ISSUE 18

Are Aggressive International Efforts Needed to Slow Global Warming?

YES: Christopher Flavin, from "Last Tango in Buenos Aires," *World Watch* (November/December 1998)

NO: Jerry Taylor, from "Global Warming: The Anatomy of a Debate," *Vital Speeches of the Day* (March 15, 1998)

ISSUE SUMMARY

YES: Worldwatch Institute vice president Christopher Flavin cites evidence that human-induced global warming has begun. He calls for decisive action based on a new approach to reducing greenhouse gas emissions.

NO: Jerry Taylor, the Cato Institute's natural resource studies director, contends that the uncertainties regarding the likely magnitude and consequences of global warming makes the implementation of an expensive agreement that he believes will have little effect on the future climate an unwise gamble.

The physics of the situation is clear. Sunlight warms the Earth, which radiates that warmth back to space as infrared radiation. Molecules of certain atmospheric gases—including carbon dioxide, water vapor, methane, chlorofluorocarbons, and nitrous oxide—absorb the infrared radiation and reemit it. Some of the reemitted infrared radiation heads back toward Earth, where it adds to the warming of the planet.

If there were no such infrared-absorbing "greenhouse gases" in the atmosphere, the Earth would have an average temperature of approximately 63 degrees Fahrenheit colder than its present average of 59 degrees Fahrenheit. If there were more than the present amounts of greenhouse gases in the atmosphere, more heat would be retained, and here is the crux of the problem. Since the dawn of the industrial age, humans have been burning vast quantities of fossil fuels, releasing the carbon the fuels contain as carbon dioxide. Because of this, some estimate that by the year 2050, the amount of carbon dioxide in the air will be double what it was in 1850. By 1982 the increase was apparent.

See Spencer R. Weart, "The Discovery of the Risk of Global Warming," *Physics Today* (January 1997).

How serious is the warming? Climate is by nature variable, but the 1990s provided several years of record-breaking warmth, and 1998 was the warmest year in the last millennium. A recent analysis of oceanographic records finds that the deep layers of the sea are warming faster than anyone had suspected. Spring is arriving earlier, and growing seasons are lengthening. See Douglas Gantenbein, "The Heat Is On," *Popular Science* (August 1999).

It is difficult to say just how warm it will get, but there is no doubt that atmospheric carbon dioxide and other greenhouse gas levels are rising. Most climatologists agree that the warming will continue but that the factors that shape climate are numerous and interact in complex ways. Consequently, there is uncertainty about the eventual outcome and what it will mean for life on Earth. Expected effects include rising sea levels (a serious hazard for low-lying coastal and island nations); changes in rainfall patterns (of obvious concern to global agriculture); increasing numbers of serious storms; shifts in the climatic zones, which define where forests can thrive; and movement of tropical diseases into temperate regions. The disease prospects are discussed by Paul R. Epstein in "Is Global Warming Harmful to Health?" *Scientific American* (August 2000).

In November 1995 the Intergovernmental Panel on Climate Change (IPCC) issued its second major study on global warming, concluding that "the balance of evidence suggests that there is a discernible human influence on climate." This report predicts that global average temperatures will likely increase by 1.8–6.3 degrees Fahrenheit before the end of the twenty-first century. The IPCC study led the United States to reverse its position and to accept the goals for reducing greenhouse gas emissions that were negotiated as part of the Framework Convention on Climate Change at the 1992 Earth Summit in Rio de Janeiro. However, the United States opposed the stronger actions advocated by other nations at the 1997 meeting in Kyoto, Japan, where a protocol was developed for achieving the goals of that convention, and at the 1998 session in Buenos Aires, Argentina, to work out the means for implementing the protocol.

In the following selection, Christopher Flavin argues that despite broad international agreement that global warming is a problem that warrants prompt global action, very little is actually happening. He calls for decisive action based on an entirely new approach to reducing greenhouse gas accumulations. In the second selection, Jerry Taylor asserts that the evidence supporting the need for global actions to combat greenhouse gas-induced climate change is "shockingly weak" and that proposed actions will not be very effective. Therefore, an expensive international effort would be unwise.

Christopher Flavin

YES

Last Tango in Buenos Aires

The world's climate rarely sends clear signals. The interactions of hundreds of variables—of sunlight, ocean currents, precipitation, fire, volcanic eruptions, topography, and the respiration of living things—produce a complex system that scientists are just beginning to understand, and that defies precise forecasts. In any given year, some regions are warmer than normal while others are cooler. Almost any short-term climatic phenomenon, even an extreme one, can be explained as something that falls within the enormous range of natural climatic variability. Until this year.

Even before 1998 comes to a close, it is clear that this year is one for the meteorological record books. Although annual temperature records have become routine recently—all 14 of the warmest years since 1860 have occurred in the past two decades—the record is usually broken by a couple of hundredths of a degree. But the average temperature for January–August 1998 was a full four tenths of a degree warmer than the average for 1997, the previous record-setting year (see figure). In fact, six of the first eight months of 1998 set an all-time temperature record for the month—exceeding the monthly figures recorded in the 139 years that global average temperatures have been tracked.

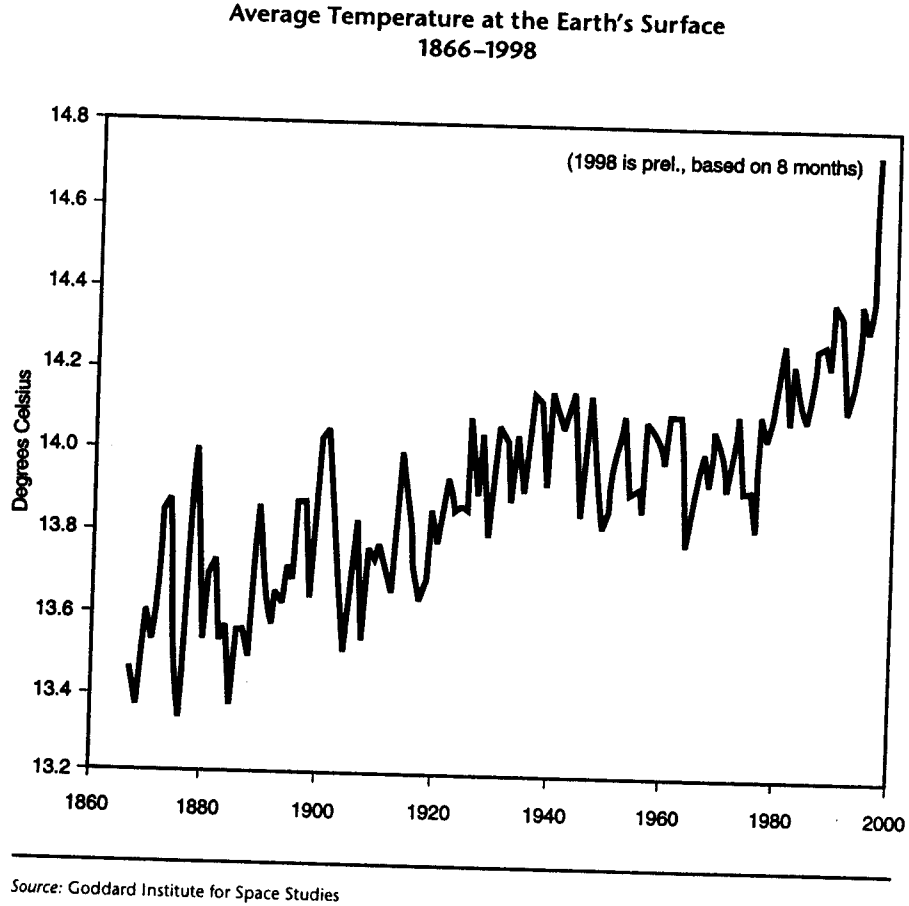
At first, scientists were inclined to attribute these surprising readings to El Niño, a periodic warming of the eastern Pacific that began in 1997 and extended through the first half of 1998. But as they looked back at the historical trend, it became clear that previous El Niño-related warmings had been far more modest. As month after month of record-breaking data spewed from their computers, the atmospheric scientists expressed growing awe. James Baker, administrator of the U.S. National Oceanic and Atmospheric Administration said, "There is no time in recorded data history that we have seen this sequence of record-setting months."

