Environmentalism
A Threat to Individual Freedom & Liberty

Václav Klaus, president of the free and democratic Czech Republic spoke the following words at the CATO Institute, Washington D.C. on March 9, 2007. “Environmentalism only pretends to deal with environmental protection. Behind their people- and nature-friendly terminology, the adherents to this ideology make ambitious attempts to radically reorganize and change the world, human society, all of us and our behavior, as well as our values. There is no doubt that it is our duty to protect rationally the nature for the future generations. The followers of the environmentalist ideology, however, keep presenting to us various catastrophic scenarios with the intention to persuade us to implement their ideas about us and about the whole human society. This is not only unfair but extremely dangerous. What is, in my view, even more dangerous, is the quasi-scientific form that their many times refuted forecasts have taken upon themselves. What belongs to this ideology?

1. disbelief in the power of the invisible hands of free market and belief in the omnipotence state dirigism;
2. disregard for the role of important and powerful economic mechanisms and institutions – primarily that of property rights and prices – for an effective protection of nature;
3. misunderstanding of the meaning of resources, of the difference between the potential natural resource and the real one, that may be used in the economy;
4. Malthusian pessimism over the technical progress;
5. belief in the dominance of externalities in human activities;
6. promotion of the so-called “precautionary principle“, which maximizes the risk aversion without paying attention to the costs;
7. underestimation of the long-term income and welfare growth, which results in a fundamental shift of demand towards environmental protection (this is demonstrated by the so-called Environmental Kuznets Curve);
8. erroneous discounting of the future, demonstrated so clearly by the highly publicized Stern-Report a few months ago.

All of these views are associated with social sciences, not with natural sciences. This is why environmentalism – unlike scientific ecology – does not belong to the natural sciences but is to be classified as an ideology. This fact is, however, not understood by the common people and by numerous politicians. The hypothesis of global warming and the role of man in this process is the last and till this day the most powerful embodiment of the environmental ideology. It has brought along many important “advantages” for the environmentalists:

1. an empirical analyses of this phenomenon is very complicated due to the complexity of global climate and the mix of various long-, medium-, and short-term trends (and causes);
2. their argumentation is not based on simple empirical measurements or laboratory experiments, but on sophisticated model experiments working with a range of ill-founded assumptions that are usually hidden and not sufficiently understood;
3. the opponents of this hypothesis have to accept the fact that in this case we are in the world of non-internalized externalities;
4. people tend to notice and remember only extraordinary climate phenomena but not normal developments and slow long-term trends and processes.

It is not my intention, here and now, to present arguments for the refutation of this hypothesis. What I find much more important is to protest against the efforts of the environmentalists to manipulate people. Their recommendations would take us back into the era of statism and restricted freedom. It is therefore our task to draw a clear line and differentiate between the ideological environmentalism and the scientific ecology. I started my speech saying I wanted to use this opportunity to present my concerns about some non-negligible tendencies of the current era. I hope you see and feel them as well."[1]

Environmentalism as a Religion

The environmental movement has all the characteristics of a secular Religion. Their object of worship is Mother Earth. A quote from Time Magazine states the following; "The image of Earth as organism--famously dubbed Gaia[2] [Earth Goddess] by environmentalist

[1] Václav Klaus, CATO Institute, Washington D.C., March 9, 2007

[2] **Gaia**

by Ron Leadbetter

Gaia or Gaea, known as Earth or Mother Earth (the Greek common noun for "land" is *ge* or *ga*). She was an early earth goddess and it is written that Gaia was born from Chaos, the great void of emptiness within the universe, and with her came Eros. She gave birth to Pontus (the Sea) and Uranus (the Sky). This was achieved parthenogenetically (without male intervention). Other versions say that Gaia had as siblings Tartarus (the lowest part of the earth, below Hades itself) and Eros, and without a mate, gave birth to Uranus (Sky), Ourea (Mountains) and Pontus (Sea).

Gaia took as her husband Uranus, who was also her son, and their offspring included the Titans, six sons and six daughters. She gave birth to the Cyclopes and to three monsters that became known as the "Hecatonchires". The spirits of punishment known as the Erinyes were also offspring of Gaia and Uranus. The Gigantes, finally, were conceived after Uranus had been castrated by his son Cronus, and his blood fell to earth from the open wound.

To protect her children from her husband, (the Cyclopes and the Hecatoncheires, as he was fearful of their great strength), Gaia hid them all within herself. One version says that Uranus was aghast at the sight of his offspring so he hid them away in Tartarus, which are the bowels of the earth. Gaia herself found her offspring uncomfortable and at times painful, when the discomfort became to much to bear she asked her youngest son Cronus to help her. She asked him to castrate Uranus, thus severing the union between the Earth and Sky, and also to prevent more monstrous offspring. To help Cronus achieve his goal Gaia produced an adamantine sickle to serve as the weapon. Cronus hid until Uranus came to lay with Gaia and as Uranus drew near, Cronus struck with the sickle, cutting the genitalia from Uranus. Blood fell from the severed genitals and came in contact with the earth and from that union was born the Erinyes (Furies), the Giants and the Meliae (Nymphs of the manna ash trees).

After the separation of the Earth from the Sky, Gaia gave birth to other offspring, these being fathered by Pontus. Their names were the sea-god Nereus, Thaumas, Phorcys, Ceto and Eurybia. In other versions Gaia had offspring to her

James Lovelock-- has probably been overworked, but that's not to say the planet can't behave like a living thing, and these days, it's a living thing fighting a fever."[3] They celebrate a religious day on April 22th, 'Earth Day.' Their devil or evil force is Capitalism. They have their High Priests and Prophets, who are Paul Ehrlich, Ted Danson and now Al Gore to name just a few. These prophets prophesy of the upcoming End Times or Doom if the Capitalists do not repent of their ways. The leaders of the environmental movement evangelize, recruit and indoctrinate their disciples, placing an emphasis on children in the public school system; "Former U.S. Vice President Al Gore's global warming documentary ("An Inconvenient Truth,") will be sent to every secondary school in England as part of a campaign to tackle climate change, the government said Friday."[4]

Propaganda & Indoctrination Techniques

A number of techniques which are based on social psychological research are used to generate propaganda. Many of these same techniques can be found under logical fallacies, since propagandists use arguments that, while sometimes convincing, are not necessarily valid.

Some time has been spent analyzing the means by which propaganda messages are transmitted. That work is important but it is clear that information dissemination strategies only become propaganda strategies when coupled with *propagandistic messages*. Identifying these messages is a necessary prerequisite to study the methods by which those messages are spread. That is why it is essential to have some knowledge of the following techniques for generating propaganda:

- **Appeal to Authority:** Appeals to authority cite prominent figures to support a position idea, argument, or course of action; *Paul Ehrlich, a scientist; Ted Danson, a TV Actor; Al Gore, former Vice President of the United States.*
- **Appeal to fear:** Appeals to fear seek to build support by instilling fear in the general population, for example, Joseph Goebbels exploited Theodore Kaufman's *Germany Must Perish!* to claim that the Allies sought the extermination of the German people. *Al Gore told a reporter that he, "believes humans may have only 10 years left to save the planet from turning into a total frying pan."*

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brother Tartarus; they were Echidna and Typhon, the later being an enemy of Zeus. Apollo killed Typhon when he took control of the oracle at Delphi, which Gaia originally provided, and then the "Sibyl" sang the oracle in Gaia's shrine.
It was Gaia who saved Zeus from being swallowed by Cronus, after Zeus had been born, Gaia helped Rhea to wrap a stone in swaddling clothes, this was to trick Cronus in to thinking it was Zeus, because Cronus had been informed that one of his children would depose him, and so to get rid of his children he had swallowed them, Gaia's trick worked and Zeus was then taken to Crete.

