

River Biomes: Essential and Endangered

1 videocassette..... 26 minutes

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INTRODUCTION

River Biomes: Essential and Endangered provides students an overview of the many facets of river ecosystems. It describes different kinds of rivers, how they are formed, what kinds of life inhabit them, and how different living things have adapted to the specific conditions found in them.

The video examines how people interact with these essential biomes. It shows how rivers have provided transportation networks and resources such as fish. It describes how rivers have been threatened by pollution and the steps people are taking to protect and conserve these important ecosystems.

The video is appropriate for grades 4 through 8.

VIEWING THE VIDEO

The video is divided into different segments, each with its own subtitle. One segment examines the physical characteristics of rivers. Another focuses on plant and animal life and how they adapt to different conditions. A final section looks at how humans interact with river ecosystems.

While the program can easily be viewed in one sitting, some teachers may find it more convenient or useful to show the segments on different days.

SUMMARY

The program begins by showing students investigating the Saw Kill, a tributary of the Hudson River. The program then describes how a river is a biome, an area that has a certain kind of community of plants and animals. A river is different from other biomes because it doesn't have a characteristic climate. Like ponds and lakes, rivers are freshwater biomes, but they are different from lakes or ponds because they flow from one place to another.

The video then uses the Hudson as an example of how a river passes through many kinds of environments. It starts at the source of the Hudson in the Adirondack Mountains, and shows how the river changes as it flows south to New York Harbor.

Rivers and the Land

This segment describes how rivers help shape the land. It uses the Salt River of Arizona as an example of how rivers erode and cut through a landscape. The Badlands of South Dakota are an example of how ancient rivers left layers of sedimentary material that were later eroded. It describes how much of the eroded material of the Badlands eventually reaches the Mississippi, and how the Mississippi deposits sediment at its mouth, forming a delta.

River Life

This segment opens with students in New York City examining fish that live among the piers of lower Manhattan. The video then describes other forms of river life. It shows how algae is able to adhere to rocks by secreting a glue-like substance. It depicts a riparian habitat along a desert river. A naturalist, Jean McAvoy, describes river estuaries and tidal marshes.

The video shows how rivers are important habitats for birds. The program then focuses on students aboard the Clearwater, a Hudson River sloop that is a floating classroom. Among the activities, the students gather samples of crabs and fish and examine phytoplankton under a microscope. The video describes how phytoplankton get their energy from photosynthesis and are food for other forms of river life.

People and Rivers

In this segment the video makes the point that people are part of a river ecosystem. Using the Hudson River as an example, the video describes how people have used the river for commercial fishing and transportation networks. The program describes how industries were established along the Hudson's shores. The program also describes the effects of pollution, particularly the dumping of chemicals called PCBs into the Hudson .

The video then shows abandoned factory buildings along the waterfront of the village of Hastings-on-Hudson. Roger Panetta, a historian of the Hudson River, describes how many industries have declined along the Hudson in the last 50 years, partly because of the development of highways as alternate transportation networks.

The program then discusses how people have become actively involved in restoring and protecting rivers.

The video ends with a brief summary.

OBJECTIVES

After viewing the program students will be able to:

1. define the characteristics of river biomes.
2. describe how rivers affect and shape the landscapes through which they flow.
3. give examples of animal and plant life in river biomes and how they adapt to their environments.
4. describe the human impact on river biomes, particularly the effects of industry and development.

REVIEW QUESTIONS

1. What is a biome?
A biome is a place that has a community of certain types of plants and animals.
2. How are river biomes like lakes and ponds and how are they different?
Both types of biomes are freshwater biomes. Ponds and lakes, however, are restricted to one location while rivers can flow over long distances.
3. What is a watershed?
A watershed is the area of land that a river and its tributaries drain.
4. How do rivers shape the land through which they flow?
Answers may vary. The video describes how erosion can cut into the land and how rivers can deposit sediment.

