

***Global Warming***  
***Emerging Science and Understanding***  
[globalwarmingclassroom.info](http://globalwarmingclassroom.info)

**DVD Lesson 3: Lesson Plan**

**Purpose:**

***\*\*To establish a base of knowledge in order to better process and understand the content of Lesson 3 of the DVD "Global Warming; Emerging Science and Understanding.\*\****

**Lesson 3 Goals:**

1. Understand that Global policy with regard to climate change and global warming is being shaped by political agendas rather than scientific evidence.
2. Students will learn that the planet has seen climate change throughout history. Species such as polar bears have adjusted and survived in spite of much warmer periods in the past. Furthermore, areas which now have very harsh climates, such as Greenland, were once much warmer and more densely inhabited.
3. Students will learn that the activity of the sun is the primary driver of Earth's climate. There is a high correlation between solar winds resulting from solar activity, and incoming cosmic radiation, on the formation of clouds on earth. Less cloud formation because of an active sun means more solar radiation reaches the earth's surface and a warming earth.
4. CO<sub>2</sub> levels have fluctuated throughout history. CO<sub>2</sub> is a naturally occurring gas which is very important to sustaining life on earth. The increase in CO<sub>2</sub> has already increased food production by 9 to 12 percent.

**Preparatory Activities**

*(To be done prior to viewing Lesson 3 on the DVD)*

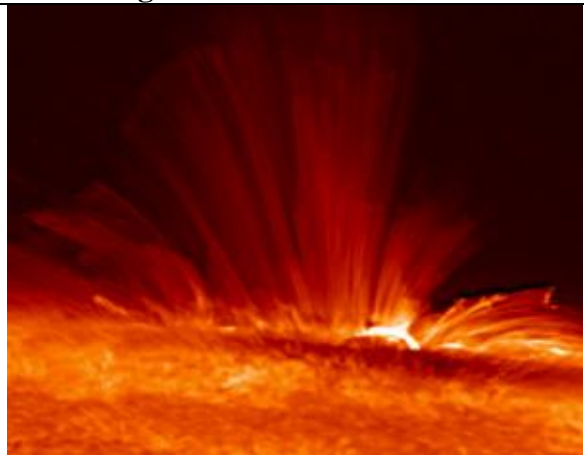
**Activity 1: Discuss Lesson Vocabulary and Terminology**

### ***Vocabulary Words:***<sup>1</sup>

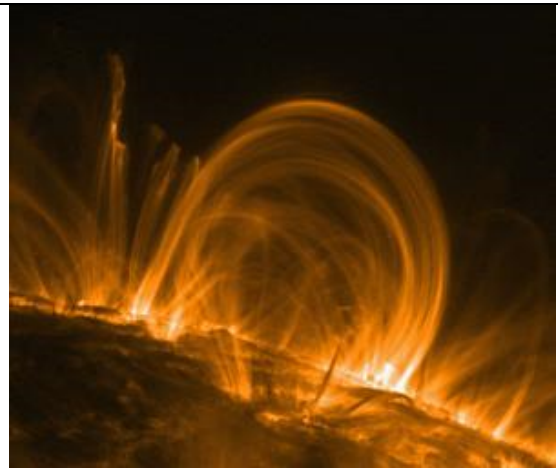
<b>Pessimistic</b>	1. A tendency to stress the negative or unfavorable or to take the gloomiest possible view 2. The doctrine or belief that this is the worst of all possible worlds and that all things ultimately tend toward evil.
<b>Accumulated</b>	1. to gather into a heap, mass, cover, etc.; form a steadily increasing quantity 2. to mount up; increase
<b>Decline</b>	To cause to decrease or diminish; go down
<b>Indicate</b>	to be a sign of; betoken; evidence; show
<b>Correlation</b>	mutual relation of two or more things, parts, etc.
<b>Detrimental</b>	causing detriment; damaging; harmful.
<b>Analysis</b>	this process as a method of studying the nature of something or of determining its essential features and their relations
<b>Verification</b>	evidence that establishes or confirms the accuracy or truth of something
<b>Theory</b>	In science, an explanation or model that covers a substantial group of occurrences in nature and has been confirmed by a substantial number of experiments and observations. A theory is more general and better verified than a hypothesis.
<b>Corrupted</b>	containing errors or alterations
<b>Connotation</b>	an idea that is implied or suggested

