Studies May Alter Insights Into Global Warming

By CURT SUPLEE
Washington Post Staff Writer

Two new studies of the Earth's ancient atmosphere may alter the way scientists understand the relationship between airborne carbon dioxide and climate change—and hence the dynamics of future "greenhouse" global warming.

In one paper, published in the March 11 issue of the journal Nature, researchers said they found that during the past 11,000 years—the period known as the Holocene epoch that began around the end of the last ice age and extends to the present—levels of carbon dioxide, a potent greenhouse gas, did not remain constant until the onset of the industrial revolution, as many had long supposed.

Instead, although average global temperatures stayed relatively stable, carbon dioxide levels fluctuated considerably during the Holocene, according to a team from the Scripps Institution of Oceanography and the University of Bern, Switzerland. "The system was never in equilibrium because the carbon dioxide levels never stabilized," said Martin Wahlen of Scripps, part of the University of California at San Diego.

Presumably this occurred because of still-unexplained changes in the amount of carbon dioxide taken up by oceans and vegetation, especially short-term variations of 10 percent or more in the quantity absorbed by plants. "This suggests that the terrestrial biosphere may also exhibit changes in the future," said Thomas F. Stocker of the University of Bern. What they might be, however, is uncertain.

In the other study, reported in the March 12 issue of the journal Science, Scripps investigators addressed one of the most vexing "chicken-and-egg" questions in climate research. Namely, when the Earth shifts from glacial to warm periods (as it does every 100,000 years or so), which comes first: an increase in atmospheric carbon dioxide levels, or an increase in global temperature? Contrary to what many believe, the team concluded that the temperature rise comes first, followed by a carbon dioxide boost 400 to 1,000 years later.

That's what the researchers found at glacial-interglacial transitions from 240,000, 140,000 and 13,000 years ago. That sequence of events appears to contradict the fundamental logic of simple greenhouse warming theories, which argue that increases in heat-trapping gases will be followed by higher surface temperatures.

The analysis also points to vegetation as a major source of the carbon spike. "Previously it was thought to have originated primarily in the ocean biosphere," said Julie Palais of the National Science Foundation, which supported both studies. "But this work suggests that the terrestrial biosphere played a significant role. . . . There are clearly implications for the future, considering the rate at which the rain forests in South America are currently being destroyed."

Both research projects used evidence from hundreds of ice specimens, or "cores," taken far below the surface of Antarctica. Each layer contains tiny bubbles of air snared in the ice when it formed from snow. Investigators placed the samples in vacuum chambers, released the traces of air, and analyzed them for carbon dioxide content and an isotope of carbon that indicates where the gas was last.

Carbon, a ubiquitous element in the Earth's surface and atmosphere, exists in three isotopes. Photosynthesis, the process whereby plants use sunlight to turn carbon dioxide into organic matter, favors the uptake of the lightest, carbon-12 atom, leaving the atmosphere with a relative plenitude of carbon-13, the next heaviest isotope. When plants die and rot, they release that carbon-12 back into the atmosphere. So the ratio between the two isotopes at any time indicates how much carbon dioxide is being absorbed by plants.

That quantity may be critical to future climate changes. In general, civilization releases about 6 billion tons of carbon (in the form of carbon dioxide) into the atmosphere every year. But only 3 billion tons stay there; the rest is absorbed into what are called carbon "sinks." Half dissolves into the ocean; the remainder ostensibly is taken up by vegetation. Consequently, the performance of these sinks is an important variable in how much carbon dioxide is left in the air to trap heat and possibly raise global temperatures.

The Scripps-Bern authors writing in Nature found that at the beginning of the Holocene, the atmosphere contained about 268 parts per million by volume of carbon dioxide, up from 180 to 200 ppmv in the depths of the last ice age about 18,000 years ago. By the late 1700s, it had risen to 285 ppmv. (Since then, the concentration has climbed to 364 ppmv and is still growing. That is, it rose by the same amount—80 ppmv—in the past 200 years that it had from the coldest part of the previous ice age to the late 1700s.)

In accordance with orthodox notions, "one commonly referred to the 'preindustrial CO_2 concentration of 280 ppmv,' " as if it were constant, Stocker said. But now "this has to be revised," he noted.

