



*Connecting Oceans  
Academy*

## **New Bedford ECHO Project**

## **Maps and the Environment**

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# Maps and the Environment

## Overview

Why do we use maps? How can they help us organize information when we need to analyze a potentially devastating situation? What do different types of maps tell us? What is the value and difficulty of synthesizing the information provided on different types of maps?

This unit explores several types of maps in relation to a complex issue: climate change. First, students explore the development and use of maps as well as the skills needed for map interpretation: scale, contours, elevation, cardinal directions, etc. Then students use maps as the focal point for examining a potential change in land formation. Finally, students look at how maps provide an aid to planning for the future.

## Content

This unit is designed for students in grades six through eight, using maps, field study, articles and writing as a focus for understanding how maps can help us better understand our ever-changing environment. The ultimate goal of these learning experiences is to provide students with several means by which to access information in order to synthesize their findings, make connections in their learning, propose solutions, and engage in further inquiry.

The unit provides students with learning experiences that immerse them in the use and development of maps. Students create topographical maps, go into the field to determine elevation levels, compare topographical maps with political maps, and then use that information to persuade their community to follow their created plan for changes in the coastline due to climate change.

The six Learning Experiences in this module include a “learning log” or reflective journal, which students maintain throughout the unit as a means of ongoing, formative assessment. Students study map making and interpretation through Science, Technology (GPS or global positioning system and digital mapping), Mathematics (slope/rise and scale), English (content area literacy and persuasive writing), and Social Studies (the effect of climate change on a community).

Enduring understandings and essential questions address critical concepts throughout the unit, such as why we need maps and mapping skills, what use we can make of this knowledge, and how maps influence our relationship with the environment.

## **Notes from the Pilot Classrooms**

As the pilot teachers taught the unit, many issues came up that they did not foresee when they began the inquiry, including civic responsibility, local resources as a tax base, the importance of natural systems versus social systems, the challenges to seek alternative energy sources, jobs in our region, and what we value as a community. Other teachers will likely have the same opportunity to open discussions on such issues throughout the Learning Experiences.

As an example, a teacher taught a language arts lesson on irony. It was precipitated by an activity in which the students were given a list of places in their community and asked to select one they most wanted to move out of the impact area. Nearly half of the students chose the power plant, and twenty-five percent chose the oil transfer station. Not a single student considered the environmental consequences of their choices. When the teacher pointed out to the students that they had just relocated the problem of global warming without creating any real change, the students were shocked.

## Stage 1– Desired Results

### Established Goals

**Teacher’s Note:** Standards and goals for this module are from the *Massachusetts Curriculum Frameworks* published by the Massachusetts Department of Education. For more information, see: <http://www.doe.mass.edu/frameworks/current.html>

This curriculum module is shaped by five geography-related themes:

- Location
- Place
- Human/Environment Interaction
- Movement
- Region

### Established Goals: Standards

Social Studies: Grade Six

- Use map and globe skills learned in pre-kindergarten to grade five to interpret different kinds of projections, as well as topographic, landform, political, population, and climate maps.
- Use geographic terms correctly, such as delta, glacier, location, settlement, region, natural resource, human resource, mountain, hill, plain, plateau, river, island, isthmus, peninsula, erosion, climate, drought, monsoon, hurricane, ocean and wind currents, tropics, rain forest, tundra, desert, continent, region, country, nation, and urbanization.
- Interpret geographic information from a graph or chart, and construct a graph or chart that conveys geographic information (for example, information about rainfall, temperature or population size).
- Explain the difference between absolute and relative location and give examples of different ways to indicate relative location for countries or cities across the world.
- Identify how current world atlases are organized and the kind of information they provide for each continent and country.

Social Studies: Grade Seven

- Compare information shown on modern and historical maps of the same region.
- Describe the great climatic and environmental changes that shaped the earth and eventually permitted the growth of human life.
- Identify the characteristics of civilizations, including (1) the presence of geographic boundaries and political institutions; (2) an economy that produces food surpluses; (3) a concentration of population in distinct areas or cities; (4) the existence of social classes; developed systems of religion, learning, art, and architecture;(5) a system of record keeping.

### Social Studies: Grade Eight

- Explain how a cause and effect relationship is different from a sequence or correlation of events.
- Distinguish between long-term and short-term cause and effect relationships.
- Show connections, causal and otherwise, between particular historical events and ideas and larger social, economic, and political trends and developments.

### Science & Technology: Grades Six to Eight

- Recognize, interpret, and be able to create models of the earth's common physical features in various mapping representations, including contour maps.
- Describe and give examples of ways in which the earth's surface is built up and torn down by natural processes, including deposition of sediments, rock formation, erosion, and weathering.

### English Language Arts: Grades Six to Eight

1. Determine the meaning of unfamiliar words using context clues (definition, example).
2. Identify and analyze main ideas, supporting ideas, and supporting details.
3. Identify and use knowledge of common textual features (paragraphs, topic sentences, concluding sentences, glossary, index, introduction, conclusion, footnotes, bibliography).
4. Identify and use knowledge of common graphic features (charts, maps, diagrams, captions, illustrations).
5. Identify and use knowledge of common organizational structures (logical order, comparison and contrast, classification schemes, cause and effect relationships). For example, students read a variety of informational materials (biography, diary, textbook, encyclopedia, magazine article) on a Civil War figure and write a report using an appropriate organizational structure.
6. Recognize use of arguments for and against an issue.
7. Identify evidence used to support an argument.

<b>Enduring Understandings</b>	<b>Essential Questions</b>
<ol style="list-style-type: none"> <li>1. The natural environment (topography, climate, and natural resources of a region) shapes a region's culture, social system, economy, and lifestyle.</li> <li>2. Global warming has become a widely accepted scientific theory. If current estimates are correct, humans could witness a sea-level rise that would greatly impact our environment.</li> <li>3. Maps are visual images that convey many types of data that can be organized for various uses.</li> <li>4. Effective readers use specific strategies to help them better understand the text.</li> <li>5. The relationship between humans and the environment is ever changing and requires a constant state of rebalancing.</li> </ol>	<ol style="list-style-type: none"> <li>A. Why do we need maps and mapping skills?</li> <li>B. How can we use our knowledge of mapping concepts and skills?</li> <li>C. How might global warming impact our environment, cultures, and social systems? Why is this important?</li> <li>D. How does geography influence the history, culture, and settlement of a region?</li> <li>E. Why read? What can we learn from print?</li> <li>F. How do maps help us understand the distribution of living things and resources?</li> <li>G. Why do maps make a difference about how we understand and use the environment?</li> <li>H. How will a population have to adjust to a major change to its physical environment?</li> </ol>

<p><b>Students will know and understand:</b></p> <ul style="list-style-type: none"> <li>a. How to read and use topographical maps.</li> <li>b. The applications and benefits of Global Positioning Systems.</li> <li>c. The potential impacts of global warming.</li> <li>d. How to discover the infrastructure of their local area.</li> <li>e. That there are organizations that study global change and provide critical information about the impact of global change on various aspects of the environment.</li> </ul>	<p><b>Students will be able to:</b></p> <ul style="list-style-type: none"> <li>a. Read and interpret political maps.</li> <li>b. Build and analyze topographical maps.</li> <li>c. Build and analyze political maps.</li> <li>d. Conduct a GPS study of landmark elevation.</li> <li>e. Summarize and analyze expository text.</li> <li>f. Write an argument.</li> <li>g. Give an oral presentation.</li> </ul>
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**Stage 2–Assessment Evidence**

**Performance Tasks**

Students will:

1. Create a three dimensional topographical mountain and translate it into a topographical map.
2. Create a two dimensional map of their school and neighborhood.
3. Use a global positioning system (GPS) to predict and explore specific landmarks.
4. Identify five resources and explain how they would be impacted in the event of a 20-foot sea-level rise.
5. Develop a written plan to address the need to relocate or redesign five resources that would be affected by a rise in sea level. The infrastructure plan should persuade the audience of local government members that these five resources are indeed crucial in addition to why and how these resources should be relocated.
6. Present and defend their plan to the class, who will act as the governing body of the city to determine the validity of the plan and help assess the persuasive arguments presented in the plan with a rubric.
7. Generate a claim, support, and questions about the outcome of sea-level rise in their local impact area.
8. Develop and teach a short lesson that uses visual aids to summarize and analyze a portion of the TIME article, “Earth at the Tipping Point.”
9. Create a map that displays topographical and political information. The map should illustrate the actual impact area using color coding.

