

JOURNEY TO PLANET EARTH

Educators Guides

(Grades 6-12)

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"JOURNEY TO PLANET EARTH" CORRELATES TO THE FOLLOWING
NATIONAL SCIENCE EDUCATION STANDARDS:

Content Standard A— Abilities Necessary to Do Scientific Inquiry

Content Standard C— Life Science

Structure and Function in Living Systems

Reproduction and Heredity

Regulation and Behavior

Populations and Ecosystems

Diversity and Adaptations of Organisms

Content Standard D— Earth and Space Science

Structure of the Earth System

Earth's History

Content Standard E— Science and Technology

Abilities of Technological Design

Understandings about Science and Technology

Content Standard F— Science in Personal and Social Perspectives

Personal Health

Populations, Resources and Environments

Natural Hazards

Risks and Benefits

Science and Technology in Society

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Episode #1 -- "RIVERS OF DESTINY" (25 Minutes)

Overview

"Rivers of Destiny" focuses on four rivers -- the Mississippi, the Amazon, the Jordan and the Mekong. Each locale serves as an example of what can happen when human beings tamper with the natural system of a river. Without thoughtful planning, the consequences can be disastrous. But if communities work together, a balance can be achieved between the needs of people and the needs of the river. The people who live in the Mississippi River community of Grafton, Illinois were forced to endure the uncertainties of annual flooding until the government built levees to control the problem. But the construction of levees left the people with even more serious environmental problems. Over fishing and deforestation are having dramatic impacts on the Amazon River. Can a balance be found that preserves this river basin, which is so critical to Brazil's inhabitants? The Jordan River sustains a narrow ribbon of life through a dry and barren desert. Access to its waters is essential for survival but the river is heavily guarded. Southeast Asia's Mekong River is at the heart of economic growth in the region. How can the nations that depend on the Mekong for their new-found prosperity exploit the river without doing permanent damage? The flow of sediment into the Mississippi River delta has been altered by upstream development and flood control. As a result, large areas of wetland are disappearing and the shrimping industry is in decline.

Learning Objectives

Students will be able to:

- Explain the importance of rivers in the natural balance of life on Earth.
- Identify what happens when people tamper with a river's natural system.
- Offer suggestions for dealing with the outcomes of human intervention.

Pre-Viewing Activities

1. Introduce the following key terms to students:

- **Aquatic feeding ground** – an area from which water-life obtains food.
- **Deforestation** – the chopping down of trees from a specific area.
- **Delta** – a fan-shaped outgrowth of sediment at the mouth of a river.
- **Flood plain** – a strip of relatively flat land bordering a stream, river or lake that conveys the overflow of floodwaters.
- **Levee** – an embankment built alongside a river to prevent high water from flooding surrounding land.
- **Rain forest** – a woodland with an annual rainfall of at least 100 inches and marked by broad-leaved evergreen trees forming a continuous canopy.
- **Runoff** – that part of precipitation that cannot immediately be absorbed into the surrounding earth.
- **Water pollution** – the presence or addition of any contaminating substance in water that restricts the use of the water.

2. To familiarize students with the locations featured in the program, use a wall map, desk map or atlas and have students locate:

- Mississippi River
- Grafton, Illinois
- New Orleans
- Amazon River
- Andes mountain range
- Jordan River
- Jerusalem, Israel
- Mekong River

After the students have found each of the locations, begin a discussion to discover what they already know about these regions, rivers or mountains. Have the discussion center on environmental problems that they may be familiar with, such as the destruction of the Amazon rain forest.

Post-Viewing Discussion

Mississippi River

1. If the actual amount of rainfall along the Mississippi River hasn't really changed over the past 90 years, what caused the flooding in Grafton? (Answer: Deforestation and the addition of concrete and asphalt to the wetlands accelerated runoff and flooding.)
2. What are some of the results of the flooding? (Answers will vary.)
3. Have students discuss any flooding problems that have occurred locally or in nearby areas. Ask them: "How has this flooding resulted in changes in the way of life for the community?" "What efforts are being made to deal with this problem?"

