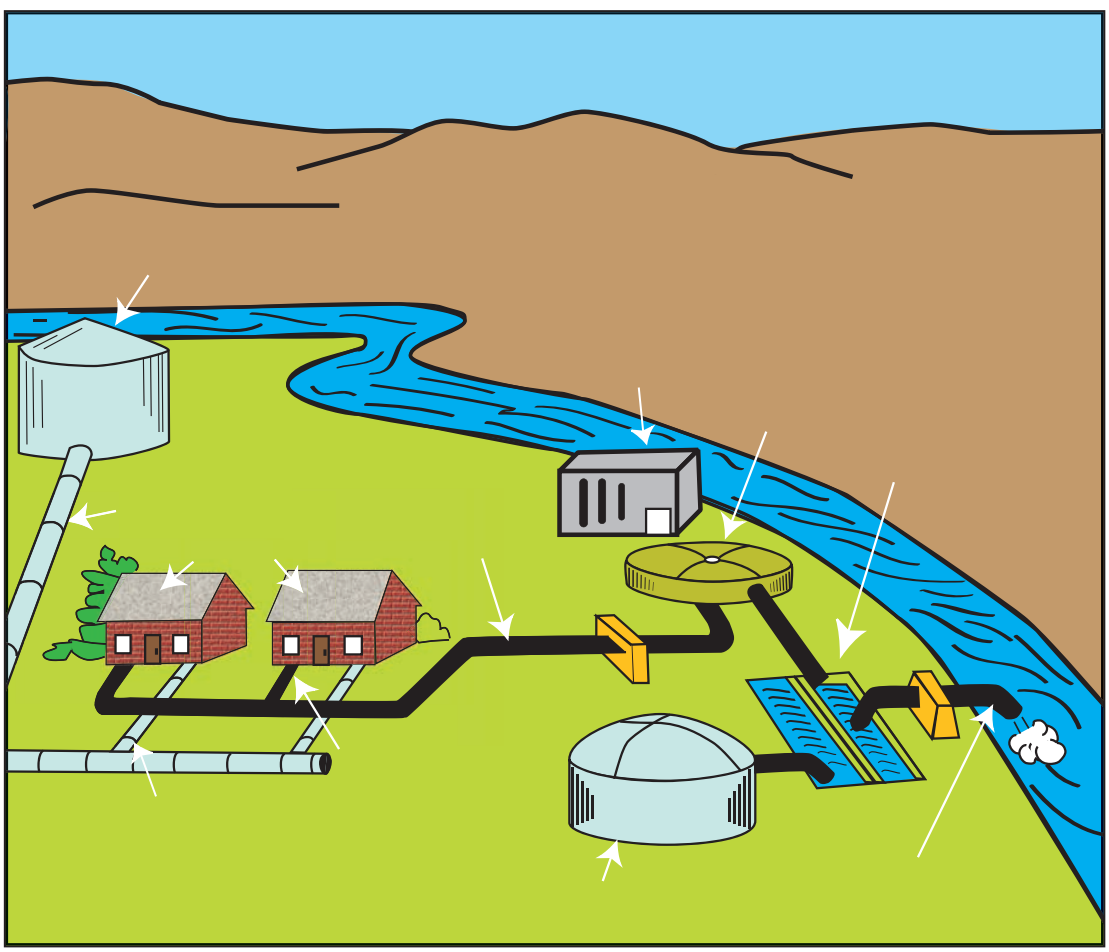
Use the Answer Key and Sample Answers on page 77–78 to assess students' work.

Answer Key and Sample Answers



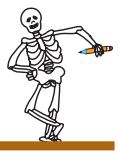
Our Wastewater Management System

This drawing shows a wastewater management system. Go through each part with your teacher. Then mark where decomposers work in the system.



10

Our Wastewater Management System



We Could Not Do It Without Them!

Think about what you have learned about decomposers and decomposition.

Then answer these questions:

1. How do decomposers help all living things?

They break down waste and help recycle nutrients back into the environment so that other living things can live and grow.

2. How do communities manage waste by using decomposers?

Communities use decomposers to break down the waste from homes. Decomposers work in wastewater treatment plants. Humans put wastewater into lakes, rivers, and the ocean, hoping that the decomposers will break down wastes there.