Gaia being the primordial element from which all the gods originated was worshiped throughout Greece, but later she went into decline and was supplanted by other gods. In Roman mythology she was known as Tellus or Terra. http://www.pantheon.org/articles/g/gaia.html

[3] Sunday, Mar. 26, 2006 Global Warming Heats Up By Jeffrey Kluger

[4] British to Show Al Gore Movie in Schools Fri Feb 02,11:25 AM ET
http://entertainment.tv.yahoo.com/entnews/ap/20070202/117044430000.html

- **Argumentum ad nauseam:** Uses tireless repetition such as *'Global Warming.'* An idea once repeated enough times, is taken as the truth. Works best when media sources are limited and controlled by the propagator; *CNN, ABC, NBC, CBS and PBS.*

The Prophets

In the 1970's, Paul Ehrlich, Bing Professor of Population Studies in the department of Biological Sciences at Stanford University, became a prophet. In the 1980's Ted Danson, a TV actor, took on the prophet's mantel. Now in the year 2007, Al Gore is their present prophet and high priest.

Paul Ehrlich's Prophesies in the 70s that:[5]

1. Population will inevitably and completely outstrip whatever small increases in food supplies we make, ... The death rate will increase until at least 100-200 million people per year will be starving to death during the next ten years." Paul Ehrlich in an interview with Peter Collier in the April 1970 edition of the magazine *Mademoiselle.*

2. The battle to feed humanity is over. In the 1970s the world will undergo famines . . . hundreds of millions of people (including Americans) are going to starve to death." (*Population Bomb* 1968)

3. "Smog disasters" in 1973 might kill 200,000 people in New York and Los Angeles. (1969)

2. "I would take even money that England will not exist in the year 2000." (1969)

2. "Before 1985, mankind will enter a genuine age of scarcity . . . in which the accessible supplies of many key minerals will be facing depletion." (1976)

2. "By 1985 enough millions will have died to reduce the earth's population to some acceptable level, like 1.5 billion people." (1969)

7. "By 1980 the United States would see it's life expectancy drop to 42 because of pesticides, and by 1999 its population would drop to 22.6 million." (1969)

Ted Danson's Prophesy

In 1988, Ted Danson prophesied that our oceans will be dead by 1998.

Al Gore's Prophesy

1. "He believes humans may have only 10 years left to save the planet from turning into a total frying pan.

2. Gore argues – with scientific evidence projected on big screens at his back – that global warming may soon lead to catastrophic sea level rises, which could inundate cities such as New York (flooding the former site of the World Trade Center), producing scary nonlinear runaway spasms of extreme weather (bigger, badder

[5] http://www.igreens.org.uk/paul_ehrlich.htm

hurricanes and typhoons), global pandemics and, depending on where you live, torrential rains or decade-long drought. It is not a pretty picture."[6]

The Apocalypse of the End Times Predicted

"In Africa, drought continues for the sixth consecutive year, adding terribly to the toll of famine victims. During the year record rains in parts of the U.S., Pakistan and Japan caused some of the worst flooding in centuries. In Canada's wheat belt, a particularly chilly and rainy spring has delayed planting and may well bring a disappointingly small harvest. Rainy Britain, on the other hand, has suffered from uncharacteristic dry spells the past few springs. A series of unusually cold winters has gripped the American Far West, while New England and northern Europe have recently experienced the mildest winters within anyone's recollection.

As they review the bizarre and unpredictable weather pattern of the past several years, a growing number of scientists are beginning to suspect that many seemingly contradictory meteorological fluctuations are actually part of a global climatic upheaval. However widely the weather varies from place to place and time to time, when meteorologists take an average of temperatures around the globe they find that the atmosphere has been growing gradually _____…" I have interrupted this article allowing you to guess the year this article was written. Also I would like for you to fill in the blank with the missing 'word.' Today the public would fill in the blank with the word, 'warmer.' Wrong! This article was printed in Time Magazine in 1974, thirty-three years ago, with the title, "**Another Ice Age?"** I will resume the rest of the article … "cooler for the past three decades. The trend shows no indication of reversing. Climatological Cassandras are becoming increasingly apprehensive, for the weather aberrations they are studying may be the harbinger of another ice age." (See Appendix A for the Full Article) Let us now observe Time Magazines new revelation in the year 2006!

"No one can say exactly what it looks like when a planet takes ill, but it probably looks a lot like Earth. Never mind what you've heard about global warming as a slow-motion emergency that would take decades to play out. Suddenly and unexpectedly, the crisis is upon us. It certainly looked that way last week as the atmospheric bomb that was Cyclone Larry--a Category 4 storm with wind bursts that reached 125 m.p.h.--exploded through northeastern Australia. It certainly looked that way last year as curtains of fire and dust turned the skies of Indonesia orange, thanks to drought-fueled blazes sweeping the island nation. It certainly looks that way as sections of ice the size of small states calve from the disintegrating Arctic and Antarctic. And it certainly looks that way as the sodden wreckage of New Orleans continues to molder, while the waters of the Atlantic gather themselves for

[6] Al Gore, Sundance's Leading Man, 'An Inconvenient Truth' Documents His Efforts To Raise Alarm on Effects of Global Warming, *By William Booth*Washington Post Staff Writer Thursday, January 26, 2006; Page A01

a new hurricane season just two months away. Disasters have always been with us and surely always will be. But when they hit this hard and come this fast--when the emergency becomes commonplace--something has gone grievously wrong. That something is global warming." (See Apprendix B for the Full Article)

How can this be? We have just been told, by Time Magazine, that for the past three decades we have been entering an 'Ice Age.' Now, according to Time Magazine and Al Gore, we are all going to fry instead of freezing to death! Al Gore said that our global warming may soon lead to catastrophic sea level rises, which could inundate cities such as New York (flooding the former site of the World Trade Center), producing scary nonlinear runaway spasms of extreme weather (bigger, badder hurricanes and typhoons), global pandemics and, depending on where you live, torrential rains or decade-long drought. Time Magazine prophesied that now, "From heat waves, to storms, to floods, to fires, to massive glacial melts, the global climate seems to be crashing around us."[7] One thing common among the prophets of environmentalism is that there will always be a catastrophic scenario, constructed by their high priests, if we do not repent and do what they say. The propaganda tool used above is called the 'Appeal to Fear.' The High Priests of the Church of the 'Religion of Environmentalism,' tried the propaganda of another Ice Age, which did not stop Capitalism. Now their prophets herald the opposite doom, which is their god, Gaia (Mother Earth), being burned up by the evil Capitalist!

P.S. Please read the article presented in Appendix C, "How Serious is the Global Warming Threat?" which was written by a former NASA scientist; **Roy W. Spencer**,[8] Principal Research Scientist, The University of Alabama in Huntsville, Huntsville, Alabama 35805 19 April, 2006.

[7] Sunday, Mar. 26, 2006 Global Warming Heats Up By Jeffrey Kluger

[8] Principal Research Scientist, University of Alabama

Dr. Roy Spencer is a principal research scientist for the University of Alabama in Huntsville and the U.S. Science Team Leader for the Advanced Microwave Scanning Radiometer (AMSR-E) on NASA's Aqua satellite. In the past, he has served as Senior Scientist for Climate Studies at NASA's Marshall Space Flight Center in Huntsville, Alabama.

Dr. Spencer is the recipient of NASA's Medal for Exceptional Scientific Achievement and the American Meteorological Society's Special Award for his satellite-based temperature monitoring work. He is the author of numerous scientific articles that have appeared in *Science*, *Nature*, *Journal of Climate*, *Monthly Weather Review*, *Journal of Atmospheric and Oceanic Technology*, *Journal of Climate and Applied Meteorology*, *Remote Sensing Reviews*, *Advances in Space Research*, and *Climatic Change*.

Dr. Spencer received his Ph.D. in Meteorology from the University of Wisconsin in 1981.

Appendix A

Monday, Jun. 24, 1974

Another Ice Age?

