



Does Global Warming Increase the Intensity of Atmospheric Natural Disasters?

Curriculum Unit 07.04.06
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I am a special education / hearing impaired teacher. Currently I work with 9th grade hearing impaired students at Hill Regional Career High School in the resource room along with 3 other teachers with students of their own. Resource is a credit class for special education students 9th - 12th grade. I will be teaching my unit to the students who have a resource period next school year.

Tenth grade students are given the Connecticut Academic Performance Test (CAPT), and are expected to pass in order to receive a high school diploma. It is an unfortunate fact that many of our students fail the test and have to take the test a second time in the 11th grade, often this test is also failed and eventually they are required to take a CAPT class in the specific area they failed and then pass an exam at the end of the class. Writing (persuasive essay) as well as Science (weather) are areas on the CAPT. This unit will assist in both of these areas.

Rationale

In the seminar "The Science of Natural Disasters" we will discuss the science of some of the most prevalent and/or catastrophic natural disasters. Climate changes, global warming and rising sea level appear to have serious adverse impacts on human and animal life on our planet and are the cause of great concern. The effect of global warming on weather patterns is frequently blamed for an apparent increase in intensity of weather-related disasters such as windstorms and hurricanes, among others. The responsible climate changes result from natural and human factors.

The information learned in this seminar will educate me in the areas of climate-related natural disasters that I will explore in this unit:

- Extreme temperature highs - heat waves
- Storms, including windstorms, dust storms, hurricanes, etc.
- High levels of precipitation, and associated flooding in some regions

- Lack of precipitation, and associated drought in other regions.

There is evidence supporting and arguing against linking climate change (that links to man) and extreme weather conditions. After learning about the above natural disaster, the students will choose a disaster and read different views. The students will take a stance and write a persuasive essay to convince others to their way of thinking.

The activities in this unit will prepare the students for the Science and Writing portion of the CAPT.

Objectives

Students will:

1. know that heating Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents.
2. understand that global climate is determined by energy transfer from the sun at and near the earth's surface.
3. be able to communicate the problem, process, and solution in regards to global warming.
4. know that human activities can enhance potential for hazards.
5. understand that natural and human-induced hazards present the need for humans to assess potential danger and risk.
6. make inferences based on implicit information from text and provide justification.
7. make comparison between text.
8. establish a purpose for reading (literary, information, performance task).
9. use graphic organizers, and note-taking techniques to organize information.
10. respond to materials read by demonstrating a critical stance.
11. demonstrate effective use of writing process: pre-writing, drafting, revising, editing, and publishing.

Greenhouse Effect

The "greenhouse effect" is defined as the buildup of heat beneath substances such as glass, water vapor, and carbon dioxide that allow incoming, short - wave length solar radiation but block or absorb long - wave length reradiation.

Carbon dioxide (CO₂), water vapor (H₂O), methane (CH₄), nitrous oxide (N₂O), and a few other gases are greenhouse gases. They all are molecules composed of more than two component atoms, bound loosely enough together to be able to vibrate in such a way as to absorb heat. The major component of the atmosphere (N₂ and O₂) are two - atom molecules too tightly bound together to vibrate and thus they do not absorb heat as well and do not contribute to the greenhouse effect. (Abbott, 2006)

Activities:

1. The students will search the web for pictorial representation of the greenhouse effect, to use as a guide so they can create one to show their understanding of the concept.
2. Complete an experiment to understand how a greenhouse works to retain heat. The students will use two two - liter bottles and construct them into experimental chambers. One bottle will remain intact and the other bottle will have cut outs along the sides to serve as vents. Thermometers will be placed in each bottle and they will be placed under a lamp. Data will be collected and graphed every 20 minutes. The students will compare and contrast the graphed data. They will tell what happened by explaining their observations. The class will discuss results and develop possible explanations, compare and contrast plastic greenhouse to the greenhouse effect on earth. The complete experiment can be found at www.woodrow.org/teachers/esi/1998/p/ghe/

Global Climate Change "Global Warming"

