

10. What happens if dissolved oxygen levels in a pond get too low?
11. Why are all the organisms in an ecosystem interdependent?
12. Explain what happens to a stream, from the headwaters to the delta.
13. What is the role of plankton in aquatic ecosystems?
14. Share specific examples of the special adaptations of plants and animals that live in freshwater ecosystems.
15. Why have humans built most of the world's major cities along rivers?
16. What impacts have humans had on freshwater ecosystems?
17. Wetlands are described as an ecotone. What does that mean?
18. Why do you think that wetlands were once considered to be wastelands?
19. What is an important function of wetlands?

Follow-up Discussion

Research indicates that students will retain their previous misconceptions about a topic, in preference to new information, until they actively recognize and correct their own errors. Therefore, it is important to have your students re-examine the facts/beliefs they put on their "Everything We Think We Know About..." list. It might also be helpful to review the list by marking each entry with a "+" or "-" to show which facts were correct and which were incorrect.

Thought-provoking discussions provide a good way to assess the overall depth of student understanding. The following are some suggested discussion topics.

- If you were a creature who lived in a freshwater ecosystem, which type of freshwater environment would you prefer to live in, and what types of adaptations would you need to survive there?

Follow-up Activities

- Arrange a field trip to a freshwater ecosystem (pond, lake, creek, marsh, bog or river). Using field guides, have students observe and identify different organisms found there and construct a food web that shows how interdependent the living things in the ecosystem are on each other and abiotic factors. Conduct some studies of temperature, pH, dissolved oxygen, and plant and animal life, through a 24-hour period or throughout the year.
- Have students research and report on local water resources and the agencies responsible for protecting their own watershed. A great source of background information is "Water: From the River to You" which can be downloaded at www.acnatsci.org/education/river.

Suggested Internet Resources

Periodically, Internet Resources are updated on our Web site at www.LibraryVideo.com

- thechalkboard.com/Corporations/Dow/Programs/1998_NSTA/1998%20Lessons/unit798.html
This Web site, sponsored in part by the National Science Teachers Association, has a number of detailed lesson plans that explore the concept of "parts per million" and laboratory activities that illustrate that a very small amount of a pollutant can affect an entire aquatic ecosystem.
- www.acnatsci.org/education/skytosea/clean.html
The Academy of Natural Sciences developed this Web supplement titled "Water: From Sky to Sea" that contains instructions for a model wetland.

Suggested Print Resources

- Barrett, Katharine and Carolyn Willard, *Aquatic Habitats: Exploring Desktop Ponds*. Lawrence Hall of Science, Berkeley, CA; 1998.
- Hibbert, Adam. *Freshwater Pond*. Crabtree Publishing, New York, NY; 1999.
- Lisowski, Marilyn and Robert A. Williams. *Wetlands*. Franklin Watts, New York, NY; 1997.
- Martin, Patricia. *Rivers and Streams*. Franklin Watts, Danbury, CT; 1999.

TEACHER'S GUIDE CONSULTANT

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TITLES

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| • CONIFEROUS FORESTS | • GRASSLANDS |
| • DECIDUOUS FORESTS | • MARINE ECOSYSTEMS |
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Freshwater Ecosystems

Grades 5–8

Students in grade 5-8 classrooms possess a wide range of background knowledge. Student response to this video program is sure to be varied, so the teachers at these grades need all the help they can get! This guide has been designed to help the 5-8 science teacher by providing a brief synopsis of the program, preview and follow-up questions, activities, vocabulary and additional resources.

Before Viewing: Extensive research tells how important it is for the teacher to discover what the students know — or think they know — about a topic, before actually starting a new unit. Therefore, after prompting discussion with the pre-viewing questions, lead your class to create an "Everything We Think We Know About..." list. You may also wish to preview key vocabulary words, and have students raise additional questions they hope will be answered.

After Viewing: Have your students share video excerpts that fascinated or surprised them, then challenge your students to prove or disprove the accuracy of the facts they put on their "Everything We Think We Know About..." list. Discuss what else they learned and use the follow-up questions and activities to inspire further discussion. Encourage students to research the topic further with the Internet and reading resources provided.



Program Summary

Biomes are large regions of the world that have similar characteristics, and are usually named for the dominant feature of the area. There are land biomes and aquatic biomes, each made up of many different ecosystems. An ecosystem is an area where communities of living things interact with each other and with nonliving things like soil and water. Freshwater ecosystems include ponds, lakes, streams, rivers and wetlands. They can be as small as a puddle or as large as a raging river. The variety of living things in a freshwater ecosystem depends on many factors, including the movement and the temperature of the water and the amount of dissolved nutrients and pollutants in the water.

Only three percent of Earth's total water supply is fresh water, and two-thirds of that is locked within glaciers and polar ice caps. The remaining one percent is distributed among all of the world's freshwater ecosystems. Freshwater ecosystems can be divided into two main types: standing water and running water. Standing water ecosystems include ponds, lakes and wetlands. Streams and rivers are running water ecosystems. Wetlands such as marshes, bogs and swamps represent an environmental transition between ecosystems called an ecotone.

Aquatic environments can have layers, involving differences in sunlight, temperature and plant and animal life. The photic zone is the surface layer which sunlight can penetrate. This is the layer in which photosynthesis takes place, and is also known as the "layer of life" because this is where most of the animals and plants live. The benthic zone is dark and supports less life.

