

Climate Change and Florida

Some call it *global warming*. Others say it's the *greenhouse effect*. Still others think in terms of *sea-level rise*. Many scientists, however, are beginning to use the term *global climate change*. But by whatever name, most scientists now agree that it seems likely that some degree of climate change will be with us and affect our lives over the course of the next century.

Why then is there still a debate over global climate change? In part, it is because of everything we aren't certain of about the likely worldwide changes in climate that lie ahead.

A few things are predictable:

- Because of the increased load of greenhouse gases in the atmosphere, the world is getting warmer, and will continue to warm into the next century.
- A warming world will cause changes in the global weather and rainfall patterns, affecting the world's agriculture.
- In a warmer world, the intensity of storms is likely to increase.
- Sea levels will rise.

The uncertainty creeps in, however, when we ask, "by how much?" And "when?"

What Causes Climate Change?

We are and will be the cause of global climate change. Climate change will result from everyday human activities -- principally the burning of fossil fuels (gasoline, coal, oil and natural gas), in transportation (the family car is a major contributor to the problem), and by industry and agriculture. These activities send carbon dioxide and other greenhouse gases into the atmosphere.

Once there, these gases effectively trap the heat that radiates from the earth -- much like the glass in a greenhouse traps the sun's rays in winter to keep the air inside the greenhouse warm enough for delicate tropical plants. Hence, the *greenhouse effect*.

Of course, there are **natural sources** of greenhouse gases too, and there always have been. They include gases from volcanoes and decaying

vegetation in the world's marshes and swamps, and water vapor from evaporation from the ocean and lakes, and transpiration by plants. But the world's ecosystems are adapted to these natural and, as in the aerosols released by volcanoes, largely temporary -- sources. It is the *extra* greenhouse gases that humans add that are of concern.

What Are the Greenhouse Gases?

There are several, but human activities contribute three important ones: **carbon dioxide** from the use of fossil fuels and the burning of plant material as a result of deforestation; **methane** from drilling for gas, from **decomposition in landfills**, and from animal

wastes; and **nitrous oxide**, also related to the burning of fossil fuels. Carbon dioxide and methane are by far the most important. Others include the Chlorofluorocarbons and some of their substitutes.



The Effects of Climate Change

The Earth is already warming. Over the past century, scientists have recorded a gradual overall warming of the earth by one degree Centigrade. And the 1990s are the warmest decade in recorded history. In fact, 1998 was the warmest year on record. Climate models indicate the likelihood that temperatures may rise between 1.5 and 4.5 degrees Centigrade over the next 100 years.

That range of temperatures, however, clearly indicates the amount of uncertainty still associated with the modeling of global climate. (For comparison's sake, the global surface temperature of the Earth during the last ice ages -- some 18,000 years ago -- was only 5 degrees Centigrade lower than it is today. Even a slight change in worldwide temperature may have significant effects.)

Other recent evidence of a changing climate includes:

- A study by **Boston University** and **NASA** scientists that shows that plant growth in northern latitudes has increased by about 10 percent,

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- Related studies by scientists at **Scripps Institute of Oceanography** that indicate that temperate-zone growing seasons are lengthening every year,

- **Ohio State University** research showing that alpine glaciers are melting at “a phenomenal rate.” One, a glacier high in the Peruvian Andes, is melting at a rate of 30 meters (99 feet) a year,

- **Ice shelves** on both sides of the of the Antarctic Peninsula have been retreating since the middle of this century. Dramatic retreats have been observed in the Wordie and northern-most Larsen ice shelves, and significant reductions in size are now seen in the Wilkins, and George VI ice shelves. This retreat is coincident with a Peninsula-wide increase in air temperature of about 2.5 degrees C.¹

- **The freezing level in the Earth’s atmosphere**--the height where the air temperature reaches zero degrees Centigrade--has been gaining altitude since 1970, at a rate of 4.5 meters (nearly five feet) a year,

- In California, the Edith’s checkerspot butterfly is being driven north to escape rising temperatures, and

- A small but steady rise in sea levels over the last century.

A warming earth causes the sea to rise in two ways: most importantly through **thermal expansion** of ocean water, but also through the **shrinking of ice caps and mountain glaciers**.

Scientists have recorded a rise in sea levels of perhaps 6 inches (15 centimeters) over the last century. If the predicted warming occurs, sea level may rise by another 20 cm (8 inches) by 2030.

