Good news, Mr. Gore, the Apocalypse has been postponed

The Gospel according to Gore

You may have missed it, but April 22nd was National Day of Hope, Prayer and Reflection about Global Warming – presumably not by the edict of the current administration. In the political world Bush is becoming more and more isolated in his stance on this subject. Other public figures are acquiescing one by one. Even Arnold Schwarzenegger, who once seemed likely to be an unmovable bastion of big-business conservatism, has been converted and is on the cover of Newsweek, twirling a fragile and endangered world on his finger and announcing draconian measures to limit carbon emissions in California. He's a believer.

Global warming has galvanized the developed world. Liberals sound the warning, Conservatives respond with gradually mounting enthusiasm. Clergy fall to their knees in prayer and repentance. Atheists find new purpose and a moral lodestone. Americans slap concerned bumper stickers on their SUVs and flock to "An Inconvenient Truth". Hollywood swoons and bestows on Gore's slideshow two Academy Awards. The scientific community churns out technical paper after paper in the journals reporting the mounting evidence.

Or do they?

Gore assures us of it, stating that there is no controversy. He refers to the multitudes of the world's top scientists voicing unmitigated concern through the UN's Intergovernmental Panel on Climate Change (IPCC) report. He cites a study of a random sample of 928 articles on global warming, none of which were found to express doubt. There is a consensus.

However, Michael Crichton (best known for his novels but also a graduate of Harvard Medical School and a former postdoctoral fellow at the Salk Institute for Biological Studies) warned his audience of the dangers of "consensus science" in a 2003 speech,

> Historically, the claim of consensus has been the first refuge of scoundrels; it is a way to avoid debate by claiming that the matter is already settled. Whenever you hear the consensus of scientists agrees on something or other, reach for your wallet, because you're being had.
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> Let's be clear: the work of science has nothing whatever to do with consensus. Consensus is the business of politics. Science, on the contrary, requires only one investigator who happens to be right, which means that he or she has results that are verifiable by reference to the real world. In science consensus is irrelevant. What is relevant is reproducible results. The greatest scientists in history are great precisely because they broke with the consensus.

Think of Semmelweiss and puerperal fever. Think of Goldberger and pellagra. Even Gore's favorite example of continental drift highlights the folly of the scientific consensus that mocked Alfred Wegener's theory of Pangaea for half a century.

Al Gore Goes to Hollywood (but not to Caltech)

In his film Gore urges an auditorium full of students to "separate the truth from the fiction and the accurate connections from the misunderstandings". In keeping with

that exhortation I watched the *An Inconvenient Truth* with careful attention to the research on which its arguments were founded. At the time of my second viewing, I began to take notes and read the scientific literature.

Within the first half hour of the film it is clear that Gore does not see global warming merely as a future threat. He states, "Now we're beginning to see the impact in the real world." The example of this impact that made the biggest impression on me was that of Lake Chad in Northern Africa. Gore showed dramatic satellite images demonstrating the rapid shrinking of the once-giant lake to near dryness since the turn of the previous century. He suggested that this water shortage has brought on the conditions that have lead to the tragedy and mass violence in the bordering areas of Niger and Darfur. This made me listen. What would it take for a lake of such magnitude to dry up? The warming must be dramatic indeed. I decided to Google it.

The first site that came up was Wikipedia, where I learned that, indeed, Lake Chad is a critical water source for over 20 million people and its rapid shrinkage is extensively documented. At this point the surface area is about 1,350 km^2, down from its all time high of about 400,000 km^2 in about 4,000 BC. However, there were also some details that Gore failed to mention. The lake itself is only seven meters deep *at its deepest*. Its average depth currently is 1.5 – 4.5 meters (depending on your source). Essentially, it is a large and geo-politically important swamp. For comparison, Lake Champlain covers approximately the same amount of land and has an average depth of 19.5 m and a max depth of 112. Lake George, with one-tenth the surface area, is almost nine times as deep. It turns out Lake Chad has actually been dry multiple times in the past: in 8500 BC, 5500 BC, 2000 BC and 100 BC. Though Wikipedia and a paper in *Journal of Geophysical Research* on the topic agree that global climate change may have played a role, they also report that the major factors were significant local changes – a rapidly expanding population drawing water from the lake, the introduction of irrigation technologies and local overgrazing. Yes, these are anthropogenic causes, but they are neither global nor warming, and are utterly independent of CO_2. In addition, Africa as a continent experienced a dramatic shift towards dryer weather in the end of the 19^{th} century that is not generally attributed to CO_2. (Coe, M.T. and J.A. Foley, Human and natural impacts on the water resources of the Lake Chad basin. *Journal of Geophysical Research (Atmospheres)* 106, D4, 3349-3356. 2001) Gore might as well have photographed a glass of water on a picnic table, called it a lake, drunk its contents and then attributed the change to global warming. Was he purposefully misrepresenting the evidence or had he really not done his homework even on the most basic level?

