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[Environment](#), [Climate Change](#)



West Visayas State University College of Education Center of Excellence and
Center of Training for Teacher Education GRADUATE SCHOOL La Paz, Iloilo
City, Philippines Outline of the Topic for the Course PSC 504- The

Atmosphere Second Semester 2012-2013 PSC 504-THE ATMOSPHERE THE
CHANGING CLIMATE PROF. RUTH GELVESON KAREN S. SUMADIC M. A. Ed.-

Biological Science Objectives: 1. Describe several ways in which humans are
changing the composition of the atmosphere 2. Review the atmosphere's
responses to human caused changes in the composition of the atmosphere
3. Contrast positive and negative feedback mechanisms and provide
examples of each 4. Discuss possible consequences of global warming Key

Words: Greenhouse Effect Greenhouse gases Global Mean Temperature
Biomass Burning Climate Feedback Mechanism Positive Feedback

Mechanism Negative Feedback Mechanism Climate System Trace Gases

Permafrost Introduction: Human influence on regional and global climate did
not just begin with the onset of the modern industrial period. There is
evidence that people have been modifying the environment over extensive
areas for thousands of years. The use of fire and the overgrazing of marginal
lands by domesticated animals have both reduced the abundance and
distribution of vegetation. By altering ground cover, humans have modified
such important climatological factors as surface albedo, evaporation rates,
and surface winds. Most scientists believe that human activity is altering the
composition of the atmosphere by increasing the concentration of
greenhouse gases (GHGs). Greenhouse gases occur naturally in the
atmosphere and their presence results in what atmospheric scientists call
the greenhouse effect. It is important to remember that the greenhouse

effect is what keeps the earth warm enough to be habitable. The current concern is directed at an enhanced greenhouse effect, one that would put more heat-absorbing gases into the atmosphere, thereby increasing global temperatures. The enhanced greenhouse effect has been linked to increased GHG emissions from human activities. Engage Capture the students' attention, stimulate their thinking and help them access prior knowledge.

The teacher will begin a discussion with: “ What do you know about Global warming? What are some of the outcomes of global warming? Are there good effects of global warming? How about the negative effects? EXPLORE

Activity 1: Global Warming Experiment — Is it Getting Hot in Here? Supplies:

You will need: 1. two jars 2. two thermometers 3. two dark washcloths 4. a paper and pencil to record results 5. one lid 6. a sunny window Procedures:

1. Put a dark washcloth inside each jar. Lay the jars on their side in the sunny window. 2. Lay one thermometer inside each jar facing up so you can read it. 3. Put a lid on one jar. Leave the other one open. 4. Watch the thermometers closely for 20 minutes. Check the temperatures every 2 minutes. 5. Record the time and temperatures. 6. After 20 minutes open the jars and remove the thermometers. Explain what you see. Activity 2: Human

Activity and Climate Change Procedure 1. Brainstorm possible human sources of GHGs. Read and discuss the given charts and graphs (Appendix A). 2. Encourage the students to compare the GHG graphs with other graphs (for example, global temperature and human population increases) during the same time span. Encourage them to come up with their own comparisons. 3. Ask students to discuss global emissions of GHGs. For example, the United States has only a small percentage of the world's

population but emits a disproportionate share of the global [pic]. China has a population of over a billion people. What would happen if China "developed" to the point where most families owned an automobile that emitted [pic]?

Activity 3: Allow students to watch a video on "Global Warming, What You Need to Know" by Tom Brokaw, which explains greenhouse effect, carbon dioxide emissions, CFCs, effects on weather and rising sea levels. It also shows global warming hot spots where the planet is most affected by climate change and discuss a graphical timeline of global warming throughout history. The video also shows some solutions that can be done to slow the effects of global warming. After the film-viewing, request the students to make Graphic Organizers/Concept Maps on the Effects of Global Warming. For additional information, allow the students to read an article related to the effects of Global warming (Appendix B and C). To make their own graphic organizers/concept map on the possible effects of Global Warming, students can see sample, Appendix D. Analysis: For Activity 1: 1. What difference did you notice in the temperatures between the two jars? Why do you think so? 2. How does the lid on the closed jar represent the Earth's Atmosphere? 3. How would the greenhouse effect warm up the Earth's climate? For Activity 2: 1. Where do these gases come from? Are the sources common all over the world or are some areas larger sources than others? How does the information support or contradict the ideas formed during the brainstorming session? 2. What kinds of trends do they predict? Can seemingly upward trends be reversed? How? 3. Is global warming a problem that needs to be addressed? Why? For Activity 3: 1. Identify some sources of CO₂. Which source(s) are controlled by humans and which are not? 2. Of those that are

controlled by humans, which one(s) have the greatest effect on global warming? Explain. 3. Describe the car analogy as it relates to the greenhouse effect. What are 5 facts about CO₂ as it relates to the greenhouse effect? Abstraction: The greenhouse effect is defined as the transmission of short-wave solar radiation by the atmosphere coupled with the selective absorption of longer-wavelength terrestrial radiation, especially by water vapor and carbon dioxide (EPA 2001, Lutgens & Tarbuck 2002). Solar energy passes through the atmosphere and reaches Earth's surface as short-waves. The Earth absorbs a portion of the solar energy, but the remain energy is reradiated into the atmosphere as long-waves. The greenhouse gases in the atmosphere absorb the energy radiated from the Earth's surface. This energy is eventually released and reabsorbed by the Earth (EPA 2001, McArdle 2001, Lutgens & Tarbuck 2002). All life on Earth relies on the greenhouse effect. Because of the greenhouse effect, the Earth is able to maintain a roughly constant temperature sufficient for supporting life (Cox & Miro 2001, EPA 2001, McArdle 2001). However, a growing excess of greenhouse gases in Earth's atmosphere threatens to tip the balance in the other direction — toward continual warming. An increase in the concentration of the greenhouse gases results in the absorption of additional energy and increased warming of the environment near Earth's surface (Cox & Miro 2001, EPA 2001). [pic] The different greenhouse gases include: Carbon Dioxide An increased level of atmospheric carbon dioxide is the main contributor to global warming (Harte 1997). It contributes about half the total greenhouse effect (Jo & McPherson 2001). Carbon dioxide is the second most abundant greenhouse gas, following water vapor. Carbon

