Teaching Activity: Changes on Kamaeha's Island

Introduction: It is estimated that if the concentration of carbon dioxide, the major greenhouse gas, doubles by the middle of the next century, that this doubling will result in increased global temperatures between 2 and 9 ° F. This may not sound like much, mainly because we tend to confuse temperature with climate. Warmer weather is preferred to colder weather, and the prospect of days with 75 ° F temperatures sounds great! To understand what all the fuss is about, it is important to understand the difference between long-term climate and short- term weather, and then consider the implications of a worldwide climate change and the dramatic regional differences in habitability that result from such small changes.

One of the best ways to see the result of these changes on societies around the world is to look at past climate changes. About 500 years ago, the average world temperature dropped by about 2 °F and ushered in the "Little Ice Age". For the Vikings, who had colonized Greenland when it really was green, this proved to be disastrous! With only a 2° F Change in temperature, Greenland became perpetually snow and ice covered and the previously thriving Viking colonies collapsed . At around the same time, thousands of miles away, many Native Americans were forced by the change in climate to shift their way of life from raising corn and hunting deer, to transient hunting societies dependent on bison. George Washington's army spent a bitterly cold winter at Valley Forge, PA near the very end of the Little Ice Age.

In the last major glacial period (which ended about 10,000 years ago), the global temperature was about 9-10 ° F below the current average. During this period, the polar ice sheets extended down past the U.S. - Canada border and many of the current forests, grasslands and deserts supported very different types of vegetation than they do today.

In the past, climate changes have taken place gradually. The current concern of climate specialists is that as industrialization continues throughout the world, carbon dioxide and other greenhouse gases will continue to buildup in the atmosphere, causing a rise of 2 - 9° F by the middle of the next century. This is rate of increase is between 10 and 50 times greater than when the Earth emerged from the last ice age. What are the effects of such a rapid change likely to be and how will societies around the world cope with the changes?

Objective:

- To provide students with insights into the effects of global warming on a society and culture very different from our own;
- To provide experience of looking at an environmental issues from viewpoints that may be very different from their own;
- To introduce the concept of an international forum for discussing environmental problems and possible solutions;

Important Terms: Conservationist, agriculturalist, average global temperature, ecological chaos, greenhouse gases, fossil fuels, carbon dioxide, thermal expansion, Little Ice Age;

Materials: Copy of " Kamaeha's Island" , copies of 1-2 articles on the " Possible Effects of Global Warming", copies of the relevant interest group descriptions and list of questions for each interest group, paper /pencil, 5 sheets of butcher paper, strips of paper about 2 feet long, masking tape;

Procedure:

Part I: Kamaeha's Island

1. Pass out copies of the story about "Kamaeha's Island" **OR** read the story to the class.
2. Ask students to imagine that they are living in a developing country that will probably be affected by rising sea levels.
    - Explain that although people in that country contribute very little to the cause of global warming, they will be affected by it as much as any of the industrialized countries—and in some cases even more.
3. Tell students that they are going to hear a story about life in a developing country and how people in that country may be affected by global warming.
    - Explain that while the story is imaginary, it does describe a real situation for millions of people who live on islands or low coastal areas around the world.
4. The story should be read slowly and carefully and is meant to transport the students into the world of an ocean island facing the problem of rising sea levels.
    - Where you feel it is appropriate ask some questions to check comprehension.

5. After students have heard the story, ask the following questions:
    - What would people on the island need that they couldn't provide for themselves from natural resources on the island?
    - How do you feel about things like traffic jams, bright lights, hamburger stands and air pollution?
    - Why would plants and animals be disappearing from the island?
    - What would you do if you were Kamaeha's situation?
    - Do you think that other countries are going to respond to this dilemma of the low-lying ocean islands? Why or why not? How?
    - If you were Kamaeha, how would you be feeling at the end of the story?
    - What did you think of the story?

6. Suggest the following closure activities to students:
    - Draw a picture of what they imagine the island to be like before and /or after the effects of global warming kick in.
    - Write a letter to Kamaeha that explains to the island people what is currently known about global warming and what solutions there might be to the problems that it is causing.
    - Write a play about Kamaeha and global warming to present to the class.
    - Write out an imaginary interview with Kamaeha.

