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An Island Home



Suddenly from behind the rim of the Moon . . . there emerges a sparkling blue and white jewel, a light, delicate sky-blue sphere laced with slowly swirling veils of white, rising like a small pearl in a thick sea of black mystery. It takes more than a moment to fully realize this is Earth . . . home.

Edgar Mitchell
astronaut, USA, 1971

Background

Since the Soviet Union launched the tiny satellite called Sputnik in 1957, hundreds of men and women and thousands of electronic “eyes” have looked back at Earth, capturing images that reveal certain effects of human activity on the Earth’s natural systems. People have increased the use of air, water, and other natural resources by a factor of 10 in the last 200 years. This activity has in turn affected the atmosphere, the water cycle, and the climate, and has altered ecological systems. Scientists have begun to monitor these effects both from the ground and from space, to identify problems, as well as to predict the future health of the planet.



Earth is surrounded by a delicate envelope of air, part and product of life on the planet. Human beings have changed the composition of this atmosphere. Tons of carbon dioxide and methane, among other compounds, are added annually to the atmosphere from the burning of fossil fuels. These and other chemical pollutants raise concerns about the effects a changing atmosphere may have on life.

Most life on Earth owes its existence, directly or indirectly, to photosynthesis, the “greening” process by which plants convert sunlight, carbon dioxide, and soil nutrients to energy. Green plants cover much of Earth’s land area, and microscopic plants known as phytoplankton inhabit its waters. More than 35 percent of the planet’s surface is used, at least indirectly, for harvesting food and other materials.

Grazing, agriculture, and timber harvesting disturb topsoil, increasing soil erosion. More than 75 million tons of soil are blown or washed into the oceans each year. Natural ecosystems shrink in the face of society’s need to use land. Fragmentation of many ecosystems has created a series of ecological “islands.” Some species, unable to survive in such reduced areas, become extinct.

Life requires water. On land, the amount and frequency of rainfall determine the success of crops, as well as the survival of natural ecosystems. It takes about 10

Global Change

days, on average, for a drop of water that becomes airborne vapor in one place to return to Earth's surface as rain or snow in another. Precipitation varies by both season and geographic area. As one result, highly specialized ecosystems have developed, from deserts to rain forests.

In the event of global warming, regional rainfall patterns may shift. Similarly, the removal of forest cover may alter rainfall distribution because of reduced evaporation of water from plants. Changes in patterns of precipitation could have dramatic effects, positive or negative, on all life on Earth.

Throughout most of the Earth's history, Earth's systems have functioned unmonitored, but not unrecorded. Climate records can be found in the types of pollen in lake-bottom sediments; in the patterns of tree-ring growth; in air bubbles frozen in glaciers; in the growth rings of coral; and in many other places.

These records indicate that significant environmental changes have occurred throughout Earth's history. Even moderate changes in global temperature can freeze or melt significant amounts of fresh water, building or shrinking glaciers and the polar ice caps. This affects sea levels.

Inasmuch as 50 percent of the world's people live within 50 kilometers of the sea, the effects of even a moderate rise in sea levels, on the order of a meter or less, would be significant. This is one reason why understanding past climate changes, and their effects on plant and animal life, is crucial. Studies of past climates, then, can help determine what processes may have caused changes, giving us some clues as to which human activities might induce similar changes.

The environments surrounding marshes, dunes, and reefs can be unbalanced by many human activities such as fishing, building, highway construction, and the use of chemical fertilizers. Ecosystems weakened by such activity may not withstand major storms. Although

occupying just 8 percent of the Earth's surface, these coastal environments produce 90 percent of the world's seafood.

Global environmental change concerns us all. Scientists are using instruments borne on satellites to gain new perspectives on previously unknown linkages between the Earth's land, air, and water. Monitoring, however, can only show that changes are taking place. Halting or reversing changes, if necessary, will test the will and the ingenuity of humankind.

Activity (Allow 45 to 60 minutes for 2 or 3 days)

This activity is designed to help students understand some of the effects people have on their natural environment.