Climate is defined as the average weather conditions at a place over many years. Change is defined as any deviation from the norm. Over the years the earth's climate has change with an increase in average temperature constituting what is called Global Warming. Global warming is a phrase that refers to the effect on the climate of human activities, in particular the burning of fossil fuels (coal, oil and gas) and large -scale deforestation, which cause emissions to the atmosphere of large amounts of greenhouse gasses, of which the most important is carbon dioxide. Such gases absorb infrared radiation emitted by the Earth's surface and act as blankets over the surface keeping it warmer than it would otherwise be. Associated with this warming are changes of climate. (Weler, 2002)

Causes

Most scientists believe that human activity is the cause of increasing greenhouse gases, resulting from burning of fossil fuels. However, a few scientists say that recent warming could be due to natural causes.. Still other scientists claim that the evidence for warming is not convincing. Their argument is that the temperature sampling around the world is incomplete, especially in very cold areas that are inaccessible. For every iceberg that melts, new ones are forming, with the exception of satellite images showing entire ice caps (like Greenland) melting. Although, there are satellite measurements and balloon measurements, how accurate are they and how can we know for sure just what is the average temperature of the earth?

Natural Causes

Some scientist say that global warming has natural causes, they argue that we know from studying the earth's history that there have been Ice Ages and global warming periods long before humans existed. Scientists do not know precisely why these major climate changes have occurred, but there are some possibilities:

- Solar variability ("sun spots" / cycle)
- Volcanic eruptions on a massive scale
- Changes in earth orbit
- Changes in earth's orientation toward the sun
- Effects of large meteors hitting the earth although rare

As the world evolves, changes in the earth's environment affect the climate in various ways. For example, violent nuclear reactions on the sun generate even more heat than the sun normally gives off and some of this heat makes it to the earth causing rising temperatures. Volcanic eruptions on Earth can cause temperatures to decrease, because the ashes and particles given off can prevent sunlight from passing through the atmosphere. Any slight change in the earth's orbit could cause the earth to move closer or farther away from the sun over a period of tens of thousands of years. This could radically change temperatures, because the earth would be closer or farther away from its principle source of heat. (Pidwirny, 2007) Changes in tilt or rotation known as obliquity also will effect climate zones and how heat circulates around the globe. It causes differences between summer and winter. When the tilt is less there less differences in seasons. Amount snow will increase because less melting will occur because of cooler shorter summers and longer milder winters, still with below freezing temperatures, but warmer air will produce more snow. (Tennesen, 2004, pg. 144)

Human Causes

Many scientists believe that humans have been artificially raising he concentration of greenhouse gases in the atmosphere over the past 250 years. Factories, power plants, and cars burn coal and gasoline and spit out an endless stream of carbon dioxide. We produce millions of pounds of methane by allowing our trash to decompose in landfills and by breeding large herds of methane-belching cattle. Nitrogen-based fertilizers, which we use on nearly all our crops, release unnatural amounts of nitrogen oxide into the atmosphere. They also fear that the increased concentrations of greenhouse gases over the last 100 years have prevented

additional thermal radiation from leaving the Earth. (Weler,2002)

Activity:

The students will gather information on the three theories surrounding global warming: natural causes, human causes and no evidence of global warming. They will use the information to create a chart displaying facts of each theory and then create a Venn diagram to see if any information from each overlaps the other.

Possible Effects of Global Warming on the Atmosphere

As science goes there is never one view deemed as gospel. Although more scientists believe that global warming is real than not, others believe it is impossible to tell how it will alter the weather. Some scientist believe that global warming will continue to have a relatively little impact on the day-to-day climate conditions. Others believe that future changes will likely be subtle, and they will spread over large areas of the globe from decade to decade and creep up on us like old age. While others yet hypothesize that when the Earth's surface temperatures reaches some critical threshold, the heat will trigger relatively drastic changes to the atmosphere and the oceans and transform the Earth's weather patterns in a matter of years.