In earlier years, some scientists' concerns about global warming were assuaged by the fact that satellite-based microwave measurements of temperatures high in the atmosphere since 1979 did not appear to reflect the warming trend from ground-based readings. But this slender straw was swept away in August by a report by scientists Frank Wentz and Matthias Schabel that appeared in the British journal *Nature*. It demonstrated that the widely reported satellite data were skewed by the failure to account for the predictable gravity-induced decay

From Christopher Flavin, "Doomsday Every Day: Sustainable Economics, Sustainable Tyranny," *The Independent Review* (November/December 1998).

in the orbits of the satellites. Once corrected for, the satellite data demonstrate the same broad warming trend as the ground-level thermometers—including the dramatic spike in 1998.

Figure 1



Source: Goddard Institute for Space Studies

Scientists have known for some time that the climate is a "non-linear system" that may respond marginally or not at all to initial changes—but then leap suddenly to a new equilibrium, if pushed a little further. Although it is too early to know for sure, the global climate may have just crossed such a threshold. Since the beginning of the twentieth century, human activities have added 925 billion tons of carbon dioxide (CO_2) to the atmosphere, taking concentrations of this heat-trapping gas to the highest levels in 160,000 years. The climate record shows that when CO_2 concentrations reached even close to such levels in

the past—during the Eemian interglacial period, for example, beginning 135,000 years ago—they were accompanied by a rapid rise in temperatures.

Though it is impossible to connect any single weather event to global climate change, the past year has been marked by a worldwide pattern of unusually severe weather. China was swept by its worst floods in three decades last summer, with 56 million people reported to be at least temporarily displaced from their homes in the Yangtze basin alone. The $36 billion in estimated damages matches or exceeds the total weather-related losses for the world in every year prior to 1995. Meanwhile, two-thirds of Bangladesh was under water for most of the summer, as torrential monsoon rains cascaded down from the Himalaya and storm surges came up from the sea, covering much of the capital, Dhaka, and destroying the country's rice crop.

At least 54 other countries were hit by severe floods in 1998, and at least 45 were stricken by droughts, many of which led to runaway wildfires. Tropical forests normally do not burn, but unusually harsh droughts contributed to a series of unprecedented fires in southeast Asia starting in late 1997 and in the Amazon through most of 1998. Last spring, much of southern and central Mexico was aflame, leading to air quality alerts in Texas and noticeably smoky air as far north as Chicago. By early summer, scores of fires were sweeping the sub-tropical forests of Florida, leading to the evacuation of an entire country.

Rarely have the rhythms of the natural world been so out of synch with those of the political world. Even as the climate sent ever-stronger signals of disruption in 1998, efforts to deal with the problem bogged down in glacial and contentious negotiations over the terms of the Kyoto Protocol on climate change.

The effort to build a global climate agreement is in fact already a decade-long saga that began with a major scientific conference on the issue in Toronto in 1988. The scientists there called for a 20 percent cut in carbon dioxide emissions by 2005, which then led to extended efforts on the part of scientists, industrial interest groups, non-governmental organizations, and politicians to forge an international agreement to move in that direction. By the time of the 1992 Earth Summit in Rio de Janeiro, the "Framework" Convention on Climate Change had been forged, but due to the strong objections of the Bush Administration in the United States, still did not include legally binding limits.

After Rio, governments worked for several years to strengthen the climate treaty by adding specific limits on the amounts of greenhouse gases that could be emitted by each industrial country. This process was expected to culminate in the signing of a protocol to the convention that included legally binding emissions limits, in Kyoto, Japan last December. But agreement proved elusive. As the Kyoto conference began, governments were still widely divided on key elements of the agreement, including the overall level to which emissions would be limited. The United States, for example, only wanted to cut emissions back to the 1990 level, while the European Union wanted to cut them to 15 percent below that level.

By the beginning of its final week, the Kyoto conference had become "an emotional roller-coaster for delegates who watched the treaty's fortunes rise, fall, and rise again," according to a *Washington Post* correspondent. Core elements of the treaty remained unresolved, ranging from the level of emission cuts to be mandated to whether planting or protecting trees could be counted against those emission commitments.

With the negotiations bogged down, U. S. Vice President Al Gore, who had devoted much of his 1992 book *Earth in the Balance* to the problem of climate change, was dispatched to Kyoto. Soon after his arrival, the U. S. delegation shifted its position on emission limits and agreed to reduce its emissions 7 percent from 1990 levels—roughly half way between the U. S. and European positions. But on the evening of December 10, as the deadline for concluding the historic conference came and went, other unresolved issues remained—some of which would determine the significance of the numbers that had been agreed to. Raul Estrada Oyuela, the Argentine Chair of the conference, who had been working behind the scenes for months to forge essential compromises, refused to give up. He ordered the "committee of the whole," composed of all 159 national delegations, to re-convene at 1 am, and meet until a conclusion was reached.

Through the wee hours of December 11, Estrada methodically moved the assembled delegates through the remaining passages of disputed text: whether trading of emissions commitments would be permitted among industrial countries, and whether developing countries would be encouraged to adopt voluntary commitments.

As discussions seesawed back and forth, oil producers like Kuwait did their best to derail the agreement, while European and small island countries worked to strengthen it. But the main axis of the battle soon formed around China and the United States, the two largest emitters, who were deeply divided both on trading and on the question of developing country commitments. As positions hardened, hope of an agreement began to fade.

The U. S. delegation, which had brought Under-secretary of State Staurt Eizenstat in from Washington to be its "closer," became so panicky at one point that delegates were standing on their table, waving for Estrada's attention in the huge hall. Given the vice president's close identification with the issue, the Clinton-Gore Administration could not afford to be found holding the noose if the Kyoto agreement was strangled.

As dawn approached, the Kyoto conference hall was beginning to resemble a week-old battlefield. Bleary-eyed reporters and NGO observers wandered the facility searching for remnants of food or coffee, while inside the plenary hall government delegates held their ground on various items, waiting for the other side to back down in the face of mounting sleep deprivation. Many delegates had passed out, one with his head resting in an ashtray. Chinese and Russian speaking interpreters pulled off their headphones and left, and the Japanese conference center staff threatened to cut off the electricity if the conference was not shut down.

But Estrada, an old hand in chairing contentious negotiations, took advantage of the exhaustion. Seizing on a few half-compromises, he began gaveling

closed key portions of the agreement. With the spotlight of the world's media upon them, delegates decided they had more to fear from a failed agreement than one with which they only partially agreed, and stood aside as Estrada pushed relentlessly through the text.

At 10:15 am, Estrada called for adoption of the protocol by consensus, and despite remaining reservations, no government was prepared to stand in the way. The deed was done. Hundreds of delegates rushed out to press conferences, declared victory, and headed for the Osaka International Airport.

During the next 24 hours, headlines around the world proclaimed a great success at Kyoto. Chairman Estrada stated that he was "deeply satisfied" with the outcome, and the World Resources Institute called it "an historic step in the history of humanity." Clouds remained on the horizon—particularly the threats of U. S. Senators not to ratify the agreement—but most observers, including this author, were hopeful that the remaining holes could be patched by the Fourth Conference of the Parties in Buenos Aires this November.

