

The Unpleasant News About Global Warming

By Alan Shapiro

To the Teacher:

The "unpleasant news" of the title is widely, if vaguely, understood. Our planet is warming steadily as a result of human activities. Global warming is already having negative consequences, and will certainly produce more of the same and worse. Yet, despite the fact that plenty of information is available that could be the basis of an intelligent and essential response, the world's actions to date have been dangerously limited, the official United States' actions negligible. In short, if today we are not in imminent peril, our children are likely to be.

The three student readings below respond to some basic questions: What have we been doing to our planet? How? What will happen? What is being done? What else needs to be done?

Questions for discussion follow each of the readings. Suggestions for student inquiries and citizenship activities conclude the materials.

Student Reading 1: What have we been doing to our planet?

Some facts about the state of the planet:

- 1998 was the hottest year globally since records began to be kept; 2002 and 2003 are tied for second; 2001 is third; 2004 is fourth. The worldwide temperature is 1 degree Fahrenheit higher than it was one century ago. Some of the coldest places on the planet are much warmer. In the past 30 years the temperature of Barrow, Alaska has risen by 4.16 degrees. Earth is now nearly as warm as it has been at any time in the past 420,000 years.
- Arctic sea ice has declined by about 10 percent and shrunk by an area roughly the size of New York, Georgia, and Texas combined. Inuit hunters who live in Canada's Northwest Territories, 500 miles north of the Arctic Circle, report that they have seen robins for the first time. Average winter temperatures in Antarctica have increased by nearly 9 degrees Fahrenheit in the past 50 years. When Glacier National Park was established in 1910 it included an estimated 150 glaciers. Today there are fewer than 30, and they have shrunk by about two-thirds.
- Average global sea levels have increased 4 to 8 inches in the past century. A continuation of the rising sea level in South Florida, which has increased 9 inches in the past 75 years, will put the mangrove forests underwater in this century.
- Of 35 nonmigratory butterfly species in Europe, about two-thirds have migrated northward 20 to 150 miles in recent decades. Many European plants flower about a week earlier than they did 50 years ago and shed their leaves almost a week later. Great Britain's birds breed on average 9 days earlier than they did 50 years ago. Frogs mate up to 7 weeks earlier.

- The Great Barrier Reef of Australia is 1200 miles long and includes some 400 species of coral and 1500 species of fish. Warming ocean temperatures are causing bleaching of coral, a loss of algae that live in coral and supply nutrients, and ultimately in death to some coral.
- Western Antarctica's increased snow in recent decades has resulted from less ice covering the ocean and greater evaporation of seawater. The snow piles up on the south sides of ridges where penguins breed and fail to incubate their eggs. In the past 30 years, 884 breeding pairs have shrunk to 47.
- The levels of carbon dioxide (CO₂) in the atmosphere are higher than they have been for hundreds of thousands of years and since pre-industrial times have risen by approximately one-third. If current trends continue, levels of atmospheric CO₂ will be nearly double pre-industrial levels. CO₂ is a key "greenhouse gas" contributing to global warming.
- The average American produces 12,000 pounds of CO₂ emissions yearly. The United States is responsible for approximately 25 percent of atmospheric greenhouse gases and its emissions continue to increase. The earth's temperature will rise for every additional increment of atmospheric CO₂.

Sources: Elizabeth Kolbert, "The Climate of Man," *The New Yorker*, 4/25, 5/2 and 5/9/05; "As the World Burns," *Mother Jones*, May-June 2005; "Global Warning," *National Geographic*, 9/04

What's going on here?