By Time Magazine

In Africa, drought continues for the sixth consecutive year, adding terribly to the toll of famine victims. During 1972 record rains in parts of the U.S., Pakistan and Japan caused some of the worst flooding in centuries. In Canada's wheat belt, a particularly chilly and rainy spring has delayed planting and may well bring a disappointingly small harvest. Rainy Britain, on the other hand, has suffered from uncharacteristic dry spells the past few springs. A series of unusually cold winters has gripped the American Far West, while New England and northern Europe have recently experienced the mildest winters within anyone's recollection.

As they review the bizarre and unpredictable weather pattern of the past several years, a growing number of scientists are beginning to suspect that many seemingly contradictory meteorological fluctuations are actually part of a global climatic upheaval. However widely the weather varies from place to place and time to time, when meteorologists take an average of temperatures around the globe they find that the atmosphere has been growing gradually cooler for the past three decades. The trend shows no indication of reversing. Climatological Cassandras are becoming increasingly apprehensive, for the weather aberrations they are studying may be the harbinger of another ice age.

Telltale signs are everywhere —from the unexpected persistence and thickness of pack ice in the waters around Iceland to the southward migration of a warmth-loving creature like the armadillo from the Midwest.Since the 1940s the mean global temperature has dropped about 2.7° F. Although that figure is at best an estimate, it is supported by other convincing data. When Climatologist George J. Kukla of Columbia University's Lamont-Doherty Geological Observatory and his wife Helena analyzed satellite weather data for the Northern Hemisphere, they found that the area of the ice and snow cover had suddenly increased by 12% in 1971 and the increase has persisted ever since. Areas of Baffin Island in the Canadian Arctic, for example, were once totally free of any snow in summer; now they are covered year round.

Scientists have found other indications of global cooling. For one thing there has been a noticeable expansion of the great belt of dry, high-altitude polar winds —the so-called circumpolar vortex—that sweep from west to east around the top and bottom of the world. Indeed it is the widening of this cap of cold air that is the immediate cause of Africa's drought. By blocking moisture-bearing equatorial winds and preventing them from bringing rainfall to the parched sub-Sahara region, as well as other drought-ridden areas stretching all the way from Central America to the Middle East and India, the polar winds have in effect caused the Sahara and other deserts to reach farther to the south. Paradoxically, the same vortex has created quite different weather quirks in the U.S. and other temperate zones. As the winds swirl around the globe, their southerly portions undulate like the bottom of a skirt. Cold air is pulled down across the Western U.S. and warm air is swept up to the Northeast. The collision of air masses of widely differing temperatures and humidity can create violent storms—the Midwest's recent rash of disastrous tornadoes, for example.

Sunspot Cycle. The changing weather is apparently connected with differences in the amount of energy that the earth's surface receives from the sun. Changes in the earth's tilt and distance from the sun could,

for instance, significantly increase or decrease the amount of solar radiation falling on either hemisphere—thereby altering the earth's climate. Some observers have tried to connect the eleven-year sunspot cycle with climate patterns, but have so far been unable to provide a satisfactory explanation of how the cycle might be involved.

Man, too, may be somewhat responsible for the cooling trend. The University of Wisconsin's Reid A. Bryson and other climatologists suggest that dust and other particles released into the atmosphere as a result of farming and fuel burning may be blocking more and more sunlight from reaching and heating the surface of the earth.

Climatic Balance. Some scientists like Donald Oilman, chief of the National Weather Service's long-range-prediction group, think that the cooling trend may be only temporary. But all agree that vastly more information is needed about the major influences on the earth's climate. Indeed, it is to gain such knowledge that 38 ships and 13 aircraft, carrying scientists from almost 70 nations, are now assembling in the Atlantic and elsewhere for a massive 100-day study of the effects of the tropical seas and atmosphere on worldwide weather. The study itself is only part of an international scientific effort known acronymically as GARP (for Global Atmospheric Research Program).

Whatever the cause of the cooling trend, its effects could be extremely serious, if not catastrophic. Scientists figure that only a 1% decrease in the amount of sunlight hitting the earth's surface could tip the climatic balance, and cool the planet enough to send it sliding down the road to another ice age within only a few hundred years.

The earth's current climate is something of an anomaly; in the past 700,000 years, there have been at least seven major episodes of glaciers spreading over much of the planet. Temperatures have been as high as they are now only about 5% of the time. But there is a peril more immediate than the prospect of another ice age. Even if temperature and rainfall patterns change only slightly in the near future in one or more of the three major grain-exporting countries—the U.S., Canada and Australia —global food stores would be sharply reduced. University of Toronto Climatologist Kenneth Hare, a former president of the Royal Meteorological Society, believes that the continuing drought and the recent failure of the Russian harvest gave the world a grim premonition of what might happen. Warns Hare: "I don't believe that the world's present population is sustainable if there are more than three years like 1972 in a row."

Appendix B

Sunday, Mar. 26, 2006

Global Warming Heats Up

By Time Magazine

By Jeffrey Kluger

No one can say exactly what it looks like when a planet takes ill, but it probably looks a lot like Earth. Never mind what you've heard about global warming as a slow-motion emergency that would take decades to play out. Suddenly and unexpectedly, the crisis is upon us.

It certainly looked that way last week as the atmospheric bomb that was Cyclone Larry--a Category 4 storm with wind bursts that reached 125 m.p.h.--exploded through northeastern Australia. It certainly looked that way last year as curtains of fire and dust turned the skies of Indonesia orange, thanks to drought-fueled blazes sweeping the island nation. It certainly looks that way as sections of ice the size of small states calve from the disintegrating Arctic and Antarctic. And it certainly looks that way as the sodden wreckage of New Orleans continues to molder, while the waters of the Atlantic gather themselves for a new hurricane season just two months away. Disasters have always been with us and surely always will be. But when they hit this hard and come this fast--when the emergency becomes commonplace--something has gone grievously wrong. That something is global warming.

The image of Earth as organism--famously dubbed Gaia by environmentalist James Lovelock-- has probably been overworked, but that's not to say the planet can't behave like a living thing, and these days, it's a living thing fighting a fever. From heat waves to storms to floods to fires to massive glacial melts, the global climate seems to be crashing around us. Scientists have been calling this shot for decades. This is precisely what they have been warning would happen if we continued pumping greenhouse gases into the atmosphere, trapping the heat that flows in from the sun and raising global temperatures.

Environmentalists and lawmakers spent years shouting at one another about whether the grim forecasts were true, but in the past five years or so, the serious debate has quietly ended. Global warming, even most skeptics have concluded, is the real deal, and human activity has been causing it. If there was any consolation, it was that the glacial pace of nature would give us decades or even centuries to sort out the problem.

But glaciers, it turns out, can move with surprising speed, and so can nature. What few people reckoned on was that global climate systems are booby-trapped with tipping points and feedback loops, thresholds past which the slow creep of environmental decay gives way to sudden and self-perpetuating collapse. Pump enough CO2 into the sky, and that last part per million of greenhouse gas behaves like the 212th degree Fahrenheit that turns a pot of hot water into a plume of billowing steam. Melt enough Greenland ice, and you reach the point at which you're not simply dripping meltwater into the sea but dumping whole glaciers. By one recent measure, several Greenland ice sheets have doubled their rate of slide, and just last week the journal Science published a study suggesting that by the end of the century, the world could be locked in to an eventual rise in sea levels of as much as 20 ft. Nature, it seems, has finally got a bellyful of us.

"Things are happening a lot faster than anyone predicted," says Bill Chameides, chief scientist for the advocacy group Environmental Defense and a former professor of atmospheric chemistry. "The last 12 months have been alarming." Adds Ruth Curry of the Woods Hole Oceanographic Institution in Massachusetts: "The ripple through the scientific community is palpable."

And it's not just scientists who are taking notice. Even as nature crosses its tipping points, the public seems to have reached its own. For years, popular skepticism about climatological science stood in the way of addressing the problem, but the naysayers--many of whom were on the payroll of energy companies--have become an increasingly marginalized breed. In a new TIME/ ABC News/ Stanford University poll, 85% of respondents agree that global warming probably is happening. Moreover, most respondents say they want some action taken. Of those polled, 87% believe the government should either encourage or require lowering of power-plant emissions, and 85% think something should be done to get cars to use less gasoline. Even Evangelical Christians, once one of the most reliable columns in the conservative base, are demanding action, most notably in February, when 86 Christian leaders formed the Evangelical Climate Initiative, demanding that Congress regulate greenhouse gases.