Part II: The International Conference

1. Pass out copies of the articles and questions about global warming and assign for completion at home.
2. Discuss the articles and review the questions that students read for homework.
3. Tell student that they are now going to conduct an imaginary world conference to discuss how people might cooperate to decrease the or slow down global warming, or cope with the changes it may cause.
4. Divide the class into 5 groups as follows:
    - Automobile Manufacturers
    - Island Nations
    - Agriculturalists
    - Conservationists
    - Wood and Paper Producers

5. Give out copies of the appropriate group descriptions and questions.

6. Explain that this conference has been organized to allow each group to present their point of view and to collectively look for some solutions that are acceptable to some or all of the groups.
    - Emphasize that this will not be a debate, instead the task is to find out who is affected and how, and work out ways of doing something about it.

7. Each group should appoint a **Reader**, who will read the description and questions to the group, and a **Recorder** to write down everyone's ideas in response to the four questions on the page.
    - Allow 10-20 minutes for students to re-read the sheets and record their ideas.

8. Collect the notes from each group and read them, over and add comments before the next session.

9. .Post butcher paper around the room for each group.

10. Return the notes to each group.
    - Give them 20 minutes to finalize their statements to the conference and solutions they suggest to either cope with a warmer world or to reduce the concentration of CO_2 in the atmosphere.
    - Tell students to write each solution they suggest on a strip of paper and be prepared to present them to the class.

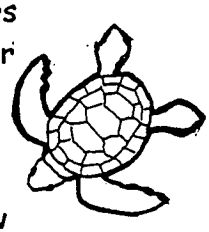
11. Each group will present their statements and solutions to the class.
    - Each group will have no more than 5 minutes to present.
    - Two additional minutes will be allowed for questions.
    - As statements and suggestions are read, they should be posted on the butcher for each group.

12. Discuss possible solutions with the entire class.
    - Ask the assembled delegates whether they think any of the solutions suggested are acceptable to all or at least a majority of the groups.
    - Discuss the relative merits of the suggestions and rewrite or modify the statements to arrive at a short list of 3-4 statements that are acceptable to most.
    - Taking each solution in turn, give the groups 30 seconds to decide whether they would vote "Yes" , "No" or "Maybe". Take one vote from each group and record the results in a space next to the solution. Discuss the results with the class.
    - Instruct the students to **individually** choose the point of view that they relate to the best and defend it in a paragraph of about 500 words or less.

KAMAEHA'S ISLAND

Your name is Kamaeha and you live on one of a group of tropical islands in the middle of the western Pacific Ocean. For as long as the elders of your family can remember, people have lived on these islands.

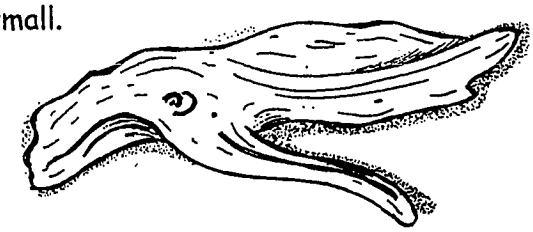
You live with your family in a small village of wooden, thatch -roofed houses at one end of a long narrow beach of white sand. A crescent- shaped coral reef is beyond the beach and encloses a small lagoon of clear, blue water. The weather is warm and gentle -there is no real winter. There are no mountains on this island, only lush tropical forest and sand. The highest point of land is only a few feet above the level of the sea. Hurricanes come to the islands at certain times of the year, and while they are very frightening, your people have learned to live with them over many generations. They know how and where to construct safe shelters to protect them from high winds, giant waves and floods and how to quickly repair the damage.

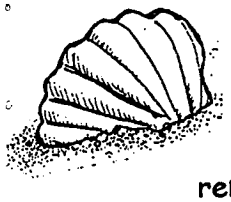


As you grew up on your island, you were taught many things to help you survive: how to collect coconuts and bananas from the trees along the beach, how to gather special plants from the forest further inland for eating and making clothes and medicines, how to grow vegetables in the fields next to the village and how to hunt for fish in and around the lagoon and the reef. One of your daily tasks is to collect drinking water from a freshwater pool near the village. You enjoy this job because here you see many water birds, and different sorts of fish, frogs and tortoises.

