

BOOK REVIEW

Thomas G. Moore: 1998, *'Climate of Fear' (Why We Shouldn't Worry about Global Warming)*, Cato Institute Press, 175 pp.

'Don't worry, be happy'. The greenhouse effect, even if real, will be a golden age for man. Forecasts of severe impact are overstated. Rather, agriculture will benefit, people will live longer, culture will flower, etc. etc. And by the way, extinctions will not nearly be as bad as suggested.

Stated in so many words, this is the portrait presented by Thomas Moore in his recent book. The timing of the publication presumably reflects the desire of the author to influence decision makers in Congress when it comes to debating the Kyoto Treaty on restricting greenhouse gas emissions. Dr. Moore is an economist who has been affiliated with the Hoover Institution. The book jacket comes with strong endorsements from the likes of Edward Teller, Milton Friedman, and Murray Wiedenbaum.

The book begins with a general statement of the greenhouse problem by the author and then proceeds into a review of the global warming problem, observations on past climates, discussion of cultural/societal changes associated with past climate change, an economics-based disputation of the claim that preventing the spread of disease is an important element for restricting greenhouse gas emissions, and a discussion of economic scenarios in which Dr. Moore concludes that greenhouse warming will be beneficial to society because individuals and societies generally prosper more in warm climates than in cold climates. He estimates that the U.S. will benefit \$100 billion annually due to greenhouse warming. He further argues that implementing the Kyoto Treaty will have a negative impact on the U.S. economy.

Throughout the book, Dr. Moore adopts the position of granting the possibility, perhaps even the likelihood, that the greenhouse effect may be real. This is a distinctly different approach than some discussions on the issue. The book is well written and includes a number of interesting examples about cultural developments during various climate periods.

But can Dr. Moore's claims be believed? If so, they would cast a much different light on the climate change debate. After reading his book I believe there is merit in some of his arguments but that his case is weakened by a number of factual, logical, statistical, and 'fairness' gaps. My reasons for this conclusion involve the following topics:



(1) *Discussion of the physical climate system.* Although Dr. Moore ‘concedes’ that the greenhouse effect might be real, he actually inserts a number of questions and concerns that suggest he is not really convinced it is. This is a standard rhetorical device, but I am not sure how many people he convinces with the tactic. For example, he repeats the oft-cited true point that the anthropogenic carbon dioxide flux is less than the natural cycle of carbon dioxide transfer between the land and the atmosphere. He fails to note that the natural flux is in balance on the long time scale, so rising atmospheric CO₂ levels reflect the anthropogenic perturbation of the balance. In other words, the relative amounts of natural vs. anthropogenic carbon dioxide is irrelevant, since we are concerned with the perturbation and not the basic state of the system. Ice core studies clearly show that present atmospheric carbon dioxide levels are already at their highest levels in at least 200,000 years. When the effects of other radiatively important trace gases are added to the greenhouse effect, we may already be at the highest ‘net CO₂’ level in 2–3 million years. Since we have only utilized about 5% of the available fossil fuel reservoir, should such a perturbation be taken so cavalierly?

Dr. Moore points out that technology has changed so dramatically over the last 300 years that we cannot take seriously longterm projections by ‘Cassandras’ as to the out-century effects of carbon dioxide emissions. What he fails to point out is that, despite the changes in technology, the fuel base for our economy today is the same as it was 300 years ago! Furthermore, since the average lifetime of a perturbed carbon dioxide molecule in the atmosphere is about a century, we have to be concerned in the long term about what we put up now and in the near-future. Ironically, Dr. Moore fails to note that Cassandra, the daughter of King Priam of Troy, was a tragic figure not because of wrong and gloomy predictions, but because she made true predictions that were ignored.

There are also a number of serious misstatements about projections of climate model sensitivity and sea level change. The author states that the estimated ‘best fit’ climate model sensitivity of the 1995 Intergovernmental Panel for Climate Change (IPCC) estimate is less than the 1990 IPCC report; this is not true, the estimates and ranges are identical. The author states that mid-21st century sea level projections have fallen from 6 m in the 1980s to about 20 cm in the 1995 IPCC report. This is again not true. An exhaustive 1985 Dept. of Energy assessment lists projections out to 2100 only slightly greater than the 1995 IPCC report. The 6 m number refers to the possible sea level rise due to melting of the West Antarctic Ice Sheet. But almost all scientists working on this important problem recognize that this facet of the sea level equation is very uncertain, and even if melting were to occur, it is usually phrased in terms of centuries, and the West Antarctic Ice Sheet uncertainty does not factor into the IPCC projection out to 2100 A.D.