**Other Evidence:**

- Unit “Learning Logs”
- Maps of school and neighborhood
- Responses to Visible Thinking Routine – “Claim, Support, Question” on GPS mapping in learning logs
- Written assignments regarding impacts and planning
- Creation of a global warming glossary

### How to Use Learning Logs

Each of the learning experiences in this module begins and ends with the students writing in their “learning logs.” Provide each student with a “blue book” or other notebook to use as a learning log and maintain throughout the module. Structure this activity as follows, using appropriate prompts as indicated in each module:

At the beginning of each module:

- Explain to students that they use learning logs to record their ideas and questions and/or document what they are learning.
- Tell them you might also use the learning log for teacher-student “written discussion”.
- Provide prompts to stimulate student writing.
- Allow students to make a list, write sentences, or write a paragraph. They can also use drawings.
- Assure students you do not grade the learning log. It is your way of making certain you teach them what they need to learn.
- Process with the class. Ask all students to read all or part of what they have written in their journals to the class. Record their ideas on the board or chart paper.
- Use this information to assess students’ current knowledge about mapping. Compare what students already know with the knowledge and skills taught in this module:
  - Do students possess the prior knowledge necessary for this unit?
  - Do students understand how to use a compass?
  - What other knowledge do the Learning Experiences in this module assume? What pre-teaching is necessary?

At the end of each module:

- Tell students to look back at their initial predictions about what they would be learning and to write a little about how the actual reading, summarizing and teaching activities matched up to their predictions.
- Allow students to make a list, write sentences or write a paragraph. They can also use drawings.

- Remind students there is no grade for this. It is your way of making certain that you teach them what they need to learn.
- Process with the class. Ask all students to read to the class all or part of what they have written in their journals. Return to their original ideas and compare them on the board or chart paper.
- Compare what students already know with the knowledge and skills that are taught in this module.
  - What other knowledge do the Learning Experiences in this module assume?
  - What pre-teaching is necessary?

**Student Self-Assessment: How will students reflect upon and assess their own learning?**

1. Rubric for students when they teach lesson on the TIME article
2. Rubric for map
3. Rubric for persuasive essay

**Stage 3 – Learning Plan  
See Learning Experiences**

This curriculum module consists of both integrated and content-specific Learning Experiences.

**Integrated Learning Experiences:**

- LE 3: Elevation Survey: GPS – Field Study: Mapping the Impact Area (science and social studies)
- LE 4: Topographical Maps with “Dogstail” – Creating a Topographical Map (science and social studies)
- LE 5: Topographical/Political Map Overlay – Simulated GIS\* (science and social studies)

**Content Specific Learning Experiences:**

- LE 1: Introduction to Political Maps – Mapping your school, bedroom, and coastal area (social studies)
- LE 2: “Global Warming Heats Up” (English language arts)
- LE 6: The Impacts of and Planning for Sea-level Rise – Persuasive Writing (English language arts)

## Learning Experience One

### Introduction to Political Maps

#### Overview

Students are introduced to political maps by first mapping their school, then their neighborhood, and finally their coastal region. By looking at examples of political maps, students analyze the various components of political maps (compass rose, lines of latitude and longitude, map keys, titles, etc.). Students work with many examples of different political, travel, theme, and other maps and explain the many styles and uses for maps. This Learning Experience is based on the student guide to map elements provided by National Geographic at <http://www.nationalgeographic.com/xpeditions/>

#### Evaluation

Students each create a map of the school from an aerial view and two maps of their bedrooms – an aerial view and a frontal view. Working together in a large group, students create a map of the local area showing the location of their houses, the school, and other major landmarks in the area and along the coast.

#### Materials

- Computer and Internet access
- Assortment of map samples, political world maps, local maps, travel maps, road atlases, and theme maps (beaches, points of interest, etc.)
- Blank outline map of the school for each student
- Overhead transparency of the school map
- Homework handout: National Geographic's Mapmaking Guide located on the Internet at <http://www.nationalgeographic.com/xpeditions/lessons/09/g68/cartographyguidestudent.pdf>
- Google Earth <http://earth.google.com/>
- Large political map of the local area to write on and for display
- Overhead transparency of a local map
- Compass rose for each student (<http://worldatlas.com/aatlas/infopage/comprose.htm>)

#### Teachers' Notes

The activities can be altered based on the results of your ongoing assessment from learning logs or class discussions. Also, mapping can be done with copied maps or pre-printed computer-generated maps if you do not have access to computers during class time.

If students do not understand how to use a compass, you can find excellent suggestions for teaching at <http://www.isu.edu/outdoor/maplong.htm>. Students should know how to use a compass so they understand the lessons about cardinal directions and mapping that follow.

### **Activity One: Activating and Assessing Prior Knowledge**

- Tell students they will be learning about mapping.
- Give students about five minutes to write in their learning logs. Provide the following prompt: “I predict that we will be learning about....”

### **Activity Two: Cardinal Directions**

- Post the standards (objectives for the Learning Experience) in a prominent place.
- Review the objectives with students so they know what they are learning and why.
- Provide each student with a handout of a compass rose. You can draw it using the model provided at: <http://worldatlas.com/aatlas/infopage/comprose.htm>.
- Explain to students that cardinal directions are the ones most commonly used: north, south, east and west. (A compass rose in the school lobby to orient students and visitors would be helpful.)
- Show students where the north wall of the room is located and ask them to point their compass roses in that direction.
- Ask students to visualize and list landmarks to the north in the school and neighborhood. Make a list on chart paper and post it on the north wall. Instruct students to record the list in their learning logs.
- Repeat the process for south, east, and west.
- Place students in small groups. The activity requires at least four groups. Provide time for students to discuss the items on each chart (north, south, east and west) and confirm that the lists are accurate.
- Distribute poster board or drawing paper and markers. Assign a cardinal direction to each group. Ask each group to create and illustrate a poster for their assigned direction.
- Post each group’s illustrated poster on the appropriate wall in the classroom.

### **Activity Three: Mapping the School**

- Explain to students that they are going to make maps of the school.
- Arrange, in advance, for students to be able to walk around the school to gather information for their maps.
- Provide passes that describe the assignment and specify the time that

- students are allowed to be in the corridors.
- Place students in pairs or small groups. If possible, recruit volunteers and assign one to each group.
  - Review the rules for appropriate behavior (for example, “the three inch voice” rule). Tell students the exact time to be back in the classroom, and explain the consequences for missing the deadline or for unacceptable behavior while they are out of the classroom. The teacher is, of course, in the corridors helping and monitoring students while students are working on their maps.
  - Provide each student with a blank map of the school. These are regularly available for fire drill purposes and are usually “aerial maps.” Remove all classroom labels, street names, and directions from the map before copying.
  - Ask students to examine the blank maps and explain what they see. Their responses should indicate that they are looking down at the school. This is an opportunity for you to foreshadow information you will provide about “aerial view” in the next activity.
  - Provide the following directions:
    1. Label all classrooms and offices (by teacher name and room number).
    2. Create symbols that represent each room in the school (for example, a paint brush for the art room).
    3. Label streets surrounding the school.
    4. Give the map a title.
    5. Make a map key, and include a compass rose.
  - When students have completed their maps, display the overhead of the map. Show all the information on the map so students can check their own maps to determine if what they wrote is correct. Alternatively, filling in the map with the students allows for more discussion and provides an opportunity to check for understanding.

### **Teachers’ Notes:**

As an extension, consider teaching or revisiting the concepts of longitude and latitude. You can determine the coordinate points of your school’s location through a GPS system, maps, Google Earth, etc. See:

[http://www.nationalgeographic.com/xpeditions/lessons/09/g68/cartographyguides\\_tudent.pdf](http://www.nationalgeographic.com/xpeditions/lessons/09/g68/cartographyguides_tudent.pdf)

As an additional or alternate extension, consider teaching the concept of scale. See:

<http://www.leo.lehigh.edu/envirosci/watershed/gis/toposkills/Basics/scale.html>

[http://www.leo.lehigh.edu/envirosci/watershed/gis/toposkills/Teacher/pdf/Tch\\_scale.pdf](http://www.leo.lehigh.edu/envirosci/watershed/gis/toposkills/Teacher/pdf/Tch_scale.pdf)

## Activity Four: Homework Assignment—Mapping Your Bedroom

- Show students some examples of different kinds of maps. Instruct them to brainstorm words about mapping to start them thinking and to provide an opportunity for you to assess their current knowledge.
- Place students' words on the board or on chart paper. Be sure to use "wait-time" (wait a few seconds before calling on students to give them time to think). Ask students to explain what the words mean. They can use the example maps with their explanations.
- Add words (use the example maps to explain the words) so the list includes scale, view, and projection.
- Process with the class:
  - **Discuss map projections.** Explain that a map projection is used to portray all or part of the Earth on a flat surface. For additional information about the various types of map projections, see: <http://erg.usgs.gov/isb/pubs/MapProjections/projections.html>.
  - **Aerial and frontal views:** Remind students that the maps they constructed of the school represent aerial views (as if they were looking down on the school from the air). Ask students where they think they would be standing if they created a frontal view map of the school. Discuss frontal views (looking straight ahead) and show examples, e.g., looking "through a wall" into a room.
    - **Check for understanding.** Ask students to explain the words "projection", "frontal view", and "aerial view" in their learning logs. As students write, circulate and check individual students' responses. Re-teach if necessary, using drawings and examples.
- Tell students their homework assignment is to create two maps of their bedrooms, a frontal view and an aerial view.
- Provide each student with grid paper and a copy of the following National Geographic Mapmaking Guide at: <http://www.nationalgeographic.com/xpeditions/lessons/09/q68/cartography/guidestudent.pdf>
- Review the information in the Mapmaking Guide (above) with students.
- Explain that the maps they create for homework should include the following items from the Mapmaking Guide:
  - Date
  - Orientation
  - Grid
  - Scale
  - Title
  - Author
  - Index
  - Legend
  - Source

**Teachers' Note:** Revisit these views during the unit as you look at political maps and topographical maps, and discuss why it is helpful when evaluating topography to provide more than one view.