"Greenhouse gases are accumulating in Earth's atmosphere as a result of human activities. Global warming could well have serious adverse societal and ecological impacts by the end of the century." *ó National Academy of Sciences*

"While some historical changes in climate have resulted from natural causes and variations, the strength of the trends and the patterns of change that have emerged in recent decades indicate that human influences, resulting primarily from increased emissions of carbon dioxide and other greenhouse gases, have now become the dominant factor." *óA report commissioned by the Arctic Council, which consists of 8 nations with Arctic territory (the U.S. Canada, Denmark, Finland, Iceland, Norway, Russia and Sweden)*

"Continuing growth in greenhouse gas emissions is likely to lead to annual average warming over the United States that could be as much as several degrees Celsius (about 3 to 9 degrees Fahrenheit) during the 21st century." *óU.S. Environmental Protection Agency report to the UN*

"There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities." *óIntergovernmental Panel on Climate Change (IPCC), a United Nations panel made up of representatives worldwide*

"Natural influences cannot explain the rapid increase in global near-surface temperatures." *óAmerican Geophysical Union*

"Human activity is putting such strain on the natural functions of earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted." *óMillennium Ecosystem Assessment, a study by 1,360 researchers in 95 nations*

What are greenhouse gases?

Greenhouse gases, such as carbon dioxide, trap some of the energy the earth receives from the sun, preventing the energy from radiating back into space. To a large extent, this is a natural process. Without some greenhouse gas effect, temperatures on earth would be much lower than they are and the life we know would not be possible. Thanks to greenhouse gases, the earth's average temperature is a much more comfortable 60 degrees F.

So why are greenhouse gases a problem?

They are a problem because atmospheric concentration of them has increased enormously since the dawn of the industrial revolution in the 18th century. For example, CO₂ is an odorless, colorless, non-poisonous gas emitted by decaying plant matter and a normal part of the air surrounding us. But for more than two centuries, fossil fuels—coal, oil, and natural gas—have been burned in greater and greater amounts to generate electric power; to run factories, businesses, cars, buses, trucks; to heat homes and offices, and in the process have been emitting CO₂ in huge quantities. As much as 98 percent of U.S. CO₂ emissions come from such sources, according to the EPA, and contribute the most to the human-produced greenhouse effect.

Another greenhouse gas is methane. It comes from waste materials decomposing in landfills, decomposing animal wastes, as well as fossil fuel production and combustion. A third is nitrous oxide. Its major sources include soil cultivation practices, especially the use of various fertilizers, as well as fossil fuel combustion.

Scientists from nations all over the world have applied their particular disciplines to the undeniable fact that our planet is getting warmer. They have concluded that:

- 1) the emission of greenhouse gases—especially CO₂—is creating a "greenhouse effect" in the atmosphere that is steadily increasing the earth's temperature.
- 2) human industry and transportation are the main causes.
- 3) global warming is already producing consequences—from melting Arctic sea ice and the appearance of robins in the far North to rising sea levels and disappearing coral reefs—and will produce many more.

Not everyone agrees. There are some who insist that greenhouse gas emissions are good for us, others who believe that the reasons for the growing warming of the earth are either a product of natural forces or uncertain. For example:

"Carbon dioxide emissions from fossil fuel combustion are beneficial to life on earth."
—Greening Earth Society, an organization created by the Western Fuels Association

The idea of human-induced warming is "the greatest hoax ever perpetrated on the American people."
—Chairman of the Senate Environment and Public Works Committee James Inhofe (Oklahoma Republican), who views global warming as a natural phenomenon

But given the evidence, most scientists now agree that global warming is a human-made problem, and a serious one:

"Oh, sure, there are people insisting that warming is just a part of natural weather cycles, but their claims are not close to being scientifically credible. And while there certainly are long climate

cycles, the fact is that the strong warming we are seeing is happening in an era of ever increasing CO2 emissions. These people remind me of the folks who kept trying to cast doubt on the science linking cancer to tobacco use. In both situations, the underlying scientific knowledge was quite well established, while the uncertainties were never enough to render the problem inconsequential. Yet, this offered misguided incentives to dismiss a danger. Global warming is unpleasant news. The costs of doing something substantial to arrest it are daunting, but the consequences of not doing anything are staggering."

óDr. Jerry D. Mahlman, senior researcher at the National Center for Atmospheric Research (New York Times, 12/16/03)

Global warming is "an issue that we need to take very seriously," said George W. Bush, in 2000 when he was running for president, and who also said at that time that, if elected, he would put federal limits on CO2 emissions.