Sadly, the past 12 months have turned the Kyoto conference into a kind of high-water mark, from which the climate negotiations have steadily retreated in the past year. Divisions among national governments have only widened since Kyoto, and the holes in the agreement are beginning to seem more substantial than the protocol itself. Indeed, by creatively papering over wide differences between various nations, the Kyoto negotiators may have crafted an agreement that is barely workable in the best of circumstances, and in the current political climate could lead to paralysis.

At its core, the Kyoto Protocol has four major weaknesses that will need to be remedied if it is to be effective in slowing climate change before irreversible damage is done.

1. Weak commitments: Since the 1988 Toronto Conference, the cornerstone of climate negotiations has been the setting of binding limits on the emissions of greenhouse gases by industrial countries—the countries that have accounted for the bulk of the emissions so far. The 1992 Framework Convention includes a voluntary goal of holding those emissions to the 1990 level in 2000. Some European countries are already meeting this goal, thanks mainly to cuts in coal subsidies. But Australia, Canada, the United States, and other industrial nations are not, due in part to their low fuel prices, and to their failure to enact aggressive energy conservation measures. The main goal for the Kyoto agreement was to establish a new legally binding target for the year 2010.

The negotiators in Kyoto settled on nation-by-nation limits that add up to a reduction in greenhouse gas emissions of 5.2 percent below the 1990 level for all industrial nations. Little noticed outside climate policy circles, however, was the curious fact that total CO_2 emissions by industrial countries was—and is—already below 1990 levels, due to steep declines in the former Soviet Union. As a result, the protocols target, were it to cover just CO_2, translates to a mere 2.5 percent cut from the 1997 level.

Within that goal, industrial countries agreed to a range of specific targets —cuts of 8 percent in the European Union, 7 percent in the United States, and 6 percent in Japan—along with an 8 percent increase in Australia. These numbers represent backroom political deals more than they do analyses of the economic potential to reduce emissions in a given country. Australia, for example, has a government dominated by mining interests that wish to boost their export of energy-intensive products to Asian nations—a development that will of course worsen the greenhouse problem.

The anemia of the Kyoto figures can be seen when they are contrasted with what is eventually needed to stabilize CO_2 concentrations. According to the International Panel on Climate Change, the official scientific body that advises the Conference of the Parties, the amount of reduction that eventually will be required is not 5.2 percent, but 60 to 80 percent below the 1990 levels. Yet, when emissions of developing countries are added to those of the industrial countries covered by the protocol, the global total is projected to increase to some 30 percent *above* the 1990 level by 2010.

The most hopeful thing that can be said of the Kyoto Protocol is that it echoes Lao Tse's comment that a journey of a thousand miles begins with single step. The protocol could, perhaps, set the stage for more ambitious agreements later, as has occurred with earlier environmental treaties. But if—as now seems likely—it takes years to ratify the protocol, and years more to enact the national policies needed to achieve its weakened goals, the encounter in Buenos Aires could turn out to be little more than an elaborate tango—a few impressive steps that end up going nowhere.

2. Searching for "flexibility": As climate negotiations grew tense last year, the Clinton Administration was increasingly desperate to find a way of bridging the huge gulf in emissions goals that separated the United States from the European Union. The key, U. S. officials felt, was to come up with a series of provisions—critics called them loopholes—that would make it less expensive to meet the protocol's goals, and that would avoid the need to take a big bite out of domestic CO_2 emissions. The levels the Europeans were asking for, they believed, would require politically impossible measures that were already being aggressively fought by a multimillion dollar TV and newspaper ad campaign sponsored by the coal, oil, and automobile industries.

Australia, Canada, and New Zealand had similar concerns, and strongly supported the search for "flexibility." European governments were not nearly so worried about tough targets since, unlike the United States, they had not substantially increased their emissions during the 1990s. But even many of their leaders privately welcomed the notion of flexibility that would allow them to delay enacting any new energy taxes or other constraints on politically powerful industries.

During the Kyoto negotiations, the focus turned to a target that would cover a "basket" of six greenhouse gases rather than focusing on each one individually. This "comprehensive" approach seemed logical enough, since it covered all the important greenhouse gases, including methane and HFCs, not just CO_2. But it also happened to be a great convenience to U. S. delegates who were looking for ways to avoid sharp CO_2 reductions that would arouse a hornet's nest of industry outrage. Experts had identified a potential for easy

reductions in some of the more minor greenhouse gases, which might offset some of the projected increase in the nation's carbon dioxide emissions.

But this approach seems likely to lead to an accounting nightmare, in part because there is no reliable emissions inventory for some of these gases, and each has a distinct (and in some cases uncertain) lifetime in the atmosphere. As as a result, this "comprehensive" approach is likely to reduce the clarity of the protocol, and could well encourage cheating. (One of the keys to the pioneering 1987 Montreal Protocol on Substances That Deplete the Ozone Layer is that it dealt with each of the offending gases individually and specifically, so that countries knew exactly what was needed—and would be exposed if they did not.)

At the insistence of the United States, as well as Canada and New Zealand, the Kyoto Protocol also allows countries to count carbon absorption by forests (and perhaps later by peat bogs and other carbon "sinks") as offsets against emissions. Under the agreement, carbon flow resulting from both additions to and subtractions from sinks is to be included in national inventories. A coal-burning power company in Ohio, for example, could receive offset credits for financing a tree-planting project in Oregon.

In principle, this idea makes sense—tree planting should be encouraged. But the proposed scheme for doing this is exceedingly complex, combining an accounting maze with uncertain science. Biologists point out that there is not yet enough data on natural carbon cycling to establish full accounting and verification procedures for carbon sinks. And like the provision on the "other" gases, this one complicates monitoring and enforcement, and encourages governments to fiddle with the figures. In response to these concerns, the provision on sinks has been sent back for scientific review, which is to be completed by 2000.

3. Hot air trading: Another form of "flexibility" in the Kyoto Protocol is the concept of emission-allowance trading, an idea pioneered and highly touted by U. S. government regulators, private companies, and even some environmental groups. It is modeled on provisions in the U. S. Clean Air Act that allow power companies to "trade" their sulfur dioxide reduction obligations, in the theory that this will encourage cuts to be made wherever it is least expensive to do so. In the context of global climate change, nations would have the option of buying greenhouse gas emission allowances from other countries that have more than met their own requirements.

The concept has met with considerable skepticism in Europe, as well as in developing countries, which worry that it will dilute the commitments and encourage some governments to avoid difficult domestic policy decisions. Still, a growing number of governments have warmed to the idea in recent months, recognizing that it could improve the economic efficiency of the agreement by channeling capital to economies where it can make the most difference. After a tense standoff, the U. S.-sponsored article on emission allowance trading was accepted, though with obvious reluctance. In a gesture that carried symbolic, if not legal, weight, Estrada cut the trading provision to a few lines and pushed it to the back of the protocol.

It was not until after the weary delegates had arrived home from Kyoto that many of them realized that the United States had pulled a fast one. Under the protocol, Russia and Ukraine must only hold their emissions to the 1990 level, which would allow them to increase emissions 50 and 120 percent respectively from their current depressed levels. Experts do not expect either nation to come close to such increase, even if their economies rebound robustly, so these emission allowances would be available for purchase by countries like the United States, which expect to fall well short of the targets in the protocol. In short, the United States and Russia could make a trade that allowed the United States to take credit for emission reductions that stemmed from the Russian economic collapse of the early 1990s—without reducing future greenhouse gas output by even a molecule.