### **Activity Five: The Class Creates a Local Political Map**

- Explain to the class that they will be creating a local political map.
- Place students in pairs. Ask them to explore the National Geographic Mapmaking Guide on the Internet (see above). Their task is to learn about political maps and to write an entry in their learning logs about the characteristics of political maps.
- Check for understanding: On the board or chart paper, ask students to devise a commonly agreed upon definition of political maps: Political maps show the names and boundaries of political geographic units (towns, cities, states, countries) and important physical and human features. Students should record the definition in their learning logs.
- Place a copy of a (blank) local political map on the overhead. Together with the students, place the following information on the map:
  - Location of each student's home
  - Your school
  - Major local landmarks (city hall, ports, town library, etc.)
  - Landmarks on the coastline.
- This class political map will be used in conjunction with the TIME Magazine article, "Earth at the Tipping Point." It will provide the basis for discovery and discussion about the impact to the area if a rise in sea level should occur. Update and revise the map for the duration of the unit.

### **Activity Six: Checking for Understanding**

- Explain to students that they have had several distinct experiences in mapping various areas.
- Invite them to reflect on the maps they created, including what use the maps could serve and what struggles were involved in creating the maps.
- Ask students to reflect on the essential question "Why do we need maps and mapping skills?", and offer them the idea of a world without maps. What would be the difficulties and the differences in our world today?
- Use this information to assess students' new knowledge about mapping.

## Learning Experience Two

### “Global Warming Heats Up”

#### Overview

Students read the TIME Magazine article, “Global Warming Heats Up”, by Jeffrey Kluger. The teacher divides students into groups of two to work on a glossary/vocabulary list from the article with the help of context clues, dictionaries or the Internet. Each student group helps build a glossary to aid in understanding the article. Then, working in groups of five, students are assigned portions of the article that they will summarize (possibly doing further research) and provide one visual aid to teach to the rest of the class. Finally, students reflect on their understanding of the article in their learning logs.

#### Evaluation

Students respond to a rubric to evaluate the lesson taught, their participation in their group and their understanding of the material.

#### Materials

- Handout One: “Global Warming Heats Up” by Jeffrey Kluger, TIME Magazine, Time Inc., March, 26, 2006. Print from: <http://www.time.com/time/archive/preview/0,10987,1176980,00.html>
- Handout Two: Glossary
- Glossary—Teacher’s Guide
- Handout Three: Rubric for Evaluation
- Dictionaries
- Internet access, if available
- Environmental Protection Agency website on global warming for kids - <http://epa.gov/climatechange/kids/version2.html>
- Supplies for student groups to create visual aid (poster, drawing, collage, Power Point slide, or Inspiration web)
- Learning logs

### Activity One: Activating and Assessing Prior Knowledge

- Tell students they will be learning about global warming.
- Give students about five minutes to write in their learning logs. Provide the following prompt: “I predict that we will be learning about....”

### Activity Two: Breaking Down the Vocabulary

- Tell students that they will be reading an article from *Time* magazine. Explain that the article has complex vocabulary and concepts, but the class will work with it in a number of different ways in order to build understanding of the concepts presented.
- Distribute Handout Two. Place students in pairs to work on assigned clusters of the vocabulary list. Once students determine the meaning of their words, using context clues, the dictionary, or the Internet, they enter the definitions in Handout Two.
- Discuss and brainstorm ideas related to the vocabulary presented prior to reading the article to ensure students have a grasp of the terms.
- Use the United States Environmental Protection Agency’s Climate Control Site which has excellent visual aids for much of the vocabulary in this unit. This site provides:
  - an interactive diagram for the major concepts presented  
<http://epa.gov/climatechange/kids/version2.html>
  - a thorough glossary of the terms associated with global warming  
<http://epa.gov/climatechange/kids/glossary/index.html>

### Teachers’ Notes:

If students have difficulty with the space provided on the page, they can write on loose-leaf paper and then copy their definitions to the glossary worksheet.

The glossary can be used as a study guide for a vocabulary quiz later in the unit or to aid with any writing assignments over the course of studying the unit.

### Activity Three: Breaking Down the Content

- Divide Handout One into the following sections (see Teacher’s Guide version of the Handout):
  1. CO<sub>2</sub> and the Poles
  2. Feedback Loops
  3. Drought
  4. Flora & Fauna
  5. What about Us? and What We Can Do?
- Divide students into five groups, and assign a section of the article to each group.
- Tell students to use their summarization skills along with the glossary they built to find the main ideas in their section of the article. You may want to

use the “word – sentence – phrase” Visible Thinking routine to have students come up with one word, then one sentence, then one phrase (or a series of several sentences) that captures the main points of their portion of the article.

- Instruct students to create a “headline” for their portion of the article that outlines the main idea.
- Advise the groups to use the Internet, any print text and their combined knowledge to create a visual aid to teach the rest of the class a short lesson on their portion of the article. Presentation time should be limited in order to try to present the entire article (all five groups) in one class period.
- Tell students they can create a poster, collage from print images, a drawing, or an overhead transparency. Using computers, students can create a short Power Point presentation, an Inspiration web, or a digital collage using Power Point.
- After the presentations, students complete the rubric in Handout Three to assess their group participation and their presentation to the class.

#### **Activity Four: Checking for Understanding**

- Ask students to reflect on the essential question, “Why read? What can we learn from print?”
- Ask them what they learned from the article and how it might have changed their thinking about global warming.
- Ask them what skills and knowledge they gained from the vocabulary work and the summarizing work.
- Discuss the grouping during the glossary building session versus the larger group for summarizing.
- Have students reflect on how they worked best or what was challenging for them.
- Use this information to assess students’ new knowledge about global warming as well as working with challenging text.

#### **Notes to Teachers**

- For differentiation, some sections of the article are longer and more complex than others. Groups that will benefit from a longer, more challenging section should be assigned “Feedback Loops” or “CO<sub>2</sub> and the Poles”. “Drought” and “Flora & Fauna” are shorter sections. However, these concepts are all complex; and students should be encouraged to elaborate on the issues as much as possible.
- If you have a color printer, you can print the highlighted copy for students who would benefit from it.

- You may want to have the class watch “An Inconvenient Truth” prior to reading the article. Many of the main concepts are outlined and it may help to familiarize them with the vocabulary.
- Alternate views on global warming should be presented to the class. This can be done by reading additional articles and leading a class discussion using a Venn Diagram or Double Bubble graphic organizer on chart paper or the board to compare and contrast the views presented in both articles. One option is an opinion piece from Newsweek’s April 16, 2007 issue entitled: “Why so Gloomy? Global Warming Fears Overblown” by Richard S. Lindzen. <http://www.msnbc.msn.com/id/17997788/site/newsweek/>
- Examples of graphic organizers can be found at <http://www.thinkingmaps.com/htmexam.php3>

**Glossary: Teacher's Guide**

Articles that deal with complex topics, for example a health issue, a political debate, or a science issue like global warming, can have a tremendous amount of challenging vocabulary. These can include names of professions, science vocabulary, general words, and acronyms (words formed from the initials of several words, e.g., FBI).

It is helpful to create your own glossary to deal with all of the terms in an article. As a class we will build a glossary for the TIME Magazine article, "Global Warming Heats Up." You will each be assigned several words to look up on your own; then, as a class we will each report our answers so each student will have a complete glossary to save as a study guide and to be used with the article that will be used over the next few weeks in class.

