College Guild
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ENVIRONMENTAL ISSUES

UNIT 2 OF 5

Climate Change

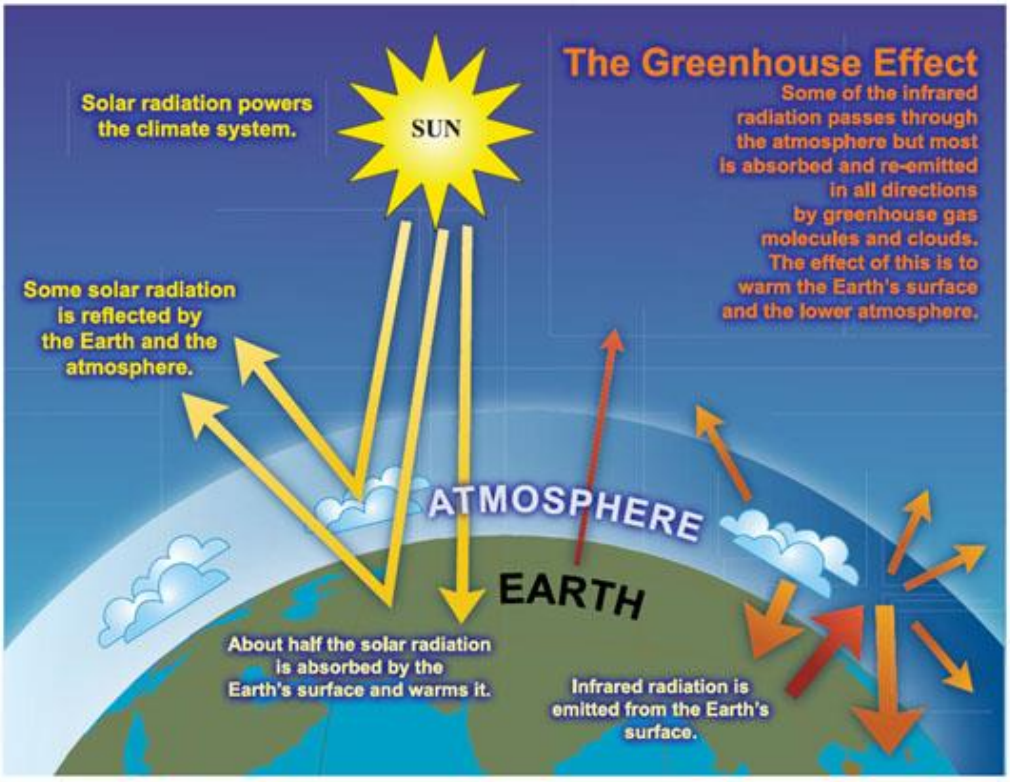
In June, 1988, Dr. James Hansen, a scientist with the National Aeronautics and Space Administration, presented testimony to the U.S. Congress in which he said that 1) the earth is warmer than at any point in the 100 years since temperature measurements have been taken, 2) it is highly probable that this warming has been caused by the greater presence in the atmosphere of "greenhouse gases" due to increased burning of coal, oil, and natural gas, and 3) this warmer atmosphere increases the probability of extreme weather events, such as summer heat waves. Scientists had been studying the possible effects of human activities such as the burning of fossil fuels on the world's climate for about a decade before this, but there had been little interest outside the world of science. Hansen's testimony, however, caught the attention of political leaders and the media, with the result that public awareness of the issue doubled, from just under 40 percent to almost 80 percent. In the years since then, scientists have become even more certain that human activities, especially those related to manufacturing, transportation, energy generation, and agriculture, are causing serious disruptions to the world's climate, with possibly catastrophic consequences.

(Note: The terms "Climate Change" and "Global Warming" are used interchangeably and both refer to the same phenomenon.)

1. **Do most people you know think about global warming or believe in it?**
2. **Has your area of the country experienced more severe weather (heavier rainfall, tornados, longer droughts, etc.) in recent years?**
3. **Have you noticed any changes in the climate since you were a child? If so, what were they?**
4. **Write a poem or story about any kind of weather. You can relate a memory, speak as a fictional character, or even be the voice of the weather itself!**

How does climate change work? Here's a very brief explanation. The sun warms the earth's surface and the earth radiates energy back through the atmosphere into space. Some of this energy is kept from re-entering space by greenhouse (or heat trapping) gases. These gases perform a vital function by keeping our planet's temperature at livable levels for humans and other creatures. Without them, earth's average temperature would be about sixty degrees Fahrenheit cooler than it is. The most plentiful of these gases is water vapor, out of which clouds are formed. Others include carbon dioxide (CO_2) and methane (CH_4). The problem arises when the level of greenhouse gases in the atmosphere rises, thus producing additional warming on the earth's surface. Around 1800, when the Industrial Revolution was just getting under way, the level of CO_2 in the atmosphere was around 280 parts per million (ppm), where it had been for thousands of years. Today, that level is 400 ppm, the result of two centuries of burning coal, gasoline, and heating oil. This increase of only 120 ppm doesn't seem like much, but it has upset the delicate balance in the atmosphere, with serious consequences for life on earth.