A collection of new global-warming books is hitting the shelves in response to that awakening interest, followed closely by TV and theatrical documentaries. The most notable of them is An Inconvenient Truth, due out in May, a profile of former Vice President Al Gore and his climate-change work, which is generating a lot of prerelease buzz over an unlikely topic and an equally unlikely star. For all its lack of Hollywood flash, the film compensates by conveying both the hard science of global warming and Gore's particular passion.

Such public stirrings are at last getting the attention of politicians and business leaders, who may not always respond to science but have a keen nose for where votes and profits lie. State and local lawmakers have started taking action to curb emissions, and major corporations are doing the same. Wal-Mart has begun installing wind turbines on its stores to generate electricity and is talking about putting solar reflectors over its parking lots. HSBC, the world's second largest bank, has pledged to neutralize its carbon output by investing in wind farms and other green projects. Even President Bush, hardly a favorite of greens, now acknowledges climate change and boasts of the steps he is taking to fight it. Most of those steps, however, involve research and voluntary emissions controls, not exactly the laws with teeth scientists are calling for.

Is it too late to reverse the changes global warming has wrought? That's still not clear. Reducing our emissions output year to year is hard enough. Getting it low enough so that the atmosphere can heal is a multigenerational commitment. "Ecosystems are usually able to maintain themselves," says Terry Chapin, a biologist and professor of ecology at the University of Alaska, Fairbanks. "But eventually they get pushed to the limit of tolerance."

CO2 AND THE POLES

As a tiny component of our atmosphere, carbon dioxide helped warm Earth to comfort levels we are all used to. But too much of it does an awful lot of damage. The gas represents just a few hundred parts per million (p.p.m.) in the overall air blanket, but they're powerful parts because they allow sunlight to stream in but prevent much of the heat from radiating back out. During the last ice age, the atmosphere's CO2 concentration was just 180 p.p.m., putting Earth into a deep freeze. After the glaciers retreated but before the dawn of the modern era, the total had risen to a comfortable 280 p.p.m. In just the past century and a half, we have pushed the level to 381 p.p.m., and we're feeling the effects. Of the 20 hottest years on record, 19 occurred in the 1980s or later. According to NASA scientists, 2005 was one of the hottest years in more than a century.

It's at the North and South poles that those steambath conditions are felt particularly acutely, with glaciers and ice caps crumbling to slush. Once the thaw begins, a number of mechanisms kick in to keep it going. Greenland is a vivid example. Late last year, glaciologist Eric Rignot of the Jet Propulsion Laboratory in

Pasadena, Calif., and Pannir Kanagaratnam, a research assistant professor at the University of Kansas, analyzed data from Canadian and European satellites and found that Greenland ice is not just melting but doing so more than twice as fast, with 53 cu. mi. draining away into the sea last year alone, compared with 22 cu. mi. in 1996. A cubic mile of water is about five times the amount Los Angeles uses in a year.

Dumping that much water into the ocean is a very dangerous thing. Icebergs don't raise sea levels when they melt because they're floating, which means they have displaced all the water they're ever going to. But ice on land, like Greenland's, is a different matter. Pour that into oceans that are already rising (because warm water expands), and you deluge shorelines. By some estimates, the entire Greenland ice sheet would be enough to raise global sea levels 23 ft., swallowing up large parts of coastal Florida and most of Bangladesh. The Antarctic holds enough ice to raise sea levels more than 215 ft.

FEEDBACK LOOPS

One of the reasons the loss of the planet's ice cover is accelerating is that as the poles' bright white surface shrinks, it changes the relationship of Earth and the sun. Polar ice is so reflective that 90% of the sunlight that strikes it simply bounces back into space, taking much of its energy with it. Ocean water does just the opposite, absorbing 90% of the energy it receives. The more energy it retains, the warmer it gets, with the result that each mile of ice that melts vanishes faster than the mile that preceded it.

That is what scientists call a feedback loop, and it's a nasty one, since once you uncap the Arctic Ocean, you unleash another beast: the comparatively warm layer of water about 600 ft. deep that circulates in and out of the Atlantic. "Remove the ice," says Woods Hole's Curry, "and the water starts talking to the atmosphere, releasing its heat. This is not a good thing."

A similar feedback loop is melting permafrost, usually defined as land that has been continuously frozen for two years or more. There's a lot of earthly real estate that qualifies, and much of it has been frozen much longer than two years--since the end of the last ice age, or at least 8,000 years ago. Sealed inside that cryonic time capsule are layers of partially decayed organic matter, rich in carbon. In high-altitude regions of Alaska, Canada and Siberia, the soil is warming and decomposing, releasing gases that will turn into methane and CO2. That, in turn, could lead to more warming and permafrost thaw, says research scientist David Lawrence of the National Center for Atmospheric Research (NCAR) in Boulder, Colo. And how much carbon is socked away in Arctic soils? Lawrence puts the figure at 200 gigatons to 800 gigatons. The total human carbon output is only 7 gigatons a year.

One result of all that is warmer oceans, and a result of warmer oceans can be, paradoxically, colder continents within a hotter globe. Ocean currents running between warm and cold regions serve as natural thermoregulators, distributing heat from the equator toward the poles. The Gulf Stream, carrying warmth up from the tropics, is what keeps Europe's climate relatively mild. Whenever Europe is cut off from the Gulf Stream, temperatures plummet. At the end of the last ice age, the warm current was temporarily blocked, and temperatures in Europe fell as much as 10°F, locking the continent in glaciers.

What usually keeps the Gulf Stream running is that warm water is lighter than cold water, so it floats on the surface. As it reaches Europe and releases its heat, the current grows denser and sinks, flowing back to the south and crossing under the northbound Gulf Stream until it reaches the tropics and starts to warm again. The cycle works splendidly, provided the water remains salty enough. But if it becomes diluted by freshwater, the salt concentration drops, and the water gets lighter, idling on top and stalling the current. Last December, researchers associated with Britain's National Oceanography Center reported that one component of the system that drives the Gulf Stream has slowed about 30% since 1957. It's the increased

release of Arctic and Greenland meltwater that appears to be causing the problem, introducing a gush of freshwater that's overwhelming the natural cycle. In a global-warming world, it's unlikely that any amount of cooling that resulted from this would be sufficient to support glaciers, but it could make things awfully uncomfortable.

"The big worry is that the whole climate of Europe will change," says Adrian Luckman, senior lecturer in geography at the University of Wales, Swansea. "We in the U.K. are on the same latitude as Alaska. The reason we can live here is the Gulf Stream."

DROUGHT

As fast as global warming is transforming the oceans and the ice caps, it's having an even more immediate effect on land. People, animals and plants living in dry, mountainous regions like the western U.S. make it through summer thanks to snowpack that collects on peaks all winter and slowly melts off in warm months. Lately the early arrival of spring and the unusually blistering summers have caused the snowpack to melt too early, so that by the time it's needed, it's largely gone. Climatologist Philip Mote of the University of Washington has compared decades of snowpack levels in Washington, Oregon and California and found that they are a fraction of what they were in the 1940s, and some snowpacks have vanished entirely.

Global warming is tipping other regions of the world into drought in different ways. Higher temperatures bake moisture out of soil faster, causing dry regions that live at the margins to cross the line into full-blown crisis. Meanwhile, El Niño events--the warm pooling of Pacific waters that periodically drives worldwide climate patterns and has been occurring more frequently in global-warming years--further inhibit precipitation in dry areas of Africa and East Asia. According to a recent study by NCAR, the percentage of Earth's surface suffering drought has more than doubled since the 1970s.

