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Greenhouse Gas Reductions: Not Warranted, Not Beneficial

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Contents

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Executive Summary

Increasingly, the debate over climate change is moving from alarmist *global* climate predictions, to alarmist *regional* climate predictions—reports purporting to predict the future climate impacts of rising greenhouse gas concentration on specific regions of the Earth, and calling for a laundry list of regulations long-favoured by old-school environmentalists. One of the latest alarmist reports of this nature, *Confronting Climate Change in the Great Lakes Region*, published by the Union of Concerned Scientists (UCS) and the Ecological Society of America, and bearing the imprint of the David Suzuki Foundation, offers an example of the new "local thrust" in climate change activism.

Among other dire predictions, the UCS report warns the American Great Lake states and the province of Ontario of a host of environmental threats including: declining lake levels; loss of lake ice; changes in fish distribution; invasions by non-native fish species; nutrient depletion; changes in run-off patterns; drought; river flooding; wetland shrinkage; depleted food for migrating birds; greater crop growth; more crop pests; increased ozone levels; higher shipping costs; losses of winter recreation; and more. But regional climate modeling of this sort is highly flawed. Despite the assertions of scientific certainty, the evidence supporting claims of extreme manmade climate change is limited and mixed. Climate scientists, even those within the United Nations Intergovernmental Panel on Climate Change, disagree about the extent of climate change seen in the last 150 years, the cause of that change, and the risk it poses.

Researchers at the United States National Center for Atmospheric Research, one of the leading climate modeling centers, acknowledge the limitations of regional climate modeling, saying:

> It should be noted that the future climates simulated by these models [the Hadley and Canadian climate models used in the National Assessment] are in no way to be considered predictions or forecasts of the future. They are scenarios of the future and thus inherently uncertain. This uncertainty increases as the spatial scale of focus decreases, i.e., going from continental to regional scales. Researchers should exercise extreme caution in the conclusions they draw from impacts analysis using the output from these climate models, given the uncertainty of the model results, especially on a regional scale. (Doherty and Mearns, 1999)

Worse than the misrepresentation of climate science that permeates the UCS report are the flawed policy prescriptions that are offered. A laundry list of measures sought by old-school environmental groups for 30 years, the measures proposed by the UCS study have well-documented flaws, and would do both current and future generations considerably more harm than good. Some specifics follow.

Increasing energy efficiency and conservation and *achieving more efficient fossil fuel generation of electricity* generally mean increasing energy and technology costs. Imposing higher costs on energy generally slows economic growth, which is itself a protective factor in human health and environmental quality. As pioneering environmental analyst Aaron Wildavsky and many others have shown, when it comes to economic development and individual incomes, richer is safer and environmentally cleaner.

Increasing the amount of energy produced from "renewable" power sources generally means more expensive energy, and, in any event, cannot come close to providing the power needed for industrial societies. A report by ecologists at Cornell University, for example, showed that even if deployed as thoroughly as possible, "renewable energy" sources could provide only 50 percent of the needs of the United States, while requiring nearly one-sixth of the entire land mass of the country.

Increasing the efficiency of conventional vehicles generally means influencing the market to favour smaller, lighter vehicles that use less power by imposing fuel-efficiency standards on automakers. As numerous analysts have pointed out, the market for such vehicles is quite limited, and as they lead to lighter, less robust vehicles, such fuel-efficiency standards lead to increased risk of death in automobile accidents. Indeed, it was the imposition of such fuel-efficiency standards in the United States in the 1970s that planted the seed of the sport utility vehicle trend by rendering the mid-size, not particularly profitable station wagon non-economic for automakers. This left families with only the light trucks and vans—the progenitors of SUVs and mini-vans—that were not subject to the fuel economy restrictions.

Switching from carbon-intensive energy sources, such as coal, to natural gas and biofuels is already done where it is economically efficient, a phenomenon called "decarbonization." Accelerating fuel switching beyond the point where it is economically efficient, however, diverts resources that could be used to secure safety elsewhere, ultimately leaving society less wealthy, and correspondingly less healthy and environmentally protected.

Introducing hybrid and fuel-cell cars has severe limitations, as typified by previous attempts to enshrine the battery-electric vehicle as the technology of choice. As one recent article in the *Globe and Mail* newspaper points out, Canadians, who have very high environmental values, draw the line at buying hybrid cars that offer less performance than conventional gasoline cars at a higher price.

Reducing driving, through anti-sprawl planning and public transportation has been a favoured goal of old-school environmental activists for decades, and the literature about the pitfalls of such transportation demand management techniques is extensive. In the main, anti-sprawl planning and public transportation fail to meet the demands of consumers in developed countries, while anti-sprawl controls have been shown ineffective at reducing air emissions.

Establishing greenhouse gas registries is high on the wish list for old-school activists. Though seemingly innocent, registries pose several problems. Companies ranking high on such registries immediately find themselves on "top-10 polluter" lists and may be forced to make greenhouse gas reductions, or invest in new technology, in public education campaigns, and in litigation that may be uneconomic. In addition, greenhouse gas registries put the cart before the horse by assuming that greenhouse gas reduction is a worthwhile investment, diverting attention and resources away from better-characterized, more tractable environmental challenges such as preventing surface water degradation.

The threat of rapid climate change is one that humans would do well to take seriously. Climate change would have impacts on virtually all elements of human action, from agriculture, to transportation, to the production of goods and the provision of services. But the threat of economic harms inflicted by old-school environmental activist groups may be more serious. With potent policies being urged to regulate energy, favour certain technologies, and limit economic freedom, society's response must be based on a solid understanding of the science behind climate change, and the impacts of proposed policy options.

