

JOURNEY TO PLANET EARTH

Educators Guides

(Grades 6-12)

TABLE OF CONTENTS

<u>Episode</u>	<u>Page</u>
Episode #1 -- "Rivers of Destiny" (25 Minutes)	5
Episode #2 -- "The Urban Explosion" (25 Minutes)	9
Episode #3 -- "Land of Plenty, Land of Want" (25 Minutes)	13
Episode #4 -- "On the Brink" (25 Minutes)	17
Episode #5 -- "Hot Zones" (25 Minutes)	21
Episode #6 -- "Seas of Grass" (25 Minutes)	25
Episode #7 -- "Future Conditional" (25 Minutes)	29
Episode #8 -- "State of the Planet" (25 Minutes)	35
Episode #9 -- "State of the Planet's Wildlife" (25 Minutes)	45
Episode #10 -- "State of the Ocean's Animals" (37 Minutes)	51
Episode #11 -- "State of the Planet's Oceans" (32 Minutes)	63

To purchase or preview "Journey To Planet Earth" contact:

Screenscope, Inc. / 4330 Yuma Street, NW / Washington, DC 20016
Tel (202) 364-0055 / Fax (202) 364-0058
screenscope@screenscope.com / www.screenscope.com

Educators Guide for Episodes 1-3 written by Melissa Etlin (B.A., M.A.)

Educators Guide for Episodes 4-8 written by David S. Wood (B.S., M.S.)

Educators Guide for Episodes 9-11 written by David S. Wood (B.S., M.S.) and
Margaret Pennock (B.S., M.S.)

© 2009 Screenscope, Inc.

"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

Partial funding for "Journey To Planet Earth" was provided by:

- Arthur Vining Davis Foundations
- Bernice Cross Trust
- Continental Airlines
- Honda of America Foundation
- Munson Foundation
- NASA
- National Marine Sanctuary Foundation
- National Science Foundation
- NIH: National Center for Research Resources
- NIH: National Institutes of Environmental Health Sciences
- Rockefeller Foundation
- US Department of Energy
- USDA: Sustainable Agriculture Research and Education
- W.K. Kellogg Foundation
- World Bank

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.)

China

1. In China, how has booming industrial growth affected land for farming? (Answer: Growing industries are taking over land previously available for farming.)
2. Why do you think China has chosen industrial growth over agricultural production? (Answers will vary.)
3. What other countries do you think are facing this same problem? (student discussion)

United States

1. There are a shrinking number of farmers in the United States today. At the start of this century, farmers made up nearly 35 percent of the total population. Today, fewer than two percent of American families work the land. How can this impact food production and development in your community? (student discussion)
2. What method did Joe Horan use to know exactly when and where to apply chemicals? (Answer: precision farming with satellite technology.)
3. How has technology helped to improve agricultural production? (Answer: Through the use of computers and satellites, farmers are better equipped to anticipate weather conditions and improve production.)
4. What problems have chemicals and other farm pollutants caused to our soil, air and water? (Answers will vary.)
5. What was the method that Steve Groff found to be successful in reducing the loss of topsoil on his farm?" (Answer: no-till farming)
6. Can you think of examples of soil erosion near your home or in your community? What could be done to address this problem? (Answers will vary.)
7. What are some other benefits that resulted from Steve Groff's sustainable agricultural system? (Answers: reduced use of insecticides and fungicides; consistently increased yields.)
8. How has modernized farm machinery aided farmers in new farming methods? (Have students research information about new farm machinery.)

Special Projects

1. To better understand the effects of environmental catastrophes, have students study the Dust Bowl period of the 1930s in the United States for the effects this disaster had not only on the land but also on the lives of the people involved. One place for students to start their research is by visiting two PBS Internet sites on this topic: The Great Plains Dust Bowl (<http://www.usd.edu/anth/epa/dust.html>) and Surviving the Dust Bowl (<http://www.pbs.org/wgbh/pages/amex/dustbowl>).

2. Arrange for guest speakers from the industrial and farming communities to come and present information to the class about how they are balancing economic growth with the health of the land. Work with students to develop a list of questions for the speakers prior to their presentations. Contact your local Chamber of Commerce, county extension office, or state agriculture department to arrange for speakers.
3. In order to find out long-range plans (agricultural and industrial) for your community, contact your local government's planning commission.
4. Have students research various methods of farming such as no-till and contour farming. When their research is completed, have them chart the benefits of each method and decide which one they would use if they had a farm. The class could also debate which method is better.
5. Have students research various methods of irrigation necessary for agricultural production throughout the world. How can the method of irrigation impact the type of crop produced?
6. Have students research the major imports/exports of four countries and graph the results for comparison and analysis.
7. Have students find out what agricultural products are produced locally and if any of these products are exported. Discuss the need for local agricultural imports.
8. Have students discuss how industrial growth has affected local or regional agricultural production and how they can take a part in helping to balance the agricultural and industrial growth locally. Students may want to contact their local Chamber of Commerce.
9. Have students research the evolution of farming techniques and compare and graph differences in yields over time. This is a comprehensive project and could lead to a research paper with an interdisciplinary focus involving both science and social studies.

Episode #4 -- "ON THE BRINK" (25 Minutes)

Overview

"On the Brink" explores the connections between environmental pressures and political and social instability. Environmental degradation and poverty are often linked: poverty can lead to damaging environmental practices, especially in over-populated areas, and a damaged environment can compound poverty. The conditions of poverty (over-crowding, hunger, disease, lack of food and clean water) result in desperation, which can, in turn, lead to political instability, violence, corruption and terrorism. Video segments explore these connections by focusing on case studies in Bangladesh, South Africa, Peru, and Haiti. Finally, the issues are brought closer to home through the last segment, which focuses on poverty and the movement of migrants from Mexico and Central America across the border of the United States. Thus, students will consider the potential effects of instability in developing countries with stability in the United States.

Learning Objectives

Students will be able to:

1. Explain how environmental degradation can lead to poverty, disease, and hunger.
2. Identify the connection between human population growth and degradation of the environment.
3. Describe how instability in foreign countries can affect stability in the United States

Pre-Viewing Activities

3. Introduce the following key terms to students:
 - **monsoon** – season of wind and heavy rain in India and adjacent countries
 - **arid** – land that is excessively dry; too dry to support agriculture
 - **deforestation** – the clearing of trees from a forest
 - **soil erosion** – when soil is washed away by running water, wind, or ice
 - **land reforms** – measures designed to establish a more equitable distribution of land, especially for agricultural purposes
 - **impoverishment** – a condition of being weak, poor and depleted of nutrients; can refer to people and/or to the environment
 - **guerrilla warfare** – fighting by an irregular, usually indigenous military or paramilitary unit operating in small bands in occupied territory to harass and undermine the enemy
 - **counter-insurgency effort** – military activities designed to thwart insurgencies such as a guerilla warfare
 - **coup** – a sudden overthrow of a government or leader by a small group of people already having some military or political authority
 - **conquistador** – any of the Spanish conquerors of Peru, Mexico and other parts of America in the 1500s
 - **smuggling** – to illegally and secretly bring items or people into or out of a country

- **Coyotes** – smugglers of illegal aliens from Mexico to the United States © 2003 Screenscope, Inc. Page 2 of 2 On the Brink: Study Guide
 - **deport** – to force someone to leave a country by official order
 - **environmental refugees** – people who flee their home or country to seek refuge elsewhere due to extreme environmental conditions such as erosion of good soil for crops, lack of drinking water or severe pollution
4. To familiarize students with the areas in the program segments, use a wall map, desk map or atlas and have students locate:
- India
 - Bangladesh
 - Bay of Bengal
 - South Africa
 - Peru
 - Haiti
 - Mexico and U.S. border

After the students have found each of these locations, begin a discussion to discover what they already know about these regions. Have the discussion center on environmental problems that they are familiar to the students.

Post-Viewing Discussion

Bangladesh

1. As you watched the first scene, what general observations did you make about the city: its conditions, what people were doing, and how they were doing those things. (You may want to revisit that segment with your students.) How are the conditions different from what you experience? (Answers: Students may notice many people use bicycles for transportation; buses are very old; people are cooking and bathing on the street; water is obtained at a central water pump, not from running water in homes; conditions are very crowded; people sit on the street while selling goods.)
2. What is the average income in Bangladesh? (Answer: \$225/year.) Why did people from Bangladesh move to Calcutta, India? (Answer: They were trying to escape the conditions of extreme poverty in Bangladesh, and were trying to find a better way of life. However, in many respects, Calcutta had similar conditions.)
3. How are the people of Bangladesh plowing and harvesting? How does this compare to methods you have seen or learned about in the United States? (Answer: People were using hand tools or tools pulled by oxen rather than tractors and other mechanized equipment.)

South Africa

1. Where do most people live when they arrive in urban areas? (Answer: They often live in illegal shanties or squatter settlements that are set up on the edge of town. The conditions are very tough: no electricity, running water, hospitals, and sanitation systems.)
2. What is the city of Alexandra trying to do to help migrants? (Answer: An \$80 million government initiative provides money for homes, schools, and health facilities.)

Peru

1. Why are the peasants in the high Andes so poor? (Answer: The terrain is very dry, so cultivation of crops is difficult. Farmers generally produce just enough food to live for a year. In years of drought, there is hunger.)
2. Why are millions of peasants moving to Lima, Peru? (Answer: They are leaving their subsistence way of life in hopes of economic opportunity.)
3. What two circumstances led to the rise of the Shining Path? (Answer: Land scarcity and impoverishment.)

Haiti

1. What are the two most significant environmental pressures facing Haiti? (Answer: Loss of forests because wood is used as charcoal for cooking; severe soil erosion due to deforestation, so fertility of soil for crops is poor.)
2. Why has so much of the forest been cut down? (Answer: Wood is used as charcoal for cooking; Haitians don't have access to gas or electric stoves as we do. Trees are also cut down for farmland.)

Illegal Immigrants along the Mexico-United States Border

1. Why is so much debris found in such an isolated desert? (Answer: Thousands of migrants try to enter the United States on foot each day. They must carry food and water with them.)
2. Who is being recognized in the street ceremony in Douglas, Arizona? (Answer: The hundreds of migrants who perish each year from heat and dehydration while trying to enter the United States.)
3. Why are so many people trying to leave Mexico, Central, and South America? (Answer: Acute poverty and environmental degradation, which make their lives more difficult.)
4. What happens to people who get caught while crossing the border? (Answer: They are put in detention centers where they are asked questions and held until they are returned to Mexico. Most of them will attempt to cross the border again. On any given day, an average of 20,000 people are held in detention centers.)

Special Projects

1. Compare the number of people per square mile in your town, city, or state to the number of people per square mile in Dhaka, Bangladesh and Port-au-Prince, Haiti. Have your students work in small groups to discuss how life would be different in your hometown if it were as densely populated. What services would need to be provided to accommodate the higher number of people? In what ways would the quality of life improve or suffer? How might a higher population affect the local environment?

2. Research the projected population for your area in 10-20 years. Compare that to the projected population in the developing countries highlighted in this film. Make graphs showing the projected growth rates for both areas. Which graph shows a higher rate of growth? Ask the students to consider various explanations for the results and present them to the class. Discuss the repercussions of these trends socially, environmentally, and politically.
3. Conduct research to compare trends in developing countries compared to developed countries. Visit the World Resources Institute's web site for data (www.wri.org/). Go to the Earth Trends section on Population, Health and Human Well-being. You can obtain data tables or compare statistics from selected countries. Consider the following:
 - birth and death rates
 - life expectancy
 - literacy rate
 - school enrollment
 - population density
 - population growth rate
 - access to water and sanitation
 - poverty
 - nutrition
 - immunization rates
4. After comparing the data for various countries, consider the political, social, and environmental repercussions of these trends.
5. Take part in a global role-playing simulation on a large world map. The World Game Institute offers school programs for entire schools as well as kits that schools can use www.worldgame.org. The Middle School World Game Workshop simulation is an experiential learning opportunity on world and environmental issues, designed for middle school students. It takes place on a 26' X 12' world map, and invites students to develop solutions to global problems. Population, income, nutrition, and education are some of the many factors that students compare.
7. The saga of immigration is a quintessential American experience. Ask your students to interview members of their households to learn about the immigration experiences in their own families. Who immigrated here, when, from where, what did they have to overcome, and what happened after they arrived? Ask the students to share their family histories on posters or oral reports.

Episode #5 -- "HOT ZONES" (25 Minutes)

Overview

Fifteen million people worldwide die from insect and water-borne diseases each year. Among the killers: malaria, dengue fever, diarrhea, and cholera. Most of their victims live in the developing countries of Africa, Asia, and Latin America; most of the diseases afflicting them are preventable. Clean, potable drinking water, vaccines, mosquito control programs, and adequate health care are required, but too frequently developing countries lack the means to provide them. To confront these diseases, people also need to consider the ways they contribute to the problem. Urbanization, with its associated wells, trash, and drainage ditches, provides ideal breeding places for the mosquitoes that transmit malaria and dengue fever. Drinking and bathing in water contaminated with human wastes can lead to diarrhea and cholera. While many people in developed countries believe they are safe from these diseases so typical of poor, tropical countries, it is true that these diseases present a risk to us all. In the age of air travel, people, animals and insects, which are infected with disease-causing organisms such as the malaria blood parasite, can, and do, travel around the developed world. A recent example: the appearance in 1999 of West Nile Virus in New York City. Possibly carried by mosquitoes hitchhiking on planes flying from Africa, this potentially lethal disease has since infected thousands of people throughout the United States.