There is a small school in your village. Each day you go there to learn from the old people about the history of the island, and how to get food, make clothes and houses. The lagoon, the reef, the beach and tropical forest are your playground and your classroom.

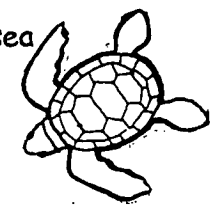
After school, you sometimes earn money by running errands for the tourists who stay in the huts at the far end of the beach. Several island families own these huts and the money from them is used by the village to buy things that they cannot make themselves. These things- like sewing machines and refrigerators- come from stores in big cities on a main island , many miles away. Your learn many things both from the tourists and from the one T.V. in the village - about places where there are high mountains, huge buildings, freeways with cars bumper to bumper, bright lights, hamburger stands and air pollution. Hearing about these things is very exciting, but it also makes you feel scared and very small.





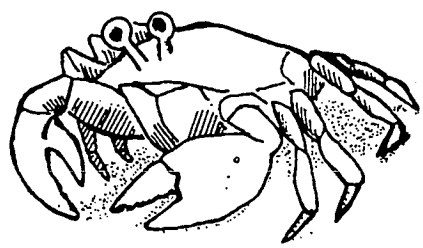
One night, a severe hurricane hits the island, worse than anyone can remember. Huge waves crash over the reef and sand bank, and sweep away the lower part of the village. Three people are killed and many more injured. Several families are left homeless and have to be taken in by neighbors. The season's crops are destroyed, and some of the biggest coconut and banana trees along the beach are knocked down. Sea water has swept into the fresh water pool, making the drinking water too salty to drink for weeks. Barrels of freshwater have to be brought in by canoe from a nearby island.

Over the next several months the damages are repaired and life slowly gets back to normal. Unfortunately, many of the people are very worried about the possibility of other storms and their effect on the island. There have been strange reports on the T.V. about something called " the greenhouse effect", the temperature of the world increasing, the ice caps melting and the level of the ocean rising. The news reporter says that it is caused by people driving cars and burning coal and oil in countries far away. Some of the scientists predict that there may be even more intense storms in coming years, as well as other harmful results on ocean islands, like freshwater pools being contaminated by the rising sea water.



One night, after watching the T.V. report, you have a bad dream. In your dream the scientists' predictions come true - there are many more bad storms, more houses in the village are destroyed, and more people are killed. Eventually, the sandy beach is washed away and the sand deposited on top of the coral reef, covering up food for the fish. As the trees along the shoreline die off, the sand dunes at the top of the beach start to erode. When the protection they gave to the plants that grew behind the beach is gone, the plants turn brown and die, and the shoreline erodes even further.

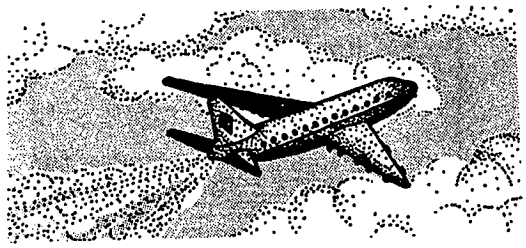
In your dream, all of the things that the village has depended on for its survival for many generations are also being destroyed. The lower part of the vegetable garden is covered by salt water, killing all the plants, the freshwater pool that you used to drink from is saltier than ever, whether there are storms or not, and many of the plants that you used to collect for food, clothes and medicine have disappeared. Even some of the birds and other animals that you looked forward to seeing do not appear in the island any more.

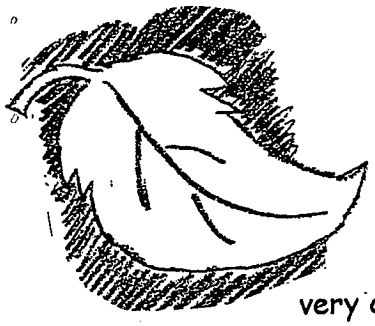


Tourists do not come to the island any more and there is no money to buy spare parts for the sewing machine and refrigerator, or even to buy new tools for working in the garden. In your dream, a number of your friends have grown older and there is no work or food to support them. One by one, they are leaving the island and moving to the big island in the north, with other people with children who are no longer able to feed and clothe themselves on your island. When people leave the island, you hardly ever hear about them anymore; communication with them is cut off and its as if they get lost in the huge-ness of the city. People argue about why things are different and some of the old people say it is because the spirits are angry with humans for something bad that they have done. Some of the old people say they would rather die than leave the island for someplace they don't know.