The shrinking of the snows of Kilimanjaro is another dramatic example. Scientists have noted this phenomenon for over a hundred years. A search of the scholarly literature immediately produced Georg Kaser's 2004 article in *The International Journal of Climatology* on the subject. He states that all three of the major East African glaciers have seen significant retreat since the late 1800s. Kaser writes, "The dominant reasons for this strong recession in modern times are reduced precipitation and increased availability of shortwave radiation due to decreases in cloudiness". This dryness began relatively abruptly around 1880. "In contrast to this 'switch' in moisture conditions, there is no evidence of an abrupt change in air temperature.... Temperature increases in the tropics on the surface and in the troposphere have been little in recent decades compared with the global trend." The very shape of the

glacier speaks out against Gore's theory: melting from temperature rise "would round-off and destroy the observed features within a very short time, ranging from hours to days". Indeed, a year and a half record from 2000-2002 showed that air temperatures never exceeded -1.6^{o} C (in fact, Gore's friend Lonnie Thompson reports that the temperatures never rose above -2^{o} C during his research there), and permafrost extends far below the edge of the glacier. (Kaser et al, *Int. J. Climatol*. 24: 329–339 (2004)) In other words, not only is the recession of Mt. Kilimanjaro's snowy peak probably not due to CO_2-induced temperature rise, it isn't even driven by temperature rise at all.

At this point I would like to make a note about methodology. To find the papers cited throughout this article I searched Google Scholar and occasionally individual publications, such as *Science.* (For example, when I wanted to find articles about Lake Chad, I typed in "Lake Chad", and for the ice core record, I entered "ice core record" and "ice core record timing".) I did not dig though dozens of studies to pick out these ones. Some of these papers, in fact, include statements affirming the authors' belief in global warming despite the lack of evidence for it in their study.

Perhaps you are wondering where Gore got his article proving the undisputed "consensus" on global warming. The original review of the scientific literature was published in a non-peer reviewed essay section of *Science*, written by Dr. Naomi Oreskes, a history of science professor at UCSD. Her search included articles with "climate change" as a keyword. The study was cited and expanded in a paper in the political journal, *Globalizations*, which added the analysis of popular media. A statement by Dr. Oreskes that was not included in the *Globalizations* article read, "The scientific consensus might, of course, be wrong. If the history of science teaches anything, it is humility…." In light of that, I encourage you to look at the evidence for yourself, but I recommend you start with peer-reviewed articles before resorting to the essay section of *Science*, let alone the science section of *Globalizatons* or *Newsweek*.

There is one piece of evidence that is particularly accessible to medical students for critical analysis: Gore pointed out the potential for increases in infectious diseases due to expansion of areas suitable for insect vectors. To illustrate this he listed fifteen new or recently resurgent diseases: Ebola, Arena virus, Hanta virus, SARS, multi-drug resistant Tuberculosis (MDR TB), *E. coli 0157:H7*, Lyme disease, legionnaire's disease, *Vibrio Cholerae 0139*, Nipah virus, malaria, dengue fever, leptospirosis, West Nile virus, and Avian flu.

This litany of killers is impressive until you realize that out of the fifteen, only Lyme, malaria, dengue and West Nile virus are spread by insect vectors. A closer look at those four even further confounds the point. Lyme disease – far from being a tropical disease spreading northwards – originated in the temperate climate of Lyme, CT and spread South and West. Malaria is a disease confined to the tropics more for socioeconomic reasons than climatologic ones, and it was once prevalent in Siberia and Northern Europe. Its decline in these areas happened largely during warming periods of history. There has been a recent resurgence of malaria in some Eastern European countries that the WHO attributes to socioeconomic instability. Paul Reiter from the Pasteur Institute in Paris published a letter in *Emerging Infectious Diseases*, refuting the section of the IPCC (International Panel on Climate Change) report on infectious diseases. (Reiter was actually drafted to be one of the authors of the IPCC report, but withdrew and actually threatened to sue the organization to have his name removed from

the author list because he was so disgusted with the inaccuracy of the final product.) He focused on the misrepresentation of malaria and the lack of any evidence for climate-associated spread of dengue fever. Of these diseases, the one most commonly attributed to Global warming is West Nile Virus (WNV). Once again, the science doesn't hold up. The disease vector, *Culex pipiens* (also responsible for transmitting St. Louis encephalitis), is the most widely distributed mosquito in the world, common on every continent but Antarctica. Prevalent in temperate, not tropical, zones, it is readily found as far north as Nova Scotia. WNV's arrival in the US had nothing to do with changes in vector habitat conditions. (*Emerg Infect Dis* 6(4), 2000; and also *Environmental Health Perspectives* Supplements Volume 109, Number S1, March 2001)