Part of the problem in the science discussion is that there seems to be a mixing of statements from ‘environmental extremists’ and the ‘consensus’ IPCC position. For example, the author quotes Senator George Mitchell about ‘raging hurricanes . . . killing millions of people’. But the IPCC report is extremely careful

about this subject and makes no firm predictions on the matter. The evidence for global warming is also not nearly as foggy as Dr. Moore would have us believe. The urban heat island argument is a red herring; it has been carefully evaluated and demonstrated that its uncertainty with respect to the global mean temperature is only about 10%. Statistical studies have also demonstrated that we do not need a thermometer on every square meter of the earth in order to accurately estimate temperature trends. In fact, studies indicate that we need only about 60–70 well-placed stations in order to obtain an estimate of global temperature accurate to within about 10%.

Other statistical studies involve subsampling of dense records to determine whether the low resolution records typical of, for example, the tropical oceans and southern hemisphere, parallel high resolution records of the northern midlatitudes. Again, results support the main conclusion that the planet has warmed considerably (about 0.6 °C). This result is consistent with proxy records of climate change, including investigations of tropical glaciers indicating that snow melt levels are at their highest value in at least a thousand years.

The observation that some grid boxes on the planet have not warmed is again a red herring. This is what I call the Blue Square Syndrome. If there is a checkerboard with 64 squares, 45 of which are red, 10 blue, and 9 white, the Blue Square Syndrome is when someone standing on a blue square states that the average color of the board is blue.

With respect to projections, climate models, although clearly questionable in detail, provide an objective estimate of the future course of climate on the largest space and time scales. While even the Wall Street Journal is aware of deficiencies in models such as the cloud climate feedback, a common, usually unstated, misperception in greenhouse critiques involves the assumption that if one cannot simulate the climate perfectly then the climate simulations have no value. This is quite simply not true. The citation of a (to my knowledge) non-peer reviewed report pointing out discrepancies between model projections for the northern hemisphere and the higher smokestack aerosol loadings in the same hemisphere fails to note that models predict this pattern because land heats up more than the ocean, and there is more land in the northern hemisphere. Rigorous statistical studies indicate that the observational record more or less tracks the pattern predicted by the models.

One difference between climate and economic models is that the latter can be validated against an independent data set – the paleoclimate record. There are many striking examples of agreements between model and observations. Significant discrepancies occur, but some could reflect inadequacies in the geologic data rather than fundamental flaws in models. Even so, the discrepancies are not so large as to conclude that the model results can be completely ignored. Furthermore, the paleoclimate record can be used to validate climate model sensitivity (the magnitude of warming for any specific change in greenhouse gas radiative forcing). The present range of uncertainty from the IPCC is 1.5–4.5 °C for a doubling of carbon

dioxide. This range has varied little in 15 years. Almost all attempts to model past climates generally obtain agreement between models and data consistent with the IPCC range.

Other errors in this section involve likening the future to the early Holocene or the last interglacial. Such reasoning by analogy is questionable. Those climate changes were driven by changing orbital insolation values, which result in minuscule mean annual radiation budget changes. The future warming will involve mean annual increases significantly larger than the Holocene or last interglacial. The warming for the last interglacial is also probably overstated and probably cannot be used as a preview of the mid-21st century. Although mean annual changes occurred in the mid-high latitude northern hemisphere, changes elsewhere may not have been synchronous. This conclusion is supported by reconstructions of sea surface temperature for the last interglacial, which indicate little difference between the past and the present. Another problem with the interglacial analogy is that future change will be rapid and the climate system will not be in equilibrium (see below).

(2) *Relation between past climate change and human well-being.* Dr. Moore discusses a number of cases where warming climates were related to economic/cultural advances – e.g., the rise of agriculture during the early Holocene warm and wet period and the so-called Medieval Warm Period, which witnessed expanding economies and culture in both Europe and China. These and other examples all have merit but a number of uncertainties arise, leading me to hesitate embracing how far this relationship can be generalized, and whether the wrapup section in the chapter concluding that ‘A warm planet is a happy planet’ is a valid conclusion.