Soon after his election, he declared that he opposed such limits because the "state of scientific knowledge of the causes of, and solutions to, global climate change" were "incomplete." The president's response to the EPA report to the UN quoted above was "I read the report put out by the bureaucracy." The president has also said, "When we make decisions, we want to make sure we do so on sound science."

For discussion

1. What questions do students have? How might they be answered?
 2. What are greenhouse gases? Where do they come from?
 3. What is the greenhouse effect?
 4. What evidence is there for global climate change?
 5. Why is it a growing problem?
 6. Why do you think President Bush regards this evidence as "incomplete"?
 7. What is the scientific consensus on global climate change?
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Student Reading 2:

What will happen? What needs to be done?

What will happen?

"Projected climate change will have beneficial and adverse effects on both environmental and socio-economic systems, but the larger the changes and rate of change in climate, the more the adverse effects predominate."

óIntergovernmental Panel on Climate Change (IPCC)

"It's not so much the temperature changes, but it's the changes in all other aspects of the environment: amounts of precipitation, the ability for vegetation to maintain its status quo, the

amount of water that's available for agriculture and for water resources, and so on."
óTom Wigley, lead author of the IPCC report, climatologist, and senior scientist at the National Center for Atmospheric Research

Global warming may have beneficial effects for some. In some areas, people may have longer and more productive growing seasons for crops. Milder temperatures may reduce cold stress in Northern regions.

As the heat rises in Miami, air conditioning manufacturers and power providers to that city will prosper but not in a milder Quebec. Increased rainfall might make some Italian farmers happy but not Bangladeshi farmers who may suffer more intense monsoons, which could lead to crop reductions.

Predictable adverse effects will include more powerful storms and flooding, especially in coastal regions, as a product of sea level rise and storm surges. This could endanger such cities as Shanghai, Bangkok, Jakarta, Tokyo, and New York and threaten sources of drinking water. Other potential effects:

- melting mountain glaciers affecting rivers and dams
- increased heat stress
- increased air pollution
- fires
- droughts
- pest infestations
- ecosystem disruption leading to the loss of animal and plant species.

If it becomes severe, climate change could disrupt world food supplies.

No one knows whether the climate changes that have already begun will be gradual or swift.

What is being done?

Global warming is not affecting, and will not affect, every area or nation equally. In Arctic regions where sea ice is disappearing, Inuit hunters have increasing difficulty locating seals, a staple in their diet. In Ethiopia, where people depend upon subsistence farming, a prolonged drought leaves them hungry. These are not problems in Marseilles, France or Jakarta, Indonesia or Topeka, Kansas, where people buy their staples in markets. But climate change may produce other problems for people in those cities.

Recognizing the global character and threat of warming, delegates from around the world met in Kyoto, Japan, in 1997 and negotiated what became known as the Kyoto Protocol, an international treaty requiring cuts in the greenhouse gases that cause global warming. A key provision commits industrialized nations to reduce greenhouse gas emissions by at least 5 percent below levels measured in 1990.

Another important provision establishes an international trading system that permits a nation to earn credits toward its pollution cuts by investing in reducing emissions outside of its borders. Last year, for example, Europeans agreed to invest in a project that will produce electricity by burning 31,000 tons of methane a year coming from rotting trash at a Brazilian dump. (*New York Times*, 12/13/04)

The Kyoto agreement requires smaller cuts from developing nations like China and India than from such industrialized countries as Britain, France, and Russia. Those and other nations

agreed that they are responsible for most of the man-made greenhouse gases now in the atmosphere. Of the world's 193 countries, 130 ratified the Kyoto Protocol, which took effect on February 16, 2005.