In *Confronting Climate Change in the Great Lakes Region*, the Union of Concerned Scientists and the Ecological Society of America, backed by the David Suzuki Foundation, try to scare North Americans into adopting unwise public policy by exaggerating certainty of predictions about manmade climate change. The proposed policy options are a long-standing wish list of old-school environmental activists, and, if implemented, would seriously harm the economic freedom that is the wellspring of safety and environmental quality in developed countries like Canada and the United States.

While the threat of rapid climate change is certainly one to be taken seriously, it is equally important to be sure that we understand what is really happening with the climate. We must know what the causes of observed changes are before we take actions that will divert scarce resources into potentially fruitless, or even harmful policies that hurt individuals by raising the costs of energy and forcing them into less safe technologies, and hurt societies by reducing their economic freedom and ability to compete in a global setting.

Introduction

Increasingly, the debate over climate change is moving from alarmist *global* climate predictions, to alarmist *regional* climate predictions—reports purporting to predict the future climate impacts of rising greenhouse gas concentration on specific regions of the Earth, and calling for a laundry list of regulations long-favoured by old-school environmentalists. One of the latest alarmist reports of this nature, *Confronting Climate Change in the Great Lakes Region*, published by the Union of Concerned Scientists (UCS) and the Ecological Society of America, and bearing the imprint of the David Suzuki Foundation, offers an example of the new "local thrust" in climate change activism.

Among other dire predictions, the UCS report warns the American Great Lake states and the province of Ontario of a host of environmental threats including: declining lake levels; loss of lake ice; changes in fish distribution; invasions by non-native fish species; nutrient depletion; changes in run-off patterns; drought; river flooding; wetland shrinkage; depleted food for migrating birds; greater crop growth; more crop pests; increased ozone levels; higher shipping costs; losses of winter recreation; and more. But regional climate modeling of this sort is highly flawed. Despite the assertions of scientific certainty, the evidence supporting claims of extreme manmade climate change is limited and mixed. Climate scientists, even those within the United Nations Intergovernmental Panel on Climate Change (IPCC), disagree about the extent of climate change seen in the last 150 years, the cause of that change, and the risk it poses.

Exaggerating the Threat

The UCS report begins by seriously exaggerating the threat posed by global warming, as well as the certainty of the science behind the predictions. On page one the report declares: "Now that the world is entering a period of unusually rapid climate change, driven largely by human activities that release heat-trapping greenhouse gases into the atmosphere, the responsibility for safeguarding our natural heritage is becoming urgent" (Kling *et al*., 2003). By page 5, the UCS authors have whipped up yet more urgency: "Climate change is already making an impact on the environment of the Great Lakes region," they claim.

But from the flagrant and frequent use of such positive verbs as "will," it is obvious that the UCS authors are trying to overstate their certainty that the Great Lakes region is headed for an ecotastrophe, with temperatures predicted to rise by 5 ºF to 12 ºF in winter, and by 5 ºF to 20 ºF in summer. They follow this prediction with a string of "will" statements that would make the most daring fortuneteller blush:

- "The distribution of many fish…*will* change" (p. 2)
- "…invasions of warm water nonnative species such as the common carp *will* be more likely…" (p. 2)
- "In lakes, the duration of summer stratification *will* increase…" (p. 2)
- "Earlier ice breakups and earlier peaks in spring runoff *will* change the timing of stream flows…" (p. 3) [My emphasis.]

Of course, wherever climate change might conceivably do anything positive, the UCS authors are much more reticent. The word "may" suddenly comes to the fore, and caveats abound: "Continued deposition of nitrogen from the atmosphere *may* spur growth in forests, but the long-term consequences include increased nitrate pollution of waterways, groundwater, and drinking water supplies"(Kling *et al*., 2003, p. 3). [My emphasis].

If any of this were true, perhaps a sense of alarm would be warranted. The alarmism would still be irresponsible, but at least excusable. But this report neatly sidesteps the need to argue its case by simply assuming the worst-case scenario. The fact is, however, there is good reason to doubt the role of greenhouse gases in climate change.

The "confidence," of the UCS scientists, we are told, "refers to the level of scientific certainty and is based on expert understanding and judgment of current information supporting the likely ecological impacts of the climate-related changes described above" (Kling *et al*., 2003, p. 69). Not mathematical confidence limits, not numerical analyses of potential modeling error, but by the "judgment" of certain "experts," namely, the authors of the report. Put simply, the terms used to imply certainty were simply gathered by polling the authors as to how confident they were about what they were saying, rather than through any particular review process or mathematical derivation.

But what are these predictions based upon, and is all this confidence warranted? Harvard University's Willie Soon and Sallie Baliunas have shown that most recent warming is due to increased solar output (Soon *et al*., 1996). Other climate researchers, such as Virginia State

Climatologist Patrick Michaels, have shown that what little manmade warming actually is observed is primarily happening in the coldest, driest air masses of the world, posing little threat to temperate regions such as the Great Lakes (Michaels and Balling, 2000).

The UCS generates its predictions of future climate from a combination of two climate models, using scenarios of future greenhouse gas emissions developed for the last report of the IPCC. But the limitations of such modeling exercises have been extensively documented.