Learning Objectives

Students will be able to:

1. Trace the presence of insect and water-borne diseases to environmental conditions created by human activity.
2. Describe how these diseases, typical of poor, tropical countries, can affect the health, security, and economic well-being of people in the developed world.
3. Discuss the role that the developed world should play in helping combat these diseases.

Pre-Viewing Activities

1. Introduce the following key terms to the students:
 - **Malaria** – a serious disease caused by several species of one-celled organisms that infect red blood cells in humans and other animals and that are transmitted by mosquitoes. Malaria kills hundreds of thousands of people worldwide each year.
 - **Dengue Fever** – a serious disease caused by a virus that is transmitted by *Aedes* mosquitoes and that causes severe headache, fever, and pain in the joints. May be fatal.
 - **Diarrhea** – a condition, caused by a host of microorganisms, which causes uncontrolled bowel movements. Victims become weak and dehydrated if not treated. Millions of people worldwide, mostly from developing countries, die from diarrhea each year.

- **Cholera** – a serious disease, caused by a bacterium and transmitted by ingestion of contaminated water, that causes severe diarrhea and fever. Unless treated, patients may become seriously dehydrated and die.
 - **bacterium** – a one-celled organism, belonging to the kingdom Monera. Bacteria live everywhere on Earth; some of them cause disease in humans.
 - **virus** – a nucleic acid, either DNA or RNA, wrapped inside a protein that reproduces only inside cells of living creatures. Difficult to define as either living or non-living. Some viruses cause disease in humans.
 - **Aedes and Anopheles mosquitoes** – two genera of mosquitoes. The Aedes mosquito transmits dengue fever; the Anopheles mosquito transmits malaria.
 - **Pfisteria** – a strange aquatic protozoan that apparently lives in several different forms, one of which attacks fish. This form is thought to thrive in water contaminated with animal wastes and has been implicated as the culprit in some recent major fish kills, notably in North Carolina and the Chesapeake Bay.
 - **epidemic** – the rapid spreading of a disease through a population
 - **contagion** – a contagious disease
 - **ecotourist** – a tourist that travels to experience natural wonders, such as forests and wildlife, often in exotic locales
 - **effluent** – a discharge of liquid waste, as from a factory or nuclear plant
2. To familiarize students with the locations featured in the program segments, use a wall map, desk map or atlas and have students locate:
- Iquitos, Peru
 - Lake Victoria
 - Nairobi, Kenya
 - Lima, Peru
 - Bangladesh
 - New York City
 - Chesapeake Bay

After the students have found each of these locations, begin a discussion to discover what they already know about these regions. Have the discussion center on environmental problems that they are familiar with.

Post-Viewing Discussion

Malaria in Kenya

1. How many people in Kombewa, at any one time, are infected with malaria? How many Kombewa children will die from the disease before they turn five? (Answers: 80% and 20%, respectively.)
2. What is the role of mosquitoes in spreading the disease? (Answer: Malaria is caused by a microscopic parasite that lives inside red blood cells. Mosquitoes spread the parasite by biting an infected person, taking in the parasites with their blood meal, biting another person, and injecting the parasites in the process.)
3. Why is malaria becoming more prevalent in Nairobi? (Answer: People infected with the malaria parasite are migrating to the city where they infect others, and human-caused alteration to the local environment is creating ideal mosquito breeding conditions.)

Dengue Fever in Peru

1. How are humans creating ideal conditions for the dengue-carrying Aedes mosquitoes to breed? (Answer: They are leaving wells and basins uncovered and trash on the ground, all of which can hold stagnant water.)
2. How might malaria and dengue in Nairobi and Iquitos arrive quickly in the United States? (Answer: People can easily fly directly to these cities from the United States. Many who do so are tourists. While in Peru and Kenya, they can become infected and bring the diseases back to the United States in their bloodstreams.)

West Nile Virus in New York

1. How did people think West Nile virus arrived in the United States? (Answer: An infected mosquito on a plane traveling from Africa to New York.)
2. Why are people investigating dead crows and other birds? (Answer: The West Nile Virus also infects and kills birds. The virus was first discovered in birds. Now, by investigating dead birds, scientists can determine how common the virus is and where it has spread.)

Water-borne Diseases in Peru

1. How many people worldwide are estimated not to have access to clean drinking water? (Answer: 1.1 billion.) How many people are thought not to have access to basic sanitation services? (Answer: 2 billion.)
2. Compare your living conditions with those people residing in Lima's slums. Consider the following: Sources of drinking water, Presence of electricity, Means of disposal of human waste, Means of garbage disposal, Safe housing regulations, Roads and transportation, Health services. (Perhaps move this question to follow-up.)
3. Diarrhea and cholera are spread through contact with dirty water. Where might Peruvians come into contact with these diseases? (Answer: Water used for drinking, bathing, washing clothes, preparing food.)

Water-borne Diseases in Bangladesh

1. Why is cholera more prevalent in Bangladesh than in Peru? (Answer: The climate, the country's fresh water, and the ocean water offshore are all warmer, encouraging the growth of plankton in which the cholera bacterium lives. Massive annual floods, brought about by the monsoons, deposit contaminated water throughout the ponds and streams that people use for drinking water. Thus, Bangladesh's population density, poverty, climate, and geography all conspire to give the country the highest rate of cholera infection in the world.)
2. Why is finding a solution to the shortage of safe drinking water in Bangladesh so difficult? (Answer: Ground water tapped by over five million wells in the country contains dangerous amounts of arsenic. Another source of water needs to be found, but this is very difficult in such a poor, crowded country.)

Diseases Afflicting Aquatic Life in the Chesapeake Bay

1. What pollutants entering Chesapeake Bay are thought to be harming aquatic life? (Answer: Poorly treated sewage, pesticides, eroded soil, fertilizers, and industrial effluent.)
2. What is the connection between these pollutants and the diseases attacking oysters and fish? (Answer: The connection is not yet clear, but pollutants are suspected of weakening oysters so that they are susceptible to diseases, and they are thought to be altering water conditions in Chesapeake Bay so that the toxic algae, *Pfiesteria*, and certain species of fungi can thrive. Both of these organisms are believed to attack fish, but the relationship between them is not yet clear.)

Special Projects

1. Have the students research the life cycle of the malaria-carrying *Anopheles* mosquito. Based upon their findings, have them develop a malaria eradication program for Nairobi, Kenya, that employs more than the spraying of insecticides. They should consider the following:
2. Mosquitoes can be prevalent in urban areas because uncovered wells, ditches, and trash provide abundant breeding areas for them. To discover how mosquitoes can take advantage of such human-provided opportunities, have your students scatter a variety of receptacles filled with water around the school grounds. Receptacles may include bowls, tin cans, trashcans, or tires. Have the students check the receptacles daily and record how long it takes in each one for mosquito larvae, called wigglers, to appear. Have them note the environmental conditions for each receptacle, such as size, shape, and material of the receptacle, the amount of shade each receptacle is lying under, and the amount of fallen leaves and other organic material to be found in each. Have your students write up their results and compare their findings.
3. Several tropical parasites that infect humans have complicated life cycles. Have students research the life cycles of the following: schistosomiasis or bilharzia, tapeworm, hookworm, onchocerciasis or river blindness, filariasis, and guinea worm. The Carter Center web site (<http://www.cartercenter.org>) contains much useful information on some of these parasites. Have the students diagram the parasites' life cycles on posters. Then discuss what measures people can take to reduce the incidence of infection of these parasites.

Episode #6 -- "SEAS OF GRASS" (25 Minutes)

Overview

Among the most endangered ecosystems today are the world's grasslands. Threats menacing them include overgrazing, soil erosion, urbanization, and replacement of natural vegetation with agricultural fields and tree plantations. When native grasslands disappear, so do the unique plants and animals that depend on them. Also at risk, are unique human cultures and lifestyles specially adapted to them: Mongolian nomads, Argentine Gauchos, and American cowboys all have developed distinctive ways of thriving in the challenging conditions of the world's grasslands, whether we call them prairies, pampas, veldts, or steppes. The preservation of both our cultural and our natural heritages, therefore, depend upon how successfully we can preserve the natural grasslands that support both.

Learning Objectives

Students will be able to:

1. Identify some of the threats confronting natural grasslands worldwide.
2. Describe some of the distinctive cultures and lifestyles that have developed as adaptations to grassland conditions.
3. Describe measures that people are taking to preserve grassland ecosystems and the cultures that depend on them.

Pre-Viewing Activities

1. Introduce the following key terms to students:
 - **Pampas** – the vast plains of southern South America, chiefly in Argentina, but also in Uruguay, southern Brazil, and southeastern Paraguay
 - **Veldt** – the extensive grasslands of South Africa
 - **Prairie** – grasslands, especially in the interior of North America
 - **Steppe** – the plains of interior Eurasia
 - **Savannah** – a grassland with scattered trees, typical of East Africa
 - **erosion** – the carrying away of soil by wind, ice, water and animals
 - **carrying (grazing) capacity** – the amount of animals that can be supported by a piece of land or body of water
 - **sedimentation** – the deposition of eroding soil onto land or into water
2. To familiarize students with the areas in the program segments, use a wall map, desk map or atlas and have students locate:
 - Shanghai
 - Inner Mongolia
 - Kenya
 - Lake Baringo
 - Buenos Aires
 - New Mexico

After the students have found each of these locations, begin a discussion to discover what they already know about these regions. Have the discussion center on environmental problems that are familiar to the students.

Post-Viewing Discussion

Inner Mongolia

1. What weather conditions create the grasslands in Inner Mongolia? (Answer: Hot and dry summers, long, cold winters. These typically create grasslands worldwide.)
2. Why do the people who live on the Mongolian grasslands roam around instead of living in one place? (Answer: They move in search of grass to feed their animals.)
3. How do they live when roaming on the grasslands? (Answer: They live in mobile tents and carry everything they need with them.)
4. What is motivating people to overgraze the grasslands? (Answer: China is undergoing an economic boom, and increasing numbers of people want to buy meat and milk. The herders want to take advantage of the demand for their animals, so they want to raise as many as possible.)
5. What pressures are threatening the traditional Mongolian nomadic culture? (Answer: Environmental deterioration, notably soil erosion, is making it difficult to make a living. Increasing educational and employment opportunities in cities and town lure young people away from the traditional nomadic way of life.)

Kenya

1. Why is the erosion occurring? (Answer: Overgrazing the land destroys the vegetation that holds the soil in place.)
2. What is causing the overgrazing? (Answer: Significant human population growth around the lakes, leading to increased numbers of animals. Fewer people living a nomadic lifestyle, more people living year-round in villages. This forces livestock to focus their grazing on small areas close to villages, rather than spreading out over a wider area.)
3. What are some people doing about soil erosion? (Answer: They are planting native grasses and other plants which will hold the soil in place and provide fodder for stock.)

South Africa

1. What are some ways in which the natural grasslands of South Africa (the Veldt) are ecologically important? (Answer: Habitat for over 800 species of wildflowers, 360 species of birds, and many wild mammals. Grasslands also absorb rainwater and release it gradually to streams, rivers, and lakes. This greatly reduces the risk of extreme cycles of floods and droughts.)
2. What are some ways in which people use the grasslands? (Answer: The grasslands provide natural medicines and grazing for livestock.)
3. What is the unemployment rate in rural South Africa? (Answer: Over 60%.)

4. What happens to many of the trees? (Answer: They are sent to Japan, Australia and the United States to make paper and pulp.)

Argentina

1. Why is the pampas perfect for raising cattle? (The weather is constant -- mild and moist.)
2. What is the chief threat to the pampas? (Answer: Conversion to croplands. This wipes out native vegetation, puts more insecticides and fertilizers into the environment, and reduces water storage in spongy grassland soils.)

New Mexico

1. What are people trying to do with the Gray Ranch? (Answer: Maintain an environment that will prove healthy for wildlife, livestock, and a traditional way of life far into the future.)
2. What are some measures being implemented to bring this about? (Answer: Maintaining native vegetation, restricting the numbers of livestock that roam the ranch so that they do not overgraze, using fire to remove alien plant species and to encourage new and nutritious plant growth, employing traditional ways of managing the ranch.)

Special Projects

1. To help your students learn where the major biomes of the world are found, divide the students into work groups and assign to each a biome (tundra/alpine; coniferous forest; deciduous forest; tropical rain forest; grassland/Savannah; desert) to research. Each group should prepare a map showing where in the world each biome is found and present some animals typical of each. Results may be presented on a poster or an oral presentation, or each group can combine efforts to prepare a large world map for the classroom wall or the hallway, decorated with pictures of wildlife cut out from magazines or downloaded from the internet.
2. To compare the life found in fields, pastures, or grasslands in your neighborhood with other local ecosystems such as forests, have your students carry out a mini-transect study. The students will tie a string five meters long to two sticks and stake them into the ground in each habitat being compared. Then they will carefully survey the plants and animals they find. A range of field guides is available to your students to help them identify what they find.
3. To see the effects of soil erosion, take your students on a neighborhood stroll to compare the soil in both eroded and intact sites. Have your students consider the following:
 - Differences in soil color, texture, and moisture.
 - Plant life in each site.
 - Reasons why erosion occurred in one site and not the other.
 - Which soil evidently contains a higher percentage of decomposed plant material.