Note: The term "fossil fuels" is applied to coal, oil, and natural gas because each of these is the result of organic material – that is, fossilized plants – that has decomposed over millions of years. The illustration on the following page shows how the Greenhouse Effect works.



[from the chart above: *The Greenhouse Effect- Some of the infrared radiation passes through the atmosphere but most is absorbed and reemitted in all directions by greenhouse gas molecules and clouds. The effect of this is to warm the Earth's surface and the lower atmosphere.*]

When Dr. Hansen spoke to Congress, he did so in terms of probabilities – of things that were likely to happen, but hadn't yet occurred. Since then, many of these expectations have come true. For example, the average amount of Arctic Ocean sea ice in the winter has declined steadily over the past thirty years. Huge portions of the Antarctic Ice Sheet are melting much faster than expected, causing sea levels to rise throughout the world. Extreme weather events such as hurricanes, droughts, and heat waves are more frequent and/or more severe than they were in the past, and 2015 was the warmest year on average since worldwide temperature records were first kept in 1880. In fact, fourteen of the fifteen warmest years have occurred in this century. There have been more subtle changes too, as animals and plants normally found only in tropical or subtropical areas are being seen further north where the climate had previously been too cold for them to thrive.

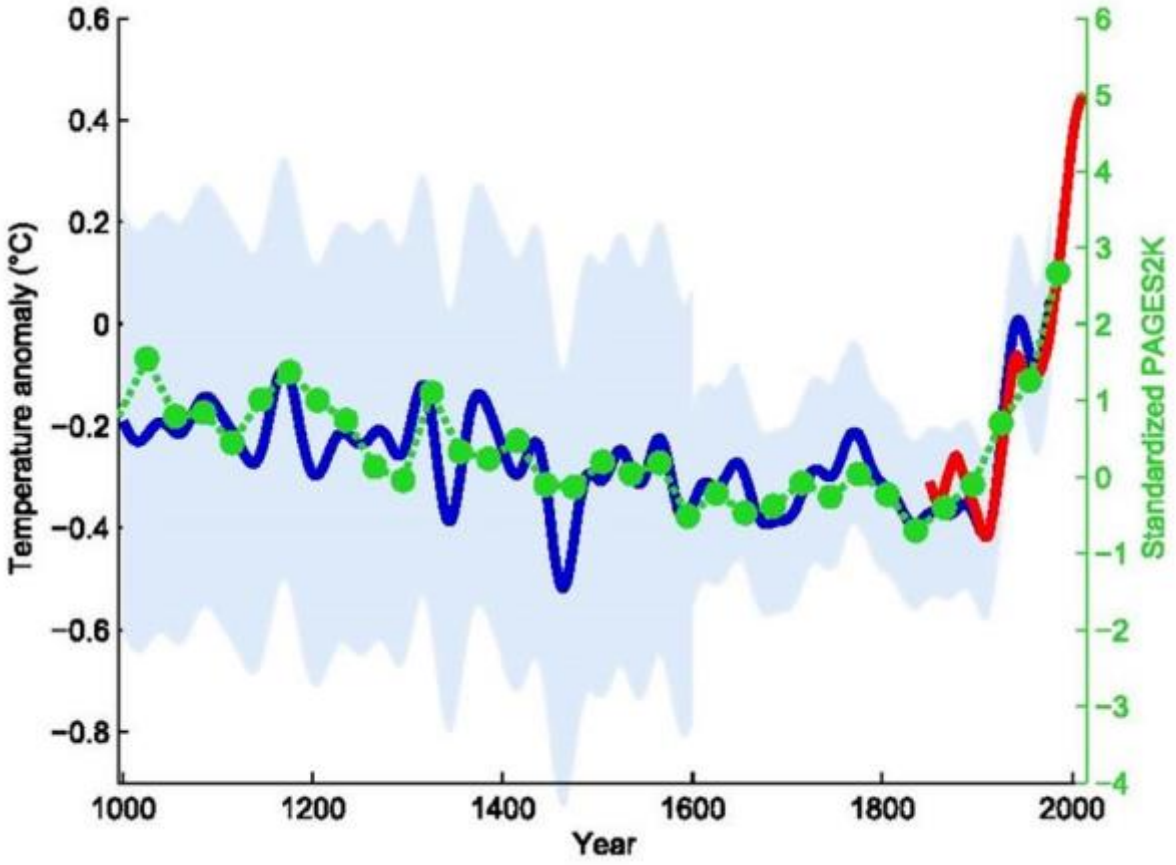
5. **How do you think a plant or tree species would "migrate" north?**