Although the U. S. government has been vague about its emissions trading intentions, the official plan produced by the White House in July would achieve up to 75 percent of the U. S. reduction requirement by purchasing allowances from the Russians and Ukrainians. While such a deal might result in the United States adding $10–$20 billion a year to Russia's empty treasury, it is hard to see how the climate would benefit. The idea has been widely denounced by everyone from Greenpeace to the U. S. National Coal Association, so it is not clear that it has much of a constituency. Indeed, this kind of trading threatens to undermine more legitimate trading proposals that are tied to specific projects, such as the article on "joint implementation" which is intended to encourage rich industrial countries to invest in climate projects in the former Eastern Bloc. European governments have suggested putting a percentage limit on trading—to encourage adoption of domestic policies—but even this might not be enough to correct a provision that undermines both the effectiveness and legitimacy of the protocol.

4. The ratification trap: While all of these problems are thorny ones, they should in theory be surmountable. But many of the all-important details—including how emissions trading will work—were not included in the Kyoto Protocol, and will have to be added to it if the protocol is to be effective. At negotiating sessions in Bonn, Germany, in June—the last before Buenos Aires—vituperation outweighed progress. In the European and developing country views, the United States has riddled the protocol with sneaky loopholes, while U. S. officials believe that the Europeans are trying to wriggle out of an agreement that was made in good faith in Kyoto.

Complicating the process further is the issue of ratification. The Kyoto Protocol will only go into force if ratified by enough industrial countries to represent at least 55 percent of industrial country emissions. In theory, the protocol could go into force without U. S. assent, as may occur with the land mines treaty negotiated last year. But due to concerns over competitiveness as well as fairness, neither the Europeans nor the Japanese with to move forward with an agreement that excludes the world's largest greenhouse gas emitter.

Leading U. S. Senators, meanwhile, say they will not move forward with ratification without "new specific scheduled commitments to limit or reduce greenhouse gas emissions" by developing countries—a position with which the

Clinton Administration has felt compelled to go along. U. S. officials have been vague as to what such a commitment might consist of, and developing countries are rightly wary of being asked to reduce their emissions, which already average less than one-tenth the U. S. per capita level. A year and a half of arm-twisting has yielded little progress, and the impasse gives the United States an effective veto over the protocol.

As 1998 drags to a close amidst financial crisis and political scandal, the climate negotiations are bogged down by a dangerous combination of impotence and ineptitude. And with the coal, oil, and automobile lobbies again stepping up their climate ad campaigns, it is unclear that the key countries have the political will needed to forge the compromises that are needed. The negotiating process itself seems to have become a kind of diplomatic black hole—sucking in endless quantities of legal, economic, and scientific capital. The thousands of government officials, NGO lobbyists, and observers who follow the process closely continue to circle the globe, attending dozens of meetings on sinks, emissions trading, and other climate issues *du jour.* The climate cognoscenti now speak their own acronym-filled language—interlaced with references to AGBM, QUELRO, SBSTA, and LUCF—and are prone to describing labyrinthine sideways movements as "progress." But the negotiations are increasingly disembodied from the real world threats—from massive floods to rampant disease—that a changing climate represents.

Meanwhile, the process of implementing national policies that will actually reduce emissions—which had gained substantial momentum prior to Kyoto—has stalled since then. President Clinton, for example, who talked extensively about climate change when he was in China this summer, has been unable to persuade the U. S. Congress to adopt even a modest package of new climate policies. Europe has seen a similar lack of progress, as it has bickered over "burden-sharing" its goals and debating emissions trading with the United States. And the new Japanese plan, released in August, is based largely on building 20 nuclear plants—a step that government officials privately acknowledge will never be permitted by the Japanese public.

One of the ironies of the year since Kyoto is that while the national and international political processes have stagnated, opportunities for economically cutting emissions have blossomed. Motivated in part by the prospect of legally binding emissions limits, companies, cities, and individuals have pursued a host of new approaches. From those emerging possibilities, a less legalistic, more productive approach to the climate problem may emerge.

- British Petroleum President John Browne surprised the oil industry when he announced last year that after extended internal deliberations, his company had concluded that climate change is a serious threat that will inevitably reshape the energy industry. Browne later announced BP's intention to reduce its emissions 10 percent and to step up investment in solar energy. The American Petroleum Institute denounced BP for "leaving the church," but Enron Corp, North America's largest gas company, and Royal Dutch Shell, the world's biggest petroleum firm, have joined BP in acknowledging the severity of the climate problem and beginning to shift their own investment strategies.

- During the very month of the Kyoto Conference, Toyota stunned the auto world with the delivery to its showrooms of the world's first hybrid electric car, the Prius—with twice the fuel economy and half the CO_2 emissions of conventional cars. Marketed as a "green" sedan, the Prius sold so quickly in Japan this year that Toyota had to open a second assembly plant. The shock waves were evident at the massive Detroit Motor Show in January, where each of the U. S. Big Three companies announced plans for new generations of hybrid and fuel cell cars. In a 1998 speech that might be compared to Mao expressing second thoughts about communism, General Motors president John Smith said, "No car company will be able to survive in the 21st century by relying on the internal-combustion engine alone."

- As national governments dither over the Kyoto Protocol, a surprising number of city governments are moving forward with active efforts to reduce their emissions. Over 100 cities, representing 10 percent of global emissions, have joined the Cities for Climate Protection program to reduce those emissions by investing in public transportation, tightening up public buildings, planting trees, and installing solar collectors. Toronto, which was the first city to announce a climate plan—in honor of its role in hosting the first major climate meeting a decade ago—is working to reduce its emissions by 20 percent. And Saarbrucken, a medium-sized city in a coal-mining region of southern Germany, has already cut its emissions by 15 percent, in part via effective energy management and public education campaigns.

- A few national governments are also showing the way. After a decade of effort, Denmark now generates 8 percent of its electricity from wind power, and another fraction from the combustion of agricultural wastes. Already, the Danish wind industry employs 20,000 people, and wind turbines are the country's second largest export. And thanks to Denmark's efforts, wind power, at 25 percent per year, has been the world's fastest growing energy source since 1990.

Taken together, these efforts suggest that it will be easier and less expensive to reduce carbon dioxide emissions than it appeared a few years ago. As has been the case with almost every other environmental problem in the past three decades, once we get serious about slowing climate change, we will likely find a host of innovative and inexpensive ways to do so. Thanks in part to the signal sent by the climate convention, as well as to those coming from the climate itself, that process is under way. The question now is how to speed it up.

tango /tan-go/ *n:* a ballroom dance of Latin-American origin in 2/4 time with a basic pattern of step-step-step-step-close and characterized by long pauses and stylized body positions; also: the music for this dance

After a decade of stylized steps—and long pauses—doubts are growing as to whether this climate dance will ever be successfully completed. The brief glow of optimism that surged from Kyoto last fall has faded. Well-meaning diplomats have become handcuffed by an increasingly complex and unruly process. While it is essential to take the long view with a problem such as climate change, even that perspective provides little comfort today: The commitments agreed to in Kyoto are less clear, and arguably less stringent—once all of the "flexibility mechanisms" are included—than the voluntary emission goals established in Rio in 1992.

The glacial pace of climate negotiations in the past decade can be attributed in part to a powerful combination of forces: the intergenerational scale of the problem; only modest public alarm; broad and well-organized industry opposition; and the complex, multi-faceted nature of the problem being addressed. Together, these four factors make the climate-policy process an order of magnitude more challenging than any others so far. Solving this problem will truly put human institutions and ingenuity to the test.

If they are to get the protocol back on track, the negotiators who meet in Buenos Aires this November would do well to remember a distinction made by environmental negotiations expert David Victor of the Council on Foreign Relations in a 1998 book: when it comes to international environmental treaties, compliance and effectiveness are two different things. Unless it leads to major governmental policy changes that in turn lead to lower emissions of the most important greenhouse gas, carbon dioxide, the Kyoto Protocol will have fallen into the trap of debilitating compromise and complication that has plagued several other environmental agreements.