- Which soil evidently contains more worms and other soil fauna.
 - Which habitat is healthier.
4. Have a discussion with your students about human carrying capacity. Ask them how humans can raise their carrying capacity, (e.g. irrigation, plant breeding, fertilization) and how humans can decrease it (e.g. desertification, soil erosion). What will happen if human populations continue to increase and human carrying capacity decreases? Do your students know of examples around the world that look like this?
 5. As an extension, ask your students to consider vanished civilizations, such as ancient Mesopotamian city-states, classic Mayan, and the Anasazi of the American Southwest. Many scientists now believe that environmental degradation, notably deforestation and soil degradation, contributed to their demise. What archaeological evidence would your students expect to find if significant environmental degradation did, indeed, occur?
 6. Ask a farmer to visit your class and discuss how he or she works to conserve soil. Have their crop yields been increasing, decreasing, or remaining the same, and why? Or, ask an agricultural extension agent to speak with your students. What soil conservation problems occur in your neighborhood, and what can people do to solve them? What can your students do?
 7. With the help of an agricultural extension agent, have your students prepare a soil conservation demonstration plot on school property. If your school is in the Midwestern United States, have your students prepare a plot of native prairie plants. Agricultural extension agents, the local land grant college, or local environmental or nature study organizations may be able to help. You may be able to have your school property warrant registration as an official wildlife habitat. Contact the National Wildlife Federation (see listing below) for information about its Backyard Wildlife Habitat program.
 8. To compare the water retention capacity of eroded and healthy soil, collect a sample of each. Then take two one-liter clear plastic bottles and cut off the bottom. Insert each bottle into a clear glass jar and fill each about two-thirds full with one of the soil samples. Now, take a container of water and gently pour into each bottle. Have the students compare the quantity and clarity of the water that comes out the other end.
 9. Have your students compose travel brochures describing the various grasslands worldwide and the cultures (e.g. Mongolian nomads, Gauchos, African pastoralists, American cowboys) found there. The brochures should accurately present what the discriminating eco-tourist can find and do in these places. Your students can use images cut from magazines or downloaded from the Internet.

Episode #7 -- "FUTURE CONDITIONAL" (25 Minutes)

Overview

"Future Conditional" explores how toxic pollutants affect environmental and human health. Viewers discover that pollutants travel great distances, affecting human and natural communities hundreds and even thousands of miles away. Case studies illustrate how Arctic food chains and the Inuit people are being poisoned by toxins being created in the United States, Central America, and even Asia; how poor factory workers in Mexico are being exposed to dangerous pollutants brought about by the new global economy, and why once-thriving fishing villages around the Aral Sea are now ghost towns, a situation that is a powerful wake-up call about the future of California's Salton Sea. The video also introduces a Barrio neighborhood in San Diego that, by successfully confronting political and business interests polluting their neighborhood, demonstrates the power that ordinary citizens have to bring about positive change in their communities.

Learning Objectives

Students will be able to:

1. Understand how the use of toxic chemicals can affect the health of both local and regional communities.
2. Discuss the role that the developed world should play in helping combat these problems.

Pre-Viewing Activities

1. Introduce the following key terms to students:
 - **Inuit** – A people who live in the Arctic from northeastern Russia across Alaska and Canada to Greenland. Formerly referred to as Eskimos.
 - **The grasshopper effect** – A description of how air-borne toxins can infect localities distant from their sources of origin. Toxins can evaporate, travel by wind for hundreds and even thousands of miles, and then return to earth in rain and snow.
 - **Plankton** – Organisms that float in fresh and salt water. The term includes animals as large as jellyfish, but usually refers to microscopic creatures. Phytoplankton refers to photosynthetic organisms, such as floating algae; zooplankton refers to animals and other creatures that eat other organisms for sustenance.
 - **North American Free Trade Agreement or NAFTA** – A treaty passed in the United States in 1993 that promotes free trade between the United States, Canada, and Mexico.

- **Barrio** – A Spanish term meaning neighborhood.
- **Asthma** – A condition characterized by difficulty in breathing that often includes wheezing, gasping, and coughing. Causes include allergies and air pollution.
- **Marco Polo (1254-1324 A.D.)** – A Venetian merchant who traveled to China and spent 17 years with the emperor, Kublai Khan, the grandson of Genghis Khan (see below). His written account of his travels and time in the Chinese court achieved widespread readership in Europe.
- **Alexander the Great (356-323 B.C.)** – King of Macedonia when he was 18, Alexander the Great embarked on a campaign of conquest that, at its completion, extended through the Middle East to Central Asia and India and south to Egypt. He died when he was 32 years old.
- **Genghis Khan (Died 1227 A.D.)** – Leader of the Mongols, a nomadic people from present day Mongolia. Genghis Khan, through armed conquest, formed the largest contiguous empire the world has ever known, stretching from China through Central Asia to Eastern Europe. His armies were known for their ruthlessness and cruelty as well as their effectiveness.
- **Karakalpak People** – A Turkic people living near the Aral Sea.
- **Silk Road** – An ancient trade route that caravans would travel transporting goods from China to Europe.

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

- | | |
|-------------------|-------------------|
| • Canadian Arctic | • Uzbekistan |
| • Iqaluit | • Aral Sea |
| • Tijuana | • Samarkand |
| • San Diego | • Tashkent |
| • Salton Sea | • Amu Darya River |
| • Colorado River | • Moynak |
| • Palm Springs | |

After the students have found each of these locations, begin a discussion to discover what they already know about these regions. Have the discussion center on environmental problems that are familiar to the students.

Post-Viewing Discussion

Canadian Arctic

1. In watching this segment, how many sources of pollution did you see? (Answer: Students may notice motorized vehicles that can release gasoline, oil, and other substances into the environment. Otherwise, there aren't many.) How, then, are Arctic residents ending up with toxins in their bodies? (Answer: The toxins are entering the Arctic environment from sites hundreds and even thousands of miles away. They are carried there by air and water.)

2. In what ways is hunting important to the Inuit? (Answer: Over 65% of their protein comes from wild animals. In addition, it is essential to preserving cultural identity and to developing the character of Inuit young people.)
3. What might happen to the Inuit if hunting were to disappear, either because the animals have disappeared or because they are so laden with toxins that they cannot be eaten? (Possible answers: Inuit would have to depend upon different store-purchased food. Such a shift in diet often leads to health problems, such as diabetes and heart problems, in people who are not accustomed to the new foods. Their cultural identity might weaken, and, since age-old traditions of raising children might be threatened, social problems might afflict Inuit young people.)
4. The skills and knowledge Inuit possess to thrive in their difficult environment and to successfully hunt the animals found there have been passed down generation by generation for millennia. If Inuit were to lose this knowledge, would this be important to those of us who are not Inuit? How important do you think it is to preserve such age-old skills and knowledge in the modern world?
5. The film states that “The discovery of toxic pollutants in the food supply has put 155,000 Inuit on the brink of a public health disaster.” To avoid being poisoned, they must either change their dietary customs, or the United States and other countries must spend huge amounts of money cleaning up the pollution they are creating. What do you think should be done? What do you think will be done?

Tijuana, Mexico

1. What is the trade-off that Mexico made regarding jobs and environment (Answer: Mexico encouraged U.S. factories to settle in Mexico because they provide employment for Mexicans. The factories, however, increase toxic pollution.) Looking at this situation, do you think the trade-off was worth it?
2. Why are people bathing and washing in what is obviously contaminated water? (Answer: They have no alternative.)
3. Is it possible that this pollution can come back and infect people in the United States? (Yes, some pollutants can enter the atmosphere and blow over the border. They can also enter the sea, float to U.S. shores, and enter marine food chains through which people can ingest the toxins while eating seafood.)

4. What is the United States' responsibility in this situation? Should the U.S. help clean up this site, treat people who are sick because of it, and even compensate families financially for the suffering they have undergone? Or, is this the Mexican government's problem?
5. As a follow-up to Question #4, if a United States company establishes a factory in a developing country, is it responsible for pollution problems it creates even if the developing country's environmental regulations are so weak or poorly enforced that the pollution is allowed to continue? Are these pollution problems our fault?

Barrio Logan

1. What did the San Diego municipal government try to do with Barrio Logan? (Answer: The government tried to cause people to leave the neighborhood, clearing the way for industrial and commercial development.) How did the government attempt to achieve this goal? (Answer: It changed zoning laws making it easier for commercial establishments to move in, and it built a large bridge right through the neighborhood.)
2. How did Barrio Logan fight back? (Answer: It forced a major polluting industry to leave the area.)
3. Barrio Logan is in a congested, polluted part of San Diego. Why do you think residents fight so hard to stay in the neighborhood and preserve it?
4. Do you know of any instances where people have tried to unite to achieve a common cause in your neighborhood? If so, what happened? What did the people try to do, what strategies did they use, and how much success did they enjoy?

Salton Sea

1. What does the film say might threaten the health of the residents of Palm Springs? (Answer: Environmental degradation of the Salton Sea. The same scenario that befell the people of Uzbekistan in the following film segment might happen to Palm Springs and other communities in Southern California.)
2. Why might Palm Springs appear to be an unlikely place for public health problems brought about by environmental pollution? (Answer: It is an affluent community, whose residents can afford to live away from areas with polluting industries.)

3. What are two ways in which the Salton Sea is being threatened? (Answer: Agricultural runoff carries huge amounts of chemicals into the lake that are killing fish, birds, and other life. Secondly, water is being diverted from agriculture to San Diego and other Southern California municipalities, thus reducing the flow of water into the lake and causing it to shrink. This scenario is similar to what has happened to the Aral Sea.)
4. Considering the Aral Sea predicament, what should people do about the Salton Sea? Should agricultural pollution be reduced? Should water be taken away from cities and returned to the farmers? What might be the consequences if nothing is done?

Aral Sea

1. What has caused the Aral Sea to dry up? (Answer: A major source of water, the Amu Darya River, was diverted to irrigate cotton fields. The river no longer reaches the sea.)
2. What has caused the sea to be polluted? (Answer: Chemicals from the cotton fields have washed into the sea.)
3. What is the connection between wind-borne toxins and the drying up of the Aral Sea? (Answer: The toxins entered the sea from agricultural runoff. When the sea evaporates, it leaves the toxins behind. The wind blows the new-dry land, now containing the toxins, throughout the area.)
4. Do you think we can use the Aral Sea as a realistic example of what could happen with the Salton Sea and Southern California, or do you think that is too far-fetched? Why or why not?

Special Projects

1. NAFTA remains a controversial program 11 years after its adoption. People are still debating its impact on trade, employment in both the United States and Mexico, environmental protection, and people's health and welfare. Your students can research the positions of people both for and against NAFTA (Typing "NAFTA debate" on an internet search engine should reveal sites produced by each side). Then, they can record each side's main points and debate among themselves whom exactly NAFTA benefits, whom it hurts, and whether its overall impact on U.S. or Mexican citizens has been positive or negative. They can also discuss how they might change NAFTA to benefit more people on either side of the border.

2. Every day, we use common household products, such as cleansers, automotive supplies, cosmetics, and pesticides that contain toxic substances. When these products leak into the environment, or when we throw their containers into the trash, the toxins they contain can enter air, water, and soil. The manufacturing of these products also produces toxic by-products that contaminate our environment. Thus, some people advocate using non-toxic alternatives instead, because, little by little, this can significantly reduce each individual's contribution to the toxic waste stream.

Lists of non-toxic alternatives have been prepared by a range of national and local environmental organizations, notably the U.S. Environmental Protection Agency, Greenpeace, and the Chesapeake Bay Foundation. Some of these alternatives perform quite satisfactorily, while others do not compare with the relatively toxic products they are supposed to replace.

Students can consult lists of non-toxic alternatives and design experiments comparing them with their toxic counterparts. This can be a meaningful and effective way to develop the students' abilities to carry out effective scientific experiments and write them up. The results of the experiments can be published in a brochure or posted on a web site, as a public service.

3. Using lists of common toxic products, students can conduct toxic substance surveys in their school. They should check how the school maintains the athletic fields, disposes of automotive wastes, and cleans the buildings and grounds. After considering the survey results, they can develop a plan for reducing the use of toxic substances and work with the school administration and student council in implementing it.

Episode #8 -- “STATE OF THE PLANET” (25 Minutes)

Overview

“State of the Planet” takes a brief look at four different environmental topics: water issues, the threat of food shortages, human population growth, and global warming. These issues are likely to have a significant impact on the future well-being of Earth’s environment and the people who depend on it for their needs and wants. At the root of these issues is a dramatic human population growth rate that is putting ever-increasing pressure on the Earth’s resources and natural systems. Most of this growth is occurring in the world’s poorer countries, putting enormous strains on their water supplies and ability to feed their citizens. “State of the Planet” discusses how food and water problems are threatening the future of developing countries.