Ponds and lakes are bodies of water totally surrounded by land. They form when depressions in the ground fill with water from rivers, springs, rain, melting snow and surface runoff. Ponds are usually much smaller and shallower than lakes, and can be formed by natural obstructions in streams, such as beaver dams. Sunlight can usually penetrate to the bottom of ponds, supporting rooted plants. Lakes are usually deep enough to have both a photic and a benthic layer, with differences in temperature from top to bottom. In summer, growth of algae and surface plants can accelerate to the point of preventing the sunlight from reaching the plants below the surface. Similarly in winter, when the surface freezes over, both plants and animals can die as a result.

Most running water ecosystems begin at high altitude headwaters as melting snow and ice, while some begin as underground springs. As streams travel quickly downhill, they combine with other streams. These are called tributaries. As they flow, they begin to pick up sand, minerals, soil and organic material from along the shores as the stream reaches more level ground and the waters slow down. Many tributaries join to form a river. Over the course of the river, the water becomes thick with sediment, eventually turning the water muddy. Where a river meets the ocean, it deposits the balance of its sediment, creating a fertile area called a delta. Streams and rivers generally have less vegetation than ponds and lakes, with plants taking root in the mud near the banks.

Vocabulary

The following words are included for teacher reference or for use with students. They are listed in the order in which they appear in the video.

biomes — Large regions of the world that have similar characteristics, usually named for the dominant plant life in the area. Biomes contain specific kinds of plants and animals.

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ecosystem — A place where communities of living things interact with each other and with nonliving components such as soil and water.

freshwater ecosystems — An aquatic biome defined by the presence of water with a salt concentration of less than one percent. Freshwater ecosystems are present on every continent, and in every climate zone, and can be classified as standing water or running water.

abiotic factors — Non living things like water, air, sunlight, minerals, soil, climate, wind and fire.

biotic factors — All the living or once-living organisms in an ecosystem.

photic zone — The part of a body of water through which sunlight can penetrate. "Photo" means light. It is where photosynthesis occurs, where there are higher levels of oxygen, and where most plants and animals live.

benthic zone — The layer in a body of water that lies beneath the photic zone. This dark area stretches down to the bottom, and supports less life because of the lack of sunlight.

oxygen — A gas (O₂) that is released by plants as a byproduct of photosynthesis and is required for the survival of all living things. The life that an aquatic ecosystem can maintain is dependent upon the amount of dissolved oxygen in the water.

ppm — Parts per million. A unit of concentration often used when measuring levels of pollutants or nutrients in water. One ppm is 1 part in 1,000,000.

lakes — Large depressions in the Earth filled with standing water. Most lakes have both a photic and a benthic zone, with two temperature layers. The bottom is usually too deep to support rooted plants except near the shore.

ponds — Small depressions in the Earth filled with standing water from rivers, springs, rain, melting snow, surface runoff or natural obstructions in streams, such as beaver dams. Ponds usually have a consistent temperature throughout and rooted plants at the bottom.

interdependent — The term used to describe animals that are reliant on each other for support and survival. All the organisms in an ecosystem are interdependent.

plankton — Tiny free-floating organisms that live in great numbers in the photic zone of all bodies of water. There are two types: plant-like phytoplankton that produce oxygen through photosynthesis and zooplankton that feed on phytoplankton.

food chain — The path that energy takes as it moves from the sun and passes from organism to organism in an ecosystem.

streams, rivers — Bodies of flowing water moving in one direction. Many people use the term stream to describe small bodies of flowing water. Streams are formed by melting ice or snow in high elevations, or from underground springs or lakes.

headwaters — The origin of a stream or river, also called its source.

tributaries — Streams of flowing water that join with the headwaters to form rivers.

sediment — Small particles of minerals, sand and organic matter that are picked up by fast flowing water.

delta — An area with rich soil, formed where slow-moving rivers filled with sediment meet the ocean.

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habitat — The specific environment where an animal lives; this includes physical and biological factors such as temperature, climate, light and the presence of food and shelter.

fish ladders — A series of elevated pools, built along the sides of dams to help fish like salmon swim upstream to breeding grounds.

wetlands — An ecosystem that is covered by water for part of the year. Wetlands are a transition between standing and flowing water, and include marshes, bogs and swamps.

ecotone — An ecosystem that is a transition between two other ecosystems. Wetlands make the transition from freshwater to saltwater or from freshwater to land biomes.

species — Organisms that are similar in appearance and can mate to produce offspring.

naturalist — A scientist who studies the interaction of living things in an ecosystem and communicates information to the public.

bioindicators — ("biological indicators") Ways to measure the health of an ecosystem.

Pre-viewing Discussion

Before students generate their list of "Everything We Think We Know About..." for this topic, stimulate and focus their thinking by raising these questions so that their list will better reflect the key ideas in this show:

- Where does the world's fresh water come from?
- How are humans dependent on freshwater ecosystems?
- How do plants and animals that live in ponds and rivers obtain oxygen?

After the class has completed their "Everything We Think We Know About..." list, ask them what other questions they have that they hope will be answered during this program. Have students listen closely to learn if everything on their class list is accurate and to hear if any of their own questions are answered.

Focus Questions

1. What is a biome? What is an ecosystem?
2. What are some examples of land biomes?
3. Where are freshwater ecosystems found?
4. What are some examples of freshwater ecosystems?
5. How much of Earth's total water supply is fresh water? How much of that is contained in freshwater ecosystems?
6. What are the biotic factors of an ecosystem? How are they affected by the abiotic factors?
7. How can water temperature influence the plants and animals in an aquatic ecosystem?
8. What are some differences between standing water ecosystems and running water ecosystems?
9. What is the "photic zone"? Why is it also called the "layer of life"?

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