On the other hand, two of the diseases – SARS and MDR TB – are transmitted person-to-person by aerosolized droplets and are therefore more likely to be spread during cold weather when people are in closer quarters. This is evidenced not only by the pattern of their epidemiology (apartment buildings for SARS, prisons for TB) but also by the seasonal (winter) pattern that we see in the US of other infections transmitted through the respiratory tract. Conversely, it could be argued that increased use of air conditioners – one route of dissemination for *Legionella pneumophilia* – in a warmer world might lead to a higher incidence of legionnaire's disease. I guess. It's a stretch.

Arena virus, Hanta virus and leptospirosis are spread by aerosolized rodent feces or direct contact with rats. Human contact with rodent population is complex and poorly studied, but epidemiologic data show that it is largely related to precipitation and flooding, with no correlation to warming. (Climate Variability and Change in the United States: Potential Impacts on Vector and Rodent-Borne Diseases, *Environ Health Perspect*. 2001 May; 109 (Suppl 2): 223–233) The effect of climate change on pigs (the Nipah virus vector), chickens (Avian flu) and non-human primates (the presumed vector for Ebola) is not immediately obvious. (Though the effect of socioeconomic development on the incidence of people living in close contact with these animals is clear.) New strains of *V. cholera* and *E. coli* are spread the same way as the old strains: contaminated food or water – again, the role of climate, if there is any, is insignificant compared to socioeconomic and hygienic factors. (Oxford Handbook of Tropical Medicine, 2nd Ed. Eddleston, M et al. 2005)

To return to Gore's original point, however, there is no evidence that any of these diseases emerged or resurged due to global climate change. Talking about these diseases in an article about Global warming is like listing Mao, Stalin, Hitler and Idi Amin as examples of the depravity of American politicians. Like the tragedies in Darfur and the loss of Mt Kilemenjaro's glaciers their mention in *An Inconvenient Truth* is totally irrelevant and manipulative – just smoke and mirrors, a distraction from the dearth of good evidence.

But these kinds of "examples" go on and on: another is the storm argument. Are we having more storms, as the film states? Not according to an article last year in the journal *Meteorology and Atmospheric Physics.* "Any changes associated with warming of the surface compared to a smaller temperature rise in the lower-troposphere (and resultant changes in atmospheric stability) have not produced detectable impacts on intensification rates of tropical cyclones in the North Atlantic basin." (Balling, R. C.; Cerveny, R. S. *Meteorology and Atmospheric Physics*, Volume 93, Issue 1-2, pp. 45-51, 2006) Shall we address them all: the drowning computer-animated polar bear, the simulated submersion

of Calcutta...?

Even if every example of the current impact of CO_2 driven temperature rise could be disproved, one stunning visual from the movie remains to haunt the viewer with doubts. Gore shows us two lines – one plotting temperature over the past six hundred and fifty thousand years, the other plotting atmospheric carbon dioxide. They appear to rise and fall with a synchronicity that would be the envy of many an aquatic acrobat. If temperature and carbon dioxide really have shown such a strong correlation over the centuries, isn't it still probable that CO_2 drives temperature? This is possible, of course, provided that the CO_2 rises coincide with or slightly predate the rises in temperature. Correlation is sensitive, but not specific – it can pick up a whole range of possible causes, but cannot prove causation. On the other hand, as we have all learned by now, if a sensitive test is negative, it *can* rule out a potential cause. Lack of correlation rules out proximate causation. Is CO_2 inducing this global fever?

Probably not.