The Limitations of Global Climate Modeling

Students of climate change realize that measuring the temperature of the Earth requires more than just taking a few temperature readings and totting up an average. In fact, figuring out the average temperature of the Earth's atmosphere is incredibly complicated. Calculating the temperature of large spaces (such as the oceans, the Earth's surface layers, and the Earth's atmosphere) is much more difficult than taking the temperature of a smaller object, or a person, or measuring the temperature of a pot of water. Trying to calculate an average temperature and to track how it changes over time would pose a serious challenge even for a single room, which would have a nearly infinite number of places where one could stick a thermometer to measure the temperature. And such a measurement would still only tell part of the story; it would not reflect the way the heat of objects within the room might change, such as the walls, or the floor, the ceiling, or the desks. It would not tell you how the plants, animals, or people in the room would react to the changing temperatures either. And even knowing the temperature, its trend, and its "normality," would not necessarily tell you the best way to change things more to your liking. When one considers the complications in figuring all this out for one room, it becomes obvious that answering the question "Is the Earth warming?" is far harder than asking it.

For about 150 years, people have taken temperature readings at weather stations, giving climate investigators four main sets of temperature readings to work with in looking at the trends in the atmosphere's average temperature. The four sets consist of temperature readings taken at weather stations on the ground, on ships at sea, from floating weather balloons, and by satellites orbiting the Earth.

The biggest set of temperature readings investigators use to study whether the atmosphere is warming are taken using regular glass thermometers at land-based weather stations. Until the recent development of electronic thermometers, these readings were taken with the same kind of glass thermometers people use to measure the temperature of the air in their living room or the water in their pool. Currently, there are millions of individual temperature measurements being taken every year using regular glass thermometers at over 8,000 weather stations all around the world.

The process of joining all these temperature readings together and calculating an average global temperature is a huge (and potentially impossible) challenge. In their last published report (2001a), the IPCC said their research indicates that temperatures recorded at measuring stations on the ground reveal an average warming ranging from 0.4 °C to 0.8 °C since the year 1850. That is, the average temperature of the atmosphere near the Earth's surface in the year 2000 was between 0.4 and 0.8 degrees warmer than it was during the year 1850. One-half to one-third of this warming, according to the investigators, has happened since the mid-1970s.

The IPCC points out that the warming of the Earth's average temperature has not caused a uniform amount of warming to happen everywhere. Some parts of the Earth have warmed more than others. For example, more of the warming seen since 1850 has happened over land, rather than over water. And the warming is not spread out evenly over the course of the day, or night. In fact, more of the warming seen since 1850 has happened at night. The warming also shows up mostly during an area's winter. So, instead of making for warmer summertime days, the warming since 1850 has made mostly for slightly warmer winter-time nights. Finally, more of the warming since 1850 has happened over the high latitude parts of the Earth, particularly in the north, rather than over areas closer to the equator.

But with a short set of temperature readings, and a very long pattern of temperature change, it is difficult to know whether the increase of the last 100 years or so is a part of a long-term trend, or is just a short-term rise in temperatures. Such short-term warm ups have happened before as a natural part of the Earth's temperature cycle from ice ages to warm periods.

Some scientists, myself included, have pointed out that 150 years worth of temperature records are not that useful when the Earth's climate has been evolving and changing for 4 *billion* years (Green, 2000, p. 20). To understand how short a stretch of history 150 years is, consider this thought experiment. If you squeezed all of the Earth's history into a single 24 hour period, humanity's direct measurement of the temperature would only cover the last three one-thousandths of a second. That is far less time than it takes for the blink of a human eye. Even 1,000 years of temperature readings would equate to only two one-hundredths of the last second

Further, as other climate researchers have observed (Parsons, 1995, p. 127), many of the temperature records suffer from accuracy problems. Thermometers used in taking older recordings were primitive by modern standards, some even having hand-painted number scales. And since the people taking the temperature readings were not all working together, they did not collect temperatures in a way that would shed the most light on the temperature of the entire Earth. For one thing, not all the temperature readings were taken in the same way. Some readings were taken in the sun, while some were taken in the shade. In some cases, the thermometer was moved around, in others, it was always in the same position. Some weather stations only recorded the temperature for a short period of time, while others recorded it for longer.

But the biggest problem with the record of temperatures taken on land is that most of the readings were taken near cities, and cities can change the local temperature all by themselves. Because they have fewer trees to shade them, and more dark-colored paved surfaces, cities tend to absorb heat during the daytime more than surrounding, less developed areas do. This effect, called the "urban heat island" effect, is what keeps your city warmer than the countryside around it.

IPCC researchers claim to have accounted for the urban heat island effect, and argue that the surface temperature record is an accurate reflection of temperature changes that have occurred over the last 150 years. But other climate research (Chagnon, 1995) suggests that the mathematical process used to average all the individual surface temperature readings exaggerates the warming because most of the readings were taken in cities which tend to be hotter than surrounding areas.

Temperature readings of both the water and the air were also taken on ships traveling the oceans. These temperature records span nearly the same time as the land-based readings, but they are not as useful for charting the Earth's temperature as the land-based reading for many reasons. For one thing, it is even more complicated to take the temperature of the air when on a ship at sea than on the ground in a city. And, until very recently, ships did not know their exact locations on the surface of the Earth unless they were in a port. Once a ship took to sea, and went beyond the sight of land, ship-captains could record their position on the globe only roughly, by calculating their latitude and longitude. That inability to know exactly where they were is important because the temperature of the Earth changes from place to place, even over the ocean, and even over only a few dozen miles. And there were other complicating factors as well. As climate researchers found when they started looking into the accuracy of ocean-based temperature readings, the changes in technology were even more dramatic at sea than they were on land. Before 1940, for example, ocean water temperatures were taken by having sailors pull buckets of water out of the ocean. Sailors would then stick a thermometer in the bucket, and take the temperature of the water while the bucket was sitting on the deck of the ship. Investigators looked at these recordings partly to learn about the temperature of the water itself, but also to learn about the temperature of the air above the water as well.