<b>Vocabulary Word or Term</b>	<b>Dictionary or On-Line Definition</b>
<b>Acute</b>	Extremely serious, severe or painful.
<b>Atmosphere</b>	The mixture of gases that surrounds a celestial body such as the Earth.
<b>Breach</b>	To break down an obstruction to allow something to pass through it.
<b>Calve</b>	To release a mass of ice that breaks away.
<b>Carbon dioxide, CO<sub>2</sub></b>	A heavy colorless odorless atmospheric gas produced during respiration and used by plants during photosynthesis. It is also formed by combustion.
<b>Century</b>	A period of a hundred years.
<b>Consolation</b>	A source of comfort to somebody who is upset or disappointed.
<b>Debate</b>	To talk about something at length and in detail, especially as part of a formal exchange or opinion.
<b>Decade</b>	A period of ten years.
<b>Deluge</b>	To flood or soak.
<b>Devastate</b>	To destroy completely; damage irreparably.
<b>Disintegrate</b>	To break or decompose into components or fragments, or break into small pieces.
<b>Drought</b>	A long period of abnormally low rainfall, especially one that adversely affects growing or living conditions.
<b>Ecosystem</b>	A localized group of interdependent organisms together with the environment they inhabit and depend upon.
<b>Emission</b>	Something that is produce or released.
<b>Environmentalist</b>	Somebody involved in issues relating to the protection of the natural world.
<b>Fauna</b>	The animal life of a particular region.

<b>Feedback loop</b>	A cycle in which two agents each act to reinforce the other's action.
<b>Flora</b>	The plant life of a particular region.
<b>Gigaton</b>	A unit of explosive force equal to one billion tons of TNT.
<b>Glacial</b>	Relating to or caused by a glacier, characterized by the presence of ice masses.
<b>Greenhouse gas</b>	A gas such as carbon dioxide, ozone, or water vapor that contributes to the warming of the Earth's atmosphere by reflecting radiation from the Earth's surface.
<b>Grievous</b>	Extremely serious or significant, very bad or severe.
<b>Habitat</b>	The natural conditions and environments, e.g., forests, deserts or wetlands in which a plant or animal lives.
<b>Inexhaustible</b>	Impossible to use up.
<b>Initiative</b>	The ability to act and make decisions without the help or advice of other people.
<b>Insurmountable</b>	Impossible to overcome or deal with successfully.
<b>Lawmaker</b>	Someone who drafts laws and causes them to be put into effect.
<b>Lockstep</b>	A standardized procedure that is closely, often mindlessly, followed.
<b>Marginalize</b>	To take or keep someone or something away from the center of attention, influence, or power.
<b>Massive</b>	Large in comparison with what is typical or usual.
<b>Molder</b>	To crumble or decay because of natural processes, or to make something crumble or decay.
<b>Monkeying</b>	Playing or tampering with something.
<b>Multigenerational</b>	Including or affecting several generations.
<b>Naysayer</b>	Someone who votes 'no' or who speaks out against something.
<b>Organism</b>	A living thing, such as a plant or animal; a functioning system of interdependent parts that resembles a living creature.
<b>Oxygen</b>	A nonmetallic bivalent element that is normally a colorless, odorless, tasteless, nonflammable, diatomic gas; constitutes 21 percent of the atmosphere by volume; the most abundant element in the Earth's crust.
<b>Paleoecologist</b>	A person who studies the interaction of prehistoric life forms and their environment.
<b>Palpable</b>	So intense as to be almost able to be felt physically.
<b>Paradox</b>	A statement or situation that seems to be absurd or contradictory, but in fact is or may be true.
<b>Permafrost</b>	Underlying soil or rock that remains permanently frozen, found mainly in the Polar Regions.
<b>Politician</b>	Someone who is actively or professionally engaged in

	politics.
<b>Prodigious</b>	Great in amount, size, or extent.
<b>Profit</b>	The excess of income over expenditures.
<b>Rhetorical</b>	Persuasive way in which one relates a theme or idea in an effort to convince; the art of persuasion through language; concerned with effect or style of writing and speaking.
<b>Satellite</b>	An object put into orbit around Earth or any other planet in order to relay communications signals or transmit scientific data.
<b>Self-perpetuating</b>	Something continuing because of having the power to preserve or renew itself indefinitely.
<b>Snowpack</b>	Accumulated snow, usually in a mountainous area.
<b>Spawning</b>	Producing and depositing eggs.
<b>Succumb</b>	To yield to somebody or something powerful.
<b>Thermoregulator</b>	Mechanism that controls temperature.
<b>Vegetation</b>	Plants in general, or the mass of plants growing in a particular place.

Extra credit:

**Laws with teeth** is an expression or idiom used in the article. What do you think the writer means by this?

Extra, extra credit:

If your team is finished and the rest of the room is still working, look up the **Gaia Hypothesis** and report about who developed the hypothesis, when, and what it states.

The Gaia Hypothesis proposes that our planet functions as a single organism that maintains conditions necessary for its survival. Formulated by James Lovelock in the mid-1960s and published in a book in 1979, this controversial idea has spawned several interesting ideas and many new areas of research. While this hypothesis is by no means substantiated, it provides many useful lessons about the interaction of physical, chemical, geological, and biological processes on Earth.

### Student Glossary

Name: \_\_\_\_\_

Articles that deal with complex topics, for example a health issue, a political debate, or an environmental issue like global warming can have a tremendous amount of challenging vocabulary. These can include names of professions, science vocabulary, general words and acronyms (words formed from the initials of several words, for example, FBI).

It is helpful to create your own glossary to deal with all of the terms in an article. As a class we will build a glossary for the TIME Magazine article: "Earth at the Tipping Point." You will each be assigned several words to look up on your own. Then, as a class, we will each report our answers so each student will have a complete glossary to save as a study guide and to be used with the TIME article over the next few weeks in class. It is important that you write the definition in words that make sense to you in order for you to master the vocabulary.

<b>Vocabulary Word or Term</b>	<b>Dictionary or on-line definition. Also, write in your own words .</b>
<b>Acute</b>	
<b>Atmosphere</b>	
<b>Breach</b>	
<b>Calve</b>	

<b>Carbon dioxide, CO<sub>2</sub></b>	
<b>Century</b>	
<b>Consolation</b>	
<b>Debate</b>	
<b>Decade</b>	
<b>Deluge</b>	
<b>Devastate</b>	
<b>Disintegrate</b>	

<b>Drought</b>	
<b>Ecosystem</b>	
<b>Emission</b>	
<b>Environmentalist</b>	
<b>Fauna</b>	
<b>Feedback loop</b>	
<b>Flora</b>	
<b>Gigaton</b>	

<b>Glacial</b>	
<b>Greenhouse gas</b>	
<b>Grievous</b>	
<b>Habitat</b>	
<b>Inexhaustible</b>	
<b>Initiative</b>	
<b>Insurmountable</b>	
<b>Lawmaker</b>	

<b>Lockstep</b>	
<b>Marginalize</b>	
<b>Massive</b>	
<b>Molder</b>	
<b>Monkeying</b>	
<b>Multigenerational</b>	
<b>Naysayer</b>	
<b>Organism</b>	

<b>Oxygen</b>	
<b>Paleoecologist</b>	
<b>Palpable</b>	
<b>Paradox</b>	
<b>Permafrost</b>	
<b>Politician</b>	
<b>Prodigious</b>	
<b>Profit</b>	

<b>Rhetorical</b>	
<b>Satellite</b>	
<b>Self-perpetuating</b>	
<b>Snowpack</b>	
<b>Sodden</b>	
<b>Spawning</b>	
<b>Succumb</b>	
<b>Thermoregulator</b>	

<b>Vegetation</b>	
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Extra credit:

**Laws with teeth** is an expression or idiom used in the article. What do you think the writer means by this?

Extra, extra credit:

If your team is finished and the rest of the room is still working, look up the **Gaia Hypothesis** and report about who made the hypothesis, when, and what it states.

**Oral Presentation Rubric**

**Teacher Name:** \_\_\_\_\_

**Student Name:** \_\_\_\_\_

<b>CATEGORY</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
<b>Preparedness</b>	Student is completely prepared and has obviously rehearsed.	Student seems mostly prepared but might have needed a couple more rehearsals.	Student is somewhat prepared, but it is clear that rehearsal was lacking.	Student does not seem at all prepared to present.
<b>Content</b>	Shows a full understanding of the topic.	Shows a good understanding of the topic.	Shows a good understanding of parts of the topic.	Does not seem to understand the topic very well.
<b>Collaboration with Peers</b>	Almost always listens to, shares with, and supports the efforts of others in the group. Tries to keep people working well together.	Usually listens to, shares with, and supports the efforts of others in the group. Does not cause "waves" in the group.	Often listens to, shares with, and supports the efforts of others in the group, but sometimes is not a good team member.	Rarely listens to, shares with, or supports the efforts of others in the group. Often is not a good team member.
<b>Time-Limit</b>	Presentation is 5-6 minutes.	Presentation is 4 minutes.	Presentation is 3 minutes.	Presentation is less than 3 minutes OR more than 6 minutes.
<b>Vocabulary</b>	Uses vocabulary appropriate for the audience. Extends audience vocabulary by defining words that might be new to most of the audience.	Uses vocabulary appropriate for the audience. Includes 1-2 words that might be new to most of the audience, but does not define them.	Uses vocabulary appropriate for the audience. Does not include any vocabulary that might be new to the audience.	Uses several (5 or more) words or phrases that are not understood by the audience.