While the U.S. is responsible for one-quarter of the world's total emissions, it refused to ratify the Kyoto Protocol. President Bush said it was unfair for industrialized nations to bear the major burden for emissions cuts. But the president also views the concept of global warming as questionable. In 2003 the White House interfered in the writing of a report by the U.S. Environmental Protection Agency that included a section on global warming. EPA staff members complained that what the president wanted to say "no longer accurately represents scientific consensus." In the end, the climate-science section was left out of the report altogether. (Kolbert, *The New Yorker*, 5/9/05)

The communications director for the White House Council on Environmental Quality said that abiding by the Kyoto Protocol would cost Americans the loss of five million jobs and higher energy prices. She also said the president "favors an aggressive approach" and "one that fosters economic growth that will lead to new technology and innovation." (*New York Times*, 5/14/05) But the president's plan, unlike the Kyoto Protocol, relies on voluntary measures rather than requiring cuts in greenhouse gases. It would give industrial firms tax breaks and other incentives for making cuts. It would allow greenhouse gas emissions to continue to rise, but would aim to slow their rate of growth by 18 percent over a ten-year period.

American companies with international operations or markets, however, will have to pay attention to the Kyoto requirements. "Almost 40 percent of our production and 50 percent of our sales are outside the United States, and we're going to be under the European Union caps and trading and allocation system," said Mark McFarland, a DuPont company representative, at the Kyoto conference. (*New York Times*, 12/13/04)

Many supporters of the Kyoto Protocol see it as a tiny but essential step in a long process. For even in the unlikely event that all 130 nations meet their obligations by 2012 as required, and even if the U.S. were a participant, atmospheric CO₂ would continue to increase to ever more dangerous levels.

One hundred and thirty-two U.S. mayors who disagree with President Bush and support the Kyoto Protocol have created a bipartisan coalition to act on global warming locally. They include the mayors of New York City (a Republican) and Los Angeles (a Democrat). Many of them said that, like the president, they have economic concerns and that's why they support Kyoto.

Seattle's Mayor Greg Nickels said that dry Northwest winters and the resulting sharp decline in glaciers in the nearby Cascade Mountains may affect Seattle's drinking water supply and hydroelectric power. In response, the city has vowed that by the end of 2005 its power utility will be the only one in the nation with no net emissions of greenhouse gases.

The mayor of New Orleans said he joined the coalition because the projected rise in sea levels "threatens the very existence of New Orleans," a low-lying city. Mayors in Florida are concerned about the increased severity of hurricanes, like those last year. The mayor of Bellevue, Nebraska, is worried about the effects of drought on his farming community. (*New York Times*, 5/14/05)

What else can be done?

Scientists recommend that all nations need to act on such measures as the following to minimize the effects of global warming (see the Natural Resources Defense Council's website, www.nrdc.org):

1. Reduce CO₂ pollution from power plants and vehicles, which is their primary source. In the U.S., coal-burning power plants produce the most CO₂ emissions—2.5 billion tons annually. Vehicles are second—1.5 billion tons annually. The technology already exists to create more modern power plants and more fuel-efficient vehicles of all types.
2. Increase the use of wind, sun, and geothermal renewable sources of energy.
3. Develop more efficient appliances.
4. Conserve energy.

The problem is not so much determining what needs to be done, for the essentials are known. "The evidence overwhelmingly shows, as predicted, that human behavior is altering the climate, with potentially catastrophic results. And yet it seems strangely difficult to scare or reason or argue Americans, the critical audience, to reach into recognizing the truth and acting on it. Instead of taking the lead, the United States—the country with the highest emissions and the most excessive consumption, as well as enormous potential to produce innovative energy technologies—seems to care the least about global warming. Short-term self-interest is a powerful buffer against reality. So is the lobbying of the fossil fuel industries and the complacency of an administration that lives in thrall to them."

—Verlyn Klinkenborg, *"Be Afraid. Be Very Afraid,"* New York Times Book Review, 5/30/04

From this perspective, the true problems are economic and political. It is not in the short-term interest of the businessmen and women who run fossil fuel industries to change their practices. Through their economic power, campaign contributions, and persistent lobbying, they have political clout with lawmakers whose short-term interest is in being elected.