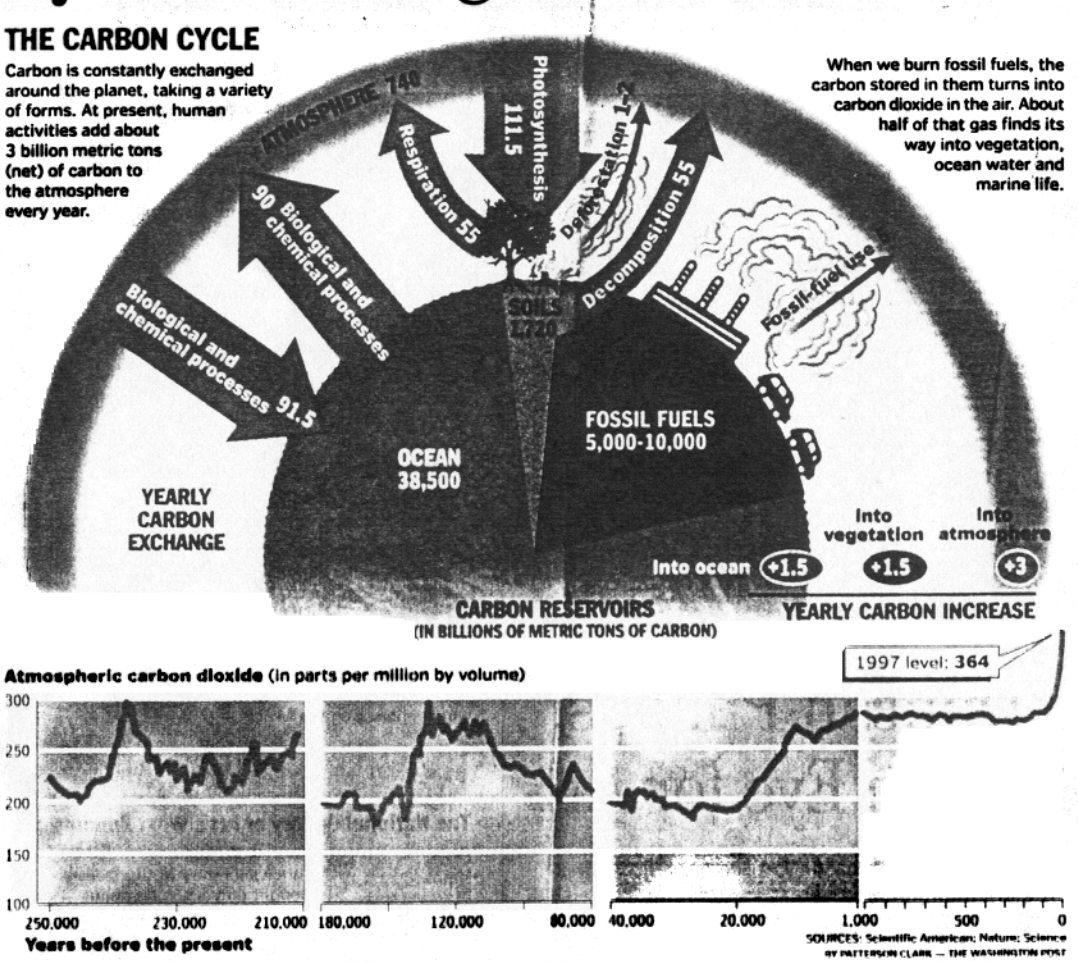
As the world warmed its way out of the last ice age, carbon dioxide levels first dipped to 260 ppmv about 8,200 years ago, probably because receding glaciers made way for the increasing vegetation that took up a lot of gas. But then the carbon dioxide content began to creep back up as ocean temperatures rose (decreasing the amount of dissolved gas oceans could hold) and land masses cooled and dried out (decreasing the carbon-trapping activity of photosynthesis).

"The direct relevance of this finding," said Jean Lynch-Stieglitz of Lamont-Doherty Earth Observatory at Columbia University, "is that we can expect that as climate warms, the terrestrial biosphere will probably be capable of holding more carbon than it can today."

But uncertainty is high. Over the past few thousand years, there have been dramatically abnormal climate events. But "none of those involved a rate of CO_2 change like that occurring now," said Lamont-Doherty's Gerard Bond, and that "is a measure of how serious the problem might be."