(Weiler,2002)

Climate Zones and prevailing winds and ocean temperatures

Researchers at the University of Wisconsin-Madison (lead researcher, Jack Williams) collaborated with Stephen Jackson at the University of Wyoming (with funding from the National Science Foundation), used climate models and greenhouse gas emission scenarios from the recent assessment by the Intergovernmental Panel on Climate Change (IPCC) to forecast differences between climate zones today and in the year 2100. This study projects that many climate zones of today will disappear by the year 2100, and will be replaced by unknown climates. The climates zones forecasted to disappear include those in tropical mountains and high latitude areas near the poles. The climate model study uses average summer and winter temperature and precipitation levels to map differences between climate zones today and the projected in year 2100 and large climate changes worldwide are anticipated. It is believed that the most severely effected areas will span in heavily populated regions including Southeast United States, Southeast Asia and parts of Africa. The study also shows drastic ecological shifts. (Sakia, 2007)

The prevailing wind is the wind that blows most frequently across a particularly region. Different regions on Earth have different prevailing wind directions which are dependent upon the nature of the general circulation of the atmosphere and the latitudinal wind zones. In general, there are a number of prevailing wind conditions on the surface and at higher altitudes in both hemispheres that greatly affect the weather. Where winds meet on the surface at the equator, the air moves upward and you will have lots of storms and rain. At 30 degrees (1/3 of the way toward the poles) cool dry air descends and winds diverge at the surface, and you get deserts and dry weather. At 60 degrees latitude (2/3 of the way to the pole from the equator) you get converging winds and another upwelling which results in storm activity. We can imagine what a few extra global warming degrees would do to this cycle when all it takes is a little extra heat to get El Nino going.

Ocean temperature affects everything from global weather systems to primary biological production and ocean circulation. All weather patterns are determined by ocean temperature including major climate events,

such as El Niño, result from ocean temperature changes. These temperature changes then have impacts on weather events such as hurricanes, typhoons, floods and droughts.

El Niño / La Niña

Changes in the ocean temperature can affect weather patterns around the world. One of these cyclic changes is the El Niño. El Niño occur when the normal pattern of trade wind circulation change. They normally move westward, carrying warm surface water to Indonesian and Australia. This allows cooler water to up well along the South American coast. When the trade winds are reduce or reversed warmer water is moved toward the coast of South America and raises water temperature. This cause heat and moisture to rise form the ocean off Ecuador and Peru. (The Green Lane, 2002)

Oceans store the sun's heat and energy, this heat is than transported through currents. A slight temperature increase in the ocean's surface water can have a great impact on the atmosphere, causing change in regional climate like increasing or decreasing rainfall levels.

Changes in rainfall levels have major environmental and economic impacts on both sides of the Pacific. They can cause such events like severe droughts or floods over parts of the world. The El Niño part of the cycle hinders the rainy season in W. Pacific regions near the equator, like Australia and Indonesia creating climate conditions that favor bushfires. (Berstand & Pierrehumbert, 2006)

Heat Waves

A heat wave is an extended interval of abnormally hot and usually humid weather, usually lasting from a few days to over a week. Heat waves form when an air mass becomes stationary over a region. Hot humid air masses form over the Gulf of Mexico and the Caribbean Sea while hot dry air masses form over the desert in the Southwest and northern Mexico. In the Eastern United States a heat wave occurs when a high pressure system originating in the Gulf of Mexico becomes stationary just off the Atlantic Seaboard. The SW winds on the back side of the High continue to pump hot, humid Gulf air North-eastward resulting in a spell of hot and humid weather for much of the Eastern States. It is projected that the average temperature will raise 3 to 9 degrees this century due to global warming. Increased average temperature increases the possibility of extreme weather patterns such as heat waves. (Vergano, 2006)

Natural Disasters

Natural Disasters are any natural occurrence that causes widespread distress, usually including loss of human life and notable damage to social system or property. They may cause large violent upheavals that usually impact a large number of people. They may cause large scale damage form which recovery is either impossible or long term. These included: avalanche, drought, dust storm, earthquake, fire, flood, hurricane (cyclone, typhoon), landslide, asteroid impact, monsoon, snow storm (blizzard), thunderstorm, tornado, tsunami, volcano, windstorm. In this unit we will discuss a few.

