

## CLIMATE CHANGE AND SPECIES AT RISK

Adapted by Duc Tran, Environmental Science Institute, April 2011

**GRADE LEVEL:** 9 – 12

**LENGTH:** 5 class periods (1 week)

**SAMPLED TEKS:** §112.37. Environmental Systems: 1A, 1B, 2I, 2K, 3A, 3C, 3D, 5C, 5D, 5E, 8E, 9D, 9E, 9H

**OVERVIEW:** Students will learn about the effects of climate change on different species. The students will simulate and observe the greenhouse effect by using 2-liter plastic bottles, soil, and water. They will measure temperature changes as well as the effects of soil dampness. This lesson plan combines topics regarding weather and ecosystem that can easily bridge to other lesson plans or units.

### OBJECTIVES:

Students will be able to:

- Explain the causes and effects of climate change on ecosystems and species.
- Collect, review, and reflect on information and opinions about climate change from various sources.
- Discuss possible solutions to the problems posed by climate change.

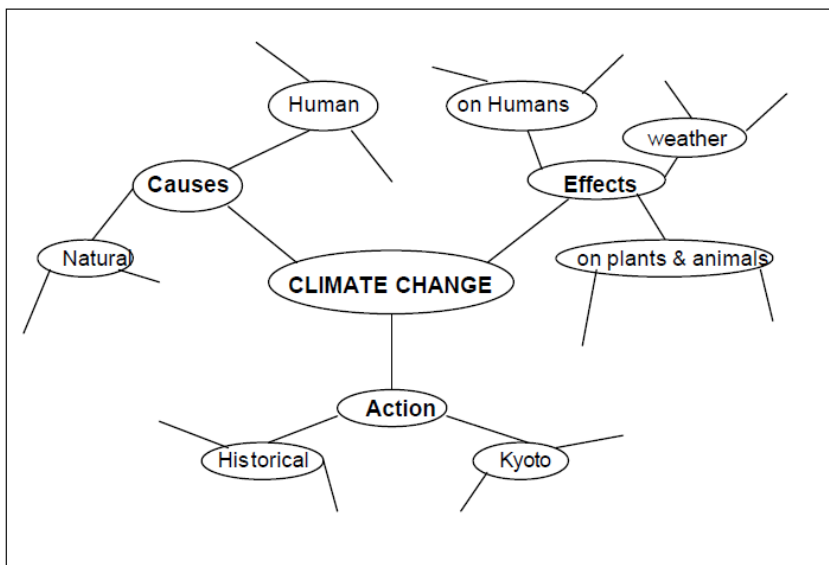
### UNIT OUTLINE:

Day 1	Day 2	Day 3	Day 4	Day 5
<ul style="list-style-type: none"> <li>- Introduction &amp; Concept Map</li> <li>- Video (Optional)</li> <li>- Unit Overview</li> </ul>	<ul style="list-style-type: none"> <li>- Reflection: Article and Journal</li> </ul>	<ul style="list-style-type: none"> <li>- Greenhouse Effect Experiment – “Making a Greenhouse”</li> <li>- Causes of Climate Change</li> <li>- Weather Impact</li> </ul>	<ul style="list-style-type: none"> <li>- Effects of Climate Change</li> <li>- Ecosystems</li> <li>- Species at Risk</li> </ul>	<ul style="list-style-type: none"> <li>- Assignment Due</li> <li>- In-class discussion</li> </ul>

### Day 1: Introduction and Concept Map

- Below is a list of sample videos:
  - *Climate Change* – Video Winner of the “Premios Fundación Biodiversidad” (Biodiversity Foundation Awards) in the category, Documentary and Short Films:  
<http://www.youtube.com/watch?v=FXntPFWi8H0&feature=related>
    - *Production Company* – Silverspace Animation Studios; *Production:* Enrique Garcia, Ruben Salazar
  - *Climate Change* - <http://www.youtube.com/watch?v=zzjOcOcQ90U>
- What is climate change? Ask students to define climate change, global warming, and greenhouse effect. (Refer to glossary below if needed.)
- Create a climate change concept map AND/OR a KWL Chart on the board as a class. Ask students to suggest different aspects of climate change, and then expand on these to get an idea of the variety of things to learn about climate change.
  - KWL Chart is composed of 3 columns that answer the following questions:
    - What we Know? What we Want to know? What have we Learned?

- Sample Concept Map:



### Day 2: Reflection - Article Collection and Journal

- Before starting the activity, discuss the different type of resources available and why certain sources are chosen over others.
  - Address the difference between Primary vs. Secondary Sources
    - Primary: firsthand, direct from the source information.
    - Secondary: analyses of the primary sources.
  - For more information about the different type of sources, please visit the following site:  
<http://library.uis.edu/findinfo/types.html#primary>
- Allow students to collect newspaper, magazine, and other current articles related to climate change. Have them write a reflection utilizing the information they found. Reflection should be around 2 – 3 paragraphs.
- Encourage students to collect articles with varying opinion, not just those they agree with.
- Have students store these articles and reflections in a science journal to hand in at the end of the week.