As for the carbon dioxide lag-time findings, "the crux of the issue" for nonscientists is that "if the observation that increases in temperature lead increases in CO_2 in the natural system, then industrialization is forcing the natural system backwards, and our natural analogs deduced from past behavior might not be good models for predicting what's going to happen in the future," said Joan J. Fitzpatrick, technical director of the U.S. Geological Survey's National Ice Core Laboratory in Denver. "That's a sobering thought."

Indeed, despite the sizable margin of possible error in the analysis, "greenhouse skeptics will probably jump on this paper as 'proof' " that there is no necessary causal relation between carbon dioxide levels and temperatures, said Anthony J. Broccoli of the National Oceanic and Atmospheric Administration's Geophysical Fluid Dynamics Laboratory in Princeton, N.J. But in fact, he said, the new findings are completely consistent with a "positive CO_2-temperature feedback" system in which changes in one prompt changes in the other.



Washington

Ex-Clinton aides admit Kyoto treaty flawed

Climate pact costlier than they thought

By Jonathan Weisman
USA TODAY

WASHINGTON — As President Bush headed off Monday to face environmental critics in Europe, he fired a parting shot at the global warming treaty he has rejected. He called the Kyoto Protocol unrealistic, costly and "fatally flawed."

In that assessment, he has some unexpected supporters: Clinton administration experts.

Economists from the Clinton White House now concede that complying with Kyoto's mandatory reductions in greenhouse gases would be difficult — and more expensive to American consumers than they thought when they were in charge.

That reassessment helped fuel Bush's decision to reject the Kyoto treaty, said Lawrence Lindsey, the president's economic adviser. Instead of embracing binding limits on greenhouse gases, Bush pledged on Monday a modest package of actions to combat global warming. They include a research initiative to fill gaps in scientists' understanding of climate change and increased use of renewable energy. But he didn't call for new money.

"America's unwillingness to embrace a flawed treaty should not be read by our friends and allies as any abdication of responsibility," said Bush, who is expected to hear vociferous complaints about his approach during his five-nation tour of Europe. Bush said the treaty would harm the economy and exclude China, the world's second-biggest producer of greenhouse gases after the USA.

The treaty, negotiated in Kyoto, Japan, in 1997, aimed to combat emissions of carbon dioxide and other gases that most scientists believe trap heat in the atmosphere. The treaty required the United States to reduce its emissions by 2012 to 7% below its 1990 levels.

At the time, the Clinton White House estimated that the cost of reaching that target was relatively low: about $7 billion to $12 billion a year starting in 2008, when binding reductions would begin phasing in. An average household's energy bills would rise $70-$110 a year, and gasoline prices would inch up no more than 6 cents a gallon, the White House said.

Other government cost estimates were far higher. The Department of Energy estimated that gasoline prices would have to rise 66 cents a gallon — or 53% over a projected 2010 price — to meet Kyoto's emissions targets.

To keep his cost estimates down, President Clinton envisioned an emissions-trading system in which countries unable to meet the greenhouse-gas reduction targets would get credits for helping other nations exceed the standards. The idea was that when all the treaty's members averaged out their emissions, the world's total output would meet a global target.

For example: If the United States wanted to emit more carbon dioxide one year, it could help Russia get below its emissions standard by paying high-polluting Russian industries to adopt technologies to clean up their dirty plants.

Clinton administration economists say that, in retrospect, their low cost estimates were unrealistic. They assumed that:

- China and India would accept binding emission limits and would fully participate in the emissions-trading system, even though they never signed the treaty.
- European opposition to emissions trading could be overcome.
- Most industries and consumers would quickly adopt new, energy-efficient technologies, such as advanced air conditioning systems and gas-electric "hybrid" cars, without financial incentives.

Since 1997, however, it has become clear that consumers love their gas-guzzling sport-utility vehicles and aren't embracing energy-efficient technologies; China has no intention of participating in the treaty; and Europe still wants to limit emissions trading as a partial solution to global warming.

Todd Stern, Clinton's global warming coordinator, says that the Europeans would likely go along with an unlimited trading system if the Bush administration would return to the negotiating table to produce a revised treaty it could sign. However, he concedes that China won't participate for now.