<b>Listens to Other Presentations</b>	Listens intently. Does not make distracting noises or movements.	Listens intently but makes one distracting noise or movement.	Sometimes does not appear to be listening but is not distracting.	Sometimes does not appear to be listening and makes distracting noises or movements.
<b>Posture and Eye Contact</b>	Stands up straight; looks relaxed and confident. Establishes eye contact with everyone in the room during the presentation.	Stands up straight and establishes eye contact with everyone in the room during the presentation.	Sometimes stands up straight and establishes eye contact during the presentation.	Slouches and/or does not look at people during the presentation.
<b>Volume</b>	Volume is loud enough to be heard by all audience members throughout the presentation.	Volume is loud enough to be heard by all audience members at least 90% of the time.	Volume is loud enough to be heard by all audience members at least 80% of the time.	Volume often too soft to be heard by all audience members.
<b>Comprehension</b>	Student is able to accurately answer almost all questions posed by classmates about the topic.	Student is able to accurately answer most questions posed by classmates about the topic.	Student is able to accurately answer a few questions posed by classmates about the topic.	Student is unable to accurately answer questions posed by classmates about the topic.

## Learning Experience Three

### Elevation Survey: GPS - Field Study Mapping the Impact Area

This LE requires that the class can take a trip to a section of coastline that would be affected by a 20-foot rise in sea level. Significant landmarks that would be inundated by this rise in sea level also must be located in the area of the study. If you do not live near a coast, the Learning Experience can be simulated using a topography map of a section of coastal land with landmarks (imaginary or actual) entered onto the map. Select a quadrant map where the elevation gradually rises. If you are substituting the study of a topographical map for the field trip, do Learning Experience Four prior to this LE since the latter LE teaches students about topography maps.

#### Overview

Students discuss some landmarks that might be impacted in the event of a 20-foot rise in sea level sometime in the future. The class goes on a field study of the impact area and its surroundings and uses a GPS device to explore whether the landmarks discussed in class would be underwater.

#### Evaluation

A Visible Thinking exercise called Claim/Support/Question will be used in relation to the project area of impact plus time.

#### Materials

- Handheld GPS device with altimeter (See “Notes from the Classroom” at the end of the LE for instructions.)
- Political map of nearby impacted area with copies for each student
- Handout One: Visible Thinking Routine, taken from Harvard Project Zero Visible Thinking  
[http://www.pz.harvard.edu/vt/VisibleThinking\\_html\\_files/VisibleThinking1.html](http://www.pz.harvard.edu/vt/VisibleThinking_html_files/VisibleThinking1.html)
- Handout Two: Field Study Worksheet
- Permission slips, transportation to impact area, chaperones
- Chart paper and markers
- Learning logs

**Teachers’ Note:** See “Notes to Teachers” at the end of this LE regarding the planning for a field study.

### **Activity One: Activating and Assessing Prior Knowledge**

- Tell the students that they will be learning about how to use a GPS to determine what could happen to their coastline after a 20-foot rise in sea level.
- Give students about five minutes to write in their learning logs. Provide the following prompt: “I predict that we will be learning about...”

### **Activity Two: Discussion and Predictions**

- Revisit the TIME Magazine article “Global Warming Heats Up,” specifically the part about the 20-foot sea level change.
- As a class, define and discuss elevation (the height above the level of the sea).
- Distribute a political map of the projected impact area and its surroundings.
- Ask students where they think the water level will be if the sea level rises 20 feet. Ask them specifically about certain landmarks in and out of the impact area.
- Discuss the topography of the impact area. Is it flat? Are there hills? How will the terrain affect the rising water?
- Select five key landmarks in and out of the impact area.
- Hand out the Field Study Worksheet. Instruct students to estimate the elevation of each landmark and predict whether the landmark would be underwater and need to be relocated.
- Gather Field Study Worksheets to distribute during the field study.

### **Activity Three: Measuring Elevation in the Field**

- Proceed to the impact area.
- Discuss GPS and the functioning of your specific device.
- Review the concept of elevation, especially sea level as a frame of reference.
- Walk to the first landmark.
- Review the students’ predictions, and then reveal the actual elevation. Ask students if they want to reevaluate their predictions about the next landmark after this first reading.
- Tell students to be aware of elevation changes as you walk between landmarks. Walk to the next landmark. Before making another elevation reading, ask the students if they think their elevation has changed since the last landmark and, if so, by how much. Take the reading, and repeat the process for the other three landmarks.

### Activity Four: Evaluation

A Visible Thinking exercise called Claim/Support/Question will be used in relation to the project area of impact plus time. After the field study, a political map of the impact area and its surroundings is hung at the front of the room. Students assume a “fast forward” in time to an actual 20-foot sea level rise. Using their learning logs to record their ideas, students make one claim about the topic of the map plus time, provide one support for that claim, and ask one question that relates to the claim. Finally, the teacher asks the students to read their Claim/Support/Question, record their answers on chart paper, and leads a discussion about the findings.

### Activity Five: Checking for Understanding

- Ask students to reflect on the essential questions: How do maps help us understand the distribution of living things and resources? Why do maps make a difference in how we understand and use the environment?
- Ask them what they learned from the field study, using GPS and elevation and how it changed their thinking about global warming.
- Use this information to assess students’ new knowledge about global warming as well as working with GPS and maps.

### Notes to Teachers

- Be sure to send out permission slips. Chaperones will be needed, along with comfortable walking shoes.
- Arrange for busses to the location if necessary.
- Try to pick four or five key landmarks that are within a 30-minute walk, and plan a route through the area that will maximize the students’ awareness of elevation changes.
- If possible, start with a landmark at or close to sea level, like the beach or a wharf. In this way students will have sea level as a strong reference point.
- Discussion of the GPS device can take place in the field or in the classroom, depending on the weather.
- A math lesson on slope—rise/run would be very helpful. The Connected Math lesson uses staircases and discusses rise and run. Performing this exercise prior to the Learning Experience can facilitate an easy connection for students.
- As an extension, consider teaching or revisiting the concepts of longitude and latitude. You can determine the coordinate points of your school’s location through a GPS system, maps, Google Earth, etc. See:

<http://www.nationalgeographic.com/xpeditions/lessons/09/g68/cartographyguidestudent.pdf>.

- As an additional or alternate extension, consider teaching the concept of scale. See:  
<http://www.leo.lehigh.edu/envirosci/watershed/gis/toposkills/Basics/scale.html>  
[http://www.leo.lehigh.edu/envirosci/watershed/gis/toposkills/Teacher/pdf/Tch\\_scale.pdf](http://www.leo.lehigh.edu/envirosci/watershed/gis/toposkills/Teacher/pdf/Tch_scale.pdf)

### **Notes from the Classroom on Using a GPS device**

The GPS devices we used had an elevation standard of deviation of 20 feet, which was a problem considering the resolution we needed (0-20 feet). I purchased the Garmin MapSource topographical CD and loaded the data onto the handhelds. I preprogrammed the waypoints that I planned on stopping at during the exercise and plugged in the actual elevations. (However, this was more difficult than I had hoped, because the topo map resolution was at 33 foot intervals. Therefore, I needed to come up with a method for determining elevation changes while walking around.)

#### Solution:

I had a couple of students bring in laser pointers into class. I attached them to a level and made sure they shot straight and level across the room. Then I measured the height of the laser beam over the level (which turned out to be 2 1/8 inch). I then took a yard stick and cut the top 2 1/8 inch off and placed the laser pointer/level on top of it. As a result the laser when held level would shoot a horizontal beam 3 feet above the ground. We then walked down to the water first and then shot the laser as we walked up the hill counting by three foot intervals. (Bringing a large whiteboard to track the laser beam on definitely helped us out). When we got to 33 feet above sea level we were able to check our accuracy against the topo maps supplied by Garmin.





## **CLAIM / SUPPORT / QUESTION**

*A reasoning routine*

### **1. Make a claim about the topic**

**Claim:** An explanation or interpretation of some aspect of the topic.

### **2. Identify support for your claim**

**Support:** Things you see, feel, and know that support your claim.

### **3. Ask a question related to your claim**

**Question:** What's left hanging? What isn't explained? What new reasons does your claim raise?

### **Purpose: What kind of thinking does this routine encourage?**

The routine helps students develop thoughtful interpretations by encouraging them to reason with evidence. Students learn to identify truth claims and explore strategies for uncovering truth.

### **Application: When and where can I use it?**

Use *Claim Support Question* with topics in the curriculum that invite explanation or are open to interpretation.

### **Launch: What are some tips for starting and using this routine?**

The routine can work well for individuals, in small groups and for whole group discussions. Begin by modeling the routine: Identify a claim and explore support and questions in a whole group discussion. On the board make one column for SUPPORT and one column for QUESTIONS. Ask the class for evidence that either supports a claim, or questions the claim and write it in the appropriate column. Take turns using the routine so that each student makes a claim, identifies support and asks a question.