### Day 3: Making a Greenhouse

**Activity:** The students will simulate and observe the greenhouse effect using 2-liter plastic bottles, soil, and water. They will measure temperature changes as well as the effects of soil dampness.

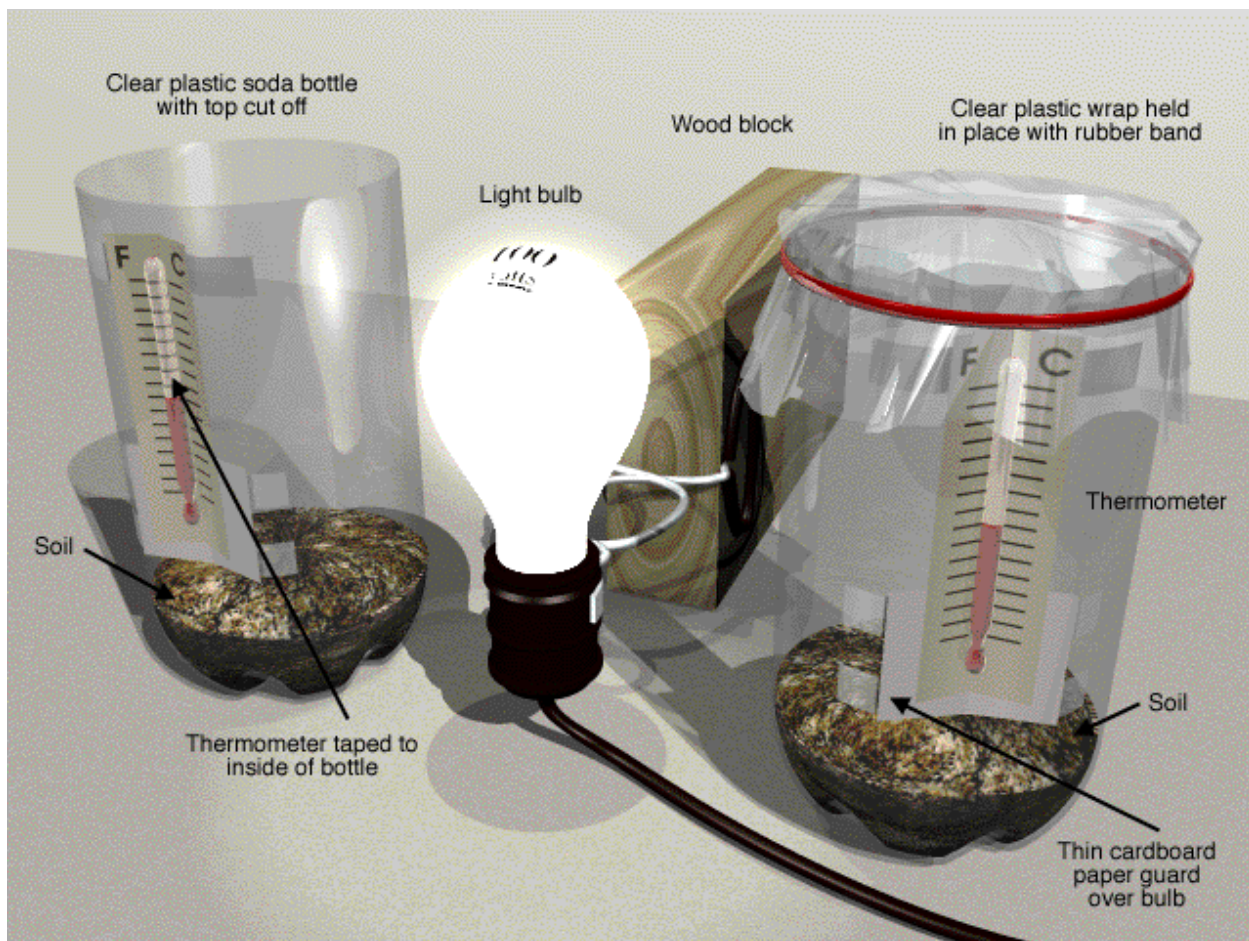
#### Materials (per group)

- 2 Clear plastic 2-liter bottles
- Plastic wrap or clear plastic bags to cover the "greenhouses"
- String or rubber bands to hold the plastic in place
- 2 Thermometers
- Two 2" x 2" pieces of thin cardboard
- Soil
- Plastic rulers
- Masking tape

- Utility knife or saw for cutting the plastic bottles
- Clip-on light source with at least a 100 watt bulb (only if you are doing the activity indoors)

### Procedure

1. After discussing the greenhouse effect and explaining the model that the students will set up, spend several minutes brainstorming for ways to test the effects of the greenhouse effect on the following: air temperature alone; air temperature above soil or soil temperature.
2. Give each team of students an equipment tray with the materials listed above. Have teams of students select one of the effects from the list in Step 1 to investigate, and design an experiment using the equipment on the tray. Each team should create a control experiment using the bottle without the plastic cover. The student-designed experiment should include a hypothesis, a procedure (including a sketch) and a data recording table, including appropriate units of measure.
3. When the experiments have been approved, the students will set-up and complete their experiment. They should let the bottles sit in direct sunlight for 30 to 50 minutes and record their observations, before, during, and after the period the bottles are in the sunlight.
4. Have each team report on their set-up and findings. Record their data on the board or on an overhead projector transparency. List their hypotheses and whether their hypotheses were confirmed by the experiment. Were there any experimental errors? What other experiments do the data suggest?