But one complication arose right away. When sailors pulled the water bucket up and left it sitting on the deck of the ship, the temperature of the water could change depending on whether it was cloudy or bright, windy or still. And if the bucket was put in a shaded place, it would cool faster than in a sunny place on deck. Even the direction the ship was traveling could change the temperature readings, because the wind might blow differently depending on which way the ship was pointed with respect to the wind. But those were only the obvious problems investigators found with the temperature readings. When looking still further, scientists found that the temperature reading of the water also changed depending on what kind of bucket was used. When pulling the bucket of water up out of the ocean, air flowing by the bucket would chill the water inside. This "evaporative" cooling is how some types of home air conditioners work, and it is also how your body cools down when you sweat and stand in the breeze. Climate investigators found that if the bucket the sailors used was made with canvas, this evaporative cooling effect would be greater than the cooling that would happen if they had used a metal, wood, or plastic bucket.

Similar problems affected the normal air-based temperature readings taken on ships. As with water temperature readings, air readings were not always taken at the same places on the Earth. But even where they were, there was a problem. Because the ships themselves got bigger over time, the sailors standing on the deck recording the air temperature were actually taking temperatures farther above the surface of the ocean than previous sailors had, even if they were in the same place.

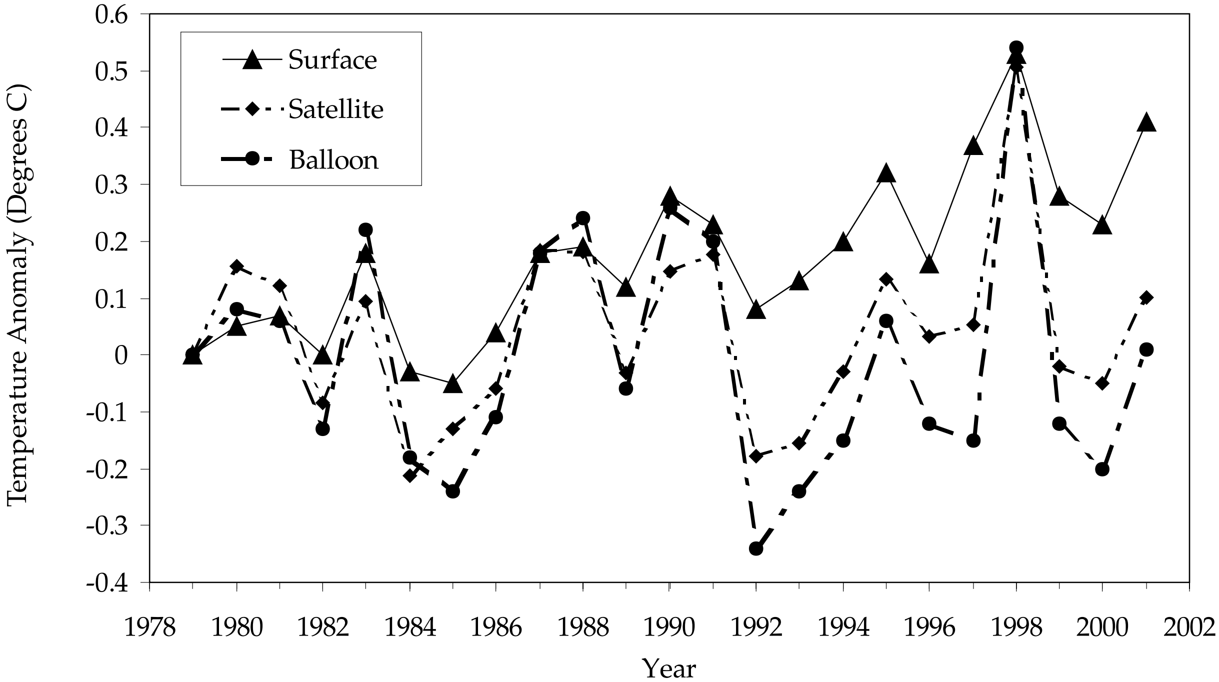
Climate researchers have some modern sets of temperature recordings taken since the 1960s, when high-technology approaches to tracking the weather became more commonplace. Since the 1960s, for example, temperatures of the air have not only been taken at ground level, but they have also been taken with thermometers and other temperature-measuring devices mounted on weather balloons.

But even these modern records are limited in the information they tell climate researchers about the global temperature. The biggest limitation of weather balloons, like that of surface temperature readings, is that they only measure the temperature over certain parts of the world, namely, where weather stations send them up. Though they do drift away from where they are launched, balloons have not been sent up to all parts of the atmosphere evenly, nor over extended periods of time. Balloons were used, originally, to detect local temperatures in order to predict short-term weather, not long-term trends in the climate. Thus, depending on what kind of information was most desired, balloons were sent up to different heights, were kept up for different periods of time, were flown at different times of the day or night, and were flown over only a tiny fraction of the Earth's surface, namely, where people lived and had weather research stations. Further complicating things, balloons also had different kinds of thermometers and radio equipment, which were used at different times and places, making temperature readings hard to compare with each other. Furthermore, while the balloon readings can record the temperature at certain heights, figuring out how the temperature varies between that measurement point and the ground poses still another challenge.