As your dream continues, it is also time for you to leave. In your sleep you feel sad and angry for the things that you will miss here: the celebrations thanking the spirits for a good season, the woman you would have married and the children you would have had, teaching your children to catch fish in the lagoon and planting vegetables in the village garden. None of that is possible now. You pack your belongings, load them into a canoe, kiss your family good-bye and take one last look at the beach you have always known. You paddle out past the reef where you have spent your life playing, learning and gathering your food, and head for a nearby island which has an airport and a plane to take you to the big city in the north.

Suddenly, you wake up.





CONSERVATIONISTS

As representatives of conservation groups around the world, you are very concerned about the major changes to the habitats of the world and to the unique plants and animals they contain, if the Earth warms up. You are also very concerned about the destruction of forests, especially rain forests in tropical and temperate areas that contain so many species. As many as 300-400 species of plants and animals become extinct each year due to the removal of forests. This "extinction crisis" is likely to increased with global warming. You would like to find ways of convincing people that the things each individual person does, such as driving cars, using plastic and paper packaging, even using too much electricity, (which is made by burning fossil fuels) can have a detrimental effect on our global environment. You want people to realize that it makes good economic sense to conserve natural resources, whether or not the predictions about global warming turn out to be accurate.

1. How would you describe the people you represent, and why they are concerned about the possibility of global warming?

2. List some questions or comments that you might like to put to other groups at the conference.

3. List some ideas for what the people you represent can do to helkp cope with a warmer world.

4. List some ideas for what the people you represent can do to reduce the amount of carbon dioxide in the atmosphere.

AGRICULTURALISTS

As representatives of the world agricultural community, including small farmers, large landowners and livestock companies, you are caught in a dilemma. Major changes in the Earth's climate due to the enhanced greenhouse effect and global warming will affect which crops and animals will be able to be raised in different regions. Thus, some farmers will be helped and other devastated by the changes. You also know that animals like cows, sheep, and horses contribute significantly to the enhanced greenhouse effect through their production of methane. (Like carbon dioxide, methane is a greenhouse gas and it is estimated to account for about 25% of the global warming that is predicted to occur in the next century.) In addition, cutting down forests to make room for crop and pasture also increases the amount of carbon dioxide in the atmosphere. While you worry about the consequences of these activities, you know that you must increase food production to feed the world's growing population.

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WOOD AND PAPER PRODUCTS

As representatives of the timber companies, wood mills , paper producers and people who work in these industries around the world, you are proud that you provide people with useful products, such as wood to build houses and make furniture, and paper to write on, to publish books and newspapers, and to make containers. Unlike plastic products, containers made from wood are better for the environment because they decay and turn into useful soil.. Yet some people blame you for destroying forests and contributing to the greenhouse effect. You already plant new trees when you cut down forests. You promote paper recycling programs, but not many people use these. Also, people seem to prefer to but their goods in cartons rather than glass bottle that can be recycled. So why should it be your responsibility? You are aware that if the use of wood and paper products is reduced, thousands of people will lose their jobs.

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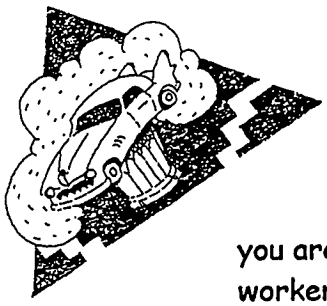

AUTOMOBILE MANUFACTURERS

As representatives of automobile manufacturers around the world, you are concerned about profits for owners and investors, and jobs for workers. People who buy new cars seem to be mostly concerned about safety, engine power, and the cost of a new car. So, these are the guidelines you use to design them. In the past ten years, many governments have required more effective pollution control equipment on cars and on the factories that produce them - all of which adds to the price of cars, making people think twice about buying a new one. Now, because of a predicted enhanced greenhouse effect, you are being asked to help reduce the amount of carbon dioxide by producing cars that are smaller, and car owners are being encouraged to use them only when necessary. You are worried about reducing profits. If this happens, investors won't put their money into your companies, and you would have to close down some of your factories. That would put thousands of people out of work.