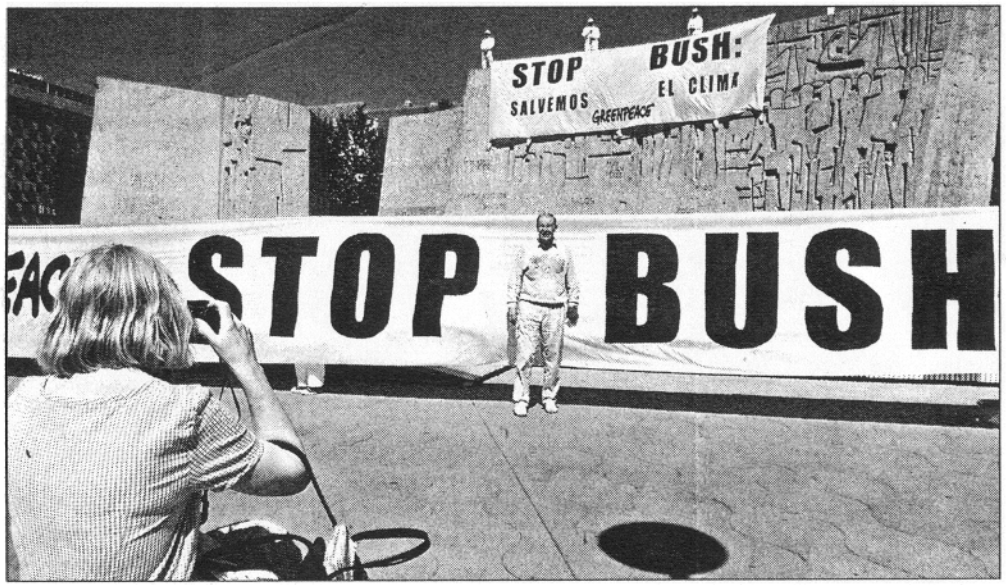
Leaving China out of a trading scheme would double the Clinton cost estimate, says Joseph Aldy, who helped develop the estimates for Clinton. "We always thought the (emissions) targets were very ambitious," he says. "But the thing that made us really uneasy about our analysis . . . was that if our assumptions didn't come true, you could come out with costs that were much, much higher."

Another problem is that energy-efficiency breakthroughs have stalled as governments argue over the treaty, says a supporter of the treaty. "As the clock ticks, this becomes a more and more difficult job," says Kathleen McGinty, who chaired Clinton's Council on Environmental Quality.

Even so, Clinton economists say, Bush could have tried to revise the treaty to reflect these new realities. By simply walking away from it, he is letting the Europeans portray the United States as the villain, even though they privately admit that they, too, may be unable to comply with the treaty. "George Bush has done all the work for the Europeans," says Robert Lawrence, a Clinton administration economist now at Harvard University's Kennedy School of Government.

Lindsey, however, insists that the Kyoto Protocol is beyond repair. "The models are not even close in suggesting Kyoto was the right approach," he says. "It was wrong. I think we did the right thing."

Contributing: Laurence McQuillan and Traci Watson



By Christophe Simon, Agence France-Presse

"Save the climate": A tourist poses by protest banners in Madrid, Spain, which President Bush visits today.

Sun too close? We'll just change Earth's orbit

By Dan Vergano
USA TODAY

Anyone worried about the sun frying Earth sometime in the next billion years can rest easy: Astronomers have devised a way to move our planet to a safer orbit.

In a paper accepted by the journal *Astrophysics and Space Science*, planetary scientist Don Korycansky of the University of California-Santa Cruz and colleagues detail a plan to remove Earth from its current orbit to a cooler one using "gravitational slingshot" tugs provided by massive asteroids or comets redirected to pass nearby.

"Large-scale planetary engineering is possible with technical procedures we know about now," Korycansky says.

The researchers say mankind will need a scheme like this to save Earth's atmosphere from the heat of the sun, predicted to grow 11% hotter over the next 1.1 billion years.

The plan would entail sticking a fusion-powered rocket or solar sail on a 62-mile-wide asteroid, or comet, to nudge it out of orbit — a simple "engineering problem," Korycansky says. While not plentiful, such sizable objects do dwell in the Kuiper Belt region of icy bodies orbiting in the region of Pluto.