Following each person's report, take a moment as a group to discuss the topic in relation to the claim before moving on to the next person. Be patient as students take a few moments to think. You may need to probe further by asking: What are some other questions you might want to ask about this statement? or Can you think of reasons why this may be true? Encourage friendly disagreement – once a student comes up with an alternative perspective about a claim, encourage other students to follow. The questions can challenge the plausibility of the claim, and often lead to a deeper understanding of the reasoning process. Let students know it is fine to disagree with one another's reasons and encourage them to come up with creative suggestions for support and questioning. After everyone has had a turn, reflect on the activity. What new thoughts do students have about the topic?

From: <http://www.pz.harvard.edu/vt/index.html>

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Location	Est. Elevation	Actual Elevation	Submerged	Notes
1)			Y / N	
2)			Y / N	
3)			Y / N	
4)			Y / N	
5)			Y / N	

**Elevation Field Study**

Reflection Questions:

1) How accurate were you initial elevation estimates? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2) Were some estimates more accurate than others? Why? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3) How did your estimates change as you walked from one landmark to the next? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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4) What made you aware of changes in elevation? \_\_\_\_\_

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## Learning Experience Four

### Topographical Maps Lesson With DOGSTAIL

The Learning Experience is adapted from National Geographic:  
<http://www.nationalgeographic.com/xpeditions/lessons/01/g68/dogstails.html>

#### Overview

Students craft miniature mountains from lumps of clay and “translate” those mountains into topographic maps. These maps will include vital features and information, including **d**ate, **o**rientation, **g**rid, **s**cale, **t**itle, **a**uthor, **i**ndex, **l**egend, and **s**ources, also known by the acronym **DOGSTAILS**.

#### Evaluation

Students write in their learning logs and then present verbal reports on the relationship between the clay mountain and the mapped representation of it. Their report should include a statement of what would change on the map if something were changed on the model. Their understanding should translate into real situations, enabling them to predict the shape and relief of a real landform by looking at a topographic map of it.

If time allows, students can demonstrate their understanding by exchanging paper maps and constructing the corresponding mountains.

#### Materials

- United States Geological Survey (in the United States) or other topographic map of your area (if outside the United States).
- Two sticks and one ball of clay per student or group (Activity Three)
- Colored pencils
- Two sheets of drawing paper per student
- Rulers
- Thin fishing line
- Pencil
- Handout: Reading Topographical Maps

#### Activity One: Activating and Assessing Prior Knowledge

- Tell students that they will be learning about landforms and terrain.

- Give students about five minutes to write in their learning logs. Provide the following prompt: “I predict that we will be learning about...”

### Activity Two: Class Discussion on Landforms

- Discuss with students some common varieties of landforms—hills, mountains, valleys, and plateaus, for example. What distinguishes hilly or mountainous terrain from relatively flat terrain? (The amount of "relief", that is, the amount of elevation change in the land surface within a given area.)
- Explain that it is sometimes important to have a map that shows the elevation of land on a flat paper surface—a topographic map. Why is this useful? Hikers cannot carry small three-dimensional models of the hills they walk very easily. Maps are more convenient.
- Show students a topographic map of your area. Help them to understand the isolines and be able to pick out land features on the map by the spacing of the isolines.
- Remind students of mapping concepts they have already encountered while studying this Learning Experience: National Geographic’s Mapmaking Guide located on the Internet at <http://www.nationalgeographic.com/xpeditions/lessons/09/g68/cartography/guidestudent.pdf>

### Activity Three: Creating Topographical Maps

- Set the clay in a warm place, like a sunny window, to soften it, then knead until the clay is very soft. Break it into lumps, placing each on a sheet of drawing paper.
- Distribute the materials to students or groups, and instruct them to shape their clay into mountains.
- Once each mountain is complete, mark its peak with a dot.
- Draw a straight line that passes through the dot while running from "north" to "south" across the mountain. Draw a second line—running "east" to "west"—perpendicular to the first. The mountain should now appear to be divided into quadrants. These *orientation lines* will be important later.
- Draw three rings around the center dot. One should be a quarter of the way down from the peak; the next should be halfway down; and the third should be three-quarters of the way down.
- Holding the fishing line taut, use it to slice through the clay along the ‘ring’ lines you have just drawn. You should wind up with four layers.
- Place the bottom layer on a fresh sheet of paper and outline it. Be sure to mark where the orientation lines meet the paper.

- Take the clay off the paper. Center the next layer within the outline, using the orientation lines to make sure the clay is in the right position. Outline this layer. Then do the same thing with the remaining two layers.
- Remove the last layer and explain to the students that they've begun making a topographic map.
- Assume that the base of the mountain was at sea level. Then assign elevations to the remaining levels. [Note: The intervals must be consistent.]
- Color each layer and create a map key. [Note: Do not use blue, which is reserved for representing water.]
- Add the other map essentials: date, orientation, grid, scale, title, author, index, legend, and sources—DOGSTAILS!

#### **Activity Four: Applying What We've Learned**

- Display several student-made maps in the classroom. Discuss how the maps represent the clay mountains.
- As a group, note the essential features that should be on each map. Gather the answers on the board or on chart paper.
- Pair students. Distribute the Handout, Reading Topographical Maps. Students work together to respond to the questions. (This may be used a homework assignment.)
- Have students demonstrate to a group of younger students the relationships between physical landforms and mapped representations. This can be done either in a presentation or by creating an informational poster describing the map elements, process for creating the map, topographical map vocabulary, and uses for topographical maps.

#### **Activity Five: Checking for Understanding**

- Ask students to reflect on the essential questions: How do maps help us understand the distribution of living things and resources? Why do maps make a difference about how we understand and use the environment?
- Ask students what they learned from the map building and discussions about elevation and terrain.
- Use this information to assess students' new knowledge about elevation and maps.

#### **Notes to Teachers**

Helpful Links:

<http://plasma.nationalgeographic.com/mapmachine/>

<http://www.topozone.com/>

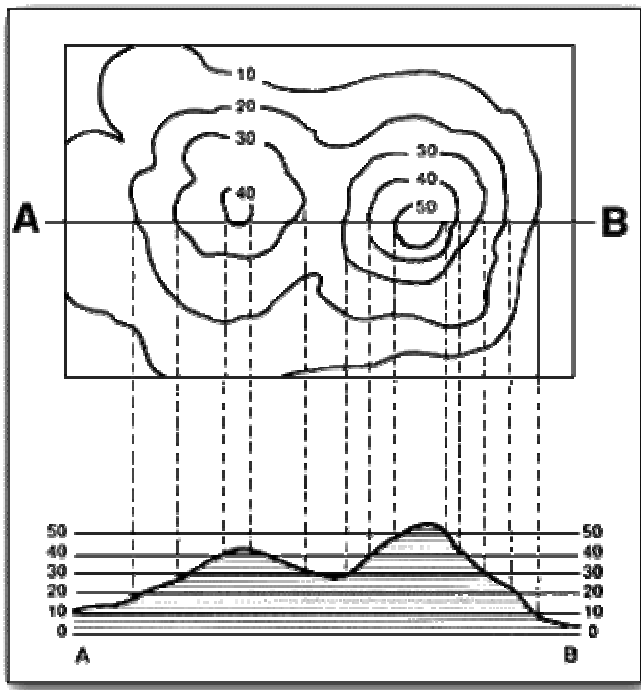
<http://mapping.usgs.gov/>

Possible Homework or additional assignment: Topographical worksheets  
attached taken from:

[http://www.nasaexplores.com/show\\_58\\_student\\_st.php?id=021217144108](http://www.nasaexplores.com/show_58_student_st.php?id=021217144108)

## Reading Topographical Maps

**Procedure:** One special kind of map is called a topographical map. It has contour lines to show the shape and elevation of the land. They are sometimes called "level lines" because they show points that are at the same level. Here's how contour lines work:



The top of this drawing is a contour map showing the hills that are illustrated at the bottom.

On this map, the vertical distance between each contour line is 10 feet.

Which is higher, hill A or hill B? \_\_\_\_\_

Which is steeper, hill A or hill B? \_\_\_\_\_

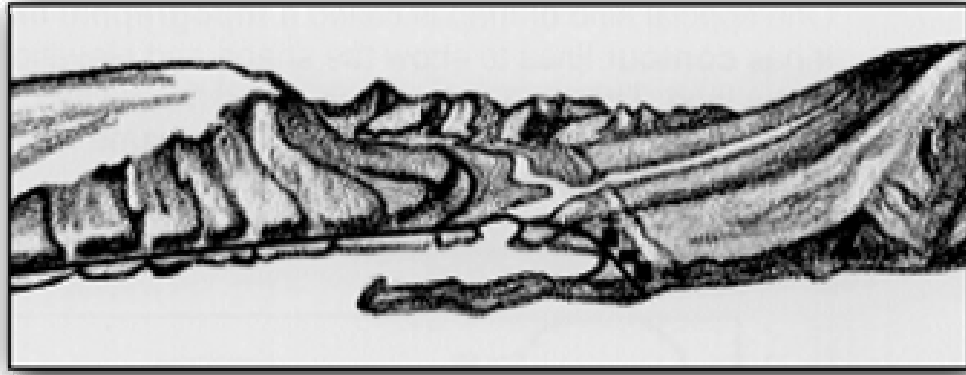
How many feet of elevation are there between contour lines?