Amazon River

1. What mountain range is the major source of water for the Amazon River? (Answer: the Andes)
2. How much of the world's fresh-flowing water is discharged by the Amazon River? (Answer: one sixth)
3. What causes the Amazon River to invade the flood plain each year? (Answer: dense tropical rains during the rainy season.)
4. What are some of the consequences of this flooding? (Answers: An underwater forest is created which serves as an aquatic feeding ground to over 3,000 species of fish. The flooding also renews the fertile soil of the flood plain.)
5. What do you think the results will be on the fish if people continue to destroy the rain forest? (Answer: fewer and smaller fish)
6. What effect do you think the destruction of the rain forest will have on you? And, why would it be in your best interests to protect the rain forest? (Answers: Plants used for producing medicines would be lost along with animal species. Destruction of the rain forest could affect global warming/the Greenhouse Effect and influence air quality.)
7. How did the fishermen of Sao Miguel increase this year's catch? (Answer: They limited the size of the catch and worked with farmers to protect the floodplain.)

8. Can you cite any examples of groups in your community that have worked together to improve the environment? (Suggestions: Alliance for Clean Rivers and Keep America Beautiful)

Jordan River

1. Which mountain is the source of the Jordan River? (Answer: Mount Hermon)
2. What makes the Sea of Galilee and the Dead Sea unusual? (Answer: They are below sea level.)
3. Why is water so critically important here? What impact does the Jordan River have on the desert? (Answer: There is very little rain; the river enables people to grow food.)
4. Why must people who live in Israel and Jordan be careful how much water they use? (Answer: Because it is a very limited resource that can run out.)
5. Should we in the United States be careful how much water we use? (Student discussion)
6. Is fresh water a finite or an infinite resource? (Answer: Finite but recyclable)

Mekong River

1. Find all the countries the Mekong River flows through. (Answer: Tibet, China, Myanmar, Thailand, Laos, Cambodia, and Vietnam.)
2. What has made available goods in the Mekong delta that used to be scarce, resulting in an economic boom? (Answer: New trade pacts between Mekong River nations.)
3. What are some of the environmental threats brought on by the prosperity and development in Chau Doc? (Answers: struggling sewage systems; runoff waters polluted by fertilizers and pesticides that drain into the river.)

Mississippi River Delta

1. What does New Orleans have in common with the Dead Sea? (Answer: Much of the city lies below sea level.)
2. Is a river's course fixed forever or can it change? How did this threaten New Orleans? (Answer: It can change. The Mississippi threatened to change course away from New Orleans, leaving the port dry.)
3. Why are the wetlands of a delta so fertile? (Answer: because a river deposits nutrient-rich sediment across the delta.)
4. What impact are the concrete levees having on sedimentation on the delta? (Answer: The levees are reducing the amount of sediment that is deposited.)
5. What is happening to the farmland and fresh-water wetlands in the delta? (Answer: They are being washed away and inundated with salt water.)

6. To continue discussions, talk about the difference between the Mississippi and the Amazon rivers; how one is free-flowing and the other is constrained by levees; how one experiences a natural annual flood cycle while the other is prevented from flooding (in theory). How would the Mississippi be different if you removed all the levees and dams? Have the students think of other rivers around the world as similar examples.
7. Now that we have looked at problems caused by the intervention of people along these four rivers, what have we learned from our effort to control our environment? (Student discussion)