5. What is a delta?
A delta is formed where a river deposits silt at its mouth.
6. What is a riparian habitat?
A riparian habitat is the habitat along the bank of a river.
7. What is an estuary?
An estuary- is the part of a river that is influenced by both the river's freshwater current and the ocean tides.
8. What is a tidal marsh?
A tidal marsh is a marsh that is affected by daily tides.
9. What are phytoplankton and why are they important parts of many food chains?
Phytoplankton are microscopic plants that float in the water. They make their own food by using the energy of the sun during photosynthesis and are sources of food for other kinds of river life.
10. Why have many industries, towns, and cities developed along rivers?
Rivers provide convenient ways to transport goods and people.

ACTIVITIES

1. Ask students to compare river ecosystems to another biome, such as a rain forest, grassland, or desert. Have them compare a river's plant life and animal life to those of the biome they have chosen. Ask them how the conditions of each biome affect the kinds of life that live there.
2. Have students research and report on a river animal or plant and describe how it has adapted to its environment. Students can report in more detail on a plant or animal depicted in the video, or choose a different one.
3. Ask students to draw a river food chain showing how energy flows from the sun to plants and from plants to animals. After students have illustrated different chains, have them combine their information to construct a more complex food web.
4. Ask students to research and report in more depth on different threats to rivers and what can be done to alleviate these threats. Possible topics include habitat destruction and pollution.

Students can write to some of the organizations listed in the appendix for more information.

5. Have students discuss ways they can help reduce threats to river biomes.
 - They can participate in river cleanups. Contact the Save Our Stream Program of the Izaak Walton League of America for more information. Their address is listed in the appendix.

- Students can reduce the amount of toxic chemicals that reach river waters by helping their families dispose of old paint, motor oils, pesticides and other chemicals properly rather than pouring them down drains or into storm sewers. Students should contact their local sanitation departments for more information about how to dispose of these chemicals.
- Students can write letters to local, state and national government officials urging them to take steps and enact legislation that help protect river ecosystems.

Students who have access to the internet can use this as a source for information about river biomes and efforts to protect them. There are several organizations with web sites focused on the Hudson River. Below are their web addresses.

Clearwater: www.clearwater.org Scenic

Hudson: www.scenichudson.org Hudson

Riverkeeper: www.riverkeeper.org

GLOSSARY

algae: simple plants that live in contact with water

biome: region of the earth that has characteristic kinds of life, particularly plants

delta: area of silt, often triangular in shape, deposited by a river where it flows into the ocean

detritus: decomposed plant and animal matter

ecotone: border between two biomes

erosion: wearing away and moving of rock, soil, and dirt from one place to another

estuary: area influenced both by a river's freshwater current and an ocean's tides

flyway: route taken by migrating birds **groundwater:**

water beneath the surface of the ground **nutrients:**

materials needed for energy and growth

PCBs (polychlorinated biphenyls): class of chemical compounds believed to cause cancer

photosynthesis: process by which light energy is used by plants to make food

phragmites: kind of grass found in marshes that is tolerant of brackish water

phytoplankton: microscopic plants that live drifting in water

riparian habitat: habitat along a river's bank

sediment: matter that settles to the bottom of a liquid

sloop: type of sailing boat

source: highest body of water leading into a river **tidal**

marsh: marsh affected by daily tides

tributary: stream or river that flows into another stream or river

watershed: total area of land drained by a river

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Struggling to Survive: Tropical Rain Forests
Temperate Deciduous Forests
Threats to Biodiversity: Why We Should Care
Treasures of the Deep: Our Ocean Resources
Wetland Biomes: Essential and Endangered

APPENDIX: ORGANIZATIONS TO CONTACT

American Rivers
801 Pennsylvania Avenue SE
Suite 400
Washington, DC 20003
(200) 547-6900

Hudson River Sloop Clearwater, Inc. 112
Market Street Poughkeepsie, NY 12601
(845) 454-7673

