



Global Warming

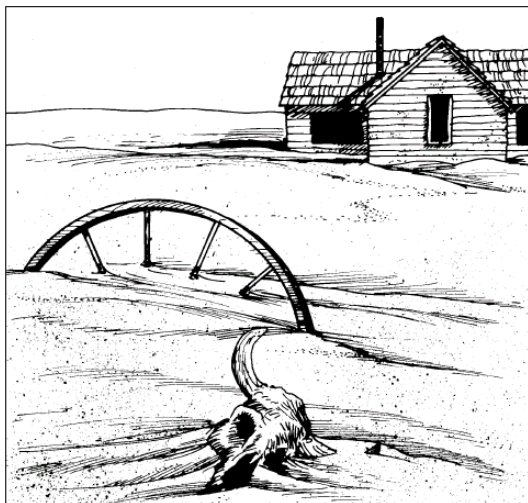
Mission Team Leader's Notes

To recognize the impact of human activities on the Earth system, Mission Team members should be introduced to some of the changes affecting the whole planet. This unit illustrates examples of land-use changes and global warming and cooling. Mission Team members' model Earth terrariums will be used to demonstrate the greenhouse effect and the difference between global warming and cooling. Global change is a complicated subject even for scientists. An integrated approach to Earth science research is needed to understand how local and regional impacts can become global-scale environmental problems.

The Mission Team member will be able to:

- Associate global change vocabulary words with pictures of environmental changes.
- Recognize that human activities are a force of global change on Earth (desertification, disappearance of forests, air pollution, global warming).
- Demonstrate that changes to one of the components in the terrarium can cause changes to all the components.
- As a member of a team, demonstrate how the terrarium is a greenhouse.

DISCUSSION:

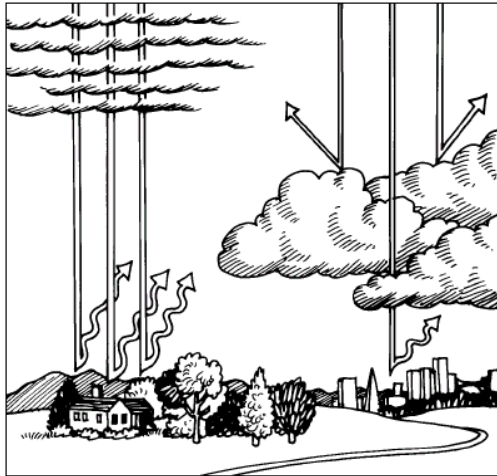


Deserts occur naturally, but people also help to create them. In their search for more farmland, people around the world have pushed into areas that naturally supported only grasses and shrubs, like the Midwestern prairie. These plants, with their deep root mat and/or succulent leaves and stems, adapt to periodic drought. However, when farmers plowed under these plants and planted food crops that depended on greater rainfall and richer soil, they damaged the area's natural balance.

During short-term droughts, these ill-adapted crops failed to hold water and large areas dried out. Livestock worsened the situation. Confined by humans to pastures, they overgrazed and killed the roots of native grasses. When rain did come, it washed away the mineral-rich topsoil. The farmers eventually moved on, leaving behind unproductive, dry land. The photo of the Sinai Peninsula in Algeria shows what deserts look like

from space. Some of the desert lands in the Middle East were fertile farmlands a few thousand years ago.

In recent history, human activities have increased significantly the amount of greenhouse gases in the atmosphere. These gases—carbon dioxide and ozone—allow the Sun’s light to pass through the atmosphere and heat the land and oceans. They also reflect ground-generated heat that otherwise would escape into space.



A similar kind of warming happens in a greenhouse or glass-covered terrarium when the glass traps heat inside. Scientists have used computer models to predict that global temperatures could rise as much in the next 100 years as they have over the last 18,000 years. High and low clouds reflect and pass light differently. High, thin (cirrus) clouds are like the glass in the jar or terrarium; they let radiation pass through, but do not let heat out. Low, thick (stratocumulus) clouds, on the other hand, are cooling clouds; they reflect light away before it reaches the ground.

Terrarium Observation: The Greenhouse.