But environmental problems are also affecting the United States; for example, “State of the Planet” illustrates how water shortages are threatening agriculture in the United States. Population growth is also increasing in the United States, and this is of major global significance because U.S. citizens, on average, use far more energy and natural resources than people elsewhere. Our energy consumption, chiefly our burning of the fossil fuels coal and oil, is the main cause of human-created global warming. As our numbers increase so will our environmental impact. At present, global warming presents perhaps the most difficult and serious environmental issue confronting the world today.

Yet, increasingly, people are focusing their commitment and ingenuity on solving environmental issues, and “State of the Planet” takes a look at some of these. These examples serve as a beacon of hope that ultimately we will learn to live in harmony with the planet’s natural systems and ensure a bountiful future for us and for future generations.

Learning Objectives

Students will learn:

1. The rate of human population growth and that most of this is occurring today in developing countries
2. The rate of population growth in the United States and why this has global environmental significance

3. The water issues confronting the world:

- Water shortages
- Water quality deterioration
- The spread of water-related diseases
- Destruction of natural wetlands

4. That food production is sufficient to feed the world's billions, but adequate food distribution to all remains a challenge

5. Evidence that global warming is happening and that it presents a significant environmental problem

6. Some innovative measures people are implementing to help address environmental problems

Pre-Viewing Activities

1. If students do not know the following locations, use a wall map, desk map, or atlas to familiarize them with the geographical areas profiled in the video:

- Great Rivers
 - Amazon River
 - Nile River
 - Amu Darya River
 - Colorado River
 - Ganges River
 - Yellow River
 - Rio Grande River
 - Mississippi River
 - Yangtze River
- Countries
 - Zimbabwe
 - China
 - Haiti
 - Israel (Negev Desert, Israel)

- Cities
 - Nairobi, Kenya
 - Shanghai, China
 - Chicago, Illinois
 - Paris, France
 - London, England
 - Calcutta, India
 - Melbourne, Australia

- United States locations
 - State of Louisiana
 - Ogallala Aquifer, Great Plains
 - Glacier National Park, Montana
 - Gulf of Mexico

2. Introduce the following key terms to students:

- **Aquifer:** An underground source of water
- **Commerce:** Buying and selling goods and services
- **Commodity:** A product that can be bought or sold
- **Communal Farm:** A farm that is owned by a group of people
- **Deprivation:** Lacking sufficient amounts of the basic necessities of life, such as food, water, housing, and health care
- **Developing World:** Regions and countries of the world where people have little money or economic opportunity and where living conditions are inadequately providing for people's needs and wants
- **Drought:** When less precipitation (rain and snow) than usual has been falling, which typically creates great problems for plants, animals, and people
- **Ecosystem:** How everything – plants, animals, soil, weather, etc. - in a certain place – a school yard, a park, a region, etc. – is interconnected
- **Epidemic:** A disease affecting many people at the same time
- **Erosion:** Soil washing or blowing away
- **Family Planning:** Having only as many children as you have decided you want
- **Fertility Rate:** The average number of children being born to women in a particular group
- **Floodplain:** Land that sometimes is covered by water from overflowing rivers, streams, and lakes
- **Fossil Fuel:** Fuels, such as coal and petroleum, that formed from ancient plants and animals
- **Fungicide:** A chemical that kills fungi
- **Genetic Engineering:** Changing the genes of living things so that the living things are somehow different

- **Global Economy:** The buying and selling of goods and services around the world
- **Ice Cap:** Vast sheets of ice, sometimes over two miles thick, that are covering the far northern and southern regions (Arctic and Antarctic) of the planet
- **Insecticide:** A chemical that kills insects
- **Irrigation:** Artificially watering plants. Drip irrigation sprinkles water onto plants
- **Life Expectancy:** The average lifespan of a group of people
- **Malnourished:** Not having enough of the nutrients needed for good health
- **Mega-cities:** Truly large cities, such as New York, Sao Paolo, Beijing, and Mexico City
- **Mulch:** A covering of wood chips or some other plant material that people put on the ground to protect the soil and help plants grow
- **Non-profit Organizations (NGOs):** Organizations that are primarily trying to help society, not make money
- **Renewable Resource:** A natural resource that can replace itself, such as trees and fish
- **Sanitation:** Preventing disease and keeping people healthy by keeping clean the places where people live
- **Sewage:** Human waste that goes into pipes and usually ends up in rivers, lakes, and oceans
- **Shantytown:** A town that people on their own just constructed with whatever materials they happened to find. They are usually built next to cities and usually lack basic services like running water and electricity. Typically, only the very poor live in them.
- **Squatter Settlements:** Homes that people build on land that they do not own, such as ranches and pastures
- **Turbine:** A machine that generates electricity, primarily by revolving magnets around cables of wire
- **Wastewater:** Water that carries the wastes from human activity, including wastes from industries, households, and the surfaces of streets and sidewalks

Post-Viewing Discussion

Threats Concerning Human Population Growth

- How rapidly is our population increasing today? (Answer: Roughly 78 million people/year or 10,000 children being born during the time this show was on the air)
- Many people and organizations believe it is crucial for the future well-being of people and the environment to slow down the rate at which human populations have been increasing. Is progress being made? (Answer: Yes,

the rate of human population growth has slowed significantly in recent years. Today people predict that population numbers will increase to 9.5 billion and then begin to slowly decrease.)

- Most population growth is occurring in developing countries. What are the chances a baby born today lives in the United States or another rich country such as Japan, Canada, Australia, or a European country? (Answer: Over five out of six people on Earth live in poor countries. If you happen to live in a rich country, you are in a true minority. Statistically, you were much more likely to be born in a poor country!)
- The population of the United States, however, is also growing. Why does the film say that this is significant? (Answer: Americans use far more natural resources and energy than anybody else. As our numbers increase, we will therefore use up more and more of the planet's resources, which will have major human and environmental consequences. For instance, we burn far more coal and oil per capita to meet our energy needs. This is thought to be the main cause of global warming. With more of us, we will burn more coal and make global warming more severe, if we keep behaving the way we do today.)

Threats Concerning Water

- What are three water problems that are affecting people in developing countries? (Answer: water shortages, water pollution, and water-related diseases)
- What water problem is afflicting farmers in the United States? (Answer: water shortages)

Threats Concerning Food

- According to the film, what is the main food-production problem afflicting the world today? (Answer: Food distribution, not food production. We are growing enough food to feed the world's billions, but we are not always successful at getting the food to the people who need it.)
- Why does the example of China give us hope about feeding the world? (Answer: Until recently, China used to experience severe famines that killed millions of her citizens. Now very few go hungry, even though China has to feed over 1.2 billion people.) What might be threatening China's success? (Answer: Economic pressure is causing China to expand industrial production, so factories are taking over good farmland, and skilled farmers are leaving their fields to work in them.)

Threats Concerning Global Warming

- According to the film, what are four types of evidence that global warming is occurring? (Answer: 1. receding glaciers; 2. species of plants and animals appearing in places where they have been unknown; 3. rising sea levels; 4. severe heat waves)

Confronting Environmental Threats: New Ideas

- The film shows several innovative measures that people are implementing to better manage our environment. What are they, and what problems are they addressing? (Answer: 1. no-till farming that reduces soil erosion; 2. plant breeding that will enable farmers to grow more crops in difficult environments like deserts; 3. wind generators that can reduce our dependence on fossil fuels, which contribute to global warming)
- After viewing the film, are you more or less worried about your future? What worries you the most, if anything? What do you think we need to do to ensure that you and the planet's environment have a healthy future? What do you think we need to change?

Special Projects

1. Since many environmental problems facing the world today are occurring in developing countries, it is important for students to try to understand what living conditions are like in those countries. This can be a challenge, because they are so different from ours. Assign teams of 2-4 students and have them select a developing country in Africa, Latin America, or Southeast Asia to research. The World Resources Institute web site www.wri.org can be helpful. Ask them to find out the following:
 - The per capita income
 - What the economy is based upon. The percentage of the economy that is based upon agriculture, rather than industrial production
 - The average life expectancy
 - The literacy rate for both males and females
 - The infant mortality rate
 - Per capital energy use
 - How energy is generated, e.g. firewood compared with fossil fuels
 - How senior citizens are looked after

Putting all this together for themselves and others, the teams can either compose a story about a typical family in the country they have studied and read it to the class, or they can make posters illustrating how people live.

Once your class is familiar with the lives of people in developing countries, they can move on to the next activity:

2. What water issues are facing your community? Surprisingly, many if not most people know little about where the water they drink comes from, what is done to make it safe for human consumption, and where it goes after people are through with it. Ask if a member of the water department, the local environmental agency, or agricultural service can come visit your classroom.

Some questions to ask:

- Where does our water supply come from?
- What potential contaminants are being monitored? Are there any that are not being looked for? Is the water department, for example, monitoring prescription drugs or caffeine, which are now showing up in water supplies?
- How is it treated to make it safe? Can we be sure that all potential contaminants are being detected and removed?
- Have there been any instances when the water was found to be unsafe? If so, what were the problems and what was done about them?
- Where does our waste water go to be treated?
- How is it treated? (Primary, secondary, or tertiary?)
- Does your community have combined sewers in which sewage from homes and industries mixes with runoff from streets and sidewalks?
- Where does the water go after it is treated?
- Are the industries in your community required to pre-treat their wastes before dumping them in the sewer system? Who monitors this pre-treatment?
- Have there been any instances where waste water did not meet local, state, or federal standards? If so, what were the problems and what was done about them?
- How polluted are the waterways in the community? What are the main pollutants? Where do they come from? How can the community reduce them?
- Have rainfall patterns changed in the last decade or so? Is your community receiving the same amount of precipitation as before?
- Is your community facing an impending water shortage? If so, what is the cause (e.g. reduced rainfall, reduced runoff from upstream, depleted aquifers)?
- If a water shortage or drought is occurring, what have been the consequences? What does the future look like?
- Is it thought that any connection exists between the changed weather patterns and global warming?

- What can people in the community do to reduce personal water use? What can the school do?
 - Where does runoff from the school end up? Obtain a topographic map that includes the school and note the watershed in which the school resides. Where the runoff goes will be downhill. Now take the class on a walk around the school. Note the pollutants on the grounds, e.g. oil, gasoline, and anti-freeze on the parking lots, fertilizers and insecticides applied to the athletic fields and gardens, dog waste, and litter. Locate the nearest storm drains and visit the water body into which they are likely to empty. Finally, discuss what the local environmental impact of the school is and what the school might do to reduce it.
3. How does the caloric intake of your students compare with that of people in developing countries? Divide your students into teams and assign to each a particular region: Asia, Europe, Middle East and North Africa, Sub-Saharan Africa, North America (A very easy one, only two countries), Central America and the Caribbean, South America, and Oceania. Now ask your students to consult the World Resources Institute web site for information. The path to take: 1) Begin with the web site home page, www.wri.org. 2) Click on Earthtrends. 3) Click on About Earth Trends, then Citing Earth Trends. 4) Click on Agriculture and Food. 5) Click on Data Tables. The right hand column will be "Average Daily Per Capita Calorie Supply (a,b) Kilocalories 1999".

Each team should then scroll down to its particular region and:

- Record the average caloric intake for the region
- Rank the countries according to their individual caloric intake.
- Note the countries with the highest and the lowest caloric intake

Each team should then return to the Agriculture and Food page, then 1) Click on Country Profiles; 2) Click on the countries with the highest and lowest caloric intake in their regions, and 3) Note the graph that describes the Index of Total and Per Capita Food Production. Record for each country whether the Per Capita Food Production is rising or falling.

Once everyone is finished, reconvene the class and summarize:

- Rank the regions according to their average per capita caloric intake. Which region sees the highest? Which region sees the lowest?
- Rank the countries with the highest and lowest per capita caloric intake.
- What 10 countries have the highest? In which regions are they found?

- What 10 countries have the lowest? In which regions are they found?
 - Of the countries profiled, how many are witnessing rising or falling per capita agricultural production?
 - A minimum healthy caloric intake is estimated to be 2350 calories/day. How many countries are below this figure? In which regions are they found?
4. The debate continues to rage concerning whether human activity is causing the planet's temperature to rise, and what, if anything, we should do about it. It is very difficult for us to get accurate and current information about this issue, since so much information seems to be coming from apparently biased sources with agendas that are coloring what they tell us. Nonetheless, it is important for us to try to decide for ourselves whether global warming is occurring and whether the ramifications could be serious. If we think it is happening, then we might feel compelled to reconsider many of our day-to-day actions and decisions. Trying to separate truth from conjecture or propaganda can be a useful exercise for your students. They can apply the lessons that they learn to other situations that they encounter when they are out of school.

Ask your students to consult the internet and find out what people and organizations are saying about global warming. They may work in teams or individually. Ask them to record the following:

- Any straight facts or data, rather than opinion, that indicate whether or not global warming is occurring
- Any opinions about whether it is occurring and whether or not it is a bad thing
- The organizations that claim global warming is serious and we need to do something about it. Try to put these organizations into categories, e.g. International, federal, state, or local governmental entities, environmental organizations, fossil fuel industries, political party organizations, and advocacy organizations with distinct agendas such as free markets, small government, or reduced taxes.
- Repeat this process for organizations that claim that global warming is not serious.