Cultural historians are very wary about drawing too tight a linkage between society and climate; there are many other factors influencing culture. In particular, one can find many exceptions – for example, the emergence of the Egyptian Dynasties came at the tail end of the early Holocene warm period and very beginning (5100 yr BP, years before present) of a two-step climate reversal known as the Neoglaciation. The ‘Little Ice Age’ (approximately 1600–1900 A.D.) was a period of tremendous expansion in the European economy and population – recall the Dutch Renaissance and Brueghel’s paintings of ice skaters on Dutch canals. Much of the intellectual and cultural fervor associated with the Renaissance and the New World discoveries occurred during this time. And let us not forget the great counterexample during the early-20th century warm period (1930s–1940s) – the Great Depression and World War II.

Estimates of population growth and life expectancy (vs climate) are also suspect. For the former, growth rates for the early Holocene warm period and 500–600 A.D. cool period are carried out to 2–3 significant figures. The life expectancy of Neolithic man (6000 B.C.) of 38 yrs. is six years greater than Rome of the Republic (300 B.C.). Are these differences statistically significant? This would imply that we know the mean age of Neolithic man to within 2–3 years – a precision I find hard to believe.

A more fundamental problem with Dr. Moore's analysis involves the 'reasoning by analogy' – if it happened this way in the past, it should happen that way in the future. It is a stretch, to say the least, to draw parallels between an era of subsistence agriculture and the age of agribusiness. Tremendous population growth suggests that 'statistical relationships', 'valid' in the past, may not be applicable to the future because of nonstationarity of the system. As society gets more complex, national boundaries become more fluid to exchange but less easy to conquer – the 'old fashioned' manner of accommodating population increases.

(3) *Impacts of greenhouse warming.* I agree with Dr. Moore that it is unrealistic to think that global warming will always have adverse impacts. Some countries might benefit from a greenhouse warming (e.g., Canada, Russia). However, sea level changes will almost certainly have an adverse impact in some regions.

There is a saying in the Philippines that 'every drop of rain is a grain of rice'. This poetic observation concisely states the dilemma facing many tropical regions under greenhouse warming scenarios. Dr. Moore makes a serious error when he states that increased precipitation in warm periods will just lead to more beneficial growing conditions. He has overlooked the fact that evaporation also increases in a greenhouse world, and the real problem with drought is precipitation-minus-evaporation. The dilemma is more complicated because in a warmer atmosphere the average holding capacity of water will increase, thereby drawing even more moisture out of the soil and vegetation without 'converting' it directly to precipitation. This process should exacerbate drying, especially in parts of the tropics. A further problem in this region is that, even if the tropical moisture cycle increases due to increased evaporation from higher sea surface temperatures, model studies suggest that any increased precipitation in the Intertropical Convergence Zone is compensated by increased evaporation in the much larger downwelling areas of the flanking subtropical zones (which affect the southeast Asia monsoon region almost eight months of the year). Changes in such areas could affect a large percentage of the world's population. These twin dilemmas indicate that a simple relation between temperature and precipitation cannot be used to dismiss concerns about the effects of greenhouse warming on droughts.

Nor can the CO₂ fertilization effect on plants be automatically invoked to dismiss the effects of climate change on agriculture. Although higher CO₂ levels can promote plant growth, some studies suggest there may be limits to that growth, because organisms also require other nutrients, and these may not change in the same way as CO₂. In poor countries especially, increasing moisture stress (see above) and fertilization efforts may not be able to keep up with higher CO₂ levels. Later in the book, Dr. Moore suggests that adding iron to the ocean will also draw down CO₂, thereby leading to a less severe climate than predicted. The iron fertilization hypothesis is intriguing but some studies indicate the effects may be limited.

Since the purpose of the book is to influence U.S. foreign policy, is what is good for Canada and Russia necessarily good for the U.S.? If one adheres to the IPCC report, the most likely consequences involve warming, sea level rise, and

possibly increased drought in the U.S. midcontinent – the breadbasket of the nation. The sea level change will certainly affect coastal regions, especially on the eastern seaboard and the Gulf of Mexico. There is also a chance for greater variability in weather (droughts, storms), but the statistics of evaluating these trends, and the ability of models to simulate them, requires that this possibility be recognized but not weighted as much as the other impacts.

Are such impacts acceptable? I doubt if few people along the northern tier of the U.S. will quarrel with a shorter winter. But since we are at present in the process of a severe heat wave and drought at Texas, I find it hard to believe that many in Texas, the South, or the Southwest U.S. would want it much warmer than what we already have. Farmers and ranchers should be concerned because of the possibility of future severe drought. All one has to do is read descriptions on the devastation caused by the droughts of the 1930s and 1950s to recognize the severe impacts of such events. As the 1996 and 1998 Texas and Oklahoma droughts indicate, droughts still have a big impact, and promise to have even more of an impact as the population and water needs increase.