Friends of the Earth 218 D
Street, SE Washington, DC
20003 (202) 543-4312

Global Rivers Environmental Education Network
(GREEN)
721 East Huron Street
Ann Arbor, MI 48104
(313)761-8142

National Wildlife Federation
1412 Sixteenth St., NW
Washington, DC 20036

National Resources Defense Council
40 W. 20th St.
New York, NY 10011

The Nature Conservancy
1800 North Kent Street
Arlington, VA 22209

River Network P.O. Box
8787 Portland, OR
97207 (503) 241-3506

Save Our Stream Program Izaak
Walton League of America 707
Conservation Lane Gaithersburg,
MD 20878-2983 (301) 548- 0150

Scenic Hudson 9 Vassar
Street Poughkeepsie, NY
12601

Sierra Club
30 Polk Street
San Francisco, CA 94109

SCRIPT

Male Narrator

On a warm autumn day, students from the Linden Avenue School in Red Hook, New York take a field trip to a stream called the Saw Kill.

Wading out into the current, one student gathers a sample of the water. Then they test the water to see how acidic it is and to measure the concentration of chemicals, such as phosphates and nitrates, that may have washed into the stream.

The students also do a variety of other tests, including stretching a line across the stream bed to help determine the rate at which the water flows.

Female Narrator

The Saw Kill is only one river among many...each with its own characteristics. Some are small.

Others, like the Mississippi, are huge. The Mississippi essentially divides the United States in two as it winds its way from Minnesota to the Gulf of Mexico.

There are rivers still largely unaffected by human contact, and rivers forever changed by humans.

All rivers, however, are a type of biome. A biome is a place that has a community of certain types of plants and animals.

Male Narrator

There are several major kinds of biomes. Some, such as grasslands and rain forests, are terrestrial, or land-based, biomes.

Others are aquatic, or water-based. A coral reef, for example, is a saltwater marine biome. Ponds and lakes are freshwater biomes.

A river is also a freshwater biome; but a river is different from a lake or pond because a river's water is not restricted to one area. Instead, a river flows, often over long distances.

A river biome is different in other ways. Most other biomes have a characteristic climate that is important in determining the kinds of plant and animal life that live in them. Cacti, for example, are suited for the dry conditions of a desert.

A river's climate, on the other hand, is largely determined by the other biomes through which it flows. There are rivers in deserts, and rivers in the jungles of a rain forest.

Female Narrator

Even when looking at just one river, its environment may be hard to define. A river constantly moves; and, as it moves, it changes.

The Hudson River is one example. Where the Hudson flows past Manhattan, skyscrapers offer a dramatic backdrop as it empties into New York Harbor. Here, nature takes a secondary role. The city scape is largely covered by asphalt and buildings, and the river's shores are lined by busy and noisy highways.

Three hundred and fifteen miles north of Manhattan the setting is very different. Instead of the din of human activity, the quieter sounds of nature echo in the forests of the Adirondack Mountains. This, too, is part of the Hudson's environment, for this is where the Hudson begins.

Male Narrator

The Hudson's source lies near the summit of Mount Marcy, the Adirondack's highest peak. A river's source is the highest body of water leading into the river. Here, water collects from rain and melting snow.

All rivers flow downhill, pulled by the force of gravity towards the sea. Water flows down the slopes of Mount Marcy. At first, what will become the Hudson is only a stream, but this stream grows in size as other streams join it. Ground water, water that lies underground, seeps into the growing stream.

The Hudson's shape and contours depend in part on the land through which it flows. As it leaves the Adirondacks at Rockwell Falls, the river is channeled through a narrow gorge. Here, the current is very fast.

Female Narrator

Below the Adirondacks, the Hudson is no longer a wild river. In places it is controlled and contained by dams, the most southern of which is this dam at Troy, New York.

In Albany, the river's channel has been dredged and deepened to make it navigable by large ships.

Continuing south, the Hudson narrows as it flows past the Hudson Highlands; but then it broadens again at Haverstraw Bay. Haverstraw Bay is the Hudson's widest point.. about three and a half miles across.