3. Circle the organisms that are part of the wastewater management system:

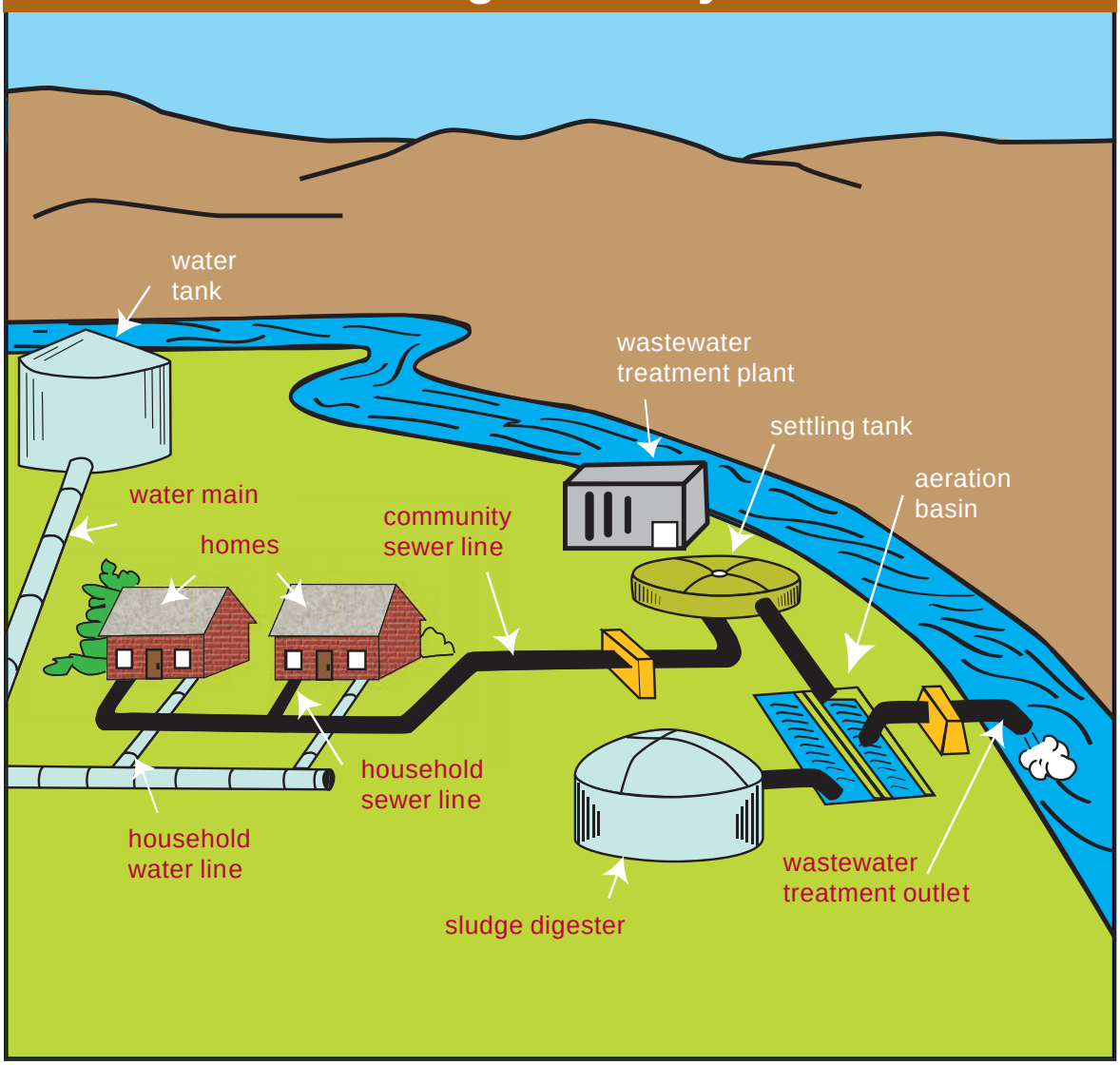
mold bacteria sea gulls sludge plankton scavengers

11

9 **Wastewater Treatment Plant**
Visual Aid — Transparency

Wastewater Treatment Plant

10 Wastewater Management System

Visual Aid — Transparency

Wastewater Management System