Now ask your students to share what they have found.

- What do the facts suggest about global warming?
- What types of organizations are claiming it is human-caused, serious, and needing to be addressed?
- What types of organizations are claiming that global warming does not need to be addressed?
- What can you conclude about the organizations on each side of this debate? Why do you think they have the views they do?
- Overall, which side seems more compelling to you and why?

Your students can now wrap up their research with a debate. They can consider the question: What should the United States do about global warming? Some options to consider:

- Impose a gasoline tax so people will drive less
- Tax people who drive SUVs and other vehicles that use a lot of gasoline
- Invest tax money in energy technology like solar power and wind power that might replace burning coal and oil
- Invest tax money in building subways and bus lines
- Establishing more HOV (high-occupancy vehicle) lanes that are restricted to people who are car-pooling
- Nothing

An effective way to structure a debate is to ask the students to “fishbowl.” Set up four or five chairs in the room so that they face each other. Three or four of these will be for students who will initiate the debate; they will stay for roughly 5-10 minutes. One chair will be the “hot seat”. This is for the rest of the class. If someone hears something in the debate that he/she wants to respond to, he/she may sit in the seat, make a point or ask a question, and then leave. Periodically you can tap the debaters on the shoulder and exchange them with others in the class, so that eventually everyone who wants to debate has a chance. Fishbowling gives everyone in the class both the chance to debate and the opportunity to be heard.

Episode #9 -- "STATE OF THE PLANET'S WILDLIFE" (25 Minutes)

Overview

This film looks at the challenges wildlife is facing throughout the world. Extinction has always been a natural part of Earth's history; five major extinctions have occurred in Earth's past in which a large number of species went extinct in a relatively short period of time, at least geologically speaking. Perhaps the most well-known of these extinctions was that of the dinosaurs 65 million years ago. The cause is believed to have been a huge asteroid slamming into the Earth. The causes of the other extinction episodes are unknown, but they are surely the result of titanic geological, meteorological, or astronomical phenomena. Now, many scientists believe that we are beginning to experience a sixth mass extinction. This one, however, would be the first created by another animal species, namely our own, Homo sapiens.

"The State of the Planet's Wildlife" examines some of the ways in which we are threatening the survival of Earth's living creatures. Human population growth and the development it creates, the poaching of animals for food and for a wide variety of products ranging from ivory to furs, and global warming are all having dramatic impact on wildlife populations around the world. But, the film will also show how innovative and concerned people are successfully working to protect wild species. The threats wild creatures are facing in the 21st Century are daunting, but hopes for saving them remain robust. The first step is to become informed. This film is intended to help.

Pre-screening Activities

Introduce the following key terms to students:

- **biodiversity**: the variety of all organisms living on Earth or in a particular region
- **browsers**: animals such as deer and domesticated animals that eat grass, trees, and other plants
- **clear-cut**: an area that has had all trees removed for logging; such areas often suffer from soil erosion because the tree roots that have held the soil in place are removed
- **commodities**: products that can be bought and sold
- **dispersers**: animals that unknowingly disperse fruits and their seeds (through scat after eating them, by carrying them in their fur, feathers, or feet, etc)
- **ecosystem**: how everything—plants, animals, soil, weather, etc.—in a certain place—a school yard, park, a region, etc—is interconnected

- **endangered species**: a species in such small numbers that it is considered at risk of extinction. Animals that are “officially” declared endangered are put on an endangered species list either at the state or national levels
- **exotic pet**: an animal from another part of the world that is kept as a pet
- **globalization**: to make global or worldwide in scope
- **indigenous plant**: a plant that is native to a particular region or area and is not naturally found in other parts of the world
- **old growth trees**: very old trees that are part of a mature forest ecosystem that has not been logged
- **over grazing**: putting too many grazing animals on a piece of land so that much of the vegetation is removed and cannot grow back. Erosion is a result and soil is lost, making it more difficult for the plants to re-establish themselves.
- **pollinator**: animals such as insects, birds, bats, and some mammals that visit flowers and unknowingly pollinate the flowers. The relationship between pollinator and plant is often critically important to both species.
- **savannah**: a grassland with scattered trees, typical of East Africa
- **shantytown**: A town that people on their own just constructed with whatever materials they happened to find. They are usually built next to cities and usually lack basic services like running water and electricity. Typically, only the very poor live in them.
- **silting**: the washing of soil and other fine particles into streams as a result of erosion. High amounts of silt can clog the gills of fish, affect the visibility in streams, and even clog streams up.
- **soil erosion**: soil washing or blowing away by wind, water, or ice
- **squalor**: poverty, neglect
- **urbanization**: development of land to make it urban in nature
- **wildlife corridor**: undeveloped stretches of land that connect wild areas together, allowing wildlife to move from one area to another even with human development

Previewing Discussion

To help students put the video in perspective, ask them the following questions:

- What challenges do you think wildlife is facing around the world? Why do you think species are on the endangered species list?
- Do you think the challenges facing wildlife are the same throughout the world, or do you think it varies from region to region?
- How do you feel when you think about the idea that we may be entering a sixth mass extinction of animals? This means that during your lifetime, you may see many species go extinct.

- What does wildlife mean to you? Is it important to you that animals such as lions, bears, and pandas exist in the wild, even if you never see them yourself? Or, is it OK with you that some of them exist only in zoos?

Post-viewing Discussion

1. How unusual is the current extinction threat? (Answer: VERY unusual! Only five instances of comparable species loss in the past 4.5 billion year history of the Earth are known. If we do not turn the current situation around, we will be witnessing the 6th major extinction episode on the planet.)

2. Why is it difficult for China to feed its citizens by itself? (Answer: China's population is 1.3 billion people, roughly 22% of the world's total. That's a lot of people to feed. China does NOT occupy 22% of the Earth's surface, and much of its territory consists of deserts and mountains, unsuitable environments for intensive agriculture.)

3. What is the connection between China and the Brazilian Amazon? (Answer: China relies on poultry and pork production to help feed its enormous population. The pigs, ducks, and chickens require feed made from soybeans. Brazilian farmers, responding to the demand, are burning and clearing the Amazonian rainforests and replacing them with soybean fields.)

4. How is urban and agricultural development outside the Everglades affecting the Everglades itself? (Answer: Most of the water in the Everglades flows into this vast wetland from outside the area. Polluting water outside the Everglades and diverting its flow elsewhere thus affects both the quantity and quality of the water inside the area.)

5. What is the connection between poverty and the killing of wild animals? (Answer: Impoverished people are often hungry, and wild animals can serve as an available source of food. The selling of wild animals for medicines, pets, trophies and other products also can provide much-needed income.)

6. Uncontrolled killing of wild animals will lead to their disappearance, thus eliminating needed sources of food and income. Why, then, don't people reduce how many animals they are killing so that they can be confident that sufficient animals will be around in the future? (Answer: Nobody "owns" wild animals. They are a commonly-held resource. People typically have no incentive to preserve such resources; if, for example, a person encounters a wild animal and refuses to kill it, there is no guarantee that the next person that comes along will do the same. The first person will have deprived herself of the animal, but the animal will not have benefited. Thus, commonly-held resources like forests, grasslands, fisheries, and wildlife tend to be over-exploited. This is called "The Tragedy of the

Commons”. Also, impoverished people are often so desperate that they can only worry about surviving the present, not preserving the future.)

7. How will global warming threaten polar bears, living in one of the coldest places on Earth? (Answer: Polar bears hunt seals that come out to rest on the ice that covers the Arctic Ocean during the colder months of the year. Once the sea ice dwindles during the summer, many of the bears must fast until the ice returns. Consequently, the bears must eat a great deal of food to tide them over during the warm season. With global temperatures rising, the Arctic Ocean ice is appearing later in the Fall and disappearing earlier in the Spring. Ultimately, the bears may not have enough time on the ice to obtain the food they need to nourish them throughout the year.)

8. How will global warming threaten African wildlife? (Answer: In two ways. First, in the face of increasing temperatures and dwindling water supplies, animals may find it more difficult to find sufficient food and water. Secondly, these climate conditions should make it more challenging for farmers to grow crops and graze animals. Increasing poverty will force many of them to hunt wild animals for food and income.)

9. How does the burning of coal and petroleum in the United States and other countries affect the welfare of animals in the Arctic, Africa, and elsewhere? (Answer: Burning coal and petroleum releases millions of tons of carbon dioxide and other gases into the atmosphere that are believed to be the cause of global warming. These gases are therefore called “greenhouse gases.” Energy conservation measures, such as riding a bike instead of driving and turning down the thermostat in your home during the winter, reduce the amount of greenhouse gases in the atmosphere, thus slowing the rate of global warming and reducing the threat of climate change.)

10. Grizzly Bears live in Glacier National Park in northwestern Montana, where they are protected. Sometimes they leave, however, entering privately-owned land on adjacent plains. Why don't they stay put where they are safe? (Answer: Frequently, the bears must find food in habitats that lie outside the national park, often in areas of lower altitude.

11. Formerly, when bears would appear on private ranch land, the ranchers would eliminate them, because they considered the bears threats to their cattle. Why do some ranchers, at least, regard the bears differently today and work to protect them? (Answer: The students may infer that the ranchers admire the bears and consider them integral parts of the magnificent territory in which they live. As one biologist says, the bears' presence “means that we've got an intact landscape. It means something bigger than just those critters.”. The ranchers

also appear to believe that they can figure out how to keep the bears and still protect their cattle.)

12. How are new technologies and techniques helping people to save the bears and prosper economically at the same time? (Answer: The film shows an example: New machinery that allows selective timber harvest while reducing damage to the forest environment, radio-collars that help biologists track the movements of grizzly bears.)

13. Why might it be difficult to achieve the same results in developing countries? (Answer: These countries might not have access to the technology and expertise available in Montana.)

14. Zoos are enormously popular, and offer most people the only opportunities they will have to view rare and exotic animals such as cheetahs, tigers, and gorillas. They are also controversial at times, as some people feel they cruelly hold animals captive which should be wild and free. Have a discussion with your students to explore how they feel about zoos. You can pose the following questions:

- Is it important to have zoos, so that people can see animals they would not encounter otherwise, learn about them, and become concerned for their welfare? If people could not see these animals, would they care about them as much? Is it important to keep some animals captive to fill the role as “ambassadors” for their kind?
- Zoos are important breeding centers for many species of endangered animals. Is it worth keeping some animals captive so that we can ensure that at least some representatives of endangered species can breed safely?
- Would it be satisfactory to you if animals such as gorillas and polar bears were to become extinct in the wild and exist only in captivity? Is it important to you to have these animals in the wild, as well?
- Zoos, of course, can only hold a tiny percentage of the world’s wild creatures. For example, the vast majority of animals on Earth are invertebrates, such as insects, sponges, spiders, and shrimp. Is it important to you to preserve these creatures in the wild, or is it satisfactory to you to only preserve large, attractive, and spectacular creatures in zoos?

15. Grizzly bears are rare in the lower 48 states, and their future is uncertain. They require large amounts of wild country to survive, their behavior (e.g. preying on livestock, pilfering beehives) often runs them afoul with humans, and they are unpredictable, dangerous animals who have been known to seriously injure and even kill human beings. Two national parks where they live are Yellowstone and Glacier. Millions of people visit these parks every year, many of whom are unfamiliar with bears and how to avoid trouble with them. Ask your students how

they feel about the presence of grizzlies in these national parks. Do they pose too much of a risk to visitors to live there? Should they only be allowed to live in more remote, less visited areas? On the other hand, what do the grizzly bears add to the national parks? Would they be diminished without the bears? Would visitors, free from the worry of dangerous bear encounters, find their visits to Glacier and Yellowstone more enjoyable? Or, do you think they should find it worth a little risk to be in a place sufficiently wild and pristine to harbor bears? If your students prove to have a range of opinions on the matter, you might want to have a class debate.

Episode #10 -- STATE OF THE OCEAN'S ANIMALS" (37 minutes)

Overview

“The State of the Ocean’s Animals” examines some of the ways in which humans are threatening the survival of ocean animals. Extremely efficient, but ecologically destructive, fishing techniques threaten many of the ocean’s big fish; the demand for seafood delicacies and fear threaten the world’s sharks; global warming and the damming and diversion of rivers threaten yet others. And, not only ocean animals are at risk; a huge number of the world’s people relying on this marine bounty for food and livelihood are, as well. But, the film also shows concerned and dedicated people who are working hard to learn about ocean animals and to educate and motivate people to help preserve them. The threats facing ocean animals in the 21st Century are daunting, and “The State of the Ocean’s Animals” challenges our generation to understand the problems and take action.