FLORA AND FAUNA

Hot, dry land can be murder on flora and fauna, and both are taking a bad hit. Wildfires in such regions as Indonesia, the western U.S. and even inland Alaska have been increasing as timberlands and forest floors grow more parched. The blazes create a feedback loop of their own, pouring more carbon into the atmosphere and reducing the number of trees, which inhale CO2 and release oxygen.

Those forests that don't succumb to fire die in other, slower ways. Connie Millar, a paleoecologist for the U.S. Forest Service, studies the history of vegetation in the Sierra Nevada. Over the past 100 years, she has found, the forests have shifted their tree lines as much as 100 ft. upslope, trying to escape the heat and drought of the lowlands. Such slow-motion evacuation may seem like a sensible strategy, but when you're on a mountain, you can go only so far before you run out of room. "Sometimes we say the trees are going to heaven because they're walking off the mountaintops," Millar says.

Across North America, warming-related changes are mowing down other flora too. Manzanita bushes in the West are dying back; some prickly pear cacti have lost their signature green and are instead a sickly pink; pine beetles in western Canada and the U.S. are chewing their way through tens of millions of acres of forest, thanks to warmer winters. The beetles may even breach the once insurmountable Rocky Mountain divide, opening up a path into the rich timbering lands of the American Southeast.

With habitats crashing, animals that live there are succumbing too. Environmental groups can tick off scores of species that have been determined to be at risk as a result of global warming. Last year, researchers in Costa Rica announced that two-thirds of 110 species of colorful harlequin frogs have vanished in the past 30 years, with the severity of each season's die-off following in lockstep with the severity of that year's warming.

In Alaska, salmon populations are at risk as melting permafrost pours mud into rivers, burying the gravel the fish need for spawning. Small animals such as bushy-tailed wood rats, alpine chipmunks and piñon mice are being chased upslope by rising temperatures, following the path of the fleeing trees. And with sea ice vanishing, polar bears--prodigious swimmers but not inexhaustible ones--are starting to turn up drowned. "There will be no polar ice by 2060," says Larry Schweiger, president of the National Wildlife Federation. "Somewhere along that path, the polar bear drops out."

WHAT ABOUT US?

It is fitting, perhaps, that as the species causing all the problems, we're suffering the destruction of our habitat too, and we have experienced that loss in terrible ways. Ocean waters have warmed by a full degree Fahrenheit since 1970, and warmer water is like rocket fuel for typhoons and hurricanes. Two studies last year found that in the past 35 years the number of Category 4 and 5 hurricanes worldwide has doubled while the wind speed and duration of all hurricanes has jumped 50%. Since atmospheric heat is not choosy about the water it warms, tropical storms could start turning up in some decidedly nontropical places. "There's a school of thought that sea surface temperatures are warming up toward Canada," says Greg Holland, senior scientist for NCAR in Boulder. "If so, you're likely to get tropical cyclones there, but we honestly don't know."

WHAT WE CAN DO

So much for environmental collapse happening in so many places at once has at last awakened much of the world, particularly the 141 nations that have ratified the Kyoto treaty to reduce emissions--an imperfect accord, to be sure, but an accord all the same. The U.S., however, which is home to less than 5% of Earth's population but produces 25% of CO2 emissions, remains intransigent. Many environmentalists declared the Bush Administration hopeless from the start, and while that may have been premature, it's undeniable that the White House's environmental record--from the abandonment of Kyoto to the President's broken campaign pledge to control carbon output to the relaxation of emission standards--has been dismal. George W. Bush's recent rhetorical nods to America's oil addiction and his praise of such alternative fuel sources as switchgrass have yet to be followed by real initiatives.

The anger surrounding all that exploded recently when NASA researcher Jim Hansen, director of the Goddard Institute for Space Studies and a longtime leader in climate-change research, complained that he had been harassed by White House appointees as he tried to sound the global-warming alarm. "The way democracy is supposed to work, the presumption is that the public is well informed," he told TIME. "They're trying to deny the science." Up against such resistance, many environmental groups have resolved simply to wait out this Administration and hope for something better in 2009.

The Republican-dominated Congress has not been much more encouraging. Senators John McCain and Joe Lieberman have twice been unable to get through the Senate even mild measures to limit carbon. Senators Pete Domenici and Jeff Bingaman, both of New Mexico and both ranking members of the chamber's Energy Committee, have made global warming a high-profile matter. A white paper issued in February will be the subject of an investigatory Senate conference next week. A House delegation

recently traveled to Antarctica, Australia and New Zealand to visit researchers studying climate change. "Of the 10 of us, only three were believers," says Representative Sherwood Boehlert of New York. "Every one of the others said this opened their eyes."

Boehlert himself has long fought the environmental fight, but if the best that can be said for most lawmakers is that they are finally recognizing the global-warming problem, there's reason to wonder whether they will have the courage to reverse it. Increasingly, state and local governments are filling the void. The mayors of more than 200 cities have signed the U.S. Mayors Climate Protection Agreement, pledging, among other things, that they will meet the Kyoto goal of reducing greenhouse-gas emissions in their cities to 1990 levels by 2012. Nine eastern states have established the Regional Greenhouse Gas Initiative for the purpose of developing a cap-and-trade program that would set ceilings on industrial emissions and allow companies that overperform to sell pollution credits to those that underperform-- the same smart, incentive-based strategy that got sulfur dioxide under control and reduced acid rain. And California passed the nation's toughest automobile- emissions law last summer.

"There are a whole series of things that demonstrate that people want to act and want their government to act," says Fred Krupp, president of Environmental Defense. Krupp and others believe that we should probably accept that it's too late to prevent CO2 concentrations from climbing to 450 p.p.m. (or 70 p.p.m. higher than where they are now). From there, however, we should be able to stabilize them and start to dial them back down.

That goal should be attainable. Curbing global warming may be an order of magnitude harder than, say, eradicating smallpox or putting a man on the moon. But is it moral not to try? We did not so much march toward the environmental precipice as drunkenly reel there, snapping at the scientific scolds who told us we had a problem.

The scolds, however, knew what they were talking about. In a solar system crowded with sister worlds that either emerged stillborn like Mercury and Venus or died in infancy like Mars, we're finally coming to appreciate the knife-blade margins within which life can thrive. For more than a century we've been monkeying with those margins. It's long past time we set them right.

With reporting by David Bjerklie, Andrea Dorfman/ New York, Dan Cray/ Los Angeles, Greg Fulton/ Atlanta, Andrea Gerlin/ London, Rita Healy/ Denver, Eric Roston/ Washington

Appendix C

How Serious is the Global Warming Threat?

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Abstract

Global warming is the quintessential environmental scare. While the local effects of litter, chemical contamination, and aerosol pollution had dominated our environmental concerns in the 1970's and 1980's, we are now faced with a threat that is global in extent and predicted to be long-lasting[1]. The culprit is humanity's use of fossil fuels, which release carbon dioxide into the atmosphere when burned. Since carbon dioxide is a 'greenhouse gas', it affects the radiative energy budget of the Earth. While carbon dioxide is a relatively minor atmospheric constituent, with a concentration now approaching 400 parts per million (pre-industrial levels were about 280 parts per million), it acts like a 'blanket' for infrared (heat) radiation, warming the lower atmosphere, and cooling the upper atmosphere.

The direct warming effect of a doubling of carbon dioxide concentrations (doubling is predicted to occur late in this century) has been estimated to be only about 1 deg. C. While this is not a very worrisome level of warming, many computer climate models suggest warming levels of three or four times this magnitude. This extra warming is due to 'positive feedback' in the models. Positive feedbacks occur when the direct warming tendency of the carbon dioxide is amplified by changes in clouds, water vapor, snow cover, and sea ice in the models. The existence and magnitude of these positive feedbacks are at the heart of scientific arguments over how much of the current global warmth is due to mankind's activities, and therefore how much global warming we can expect in the future.