Then the river changes character again as it flows past the cliffs of the Palisades, and under George Washington Bridge.

Finally, the Hudson flows past Manhattan and empties into New York Harbor and the waters of the Atlantic Ocean. The Statue of Liberty is a final landmark at the end of the river's journey.

Male Narrator

While the Hudson changes often in its journey south from Mount Marcy, its influence reaches way beyond the confines of its banks.

Every stream and river drains an area of land called a watershed. The Hudson and its tributaries drain a watershed that consists of much of New York State and parts of Vermont, Massachusetts, Connecticut, and New Jersey.

This watershed is small compared to that of the Mississippi. The Mississippi and its many tributaries together drain most of the interior of the United States. The water in places as far apart as Montana, Pennsylvania, and Arkansas eventually reaches the Gulf of Mexico by way of the Mississippi.

But rivers do more than drain the land through which they flow. They help shape the land.

Subtitle: Rivers and the Land

Female Narrator

In Arizona, the Salt River snakes its way through canyons hundreds of feet deep. This spectacular landscape is the result of forces that have sculpted it over many millions of years.

The earth's surface is constantly changing, and water is one of the most important agents of change. Running water wears away the earth's surface through erosion, the breaking up and moving of rock and soil.

Running water and erosion wear away the rock and soil in two ways. The water carries sand, pebbles, and even boulders that grind the rock, just as sandpaper wears away the surface of a piece of wood. At the same time rapidly flowing water removes the rock and soil, washing it away.

Male Narrator

Another way rivers shape the land is by depositing the materials they have eroded and transported from somewhere else. The unusual landscape of South Dakota's Badlands is the result of both the depositing and erosion of rock and soil.

The spires and buttes of the Badlands are marked by distinct bands of rock and clay. Many of these bands are the result of sediment laid down at different times over millions of years when ancient rivers flooded their banks.

Then, starting about 500,000 years ago, erosion began to slice through the soft sedimentary layers...exposing them as clearly as a knife exposes the layers of a cake.

The rock and clay eroded in the Badlands washes into the White River, which gets its name from the milky color of the sediment in its current. The faster a river flows, the more sediment it can carry.

Much of the White River's sediment reaches the Mississippi, whose current carries the sediment, along with sediment from other places, downstream. As the Mississippi

reaches the Gulf of Mexico, it slows down and dumps huge amounts of the sediment picked up along its journey, forming a delta. A delta is a layer of silt deposited by a river where it flows into the ocean.

Female Narrator

From beginning to end, a river shapes the land in many ways. All along its path, a river also shapes the lives of many different kinds of plants and animals.

Subtitle: River Life

Female Narrator

On Pier 26 in lower Manhattan, New York City students participate in the River Project, an environmental organization dedicated to researching and protecting the Hudson River. Among other things, they study the life that exists along the city's shoreline.

Here, students raise a basketlike net from the river near where it empties into the harbor. They then take their catch and measure it as part of an ongoing project that documents the kinds of life that exist among the piers of lower Manhattan.

Male Narrator

A river's many environments influence the kinds of life that live in its water and along its shores.

Three hundred and fifteen miles north of Manhattan, in the Adirondack Mountains, the flowing current determines what kinds of plant life can exist in midstream.

Most plants could not survive in the fast-flowing water, which would easily break stems and prevent roots from taking hold; but if you look closely, you can see that some

of the rocks in the water are covered by algae. The algae secrete a kind of mucus that acts like a glue and enables the algae to adhere to a rock.

Female Narrator

The border between a river and the land provides another kind of environment known as a riparian habitat. A riparian habitat is an example of an ecotone, a border between two biomes...for example, a river and a desert.

The water in a river or stream makes it possible for vegetation to grow, even where, only a short distance away, it couldn't survive because conditions would be too dry. Along the banks of desert rivers in Arizona, there is enough moisture for plants such as cottonwood trees to survive. Cottonwood trees drop their seeds into the water, where they are carried downstream.