National Science Education Standards: Grades 5-8

<http://www.nap.edu/readingroom/books/nses>

Content Standard C—Life Science

Structure and Function in Living Systems
Populations and Ecosystems
Regulation and Behavior
Diversity and Adaptations of Organisms

Content Standard D—Earth and Space Science

Structure of the Earth System

Content Standard F—Science in Personal and Social Perspectives

Populations, Resources, and Environments
Science and Technology in Society

Learning Objectives

Students will be able to:

- Explain some of the key reasons why ocean animals are becoming threatened
- Identify some ocean animals that are threatened
- Describe some issues threatening ocean animals in various parts of the world
- Discover steps people are taking to protect ocean animals

Previewing Activities

If students do not know the following locations, use a wall map, desk map, or atlas, to familiarize them with the geographical areas profiled in the video:

- A. North America
 - Melbourne Beach, Florida
 - Klamath River, Northern California
 - Monterey Bay, California

- B. Africa
 - Senegal

- C. Antarctica

The following terms are used in the video and may need to be introduced to students:

- Biological diversity: the variety of all organisms living on Earth or in a particular region
- By-catch: the marine organisms caught in fishing nets that are not marketable; they are often killed and thrown back into the sea
- Clear-cutting: usually this term refers to a practice in which all trees in a forest are cut down; in this case it refers to fishing nets that remove all ocean life in their path, including species that are undesirable or unwanted
- Dead zones: a large area in a body of water where conditions cannot support life, often due to oxygen depletion
- drag net or trawl net: a fishing net that is dragged along the bottom of the ocean, gathering everything in its path and incidentally destroying habitat
- extinction: when a species dies out; there are no more individuals left alive
- indigenous people: a group of people native to a particular region or area
- infectious disease: a disease caused by a microorganism or other agent (bacterium, fungus, or virus) that enters the body of a living organism
- migration: in this case, when fish return to the streams in which they hatched to lay eggs
- predator: an organism that preys upon or eats other organisms
- prey: an animal that is eaten by another animal
- reproductive rates: the total number of births expected for a group of female animals over their lifetime
- spawning: the act of fish depositing their eggs
- trawler: a fishing boat that uses nets dragged along the bottom of the ocean floor

Previewing Discussion

To help students put the video in perspective, ask them the following questions:

- What challenges do you think ocean animals (fish, shark, whales, dolphins, etc) are facing around the world? Do you know examples of ocean animals that are facing big threats?
- Do you think the challenges facing ocean animals are the same throughout the world, or do you think it varies from region to region?
- What do ocean animals mean to you? Is it important to you that animals such as porpoises, whales, and penguins exist in the wild, even if you never see them yourself? What about species such as sharks, which the media often portrays as dangerous and evil? What would a world without these creatures feel like?
- In what ways are people's lives affected by a decline in ocean animals?
- What responsibility does our generation have to resolving the threats to ocean animals?

Viewing Activities

Segment One Topic: Over-fishing

Large ships drag vast nets along the bottom of the ocean, pulling up all ocean life in their paths and tearing up vital habitat. Many of the organisms brought up in the nets aren't marketable; known as "by-catch" they die and are thrown back into the ocean. With fish populations depleted, fishing boats often move into new fishing areas, threatening fish populations that local, often poor, people rely upon. This is happening in parts of Africa, such as Senegal, and other parts of the world.

Finding Segment One

(Visual and audio cues: Start when you see a beached whale and Matt Damon asking "How could this have happened? How could we have allowed so many of our ocean animals to be on the brink of extinction?..." Stop with a scene of a Senegalese fish market and Roger Payne saying "What happens when you remove this source of protein? Well, I think you have a problem.")

Post-viewing Discussion

1. Why are trawlers called “killing machines?” (Answer: They drag long nets along the bottom of the ocean. These nets can pull up huge amounts of fish as well as everything else in their path, and can destroy their habitat in the process. These huge ships only process and freeze certain fish species; everything else is thrown overboard as “by-catch.”)
2. People often use the term “harvesting the world’s oceans.” Why is this a misleading term to use? (Answer: People “harvest” what they have grown, and, if they want to keep “harvesting” year after year, they make sure to plant and raise new plants and animals. In contrast, nobody grows the ocean’s fish; we simply take them and hope that nature replaces them. “Hunting” and “gathering” describe the practice of fishing more accurately than “harvesting”.)
3. Why are people in the developing world especially vulnerable to over-fishing? (Answer: Large, mechanized fishing vessels that no longer catch enough fish in their traditional waters often move into new areas, such as off the coast of Africa. Local fishermen simply cannot compete with the large “factory” ships. The large ships also remove the fish that local people rely on as a food source.)
4. If fishermen rely on having enough fish to make a living, why do they take too many fish? Aren’t they hurting themselves? (Answer: Nobody owns marine fish; they are available to anyone who can catch them. This means that it often does not pay for a fisher-person to restrain herself and intentionally leave fish alone so they can reproduce and keep the fishery going. If, say, fisher-person A leaves the fish alone, what is to prevent fisher-person B from coming along and taking the fish himself? Fisher-person A will have lost some fish, but the fish populations will not have benefited from his actions. And so, even those who know over-fishing is threatening their livelihood often persist in catching too many fish because they figure somebody else will catch the fish if they don’t.)

Segment Two: The Effects of Global Warming on Ocean Animals

Section Two describes how global warming is menacing the continued survival of sea turtles and emperor penguins. Global warming is causing ocean levels to rise, which may drown the beaches where sea turtles lay their eggs. Global warming may also melt the sea ice surrounding Antarctica upon which emperor penguins rear their young. The film, however, illustrates efforts to preserve these extraordinary animals. In Melbourne Beach, Florida, people are determined to keep their beaches welcoming to nesting Loggerhead sea turtles. Carefully marking turtle nest sites so they are not disturbed, community residents are

rewarded by the enthralling sight of baby turtles making their way to the sea. Meanwhile, in Antarctica, scientists brave extreme cold to study penguins so we can know how best to protect them. The future of these, and other, animals, however, remains uncertain in the face of global climate change.

Finding Segment Two

(Visual and audio cues: Start when you see the scene of a sea turtle swimming through sea grasses and you hear “Like the shark, sea turtles have been wandering the oceans of the world for millions of years....” Stop when you see Matt Damon say, “Though the full impact of climate change may be only decades away – there are other threats to wildlife habitats that have already surfaced.”)

Post-viewing Discussion

1. Sea turtles have survived on Earth for millions of years, but why are they threatened today? (Answer: Sea turtles return to their birthplace to lay eggs in the sand. Many nesting beaches, however, are now unavailable to them, having been developed into resorts, public beaches, and beach communities. Sea turtles are also threatened in some places by uncontrolled egg collecting and hunting for food and by accidental drowning in fishing nets. Long-term, global climate change may drown vital nesting beaches.)
2. Why is Melbourne Beach, Florida such a success story for loggerhead turtles? (Answer: The community monitors the beaches at night and marks the locations of sea turtle nests so people won't disturb them during the day. The local population of turtles has nearly doubled.)
3. Why do sea turtles need a lot of beach to sustain their population? (Even though one turtle may lay 100 eggs at a time, only one baby in 10,000 will reach maturity. Most of them become prey to other animals.)
4. It appears that the loggerhead turtles at Melbourne Beach are in good hands. Why is there a concern about the turtles 30 years from now? (Answer: It takes a young turtle about 30 years to become old enough to reproduce. When they return in 30 years, the beaches that exist now may be underwater due to sea level rise caused by global warming. It may be difficult for them to lay eggs further inland because houses and other human construction may be blocking the way.)
5. What hopeful signs are there for saving these turtles? (Answer: Dedicated citizens and volunteers are working hard to protect turtle nesting areas.)

6. Why are Emperor penguins so vulnerable to global warming? (Answer: They aren't capable of walking on the rough terrain of mainland Antarctica, so these birds are completely reliant upon sea ice to reproduce and raise their young.)
7. What other species might be affected by global warming? (Answer: Corals may not tolerate warmer water temperatures. Whales may find it difficult to find food: Their food animals may move to different areas because of changes in water temperature, and the whales may not be able to find them because their brains are "wired" to follow traditional migratory routes.)

Segment Three: Chinook Salmon in the Klamath River

In Northern California, adult Chinook salmon migrate from the Pacific Ocean up the Klamath River to spawn in the place of their birth. Segment Four of the film shows their desperate plight as the salmon find they cannot complete the journey. The cause? Dams built to divert water for agricultural irrigation are leaving too little water in the river for the salmon. They are dying by the thousands before spawning. The indigenous Yurok Indians are left without the fish that have sustained them for generations, as are commercial fishermen fishing for salmon hundreds of miles away in the Pacific.

(Visual and audio cues: Start when you see a forested coastline and Matt Damon says, "Though the full impact of climate change may be only decades away, there are other threats to wildlife habitats that have already surfaced..." Stop when you see Raymond Mattz say, " I love this river. I love being here. I'd like my grandkids to grow up and see what I seen. I'd like to see it before my time...')

Post-viewing Discussion

1. What factors caused the Klamath River watershed to be degraded for salmon? (Answer: Cutting of forests along the river muddied the water. Wetlands often provide sanctuary for young fish, and connected wetlands were destroyed. Also, a series of dams were built to produce electricity and to provide water to farmers for irrigation. The dams siphoned off water from the river and blocked the salmon from their migratory route.)
2. What groups of people were in conflict over the use of the water in the Klamath River? Who decided how the water would be used? (Answer: Farmers wanted the water to irrigate crops. Native American fishermen wanted the water to remain in the river so they could continue to fish in the traditional way of their tribe. The federal government came down on the side of the farmers.)

3. What caused one of the largest salmon die-offs in American history in September 2002? (Answer: A two-year drought hit the area in 2001, so there was simply not enough water for everybody's needs. When the federal government decided farmers would get Klamath River water, insufficient water remained to accommodate the annual salmon spawning migration. Approximately 33,000 salmon suffocated along the river's shores.)

Segment Four: Returning the Sea Otter to Monterey Bay, California

The sea otter, a marine mammal adored by humans for being cute and playful, was on the brink of extinction due to hunting for its luxuriant fur. At one point, the population in Monterey Bay was down to 50 individuals. The decline of sea otters had a big impact on the kelp forest ecosystem. Without otters to eat shellfish such as abalone and sea urchins, these grazers of the sea devoured the kelp, upon which hundreds of other animals depended for food and sanctuary. Once laws were in place to protect the sea otter, their numbers increased and the health and diversity of Monterey Bay returned. Now, for unknown reasons, sea otter numbers in Monterey Bay are no longer rising. Scientists are working hard to find out what might be harming sea otters; they understand that sea otters are essential to the kelp forest ecosystem and are good indicators of ecosystem health.

(Visual and audio cues: Start when you see footage of Monterey Bay; Matt's voiceover will say, California's Monterey Bay overlooks one of the most diverse marine ecosystems in the world. Its waters teem with life. Each year millions of tourists thrill to the rich variety of sea mammals living or migrating through the bay... " Watch until the end of the film.)

Post-viewing Discussion

1. Why are sea otters so important to the kelp forest ecosystem? (Answer: Otters prey upon sea urchins and abalone. Unchecked, these creatures would devour kelp forests, which provide sanctuary to hundreds of other marine species.)
2. Why were sea otters so close to extinction? (Answer: They were hunted for their fur.)
3. Why are scientists monitoring the sea otters at Monterey? (Answer: Although their population bounced back, population growth has now leveled off for unknown reasons. Scientists want to monitor the sea otters to find out if something is making them sick. This is especially important because the sea otters are such vital animals in the kelp forest ecosystem.)

Special Projects

1. Global climate change has lately been receiving a good deal of attention. It seems as though hardly a week goes by without some new revelation being reported on T.V., in the newspapers, and on the radio. Though increasing numbers of people are becoming convinced that global climate change poses a real threat to life on our planet, including humans, some people and organizations are on record as not being convinced that global climate change requires our immediate attention.

Have your students research the controversy on the internet. Each student can record three examples of evidence either supporting or refuting the premise that global climate change is a serious problem that people need to address. Each student can also record the types of organizations (e.g., environmental groups; state, federal, and international governmental agencies; oil and coal companies, political parties, religious denominations) that are lining up on each side.

After conducting their research, have the students convene and compare their findings. Does the accumulated evidence seem to point in one direction or not? What do organizations on each side of the debate say to support their positions? What might be motivating the organizations to take the positions they do; which side seems to be more objective; which side seems more convincing? Finally, should we take action to confront global climate change or not? If your class is divided on the issue, a spirited debate might ensue!

2. Have your students visit markets or restaurants that sell seafood. Ask them to query the proprietors about seafood trends that they see. Questions to ask:
 - Where does the seafood being sold come from?
 - What kinds of seafood are becoming scarcer and, therefore, more expensive? What kinds of seafood remain abundant?
 - Do dwindling species share anything in common, e.g. habitat, such as salt or fresh water; geographic location where they came from, biological classification (mollusk, crustacean, fish, etc.), and fish size?

Once your students have completed their research, they can compare results. What species seem to be dwindling? Which species are not? Why might this be?

3. Marine animals that are currently in danger of becoming extinct include whales, sea turtles, manatees and the dugong, some seals and sea lions, crocodiles, and some fish like salmon and sturgeon that spawn in freshwater rivers but live much of their lives in the sea. Have your students choose a particular marine animal to research. They can find animals to research on these web sites:
- www.endangered.fws.gov/wildlife.html
 - www.iucnredlist.org

Ask your students to find out:

- Where the animal lives
- Why it is threatened with extinction
- What is being done to help it survive

Each student can then put the information on a poster, preferably with a picture of the animal being presented. You can then put the posters up in the classroom or the hallway to create a gallery of endangered marine creatures.