But even if predictions of strong warming, say 10 deg. F by the end of this century, are correct it is not at all clear what the best policy reaction to that threat should be. Because of the necessity of inexpensive energy sources for the health and well being of humans, it will be impossible to achieve substantial reductions in energy use through conservation. Instead, massive reductions in greenhouse gas emissions will require new energy technologies. Those technologies will likely be developed in the countries that can afford massive energy R&D efforts. Therefore, draconian, government-mandated punishment of fossil fuel use through taxes or carbon caps could very well hurt rather than help efforts to develop those new technologies.

1. Global Warming to Date

Globally averaged temperatures as measured by surface thermometers have warmed by about 0.6 deg. C (about 1 deg. F) over the last one hundred years (see Fig. 1). There are three major features in this temperature record. The first is a warming trend up until 1940, which is believed by many to represent the end of the "Little Ice Age". Then, a gradual cooling trend is seen from the 1940's through the 1970's. This cooling could have been due to man-made aerosol pollution, which reflects sunlight, but this explanation is somewhat speculative.

Finally, stronger warming has occurred since the 1970's up to the present. This warming is widely attributed to manmade greenhouse gases. It is this recent warming trend that is the most worrisome for many scientists, and has led to considerable media hysteria over the issue. Some believe that global temperatures are now warmer than they have been anytime in the last 1,000 years. (Year-to-year temperature fluctuations seen in Fig. 1, which can be quite large, are mostly due to El Nino, La Nina, and volcanic eruptions, the effects of which all last about two or three years.)

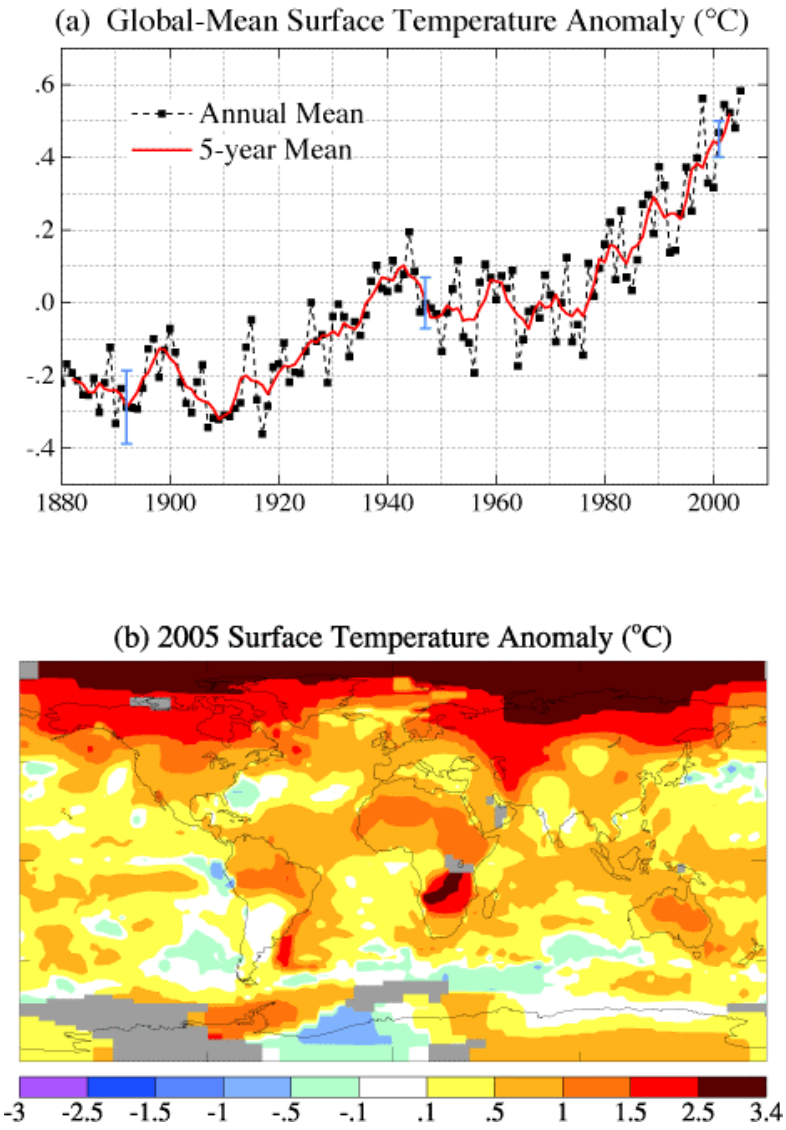

Fig. 1. (a) Globally averaged yearly surface temperature fluctuations measured by thermometers for the period 1880 – 2005; (b) the geographic distribution of those temperature anomalies for 2005 (Goddard Institute for Space Studies).

The claims that current temperatures are warmer than anytime in the last 1,000 years depend critically on proxy measurements – primarily tree ring data from a handful of locations that have long-lived species of trees. While I'm sure that most of the paleoclimate experts that perform this kind of research are fully convinced of the accuracy of these proxy estimates, many of the assumptions involved can never be tested and verified. Therefore, I view any conclusions based upon proxy data to be very suspect.

A central issue is how much of the present warmth is due to mankind's activities. While several climate modelers have indeed come up with assumed magnitudes for aerosol cooling and greenhouse gas warming effects that explain the current warming trend, these are by no means the only possible explanations. Since we really do not understand, and thus are unable to model, the decadal-scale natural climate variability of the climate system, we really can not know with any certainty how much of the present warmth is due to the burning of fossil fuels. For instance, due to a lack of sufficient observational

data, changes in ocean circulation or cloud amounts could have occurred without being detected. But science can only deal with what is understood, not with what is unknown. So science has fallen into the bad habit of attributing most climate changes to the activities of man.

Anecdotal evidence such as melting sea ice and retreating glaciers would seem to provide convincing evidence. But thermometer measurements suggest that the Arctic region was at least as warm in the late 1930's as it is now. Since we only have reliable sea ice measurements since about 1979, when satellite measurements first began, we really do not know whether recent sea ice trends are outside the realm of natural variability.

Similar points can be made about the receding of glaciers. Glaciers respond to a variety of influences, especially precipitation. Only a handful of the thousands of the world's glaciers have been measured for decades, let alone for centuries. Some of the glaciers that are receding are uncovering tree stumps, indicating previous times when obviously natural climate fluctuations were also responsible for a restricted extent of the ice fields.

The bottom line is that, while we are indeed in a period of unusual warmth, it not at all obvious whether it is either unprecedented, or directly attributable to manmade greenhouse warming. While science has come up with suggested explanations for the current warmth that only involve manmade aerosol and greenhouse gas pollution, these are by no means the only possible explanations.

2. **The Earth's Greenhouse Effect**

The term 'greenhouse effect' really has two meanings. The Earth has a natural greenhouse effect that is mostly due to water vapor (about 90% of the effect), as well as and carbon dioxide and methane. It has been pointed out many times that the Earth's natural greenhouse effect[11] (again, primarily due to water vapor) keeps the Earth habitably warm. Indeed, were it not for this warming effect, life as we know it might not exist on Earth, as the surface would be too cold.

But the term 'greenhouse effect' is also used to refer to the manmade 'enhancement' of the Earth's natural greenhouse effect from our production of extra carbon dioxide from burning of fossil fuels. Thus, 'global warming' usually refers to the manmade enhancement of the Earth's natural greenhouse effect by the burning of fossil fuels.

A useful analogy for the Earth's natural greenhouse effect is that of a blanket. The blanket of water vapor, carbon dioxide, and methane traps infrared radiation and warms the lower atmosphere, while at the same time cooling the upper atmosphere. This effect is somewhat analogous to that of a blanket keeping warm air close to your body, while at the same time keeping cooler air away from your body. The thicker the blanket, the warmer it stays under the blanket, and the cooler it remains outside of the blanket.

While sunlight is what ultimately drives the climate system, infrared radiation is an equally important player. For the temperature of the Earth to remain roughly constant, the amount of sunlight absorbed by the entire Earth must equal the amount of infrared radiation lost to outer space. This is called *radiative energy balance*. Adding carbon dioxide, a greenhouse gas, changes the radiative balance of the Earth by not allowing as much infrared cooling to occur to balance the solar heating. The result is presumed to be a warming that proceeds until the higher temperatures push the outgoing infrared radiation intensity back up to where it, once again, balances the incoming sunlight.