dioxide occurs naturally in the atmosphere, soils, carbonate rocks, and dissolved ocean water (McArdle 2001). Natural sources of carbon dioxide release include animal respiration and decay of organic matter. Carbon dioxide is removed from the atmosphere when it is dissolved by the ocean and absorbed by photosynthetic plants (Cowen 2001, McArdle 2001). All life participates in the "carbon cycle" (McArdle 2001). Nature established the carbon cycle so that oceans and photosynthesis would absorb excess carbon dioxide in the atmosphere. However, over the past few hundred years humans have released carbon dioxide into the atmosphere at a much faster rate than that at which Earth's natural processes can cycle this gas (EPA 2001, McArdle 2001). Atmospheric carbon dioxide concentrations increase by about 1.5 ppm per year. The increased carbon dioxide enhances the heat-trapping capability of the earth's atmosphere. Humans increase the atmospheric levels of carbon dioxide when they burn fossil fuels, solid wastes, and wood products to heat buildings, drive vehicles, and generate electricity (Barnard & Morgan 2000, Cox & Miro 2001, EPA 2001, Harte 1997). Burning fossil fuels releases billions of tons of carbon dioxide into the atmosphere each year (Harte 1997). The use of coal and other fuels is the most prominent means by which humans add carbon dioxide to the atmosphere. The clearing of forests also contributes substantially because carbon dioxide is released as vegetation is burned or decays. Deforestation is common among the tropics, due to the ranching and agriculture, as well as commercial logging operations (Lutgens & Tarbuck 2002). According to predictions, the atmospheric carbon dioxide concentration will reach 600 ppm by the second half of the twenty-first

century. Models predict that the rapid increase in atmospheric carbon dioxide will produce a 2.5°C (4.5°F) increase in average surface temperature. The Earth's surface temperature has increased approximately 2.5°C since the last Ice Age. The change in temperature has not had severe effects on the climate because the change occurred over an 18,000 year time period. The effects of global warming will be more severe because the temperature change is occurring over a relatively short period of time (Lutgens & Tarbuck 2002). Methane — the increase in the concentrations of methane in the atmosphere has been in step with the growth in the human population. This relationship reflects a close link between methane formation and agriculture. Nitrous Oxide — also called "laughing gas" is also building in the atmosphere. The increase is believed also to be a result of agricultural activity, when farmers use nitrogen fertilizers to boost crop yield. Some of the nitrogen enters the air as nitrous oxide. This gas is also produced by high-temperature combustion of fossil fuels. CFCs — are manufactured chemicals with many uses but are responsible for ozone depletion in the stratosphere. They are also very effective greenhouse gases. The consequences of global warming includes higher maximum and minimum temperature, frequency of heavy precipitation, increases in the area affected by drought and intense tropical cyclone activity (Lutgens & Tarbuck 2002).. Some signs of climatic stress have already begun to appear in the last century. Snow in the Northern Hemisphere and ice in the Arctic Ocean have decreased. The sea level has risen 15-20 centimeters due to glacial melt and water expansion. Worldwide continental precipitation has increased by 1% with a rise in the

frequency of extreme rainfall in the United States (EPA 2001). The future effects of global warming have been predicted using computer models. The models show that addition carbon dioxide will warm the climate. Different regions of the world will be affected differently (Cox & Miro 2001). In any region, the predicted effects of global warming will accelerate the rate of climate change and be detrimental to life on Earth (EPA 2001). It is predicted that global warming will have the following affects: warmer weather, rise in sea level, polar ice melt, reduced agricultural productivity, climate stress (i. e. drought, storms forest fires, and hurricanes), depletion of natural ecosystems (i. e. coral reefs, grasslands, forests, wetlands), and extinction of species (Cox & Miro 2001, Harte 1997, Lutgens & Tarbuck 2002). Application: References: Lutgens, F. K., Tarbuck, E. J.,(2010) The Atmosphere. An Introduction to Meteorology. Glenview, IL. Pearson S. Henderson, S. Holman, and L. Mortensen (Eds.), Human Activity and Climate Change. Retrieved from [http://www. ucar. edu/learn/1_4_2_20t. htm](http://www.ucar.edu/learn/1_4_2_20t.htm) Additional Readings: <http://www. vcapcd. org/AirTheFilm/pubs/EffectsOfGlobalWarmingLessonPlan. pdf> <http://www. exploringnature. org/db/detail. php? dbID= 45&detID= 2677> http://successlink. org/GTI/lesson_unit-viewer. asp? lid= 8313 <http://www. environmentalgraffiti. com/sciencetech/5-deadliest-effects-of-global-warming/276? image= 12#fUmIBhvGcXMmqTdw. 99> <http://www. stfrancis. edu/content/ns/bromer/earthsci/student1/globalwarming. html>