With respect to the impact on biota, Dr. Moore seems to believe that vegetation zones and organisms will just shift north so there is no reason to worry about them. What he fails to note is that ecosystems are in quasi-equilibrium with their environment and that biota may not be able to adjust quickly enough to rapid changes. Such changes would create a non-equilibrium climate because different components of the climate system cannot keep up with the rate of change of greenhouse forcing. Insects and weeds can adapt more quickly than large plants, which also require that soils adjust to the new conditions. But since soils require centuries to millennia to change, that will probably not happen. Besides, there is not much soil on the Canadian Shield.

(4) *Impact of global warming on health.* I tend to agree with Dr. Moore that if one wants to improve world health conditions, there are a lot cheaper and more efficient ways to do so than to enact legislation on greenhouse gas reductions. However, I am not convinced by his analysis minimizing the effects of heat wave and temperature on urban air pollution. I also disagree with Dr. Moore that the point should be completely excluded. If there are other compelling reasons for greenhouse gas emission reduction, then the impacts on health (e.g., poleward spread of insect-borne diseases) are an additional consideration for a treaty. But legislation should not invoke that benefit as the primary reason for signing a treaty.

(5) *Economic consequences of global warming.* One might question whether a climatologist has the right to dispute economic predictions, but experience with models and statistical evaluation can cut across disciplines. Since economists feel justified to question climate models, I will proceed on a quid-pro-quo basis. At least climate models have a fundamental physics and an independent data set (the geologic past) to test model predictions against. Which leads me to wonder how economists validate their models. 'I have calculated...' is just not a sufficient demonstration of accuracy, especially since there seems to be a plethora of mod-

els yielding different results (there is a joke on Wall Street that economists have correctly predicted ten of the last five recessions). Despite claims of 'conservative' estimates, it is not clear how robust Dr. Moore's economic model calculations are (testing for robustness is a routine practice in climate models). Nor is the all-critical 'discounting' concept explained as to its effects on his economic projections. This term refers to the decreased value of a commodity in the future; for example, at a 5% discount rate, the present value of a dollar would be worth 0.006 cents in 200 years. The book by William Smith, which Dr. Moore criticizes, at least explains this term and furthermore points out that one can get just about any answer they want as to future impact depending on the choice of the discounting value.

When delving into the reasons for Dr. Moore's optimistic greenhouse economic forecast, 75% of the variance in the 'benefits' of global warming is due to the effects of climate change on health (increased longevity and decreased morbidity). These latter estimates in turn are based on correlation studies between health and temperature that Dr. Moore has conducted. For example, Dr. Moore 'conservatively' estimates that saving 40,000 lives will result in a total benefit to society of \$40 billion \$1 M/person! Another \$36 billion will be saved from reduction in hospital costs. I am uncomfortable with staking so much of the primary conclusions on such reasoning and correlations. I would certainly be interested in hearing other sides of this problem to see if there are alternate views to the accuracy and thoroughness of this analysis. Based on Dr. Moore's statements on topics I know more about, I wonder whether the same type of selectivity has been employed in his analysis of health consequences. For example, Dr. Moore seems to shrug off the deaths of old people during heat waves (they would have died soon anyway) but seems to happily include them when warming has a positive health benefit. His statement that people will just adapt to warmer climates fails to note that models predict temperature will just keep getting hotter, and it is not at all clear that people can keep up with constantly changing conditions. Again, the oppressive heat wave in Texas this year is hardly a testament to the smooth adaptability of human nature.

(6) *Economic costs for implementing global warming cutbacks.* Dr. Moore contends that implementing the Kyoto Treaty will have a negative impact on the U.S. economy. I only agree in part with this assessment and question some of the cost statements, for example the cost/ton estimates on reducing carbon emissions. Experience with sulphur trading for reducing acid rain indicates that initial estimates of trading costs (by the same types of industry and economic sources who oppose greenhouse regulations) were wildly off once the free market was allowed to operate in the system. At a White House Teleconference in October 1997 one of the leading administrators of the Chicago Board of Trade – one of the bastions of the capitalist system – stated that he felt the free market could significantly reduce the costs of carbon trading below the present high estimates.