The plan would have the asteroid give Earth a gravity tug as it passes by. Then the asteroid would slingshot around the sun and loop around Jupiter for another return trip past Earth. Each round trip would last 6,000 years.

Over millions of years, the gravity assists would pull the planet from 93 million miles away from the sun — too close — to a comfy 140 million-mile orbit, Korycansky estimates.

By Sam Ward, USA TODAY

However, he and his colleagues note a few drawbacks:

- We may lose the moon.
- The gravity tugs might spin Earth faster, shortening a day to a few hours.
- Mars and Venus apparently need Earth to stay in their orbits.
- The scheme might pull Jupiter 10 million miles closer to the sun, disturbing the asteroid belt and sending more rocks hurtling onto our planet.
- A miscalculation might send the 62-mile-wide asteroid slamming into Earth, which "would sterilize the biosphere most effectively, at least to the level of bacteria," the astronomers warn.

"Their analysis shows that it works, but I don't think we'd want to do it this way," says astronomer Jack Lissauer of NASA's Ames Research Center in Moffett Field, Calif.

A story about the analysis carried by BBC Online caught the attention of astronomers concerned with ways to deflect asteroids aimed at the Earth. A gravity slingshot may represent one way to handle such hazards, Lissauer suggests.

"If we don't destroy ourselves, we have a billion years to figure this one out," he adds. "Who knows what technology we will have in just 1,000 years?"

In the final analysis, he compares the planet-moving scheme to primitives figuring out a way to build the Golden Gate Bridge out of rope. "We could do it, but who'd want to?"

Satellite study shows ice shrinkage

Associated Press

WASHINGTON — Scientists have worried for decades that the Antarctic ice sheet was shrinking, threatening a global rise in sea level. Now, satellite studies show that about 7.5 cubic miles of ice have eroded from a key area in just eight years.

Melting of that much ice doesn't mean that it is time to get into boats, said one researcher, but the finding may be a "yellow warning flag" that confirms long-term changes are under way in the ice fields covering the south polar region.

The study, which appears today in the journal *Science*, involved altitude measurements of the West Antarctica Ice Sheet, the smaller of two major ice sheets. It covers 740,000 square miles of the frozen continent.

Based on satellite measurements, said Andrew Shepherd, a University College London geologist and first author of the study, it appears that since 1992 the ice sheet has lost ice principally through the speeded-up movement of the Pine Island Glacier, an ice stream that drains about a third of the ice sheet.

Melting of the entire sheet theoretically could cause a global sea level rise of 25 to 45 feet, but Shepherd said that at the present rate of change it would take centuries for the Pine Island Glacier, which is only about 10 percent of the ice sheet, to affect sea level seriously.

Global warming is accelerating, scientists report

By Traci Watson
USA TODAY

By 2100, global warming could raise the average temperature of the Earth as much as 10 degrees more than the average temperature in 1990, according to a U.N.-sponsored panel of hundreds of scientists.

The estimate is substantially higher than the maximum temperature rise of 6 degrees predicted in the 1995 edition of the United Nations report and will renew debate over what causes global warming and how to address it.

The report goes further than the 1995 edition in tying humans to the warming of the planet. It says "it is likely" that gases produced by human activity "have contributed substantially" to the warming seen so far. The report defines "likely" as a chance of 66%-99%.

"It is indeed a much stronger statement" than five years ago, said Kevin Trenberth of the National Center for Atmospheric Research. The 1995 report said most of the evidence "suggests a discernible human influence on climate."

The Earth has warmed about 1 degree in the past 100 years. Many scientists believe that part of the cause is a buildup of greenhouse gases. These gases, emitted by factories and fossil-fuel use, linger in the atmosphere and trap heat.

However, a minority of scientists say there is no proof that the warming of the 20th century is anything but natural, and they argue that the computer models used to predict climate change are not reliable.

The new report, a draft summary prepared by the United Nations' Intergovernmental Panel on Climate Change, was being circulated for review to scientists this week.

The report says that the Earth could warm 2.5 to 10.4 degrees by 2100, compared with the 1.8 to 6.3 degrees estimated in the 1995 report.

Scientists say that the new estimates are higher partly because they assume developing nations will cut emissions of sulfur, an air pollutant that causes health problems and haze. Sulfur in the atmosphere cools the Earth.