The climate negotiations have been guided in part by the lessons of one of the most successful of those agreements, the 1987 Montreal Protocol to protect the ozone layer. That agreement, in which many of the Buenos Aires negotiators were involved, led to an 80 percent reduction, within a decade of its adoption, in production of the gases that most damage the ozone layer. It did so by relying on three simple principles: Politics must follow science; environmental goals should be clear and simple; and industry consensus is essential to drive the process forward.

But the challenge of Kyoto is far greater, in large measure because where the ozone problem could be solved with the effective participation of just a few dozen companies, the climate problem is driven by millions of actors, indeed by society as a whole. Although the new business created by the move away from fossil fuels is likely to roughly equal the business lost, the potential losers are far better organized.

As with the Montreal Protocol, the central focus of the Framework Convention on Climate Change is national emissions limits, leaving individual nations to decide how to achieve them. While the principle seems like a solid one, since it allows for national differences and permits flexibility, it has not worked in the climate arena, where carbon dioxide, unlike chlorofluorocarbons, is a virtual currency of modern energy economies that can be reduced only by addressing structural economic issues.

Even among industrial countries, the differences in emissions levels, economic structures, and political philosophies are so wide that no single goal has universal logic. One of the problems in Kyoto was the fact that countries such as the United States, which had substantially increased their emissions since 1990, were panicked by the challenge of meeting goals that seemed reasonable to other countries that had already reduced theirs. But once governments began differentiating the goals in Kyoto, the negotiations became a political free-for-all that undermined the credibility of the entire process. In addition, by bundling together six gases, and adding the highly complicated issues of sinks and trading to the protocol, the negotiators have created an agreement that will be nearly impossible to review or enforce, and that at best sends an ambiguous signal to governments and industries.

The challenge now is to renovate the baroque structure that the Kyoto plan has become—or else scrap it and get ready to start over. The negotiators who have labored so hard over the past decade to get the foundation of the protocol in place deserve one more try in Buenos Aires. But if—as now seems likely—that try produces no serious prospect of ratifying the protocol and implementing it, new approaches may be needed.

David Victor points out that when other environmental treaties have run into similar problems, a leadership group of more committed governments has sometimes formed—adopting a more stringent set of voluntary goals, which they then move immediately to implement. In the 1980s, European negotiations to reduce North Sea pollution and nitrogen oxide emissions each ran aground due to vehement opposition of major governments. But other countries moved ahead with voluntary commitments—complementing more modest, legally binding agreements that were also agreed to. Similarly, the international land-mines treaty of 1997 was spearheaded by NGOs and by a small group of like-minded governments. They formulated an agreement that quickly won the support of most—though not all—governments. Holdouts like the United States are expected to join eventually.

This approach might well work for climate policy, building on the leadership roles of several European countries, and building support outward from there. Taking the idea a step further, it might even be feasible to bring regional and city governments and companies into such an agreement. They would pledge to each other not just to meet certain levels of emissions reductions, but to identify and adopt specific policy changes and investments—such as incentives for purchasing more efficient cars or rejuvenating public transportation—that will expeditiously achieve these reductions. They might also agree to experiment with emissions trading and CO_2 taxes.

The guiding principle of this new initiative would be to make climate stabilization an economic opportunity as well as an environmental necessity. As John Topping of the Climate Institute puts it, "A strategy that works is going to have to be one that has its own very positive economic feedbacks, one that ex-

tends opportunity rather than slowing it down." Like the Kyoto Protocol itself, this approach would still require political support—but on a local, regional, or national level.

Such an initiative would start with a relatively small group of committed institutions, drawing in a larger circle of participants over time, and gradually marginalizing those who are so mired in the status quo that they refuse to go along. The psychology of marginalization—and of shame—could turn out to be a powerful spur to action. If history is a guide, it might eventually lead to a second generation protocol—one that really works.

The key to any approach, of course, is strong public support for action on climate—support that is substantial enough to overcome the unavoidable tendency of many industries to fight change. Environmental groups need to do a better job than they have so far in mobilizing public action—but in the end, it may come down to the weather. Catastrophes have been the driving forces behind many previous environmental agreements. Tragically, the probability of such crisis is rising with the temperature.

NO

Jerry Taylor

Global Warming: The Anatomy of a Debate

Delivered to the Johns Hopkins University Applied Physics Laboratory, Baltimore, Maryland, January 16, 1998

The national debate over what to do, if anything, about the increasing concentration of greenhouse gases in the atmosphere has become less a debate about scientific or economic issues than an exercise in political theater. The reason is that the issue of global climate change is pregnant with far-reaching implications for human society and the kind of world our children will live in decades from now.

Introducing nuance and clear-headed reason to this debate is something of a struggle. As Cato Institute chairman William Niskanen has noted, for any international action to merit support, all of the following propositions must be proven true:

1. A continued increase in the emission of greenhouse gases will increase global temperature.
2. An increase in average temperature will generate more costs than benefits.
3. Emissions controls are the most efficient means to prevent an increase in global temperature.
4. Early measures to control emissions are superior to later measures.
5. Emissions controls can be effectively monitored and enforced.
6. Governments of the treaty countries will approve the necessary control measures.
7. Controlling emissions is compatible with a modern economy.

The case for any one of those statements is surprisingly weak. The case for a global warming treaty, which depends on the accuracy of all those statements, is shockingly weak. My talk this afternoon will concentrate on a few of the most important of those propositions.

From Jerry Taylor, "Global Warming: The Anatomy of a Debate," *Vital Speeches of the Day* (March 15, 1998).

A Continued Increase in the Emission of Greenhouse Gases Will Increase Global Temperature

First off, this subject is terribly complex; the 2nd Assessment Report of the International Panel on Climate Change [IPCC] is 500 pages long with 75 pages of references. As Ben Santer, author of the key IPCC chapter that summarized climate change science, has noted, there are legions of qualifications in those pages about what we know and what we don't. But, unfortunately, those qualifications get lost in the journalistic and political discourse.

I will dispense with an introductory discussion of the rudimentary elements of greenhouse theory. I'm sure you're all familiar with it. Largely on the basis of computer models, which attempt to reflect what we know, what we assume, and what we can guess, many people believe that continued emissions of anthropogenic greenhouse gasses will increase global temperatures anywhere from 1 to 3.5 degrees Celsius.

At this point, I should note that those estimates have been coming down over time. The 1990 IPCC report predicted a little more than twice this amount of warming, and projections have been declining ever since as better models have been constructed. One wonders, at this rate, whether the models will continue to predict increasingly smaller amounts of warming until even the upper bound forecasts become so moderate as to be unimportant.

What We Know—And What We Don't Know

Here's what the data say, about which there is little debate; ground-based temperatures stations indicate that the planet has warmed somewhere between .3 and .6 degrees Celsius since about 1850, with about half of this warming occurring since WWII. Moreover:

- Most of the warming occurs over land, not over water;
- Most of the warming occurs at night; and
- Most of the warming moderates wintertime low temperatures.

But even here, we have uncertainties. Shorter sets of data collected by far more precise NASA satellites and weather balloons show a slight cooling trend over the past 19 years, the very period during which we supposedly began detecting the greenhouse signal. Those data are generally more reliable because satellite and balloons survey 99% of the earth's surface, whereas land-based data (1) only unevenly cover the three-quarters of the earth's surface covered by oceans and (2) virtually ignore polar regions.

While some of that cooling was undoubtedly a result of Mt. Pinetumbo and the increased strength of the El Nino southern oscillation, those events fail to explain why the cooling occurred both before and after those weather events were played out and why, even correcting for those events, the temperature data show no significant warming during the 19-year period.