According to the U.S. Global Change Research Information Office (GCRI), “*an increase in the earth’s average temperature of about 3.5 degrees Fahrenheit, which is probably too little to melt most polar ice, would result in an increase in sea level of between 8 and 30 inches. This is too little to flood most coastal cities, but could damage some coastal plants and animals, beaches, and water supplies. . . . (and) higher sea level would mean that (storm surge from) hurricanes and similar large storms could do more damage than in the past.*”

For Florida, rising seas could mean the drowning of **coral reefs**, and other coastal ecosystems, such as **mangrove swamps** and **coastal marshes**, as well as the **intrusion** of salt water into our drinking water aquifers.

Climate change also could affect agriculture, bringing heat waves and drought to some areas, rain and flooding to others. On the other hand, fewer frosts and warmer weather might extend the growing season for other areas of the world, possibly resulting in improved agricultural yields. But will that offset the losses in areas that suffer from increased drought? We still can’t make those kinds of exact predictions.

Global precipitation trends between 1900 and 1994 reveal a general tendency toward more precipitation at higher latitudes (north and south toward the poles) and less precipitation at lower ones (a wide band around the equator). Florida, perhaps because it is a peninsula surrounded by water, has shown little change.

Some climate models predict a greater frequency and perhaps severity of tropical cyclones--hurricanes. We’ve recently seen a few years of higher-than-usual hurricane activity. Is that because of global climate change? Some scientists suspect it may be so.

Health experts worry that warmer temperatures also could mean the introduction of tropical disease into the northern hemisphere. Warmer, humid weather, they reason, would increase the range of disease-carrying mosquitoes, which then would reach human populations that have no natural defenses against such illnesses as malaria or dengue fever.

So, Can We Be Certain?

The United Nations’ Intergovernmental Panel on Climate Change (IPCC) concluded in its *Second Assessment Report* (1995) that “*humans are changing the global climate. The balance of evidence suggests a discernible human influence on global climate.*” The report projected a temperature change between 1990 and 2100 of between 1.8 to 6.3 degrees F., which, in any case, “*. . . would probably be greater than any seen in the last 10,000 years. . . .*”

So, while most scientists believe that man-made greenhouse gas emissions are changing the climate, they are less sure about the details, particularly about the speed of the change or exactly when it will occur.

Many factors complicate the issue. One complicating factor is *feedback mechanisms*--processes which act to modify the response of a system to change. Some feedbacks increase the

potential for global warming, while others decrease it.

Two examples of feedback:

- **Warmer temperatures** increase evaporation -- putting more water vapor in the atmosphere. Water vapor is a major natural greenhouse gas, so this might *add* to global warming. On the other hand, more water vapor probably means more clouds, which might reflect more solar radiation back into space, *reducing* warming; or the clouds could reflect more radiated heat back to earth, *increasing* warming.

- **As the planet warms**, ice and snow will melt in some regions, exposing a darker underlying surface, either water or land. This darker surface will absorb more heat, increasing the warming. However, warmer temperatures would evaporate more water vapor into the air, possibly increasing snowfall in northern latitudes and Antarctica and reflecting more heat back into space, reducing sea-level rise, and possibly, warming.

With All the Uncertainty, Should We Be Concerned?

The IPCC, and two thousand of the nation's top economists -- including six Nobel Laureates -- say we should be. In a statement issued in early 1977, the economists stated that *"a distinguished international panel of scientists . . . has determined that 'the balance of the evidence suggests a discernible human influence on global climate.' As economists, we believe that global climate change carries with it significant environmental, economic, social, and geopolitical risks, and that preventative steps are justified."*

The economists pointed out that *"there are many potential policies to reduce greenhouse gas emissions for which the total benefits outweigh the total costs. For the United States . . . sound economic analysis shows that there are policy options that would slow climate change without harming American living standards . . . (and which) may in fact improve U.S. productivity in the long run."*²

Florida, with its low coastlines -- especially in its populous southeast and western coasts -- and susceptibility to tropical storms and hurricanes, is among the most vulnerable of U.S. states.

Scientists and others point out that if we wait to act until we are certain that warming is occurring, it will be too late. Global warming is not something that can be switched off and on like a thermostat. Greenhouse gases -- such as carbon dioxide, the most important one -- are persistent, and remain in the atmosphere for centuries.

What Is Being Done About Global Climate Change?