1980 - 2006 Billion Dollar U.S. Weather Disasters

(table available in print form)

www.ncdc.noaa.gov/loa/reports/billionz.html

Nor'easter

Like a hurricane a nor'easter is counter-clockwise turning cyclone. Nor'easters are spawned by a very curvy Jet stream that dips far south allowing cold arctic air to meet warm air. The warm air rises over the cold, creating instability up high and an area of low pressure below. Once the system is formed, the earth's rotation causes the air to circle around the center (similar to when you drain the water out of your bath-tub). This creates the northeast wind, hence its name nor'easter. They typically form near the Bahamas or north of Cuba, along the Appalachians or off Cape Hatteras.

The Jet Stream plays a very important role also in the strengthening of the storm. As the incoming air rises around the center, the Jet Stream moves it away further increasing the speed of the incoming air. The faster the air moves the faster the barometric pressure drops. Weather forecasters call a 24 mill bar drop in 24 hours "The Bomb". Normal Jet Stream winter pattern is to follow the coast and consequently drags the storm northeastward. Some time a High Pressure zone further north blocks its path and so it churns over the ocean for a long time sending beach-eroding waves onshore. Also, warm water dragged up from ocean mixes with cold air from north causing lots of rain or snow. During the October to April nor'easter season February is the busiest month. Researchers say the biggest ones occur in October, January and March. What nor'easters don't achieve in wind-speed as compared to hurricanes, they achieve in duration (up to a week) and size (up to 1000 miles or more in diameter). (Nor'easter, 2001)

Hurricanes

A hurricane is a type of tropical cyclone. The combinations of these conditions are needed for a Hurricane to form: 1) sea surface temperature has to be at least 20 degrees C / 80 degrees F., 2) unstable air that is warm and humid. 3) higher level winds that are weak and blowing in the same direction that the developing storm is moving. Tropical storm systems are classified as follows:

1. Tropical Depression - An organized system of clouds and thunderstorms with a defined circulation and maximum sustained winds of 38 mph or less.
2. Tropical Storm - An organized system of strong thunderstorm with a defined circulation and maximum sustained winds of 39 to 73 mph.
3. Tropical Cyclone or Hurricane - An intense tropical weather system with a well defined circulation and maximum sustained winds of 74 mph or higher. In the western Pacific, hurricanes are called "typhoons", and similar storms in the Indian Ocean are called "cyclones."

Hurricanes are products of the Tropical Ocean and atmosphere. They can develop when the sun's rays warm tropical waters heat to a least 82 degrees F, causing the air to grow warmer and rise. Water rises with it as

vapor, and the heat causes the air to rise faster and faster. In several hours, the heated air will begin to circle counterclockwise, forming stronger and stronger winds that whirl with increasing speed. The moist, hot winds of a hurricane swirl upward around a calm column of low pressure air (the eye) it measures an average of 15 miles across. Inside the eye there are no storm clouds, almost no wind and calm conditions. The rising winds rotate around the eye, rising faster and faster. When the hot air rises high enough it cools and forms water droplets that cluster together as clouds and drop rain that is blown by harsh winds. Hurricanes are steered by the easterly trade winds and the temperate westerlies as well as by their own strong energy. Around their core, winds grow with great force, generating violent seas. As they move ashore, they sweep the ocean inward while spawning tornadoes and producing torrential rains and floods. Each year on average, ten tropical storms develop over the Atlantic Ocean, Caribbean Sea, or Gulf of Mexico. Many of these remain over the ocean. (Abbott, 2006, 336- 339)

Tornadoes

A tornado is a powerful column of winds spiraling around a center of low atmospheric pressure. Three air masses, all moving different directions create conditions, giving spin to a thunder cloud. 1) A low - altitude northern flow of marine tropical air from the Gulf of Mexico that is humid and more than 72 degrees F. 2) Mid altitude, cold, dry air mass moving down from Canada or out from the Rocky Mountain at speed in excess of 50 mph. 3) And high altitude jet stream winds moving east more than 150 mph. The warmer air lifts vertically, releasing latent heat and forming a strong updraft that is spun at mid levels by fast moving polar air and then twisted in another direction at its upper level by jet stream. The twisting motion is increased by vertical movement of warm air rising on the leading side and cool air descending on the trailing side. It looks like a large black funnel hanging down from a storm cloud. The narrow end will move over the earth, whipping back and forth like a tail. The winds inside a twister can spin around at speeds up to 500 miles an hour, but usually travels at roughly 300 miles per hour. This makes the tornado the most dangerous storm known to mankind. Because of the earth's unique weather system, twisters rotate counterclockwise in the Northern Hemisphere and move eastward. They rotate clockwise in the Southern Hemisphere. Tornadoes also often come with hailstones. (Abbott, 2006, pg. 325)