That is, not if you trust the ice core records that Gore speaks so highly of in his Oscar-winning Powerpoint presentation. The Antarctic melting during the third glacial termination (210-225 thousand years ago) show that the CO_2 rise lagged *behind* the temperature increase by about 800 years. An article by Fischer in *Science* reported a lag of 400-1000 years during all three glacial interglacial transitions on record. A later analysis using argon – which has been shown to correlate with temperature as well as the standard oxygen isotopes and would be less prone to inaccuracies in timing – confirmed the previously reported findings. That kind of a lag is easy to miss in charts covering hundreds of millennia, but it is hard to dismiss as insignificant on a practical level. The Fischer article states that the generally observed correlation between CO_2 and temperature rise and fall is "connected to a climate-driven net transfer of carbon from the ocean to the atmosphere". In other words, the ocean acts as an enormous organism that exhales carbon dioxide during warming periods of earth's history, and absorbs it during periods of cooling. Caillon et al report that "this confirms that CO_2 is not the forcing [that is, the causative factor] that initially drives the climatic system during a deglaciation". (Caillon, N. et al, *Science* 14 March 2003: Vol. 299. no. 5613, pp. 1728 – 1731; Fischer, H et al, *Science* 12 March 1999: Vol. 283. no. 5408, pp. 1712 – 1714).

The temperature records have more to tell: even with a cursory investigation of Gore's charts you will notice that the temperature rises during the early part of the 20th century. This rise begins decades before cars or planes were in use, at a time when the global economy was struggling under war and economic depression. Industry, and with it, CO_2 emissions, didn't really take off until the post-war period, at which point *temperatures went down.* I'm not making this up.

"But these details are missing the point," I hear you cry. "The critical issue is that we're seeing extreme, rapid climate changes." Not really. If you look back at Gore's chart of the past couple hundred thousand years (though not his chart of the past 2000 years which does not resemble any other temperature record I've come across), even he shows our current temperature as still within the high end of the normal limits. His graph also reveals something else, noted by a team of Chinese scientists in *The Geophysical Research Letters* in 2003. In their paper Ming Tan and his colleagues record data taken from temperature proxies found in a 2560-year-old stalagmite. They report that, over this period warming and cooling trends have followed a distinct pattern: the warming

occurring rapidly over approximately a century followed by gradual, multi-centennial cooling, creating what they described as a "saw-toothed pattern". (*Geophysical Research Letters, Vol. 30, No. 12, 1617, 2003*. This article also contains a markedly different two millennia temperature record than that shown in *An Inconvenient Truth*.) Based on available records, the current warming curve is consistent with the known historical pattern.

Unlikely CO_2, possible meteorites, probable sunshine

Carbon dioxide has never driven temperature. In fact, the evidence shows that historically, temperature has driven CO_2. We cannot rule out the possibility that CO_2 could drive climate, just as it would be hard to rule out the possibility of a devastating meteor striking earth. But we are not enacting expensive legislation to erect retractable meteorite shields around major US cities, or pouring money into the development of meoteorite-proof material. No one is pressuring poor nations to sign treaties swearing they will dedicate a portion of their meager GDP to combat this potential threat. It would be absurd. And in that case we're talking about an event that has actually happened in the past.

So, if it isn't CO_2, what does drive climate change?

I don't know.

One convincing theory is that of solar magnetic activity and irradiance – two separate but generally coinciding phenomena. An article in the *Astrophysical Journal* in 1996 argues for a combined effect of greenhouse gasses and solar factors, with solar factors contributing a more significant amount. (*The Astrophysical J.*, 472: 891-902, 1996 Dec 1) The authors of the article on the saw-toothed climate pattern favor the solar explanation, saying, "All centennial to sub-millennial scale cycles exhibited by the WTR [warm season temperature record] could be connected to solar variation cycles of about 208, 350, 700 and 950 years." (*Geophysical Research Letters, Vol. 30, No. 12, 1617, 2003)* Other articles expressly denounce these solar theories or claim they are insufficient to account for the full extent of the warming. (*The Geophysical Research Letters*, Vol. 25, No. 23, pp 4377-4380, Dec. 1, 1998; *GSA Today*, v. 14, no. 3, 1052-5173, 2004) There is the potential for localized anthropogenic warming effects secondary to changes in land use, which have been widely documented and are known as the "urban heat island effect". (eg. The Urban Heat Island Effect at Fairbanks, Alaska, *Theoretical and Applied Climatology*; Volume 64, Numbers 1-2 / October, 1999, pp. 39-47) There are the ocean currents and oscillations, such as the Gulf Stream and El Nino, that have changed throughout the Earth's history and to which many significant warming and cooling effects are attributed. The fact is, weather is a complex, perhaps even chaotic, system. It is determined by multi-factorial processes. Some variables are independent and others are interdependent in complex and unpredictable ways. Some are subject to human manipulation, but we are utterly at the mercy of others.

Crichton states, "Nobody believes a weather prediction twelve hours ahead. Now we're being asked to believe a prediction that goes out 100 years into the future? And make financial investments based on that prediction? Has everybody lost their minds?" He goes on to point out:

> Let's think back to people in 1900 in, say, New York. If they worried about people in 2000, what would they worry about? Probably: Where would people get enough horses?

