

GLOBAL WARMING

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S E A F A C T S

FACT OR FICTION: GLOBAL WARMING

Spend a day in the Louisiana sunshine and you can understand the important part it plays in life on planet earth. The sun warms us, gives us light, and interacts with the gases that surround earth to nourish all living things through photosynthesis, growth and decay cycles, transpiration, and evaporation. This interaction produces our climate. Some people think that the earth's surface temperature is increasing and fear possible changes in these processes. Is the sun's effect on earth changing? Is our globe warming?

What's Happening?

The sun is the source of the energy that maintains the earth in its current state. Climate forms the earth's life support system. Visualize the atmosphere as a huge glass greenhouse, trapping heat radiating from the sun to earth and back toward space. Certain gases in the atmosphere (water vapor, carbon dioxide, methane, chlorofluorocarbons, and ozone) are called "greenhouse gases" because they act like the glass panes, allowing sunlight to reach the earth while absorbing some of the trapped heat and radiating the rest back into space. Life for a variety of plants and animals is promoted by the delicate balance between the solar energy coming to the earth and the reflected and reradiated energy leaving it. These principal greenhouse gases are formed by plant and animal life cycles and volcanic eruptions that weakly interact with light from the sun and strongly interact through absorption and emission with heat from the earth's surface. As these gases have become more abundant in the atmosphere, more heat has been trapped—the concept of *the greenhouse effect*.

Theoretically, the solar energy reaching the earth is supposed to equal the energy radiating from the planet. But that doesn't seem to happen. Instead, the globally averaged temperature appears to be increasing slowly — a concept called *global warming*. Researchers

monitoring the atmospheric concentration of the greenhouse gases (by comparing them with gases in air bubbles trapped years ago in glacial ice sheets) have noticed that this concentration seems to rise with increasing industrial activity. They have observed a corresponding increase in global temperature. The general conclusion is that increased concentrations of greenhouse gases intensify the greenhouse effect. This, then, can intensify global warming.

Although several atmospheric gases are responsible for the greenhouse effect, half to two-thirds of this phenomenon is caused by increasing concentrations of atmospheric carbon dioxide (CO₂). Many human activities, such as burning fossil fuels for heat and transportation, emit CO₂, as do forest fires and volcanic eruptions. Humans breathe it out; plants breathe it in.

Atmospheric CO₂ has increased about 25 percent since the early 1800s, according to the U.S. Department of Energy. Since 1958, scientists have detected a 10 percent increase and they say that CO₂ is increasing at a rate of about 0.4 percent per year. These numbers indicate that more CO₂ is emitted than absorbed.

Two human activities are primarily responsible: burning fossil fuels and deforestation. About 75 percent of CO₂ emissions come from burning petroleum, coal, and natural gas — activities that sustain human life in food production, transportation, heating and air conditioning as well as industrial production.

When trees are cut, fewer plants are available to remove this compound from the air. Burning trees release CO₂ rapidly, cut timber, gradually as it decays. Every time a farmer plows a field he exposes the decomposing organic materials to oxygen and CO₂ is released.

Plants also help to remove CO₂ from the atmosphere by storing the carbon in roots, trunks, branches, and leaves. Some scientists from the U.S. departments of Energy and Agriculture have determined experimentally that higher levels of atmospheric CO₂ can

enhance photosynthesis; others have not found this to be true. CO₂ is also dissolved in the surface water of oceans where natural mixing and circulation transport it to greater depths and wider locations. Eventually the CO₂ is fixed under water in shells or limestone deposits. Researchers are also studying the ocean's capacity to absorb heat energy.

Scientists estimate that these natural processes remove or store about half of the CO₂ produced by human activities. Research now being conducted at many universities and federal agencies seeks more precise information on how much is stored and whether the amount of stored CO₂ changes as the concentration of atmospheric CO₂ changes.

Is This A Trend?

Will the earth's climate become warmer in the next century? Will this change be important to our daily lives?

Research has shown a trend toward increasing quantities of noxious chemicals in the air and water, as well as increasing global surface temperatures. In response to air and water pollution, communities and industries have begun to control chemical emissions and monitor acid rain as well as air and ground water pollution.

Temperature changes are more difficult to pinpoint. No firm, mathematically precise increase in global temperature has been proven. Through computer modeling, researchers have been able to use the observed relationship between temperature patterns and atmospheric conditions to predict that the temperature of the earth's surface could increase by 1.5 to 4.5°C (35-40°F) by the year 2050. But these computer-generated conclusions are based on a small amount of real data about temperatures on the earth's surface and the program is limited by the computer's own technology. Researchers hesitate to state unconditionally that global temperature is rising at specific rate. Therefore the best answer available to the first question above is that the earth's climate *will probably* become warmer in the next century.

Why Is Global Warming Important?

Higher global surface temperatures can affect the basics of life as we know it: water, plants, animals, habitats. It can affect the way we make a living: transportation, agriculture, commercial fishing, forestry. And it can affect outdoor recreation.

■ Humidity and precipitation patterns would change with increased global temperatures. Some polar ice would melt, leading to sea level rise. People living at low elevations or in coastal areas would probably be affected by flooding and land loss.

Other areas might experience just the opposite because an increase in global temperature can also cause some increase in water temperature. When water temperatures increase, evaporation occurs, and water levels decrease. Experience also shows that decreased water levels lead to subsidence. Through evaporation, erosion, and subsidence, our major bodies of water and our wetlands could drastically change.