The students will act as owners and developers of a lush, 14-square kilometer tropical island. Groups of students will select the forms and extent of development on their island by considering the benefits of the development and the risks their actions pose for the island and the planet.

The activity is best scheduled over 2 or 3 days, depending on the level of sophistication in student planning and the extent to which each team will report to the entire class upon completion of the project.

Materials

For each group of three to five students:

- Large physical map of the world
- Graph paper
- Drawing paper
- Colored pencils
- Reference materials on rain forests and coral reefs (see classroom resources)

Procedures

1. Say this to the class:

Congratulations. You have just been awarded ownership of a tropical island in recognition of your concern for the environment and your wisdom in management. As owners of this island, you have some responsibilities.

First, it is important to create jobs for your fellow citizens. There is a native population living in thatched-roofed huts and subsisting on fish, fruit, and nuts. Second, you must develop your island as a model environment for business **and** for natural habitats.

The island is covered by virgin rain forest and is surrounded by well-developed coral reefs. Both of these types of ecological systems are in danger all over the world. The island is in your care. Consider your actions carefully.

2. As a class, brainstorm the possible range of businesses that could be developed on a tropical island. A few suggestions to get the class thinking:

Scuba diving resort

Timber company

Pharmaceutical research station

Golf resort

Naval base

These and other suggestions can be written on the board for students to select a topic of interest.

3. Discuss the ways the outcomes of this project could be presented. Use the list below for possibilities:

A scale map of the island using graph paper

A physical map of the island using white drawing paper

A brochure, with a map, advertising the company and island

A group report about the island and its efforts to protect the environment.

4. Form interest groups of three to five students.

Provide resources from the suggested list or from your school library for discussions about the importance of rain forest and coral reef ecosystems. Discuss rain forest destruction. What is the benefit? What are the immediate and long-term costs? Who pays?

5. Once the students have discussed some characteristics of a rain forest and coral reef, focus the students' thoughts on the business opportunities these environments offer and the risks associated with these enterprises in a fragile environment. Have students complete the third column on the following chart as they explore the impacts of their particular businesses. The chart can be duplicated to hand out.

6. Have each team report on the specific solutions that they propose to counter the risks presented by their development plans.

Considerations	Risks	Solutions
Clearing of land	Loss of habitats	_____
	Loss of ability of land to filter water	_____
	Increased impact of storms	_____
	Increased erosion with loss of topsoil and loss of water clarity	_____
	Extinction of species	_____
Buildings and roads	Need for natural resources for building materials	_____
	Need for air conditioning and refrigeration, requiring power plants	_____
	Vulnerability to natural hazards	_____
Water supplies	High demand	_____
	Loss of quality	_____
	Intrusion of salt water and contaminants into groundwater aquifers	_____
Electricity	Need for power plants: coal, oil, or nuclear	_____
	Pollution from the burning of fossil fuels	_____
	Hazard from handling nuclear material	_____

Considerations**Risks****Solutions**

Automobile traffic

Air pollution

Noise

Road requirements

Solid and liquid
waste disposal

Pollution

Space limitations

Marine life

Overfishing

Damage by people and boats

Death of coral, changing food sources
and modifying water flow patterns

Need to import food if fish
populations decline

Shore and land plants
and animals

Destruction of beaches and dunes

Introduction of nonnative species

Extinction of plant and animal species

Indigenous culture

Cultural change

Changes in social relationships

Exploitation

Loss of traditions

Social unrest

Extensions

1. This exercise can be done using other environments including wetlands, deserts, polar regions, etc. Adjust the text of the story and the project requirements accordingly.
2. Ask teams of students what components would be necessary to create a habitable environment on another planet. What unique equipment and risks would have to be considered for such a project? For example, what would it take to transform an area on the planet Mars to make it acceptable for human habitation? (Mars has no oceans and four times the land area of the Earth.)
3. Groups of students can create a model of their island.

Classroom Resources

- Landau, Elaine, 1990, Tropical rain forests around the world: New York, Franklin Watts, 64 p.
- Arnold, Caroline, 1988, A walk on the Great Barrier Reef: Minneapolis, Carolhoda Books, Inc., 48 p.