> And what would they do about all the horseshit? Horse pollution was bad in 1900, think how much worse it would be a century later, with so many more people riding horses?
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> But of course, within a few years, nobody rode horses except for sport. And in 2000, France was getting 80% its power from an energy source that was unknown in 1900. Germany, Switzerland, Belgium and Japan were getting more than 30% from this source, unknown in 1900. Remember, people in 1900 didn't know what an atom was. They didn't know its structure. They also didn't know what a radio was, or an airport, or a movie, or a television, or a computer, or a cell phone, or a jet, an antibiotic, a rocket, a satellite, an MRI, ICU, IUD, IBM, IRA, ERA, EEG, EPA, IRS, DOD, PCP, HTML, internet. interferon….
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> Now. You tell me you can predict the world of 2100. Tell me it's even worth thinking about. Our models just carry the present into the future. They're bound to be wrong. Everybody who gives a moment's thought knows it.

Counting the cost of the precautionary principle

People will appeal to the Precautionary Principle – that it's better to be safe than sorry. Why not sign global treaties to limit carbon emissions? The April 16th Newsweek had a telling map entitled "Leaders and Laggers". Based on the Environmental Performance Index from Yale, it rated countries based on how environmentally friendly their policies were – the "leaders" dark green and the "laggers" in coal black. One immediately notes a rough correlation between wealth and environmental policy on this map. Why not encourage developing nations to get with the program and use more "clean energy"?

Well, why don't *you* have a solar paneled house? Probably because it's too expensive. No matter what we say about saving costs down the road, as a practical matter these solar technologies involve too much of an initial capital investment to be feasible for most Americans. Installation costs for one entirely solar house in Boston was $35,456. Presumably the technology will get cheaper and more efficient in the future, but this is where it stands today. A recent article came out about a group of Virginia Tech engineering students who designed a solar energy system to power a clinic in Getongoroma village in Southwestern Kenya. The high tech system will provide the clinic with an ample 24 kilowatt hours per day (25% more than was requested, but still 20% less than the average US household uses). The projected cost: $120,000. Surrounded by the relative riches of America, the project is still in the fund raising stage. How can we possibly be serious in prescribing this to countries where the average person earns a couple of dollars a day? James Shikwati, a Kenyan economist and author, has said, "The rich countries can afford to engage in some luxurious experimentation with other forms of energy. But for us, we are still at the stage of survival."

Of course, there are places where solar energy is the best option for electricity in developing countries. These are generally places that have no hope of getting connected with a power grid, such as remote clinics in agricultural communities in Kenya or guerilla-controlled areas of Burma. The technology generally used in clinics along the Thai-Burmese border, for example, utilizes solar panels which each cost $525. Sounds a little more reasonable, right? Each of these panels supplies *130 watts of power*. If you have two incandescent light bulbs on in your house right now, you are probably exceeding this wattage. If you made coffee this morning, you used almost seven times

this amount of power. The medics along the Thai-Burma border don't really focus much on immunizations because a refrigerator requires at least 200-700 watts of power. Of course, this also precludes the possibility of blood banks, in a part of the world where medics are frequently faced with treating postpartum hemorrhage, malarial hemolysis and trauma. At a household level, lack of refrigeration has profound repercussions in the form of prevalent and deadly diarrheal diseases that account for 50% of childhood mortality in this population. What else might you want in a clinic? An ultrasound? Cautery? A microscope that can be used at night? A pulse-oximeter? A UV lamp?

These affordable solar panels are a valuable stopgap, but they are by no means a permanent panacea for the word's energy needs. Economist James Shikwati says, "I don't see how a solar panel is going to power a steel industry, how a solar panel is going to power a railway train network. It might work to power a small transistor radio…. One clear thing that emerges from [this] debate is the point that there's somebody keen to kill the African dream. And the African dream is to develop." By telling developing countries to use "clean energy sources" what we are saying is, "You will not have electricity at all." We are saying, "You will live a life of backbreaking work. You will see at least one of your children die in early childhood, probably more than that. You will experience incomparably more painful and dangerous pregnancy and labor than women in developed countries, and you will face it more frequently because you will fear losing your children to disease, starvation or violence. You will be too busy struggling for survival to protest the rampant official corruption or the government troops who rape you, destroy your villages and disregard your votes. Ultimately, you will die 20-30 years younger than I will.

"But it will be worth it, because I've been told there is a scientific consensus that all this is necessary to avert global warming."