

Allison Gest
COSEE WEST
November 2008

Title: Losing An Island

Objectives:

- Students will define albedo, feedback loop, cryosphere, & geochemical cycle.
- Students will determine the impact of greenhouse gases on the four earth spheres.
- Students will explain the path of carbon dioxide through the four earth spheres.
- Students will describe at least 2 reasons why sea level rises.
- Students will determine the effects of sea level rise on coastal areas.
- Students will assess the Kiribati Islands topography & future of its land use in regards to climate changes.

Materials:

- Carbon Dioxide Cycle/Sea Level Rise Concept Map
- Carbon Dioxide Cycle Picture
- Plastic container
- Plastic Island Model representing Kiribati Islands
- Small plastic container
- Ice cubes
- Heat lamp
- CO₂ cut outs

National Science Standards:

Taken from <http://www.nap.edu/readingroom/books/nses/overview.html#content>

Earth & Space Science

CONTENT STANDARD D: As a result of their activities in grades 9-12, all students should develop an understanding of:

- Energy in the earth system
 - Global climate is determined by energy transfer from the sun at and near the earth's surface. This energy transfer is influenced by dynamic processes such as cloud cover and the earth's rotation, and static conditions such as the position of mountain ranges and oceans.
- Geochemical cycles
 - The earth is a system containing essentially a fixed amount of each stable chemical atom or element. Each element can exist in several different chemical reservoirs. Each element on earth moves among reservoirs in the solid earth, oceans, atmosphere, and organisms as part of geochemical cycles.
 - Movement of matter between reservoirs is driven by the earth's internal and external sources of energy. These movements are often accompanied by a change in the physical and chemical properties of the matter. Carbon, for example, occurs in carbonate rocks such as limestone, in the atmosphere as carbon dioxide gas, in water as dissolved carbon dioxide, and in all organisms as complex molecules that control the chemistry of life.

Science in Personal and Social Perspectives

CONTENT STANDARD F: As a result of activities in grades 9-12, all students should develop understanding of:

- Natural resources
 - Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans. Materials from human societies affect both physical and chemical cycles of the earth.
- Science and technology in local, national, and global challenges
 - Individuals and society must decide on proposals involving new research and the introduction of new technologies into society. Decisions involve assessment of alternatives, risks, costs, and benefits and consideration of who benefits and who suffers, who pays and gains, and what the risks are and who bears them. Students should understand the appropriateness and value of basic questions--"What can happen?"--"What are the odds?"--and "How do scientists and engineers know what will happen?"

Curriculum Requirements:

- Hydrosphere, Cryosphere, Atmosphere- Geochemical Cycles (Carbon Dioxide) & Global Warming

Relationship to COSEE WEST Workshop November 2008:

- Hydrosphere: how a glacier is related to the water cycle
- Cryosphere: glacial melting vs. sea ice melting (Greenland & Antarctica) and effects on sea level changes
- Atmosphere & Biosphere & Geosphere: Carbon dioxide cycle between air & land and effects on ocean sea level

Procedure:

1. Review glacier formation & melting
2. Have students do carbon dioxide cycle activity & complete concept map or picture (pick one based on learning style)
3. Discuss possible reasons for sea level rise. Show pictures on LCD to capture student attention.
 - a. Glaciers melting into ocean
 - b. Sea water expansion due to temperature rise (added heat)
4. Misconception: Show students sea ice melting does not change sea level (have ice in water and let it melt).
5. Perform Kiribati Lab:
 - a. Discuss background of current situation with sea level: Links below
http://www.panda.org/about_wwf/what_we_do/climate_change/problems/impacts/sea_level/index.cfm
http://www.greenpeace.org/international/campaigns/climate-change/impacts/sea_level_rise

- b. Have island model in plastic container. Fill with water up to a line to represent current sea level.
- c. Have certain number of ice cubes in small container representing a land glacier. Have heat lamp on ice cubes to represent sun.
- d. While heat lamp melts ice cubes, have students place CO₂ cycle cut outs around the lab to show how carbon dioxide affects glacial melting.
- e. Pour melted ice into the island container in increments of 10 ml. Record the sea level change over each 10 ml. Students would fill out question sheet.
- f. Assessment: Have students write a RAFT telling the people of Kiribati the reason why they are losing land in regards to climate change. Students will have to explain the carbon dioxide cycle and how it relates to climate change.
- g. Have students assess Kiribati's future as an island still "above" sea level. Have students propose: A bit of an extension activity...
 - i. Why is it happening?
 - ii. What could happen in the future?
 - iii. How long will it take to happen based on current models?
 - iv. What should the Kiribati people do to save their island?

Assessment:

- Have students write a SPAM (Subject, Purpose, Audience, Mode) telling the people of Kiribati the reason why they are losing land with sea level rise. Students will have to explain the carbon dioxide cycle and how it relates to climate change.

Activities:

- Kiribati Island Lab Simulation (explained above)
- Sea Ice Misconception Activity (explained above)
- Carbon Dioxide Activity (maybe online game or similar to nitrogen game)
- RAFT Assessment: Postcard, letter, editorial, etc. (Choice for student)