Fill a terrarium or glass jar with dark soil; place a thermometer inside; cover the terrarium; and place it in the sunlight for one hour. Take the temperature inside the glass terrarium and compare it to the temperature of the room. Temperatures are warmer inside the terrarium. Explain what has happened. The air inside the glass containers represents the atmosphere, and the dark soil, land. When the soil is heated by the sunlight, the radiated heat is trapped by the glass, creating a greenhouse effect.

Field Trip Visit a Greenhouse.

If possible on a cold sunny day, visit a local greenhouse, zoo with a jungle habitat, botanical garden, or solar-heated atrium. Mission Team members can feel what it is like to be inside a greenhouse. Have the Mission Team members identify the life-supporting components. What cycles can they identify? Ask them to compare the greenhouse to their terrarium and to the whole Earth.

Materials

Terrarium or jar, and U. S. maps showing coasts.

Activity

Global Warming Map.

Discuss with Mission Team members how a temperature change of a few degrees could drastically change our world. If global temperatures rise, the heat would melt glacial ice and raise sea levels (see glacier photograph in the lithograph, “Water is a Force of Change”). What would happen to us if all the world’s coasts flooded? On a U.S. map, identify some of the coastal cities (low-lying areas) that might be covered with water if sea levels rise. What would happen

inland to cities and farms if the climate became warmer? Are there other ways people's lives would change due to global warming in your area? It is okay to speculate.

Global Warming Mural.

Have Mission Team members draw a picture of the places around them after global warming has taken place. Display the pictures as part of a mural on "Global Warming." The pictures could be mounted on a map of the world.

Alternative Activity

This activity assumes the Mission Team does not have a "sunny day" to heat the terrarium. It is equally effective in illustrating global warming and the "Green House" effect.

Materials Required

- a globe
- a blanket to cover the globe
- safety goggles for all Mission Team members
- Each group of four will need: two thermometer (non-mercury), 2 of the same size jars glass, hot water, and clear plastic wrap.

Mission Team Leader's Notes

Show Mission Team members a globe. Place a blanket over the globe. Tell Mission Team members that the Earth is surrounded by blanket that keeps the Earth warm. Ask volunteers if they know what the blanket that helps keep the Earth warm is called. Tell Mission Team members that they will be making a model that shows how water vapor and carbon dioxide and water vapor affect the rate at which the earth loses heat. Make a large chart of steps for the experiment and go over the chart. Have a model on hand. Review tips with Mission Team members. "Do not shake thermometer. Read it straight on not at an angle."

Follow These Steps.

Step 1: Fill out your lab sheet as you do the experiment.

Step 2: Put on your cover goggles.

Step 3: Carefully pour hot water into each one of the glass jars. Each jar should be about two-thirds full.

Step 4: Put a thermometer into each jar.

Step 5: Quickly cover one of the jars and its thermometer with a sheet of clear plastic wrap. Make sure it is sealed tightly.

Step 6: Record the temperature of each jar on your lab sheet. Make a prediction for question 1.

Step 7: Record the temperature of the water in each jar every 2 minutes for the next 20 minutes.

Dismiss Mission Team members to work on the experiment (Groups of 4). Assist and monitor Mission Team members as they do the experiment. A parent helper would be great for doing this experiment.

Closure

Allow the groups to discuss their findings. Then have the groups do a quick write up on what they have learned in this experiment. They could also talk about things that they want to learn.

Assessment lab sheet answers, and observation of Mission Team members during experiment

Lab Sheet

1. Predict: (Make a guess, based on what you already know.)
Which container will keep the water hot longer?

After the experiment is completed answer the following questions.

Conclude

2. Which of the 2 jars of water lost more heat?

3. Why do you think the other jar of water lost less heat?

4. Assume that water vapor and carbon dioxide in the atmosphere are similar to plastic wrap.
What effect would they have on Earth's temperatures?

Generalizations

1. Pollutants in the air change the atmosphere.
2. The human population contributes pollutants to the air.
3. Greenhouse effect.

Assessment Ideas

Groups cluster on what they think causes air pollution. Groups are given pictures of a smoggy day and pictures of smoke stacks giving off smoke. From the pictures, groups can talk about each.