While it is true, as critics point out, that the satellite and weather balloons measure temperatures in the atmosphere and not on the ground where ground-based measurements are most reliable—over the North American and European land masses, the correlation coefficient between satellite and surface measurements is 0.95—close to perfect agreement, and the computer models predict at least as much warming in the lower atmosphere as at the surface, so if warming were occurring, it should be detectable by the satellites and weather balloons.

Even assuming that ground-based temperature data are more reflective of true climate patterns, that still leaves us with a mystery. When fed past emissions data, most of the computer models predict a far greater amount of warming by now than has actually occurred (the models that are reasonably capable of replicating known conditions are a tale unto themselves to which I'll return in a moment). Notes the IPCC, "When increases in greenhouse gases only are taken into account... most climate models produce a greater mean warming than has been observed to date, unless a lower climate sensitivity is used." Indeed, the most intensive scientific research is being done on why the amount of warming that has occurred so far is so low. After all, a .3-.6 degree Celsius warming trend over the last 150 years all but disappears within the statistical noise of natural climate variability.

There are three possibilities:

- something's wrong with the temperature data;
- something's masking the warming that would otherwise be observed; or
- the atmosphere is not as sensitive to anthropogenic greenhouse gases as the models assume.

Indirect Evidence of Global Temperature

Scientists who argue the first possibility cite the largely incompatible, imprecise, and incomplete nature of even recent land-based temperature records. Those observations, of course, are absolutely correct. Instead, these scientists concentrate on indirect evidence suggesting that the planet has been warming and has been warming significantly over the relatively recent past. They typically point to precipitation trends, glacial movement, sea level increases, and increased extreme temperature variability as suggestive of a significant warming trend. Let's take each of these issues in turn.

Precipitation trends According to the IPCC, global rainfall has increased about 1% during the 20th century, although the distribution of this change is not uniform either geographically or over time. Evidence gleaned from global snowfall is definitely mixed. Still, measuring either rain or snowfall is even more difficult than measuring simple temperature. As the IPCC notes, "Our ability to determine the current state of the global hydropologic cycle, let alone changes in it, is hampered by inadequate spatial coverage, incomplete records, poor data quality, and short record lengths."

Recent evidence from climatologist Tom Karl that the incidence of 2-inch rainfalls has increased in the U.S. received sensational coverage but even according to Karl amounts to "no smoking gun." Why? Because he found only one additional day of such rainfall every two years—well within statistical noise—and that most of those days occurred between 1925 and 1945, a time period that does not coincide with major increases in emissions of anthropogenic greenhouse gases.

Glacial movement The data here are contradictory. Glaciers are expanding in some parts of the world and contracting in others. Moreover, glacial expansion/contraction is a long-running phenomenon and trends in movement do not appear to have changed over the past century.

Sea level While there is some evidence that sea levels have risen 18 cm over the past 100 years (with an uncertainty range of 10–25 cm), there is little evidence that the rate of sea level rise has actually increased during the time that, theoretically, warming has been accelerating. Says the IPCC, "The current estimates of changes in surface water and ground water storage are very uncertain and speculative. There is no compelling recent evidence to alter the conclusion of IPCC (1990) that the most likely net contribution during the past 100 years has been near zero or perhaps slightly positive."

Concerning both ice and sea level trends, the IPCC reports that "in total, based on models and observations, the combined range of uncertainty regarding the contributions of thermal expansion, glaciers, ice sheets, and land water storage to past sea level change is about 19 cm to +37 cm."

Extreme weather variability Again, the data here are mixed. Reports the IPCC, "... overall, there is no evidence that extreme weather events, or climate variability, has increased, in a global sense, through the 20th century, although data and analyses are poor and not comprehensive. On regional scales, there is clear evidence of changes in some extremes and climate variability indicators. Some of these changes have been toward greater variability; some have been toward lower variability."

The Masking Theory

The second theory is more widely credited. The most likely masking culprit according to the IPCC are anthropogenic aerosols, primarily sulfates, that reflect some of the sun's rays back into space and thus have a cooling effect on the climate. That aerosols have this effect is widely understood. But as ambient concentrations of anthropogenic aerosols continue to decline (yes, global pollution is on the decline, not on the rise), the argument is that this artificial cooling effect will be eliminated and the full force of anthropogenic greenhouse gas loading will be felt in short order.

This theory becomes particularly attractive when the details of temperature variability are considered. The warming, as noted a moment ago, is largely

a nighttime, winter phenomenon; patterns, which suggest increased cloud cover, might have something to do with the temperature records.

The best evidence marshaled thus far in support of the masking theory was published in *Nature* in the summer of 1996. The study, by Santer et al., used weather balloon temperature data from 1963 to 1987 to determine temperature trends in the middle of the Southern Hemisphere, where virtually no sulfates exist to counter greenhouse warming. The article, which caused a sensation in the scientific world, showed marked warming and seemed to confirm the argument that, when sulfates were absent, warming was clearly evident. The article was featured prominently in the 1995 IPCC report as strong evidence that artificial sulfate masking was behind the dearth of surface warming.

Yet it turns out that, if one examines a fuller set of data from the Southern Hemisphere (1958–95, 13 years' worth of data that Santer et al. did not use), no warming trend is apparent. Moreover, if we carefully examine the land-based temperature records, we discover that it is the regions most heavily covered by sulfates—the midlatitude land areas of the Northern Hemisphere—that have experienced the greatest amount of warming. That, of course, is the exact opposite of what we should discover if the masking hypothesis were correct.

Climate Sensitivity

As I noted a few moments ago, a few of the climate models come reasonably close to replicating past and present climatic conditions when historical data are entered. Those models, interestingly enough, predict the least amount of future warming based on present trends. The two most prominent of those models, those of the National Center for Atmospheric Research and the U.K. Meteorological Organization, predict warming of only 1.2 degrees Celsius and 1.3 degrees Celsius over the next 50 years; the lower-bound estimates reported by the IPCC.

The argument for moderate climate sensitivity to anthropogenic greenhouse gas emissions largely rests on three observations:

First, there appear to be carbon sinks that continue to absorb more carbon dioxide than can be explained. While most models assume that those sinks are presently or nearly beyond their carrying capacity, we have no way of knowing that.

Second, 98% of all greenhouse gases are water vapor, and many atmospheric physicists, most notably Richard Lindzen of MIT, doubt that a doubling of anthropogenic greenhouse gases would have much climate effect absent a significant change in the concentration of atmospheric water vapor.

Finally, a warming planet would probably lead to increased cloud cover, which in turn would have uncertain effects on climate. Concedes the IPCC, "The single largest uncertainty in determining the climate sensitivity to either natural or anthropogenic changes are clouds and their effects on radiation and their role in the hydrological cycle... at the present time, weaknesses in the parameterization of cloud formation and dissipation are probably the main impediment to improvements in the simulation of cloud effects on climate."

The Anatomy of the "Consensus"

Despite all the uncertainty, we are constantly told that there is a "consensus" of scientific opinion that human-induced climate changes are occurring and that they are a matter of serious concern. That belief is largely due to the weight given the IPCC report, where this consensus is supposedly reflected. Here is the talismanic sentence of that report, inserted by a small, politically appointed committee after the large-scale peer review was completed: "the balance of the evidence suggests a discernible human influence on global climate." Now, compare that statement with this, which appears on p. 439 of the report:

> Finally, we come to the difficult question of when the detection and attribution of human-induced climate change is likely to occur. The answer to this question must be subjective, particularly in the light of the large signal and noise uncertainties discussed in this chapter. Some scientists maintain that these uncertainties currently preclude any answer to the question posed above. Other scientists would and have claimed, on the basis of the statistical results presented in Section 8.4, that confident detection of significant anthropogenic climate change has already occurred.