Flooding

A flood is the submerging with water of a normally dry area. Floods are caused by many things, including rainstorms, slow water run-off, earthquakes, broken dams, underwater volcanic eruptions and tsunamis, or hurricanes.

During storms heavy rains fall for days and days, building up too much water for groundwater systems to handle. Slowly, the water levels begin to rise, creeping higher and higher until floods occur. In extremely bad cases, flash floods, with their rushing muddy water, sweep away houses, cars, trees, and people with ease.

Flash floods are much more dangerous and flow much faster than regular floods. They result from rapid / torrential rainfall during storms, dam failures, or excessive snow melts.

Heavy rains that come with Tropical storms are an example of one of the most common causes of floods. Such storms form over the warm water of the tropics, so they are full of moisture causing many inches of rain to fall. The heavy precipitation is too much for the streams and rivers to handle, causing water to overflow and produce inland floods. Many of these tropical storms form over the Gulf of Mexico.

Seasonal flooding can be caused by a variety of scenarios from heavy rainstorms, followed by heavy winter snow, then followed by unexpected heat waves in spring melting snow quickly and to flood rivers and tributaries.

Coastal flooding usually occurs as a result of severe storms, either tropical or winter storms. Ocean waves intensify and the storms make surface water choppier and stronger than normal. Raging winds can create huge waves that crash on unprotected beaches.

Coastal flooding can also be caused by long, low sea waves caused by volcanoes, melting ice, landslides, earthquakes, or explosion. These waves are called tsunamis. These giant waves are difficult to detect on the open sea, so seismologist must keep track of earthquake movements that warn of possible tsunamis. These are extremely dangerous because of their high speeds. Deeper water means faster-traveling waves. When the sea floor is several miles below, waves can travel more than 600 miles an hour. As they near shallow water, they slow down, but build in height. Some tsunamis can be 50 to 100 feet high when they hit shore. (Abbott, 2006, pp. 372 - 382)

Droughts & Wild Fires

A drought occurs when there is not enough rain to support people or crops. In temperate regions, a drought is classified as 15 consecutive days with less than 0.01 inches of rain. During a drought, it still rains once in a while. However, storms or cloudburst are brief and any precipitation that falls dries up quickly afterwards. Small droughts occur every now and then, and these are not particularly harmful. Most happen in the summer, when hot and dry weather is normal. However, sometimes droughts can occur for months, years, or even decades.

When there is a dry spell, grass begins to turn brown. Flowers need to be watered more frequently. Dirt patches dry up. Cracks form across the surface of the ground. After many weeks of such weather, plants die out. The roots of the plants, which previously anchored soil down, can no longer keep the soil from eroding. The dirt is then blown up by the wind, causing huge clouds known as dust storms. Because they can turn the sky dark, they are sometimes known as black blizzards.

A wildfire has the devastating power to wipe away acres and acres of forest each year. Usually, forest fires occur in tropical rain forest and forest after dry spells. The dry needles of trees provide ideal fuel for wildfires, as well as the leaves of evergreen broad-leaved trees like holly, evergreen oak, and eucalyptus. In Australia, where eucalyptus grows in the bush (open forest land), bush fires are a common threat. (Lott, 2007)

The Connection

It has been well established that over the past several decades' global surface temperature including the sea surface temperatures over most tropical oceans basins have increased.

Within the field of climate science it is well accepted that the most likely cause of the observed increased of global mean surface temperature is a long term increase in greenhouse gases.

Understanding that weather and climate is the combination of sun/heat, air/wind and water/oceans & seas, it

is expected that any long term changes due to global warming will affect atmosphere natural disasters.