Most nations, including the United States, have not ratified a 1997 treaty intended to slow global warming.

A spokesman for Al Gore said the report shows that climate change will be an important issue for the next president. A spokesman for George W. Bush said the Texas governor believes more research is needed.

The Nation

U.N. study: Global warming has effects now

By Traci Watson
USA TODAY

Global warming is already having clear effects on animals, birds, glaciers and other features of the natural world, says a report out today from a U.N.-sponsored panel of scientists and other technical experts.

The evidence shows "there is high confidence" that the recent rise in the Earth's temperature has had "discernable impacts on many physical and biological systems," the scientists wrote. "High confidence" means there's a 67% to 95% chance the statement is true.

Changes noted in the USA:

▸ Tree swallows are building nests earlier in the year.

▸ A western species of butterfly is moving farther up the West Coast and higher up mountainsides.

▸ Flowers in Wisconsin are budding earlier in the spring.

As the planet warms even more, the report says, humans, too, are likely to feel the heat. Countries in southern Africa are likely to have even less fresh water. Farming in the Midwestern USA will probably suffer. Higher sea levels and more intense cyclones are likely to displace millions of people in Asia.

A report released in January by the same panel said the average surface temperature of the Earth rose 1 degree during the 20th century and could rise 2.6 to 10.4 degrees from 1990 to 2100.

The January report said it's likely that "most" of the warming since the 1950s is "due to the increase in greenhouse gas concentrations."

Greenhouse gases, which have built up to unnaturally high levels in the Earth's atmosphere, trap heat. They include carbon dioxide, which is emitted when fossil fuels are burned, and other gases produced by human activity.

The sponsor of both reports, the United Nation's Intergovernmental Panel on Climate Change, carries enormous weight with governments around the world. Previous editions of the report, which is produced every five years, have often been cited at the international negotiations over a treaty to control global warming.

More than 160 nations agreed to such a treaty, called the Kyoto Protocol, in 1997. However, talks over the treaty collapsed in December.

Those talks are to resume this summer, but President Bush said on the campaign trail that he opposes the Kyoto Protocol. His administration has yet to fill positions key to directing global-warming policy.

Environmentalists hope the new findings will coax the White House into taking a strong stance on global warming. "I hope they really study this report," said Jennifer Morgan of the World Wildlife Fund.

Some scientists argue the planet may be warming naturally. The new report doesn't touch on that argument, nor does it explicitly tie the changes in natural patterns to warming caused by humans.

However, several scientists said it's not hard to connect the dots.

Others criticized the newer report for relying on what they say are simplistic estimates of how much the Earth will warm.

"No one says we can predict the weather next year," says Roger Pielke Sr., an atmospheric scientist at Colorado State University. "So why do we think we have better skills for 50 years in the future?"

A lack of consensus on global warming

PETE DU PONT

The Clinton Administration recently unveiled the latest monster to lumber from the capital to terrorize the nation: a global climate change treaty intended to cut greenhouse gas emissions. The tragic flaw in this monster, like Dr. Frankenstein's creation, is its reliance on faulty and overreaching science. The treaty will not produce the benefits touted by its creators.

Though ground-level temperature measurements suggest the Earth has warmed between 0.3 and 0.6 degrees Celsius since 1850, data from global satellites and weather balloons, the most reliable of climate measurements, show no evidence of warming during the past 19 years. While increased carbon dioxide (CO_2) from human energy use is alleged to be the primary culprit behind the surface warming, the fact is most of the measured warming occurred before 1940, which predates the vast majority of CO_2 emissions.

Another difficulty for global warming prognosticators: Why should people believe the apocalyptic projections of climate models when the models don't reflect past climate conditions closely, or even track current climate conditions very well?