■ Most plants and animals thrive in specific climates. Whole species could be relocated if temperature change caused their habitat to disappear. For instance, shrimp require saltwater marsh for the juvenile stage of development. A loss of this marsh because of sea level rise would force the shrimp to seek habitat elsewhere. In a similar manner, if the soil temperature or availability of moisture decreased in an area, certain plants might not grow.

We could hope but not guarantee that both the shrimp and the plants would thrive in another climate. Seeds move on wind and in animal wastes to begin life elsewhere. Animals living near inhospitable conditions will move into areas with more comfortable conditions, but individual animals do not stray great distances from their home territory. Plants change habitats in a similar, gradual manner.

The global warming predicted for the next 50 to 75 years would occur over a short time. Time and distance factors are strong barriers to simple animal and plant migration. Some species will probably become extinct

What Can We Do?

It isn't necessary to wait for global warming to be scientifically confirmed. We can take action to slow the effects of greenhouse gases and perpetuate our lifestyle. We can be good conservationists and ecologists.

Conservation of our natural resources, especially fossil fuels, saves them for future generations while it slows the formation of greenhouse gases. Specifically, we can obey air and water pollution laws in industrial and residential settings, use energy-efficient automobiles and home heating and cooling systems that burn less coal, petroleum, and natural gas. We can recycle newspapers and plastics so that less wood and hydrocarbons are burned or processed. We can cut down fewer trees. Finally, we can support government guidelines to the safe use of groundwater and develop existing wetlands wisely.

Pushing a panic button and stopping all greenhouse gas-producing activities is foolhardy. Most of the activities that stimulate the greenhouse effect and possibly increase global warming are the same activities that sustain the quality of human life. Even if it were possible, to stop all industrial activity, cease all logging, or return to plowing with horses and traveling by foot would only slow the world economy and reduce the quality of human life, maybe even reduce the numbers of humans. To champion drastic measures would be akin to killing the goose that lays the golden egg.

Available Materials:

"Global Change," *Current, The Journal of Marine Education*, Vol. 10 No. 3, 1991.

Houghton, Richard A., and George M. Woodwell. "Global Climatic Change," *Scientific American*, Vol. 260(4): 36-44, April 1989.

Our Changing Planet: A US Strategy for Global Change Research, A Report by the Committee on Earth Sciences to accompany the U.S. President's Fiscal Year 1990 Budget, Office of Global Programs, National Oceanic and Atmospheric Administration, Washington D.C.

because they are unable to migrate the distance to a new hospitable habitat. Some large cities and metropolitan areas, which break up the continuity of habitat throughout the world, are barriers to animal and plant migration although the straight-line distance across them might be comparatively short. Some species cannot thrive long enough to migrate across man-made areas.

Human habitats would be affected. Flooding can contaminate water supplies as well as damage cropland and property. Subsidence can result in damage to roadways and buildings.

Whole populations could experience changes in ways of making a living. Imagine that the U.S. bread basket (North Dakota, South Dakota, Nebraska, and Kansas) became too warm to support wheat production. This plant, vital to human survival throughout the world, could grow in a new habitat — possibly in the Canadian province of Manitoba. Although Canadian farmers would be excited about their longer growing season and increased production, American farmers would have to find new crops to grow, or change the way they make their living. Similarly, many loggers and papermakers would have to find new vocations because numerous hardwood and several softwood tree species prefer cool and cold climates. With global warming, whole forests might stop growing, perhaps even die, due to temperature change.

Sea level rise could disrupt or flood ports or change commercial fisheries. A decrease in lake or river levels could change inland shipping patterns — operating costs for towing companies would increase because barges could not be loaded as heavily, and routes would have to be changed because some waterways could no longer handle intrastate commerce. Airlines, roads, and railroads would have to provide more shipping services.

■ Even our recreational patterns could be affected. Today's beaches might be underwater; state parks might not continue to support the same plants and animals. Snowfall patterns might miss some ski slopes.

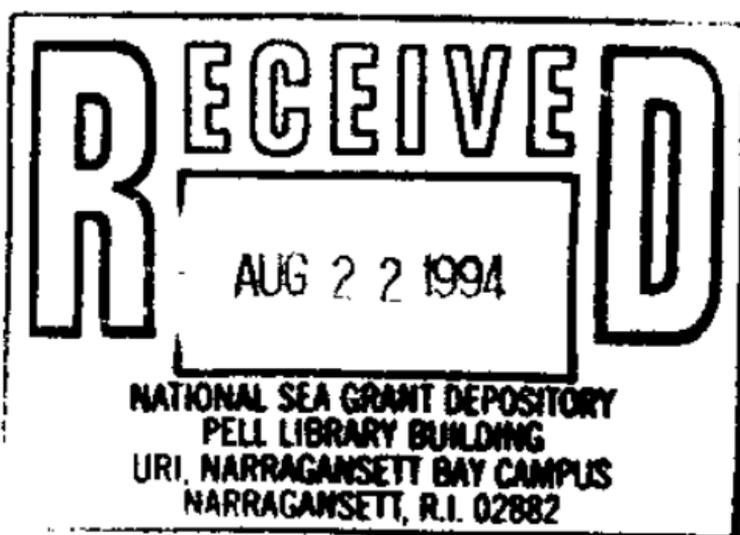
"The Greenhouse Effect: What Can We Do About It?" EPA Journal, Vol. 16 No. 2, March/April 1990.

"What Would It Be Like To Live In A World Where The Sun Was Dangerous?"
UNIHI-SEAGRANT-AB-92-01, University of Hawaii.

Additional publications on global warming are available by contacting the Hawaii Global Change Education Project, 1000 Pope Rd., University of Hawaii, Manoa, Honolulu, HI 96822.

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