A riparian habitat provides a zone where not only plants, but also animals thrive. Birds such as hummingbirds nest in these green spaces, and river otters survive by feeding on fish.

Male Narrator

Another kind of ecotone is an estuary, a place influenced by both river and ocean biomes. This is Jean Valla McAvoy, a naturalist who studies the estuaries of the Hudson.

Jean McAvoy

Some rivers are special in that part of their length is very close to sea level, and that means that not only can water flow down from the mountains and out to the sea but that the pulse of the tides can push ocean water back up that channel. The portion of the river that feels the effects of the

water coming down and the water pushing back... that's the estuary. It's marked by a mix of freshwater coming down and ocean water coming up.

Male Narrator:

Jean McAvoy is a naturalist at the Tivoli Bays on the Hudson. If you stand on the banks of the Tivoli Bays at low tide, the muddy bottom is exposed near the shore; but if you look closely you can see the effects of the rising tide. Water slowly but steadily covers the exposed mud. In a few hours, the scene is very different as the Tivoli Bays become filled with water.

One part of the Tivoli Bays is a tidal marsh. The plant life in a tidal marsh consists of soft stemmed plants, mainly different kinds of grass. These plants have to be able to adapt to very changeable conditions.

Jean McAvoy

Tidal marshes are places of tremendous change. Besides the change in water level...you have extreme changes in temperature. At high tide your feet are cooled by the waters of the river... At low tide you're in sun-baked mud.

Male Narrator

The plants in a tidal marsh also have to adapt to changes in salinity. The water in a tidal marsh may at times be mostly fresh and at other times very salty. The grass in this marsh in Piermont, New York, is mainly phragmites, which is well adapted to tolerating brackish water, water that is a mixture of fresh and salty water.

In the autumn, much of the plant life in a tidal marsh dies and decomposes, forming a nutrient-rich muck called detritus. Detritus is an important source of food for bacteria;

and other kinds of life, such as clams and worms, feed on the detritus and the bacteria that coat its surface.

Female Narrator

All along most rivers, aquatic birds such as ducks and geese are common. Many rivers, including the Hudson, are flyways, which means that they are routes along which ducks, geese, and other birds migrate north in the spring and south in the fall.

Harder to see than birds are the many kinds of life that live below the river's surface; but it is possible to explore this environment as well.

On a late October day, students from the Hackett Middle School in Albany help bring in a net that has been dragged along the bottom of the river. They are on board a boat called the Clearwater. The Clearwater is a type of sailing ship called a sloop. Sloops were used to carry cargo up and down the Hudson from the 1600s to the 1800s.

Today, the Clearwater is used for different purposes...to teach people about the Hudson and the kinds of life that live in it. Sean Madden, an educator with the Clearwater, talks about some of the life caught in the net hauled aboard by the students.

Sean Madden

Another cool thing about blue crabs, they're what's known as swimming crabs. Their last appendage is flattened into a paddle. You find them swimming right up near the surface. They're excellent, excellent swimmers.

Female Narrator

The students aboard the Clearwater use a microscope to look at phytoplankton in a sample of river water.

Phytoplankton are microscopic plants that float in the water. Like other plants, phytoplankton use the energy of sunlight to manufacture their own food. Phytoplankton are important parts of many food chains because other living things feed on them. Even fish and other creatures that don't themselves eat plankton may feed on things that do.

By catching and eating river fish, even we humans become part of the food webs of a river. In fact, humans affect river biomes in many ways.

Subtitle: People and the River

Male Narrator

People have depended on rivers for many reasons. Before there were highways or railroads, rivers were often the most convenient way to get from one place to another. Towns and cities grew along river shores as centers of trade and commerce.

Up until the early 1800s, commerce on rivers depended on sailing ships. These ships, however, were at the mercy of winds and tides.

The steamboat revolutionized transportation along the world's rivers. No longer dependent on currents, tides, or winds, these boats could go upstream almost as easily as downstream.