### ***Lesson Terminology*** (These words can be found on the Introductory Sheet)

#### **Sun's Magnetic Fields**



This image reveals the structure of the solar magnetic field rising vertically from a sunspot



This solar corona reveals heated magnetic loops

<sup>1</sup> *The American Heritage® New Dictionary of Cultural Literacy, Third Edition.* Houghton Mifflin Company, 2005. 05 Nov. 2008. <Dictionary.com <http://dictionary.reference.com/browse>

*Student Link:*

<http://www.sciencedaily.com/releases/2007/03/070323132406.htm>

<http://solar.physics.montana.edu/ypop/Spotlight/Magnetic/what.html>

<http://solar.physics.montana.edu/ypop/Spotlight/Magnetic/cycle.html>

**The Sun's Magnetic Fields** - Just like the earth, the sun has magnetic fields. While the earth has one magnetic north, and one magnetic south pole, the sun has many. These magnetic fields on the sun can be twice as strong as the magnetic fields on the earth and extend far out into space. Gas rising from the sun's corona interacts with the magnetic field which releases energy and may power solar storms which can affect the earth.

**Cosmic Radiation/Cosmic Rays**-particle energies that bombard the earth from outside the solar system are considered cosmic Rays. They are made up of mostly protons (90%), helium (9%), and electrons (1%). Cosmic radiation acts to increase low level cloud formation which reflect the sun's energy back out into space. Since not as much solar energy reaches the earth's surface, the earth cools.

**Supernova**-A stellar explosion that causes a burst of radiation that can be seen for several weeks or months. It occurs at the end of a star's life when the nuclear fuel is exhausted and the star collapses in on itself. Often the amount of radiation put off by a super nova is more than the sun will give off in its lifetime. Supernovae are thought to be one of the primary sources of cosmic radiation that reaches the earth which then breeds low elevation clouds and a cooling earth. One of the most widely observed supernovas produced the Crab Nebula.

**Solar Flares**-Intense short bursts of energy lasting minutes to hours. The primary source of solar flares appears to be caused by tearing and reconnection of the sun's magnetic field. Solar flares dramatically increase solar winds which dampen the effect of cosmic radiation thereby reducing the amount of low level cloud formation which causes a warming earth.

**Solar winds**-Streams of charged particles (plasma) which escape the sun's gravity. It can cause geomagnetic storms, aurora borealis on planets, and plasma tails on comets. These storms have the ability to knock out power grids on earth. Solar winds dampen the effect of cosmic radiation thereby reducing the amount of low level cloud formation which causes a warming earth. The twentieth century saw increasing levels of solar winds. So far in the twenty-first century, the sun is quiet and solar winds are at a minimum.

**Coronal Mass Ejection (CME)** is an ejection of material from the solar corona (the plasma atmosphere of the sun. The ejected material is a plasma consisting primarily of electrons and protons (in addition to small quantities of heavier elements such as helium, oxygen, and iron), plus the entraining coronal magnetic

field. Like solar flares, it dampens the effects of cosmic radiation in low cloud formation, which in turn allows more of the sun's energy to reach the earth's surface, causing global warming.

### **Activity 2: Classroom experiment during the period.**

Purpose: To demonstrate that when free-floating ice melts it does not raise the level of the water it is in.

Bring a clear drinking glass or small bowl and a separate bowl of ice cubes into the classroom prior to class.