The most recently assembled, and most high-tech, set of direct temperature readings comes from satellites that orbit the Earth. These satellites record the temperature of the atmosphere using special cameras that measure the heat given off by the upper layers of the Earth's atmosphere. Satellite temperature readings are the first ones that can actually measure the temperature of the entire atmosphere at different heights. Such global satellite temperature readings have been taken nearly continuously since 1979. Still, satellite temperature readings have their shortcomings. Just like land-based and ocean-based temperature recordings, satellite recording devices have changed over time. Newer devices do not measure the temperature in exactly the same way as previous devices did. Furthermore, satellites do not stay in orbit forever. Eventually, the satellites spiral down toward the Earth and burn up in the atmosphere. Indeed, when they looked more closely, climate investigators found that the temperature readings taken by satellites change as they slowly spiral in toward the Earth. Because of the way the satellites take the atmosphere's temperature, the readings depend on how far away the satellite is from the Earth. Temperature readings taken closer to the Earth are lower than readings of the same place on the Earth's surface taken from a higher orbit.

Aside from technology changes, climate investigators differ over the real *meaning* of land-based, water-based, satellite, and balloon temperature recordings. Some have pointed out that there is no scientific rule for computing global average temperatures (Essex and McKitrick, 2002). Temperature is not an "amount" of something; instead, it measures the condition of a physical system at a single location. While temperature numbers can be added up, the result is not a "total temperature," because no such thing exists. Neither does the global "average" temperature describe the actual climate, any more than the "average phone number" describes the phone book.

Figure 1: Temperature Records, 1978 to 2002



Sources:
Surface data: Parker *et al.*, 1994.
Satellite data: Christy *et al.*, 2000.
Balloon data: Angell, 1988.

As discussed above, it is hard to know what the slight warming seen in the temperature records taken on land really means, because the land-based temperature record is so short compared to the long history of Earth's climate. Temperatures taken from weather balloons and satellites span an even shorter period than the surface temperature readings or ocean temperature readings do. Further complicating the picture is the fact that the newest temperature readings from satellites and balloons do not tend to match up well with the readings taken on the land or at sea. While the surface and ocean temperature records tend to match up pretty well with each other, and the satellite and balloon temperature readings match up with each other, the readings taken from higher up disagree with the readings taken near the Earth's surface. Figure 1 shows how the three main sets of temperature recordings match up over time.

As figure 1 shows, though the surface temperature readings suggest that the Earth is warming near the ground, the satellite and balloon evidence suggests that little or no warming has happened higher up in the atmosphere. Some researchers feel that this difference in recorded temperature trends is meaningful, while others disagree, but the majority of climate researchers agree that the discrepancy casts serious doubt on the validity of the computer models used to predict future climate change.

John Christy, a climate investigator who takes such satellite readings, is one of those researchers arguing that the satellite temperature record shows that something is wrong with the current scientific understanding of global warming. Christy claims that if the scientific theories used to understand all of the complicated climate processes on Earth are correct, then the satellite readings should not show a cooling trend. Christy and others argue that the disagreement between the different temperature records means there is something missing in the fundamental science of climate change (Christy *et al.*, 2000).

Potential Causality

After the question of whether or not scientists have proven that the climate is changing abnormally, we come to the question of potential causality. As the previous discussion showed, there are questions about whether scientists have made the case that observed change is either accurate or meaningful. But assuming that some change has happened since 1973 (the temperature changes prior to 1973 having been attributed to factors other than human activity), how strongly have scientists linked those changes to human activity?

Against the backdrop of an Earth that is warmed by its own greenhouse effect, other forces operate that can enhance or decrease the retention of heat by the atmosphere. Some of these forces are man-made, some are produced by nature, and some are produced by feedback reactions to one another.

While "greenhouse effect theory" is relatively uncontroversial in the scientific sense, the theory of global, human-driven climate change is at a much younger stage of development. Although very few articles in science journals contradict either the overall theory or details of the core greenhouse effect, the same cannot be said for the theory of man made climate change. Indeed, studies jockey back and forth about key elements of man-made climate change nearly every month on the pages of leading science journals, including America's premier science journal, *Science.* The 1995 report of the Intergovernmental Panel on Climate Change left the question almost completely open. The chapter examining the question of human attributions begins with a summary that says:

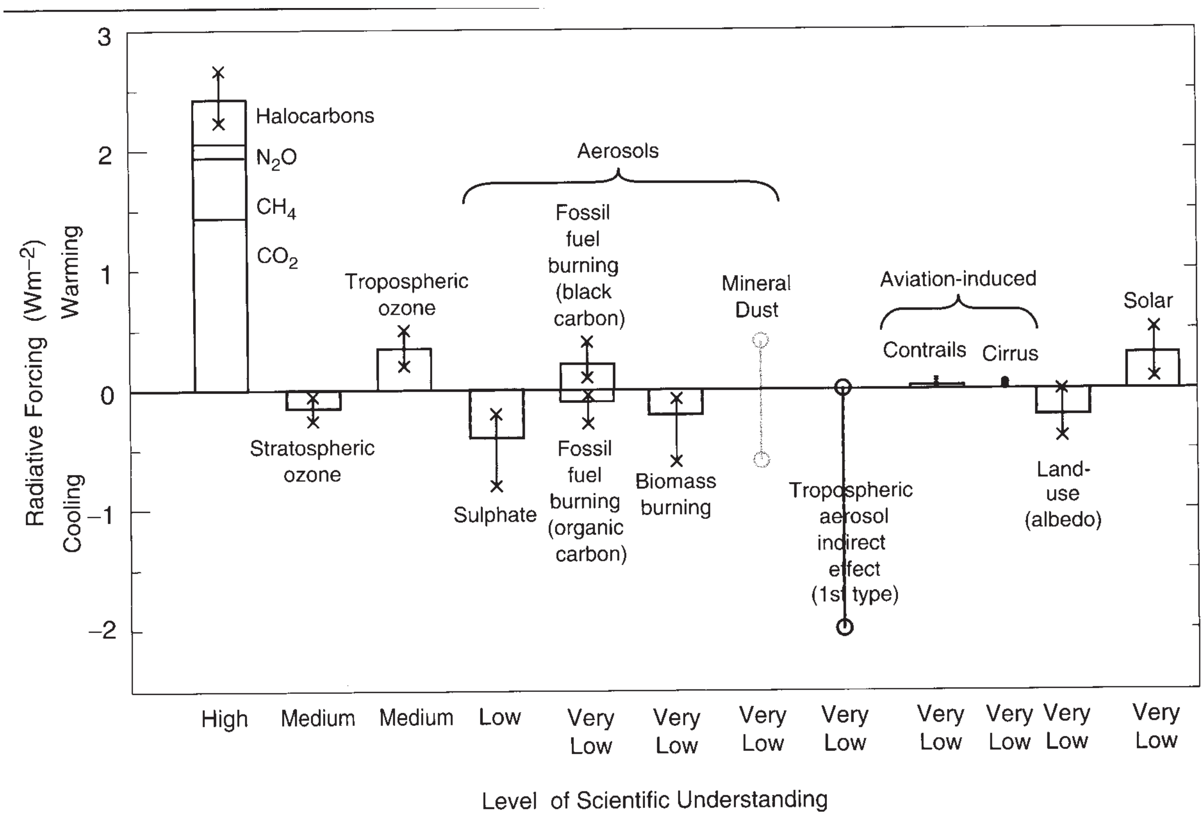
> Although these global mean results suggest that there is some anthropogenic component in the observed temperature record, they cannot be considered as compelling evidence of a clear cause-and-effect link between anthropogenic forcing and changes in the Earth's surface temperature. It is difficult to achieve attribution of all or part of a climate change to a specific cause or causes using global mean changes only. The difficulties arise due to uncertainties in natural internal variability and in the histories and magnitudes of natural and human-induced climate forcings,[1] so that many possible forcing combinations could yield the same curve of observed global mean temperature change. (IPCC, 1995, p. 411)

The IPCC report went on to address whether human impact on climate has been solidly identified:

> Finally, we come to the difficult question of when the detection and attribution of

1 Climate "forcings" are things that can change the climate, such as increased solar activity, greenhouse gases, reflective aerosols, changes in land use that alter heat retention, and so on.

Figure 2: Climate Forcings and Scientific Certainty



Source: United Nations Intergovernmental Panel on Climate Change, 2001b, p. 37.

> 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 a significant anthropogenic climate change has already occurred (p. 439).

The 2001 version of the IPCC report claims "greater certainty" regarding the linkage between human action and climate change, but only for the observed temperature changes of the past 50 years. Indeed, although it talks about climate change since 1860, the latest IPCC report lifts the blame for warming prior to 1973 from the back of humanity, attributing it, instead, to natural variations such as changes in the output of energy from the sun (IPCC, 2001a, p. 10).

But one figure from the 2001 IPCC report belies the claim to "greater certainty." Figure 2 shows the 12 potential climate forcings, and the state of scientific certainty that the IPCC allots to each. Notice that the vast majority is only poorly understood, and the range of the poorly understood cooling forcings could well offset virtually all of the warming predicted as the result of increasing greenhouse gases.

The Inherent Limitations of Regional Modeling

Everyone knows that the weather cannot be forecast over the long term. But there is an assumption (albeit an optimistic one) that the "climate" can be forecast, on the grounds that it consists of averaged conditions over larger spatial and time scales such that some small-scale chaotic variations average out. The core problem of regional forecasting, however, is that it seeks to reintroduce at a later stage some of the spatial details that were deliberately averaged out at an earlier stage to make the computations feasible. Consequently, the idea of regional climate modeling is not widely supported. As Richard Kerr points out in *Rising Global Temperature, Rising Uncertainty,* "Climate forecasting, after all, is still in its infancy, and the models rely on a sparse database: a mere 100 years of global temperatures" (Kerr, 2001, pp. 192-194). In another article in *Science*, State of Arizona climate researcher Randall Cerveny observes that "there's very much a lack of studies that have been done at a regional level" (Couzin, 1999, p. 317). The article points out that "Computer climate models aren't refined enough for researchers to trace all the causal links between human activity and regional climate" (p. 317). In one study discussed in the Couzin article, researchers found that changing the terrain parameters in a regional model could produce outputs that were warmer, or cooler, than current conditions. As Michael Oppenheimer, chief scientist at Environmental Defense is quoted by Couzin, "the processes determining regional climate change can take place at too fine a scale to be captured by most climate models, which often subdivide the landscape into regions 30 or more kilometers across and use a single number for the surface features and weather within each one" (p. 317).