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ISLAND NATIONS

As representatives of the island nations of the world, you are urgently concerned about rising sea levels, which are already spoiling the fresh water supplies and vegetable gardens on many islands. You are also very worried about the possible increase in devastating hurricanes, and the death of the coral reefs and mangrove swamps that your people rely on for fishing. You are very frustrated, because in order to solve your problem, people in large countries around the world must decide to produce less carbon dioxide and other gases. Most people in these other countries do not seem very interested in helping you, possibly because you represent less than 1% of the world's population. You are hopeful that people from large industrialized countries such as the United States will recognize that low coastal areas in their own countries will also be seriously affected by rising sea levels.

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" GLOBAL WARMING "

Excerpted from a brochure issued by the Sierra Club, May 1990

During the last Ice Age 18,000 years ago, when mile-high sheets of ice reached as far south as the Great Lakes, the Earth was just 9° F colder than it is today. To find average temperatures 9° F warmer than now, we have to go back millions of years, to the age of the dinosaurs.

These historic temperature swings, which occurred at the rate of a few degrees every thousand years, were accompanied by radical ecological changes, such as the extinction and evolution of many species.

It's not so much the profound changes that are alarming. It is the speed at which they will unfold.

Unless we slow and reverse the greenhouse gas buildup, we may have to adapt to such dramatic temperature shifts and ecological chaos in decades instead of millennia.

Many organisms will be unable to adapt to this rate of change. Humans can pick up and move to higher or wetter ground. Trees cannot. Species with short life spans, like insects and weeds, will adapt well.

Changes on the Horizon

Our world climate models cannot be precise about specific, local impacts of an overall temperature increase, but we are likely to see wider, more unpredictable weather fluctuations. The probability that we will have more hot, dry summers like the summer of 1988 is increasing. Rich grain-belts like the Great Plains could turn to deserts. Rising seas could flood coastal cities, submerging completely low-lying countries like Bangladesh. Next century could bring more severe droughts and more brutal winters; major reductions in the annual flow of some rivers; increased evaporation from lakes, inland seas, and reservoirs; more hurricanes; and the loss of many species of animals and plants.

This is an article about global climate change. Underline predictions about the effects that global climate change may have on the Earth's environment.

"HUMAN ACTIVITY AND CLIMATE CHANGE"

Excerpted from a pamphlet issued by the Union of Concerned Scientists, 1990

Human Activity And Climate Change

The 'greenhouse effect ' is so named because certain gases in the atmosphere trap heat and keep the earth warm, much as the glass of a greenhouse keeps the air inside warm. This atmospheric blanket is essential to life: without it, the earth would be much colder and uninhabitable.

But civilization is now adding to the concentrations of 'greenhouse gases' in the atmosphere, apparently causing the earth's temperature to rise beyond its natural level. Several gases are responsible, the most important being carbon dioxide (CO_2), which is released by the burning of coal, oil, and natural gas and by the destruction of forests.

Scientists have little doubt that the increase in these gases will cause the earth to get warmer in the future, but exactly how much and how fast the temperature will rise is uncertain, as are the precise consequences of the rise.

One almost certain change is that the oceans will rise, because warmer water will expand and arctic ice sheets and alpine glaciers will partially melt. Analyses suggest that the sea-level rise will be between one and three feet by the mid-21st century, enough to cause severe coastal erosion, destroy irreplaceable wetlands, and contaminate water supplies and drainage systems with sea water.

Major changes in weather patterns are also expected. Overall, average precipitation around the world should rise — but not necessarily where and when it is most needed. In the interiors of continents, the weather may actually become drier in the summer, causing more frequent droughts. And, as the oceans warm, the severity and frequency of tropical storms and hurricanes are likely to increase.

Changes like these could have a serious impact on agriculture. In the United States, decreased rainfall and hotter summers in the Midwest and West could be devastating. Forests and wildlife could be destroyed, since many species may not be able to adapt quickly enough to changing conditions.

This is an article about global climate change. Underline predictions about the effects that global warming change may have on the Earth's environment.