At the beginning of class, fill the drinking glass with ice nearly to the top. Fill the drinking glass or small bowl with water to the very top, **making sure the ice is not in contact with the bottom of the glass**, and it doesn't spill over (if it does spill over, wipe the rim of the glass with a dry cloth or paper towel. It might be a good idea to place a tray under the glass under the glass to protect the desk if a spill or heavy condensation occurs). Continue on with the lesson while the ice melts.

Near the end of the class, show that all or most of the ice has melted, but the water has not spilled over the top of the glass. The reason, the floating ice has already displaced all the water it is going to and further melting will not displace any more water.

Principle learned: Even if all the arctic ice cap melts, it will not cause the ocean levels to rise because the floating ice cap has already displaced all the ice that it is going to. Only the ice on continents can raise the ocean levels.

Note: If it is a humid day, there will be condensation on the outer surface of the glass. That is not water spilling over the top. It represents what happens when warm, humid air comes into contact with cold air immediately next to the cold glass. You can tell the students that is exactly the same thing that happens with storm formation – as warm moist air collides with cold air, the water vapor condenses out into clouds, and then rain, snow or hail. The greater the temperature difference between the warm, moist air and the cold air, the more condensation occurs and the more violent the storm).

### **Activity 3: To familiarize students with the graphs that will be used in the Video Lesson.**

Download and review the graphs with students so they will understand what they are seeing when they see them in the video. Attention should be given to the timelines on the graphs that refer to time periods so that students will understand how much time is being covered by any given data. Or, if your classroom is equipped with internet access, the graphs can be viewed at the [globalwarmingclassroom.info](http://globalwarmingclassroom.info) website.

## **\*\*View Video Lesson 3\*\***

### **Closure:**

1. Emphasize key points listed in the Lesson 3 Goals.
2. Check for student understanding with open discussion.

### **Review Graphs:**

Review any of the graphs or photos used in the video to explain them further. These graphs can be found at [http://www.globalwarmingclassroom.info/Lesson2\\_graphs.htm](http://www.globalwarmingclassroom.info/Lesson2_graphs.htm).

### **Following video discussion:**

1. What is the difference between Gore's prediction and the IPCC report on the melting of Greenland's and the Antarctic's ice caps?
  - *Mr. Gore claims that the water levels will rise 20 feet, the IPCC predicts that the most that will happen is 23 feet or 59 centimeters. In 2007 and 2008 the rise in sea levels has slowed significantly (Not in the video).*
2. What is causing the warming on the western peninsula of Antarctica? What is happening to the rest of the continent?
  - *Volcanic activity is causing the warming on the western peninsula of Antarctica. The rest of the continent is cooling and the ice cap is growing larger.*
3. What happened to the airplane called the Glacier Girl?
  - *On July 15, 1942 several airplanes flying from America to England made an emergency landing on Greenland's ice cap. The crew was rescued but the planes were left on the ice. In 1992 the planes were found 1 mile from the landing sight and 268 feet below the surface. The planes did not sink in the ice and was not pushed to a depth of 268 feet by a glacier; the plane would have been crushed. Rather 268 feet of ice accumulated on the plane. Hot water was used to dig a tunnel to extract a plane which they called the Glacier Girl. The plane was rebuilt and is now flying once again.*
4. What is the medieval optimum?
  - *800 years ago earth was considerably warmer than it is today. (It was a period of time where Greenland was fertile fields and navigable waters filled with codfish and seals. The medieval optimum was followed by the little ice age and the Vikings died out.)*