With regard to regional climate models of the sort used in the UCS study as well as the much-criticized report of the United States Global Climate Research Project, another *Science* article by Richard Kerr sheds still more light. In the Kerr article, climate modeler Filippo Giorgi observes that "For the most part, these sorts of models give a warming, but they tend to give very different predictions, especially at the regional level, and there's no way to say one should be believed over another" (Kerr, 2000, p. 2113). In the same article, Jerry D. Mahlman, past director of the US National Oceanographic and Aeronautic Association Geophysical Fluid Dynamics Laboratory in Princeton, New Jersey, observes that when you "[a]dd in uncertainties external to the models, such as population and economic growth rates… the details of future climate recede toward unintelligibility."

The United States National Academy of Sciences (NAS) is also on record regarding the limitations of regional climate models. "Current observational capabilities and practice," they observe, "are inadequate to characterize many of the changes in global and regional climate"(NAS, 2002, p. 276).

The IPCC reports themselves are clear about the uncertainty of regional climate models (IPCC, 1995). On page 41 of the 1995 IPCC Science volume, we find this description of regional climate model projections: "Tides, waves, and storm surges could be affected by regional climate changes, but future projections are, at present, highly uncertain." Further on the same page, we find that "Confidence is higher in hemispheric to continental scale projections of climate change than at regional scales where confidence remains low." By page 44, the limitations are quite well enumerated: "The global climate models used for future projections are run at fairly coarse resolution and do not adequately depict many geographic features (such as coastlines, lakes and mountains), surface vegetation, and the interactions between the atmosphere with the surface which becomes more important on regional scales."

The lack of reliability of regional modeling was documented even within the National Assessment process. An April 1999 paper written "in support of the US National Assessment" by two National Center for Atmospheric Research scientists ends with the following:

> It should be noted that the future climates simulated by these models [the Hadley and Canadian climate models used in the National Assessment] are in no way to be considered predictions or forecasts of the future. They are scenarios of the future and thus inherently uncertain. This uncertainty increases as the spatial scale of focus decreases, i.e., going from continental to regional scales. Researchers should exercise extreme caution in the conclusions they draw from impacts analysis using the output from these climate models, given the uncertainty of the model results, especially on a regional scale. (Doherty and Mearns, 1999)

In volume three of the 2001 IPCC climate report (IPCC, 2001c), we find additional warnings about regional climate models: "Uncertainties are pervasive throughout climate change impact assessment. For some sectors, such as agriculture, uncertainty is large enough to prevent a highly confident assessment of even the sign of the impacts" (p. 96).

That it is not yet possible to reliably project regional impacts is evident in a recent statement by the new chairman of the IPCC, Dr. R.K. Pachauri. Describing his hopes for the IPCC's Fourth Assessment Report to the international climate negotiators at the Eight Conference of the Parties to the Framework Convention on Climate Change, Dr. Pachauri stated: "We hope that by the time our report is completed in 2007, the climate models that provide scenarios and assessments on a regional basis and related knowledge would have reached a level of sophistication and reliability that would make both regional assessments of climate change as well as their socio-economic impacts possible."

The Limitations of Future Greenhouse Gas Scenarios

IPCC climate forecasts depend on forecasts of energy use and greenhouse gas emissions. It is becoming increasingly clear that these scenarios are exaggerated. As environmental economist Ross McKitrick observes, while the IPCC scenarios assumed that global coal consumption would rise between 4 and 31 percent over the 1990s, in reality, consumption fell by over 10 percent during this period. The IPCC scenarios predicted fossil fuel-based carbon dioxide emissions of 6.9 billion tons as of 2000, but observed emissions as of 1999 were just under 6.5 billion tons, and there was no net emissions growth since 1996 (McKitrick, 2003).

As researchers Ian Castles, formerly the head of Australia's national office of statistics, and David Henderson of the Westminster Business School and formerly the Chief Economist of the OECD, point out, the IPCC modelers inappropriately compared future estimates of GDP in terms of exchange rates, rather than purchasing power parity. This produces GDP estimates that are significantly inflated, leading to estimates of greenhouse-gas producing activity that are similarly inflated. Castle neatly illustrates the fallacy of this approach when he observes that even for the lowest emission scenarios used by the IPCC (and the UCS), the average income of South Africans will have overtaken that of Americans by a very wide margin by the end of the century (Castles, 2003, p. 22). The article goes on to explain that because of this economic error, the IPCC scenarios of the future also suggest that economic wrecks such as Algeria, Argentina, Libya, Turkey, and North Korea will all surpass the United States.

Other skeptics, including myself, have criticized the IPCC's future scenarios for assumptions that have already been shown to be false or questionable. For example:

- There are no mid-course greenhouse gas reduction programs implemented between now and 2100;
- Global deforestation is not abated;
- Most energy production will be from carbon-based fuels;
- Carbon dioxide emissions will nearly quadruple by 2100;
- Methane emissions will more than double by 2100;
- Carbon monoxide emissions will nearly triple by 2100;
- Volatile organic carbon emissions will nearly triple by 2100; and
- Fluorocarbon levels will rise dramatically by 2100, in some cases by two orders of magnitude. (Green, 2000)

In reality, however, countries around the world are already implementing programs that will reduce greenhouse gas emissions as a byproduct of controls on traditional air pollutants, while markets continue to demand the "decarbonization" of fuel as an aspect of competitiveness (Ausubel, 1996). Both governments and private conservation groups are taking action to slow deforestation. Emissions of methane, carbon dioxide, and fluorocarbons, as discussed above, are based on economic development, which was grossly over-predicted in the IPCC emission scenarios.