Other concerns I have with this chapter involve statements such as banned chlorofluorocarbons (CFCs) 'produce no known cases of harm to any men or women'. What about skin cancer? Dr. Moore states that increasing the cost of gasoline

will force people to buy smaller, lighter, and more dangerous automobiles, thus endangering more lives. I don't know how to respond to this defense of increasingly gigantic vehicles on the roads; the poor are already at the mercy of these gas guzzling monsters. Following Dr. Moore's argument to its logical limit would seem to justify buying M1 tanks so that we can all be better protected on the highways.

For over a century powerful conservatives have resisted all types of efforts to legislate the economy on the grounds of increased costs. This applies to basic workers rights, safety, and health benefits (remember the auto industry resistance to seat belts and air bags?). Yet, because these efforts were (largely) overcome, the average worker is better off than they were before, and the American economy is still booming. These trends seem to suggest that initial costs and deleterious impacts are eventually integrated into the economy without longterm harmful effects. Why should we therefore believe the dire scenarios of the future economic impact on the U.S., when the same people resisting it now have been wrong before?

(7) *Fairness*. Dr. Moore points out that third world countries are presently not part of the greenhouse gas treaty reduction. He goes on to state that 'a pound of carbon dioxide is a pound of carbon dioxide' (whether, for example, it comes from China or the U.S.). This attitude is remarkably narrow in its assessment of the problem. First-world countries are the leading 'polluters' of greenhouse gases, on both a total and per capita basis. These emissions have led to an increased quality of life for first world residents. Is there not some fairness in considering that different restrictions be put on poor countries, which are trying to upgrade their standard of living, which in the future will still be a fraction of the U.S. per capita carbon consumption?

In another example, Dr. Moore acknowledges that sea level will rise. He points out that this is a regrettable cost of global warming and that the world community can simply respond to the sea level rise by contributing money to build dikes in affected regions. The possible increase in drought in many tropical countries is another problem that needs to be addressed – Dr. Moore deals with it in one sentence 'Those poor parts of the world that might suffer the most should have help'.

Can anyone really expect heirs to the present U.S. Congress, who refuse to pay their United Nations dues, to readily provide money for building dikes in third world countries, or to drastically increase aid to third world countries afflicted with drought? One of the problems in this book is that there seems to be very little interest or concern about what happens to other countries, despite the fact that the U.S. is the principal greenhouse gas emitter. Everything seems to come down to a cost-benefit ratio, as it pertains to the U.S. Is there no concern about the flagrant waste of natural resources in this country? Conservatives love to talk about taking responsibility for one's actions. I agree with this principle, but I also believe it needs to be applied across the board, not just when it is convenient to do so.

This leads me to one further facet of the final chapter. Dr. Moore lets his guard down when describing attendees at the greenhouse meeting in sarcastic language. Although I don't side with all the opinions voiced at such a conference, to belittle

the environmental lobbyists and mock Vice President Gore merely seems to reveal Dr. Moore's true colors. Beneath the veneer of reasonable 'counter arguments' seems to lie the same attitudes found elsewhere in the greenhouse debate; they are just dressed up in more 'reasonable' language.

The greenhouse debate sometimes seems like trench warfare, in which there are three main lines of defense by those opposing greenhouse gas emissions. The first trench involves denial that the effect is real. There are clearly some large holes in this line of defense but one must admit that the issue is not conclusively proven. The second line of defense involves economic arguments as to the costs of making adjustments. Here there is much more room for debate, as conclusions are far less certain. But the real reason for the resistance to greenhouse warming predictions involves the third line, which has hardly been alluded to. This is that there are powerful interests in this country and elsewhere who are intent on protecting their assets at all costs. I firmly believe that even if the greenhouse effect could be mathematically proven, and the adverse consequences also proven, it would not make much difference to the most powerful interests involved in this discussion. They would still resist it.

In theological circles there is a saying that 'For those who believe, no proof is necessary. For those who do not believe, no proof is possible'. The whole discussion on the greenhouse warming is permeated with advocates on both sides who are either motivated to change the world or resist change at all cost. My own view on the matter is that I think the evidence for global warming is increasingly strong but that there are just enough uncertainties that some caution is called for with respect to actions to mitigate greenhouse emissions. There are also significant uncertainties with respect to physical and economic impacts. Rather than mixing all economic impacts under one summation, it would seem desirable to separate the most likely consequences (sea level rise, rising temperature, and perhaps drought) from those whose impacts are far more uncertain (health).

I don't know what the answer is to the global warming problem. But I believe that any just answer, even if it is 'do nothing', must try to assess uncertainties on all sides and examine the problem, without seeming to arrange numbers in advance to arrive at a conclusion predetermined before the subject is even analyzed or the book ever written.

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