Increase in intensity of atmospheric natural disasters is measured by the damage and cost to recover from the storm. Cost is affected by societal change, where urbanization has increased population in areas where storms are common as well as technological advances which increase the value of property.

A concrete connection is difficult to make, since there are many contradicting thoughts, ideas and data. It is easier to establish a link between climate change to change in averages than to extremes. There are three main lines of evidence, empirical, theoretical and proxy.

"Empirical data changes in quality and availability over time - unlike temperature, the pressure inside hurricanes is not something for which we have an adequate centuries-long record, for example. Further, extreme events are by their nature more variable and less frequent, making it difficult to establish patterns.

Theoretical models also have limitations. While climate models are increasingly refined, they are simplification of an incredibly complex system and are generally not suited to examining either a specific phenomenon or a specific geographical location.

Indirect proxies such as measurement of impacts are complex: non-climate aspects of the data are themselves variable (i.e. the amount of insured property keeps changing), linked to variable climatic phenomena (i.e. there is an element of chance in the location of a damaging event, and infrequent repetition to allow comparison), simply compounding the difficulty of using them as evidence." (Anderson, 2006 pg.5)

Out of all the extremes the increase in high temperatures is one of the easiest to connect to effects of global warming. The combination of a rise in mean temperatures and extreme events are not consistent with natural cycles. For example the summer of 2003 where the best explanation is climate change. (Anderson, 2006, pg. 6)

Droughts are easily recognizable but global analysis has just recently been able to determine what is caused by climate change vs. natural variability. (Anderson, 2006, pg)

Contradicting evidence of the effects of global warming is one of the reasons that disagreements are prevalent and evidence is lacking to prove global warming increases the intensity of natural disasters. For example, global warming has been blamed for stronger and more frequent El Niño's and the increase in intensity of hurricanes. When in fact hurricanes travel westward, whereas El Niño brings eastward blowing winds that disrupt storms making for a quiet hurricane season. (Abbott, 2006, pg. 345)

The Atlantic multidecadal oscillation (AMO) defined from the patterns of sea surface temperature variability in the North Atlantic once trend has been removed. The AMO is correlated to air temperatures and rainfall over much of the Northern Hemisphere. It is associated with changes in the frequency of North American droughts and is reflected in the frequency of severe Atlantic hurricanes. It makes unclear and exaggerates the global increase in temperatures due to human-induced global warming. (Wikipedia, 2007)

Proposed Solutions

Scientist

Scientists feel that the overwhelming evidence of the adverse effects of climate change should encourage the U.S. to establish mandatory federal policies to reduce greenhouse gas (GHG) emissions sharply and quickly. To prevent the worst consequences of global warming, emissions must level off between 2015 and 2025 and then be reduced as much as 80% by mid-century. They feel Congress can achieve these goals by setting a national cap on global warming and instituting policies that include:

- Updated fuel economy standards for cars and trucks
- A requirement for more efficient use of electricity
- National minimum requirements for renewable electricity use.

This will encourage all sectors of the economy for industry and consumers to adopt existing low emissions "clean" technologies rather than relying on a strict market - driven cap-and-trade approach. They also feel that the government should also initiate and invest in developing, testing and implementing new emissions reducing technologies, including methods for capturing and storing carbon dioxide from coal-fired power plants.

<http://www.net.org/warming/policy.vtml>

The Government

The United States was one of more than 160 nations that negotiated in December 1997 to reduce net emissions of certain greenhouse gases, (primarily carbon dioxide (CO₂)). This agreement is called the Kyoto Protocol. Each of the participating developed countries must decide how to meet its respective reduction goal during a five-year period (2008 - 2012). (Briefing Paper, 1998) The United States backed out of the agreement one year later. The President proposed setting a goal for late 2008 for establishing non-binding emissions reduction targets.

Under this proposal, the United States would host and lead a series of talks over the next 18 months, which include the 15 nations that emit the most greenhouse gases, including large developing nations such as China and India.

These negotiations would create an agreement to replace the Kyoto Protocol when it expires in 2012 by setting "a long-term global goal" to cut greenhouse gas emissions.