Special Projects

1. Complete the following activity to demonstrate how plants help prevent the erosion of soil. In one aluminum pan, place grass sod. In another pan of the same size, place dirt. Use a block of wood to form a slope under each pan. Put a hole at the bottom end of each pan to allow water to run off. Place a tray under each hole to catch the runoff. Using a watering can, quickly pour a quart of water into the top of each pan. Observe both pans as the water flows down each tray. Also observe the water that collects in each tray following the runoff. Discuss.
2. Find students from another area of the state, the country, or anywhere in the world to serve as pen pals. Discover what environmental issues they face and what actions they or their communities plan to take. You can begin your search for electronic pen pals at Epals (<http://www.epals.com>) where your students can connect with classrooms in over 90 countries.
3. To demonstrate that pollutants are not easily removed from the water cycle through natural filtration, conduct the following two-part experiment:
 - Using a strainer or flour sifter as the filter, layer (from the filter up), the following materials: absorbent cotton, coarse clean sand and clean pebbles. Pour muddy water slowly into the filtering system and observe the results. Let students discuss what is happening and how the water is purified.
 - Using the filtering system from the previous demonstration, introduce a pollutant into the ground water by adding food coloring to the muddy water. Slowly pour the "polluted" water through the filtering system. It is important that students observe the water filter over time to see that the "polluted" water cannot be removed naturally by the water cycle.

Episode #2 -- "THE URBAN EXPLOSION" (25 Minutes)

Overview

Every day of the year, tens of thousands of people move to the world's burgeoning cities in search of a better life. Instead they find sprawling slums, massive traffic jams, chronic unemployment, regular failure of electrical and water services, strained educational and recreational facilities and skyrocketing fuel and food costs. The uncontrolled development of the world's major cities has led to a series of problems: air pollution, water pollution, waste disposal, housing shortages and loss of farmland.

As the 21st century dawns, the question is how to balance economic growth with the health of the world's large metropolitan cities? How do these cities shelter and sustain their residents without destroying the delicate balance of the environment? The four mega-cities (cities with populations of over ten million people) profiled in "The Urban Explosion" are Mexico City, Shanghai, Istanbul and New York City. Through the activities found at the end of this lesson, students will learn more about the problems facing the world's mega-cities, possible solutions to those problems and the need for urban planning.

Learning Objectives

Students will be able to:

1. Describe the environmental problems (specifically air and water pollution) created by the rapid development of urban areas.
2. Identify some solutions for dealing with problems caused by uncontrolled urbanization.
3. Explain the importance of urban development plans in dealing with cities' environmental problems.

Pre-Viewing Activities

1. Introduce the following key terms to the students:
 - **Ecosystem** -- the community of plants and animals interacting with one another and the environment.
 - **Infrastructure** -- the foundation on which economic development is based, including the transportation, communication, electrical and water supply systems of a community, city, or nation.
 - **Mega-city** -- a city with a population in excess of ten million people.
 - **Pollution** -- the contamination of soil, water or the air by the discharge of harmful substances.
 - **Rapid transit system** -- mass transportation that enables people to move farther and faster through a city.
 - **Refugee** -- a person who flees usually to another country to escape oppression or persecution.
 - **Sewage** -- liquid and solid waste usually carried off in sewers or drains.
 - **Smog** -- fog that has become mixed and polluted with smoke.
 - **Sustainability** -- the ability to maintain or keep from collapsing.
 - **Toxic** -- poisonous, capable of causing injury or death, especially by chemical means.
 - **Urbanization** -- growth in the portion of a population living in areas of more than 2,500 people.

- **Urban sprawl** -- the unplanned, uncontrolled spreading of urban development into areas adjoining the edge of a city.
 - **Water treatment plant** -- facility for the chemical treatment and recycling of water.
2. To familiarize students with the cities featured in the program segments, use a wall map, desk map or an atlas and have students locate:
 - Mexico City
 - Istanbul
 - Shanghai
 - New York City

After students have located the cities, begin a discussion on what they already know about each of these places. Ask them to talk about what kinds of environmental problems large cities like these might face.

3. Have students discuss examples of water or air pollution in their own community and what is being done to overcome these difficulties.
4. Have students discuss whether their community has a plan for expansion.
5. If students are in rural communities, discuss how they have been affected by the urban explosion -- people leaving the farms; farm closings; young people leaving the community; store closings in their town.

Post-viewing Discussion

Mexico City

1. What are some of the environmental problems Mexico City is facing today? (Answer: air pollution, water pollution, sinking land.)
2. What geographic features contribute to Mexico City's environmental problems? What is meant by a closed ecosystem? (Answer: little wind to cleanse the air and no ocean or major rivers to exchange water and sewage.)
3. What causes the problem of smog in Mexico City? (Answers: the combination of three million cars, 35,000 factories and its geography.)
4. How do you think Mexico City might solve these problems? (Answers will vary -- stricter emission standards, public transportation, etc.)
5. Do we face any of these same problems where we live? What are we doing or what can be done to help? (Answers will vary.)