Is stabilizing carbon dioxide emissions politically possible? "I really think that's the wrong question. [It] can be done. Some people thought [slavery] was wrong, and they made their arguments, and they didn't carry the day. And then something happened and all of a sudden it was wrong and we didn't do it anymore. And there were social costs to that. I suppose cotton was more expensive. We said, 'That's the trade-off; we don't want to do this anymore.' So we may look and say, 'We are tampering with the earth.' It's clear from the record that it does things that we don't fully understand. We may say, 'We just don't want to do this to ourselves.' [It] depends on how much we give a damn."

—Robert Socolow, *professor of engineering at Princeton University and co-director of the Carbon Mitigation Initiative* (The New Yorker, 5/9/05)

"In a way, the true puzzle of global warming isn't the mechanics of man-made climate change. Those can be studied and understood. The true puzzle is human nature. Sometimes—like now—nearly everyone is aware of dramatic changes in the world. Yet we continue to live in the assumption that we can ride out the changes without changing ourselves. What it will take to wake us up is a wave of equal size traveling in the opposite direction. That wave is already on its way."

—Verlyn Klinkenborg, *New York Times Book Review*, 5/30/04

"As the effects of global warming become more and more apparent, will we react by finally fashioning a global response? Or will we retreat into ever narrower and more destructive forms of self-interest? It may seem impossible to imagine that a technologically advanced society could choose, in essence, to destroy itself, but that is what we are now in the process of doing."

—Elizabeth Kolbert, *The New Yorker*, 5/9/05

For discussion

1. What questions do students have? How might they be answered?
 2. What are the key provisions of the Kyoto Protocol?
 3. Why isn't the U.S. part of this treaty? What is your opinion of the treaty? Why?
 4. What is the president's plan? What is your opinion of it? Why?
 5. What makes global warming both an economic and a political problem?
 6. How have many of the nation's mayors responded to the economic aspect of the problem?
 7. Why is political action on global warming so difficult?
 8. What does Klinkenberg mean by writing, "The true puzzle is human nature"?
 9. How would you answer Kolbert's questions? What is your reaction to her final sentence?
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Student Reading 3: A New and Authoritative Report on Global Climate Change

The most recent authoritative assessment of global climate change (2/2/07) is a product of the Intergovernmental Panel on Climate Change (IPCC). This panel, created by the United Nations in 1988, is the most important international network of climate scientists.

Its conclusions are clear, powerful and unpleasant:

1. Human activities since the beginning of the industrial revolution are the main force behind the global build-up of concentrations of atmospheric greenhouse gases.
2. It has been confirmed by many observations that these concentrations are causing global warming.
3. As a result of the buildup of greenhouse gases, we will continue to see climbing temperatures, rising seas, and changing weather patterns for centuries.
4. If human activities do not result in significant cuts in greenhouse gas emissions, further warming will occur and cause additional changes in the global climate system.
5. Prompt action can reduce some of the harmful results of climate change.

Quotes from the report:

- "Global atmospheric concentrations of carbon dioxide, methane, and nitrous oxides have increased markedly as a result of human activities since 1750 and now far exceed pre-

industrial values determined from ice cores spanning many thousands of years....The atmospheric concentrations of carbon dioxide in 2005 exceeds by far the natural ranges over the last 650,000 years."

- "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of ice and snow, and rising global mean sea level. Eleven of the last twelve years [1995-2006] rank among the 12 warmest years in the instrumental record of global surface temperatures [since 1850]....long-term changes in climate have been observed [and] include...aspects of extreme weather including droughts, heavy precipitation, heat waves, and the intensity of tropical cyclones."
- "Continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed in the 20th century."
- The IPCC reports declares "very high confidence" that the globally averaged net effect of human activities since 1750 has been one of warming."
- "Most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic [human-influenced] greenhouse gas concentrations. Discernible human influence now extends to other aspects of climate, including ocean warming, continental-average temperatures, temperature extremes and wind patterns."

These and other conclusions "came after a three-year review of hundreds of studies of past climate shifts; observations of retreating ice, warming and rising seas, and other changes around the planet; and a greatly expanded suite of supercomputer simulations used to test how the earth will respond to a growing blanket of gases that hold heat in the atmosphere." (Elisabeth Rosenthal and Andrew C. Revkin, "Science Panel Says Global Warming Is 'Unequivocal,'" *New York Times*, 2/3/07)

This report is intended to provide scientific findings on global climate change, not make recommendations for action. However, the IPCC will provide recommendations in a later report.