However, this plan is a goal and therefore voluntary. There would be no binding commitments, and each

nation would be free to develop their own strategies for meeting the goal. (Union of Concerned Scientist, 2007)

You

Weather or not we believe that Global Warming is increasing the intensity of atmospheric natural disasters; we all have an obligation to do our part when it comes to preserving the environment. Our contribution could be as easy as to conserve energy. It should be our goal to investigate ways that we can help by changing some of our day to day activities.

Activity:

Keep a journal for one week on all the energy (electricity / gas - home & automobile) you use. Log every activity you do and for how long. ex. How many times you turn the lights on and how long they stayed on, how many showers did you take and how long, how many time you drove or rode in a car {how far & how many people), how many times did you use appliances [iron, stove, microwave, curling irons, tv,etc. . .] After a week analyze and develop a plan to reduce the amount of energy you used without drastically changing your life. Read "You Can Prevent Global Warming: and save money" by Jeffery Langholz, Ph.D. and Kelly Turner.

Lessons

Lesson 1: Introduction of Global Warming

Objectives

Student will:

- Learn about global warming, evidence for global warming, and climate change.
- Consider what might be considered as evidence of global warming.
- Learn what impact global warming might have on our lives.

Materials and Resources:

1. Internet Access
2. Library

Activity Description:

Students can use printed or on-line resources to learn about global warming, change in the earth's climate over time, atmospheric models that predict future changes, terminology, and possible impacts of global warming on earth.

As students research global warming, they should answer these three question:

1. What evidence is there that the earth is actually warming up?
2. What might be causing any global warming?
3. What effect might global warming have on the earth's inhabitants?

Lesson 2: The Power of Weather (When Natural Hazards Become Natural Disasters)

Objectives:

Students will:

- describe aspects of natural events that pose threats to humans.
- use scientific vocabulary to summarize research about natural hazards, and
- compare and discuss the relative dangers posed by natural disasters.

Materials:

1. Internet access.
2. Library

Activity Description:

Clarify the terms "natural hazard" and "natural disaster"

Students should make a list of types of natural events (weather related) that harm people, homes and or possession. Have students to decide which hazard they consider the worst and make a class list. Students will independently research a natural hazard, ideally the one they chose as the worst, if not have them choose one off the list so that the are all

researched. They will research and discuss the hazard in general and at least one that became a historical natural disaster.

Research focus questions:

- Why is this natural event hazardous for people? (Discuss the frequency and severity of the event, the number of people affected, or whether or not the event can be predicted.)
- In what states, countries, or regions does this natural event occur? Is there a spatial pattern to the event?
- What words and phrases are used when studying, describing, and measuring the event?
- How many human casualties (injuries or deaths) are caused annually by the hazard? What amount of property damage does the hazard cause? (in general and your specific disaster)
- What do scientist understand about this natural event? What do they not yet understand?

Each student will develop a power point presentation on there researched information, answering as many focus questions as possible. The presentation should include pictures, charts and graphs.

Lesson 3: The Greenhouse Effect Debate (Persuasive Essay)

Objective:

Students will write a persuasive essay with a main idea, supporting points, arguments refuting other views and a strong conclusion.

Materials:

1. Pen
2. Paper

Activity:

Students will take a position on the issue and support it with data. They will write to answer the following questions.

1. In your opinion, is global warming an imminent world threat? Why or why not?
2. Based on your opinion, what actions do you believe should be taken to address the global warming issue? Use specific information.
3. Introduction - has a hook or a grabber to catch the reader's attention. It should also include a thesis or focus statement. A thesis statement tells the reader the specific topic of your essay. It imposes manageable limits on that topic. It suggests the organization of your paper.

4. The Body - provides evidence to support opinion offered in the thesis statement in the introduction. The body should consist of at least three paragraphs. Each paragraph is based on a solid reason to back your thesis statement. One of the three paragraphs should be used to discuss opposing viewpoints and your counter-argument. Elaboration is needed, use statistics or research, real life experiences, or examples.

5. The Conclusion - Restate your thesis, summarize the main points and write a personal comment or call for action.

Teacher / Student Bibliography

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This references give an explanation for better understanding of Global Warming and the science behind the issue.

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