The Limitations of Old-School Greenhouse Gas Reduction Measures

The favoured responses to regional global warming, according to the UCS report, are strangely familiar—favourite policies of old-school environmental activist groups that have been trotted out regularly for the last 30 years. Such policies include:

- Using "technological and behavioural changes" to increase energy efficiency and conservation by industry and consumers;
- Mandating increases in the amount of energy produced from "renewable" power sources such as wind, water, and organic waste;

- Switching from carbon-intensive energy sources such as coal to natural gas and biofuels;
- Achieving more efficient fossil fuel generation of electricity;
- Increasing the efficiency of conventional vehicles;
- Introducing hybrid and fuel-cell cars;
- Reducing driving through anti-sprawl planning and public transportation;
- Increasing waste recovery and recycling; and
- Instituting greenhouse gas registries.

Thoroughly critiquing each of these ideas is beyond the scope of this report. However, the major limitations of each are well known.

Increasing energy efficiency and conservation and *achieving more efficient fossil fuel generation of electricity* generally mean increasing energy and technology costs. Imposing higher costs on energy generally slows economic growth, which is itself a protective factor in human health and environmental quality. As pioneering environmental analyst Aaron Wildavsky has shown, when it comes to economic development and individual incomes, richer is safer and environmentally cleaner (Wildavsky, 1991).

Increasing the amount of energy produced from "renewable" power sources generally means more expensive energy, and, in any event, cannot come close to providing the power needed for industrial societies. A report by ecologists at Cornell University, for example, showed that even if deployed as thoroughly as possible, "renewable energy" sources could provide only 50 percent of the needs of the United States, while requiring nearly one-sixth of the entire land mass of the country (Pimantel, 2002).

Increasing the efficiency of conventional vehicles generally means influencing the market to favour smaller, lighter vehicles that use less power by imposing fuel-efficiency standards on automakers. As numerous analysts have pointed out, the market for such vehicles is quite limited, and the downsizing effects of fuel-efficiency standards lead to increased risk of death in automobile accidents (Kleit, 2002). Indeed, it was the imposition of such fuel-efficiency standards in the United States in the 1970s that planted the seed of the sport utility vehicle trend by rendering the mid-size, not particularly profitable station wagon non-economic for automakers. This left families with only the light trucks and vans—the progenitors of SUVs and mini-vans—that were not subject to the fuel economy restrictions (Ridenour, 1999).

Switching from carbon-intensive energy sources such as coal to natural gas and biofuels is already done where it is economically efficient, a phenomenon called "decarbonization," (Ausubel, 1996). Accelerating fuel switching beyond the point where it is economically efficient, however, diverts resources that could secure safety elsewhere, as previously discussed.

Introducing hybrid and fuel-cell cars has severe limitations, as typified by previous attempts to enshrine the battery-electric vehicle as the technology of choice (Gordon and Richardson, 1995). As one recent article in the *Globe and Mail* points out, Canadians, who have very high environmental values, draw the line at buying hybrid cars that offer less performance than conventional gasoline cars at a higher price (Chase and Keenan, 2003).

Reducing driving through anti-sprawl planning and public transportation has been a favoured goal of market-hostile activists for decades, and the literature about the pitfalls of such transportation demand management techniques is extensive. In the main, anti-sprawl planning and public transportation fail to meet the demands of consumers in developed countries, while anti-sprawl controls have been shown ineffective at reducing air emissions (Bruegmann, 2001; Green, 2001).

Establishing greenhouse gas registries is high on the wish list for old-school activists. Though seemingly innocent, registries pose several problems. Companies ranking high on such registries immediately find themselves on "top-10 polluter" lists and may be forced to make greenhouse gas reductions, or invest in new technology, in public education campaigns, and in litigation that may be uneconomic. In addition, greenhouse gas registries put the cart before the horse by assuming that greenhouse gas reduction is a worthwhile investment, diverting attention and resources away from better-characterized, more tractable environmental challenges such as preventing surface water degradation.

Conclusion

The possible threat of rapid climate change is one that humans would do well to take seriously. Climate change would have an impact on virtually all elements of human action, from agriculture, to transportation, to the production of goods, and the provision of services. But the threat of economic harms inflicted by old-school environmental activist groups may be more serious. With potent policies being urged to regulate energy, favour certain technologies, and limit economic freedom, society's response to climate change must be based on a solid understanding of the science behind climate change, and the impacts of proposed policy options.

In *Confronting Climate Change in the Great Lakes Region,* the Union of Concerned Scientists and the Ecological Society of America, backed by the David Suzuki Foundation, try to scare Canadians and Americans into adopting unwise public policy by exaggerating the state of certainty regarding predictions of man made climate change. The proposed policy options are a long-standing wish list from old-school environmental activists, and would seriously harm the economic freedom that is the wellspring of safety and environmental quality in developed countries like Canada and the United States.

While the threat of rapid climate change is certainly one to be taken seriously, it is equally important to be sure that we understand what is really happening with the climate. We must know what the causes of observed changes are before we take actions that will divert scarce resources into potentially fruitless, or even harmful policies that hurt individuals by raising the costs of energy and forcing them into less safe technologies, and hurt societies by reducing their economic freedom and ability to compete in a global setting.

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