\_\_\_\_\_

How high is hill A? \_\_\_\_\_ hill B? \_\_\_\_\_

Are the contour lines closer together on hill A or hill B? \_\_\_\_\_

Look at this picture. It shows a river valley and several nearby hills.



On the illustration, locate the following:

- A church
- A bridge over the river
- An ocean-side cliff
- A stream that flows into the main river
- A hill that rises steeply on one side and more smoothly on the other

Here is a topographical map of the same place.



Find the items you located on the illustration on the topographic map.

- Circle the symbol for a church.
- Draw a church symbol here.
- Put a square around the map symbol for a bridge.
- Draw a bridge symbol here.
- Put an X on the oceanside cliff.

What is the elevation of the contour line at the top of that cliff? \_\_\_\_\_

Locate a stream that flows into the main river. Draw a pencil line down that stream.

Put an X where the stream joins the main river.

On a real topographic map, streams are shown in blue and contour lines are shown in brown.

Find the hill that rises steeply on one side and more smoothly on the other.

On the topographic map, draw a path up the hill to the highest point that would be easy to climb. (Hint: remember that when contour lines are close together, the ground is very steep.)

Draw a path showing a very steep way up the hill.

Tell how you might use a topographic map if you were selecting: 1. A route for a hike, 2. The best location for an airport. 3. A route for a new road.

## Learning Experience Five

### Topographical/Political Map Overlay

#### Overview

Students use maps (Political and Topographical) to determine the ramifications of a 20-foot sea-level rise. They map out a new shore line and list the resources impacted by the rise, both natural and manmade, in order of importance to them.

#### Evaluation

Students create a map and a list of the resources they relocated. They are able to verbally support why they relocated those specific resources.

#### Materials

- Overhead projector
- Political map of the area to be impacted (coastal area)
- Topographical map of the area to be impacted
- Photocopies of a hybrid map for the students
- Light and dark blue colored pencils or markers to fill in the current and projected waterline
- List of local resources located in the impact area

**Teachers' Note:** See “Notes to Teachers” at the end of this activity for instructions on how to create the maps.

#### Activity One: Activating and Assessing Prior Knowledge

- Tell students that they will be learning about the possible impact on a coastline from a change in sea level.
- Give students about five minutes to write in their learning logs. Provide the following prompt: “I predict that we will be learning about...”
- Use this information to assess students' current knowledge about sea level, elevation, a change in sea level, local resources.

#### Activity Two: Learning through Maps

- Place the political map of the impact area on the overhead display. Ask students to identify the image. Review the social studies and science concepts and skills they have worked on in the previous lessons.
- Identify the DOGSTAILS on the displayed map.

- Remove the map.
- Place the topographical map of the impact area on the overhead and ask the students to identify the map. (This may be the first time students have ever seen this map). Ask them to clarify the information on the map. What are the (contour) lines on the map? How much change in elevation does each line represent?
- Pose the questions: Could this map be used to analyze a change in sea level? Where is sea level now? How do you know? Ask a student to color in (dark blue) the existing sea level/coastline on the overhead. Tell students to locate the 20-foot elevation line. Ask a student come to the front of the room and color the new coastline (light blue). Ask students: Is it possible to transfer this information to the political map they were just looking at? (Discuss appropriate scale.)
- Overlay the two maps on the overhead. Instruct the students to locate the five landmarks they visited on their field study. Does the map confirm their GPS readings? Discuss the significance of this new “hybrid” map.

### **Activity Three: Student Maps and Resources List**

- Hand out the student maps and colored pencils. Instruct students to color in the existing and projected sea level and identify five key landmarks/resources that will be submerged.
- As a class, make a complete list of the landmarks/resources that would be impacted by the rising sea. Have the students record the information.
- As a homework assignment, tell students to list the sites to be relocated in order of importance (most needed to least needed). Collect the maps and revised lists the following day.

### **Activity Four: Checking for Understanding**

- Tell students to look back at their initial predictions about what they would be learning and to write about how the map overlay and discussion of resources matched up to their predictions.
- Use this information to assess students’ new knowledge about map types, uses of maps, and the value of certain resources in the area.

### **Notes to Teachers**

It is crucial that the maps used for this exercise be of the same area and the same scale. In this way they can be overlaid successfully. The maps must also be reduced to fit on an 8.5” by 11” transparency. This overlay can be accomplished more easily with a computer equipped with Arc View or some other GIS software and an LCD projector.

The following website from Nova called "If the Ice Melts" is a helpful dynamic graphic of projected sea level rise along coastlines around the world.

<http://www.pbs.org/wgbh/nova/vinson/ice.html>

### **Notes from the classroom: Making the Topographical/Political Map Overlay**

To create the topographical map I used Garmin MapSource: United States TOPO.

I zoomed in on the area of interest, loaded the topo information and exported the map into an image file. Then I pasted the map into MS Word and printed it to an 8.5 \* 11 handout. (Mine was actually two 8.5\*11 pieces of paper taped together in portrait layout.) Then I created an overhead transparency of the map using the photocopier and photocopied the map with the topo lines for the students so they could color it in.

After they created the maps we used Google Earth to "fly" over the area and identify structures and other items of interest that were in the impact area. I selected all of the data overlays possible so identifying resources was easy. As I did this I updated the resource list that I attached below.

### **New Bedford Resources**

Directions: Label all the locations in order of importance from 1-19.

(1 being the most important/19 being the least)

<b>Priority:</b>	<b>Location:</b>
_____	<b>Sea Lab</b>
_____	<b>Fort Tabor</b>
_____	<b>Sewage Treatment Plant</b>
_____	<b>Schools</b>
_____	<b>People's Homes</b>
_____	<b>Churches &amp; Temples</b>
_____	<b>Waterfront Visitor Center</b>
_____	<b>Route 6 Bridge</b>
_____	<b>Fish Processing Plants</b>
_____	<b>Historic Lighthouse (Pope)</b>
_____	<b>Marine Services</b>

<hr/>	<b>Marinas</b>	<hr/>
<hr/>	<b>Martha's Vineyard Ferry</b>	<hr/>
<hr/>	<b>Small businesses</b>	<hr/>
<hr/>	<b>Power plant</b>	<hr/>
<hr/>	<b>Whaling Museum</b>	<hr/>
<hr/>	<b>Route 18</b>	<hr/>
<hr/>	<b>YMCA</b>	<hr/>
<hr/>	<b>Seaman's Bethel</b>	<hr/>

## Learning Experience Six

### The Impacts of and Planning for Sea Level Rise

#### Overview

Using the background knowledge gained from LEs One through Five, the TIME Magazine article, and additional research on how communities (past and present) deal with sea-level rise, each student will display on a map a plan for moving local infrastructure and resources in the impact area. Students will defend their plans with written essays outlining their plans and the reasons for their decisions.

#### Evaluation

Using a map of the local impact area, students show how they would redistribute the local infrastructure and resources to take into account the new shoreline based on a 20-foot sea-level rise. Students defend their plans in written persuasive arguments, which they present to the class in an effort to create consensus for their choices.

Students are evaluated on their maps and a rubric is used to evaluate their persuasive arguments and presentations.

#### Materials

- TIME Magazine Article, “Global Warming Heats Up” by Jeffrey Kluger <http://www.time.com/time/archive/preview/0,10987,1176980,00.html>
- Graphic organizers for comparing and contrasting information for persuasive essays – use Venn diagrams or Double Bubble diagrams <http://www.thinkingmaps.com/htmexam.php3>
- Handout One: Map (or copy) of impact area for each student
- Colored pencils and markers (or a computer)
- Internet access or library
- Handout Two: Persuasive Essay Writing Guide
- Handout Three: Rubric for Written and Oral Persuasive Argument

#### Teacher’s Note:

Some available research links (and there are others):

- Environmental Defense – <http://www.environmentaldefense.org/home.cfm>
- National Center for Atmospheric Research (NCAR) – <http://www.ncar.ucar.edu/>
- USDA Forest Service – <http://www.fs.fed.us/>

- Environmental Protection Agency info on global warming  
<http://yosemite.epa.gov/oar/globalwarming.nsf/content/index.html>
- NOAA site on global Warming –  
<http://lwf.ncdc.noaa.gov/oa/climate/globalwarming.html>
- Woods Hole Oceanographic Institute (WHOI) – <http://www.whoi.edu/>
- Regional Greenhouse Gas Initiative (RGGI) – <http://www.rggi.org/>
- Truth Out Website – [http://www.truthout.org/issues\\_06/032706EA.shtml](http://www.truthout.org/issues_06/032706EA.shtml)

### **Activity One: Activating and Assessing Prior Knowledge**

- Tell students that they will be learning about persuasive arguments. Give students about five minutes to write in their learning logs. Provide the following prompt: “I predict that we will be learning about....”
- Use this information to assess students’ current knowledge about persuasive arguments.