Istanbul

1. What is causing Istanbul's water shortage problem? (Answer: a rapid increase in population due to migration to the city.)
2. What is causing Istanbul's water pollution problem? (Answer: a lack of sufficient waste water treatment facilities and excessive shipping traffic on the waterway going right through the middle of the city -- the Bosphorus Strait.)
3. How has the water pollution problem affected the fishing industry? (Answer: The catch is meager.)

4. Do you know of any water pollution problems in your area? What do you think should be done about them? (Answers will vary.)

Shanghai

1. What was the cause of the smog in Shanghai? (Answers: burning low-grade coal to warm homes and run factories; car emissions.)
2. How are they trying to solve this problem? (Answers: limitations on ownership of cars and stricter air quality regulations for factories.)
3. What are they doing about the traffic problem? (Answer: rebuilding the city's infrastructure, starting with a rapid transport system such as the subway system found in cities like New York.)
4. Would these same methods work in Mexico City? Why or why not? (Answers will vary.)
5. How about in your area?
6. How is the city of Shanghai dealing with its water pollution problems? (Answers: A series of huge tunnels are being built to collect waste water that will then be treated and flushed out to sea. A new water purification plant has been built for drinking water.)
7. Do you know where your local wastewater treatment facility is located and how it operates? (Answers will vary) Note: This may be a good field trip opportunity.

New York

1. How are the environmental issues for the people of New York City similar to those in Mexico City, Istanbul and Shanghai? (Answer: The quality of their lives is controlled by their city's ability to cope with rapid change.)
2. What sets New York City apart from Mexico and Istanbul in terms of how they deal with their environmental problems? (Answer: New York City has a vision, a plan for a unified system.)
3. What is the importance of having a plan before starting any expansion or development? (student discussion)

Special Projects

1. Group Project: "Building a City": Have students draw or construct what they consider to be "the perfect city." Plans should include methods for dealing with environmental issues, as well as a vision for sustainable growth and development of the city.
2. Group Project: "Improving Your City": Have students develop a plan to improve the city or town in which they live. Have them highlight what changes they would make to the existing infrastructure.
3. To obtain an "Environmental Profile" of where you live, visit the Center for Environmental Information and Statistics (<http://yosemite.epa.gov/ceis/ceis.nsf>).

4. Have students invite a representative from their local water utility to speak to the class. This could also be done as an individual interview. Have students prepare questions such as: Where does our water come from? Where is the waste from factories and plants released? How is our local sewage treated, and where is it released? To learn more about the effects of urbanization on water, have your students visit the U.S. Geological Survey's Water Science for Schools site at <http://www.ga.usgs.gov/edu/urbanquality.html>.
5. Have students research the development of their community in terms of land use. Have them look at questions such as how the land was first used and how it is used today. Have them compare and contrast the benefits of development due to population growth. Students can check with their local Chamber of Commerce, city government or Planning and Development Commission.
6. For students interested in conservation, help them get involved in a local conservation project. These projects might include planting trees, cleaning up riverbeds or beaches. To discover other project ideas, check out "Fun Activities" at the Environmental Protection Agency's Student Center (<http://www.epa.gov/students/>).
7. Throughout history, storytelling has been an important tool for learning about the past. Have students write a myth or legend about population growth and its effects on the environment. They may want to include such ideas as the uncontrolled growth of Earth's population and the effects on the land, the oceans and the skies. Encourage them to be creative.

Episode #3 -- "LAND OF PLENTY, LAND OF WANT" (25 Minutes)

Overview

As the population of Planet Earth continues to grow, it is necessary to understand the delicate balance that is needed to preserve the environment while feeding the world's inhabitants. Students will see in the upcoming video segments the need to find ways to reconcile economic growth with the continued health of the land.