This radiative balance (or the presumed imbalance) has not, however, actually been measured…it has only been inferred. NASA flies Earth-orbiting instruments that measure these radiative components, but the instruments are not quite accurate enough to reliably measure the sub-percent accuracy necessary to observe the expected imbalance between incoming sunlight and outgoing infrared energy. For all we know, the oceans might be giving up large amounts of heat that had been stored in centuries past, or clouds might have undergone recent changes, leading to natural radiative imbalances in the system. But instead, since we don't have enough information to conclude otherwise, most scientists simply assume that balance exists.

3. **Global Warming Theory**

There is a sound physical basis for the fundamentals of global warming theory. We know for a fact that carbon dioxide is a greenhouse gas, and that atmospheric concentrations of CO_2 are increasing. And as can be seen in Fig. 2, the atmospheric concentration of carbon dioxide has been steadily rising (routine measurements were started in 1958). Note that the atmospheric concentration is still relatively small as of 2005, only about 380 parts per million by volume.

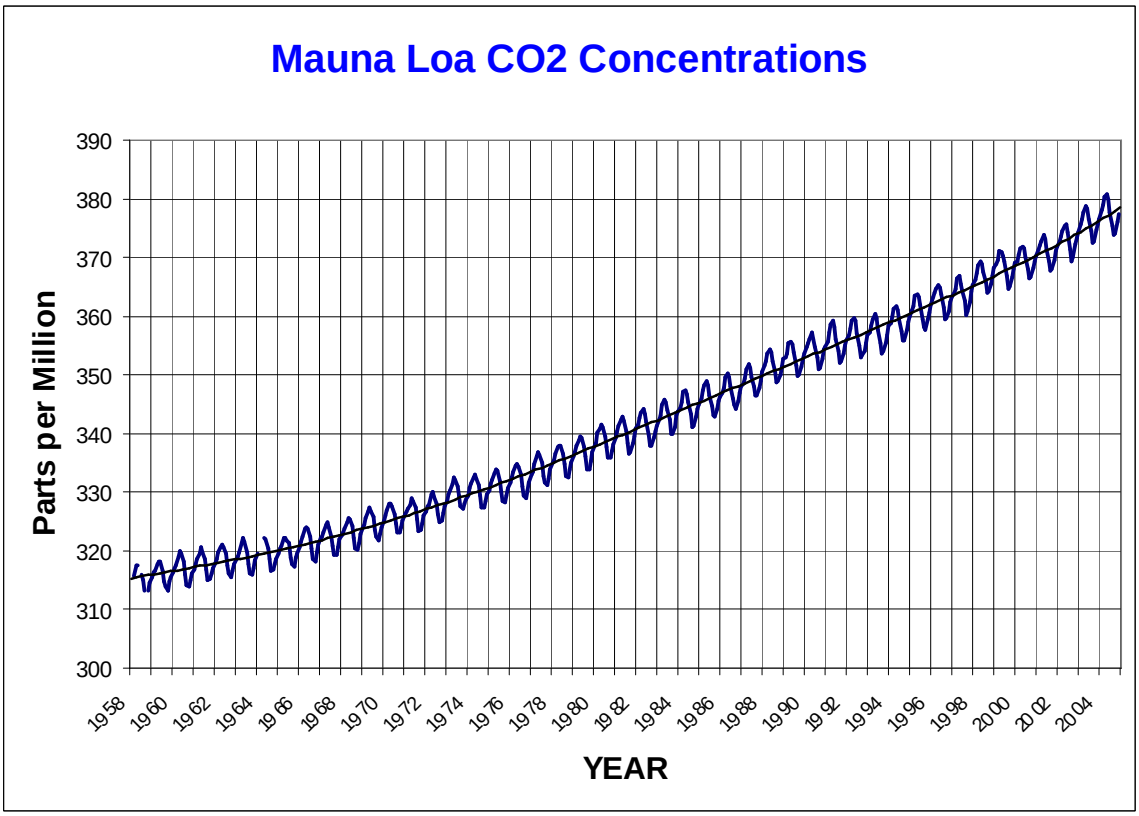

Fig. 2. Atmospheric carbon dioxide concentrations for the period 1958-2004 at Mauna Loa Observatory (based upon data collected by NOAA Climate Monitoring and Diagnostics Laboratory).

Based upon *theoretical calculations*, and assuming that no natural radiative imbalance exists, a current manmade imbalance of about 0.85 Watts per square meter has been inferred by one study.[5] For reference, this can be compared to an estimated average value of about 340 Watts per square meter for both incoming and outgoing levels of radiation at the top of the atmosphere (globally averaged). If not for the current global warmth, the calculated imbalance would be even larger since some of the imbalance has presumably been alleviated by increased global temperatures.

The accuracy of the (0.85 watts) calculation, however, depends upon assumptions about many variables, such as global water vapor and cloud distributions, that are really not measured accurately enough to give this level of precision. In other words, this small imbalance assumes all the natural forcings in the climate system are in balance. This, I believe, is unlikely to be true. Because of the ability of the ocean to store or release huge amounts of heat without large temperature changes, it would be the first suspect. Indeed, we already know that large radiative imbalances exist locally and over regions, for this is what drives much of our weather.

My focus on these potential *natural* sources of global imbalances does not by itself prove that the manmade portion of any imbalance is unimportant. I only point them out as an example of how we assume climate stability is tied to radiative balance, when in fact climate stability (say, as measured by the average surface temperature of the Earth) might well exist even in the face of substantial radiative imbalances – imbalances that climate models have not been tuned to deal with.

Despite all of these uncertainties, we *do* know that the extra carbon dioxide does indeed cause an extra trapping of infrared radiation, resulting in a warming *tendency* in the lower atmosphere (and presumably in the ocean). The warming due to a doubling of carbon dioxide *alone*, without any other changes in the atmosphere (an unlikely assumption) would amount to only about 1-2 deg. F. This doubling of CO_2 is expected to occur late in this century, and if this was the expected level of warming by then there would be relatively little worry.

Instead, the concern over how much warming will occur in the future is not so much because of the *direct* warming effects of the extra CO_2. Instead, the worry is that various weather processes might change in *response* to the warming tendency from the extra carbon dioxide in such a way that amplifies that response (positive feedback). For instance, a decrease in low clouds in response to the warming tendency would be a positive feedback, since it amplifies the warming by letting more sunlight reach the surface.

Similarly, an increase in water vapor (the Earth's dominant greenhouse gas) would also amplify the warming. Indeed, water vapor is believed by many climate scientists to be the dominant positive feedback in the climate system[13]. A warming tendency should evaporate more water from the surface, which by itself would cause further warming, which causes more evaporation, etc. This is why water vapor feedback is generally believed to amplify the warming due to carbon dioxide alone, by at least a factor of two.

In computer model simulations of the climate system, which are simplified mathematical representations of the most important weather processes, the net feedback is usually found to be positive[13]. In a few models, it is strongly positive. This is why some climate experts talk about a potential threat of temperature rises of 10 deg. F or more in response to a doubling of carbon dioxide. These large values occur because positive feedbacks combine in such a way that they tend to amplify each other.

But are these feedbacks really understood well enough to believe the predictions of climate models that include those feedbacks? Is our climate system really that sensitive to a small increase in greenhouse gases? At some point, climate modelers must depend upon faith…faith that they know the sign and magnitude of these feedbacks, and that the model forced by these feedbacks is behaving in a realistic manner.

Now you can begin to see why global warming theory depends upon assumptions as much as it does on scientific observations. How much of the current (or predicted) warming a scientist believes is due to mankind ultimately comes down to how much faith that person has in our present understanding of what drives climate fluctuations, the computer climate models that contain that understanding, and ultimately, faith in how fragile or resilient the Earth is.