### **Activity Two: A Map for the Future**

- Students create a map that shows how they have redistributed at least five major resources or landmarks in the impact area.
- Using their topographical maps that outline in color the impact area, students add to the maps a relocation plan for their resources or landmarks. The maps serve as a visual aid to accompany their persuasive essays.

### **Activity Three: A Persuasive Essay**

- Tell students they are taking on the role of a city planner. They are writing a persuasive essay to convince the city council and the mayor to support the relocation plan they have mapped out to accommodate a 20-foot rise in sea level.
- Remind students of their glossaries from the TIME article, and encourage them to use vocabulary terms in their writing.
- Provide students with all support materials necessary. If Internet access is not available, additional print material can be obtained from the library. Print out articles for students to share.
- Provide students with Handout Two, Writing Guide, as a model to organize their essays.
- Distribute and discuss Handout Three, the Rubric.
- Students should peer-edit their first, second, and final drafts with at least two peer editors using the writing rubric as a guide. Instruct students to assess their own writing using the rubric prior to submitting the final copy.

### **Teachers' Notes:**

- This is a culminating activity at the end of the unit. At this point, students should have a thorough understanding of the TIME Magazine article. Students have worked with several topographical and political maps of the impact area and should be familiar with them.
- Present several graphic organizer models to students to assist them with pre-writing their persuasive arguments. A “Double Bubble” organizer may provide the best visual aid and space for students to organize their thoughts. Examples can be found at <http://www.thinkingmaps.com/htmexam.php3>

### **Activity Four: Presentations and Summation**

- Students present their essays and their maps to the city council (class) and mayor (teacher) to gain approval for their plans.
- Tally the number of “votes” to move each resource and present the overall class findings of which resources were the top five chosen for relocation.
- As a class, discuss what elements were used to create the most persuasive arguments, and analyze why certain resources received the most votes.

### **Activity Five: Checking for Understanding**

- Tell students to review all their initial predictions about what they would be learning and to write a few “headlines” about how the actual activities matched up to their predictions.
- Ask students to reflect on the essential questions presented throughout the module (post these in the classroom), and ask them to pick one or two to reflect on that really stand out for them.
- Collect learning logs for teacher reflection on which areas of the module should be modified for future use, what student misunderstandings still exist, and what further inquiry could be implemented.

### **Notes to Teachers**

In order to differentiate for grade level or individual students' needs, the length of the writing assignment can be altered from a display of how each student would move five major landmarks in the impact area accompanied by a short sentence about each, to a five-paragraph essay outlining their background knowledge of global warming and defending their choices for redesign in the impact area, citing sources, etc.

## **Persuasive Essay Writing Guide**

### Global Warming Plan for the Impact Area

#### Essential Questions:

- How will a population need to adjust to a major change in its physical environment?
- Why do maps make a difference in how we understand and use the environment?
- How do maps help us understand the distribution of living things and resources?

#### Instructions for Writing Essay:

In a five paragraph essay, choose three local locations, and create an argument for moving them because of an impending rise in sea level caused by global warming.

1. **Introductory paragraph:** Make a strong position statement on what three places you plan to relocate. Define global warming, and include your understanding from the TIME Magazine article, “Global Warming Heats Up” and the film “An Inconvenient Truth,” as well as any other research. Discuss the impact area, your understanding of mapping, and how you determined what places would be affected by the rise in sea level. List the three places you believe should be moved and explain why you chose them.
2. **Paragraph 2:** Discuss your first relocation project, including what you are moving and where, how and why you are relocating.
3. **Paragraph 3:** Discuss your second relocation project, including what you are moving and where, how and why you are relocating.
4. **Paragraph 4:** Discuss your third relocation project, including what you are moving and where, how and why you are relocating.
5. **Conclusion:** Summarize and include the other two areas that should be considered for relocation, your findings, and what you still need to research to make a complete plan for the city and the impact area.

**Rubric for Written and Oral Persuasive Argument**

**Persuasive Essay: City Planning for Sea-Level Rise**

**Teacher's Name:** \_\_\_\_\_

**Student Name:** \_\_\_\_\_

<b>CATEGORY</b>	<b>4 – Above Standards</b>	<b>3 – Meets Standards</b>	<b>2 – Approaches Standards</b>	<b>1 – Below Standards</b>
<b>Position Statement</b>	The position statement provides a clear, strong statement of the author's position on the topic.	The position statement provides a clear statement of the author's position on the topic.	A position statement is present, but does not make the author's position clear.	There is no position statement.
<b>Support for Position</b>	Includes 3 or more pieces of evidence (facts, statistics, examples, real-life experiences) that support the position statement. The writer anticipates the reader's concerns, biases or arguments and has provided at least one counter-argument.	Includes 3 or more pieces of evidence (facts, statistics, examples, real-life experiences) that support the position statement.	Includes 2 pieces of evidence (facts, statistics, examples, real-life experiences) that support the position statement.	Includes 1 or fewer pieces of evidence (facts, statistics, examples, real-life experiences).
<b>Evidence and Examples</b>	All the evidence and examples are specific and relevant, and explanations are given that show how each piece of evidence supports the author's position.	Most of the evidence and examples are specific and relevant, and explanations are given that show how each piece of evidence supports the author's position.	At least one of the pieces of evidence and examples is relevant, and an explanation is given that shows how that piece of evidence supports the author's position.	Evidence and examples are NOT relevant AND/OR are not explained.
<b>Sequencing</b>	Arguments and support are provided in a logical order that makes it easy and interesting to follow the author's train of thought.	Arguments and support are provided in a fairly logical order that makes it reasonably easy to follow the author's train of thought.	A few of the support details or arguments are not in an expected or logical order, distracting the reader and making the essay seem a little confusing.	Many of the support details or arguments are not in an expected or logical order, distracting the reader and making the essay seem very confusing.
<b>Transitions</b>	A variety of thoughtful transitions are used. They clearly show how ideas are connected	Transitions show how ideas are connected but with little variety	Some transitions work well, but some connections between ideas are fuzzy.	The transitions between ideas are unclear OR nonexistent.

<b>CATEGORY</b>	<b>4 – Above Standards</b>	<b>3 – Meets Standards</b>	<b>2 – Approaches Standards</b>	<b>1 – Below Standards</b>
<b>Sentence Structure</b>	All sentences are well-constructed with varied structure.	Most sentences are well-constructed with some varied sentence structure.	Most sentences are well constructed but with no variation in structure.	Most sentences are not well-constructed or varied.
<b>Grammar and Spelling</b>	Author makes no errors in grammar or spelling that distract the reader from the content.	Author makes 1-2 errors in grammar or spelling that distract the reader from the content.	Author makes 3-4 errors in grammar or spelling that distract the reader from the content.	Author makes more than 4 errors in grammar or spelling that distract the reader from the content.
<b>Capitalization and Punctuation</b>	Author makes no errors in capitalization or punctuation, so the essay is exceptionally easy to read.	Author makes 1-2 errors in capitalization or punctuation, but the essay is still easy to read.	Author makes a few errors in capitalization and/or punctuation that catch the reader's attention and interrupt the flow.	Author makes many errors in capitalization and/or punctuation that catch the reader's attention and interrupt the flow.
<b>Audience</b>	Demonstrates a clear understanding of the potential reader and uses appropriate vocabulary and arguments. Anticipates reader's questions and provides thorough answers appropriate for that audience.	Demonstrates a general understanding of the potential reader and uses vocabulary and arguments appropriate for that audience.	Demonstrates some understanding of the potential reader and uses some arguments appropriate for that audience.	It is not clear who the author is writing for.
<b>Closing Paragraph</b>	The conclusion is strong and leaves the reader solidly understanding the writer's position. Effective restatement of the position statement begins the closing paragraph.	The conclusion is recognizable. The author's position is restated within the first two sentences of the closing paragraph.	The author's position is restated within the closing paragraph, but not near the beginning.	There is no conclusion - the paper just ends.
<b>Sources</b>	All sources used for quotes, statistics and facts are credible and cited correctly.	All sources used for quotes, statistics and facts are credible and most are cited correctly.	Most sources used for quotes, statistics and facts are credible and cited correctly.	Many sources are suspect (not credible) AND/OR are not cited correctly.