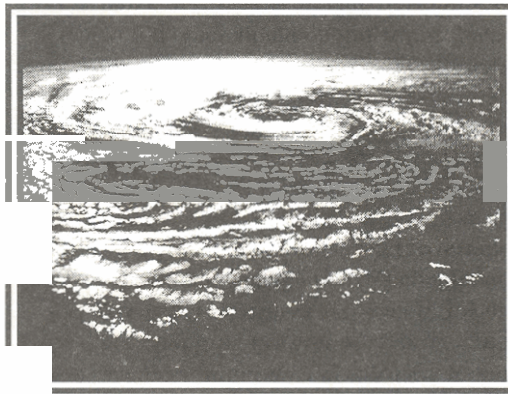
This educational leaflet (and others by other organizations) is one thing. But, more significantly, there is an international effort underway to put brakes on the causes of global warming. The *United Nations Framework Convention on Climate Change* is a binding international agreement, signed by 165 countries of the world, that has an ultimate aim to stabilize *"greenhouse gas concentrations . . . at a level that would prevent dangerous anthropogenic (man-made) interference with the climate system."* The United States is a signatory to the Convention.

Developed countries, especially, are expected to take measures that would limit emissions of carbon dioxide and other greenhouse gases, with the goal to return to the 1990 emissions levels by the year 2000. A number of observers have noted that it is unlikely that many countries (including the U.S.) will meet this goal.

The U.S. Climate Change Action Plan relies primarily on voluntary *"partnerships with the private sector, states and*

localities to address the challenge of global warming while strengthening the economy." Programs include the U.S. EPA's *Energy Star* program for energy-efficient, and low-pollution, appliances (supported in Florida by Florida Power Corp.), the EPA *Green Lights* program, The Department of Energy's *Efficiency and Renewable Energy Network*, aimed at research and development on renewable sources of energy (solar, photovoltaic, etc.) and various waste reduction and recycling programs.

In January, the U.S. presented the Convention with a broad proposal aimed at development of *emissions targets* for signatory countries, along with development of procedures for reporting and



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compliance. The U.S. proposal calls for an international *emissions trading* program and programs that take into account the needs of developing countries.

In Florida, energy conservation and energy efficiency standards for buildings and appliances are found in Chapter 553, Florida Statutes, and are implemented by the Department of Community Affairs' Energy Policy Office.

What Can I Do About Global Climate Change?

You Can Start At Home ³

- Plant a couple of additional trees around your home. **CO₂ reduction = 20 lbs/year.**

- Use a push mower to cut your lawn instead of a power mower. **CO₂ reduction = 80 lbs/year.**

- Replace your home's refrigerator with a high-efficiency model. **CO₂ reduction = 220 lbs/year.**

Buy food and other products with reusable or recyclable packaging instead of those in nonrecyclable packaging. **CO₂ reduction = 230 lbs/year.**

Replace your current washing machine with a low-energy, low-water-use machine. **CO₂ reduction = 440 lbs/year.**

- Install a solar thermal system to help provide your hot water. **CO₂ reduction = 720 lbs/year.**

Recycle all of your home's waste newsprint, cardboard, glass, and metal. **CO₂ reduction = 850 lbs/year.**

Leave your car at home two days a week (walk, bike, or take the bus or transit to work instead). **CO₂ reduction = 1,590 lbs/year.**

Insulate your home, tune up your furnace, and install energy-efficient shower heads. **CO₂ reduction = 2,480 lbs/year.**

And the number one thing you can is . . .

Purchase a fuel-efficient car (rated at 32 mpg or more) to replace your most frequently used automobile. **CO₂ reduction = 5,600 lbs/year**

If your family did all this, *you* could cut CO₂ emissions by more than **11,000 pounds each year!**

More Information

The Internet's World Wide Web: The World Wide Web is the best source for up-to-date information on scientific research on climate change, the current status of U.S. and international

climate change efforts, and the activities of other environmental organizations which are interested in the issue. There are dozens of climate change-related web sites. A few that were used in preparation of this leaflet are:

- **U.S. Environmental Protection Agency**
<http://www.epa.gov/globalwarming/home.htm>
containing useful information on U.S. efforts to curb global climate change.

- **GCRIO** - <http://www.gcrio.org/> - an excellent source for up-to-date information about climate change.

- **UNEP** (United Nations Environment Programme) <http://www.unep.ch/>

- **Global Warming Fact Sheets** -- A wealth of information on climate change, including the science, economics and diplomatic sides (more than 90 quite readable fact sheets from the UN's IUCC) <http://www.unep.ch/iucc/fs-index.html>

Print References:

The Coming Climate, Scientific American, May, 1997.

The Rising Seas, Scientific American, March, 1997.

Notes:

¹ See: http://student-www.uchicago.edu/users/chulbe/science/larsen/larsen_weakice.html

² February 13, 1997

³ U.S. EPA and City of Portland Energy Office