Another type of steam engine revolutionized travel even more. Many of the first railroads were built along the shores of rivers, where it was far easier to lay tracks. Along with shipping, railroads contributed to the rapid industrialization along rivers.

Female Narrator

There were other kinds of commercial activity along the nation's rivers...particularly fishing.

For centuries, fishermen on the Hudson caught sturgeon, shad and other fish. The fishing industry supported thousands of fishermen and their families... but this is no longer true.

Since 1976, fishing for many kinds of fish in the Hudson River has been banned or restricted because it was discovered that this factory had for years dumped chemicals called polychlorinated biphenyls, or PCBs, into the water. Settling to the bottom of the river, these chemicals have been ingested by many kinds of fish and pose a risk of cancer to people who eat these fish.

In the most heavily contaminated areas, access to the river has been restricted altogether because of the health risks. Over 25 years after the dumping of PCBs was stopped, they continue to pose a risk, and there has been ongoing debate about how best to remove these pollutants.

Male Narrator

Abandoned factories on the waterfront of the village of Hastings on Hudson are an example of other problems. For over a hundred years, the Hastings waterfront was an important industrial site where paving stones, copper cable and wire, and other products were made.

Today, the waterfront is largely abandoned and the buildings are being torn down. These ruins are emblematic of problems facing industrial sites on rivers throughout the country.

This is Roger Panetta, a historian of the Hudson River.

Roger Panetta

What we're looking at is the end of a century of industrial development. I think if you look at the ruins of these buildings you're looking at a kind of turning point of the history of the Hudson River and most rivers in the United States. The industrial age may be ending here. That happened because of the migration of cheap labor to the south...because in some cases the products themselves became obsolete and all of those things really corrupted the economic base here; and slowly, in the 1950s and 60s, in many rivertowns these waterfront industries began to dwindle and disappear.

Male Narrator

Other factors have also contributed to the decline of riverfront industries. Rivers are still important for shipping products and raw materials, but the advantage of cheap river transportation is no longer as important.

The building of highways and the development of the trucking industry has made it possible for many industries to move to other parts of the country.

Female Narrator

The abandonment of industrial sites along rivers also presents opportunities. Communities such as Hastings are beginning to reclaim their riverfronts for other purposes...such as parks.

As people are rediscovering the beauty of the nation's rivers, there is a wider appreciation of the importance of preserving the environment. Growing concern about the environment has led to pressure on federal, state, and local governments to do something about the quality of water in the nation's rivers and lakes.

Nationwide, such efforts have led to dramatic improvements in water quality. While problems persist, the Hudson and most other rivers in the United States are far cleaner today than they were 30 years ago.

Roger Panetta

I think we have a very profound, deep yearning to be close to water and to be close to rivers. And I think we've sort of reconnected with that spiritual part of our rivers.

So just as the river is getting cleaner and we talk about the improvement of the quality of the water, there also is a kind of desire to want to get back to that river, to want to be close to it.

Male Narrator

Rivers mean different things to different people. For some, a river means exploring a small stream like the Saw Kill.

For others, a river means the Mississippi's imposing presence on the landscape of North America.

Female Narrator

A single river may have many environments that change dramatically as it flows from beginning to end.

Near its source in the Adirondack Mountains, the Hudson River is very different from what it is as it passes lower Manhattan near the end of its journey.

Male Narrator

While a river is shaped by the environments through which it passes, it also plays a role in shaping those environments. Some rivers, like Arizona's Salt River, carve deep canyons.

Others, like the Mississippi, deposit delta-forming sediments as they empty into the ocean.

Female Narrator

Rivers are places to explore many different kinds of life. Among other things, they are important habitats for fish and birds.

Rivers have also been important habitats for humans, who have built towns and cities along their shores.

Male Narrator

The human presence has often been marked by pollution and other problems, but many rivers are getting cleaner as we have grown to appreciate them for their beauty and as places where we can go to restore our spirits.

END