As cities have expanded, farmland has been lost to development. In an effort to feed the ever-increasing population of the planet, farmers have experimented with various methods of increasing agricultural yields. Some of these methods, over time, have proven to be unhealthy for the environment.

Now, more than ever before, it is critical that farmers and scientists work together to develop a sustainable agricultural system through the effective management of Earth's natural resources. Sustainable agriculture is the use of farming practices that will produce food for consumption without causing harm to the environment.

"Land of Plenty, Land of Want" gives students the opportunity to view farming in four distinctly different countries: Zimbabwe, France, China, and the United States. Through viewing farming methods throughout the world and the different challenges facing the world's farmers, the students will be able to appreciate the commonality of all farmers. They all live on a thin edge; vulnerable to the natural forces of weather, climate and changing soil conditions, as well as the people-imposed forces of pollution, population shifts and political intervention.

Learning Objectives

Students will be able to:

1. Define sustainable agriculture.
2. Identify problems faced in sustainable agriculture and offer possible solutions.

Pre-Viewing Activities

1. Introduce the following key terms to the students:
 - **Agriculture** – the science, art and business of farming.
 - **Arable land** – land fit to be cultivated or farmed.
 - **Contour farming** – farming on sloping land in such a way that the land is prepared, planted, and cultivated in rows that are "on the level" and follow the contour of the slope, thus reducing soil erosion.
 - **Drought** – a long period of abnormally low rainfall.
 - **El Nino** – a warming of the surface ocean waters off the western coast of South America, occurring every four to twelve years, and affecting weather worldwide.
 - **Erosion** – process whereby materials of the earth's crust are loosened, dissolved, or worn away and moved, usually by water or wind.
 - **Industrialization** – the development of manufacturing enterprises.
 - **No-till farming** – Planting crops without plowing the land; the farmer plants a cover crop that is rolled onto the land first to protect the soil from the elements. The harvest crop is then sown in the cover crop.
 - **Pesticides** – chemicals used to kill pests, especially insects.
 - **Pollution runoff** – an overflow of fluid not absorbed by the soil that contains waste products and other contaminants.

- **Population shift** – the migration or movement of people from one country or region in order to settle in another.
 - **Sustainability** – the ability to remain in existence without exhausting resources.
 - **Topsoil** – the upper few inches of the soil in which worms, beneficial bacteria and humus can be found.
 - **Toxic waste** – poisonous by-products resulting from industrial processes, as well as organic waste from animal farms.
2. To familiarize students with the areas in the program segments, use a wall map, desk map or an atlas and have students locate:
- Zimbabwe
 - France
 - China
 - Pennsylvania
 - Iowa

After the students have found each of these, begin a discussion on what they know already about these places. Ask them what environmental concerns they think farmers from these different nations might have in common and what might be unique to each. Have students name agricultural products they use on a daily basis and discuss where these products might originate.

Post-Viewing Discussion

Zimbabwe

1. What elements in nature make farming in Zimbabwe more difficult? (Examples include environmental disasters, weather conditions, and climate. Students may also want to discuss the effects of El Nino.)
2. How do you think drought might affect the price of agricultural products in our area? (Students may want to use the Internet to research answers. Have them search under "drought.")
3. How did David Jura take the battle for agricultural sustainability into his own hands? (Answer: David built a dam.)
4. What effects do you think his solution may have had on people living downstream? (Student discussion.)
5. If you have a stream on your own property, can you build a dam to create a reservoir? Why or why not? (Note: Following this classroom discussion, students could do further research on the topic of dams by studying the dam projects on the Colorado River and the effects the projects have had on Mexico.)

France

1. Like France, other areas of the world also face pollution runoff, not just from chemicals, but also from toxic waste produced by animal farms. Pollution is a problem for which we seek solutions. What are some of the reasons we use chemicals in the production of agricultural products?" (Answers: increased yields and more efficient production)
2. Animal waste pollution in agricultural production is becoming a real problem, a problem for which we have not yet found a solution. What are some ways you think we can solve this problem?" (Student answers will vary.)