5. How were the Vikings able to settle Greenland? What happened to them?
  - *During the medieval optimum the climate was warmer and Greenland was fertile; and green, the waters were teeming with fish and seals. They had a fashionable clothing and good times. It was a vibrant and thriving culture. The climate changed and they could not get enough hay for the animals, the animals froze and died, then the people died.*
6. What is the main supplier of energy on the earth?
  - *The sun is the main supplier of energy on the earth.*
7. Increased energy of the sun is not sufficient by itself to account for the warming of the earth. What factors contribute to the earth's warming?
  - *There is a correlation between incoming cosmic radiation and incoming low elevation cloudiness. The more cosmic radiation the more cloud formation. Cloud formation reflects the sun's energy back into space. Therefore the more clouds in the lower atmosphere more of the sun's energy is reflected back into space and the temperature of the earth drops.*
  - *As the sun becomes active with solar flares and other activity, solar winds stream out from it. Solar winds keep cosmic radiation from reaching the earth and other planets. Reduced cosmic radiation cause reduced low cloud cover which allows more of the sun's energy to reach the earth. The increased energy causes the earth to warm.*
8. What is the primary driver of the earth's natural cycles?
  - *The sun's natural cycles are a primary driver of the earth's climate cycles.*
9. Is the melting polar cap a threat to polar bears?
  - *All but one population of polar bears are stable or increasing. Polar bears can swim 100 miles in the open ocean, and they have survived other warmer climate changes in the history of the earth.*
10. The sun impacts many things on the earth, list three.
  - *Air circulation*
  - *Ocean current*
  - *Growth of trees*
  - *It is the main driver of the weather and climate system*
11. In the video you learned that the sun's magnetic fields impact the earth and have regular natural cycles. How do the cycles of the sun impact the earth?
  - *When sunspot activity is compared to temperature change over the same period radiation from the sun seems to contribute to variation to temperature and climate on earth. The sun's natural cycles are a primary driver of the earth's natural cycles.*
12. Is CO<sub>2</sub> a pollutant? Why or Why not?

- *CO2 is not a pollutant, it is important for sustaining life on earth. It is a nutrient for plants. Plants take in CO2 and give off oxygen. We take in oxygen and give off CO2. It is important for sustaining life on earth and is naturally occurring.*

13. Are CO2 levels high or low compared to other times in distant history?

- *Life flourished on the earth when CO2 levels were ten times higher than they are today. Plant life was so vigorous during that time that it created all the oil and gas that we now use.*

14. What happens to plants when there is increased CO2 in the atmosphere?

- *Plants grow better. CO2 helps crops overcome harsh conditions such as drought and pollution.*

15. Name one thing that increased CO2 does for plant life.

*(Many different answers are acceptable.)*

- *Plant life increases*
- *Plants do not need as much water with increased CO2 and can survive drought conditions.*
- *We may be able to farm areas that are considered desert areas.*
- *It lengthens the growing season.*
- *It has increased crop production by 8 to 12 percent around the world.*

16. What problems do you see with the current system that is claiming global warming and driving policy changes?

*(There may be many answers to this question.)*

- *Policy changes are mostly based on IPCC recommendations and reports. The summary is written by policy makers before the actual science document is written by scientists. As scientists are writing the document they are asked to tailor their writing to the summary. Each scientist writes a small portion of the document and is never asked if they agree with the rest of the document. Very few scientists are asked to write this document and seem to be chosen based on their agreement with the summary.*
- *Global Warming proponents point to man-created CO2 as their catalyst for the earth's warming and demise. They claim that it is a pollutant, while ignoring the fact that CO2 levels were much higher at the beginning of the earth and life thrived during that time. They also ignore that increased CO2 levels are beneficial to plant life and help plants grow in otherwise desolate areas such as deserts.*
- *Climate change has many aspects and is very complex. The scientific community is still in the process of discovery and research to determine all of the components that affect our climate. Little is known about deep ocean currents that can store energy and transfer it from one part of earth to another. Our sun and galaxy also have an impact on climate change as cosmic radiation cause cloud cover to increase which blocks the sun's energy. Likewise when the sun is active with*

*solar flares, solar winds stream out from the sun. The wind keeps the cosmic radiation from reaching the earth and other planets. Reduced cosmic radiation causes reduced cloud cover which allows more of the sun's energy to reach the earth and the earth to warm.*

3. Perform student assessments.

Recommended assessments: quizzes, take home essay questions