6. **What other reasons might cause a species of insect to seek a new habitat? How about a reptile? How about a mammal?**

7. **What other reasons might cause humans to seek a new habitat?**

8. **How would a ten degree increase in the average temperature affect the area where you live?**

The chart on the following page shows how global average temperatures have risen sharply since around the middle of the twentieth century.



The term "temperature anomaly" on the left margin of this graph refers to the difference between the temperature for a given year and the long term average temperature. For example, the global temperature in 2000 was 0.4 of a degree Celsius (0.72 of a degree Fahrenheit) warmer than the long term average temperature. Notice how the line rises very sharply at the extreme right side of the chart. This represents the extensive warming that has taken place over the past fifty years.

At first glance, it can seem difficult to understand what all the fuss is about. Scientists predict the earth will warm somewhere between 4 and 10 degrees Fahrenheit. Even ten degrees warmer doesn't seem so bad on a cold January morning. It's important to remember though that human civilizations, not to mention the animals and plants they depend on, have grown over the centuries, and even millennia, in response to their environments. People settled in locations that provided fertile soil, adequate – but not too much – rainfall, abundant sources of fresh water, and a tolerable range of temperatures. The earth's temperature has fluctuated in the past before humans came along, but these changes have taken place gradually, over several centuries. Today's changes are occurring much faster - too fast for the millions of people affected to make an orderly transition.

As you might expect, solutions to a problem as complex as climate change must come from a variety of sources – all levels of government, the business community, schools, churches, and individuals, among others. The most important response is to reduce, and eventually eliminate, the introduction of greenhouse gases into the atmosphere. This is a huge task, given the extent that we rely on burning coal, oil, and natural gas to keep our economy running smoothly.

9. What are some things that individuals can do to combat climate change?

10. How about businesses?

11. How about governments?

12. Has your institution taken any steps to reduce its dependency on the burning of fossil fuels? What are some steps, or additional steps, it should take?

It is clear that sacrifices will have to be made, but it is less clear how those sacrifices should be allocated. The high standard of living enjoyed by people in the developed nations of the world like the United States was built primarily through the burning of fossil fuels. Is it fair to ask people in low income countries to delay their own economic development by not using coal for their electricity and gasoline for their cars? On the other hand, if countries in the developing world, home to four billion people, were to start emitting carbon dioxide and methane at the same rate that Americans and Europeans do, the global warming rate would double and the consequences would be even worse than they are already projected to be. This is one of the major issues facing representatives of both the developed and the developing nations as they engage in international negotiations to address climate change.

13 What advice would you give negotiators on how to resolve this dilemma? Specifically, what would you say to representatives of the United States or other wealthier countries?

14. What would you say to a representative from one of the poor countries in Africa or Latin America?

Even though the evidence is getting stronger that the world is warming and that human activities are the primary cause, a substantial number of people still don't consider dealing with it to be a priority. There are several reasons for this. 1) It's a very complex subject and many people simply haven't taken the time to inform themselves about it. 2) The broad outlines of the problem are clear, but there are still many uncertainties, such as when and where the worst impacts will occur and how severe they will be. There's a tendency to say, "If the experts don't know these things, I'm not going to worry about it." 3) Although the effects of climate change are beginning to appear today, the widespread serious damage isn't expected for several years. There are so many other more immediate problems, like the economy and terrorism, to worry about. 4) Some people are reluctant to acknowledge climate change as a problem because doing so would require that they consider making difficult lifestyle changes, such as driving less and walking or taking public transportation more. 5) Finally, powerful business interests, with much to lose from a transition away from using fossil fuels to power our economy, have launched public relations campaigns to downplay the seriousness of the problem or even to deny that it exists. Some political leaders and media personalities have helped them in this effort.

15. Write a ten-line dialogue between you and a neighbor in which you try to persuade him or her that climate change is a serious problem.

16. Pick one of the following topics and write to the President about your own views as they relate to climate change: rail service, jobs in the coal industry, standards for car emissions, the national budget, teaching environmental issues in schools, or lifestyle changes.

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Remember: First names only & please let us know if your address changes