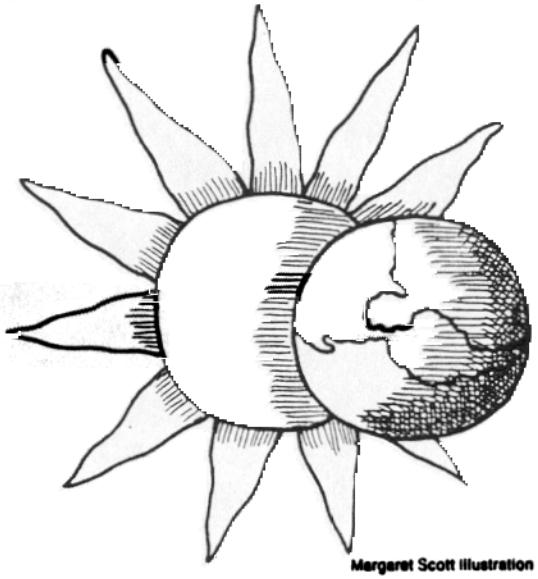
A 1997 poll conducted by American Viewpoint Inc. for Citizens for a Sound Economy demonstrates that climate experts reject climate change certainty. American Viewpoint polled 48 state climatologists about the likelihood of global warming. Their answers show that there simply is no scientific consensus that humans are causing global warming.

Eighty-six percent of state climatologists concluded that current computer models were not accurate and should not be trusted to predict future climate trends.

Eighty-nine percent agreed that past temperature changes have been large and abrupt without any human influence, and 100 percent agreed that even absent humans, the earth's climate would be constantly changing.

Clinton's response to the global warming bogeyman is to try to trick the public into believing that only immediate action can prevent threatened warming and to trick environmentalists into believing that the actions he has proposed will prevent climate change.

According to advocates of the theory that humans are causing catastrophic climate change, immediate government action is not necessarily warranted. A 1995 analysis by climatologists T.M.L. Wigley, R. Richels and J.A. Edmonds concluded that the world's governments could wait up to 25 years to take action with no appreciable negative effect on the environment. They found that governments can cut emissions now to approximately 9 billion tons per year or wait until 2020 and cut emissions by 12 billion tons per year with about the same effect. Delaying action until 2020 would yield only an insignificant temperature rise of 0.2 degrees Celsius by 2100.



Margaret Scott illustration

In short, the government has time to gather more data, and industry has time to devise new ways of lessening greenhouse gas emissions without disrupting economic progress. Even if immediate action were necessary to prevent future warming, Clinton's proposals will not do the job.

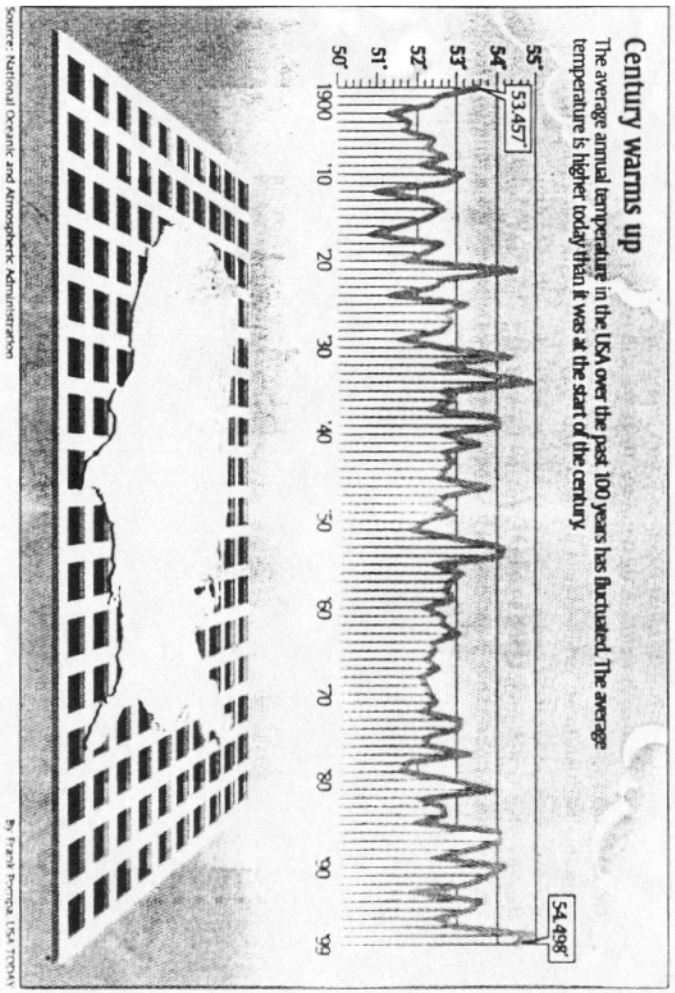
First, because of a prior agreement, developing countries will not have to make cuts in their greenhouse gas emissions. Yet according to the International Energy Agency, as much as 85 percent of the projected increase in carbon dioxide emissions will come from developing countries.