On p. 411, the statement is even clearer:

> Although these global mean results suggest that there is some anthropogenic component in the observed temperature record, they cannot be considered as compelling evidence of clear cause-and-effect link between anthropogenic forcing and changes in the Earth's surface temperature.

Counterbalancing IPCC's note of cautious concern are other, far harsher judgements about the scientific evidence for global climate change:

4,000+ scientists (70 of whom are Nobel Prize winners) have signed the so-called Heidelberg Appeal, which warns the industrialized world that no compelling evidence exists to justify controls of anthropogenic greenhouse gas emissions.

A recent survey of state climatologists reveals that a majority of respondents have serious doubts about whether anthropogenic emissions of greenhouse gases present a serious threat to climate stability.

Of all the academic specialists, climatologists (only about 60 of whom hold Ph.D.'s in the entire U.S.) and atmospheric physicists are those most qualified to examine evidence of climate change. It is those professions that are most heavily populated by the so-called "skeptics."

A recent joint statement signed by 2,600 scientists under the auspices of the environmental group Ozone Action is less than compelling. A survey of those signatories by Citizens for a Sound Economy concludes that fewer than 10% of them had any expertise at all in any scientific discipline related to climate science.

An Increase in Average Temperature Will Generate More Costs Than Benefits

How costly might global warming prove to be 100 years hence? Well, that largely depends on the distribution of warming through time and space. It also depends on how much warming occurs; will it be the upper bound or lower bound estimate that comes to pass?

Benign Warming Patterns

For what it's worth, I tend to agree with the IPCC's summary statement that the "balance of the evidence suggests" that anthropogenic greenhouse gas emissions explain some of the detected warming observed thus far over the past 100 years. But as noted earlier, that warming has been extremely moderate, has been largely confined to the northern latitudes during winter nights, and has exhibited no real detrimental effects thus far. I expect those trends to continue and that's the main reason why I doubt that the costs of warming will be particularly consequential.

The present observed warming pattern is certainly consistent with our understanding both of atmospheric physics, which indicates the following:

The driest air-masses will warm faster and more intensely than moister air-masses. The driest air-masses are the coldest; i.e., those in the northern latitudes during the night.

Increased warming will increase the amount of water evaporation, which will in turn result in greater cloud cover. Cloud cover during the daytime has a cooling effect; during the nighttime, a warming effect.

Virginia state climatologist Pat Michaels concludes that:

> If warming takes place primarily at night, the negative vision of future climate change is wrong. Evaporation rate increases, which are a primary cause of projected increases in drought frequency, are minimized with nighttime, as opposed to daytime, warming. The growing season is also longer because that period is primarily determined by night low temperatures. Further, many plants, including some agriculturally important species, will show enhanced growth with increased moisture efficiency because of the well-known "fertilizer" effect of CO2. Finally, terrestrial environments with small daily temperature ranges, such as tropical forests, tend to have more bio-mass than those with large ones (i.e., deserts and high latitude communities) so we should expect a greener planet.

Nighttime warming also minimizes polar melting because mean temperatures are so far below freezing during winter that the enhanced greenhouse effect is sufficient to induce melting.

Indeed, this warming scenario predicts benign, not deleterious, effects on both the environment and the economy.

But what if the warming turns out to be more serious than this? What if the median estimate reported by the climate models comes to pass: a 2.5 degree Celsius warming over the next 100 years?

There have been six particularly comprehensive or prominent serious studies undertaken to estimate the macro-economic consequences of such a warming. None of them gives us much reason for alarm. The main reason is that most modern industries are relatively immune to weather. Climate affects principally agriculture, forestry, and fishing, which together constitute less than 2 percent of U.S. gross domestic product (GDP). Manufacturing, most service industries, and nearly all extractive industries remain unaffected by climate shifts. A few services, such as tourism, may be susceptible to temperature or precipitation alterations: a warmer climate would be likely to shift the nature and location of pleasure trips.

1974 Department of Transportation Study

Back when the world was more concerned with global cooling than global warming, the DOT brought together the most distinguished group of academics ever assembled before or after to examine the economic implications of both cooling and warming. In 1990 dollars, the DOT study concluded that a .9 degree Fahrenheit warming would save the economy $8 billion a year. Only increases in electricity demand appeared on the "cost" side of the warming ledger. Gains in wages, reduced fossil fuel consumption, lower housing and clothing expenses, and a slight savings in public expenditures appeared on the "benefit" side. The amount of warming examined by DOT is roughly equivalent to what the ground-based monitors suggest the planet has experienced over the last 100 years.

1986 EPA Study

Crafted mostly by internal staff (not one of whom had any economics training), the EPA produced few figures, and no quantitative estimates of costs or benefits, failed to even refer to the DOT study of only 12 years earlier, and was littered with qualifications like "could" and "might." While conceding that global warming would reduce mortality slightly, the report nonetheless concluded impressionistically that warming would probably cost the economy.

1991 Nordhaus Study

Perhaps the most prominent academic study of the economic consequences of warming was produced by Yale economist William Nordhaus, an informal adviser to the Clinton administration. Nordhaus calculates that a doubling of atmospheric carbon dioxide concentrations would cost the economy approximately $14.4 billion in 1990 dollars, or about 0.26% of national income. On the "cost" side, Nordhaus places increased electricity demand, loss of land due to flooding, coastal erosion, and the forced protection of various threatened seaboard properties. On the "benefits" side, Nordhaus places reductions in demand for non-electric heat. He concludes that agricultural implications are too uncertain to calculate but estimates that losses could be as great as $15 billion annually while gains could reach $14 billion annually. Finally, Nordhaus assumes that unmeasured impacts of warming could dwarf his calculations, so he arbitrarily quadruples his cost estimates to produce an estimate of warming costs somewhere around 1% of GDP.

1992 Cline Study

One of the most extensive treatments of the economic consequences of climate change and climate change abatement was produced by economist William Cline of the Institute for International Economics. Instead of assuming a median—4.5 degree Fahrenheit—estimate of warming a century hence (as all other studies tend to do), he assumes 18 degree Fahrenheit warming by 2300 and works back from there. Moreover, Cline includes an extremely low "social" discount rate to calculate the value of future investment. Despite all this, his preliminary calculations reveal that, for every $3 of benefits to be gained by emission restrictions, $4 of costs is incurred. Only by applying arbitrary adjustments after his initial calculations are performed does he find that the benefits of control exceed their cost; but that won't occur, even according to Cline, for at least a century.

Even more controversial are Cline's allocations of costs and benefits of warming. He finds no benefits whatsoever. Costs are found not only in the traditional places (sea level rise, species loss, and moderately increased hurricane activity) but also in areas where most economists have found benefits: agricultural productivity, forest yields, overall energy demand, and water demand. His net estimate is that, spread out over 300 years, the costs of warming will be approximately $62 billion annually.

Unfortunately, it is the Cline study that receives the lion's share of attention from the IPCC. The existence of contrary studies is often simply ignored in the document.

1997 Mendelsohn Study

Robert Mendelsohn of the Yale School of Forestry and Environmental Studies calculated late last year that a temperature hike of 2.5 degrees Celsius would lead to a net benefit of $37 billion for the U.S. economy. Farming, timber, and commercial energy sectors all benefit, with agriculture enjoying "a vast increase in supply from carbon fertilization."

1998 Moore Study

Economist Thomas Gale Moore of Stanford University might be termed the "anti-Cline." Whereas Cline has reported the steepest potential costs of warming, Moore's review of the literature this year, in addition to his own investigation, pegs net annual benefits of the median warming scenario at $105 billion. While Moore too, finds costs in species loss, sea level rise, increased hurricane activity, and increased tropospheric ozone pollution, he finds moderate benefits in agricultural productivity, forest yields, marine resource availability,

and transportation. Moreover, he argues that major benefits will accrue from reduced energy demand, improved human morbidity, an increase from miscellaneous amenity benefits, lower construction costs, greater opportunities for leisure activities, and increased water supplies.