4. Sea otters are important to the kelp forests where they live, because they eat huge numbers of sea urchins that, in turn, devour kelp. Without this predation, sea urchin numbers can grow so large that they can wipe out the kelp forests upon which many marine creatures depend for survival. Species like sea otters that have unusually significant impact on their habitats are often referred to as keystone species.

The New York Times published an article January 5th, 1999, entitled “Search for Missing Otters Turns Up a Few Surprises” that detailed what happened when sea otters were removed from a kelp forest in Alaska. Among other things:

- Sea urchin populations exploded and ate the kelp.
- Fish that depended on the kelp disappeared.
- Bald eagle numbers that ate the fish dwindled.
- Starfish numbers increased because sea otters eat them, as well.

With butcher paper or poster board and markers or crayons, have your students diagram this process. Further exploration of the keystone species concept might lead your students to complete diagrams featuring other examples. Some possibilities might include the saguaro cactus, the gopher tortoise, the tropical fig, and the elephant. See what other examples they uncover!

5. Marine fish and other sea creatures are no one's property, but are available to anyone who can catch them. As a natural resource that no one owns, they constitute a commons. Examples of other commonly-owned resources include open grazing land, wildlife, and the air we breathe.

Such resources are often over-exploited in ways that privately-owned resources are not. A rancher, for example, is not going to send all of his cattle to market at once, because then he will have no cattle left to replenish his herd. To be successful, he has to think long-term. A fisher-person looks at things differently. Thinking that a particular species is being over-fished, she may decide to intentionally leave some in the ocean so they can reproduce and produce enough fish for her to catch next year. If she does this, however, she has no way of knowing whether the next fisher-person that comes along and catches the fish will make the same decision. She will have given up some income, but she will not have gained anything from her decision because the fishes she left behind are not going to reproduce after all. And so, she is motivated to take what she can whenever she can in a way that the cattle rancher is not.

To fully grasp this phenomenon, often termed The Tragedy of the Commons, your students can play a game to be accessed on the internet. Have them call up the web site of the Cloud Institute, <http://www.sustainabilityed.org>. Once they do, have them click on Play the Sustainability Game at the bottom of the page. The game will walk your students through a scenario that details why commonly-owned resources such as marine fish typically get over-exploited.

RESOURCES

Conservation International (www.conservation.org)

Visit this page on sea turtle conservation to get information on endangered sea turtles and links to other useful sites.

Earthtrust (www.earthtrust.org)

This web site features information on an anti-driftnet campaign, a campaign to save whales, and an effort to protect Hawaii's marine wildlife.

The Leatherback Trust (www.leatherback.org)

This organization is dedicated to the conservation of leatherback sea turtles as well as other sea turtles. Look at nesting highlights for the current year.

MarineBIO (www.marinebio.org)

This web site offers a great deal of information on marine conservation, sustainable fishing, and marine species.

National Coalition for Marine Conservation (www.savethefish.org)

This organization is dedicated to protecting marine habitat, preventing over-fishing, and reducing by-catch.

NOAA Fisheries Service (www.nmfs.noaa.gov)

This site has a wide variety of information on all kinds of marine fisheries issues and conservation. Go to the following site for information specifically about sea turtle conservation: <http://www.nmfs.noaa.gov/pr/species/turtles/>.

Pelagic Shark Research Foundation (www.pelagic.org)

A non-profit research and education group dedicated to the conservation of sharks, especially those off the California coast. The site has good information on sharks and their current status in California.

Public Broadcasting System—NATURE (www.pbs.org/wnet/nature/dolphindefender/credits.html)

Visit this site to find out more about Hardy Jones, dolphins, and an excellent resource list.

Shark Research Institute (www.sharks.org)

This non-profit organization does research on sharks and promotes the conservation of sharks. It also sponsors the Peter Benchley Shark Conservation Award.

Whale and Dolphin Conservation Society (www.wdcs.org)

The education page at this site includes a few simulations and games related to by-catch, and they also offer an adopt-a-dolphin project.

Episode #11 -- "STATE OF THE OCEAN'S ANIMALS" (32 minutes)

Overview

Seventy percent of our planet is covered by oceans. They provide food and livelihood to billions of people and homes to a glorious array of marine life; they also regulate Earth's climate. In short, they are vital to the health of the planet and its living things. Yet, vast though they may be, the planet's oceans, and the life they sustain, are confronting unprecedented threats because of human activity. The State of the Planet's Oceans takes us on a journey, exploring the impact over-fishing, habitat destruction, and global climate change are having on our oceans. The threats are serious, to say the least, but the film also shows how people are successfully protecting marine resources. These actions give us hope that, with sufficient commitment, we have the ingenuity and resources needed to protect the oceans and its life.

National Science Education Standards: Grades 5-8

Content Standard C—Life Science

Structure and Function in Living Systems
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 F—Science in Personal and Social Perspectives

Populations, Resources, and Environments
Science and Technology in Society

Learning Objectives

Students will be able to:

- Explain the ecological and economic impact of over-fishing, notably in the North Atlantic Ocean;
- Describe several likely consequences affecting oceans from global climate change;
- Describe several creative measures that people are implementing to protect marine life.

Previewing Activities

If students do not know the following locations, use a wall map, desk map, or atlas to familiarize them with the geographical areas profiled in the video:

A. North America

- New Bedford, Massachusetts
- The Dry Tortugas National Park, Florida
- Newfoundland, Canada

B. Central America

- Belize

C. South America

- Peru and its capital city, Lima
- The Andes Mountains

D. Greenland

E. Europe

- Portugal

F. Asia

- Bangladesh and its capital city, Dhaka
- Calcutta, India

G. Antarctica

The following terms are used in the video and may need to be introduced to students:

- Carbon Dioxide: A naturally-occurring gas that is also created as a by-product of burning fossil fuels such as coal and oil. Plants draw in carbon dioxide from the atmosphere to make their food. Because we burn so many fossil fuels, the amount of carbon dioxide in the atmosphere is rising significantly. This is thought to be a primary cause of global climate change.

- Coral Reef: Corals are invertebrate animals (without backbones) that manufacture homes made of calcium carbonate. Together, these homes create huge living structures called reefs that provide vital habitat for a splendid array of marine creatures.
- Delta: When rivers empty into standing bodies of water, such as lakes and the ocean, the soil they have been transporting accumulates at the river mouths and builds up over time. This newly-created land is called a delta.
- Eco-tourism: When tourists visit natural areas, such as forests, mountains, wildlife reserves, and coral reefs. Interest in such activities is growing, and eco-tourists often supply substantial income to communities situated near these natural sites, thus providing important incentive to maintain their preservation.
- Fossil Fuels: Fuels such as coal and petroleum that are derived from the fossilized remains of plants and other living things.
- Glacier: A river of ice that typically flows so slowly that it does not appear to be moving at all.
- GPS sensor: GPS stands for Global Positioning System. GPS is a technology that employs satellites for navigation. With GPS, you can pinpoint the exact location (latitude and longitude) of where you happen to be. In the film, scientists are shown using GPS technology to measure the flow of Greenland glaciers.
- Incas: Native Americans, whose ancestral language is Quechua, who chiefly live in the South American Andes of Bolivia, Peru, and Ecuador.
- Renewable Fuels: Fuels that can renewed indefinitely, unlike fossil fuels, which exist in fixed amounts. An example is ethanol, which comes from corn.
- Sewage: Human waste (the kind you would flush down the toilet) that is a major water pollutant worldwide.
- Spawning: The act of fish depositing and fertilizing their eggs.

Pre-viewing Discussion

To help students put the video in perspective, ask them the following questions:

- What do you know about the health of the oceans and marine creatures? What is polluting the water? What marine creatures are disappearing? What are coral reefs, where are they found, and what is happening to them?
- What have you heard about global climate change? Do you know what human activities are thought to be causing it and what the consequences might be? Do you think it is actually happening? Do you think it's important to find out?
- Do you know how global climate change might be affecting the oceans?

- How important do you think healthy oceans will be for your future? What do you think the conditions of the oceans will be twenty or thirty years from now?

Viewing Activities

Segment One Topic: Over-fishing

Segment one focuses on the collapse of the cod fishery of the North Atlantic Ocean and its effect on the communities of Aveiro, Portugal, and New Bedford, Massachusetts. The economies and even cultural identities of these communities have been intertwined with the cod for generations, so the impact has been severe.

Finding Segment One (Length: 13 minutes and 30 seconds)

(Visual and audio cues: Start when you see ships moored in a harbor and hear Matt Damon say, “We begin our story in a small town...” Stop when you see New Bedford in the background and Andrew Light says, “We certainly don’t want to lose the forms of knowledge that we have gained over hundreds and thousands of years of having some kind of relationship with the oceans and with the seas.”)

Post-viewing Discussion

1. If people have been fishing for North Atlantic cod for at least 400 years, why has the fishery collapsed so recently? (Answer: As long as people did not catch too many fish, enough cod would survive to reproduce and replenish the population. Unfortunately, the numbers of people fishing for cod, using ever-more efficient equipment, increased to the point where the fish populations became too depleted to recover. The harvest could not be sustained.)
2. Why didn’t people just agree to catch less fish to preserve the resource upon which their livelihood depended? (Answer: There are several reasons for this. First, the over-harvest of the cod was difficult to detect. Since it was going on under water, people didn’t see it happening the way they would have if the animals disappearing were living on dry land in plain view. Secondly, the fisher persons confronted real economic pressures that encouraged them to catch as many fish as they could to make as much money as they could. Cutting back on the numbers of fish caught would have reduced their income. But, what was also highly significant was that no one owned the cod; the fish were available for anyone to catch. This meant that there was no incentive for individuals to reduce their catch. If someone had, what would have prevented someone else from catching the fish that the first person had left alone? The first person would have lost money, but the cod population would not have

benefited. And so, without everyone working together to catch less fish, it was in everyone's best interests to catch as many fish as he or she could.)

3. If towns like Aveiro and New Bedford lose their identity as fishing communities, and people stop fishing, does it matter? How important is it to preserve the special traditions and knowledge that these towns have accumulated? How important is it to you to preserve places that are different than everywhere else? (Opinions will vary, but students might mention that we need fishing expertise to endure if we are to continue to enjoy seafood, and that the world would be a less interesting place if we allow places with unique personalities to become like everywhere else.)

Segment Two: Marine Habitat Protection: The Dry Tortugas, Florida

The preceding segment discussed a serious issue – the depletion of the North Atlantic cod fishery – that is proving to be a difficult challenge to solve. In contrast, this segment illustrates what people can accomplish with creativity and commitment. To combat coral reef destruction and the overharvesting of the reefs' denizens, the United States established a 200 square mile marine sanctuary around the Dry Tortugas Islands in the Florida Keys. The results: coral, fish, and other marine creatures have rebounded in spectacular fashion. Key to the reserve's success are the efforts of committed law enforcement officials, and the film takes viewers along as these officials patrol the sanctuary and ensure its continued protection.

Finding Segment Two (Length: 9 minutes and 55 seconds)

(Visual and audio cues: Start when you observe an aerial view of a Florida coastline and hear Matt Damon say "About 70 miles off the coast of Key West, Florida, surrounding a chain of small islands..." Stop when you see Joe Scarpa in his boat saying "...by enforcing the laws that are there, they are learning their lessons from that, they're learning from that, and we're gaining voluntary compliance.")

Post-viewing Discussion

1. Do you think establishing marine reserves like the Dry Tortugas is a good idea? If so, why do you think we don't have more of them? What's standing in our way? (Answers will vary, but might include pressure from commercial and sport fishers to keep places open for fishing, and the difficulty and cost of enforcing reserve laws and restrictions.)

Segment Three: Global Climate Change: Greenland

Threatening the future of our oceans, along with over-fishing and habitat destruction, is the looming specter of global climate change. The following three segments explore this critical environmental issue. Segment Three travels to Greenland, where scientists are investigating how fast glaciers are flowing into the sea. The findings of these scientists are of great interest, because as glaciers disappear into the ocean sea level rises. This is expected to be disastrous to people living in coastal communities worldwide.

Finding Segment Three (Length: 6 minutes and 13 seconds)

(Visual and audio cues: Start when you see a smoke stack spewing forth a cloud of dark smoke and hear Matt Damon say, “The scientific community now reports that the level of carbon dioxide... “ Stop when you see glacial ice crashing into the sea and hear Matt Damon say, “If the entire ice sheet should melt, the oceans of the world would rise by a catastrophic 23 feet.”)

Post-viewing Discussion

1. How is global warming thought to be increasing the melting of Greenland glaciers? (Answer: Warming temperatures are creating meltwater lakes on the glacier surfaces. This water drains through cracks in the glaciers until they reach the bottom where the glaciers are in contact with rock. The water lubricates the glaciers, causing them to flow more rapidly into the ocean.)
2. How does glacial melting lead to sea level rise? (Answer: When the glaciers flow into the sea, they break up and produce icebergs. These float away and eventually melt into the ocean. In addition, any water produced by melting glaciers on land will ultimately flow into the sea. Because of global warming, glaciers are melting and flowing more rapidly than before.)