Achim Steiner, executive director of the United Nations Environment Program, which, along with the World Meteorological Organization, administers IPCC, said, "In our daily lives we all respond urgently to dangers that are much less likely than climate change to affect the future of our children. February 2 will be remembered as the date when uncertainty was removed as to whether humans had anything to do with climate change on this planet. The evidence is on the table."

John Holdren, an energy and climate expert at Harvard and president of the American Association for the Advancement of Science, said the report "powerfully underscores the need for a massive effort to slow the pace of global climatic disruption before intolerable consequences become inevitable." (*New York Times*, 2/3/07)

Note: The IPCC report of 2001, as well as the current one, are available online at www.ipcc.ch.

Other Classroom Activities

For discussion

1. What questions do students have on the IPCC report? How might they be answered?
2. What has the industrial revolution, which began around 1750, got to do with global climate change?
3. Why does the report say the climate change is "unequivocal"?
4. Why might continued greenhouse gas emissions at or above current rates be "very likely" to induce changes larger than those that occurred in the 20th century?
5. The IPCC report has received much attention. Why do you think it has?

For further inquiry

- Unanswered student questions.
- The pros and cons of nuclear power, which doesn't produce greenhouse gas emissions
- The practicability of such renewable sources of power as sun, wind, and geothermal
- The available technology for more fuel-efficient vehicles and why it is not being used more broadly
- Sources of greenhouse gas emissions in every household and how they can be reduced
- Evidences of global warming e.g., coral bleaching-and its ecological impact
- Improvements for the Kyoto Protocol

For citizenship

"Why should I care? There's nothing I can do about it." Many students hold this usually unarticulated and negative view about major national and international problems. Thinking globally and acting locally might be a useful approach. One way of generating interest and a response is to have a brainstorming session, consider possibilities, then move to action.

1. Ask students to think of anything they might do individually or collectively to respond to the problem of global warming.
2. Tell students not to make any comments, judgmental or otherwise, about any idea.
3. List, without comments, all ideas on the chalkboard. Ask clarifying questions, as you think necessary.
4. When students have generated all the ideas they can think of, invite a discussion of their responses. One approach would be to divide the class into groups of four to six to select the one or two ideas they think most promising. After 10-15 minutes, have a report from each.
5. Ask students for the next day or two to continue the discussion with friends and family members. Do they have any additional ideas for the class to consider? They may come up with some by checking the websites of environmental organizations like the Natural Resources Defense Council (nrdc.org), the Environmental Defense Action Fund (environmentaldefense.org), and the Pew Charitable Trust's environmental arm (pewclimate.org).

6. Debrief students a day or two later. What additional ideas do they have to suggest?
7. The question now is: How can they make a difference? Which of the action ideas seems most doable, most realistic?
8. Following any further necessary discussion, have students consider how they want to decide: by a majority vote? By a two-thirds majority vote? By consensus? Let them decide and talk through decision-making possibilities.
9. After students have made their decision, what should they do next? Make further inquiries into the subject to inform themselves as well as possible? How? Take some action? What? Is a smaller planning committee desirable? If so, how should it be set up and what provisions are necessary for reports to the class?
10. Insofar as possible, guide students so that they make the key decisions and any project becomes their own.

For writing

Following their studies and any project, students might write to their representatives, their senators, and the president with their views on global warming.

Interest in informing others could lead to a student-prepared newspaper or magazine with news and feature articles, charts and graphs, and photographs on global warming that might be distributed within the school and to parents.

Additional Sources

Woods Hole Research Center (whrc.org)

Environmental Protection Agency (epa.gov)

Public Broadcasting System, "What's up with the Weather?" (pbs.org/wgbh/warming for articles, a glossary, a teacher's guide)

Intergovernmental Panel on Climate Change (IPCC), a United Nations panel that is a leading agency in the global effort to halt climate change: www.ipcc.ch.

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