4. **The Earth's Thermostat**

There is a simple aspect of the climate system that I have not yet mentioned that I believe argues against substantial future warming. It has been computed that, even though the natural greenhouse effect 'tries' to increase the surface temperature of the Earth to about 140 deg. F, 75% of that warming is prevented from ever occurring[14]. Weather – clouds, rain, wind – all are the result of the atmosphere's response to the warming rays of the sun, short-circuiting the Earth's natural greenhouse effect and greatly limiting surface warming.

Thus, even though water vapor (through its greenhouse effect) keeps the Earth habitably *warm*, the same water vapor also represents *heat removal* processes that also keep the Earth habitably *cool*. In other words, the characteristics of water moderate and stabilize the climate against large temperature fluctuations.

The heat absorbed by the water vapor is carried by convective air currents that transport the extra heat and water vapor upward, eventually causing clouds to form. This further cools the climate by shading some of the Earth from the sun. Some of the condensed water in the clouds returns to the Earth as precipitation, replenishing the surface water so that the whole process, called the hydrologic cycle, can start all over again. As a result of all of the cooling processes associated with weather systems, the average surface temperature of the Earth is about 55 deg. F, rather than a scorching 140 deg. F[14].

These processes are, however crudely, are indeed included in climate models. My main point is that the *net effect* of clouds, water vapor, precipitation – in short, weather and the global hydrologic cycle – is to substantially cool the surface of the Earth below what the natural greenhouse effect would cause it to be for a given amount of incoming sunlight. So, without firm evidence that the net atmospheric feedbacks are indeed positive, I would say there is still substantial uncertainty about mankind's influence on global temperatures.

But how could climate models that predict large amounts of warming all be wrong? First, let us look at a feedback that is believed to be well understood: positive water vapor feedback. It is true that if the surface warms, there will be more water evaporated from the surface, and water vapor is the Earth's dominant greenhouse gas. But the average amount of water vapor in the atmosphere is not simply due to how much water is evaporated from the surface….that is only half of the story. If evaporation was to occur unchecked, the global atmosphere would become totally saturated with water within a matter of days or weeks. This does not happen. Instead, the average amount of vapor in the atmosphere is the result of a *balance* between the vapor *source* (evaporation) and the vapor *sink* (precipitation). Therefore, one can not determine how atmospheric water vapor will change with warming without understanding precipitation systems[15,16] and their response to warming.

And how will precipitation systems change in response to warming? No one knows. A minority of scientists (like me) contend that, until we understand how precipitation processes respond to warming,

we really do not know whether water vapor feedback is strongly positive, weakly positive, or zero. Yet water vapor feedback is considered by many scientists to be a "solved" problem.

Clouds, in contrast, represent a feedback that everyone agrees is uncertain[17]. It has been calculated that only a couple percent increase in low clouds would offset the warming effects of a doubling of atmospheric carbon dioxide from fossil fuel use. And since all of these processes (evaporation, clouds, precipitation) are interconnected, it really is misleading to treat them as separate feedbacks anyway. They are all intimately tied together, and probably must all be addressed together, not individually.

5. **Global Warming Predictions as Faith**

I hope that the above discussions will help you realize how much faith is required to extrapolate our current level of climate understanding to predictions of future warming. Climate models are, their creators will admit, relatively crude representations of how the atmosphere works. Just because the models do a reasonably good job of replicating the seasons (which are forced by huge variations in the energy source, sunlight) does not mean that they respond properly to the warming tendency of a minor greenhouse gas, carbon dioxide.

Nevertheless, a majority of climate modelers and climate scientists have sufficient faith in the models to argue for their use as predictive tools. Unfortunately, the historical track record of scientific predictions of massive environmental changes of any kind has been poor. This has led to a public distrust, mostly deserved, of scientific predictions of catastrophe.

This is not to say that substantial global warming is out of the question. Instead, I would argue that, both in terms of threats to humanity as well as to the Earth, there are usually unforeseen checks and balances in place that prevent the predicted threats from ever materializing. This statement, I admit, involves faith as well. But it is grounded in past experience, whereas catastrophic global warming beliefs are founded more in fear, conjecture, and a myriad of assumptions (both explicit and implicit).

6. **Benefits from Warming**

If I was forced to predict the future, I would side with a level of future warming that is relatively modest, due to stabilizing mechanisms within the climate system. The benefits of such a modest amount of global warming are seldom discussed. There is comparatively little government research money available to investigate possible benefits, and the media would rather report predictions of gloom and doom anyway.

The largest positive impact could be in agriculture. Based upon estimates of global energy use, the current rate of rise in atmospheric carbon dioxide concentration in Fig. 2 is only 50% of what it should be. The other 50% is apparently being absorbed by the biosphere, which uses it for food. This fact alone has led some plant physiologists to conclude that some of the increase in agricultural productivity in recent decades is likely due to the increased fertilization of crops from the extra carbon dioxide. Of course, most of the vegetation on Earth is non-agricultural, and it, too, is being increasingly fertilized. Much research has been performed into the combined effects of extra warmth and extra CO_2 on various kinds of plants, with the bulk of the results showing net benefits to plant health, growth, and sensitivity to drought[18].

7. **Policy Implications**

Even if global warming ends up being a serious problem, is not at all clear what should (or even can) be done about it. If it was easy to switch to fuels that produce little or no carbon dioxide, it would be stupid not to, given the potential risks of a 10 deg. F rise in global temperatures by the end of this century. But policy changes invariably involve weighing costs and benefits. They also necessarily involve assumptions about where our future sources of energy will come from, and whether there will be any countries left that can afford to fund new energy technology R&D if we mandate CO2 reductions by fiat.

The main difficulty in "doing something" about global warming is the fact that inexpensive energy helps drive economic growth, human health and well being. Historically, those countries that build wealth through efficient use of natural resources have the lowest levels of pollution and population growth. The poorest countries have the worst environmental problems, and their high rates of population growth put additional pressures on the environment.

The concern that the richest countries of the world have the least sustainable environmental practices is contrary to the evidence that the 1991 Environmental Sustainability Index is positively correlated with per capita gross domestic product when both variables are plotted for 117 nations of the world (ref).

Since alternative fuels are, at least for now, more expensive, mandating their use through governmental controls will come at the expense of other portions of the economy. If there were alternative sources of energy that were cost-competitive with petroleum and coal, they would already be in widespread use, at least in those economies that, like the United States, have free markets. Any resulting economic downturn as a result of the punishing of fossil fuel use will affect the poor first, since those are the people who are living on the edge, from paycheck to paycheck. While the wealthy can absorb the extra cost of, say, a $2 increase in the cost of gasoline, many of the poor can not.

Even if global warming ends up being a serious problem, it is not at all clear what should be done about it right now. Nevertheless, environmentalists today seem only interested in reducing fossil fuel use *immediately.* The fact that they are unwilling to consider approaches (e.g. intensive research into new energy technologies) that might actually accomplish the greatest reductions in the long terms suggests what many have suspected for a long time: that the environmentalist movement is, fundamentally, anti-technology.

8. **Conclusion**

While catastrophic global warming is theoretically possible, such a conclusion depends critically upon a myriad of assumptions contained in computer climate models being substantially correct. These assumptions, taken together, represent faith on the part of many climate modelers that the climate system is fragile, and very sensitive to small perturbations, particularly our production of carbon dioxide, a relatively minor atmospheric greenhouse gas.

I have argued that there is just as much reason to have faith that the climate system is relatively insensitive to a doubling of carbon dioxide, which is expected to occur later in this century.

But even if predictions of strong global warming are correct, it is not clear how to avoid this eventuality from a policy point of view. Inexpensive energy is necessary for human health and well

being. Punishing the use of energy through caps or taxation will be unpopular and relatively ineffective. To me, technological solutions to the problem seem to be the only long-term option. Since only the wealthy countries of the world can afford the R&D to bring this about, it could be counter-productive to finding those solutions by hurting economies with carbon caps and taxes.

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