Segment Four: Global Climate Change: Bangladesh

Segment Four discusses the impact sea level rise will have on one country: the crowded and impoverished nation of Bangladesh. Roughly the size of Wisconsin, Bangladesh has a population of 151 million people, or roughly half the population of the United States. It is estimated that a sea level rise of three feet will drown half the country, forcing tens of millions of people into ever-smaller amounts of land and creating increased poverty, disease, and social tension.

Finding Segment Four (Length: 5 minutes and 35 seconds)

(Visual and audio cues: Start when you see people in Bangladesh paddling around in small boats and hear Matt Damon say, “Bangladesh is a place defined by water.” Stop when you see a man carrying a load of baskets on his bicycle and hear V. Ramaswamy in Calcutta, India say, “They will go over them, through them, or under them because poverty does not recognize boundaries.”)

Post –viewing Discussion

1. How are Greenland glaciers connected with the tropical country of Bangladesh? (Answer: The melting Greenland glaciers are contributing to sea level rise worldwide. A sea level rise of a few feet will inundate much of Bangladesh, even though it lies halfway around the world.)
2. How will Bangladesh flooding affect the country’s citizens? (Answer: Bangladesh is among the poorest and most crowded countries on the planet. Roughly 151 million people live there, in a country the size of Wisconsin. This is about half the population of the entire United States. Most of them depend upon subsistence farming for their living. With a projected sea level rise of three feet, over half the agricultural land will be underwater, and a huge number of people will lose their livelihood and even the land on which to live. They will have to move, most likely to the already crowded capital city of Dhaka or even to India, which has 1.1 billion people of its own. These places will not have the space, homes, schools, jobs, and health services to cope with this migration. Poverty, disease, and social unrest will be the likely result. A massive humanitarian catastrophe will likely occur.)

Segment Five: Global Climate Change: Peru

Segment Five begins high in the Peruvian Andes, an odd locale for a film about the planet’s oceans. Soon, however, the connection becomes clear. Global climate change is causing Andean glaciers to melt at such a pace that some scientists believe they will be gone entirely in a matter of decades. If this happens, the water supply for people living in the Andes will be threatened, so many of them will move to the coast. The vast majority of these migrants will end up in impoverished shantytowns, without running water or sewage facilities. Their wastes will end up polluting the ocean along the coast, and their need for food and employment will force many of them to take up fishing, thus threatening existing fish populations with over-harvesting, similar to that which has befallen the North Atlantic cod.

Finding Segment Five (Length: 8 minutes and 55 seconds)

(Visual and audio cues: Start when you see a high Andean meadow, or puna, and hear Matt Damon say, “These are the highlands of South America’s Andes, the highest tropical mountain chain in the world.” Stop when you see a power plant in the background and Scott Doney says, “I don’t really think it’s our choice to destroy something that they are never going to get to see.”)

Post-viewing Discussion

1. Why is the melting of glaciers in the Peruvian Andes expected to force people living in the mountains to move to the coast? (Answer: People living in the Andes depend on the water that the glaciers provide. They are accustomed to glaciers large enough to produce a steady stream of meltwater for drinking and irrigation, even during dry periods. The concern, however, is that global climate change will shrink the glaciers to the point that they no longer contain enough water to sustain mountain communities. They may even disappear altogether. When that happens, people will not be able to farm and will have to move.)
2. If large numbers of Andean people move to the coast, what will be the living conditions awaiting most of them? (Answer: Most of the migrants will end up in shantytowns without running water, sewage facilities, electricity, or employment.)
3. How would they be expected to affect the ocean? (Answer: The increased number of people needing to eat would likely lead to increased fishing pressure on coastal fish populations. As we have seen, people often tend to catch too many fish, leading to the crash of fish populations around the world. This might very well happen in Peru. In addition, without basic sewage facilities, the communities where these people settle will be dumping increased amounts of human waste into the ocean.)

Segment Six: Marine Conservation in Belize

Segment Six focuses on another successful conservation story. The small Central American country of Belize has, like the United States, established a marine sanctuary: the Gladden Spit Marine Reserve. This reserve is protecting a host of marine creatures and their habitat. The success of this effort has created a new eco-tourism industry. People from around the world are traveling to Belize to observe and even swim with the creatures of Gladden Spit, notably the world’s largest fish, the whale shark. In so doing, they are providing Belize with a new source of income and new opportunities for employment. The Gladden Spit reserve, like the Dry Tortugas Marine Reserve discussed earlier, illustrates that people do not have to stand by helplessly and witness the relentless deterioration of the oceans and their resources. We can choose a different course and, like a

great array of marine creatures, reap considerable benefits as a result of our good work.

Finding Segment Six (Length: 4 minutes and 13 seconds)

(Visual and audio cues: Start when you see a fisherman in a small boat throwing a net and hear Matt Damon say, “Forty miles off the coast of Belize, on a small Caribbean island...” Stop when you see a swimming whale shark and hear Matt Damon say, “It’s joined Florida’s Dry Tortugas reserve as a model for marine communities around the world.”)

Post-viewing Discussion

1. How do you think eco-tourism benefits the people of Belize? (Answer: Tourists spend money for food, lodging, guide services, and souvenirs, thus providing an income to the country and employment to its citizens. It also enables people from different countries to become acquainted with each other, thus contributing to mutual global understanding and fellowship.)
2. On the other hand, can you think of ways in which international eco-tourism might hurt a country like Belize? (Answers will vary but may include the concern that the tourists themselves may damage the environment that they have come to see by doing such things as putting pressure on fish and other marine resources, increasing human wastes, littering, and creating crowded conditions in natural areas. Students might also mention the possibility of upsetting local people by behaving rudely and being insensitive to local customs and traditions. Eco-tourism must be carefully managed to protect both the environment and local cultures.)

Segment Seven: Summary with Sylvia Earle and Matt Damon

In the final segment of The State of the Planet’s Oceans, the noted marine biologist, Sylvia Earle, and Matt Damon wrap up the film with a final testimony to the beauty of the world’s oceans and the necessity to preserve them.

Finding Segment Seven (Length: 2 minutes and 45 seconds)

(Visual and audio cues: Start when you see Sylvia Earle saying, “If I could, I would love to take anybody and everyone down into the sea, to see what I have come to know and love.” End when Matt Damon says, “What we need now are the efforts of people everywhere, all those who are willing to find ways to strike the right balance, between what we want and what the oceans can provide.”)

Special Projects

- 1. Research the Changing Availability of Seafood in Your Area** How are fish populations doing from the perspective of people in your community? Have your students visit restaurants and food markets in your community and interview the proprietors about what they have observed regarding seafood. What species seem to be scarcer, harder to obtain, and more expensive than formerly? What species seem to be as, or more, abundant than before? Perhaps your students can also find out how to contact the suppliers of the restaurants and food markets and ask them the same questions. Once your students have gathered their information, ask them to share their findings. Can your class draw any conclusions? Are there any particular geographic locations or types of habitat that seem to be experiencing population decreases of commercial fish and other marine creatures? What categories of fish, shellfish, crustaceans (crabs, shrimp, lobsters), and other types of seafood seem to be disappearing? Considering present trends, do your students think that any species are especially at risk of disappearing, like the North Atlantic cod?
- 2. Identify Best and Worst Seafood to Eat in Your Area** Print or use a projector to display a Seafood Selector or Pocket Guide to seafood-friendly consumption (see resource section). Find out which seafood in your area is best and worst to consume from an environmental standpoint. Share the findings with the school using posters, assemblies, or communications with parents.
- 3. Discover Environmental Laws Protecting Wildlife in Your Area and Local Wildlife Issues** Who is responsible for enforcing the environmental laws protecting wildlife in your community? Ask a wildlife officer or game warden to speak to your class. What are the wildlife issues with which he or she is concerned? Are there any species that are considered to be nuisances? Are there any species considered to be at risk? Is there anything students can do to help protect the wildlife in their community?
- 4. Identify Coastal Cities that Will Be Impacted by Sea Level Rise** Divide the class by continent. Locate coastal cities using an atlas or map. Find their populations and altitude above sea level. Now ask groups to determine what would happen to these cities with a six foot rise in sea level, an outcome that many climate scientists believe possible considering current climatic trends. How many people would be displaced, and what will the environmental and social consequences be? Ask the teams to share their results in class.

5. **Check Out Your Local Drinking Water Supply** Clean water is essential to our survival, but it's often amazing how little people know about where their drinking water comes from. Conduct a useful research project to find out more about drinking water in your community. Visit your water treatment plant or ask a member of your community's water department to visit your school. Try to find out:

- The source of your community's drinking water
- Whether the water supply is sufficient, or whether water shortages are a potential problem
- How many communities are upstream and whether they might be discharging contaminants into the water source.
- How the water department determines the contaminants that are in the water. What does the department test for (e.g. bacteria, nitrates and phosphates, sediment, toxic metals, pharmaceuticals), and what technology does it use to assess water quality?
- How the water department treats the community's drinking water and whether the treatment methods match the known contaminants found in the water. How the department ensures that its treatment efforts are adequate.
- Whether any water safety issues have arisen and what was done to address them.

Once your class has learned about their drinking water, they can educate the rest of the school community through such means as assemblies, posters, and the school web site. They can also determine for themselves if their drinking water is safe to drink, if it's a good idea to filter it at home before drinking, or even if they should resort to bottled water.

6. **Design an Ecotourism Travel Poster** As your class has seen, people from around the world are traveling to Belize to swim with whale sharks. Have each of your students choose a type of natural wonder (e.g. mountain range, rain-forest, coral reef, glacier, wildlife spectacle) that he or she would like to see. Each student would then identify and research a particular place with that chosen feature and prepare a travel poster that illustrates where this location is and what it offers the eco-tourist. You can then put the posters up in the hallway and even poll the students to see which place is their favorite.

7. **Describe A Special Place Worth Protecting** Sylvia Earle speaks passionately about her love for oceans and ocean life. Ask your students to think about a natural place that is very special to them. It could be a place in their neighborhood or community or a place to which they have visited or traveled. Invite them to write an essay about this special place, describing what makes it worth protecting. If desired, post the essays or have the students read them aloud.

Resources

OVER-FISHING/RESPONSIBLE CONSUMPTION OF SEAFOOD

Environmental Defense Fund

<http://www.edf.org/home.cfm>

Through the oceans section of the home page, you will find a Seafood Selector that rates the best and worst choices in terms of eating fish and seafood, as well as a wide variety of information about fishing responsibly.

Monterey Bay Aquarium

www.mbayaq.org/

The Saving Oceans section of this home page provides a pocket guide to buying ocean-friendly seafood in different regions of the U.S. You will also find information on a wide variety of marine issues such as by-catch, habitat damage, and over-fishing.

Overfishing: Guide to Good Fish

www.overfishing.org

Visit the Guide to Good Fish section to find information about ocean friendly fish to eat in various countries around the world.

History of the Northern Cod Industry

www.stemnet.nf.ca/cod/home1.htm

This site details the history of the northern cod fishery since the 1800s. The Table of Contents allows you to quickly and easily find the sections of most interest to you.

CLIMATE CHANGE

Environmental News: “Melting Andean Glaciers Could Leave 30 Million High and Dry”

www.ens-newswire.com

Find this excellent article, published April 28, 2008, at the Environmental News web site.

The New York Times: “In Greenland: Ice and Instability”

www.newyorktimes.com

To learn more about the melting of Greenland’s ice sheet, conduct a search for the January 8, 2009 article entitled “In Greenland: Ice and Instability.”

Reuter's: "Bangladesh Faces Climate Change Refugee Nightmare"

www.reuters.com

Learn more about the refugee problems Bangladesh will face with rising sea levels in this April 14, 2008 article. Visit the web site and conduct a search for the article titled here.

Science News: "For Kids: Science Loses Out When Ice Caps Melt"

www.sciencenews.org

This kid-friendly article discusses the melting of ice caps, mentioning the Andes ice caps in particular. Visit this web site and conduct a search for the article titled above, which was published on January 30, 2009.

DRY TORTUGAS AND GLADDEN SPIT MARINE RESERVES

Environmental Defense Fund

www.edf.org/article.cfm?contentid=443

The above site has information about the Dry Tortugas Ecological Reserve and a gallery of photographs of marine life found there

Friends of Nature Belize

[www.friendsofnaturebelize.org/gladden spit.html](http://www.friendsofnaturebelize.org/gladden_spit.html)

This site provides information about the Gladden Spit Marine Reserve, including research and policing of the reserve.

The Nature Conservancy

www.nature.org

Visit the Where We Work section of this site to locate special Nature Conservancy projects in Belize. Tour the special section about whale sharks. Do a search for the Gladden Spit Marine Reserve in Belize to get more information about it.

THE WONDERS OF THE OCEAN

Google Earth Ocean

www.earth.google.com/ocean/

Take a tour of this program that looks deep below the surface of the ocean and find downloads that will allow you to explore the Earth's oceans.

Sylvia Earle

www.literati.net/Earle

Books by Sylvia Earle are described and a list of media interviews that can be accessed by the internet are provided.