Second, climate change experts argue that the cuts proposed by the Clinton administration — to 1990 levels by 2012 — will be far too small to have any appreciable effect on the global climate. Indeed, more than 70 percent of state climatologists agreed that CO_2 levels would continue to rise regardless of human actions to curb emissions.

In summary, while there is no scientific consensus that humans are causing global warming, there is consensus both that the United States could delay acting for many years without causing environmental harm and that the Clinton administration's treaty proposals would not halt warming even if it were occurring.

Du Pont is policy chairman of the National Center for Policy Analysis based in Dallas, Texas

USA TODAY weather focus



File photo by Wilfredo Lee, AP

Campaigning in Saginaw, Mich.: George W. Bush stumbled over a pledge to cut power plant emissions.

CO_2 puts heat on Bush

Emissions reversal sets up quandary for White House

By Mimi Hall
USA TODAY

WASHINGTON — It was a throwaway line in a fall campaign speech — and after he delivered it, candidate George W. Bush asked one of his domestic policy aides why the line was in there in the first place.

"We have to talk about that," he said to the aide.

But in the fast-paced atmosphere of the race for the White House, Bush's promise to seek reductions in carbon dioxide emissions at power plants was simply forgotten. The campaign and the candidate moved on.

Then Bush became president. Environmentalists concerned about global warning reminded him of his pledge. Coal and oil industry advocates pressured him, warning that emissions reductions would mean higher electricity prices.

Last week, Bush decided to reverse his position. Aides didn't want the issue to fester, so they made a decision: Get the news of Bush's reversal out, take some hits from environmentalists and get the controversy behind them. Tuesday, Bush sent a letter to Republican senators informing them he would not seek reductions in emissions of carbon dioxide, or CO_2.

Now, Bush is facing the political fallout from a decision critics are portraying as evidence he is exactly the kind of man he says he's not: a typical politician who says what voters want to hear on the campaign trail and then fails to make good on his promises.

The questions being debated in Washington are these: Is Bush a political opportunist who is captive to big business? Or is he simply being honest when he says an energy crisis — which has worsened since the campaign — forced him to change his mind?

The White House bets voters will believe the latter.

Bush's promise came in a speech Sept. 29 titled "A Comprehensive National Energy Policy." Near the end, he said: "With the help of Congress, environmental groups and industry, we will require all power plants to meet clear air standards in order to reduce emissions of sulfur dioxide, nitrogen oxide, mercury and carbon dioxide within a reasonable period of time."

"What was that CO_2 line?" Bush, who had stumbled over the words in the speech, asked an adviser.

On Wednesday, spokesman Ari Fleischer told reporters that "including CO_2 as a pollutant" in Bush's speech had been "a mistake."

Karl Rove, Bush's political adviser, says Bush hasn't lost the right to say he'll fulfill his campaign promises, because curbing CO_2 emissions was never one of the six big promises he made over and over: a tax cut, education reform, Social Security reform, restructuring the military, a prescription drug program for poor seniors and a "faith-based" initiative to allow religious groups to use government money for social programs.

"The president ran on six big things, and people know what those six big things are, and he's pursuing them," Rove says.

But Republicans hold only a slim majority in Congress, and to fulfill his promises, Bush needs help from Democratic lawmakers. His decision on CO_2 could make negotiations more difficult.

"The Democrats want to get something done and work in a bipartisan way," says Rep. Nita Lowey, D-N.Y., head of the Democratic Congressional Campaign Committee. She says Democrats already were angered by Bush's decisions to roll back workplace-safety regulations, cut off funding for overseas groups that counsel on abortion and allow a House vote on his tax-cut plan without hearings. The CO_2 decision, she says, is creating more tension: "It certainly doesn't contribute to the civility the president has talked about."

And previewing a likely Democratic theme in the elections of 2002 and 2004, Sen. Harry Reid, D-Nev., recalled a broken promise that helped cost Bush's father re-election. In the future, he says, "Maybe we'll need to read the president's lips more carefully."

Contributing: Judy Keen