### Discussion Questions

1. What is the greenhouse effect? Discuss it with students.
2. What are the some common greenhouse gasses? [water, carbon dioxide, methane, nitrous oxide, and CFCs]
3. What are some ways that humans produce greenhouse gases? [primarily burning of fossil fuels in automobiles, industry]
4. What might happen if we continue to release greenhouse gases into the atmosphere?

### **Day 4: Effects of Climate Change - Species at Risk**

1. Have students get into groups of 2 or 3 and ask them to discuss the following question: What are some effects of climate change?
2. Have each group share at least one of their ideas. Some of the effects of climate change may include:
  - a. Greater frequency and violence of extreme weather events (droughts, hurricanes, heat waves)
  - b. Melting of glaciers and ice caps
  - c. Higher evaporation rates
  - d. Ocean thermohaline circulation changes
  - e. Increased smog and air pollution
  - f. Disturbed ecosystems and species that are at risk
3. Encourage students to consider secondary effects. For instance, it is estimated that the melting of the West Antarctic ice sheet would not only destroy the habitat of the species that live there, but would also raise sea levels worldwide by 6 meters. What might be the effects of raised water levels?

### **Day 5: Ecosystems at Risk**

1. What is an ecosystem? How are different ecosystems affected by climate change?
  - a. Arctic/Antarctic ecosystems: ice melting destroys the habitat of many species.
  - b. As temperature rises, species will need to migrate to stay in an appropriate climate. For many, they will need to migrate faster than they are able, and many will become extinct or extirpated.
  - c. Migration is further hampered because we have already fragmented many ecosystems in small areas. Surrounded by inhospitable environments, many species will not be able to migrate when these areas become inhospitable.
  - d. Greater climatic instability (e.g., increased droughts, hurricanes) could destroy many species' habitats.
  - e. Though species and ecosystems have a remarkable ability to adapt, the rate at which climate change is proceeding is likely too high for many species.
2. Discuss specific examples of species that have already been affected using pictures/slides and asking the class the brainstorm reason why the species might be affected by climate change:
  - a. Pacific salmon have experienced a drop in population along the West Coast.
  - b. In Britain, birds are laying their eggs earlier than normal. Scientists worry that birds may not survive if insects are not available at hatching time.
  - c. Because of increased dryness, Canada boreal forests are burning in areas three times larger than a decade ago.
  - d. Rising sea temperature could eliminate coral marine ecosystems.

3. In-Class Discussion

- a. Discuss/debate the question “What should be done?” Encourage students to consider all aspects – economic, social, and environmental – of the issue. Allow students to use their science journals to support their opinions.

### **GLOSSARY**

1. **Climate change:** a more general term than global warming, it refers to a change in climate over time, not only temperature. Some use it to refer only to changes caused by human activity, while others use it to refer to any change in climate.
2. **Extinct:** a species that no longer exists anywhere
3. **Extirpated:** a species that no longer exists in one area but occurs elsewhere
4. **Endangered:** a species facing imminent extinction or extirpation
5. **Threatened:** a species likely to become endangered if limiting factors are not reversed
6. **Special Concern:** a species whose characteristics make it particularly sensitive to human activities or natural events
7. **Global warming:** refers to changes in the surface-air temperature (global temperature) brought about by the greenhouse effect.
8. **Greenhouse effect:** refers to the trapping of heat in the atmosphere by greenhouse gases (such as carbon dioxide). Without the greenhouse effect, the temperature of the earth would be about -18°C. However, an excess of greenhouse gases in the atmosphere can lead to global warming.
9. **Habitat:** The environment in which a species lives; necessary components include food, water, shelter and space.

### **RESOURCES**

- Grade 10 Lesson Plan – Climate Change and Species at Risk:  
<http://www.zooaction.ca/forms/lessongrade10.pdf>
- Making A Greenhouse: [http://www.bigelow.org/virtual/handson/greenhouse\\_make.html](http://www.bigelow.org/virtual/handson/greenhouse_make.html)
- Government of Canada Climate Change: <http://www.climatechange.gc.ca/>
- United Nations Environment Program site on climate change:  
<http://www.unep.org/climatechange/>
- World Wildlife Fund site on climate change: [www.panda.org/climate](http://www.panda.org/climate)
- David Suzuki Foundation: [www.davidsuzuki.org/Climate\\_Change/](http://www.davidsuzuki.org/Climate_Change/)
- The Canadian Wildlife Service provides profiles on all species given designations by the Committee on the Status of Endangered Wildlife in Canada: <http://www.speciesatrisk.gc.ca/>
- The Committee on the Status of Endangered Wildlife in Canada: <http://www.cosewic.gc.ca>
- United Nations Framework on Climate Change: <http://unfccc.int/>