Historical Evidence

There is some historical precedent for optimism regarding the consequences of the median computer model warming scenario. The period 850 AD–1350 AD experienced a sharp and pronounced warming approximately equivalent to that predicted by the median warming scenario; 2.5 degrees Celsius. That period is known to climate historians as the Little Climate Optimum. While there were some climatic dislocations such as coastal flooding, there were marked increases in agricultural productivity, trade, human amenities, and measurable improvements in human morbidity and mortality.

Only when the climate cooled off at the end of the Little Climate Optimum did trade drop off, harvests fail, and morbidity and mortality rates jump largely due to an increase in diseases, particularly the plague.

The reason for optimism here is that human civilization was far more weather dependent a millennia ago than it is today. And even our more primitive, weather dependent ancestors appeared to do fairly well during their episodic warming.

Early Measures to Control Emissions Are Superior to Later Measures

Assuming even the worst about the consequences of unabated anthropogenic greenhouse gas emissions and their economic consequences does not necessarily imply that emissions controls today make more sense than emissions controls tomorrow.

There is no compelling need to act now. According to a recent study by Wigley et al. in *Nature*, waiting more than 20 years before taking action to limit anthropogenic greenhouse gas emissions would result in only about a .2 degree Celsius temperature increase spread out over a 100-year period.

Why might we want to wait a couple of decades before acting? First, we might profitably "look before we leap." There are a tremendous number of uncertainties that still need to be settled before we can be reasonably sure that action is warranted. Second, we can't anticipate what sorts of technological advances might occur in the intervening period that might allow far more efficient and less costly control or mitigation strategies than those before us today. Given the low cost of waiting, it would seem only prudent to continue to try to answer the open questions about climate change before making major changes to Western civilization.

Controlling Emissions Is Compatible With a Modern Industrialized Economy

The restrictions on greenhouse gas emissions agreed to in Kyoto are not in any way minor or insubstantial. Reducing U.S. emissions 7% below what they were in 1990 by the year 2012 means reducing emissions almost 40% below what they would be absent the agreement. Adjusted for expected population growth, this means a 50% reduction per capita in greenhouse gas emissions. Virtually everyone agrees that these targets can be met only by reducing fossil fuel consumption, the main source of virtually all anthropogenic emissions.

Environmentalists argue that such reductions can occur relatively painlessly, that we can cut the amount of fuel we use by 50% and actually produce even more economic growth as a result. Virtually no mainstream academic economist shares that opinion. The two most prominent and well respected academic specialists—Robert Stavins of the John F. Kennedy School of Government at Harvard and William Nordhaus of Yale—maintain that only the functional equivalent of a $150 per ton carbon tax can accomplish this, which they calculate would reduce GDP by 3%, or, as Stavins puts it, "approximately the cost of complying with all other environmental regulations combined." A recent survey in *Forbes* summarizing the recent macro-economic modeling that's been done on the subject broadly agrees with Stavins's and Nordhaus's estimates.

Then there is the matter of whether the emissions cuts presently on the table are even worth the bother. According to the best computer model from the National Center for Atmospheric Research, the Kyoto agreement, even if signed by all the nations of the world, would reduce global warming by an infinitesimal .18 degrees Celsius over the next 50 years. That's not much bang for the global warming buck.

The reason is that, according to all observers, actually stopping any further global warming from occurring (assuming the median predictions of present climate models) would require a 70% reduction of present emissions, roughly the equivalent of completely abandoning the use of fossil fuels. This, according to Jerry Mahlman, director of the Geophysical Fluid Dynamics Laboratory at Princeton, "might take another 30 Kyotos over the next century." Indeed, environmentalists are frequently quoted as saying that, ultimately, we will need to completely restructure society around the objective of energy efficiency and sustainability, the economic and political costs of which we can only imagine.

Unless we're prepared to see that journey to its completion, there's little point in even bothering to sign the Kyoto agreement because, in and of itself, it will make virtually no difference to our planetary climate.

Conclusion: A Matter of Perspective

Let me wind up my comments on a provocative note. We are constantly urged to act because "we shouldn't be gambling with our children's future." In fact, our kids are marshaled endlessly to shame us into planning for the worst... for their sake. But even assuming the absolute worst case about future planetary climate change and the most extreme estimates about what that climate change

will ultimately cost society, conservative estimates are that our grandchildren 100 years hence will not be 4.4 times wealthier than we are—as they would be absent global warming—but will instead be only 3.9 times wealthier than we are at present.

I ask you, would you have been comfortable had your grandmother impoverished herself so that you could be 4.4 times wealthier than she rather than 3.9 times wealthier than she? Remember also that increased energy costs are borne most directly by the poor, who spend a greater portion of their income on energy than do the wealthy. Moreover, the poor who will pay the highest price of greenhouse gas abatement will be those in the developing world who will be denied the opportunity to better their lifestyle and standard of living. They will be "saved" from the fate of industrialization and experiencing even the most rudimentary comforts of Western consumer societies.

We're not really gambling with the lives of our grandchildren. They'll be just fine regardless of how the climate plays itself out. We're gambling with the lives of today's poor, who stand to lose the most if we act rashly. Thank you very much.

POSTSCRIPT

Are Aggressive International Efforts Needed to Slow Global Warming?

Taylor makes use of a common debating tactic. He begins by enumerating a set of propositions that he contends must be true to justify international action on climate warming. He then devotes most of the essay to demonstrating that little evidence exists to support these propositions. In addition to taking issue with Taylor's evidence and conclusions, most supporters of the need for a concerted effort to reduce greenhouse gas emissions would dispute the premise that proof of all of Taylor's propositions is required to justify their case. For example, since promoting the use of renewable energy sources as a means of reducing greenhouse gases would be environmentally beneficial, regardless of whether or not it reduced global warming, support for such actions does not require conclusive proof of any of Taylor's propositions.

Scientific acceptance of a phenomenon like global warming, which emerges from a background of normal climatic fluctuation, is a gradual process. If the predictions of greenhouse gas theorists are correct, then belief in the theory will grow as more evidence accumulates. In fact, during 1997 and 1998, continued above-normal worldwide temperatures and other phenomena, such as unusually severe storms, thinning glaciers, and lengthening of growing seasons, have increased scientific support for the position that the consequences of greenhouse gas warming are beginning to be observed. The current consensus is well documented in the March–April 1999 issue of *The Ecologist,* which was devoted to the global warming issue. For a discussion of several schemes for removing carbon dioxide from the atmosphere, see Howard Herzog, Baldur Eliasson, and Olav Kaarstad, "Capturing Greenhouse Gases," *Scientific American* (February 2000).

S. Fred Singer is a member of the group of scientists who dismiss the seriousness of greenhouse gas-induced global warming. Singer presents a succinct summary of his arguments in "Warming Theories Need Warning Labels," *The Bulletin of the Atomic Scientists* (June 1992). Some scientists who oppose efforts to reduce greenhouse gas emissions do so not because they dismiss the climate change threat but because they advocate the alternative of using one of several proposed "technological fixes." Physicist Gregory Benford makes such an argument in his article "Climate Controls," *Reason* (November 1997).

The 1997 international conference in Kyoto that developed a protocol for reducing greenhouse gas emissions stimulated the writing of numerous articles about all aspects of this issue. See, for example, "Kyoto and Beyond," by Robert M. White, and "Implementing the Kyoto Protocol," by Rob Coppock, both in the Spring 1998 issue of *Issues in Science and Technology.*