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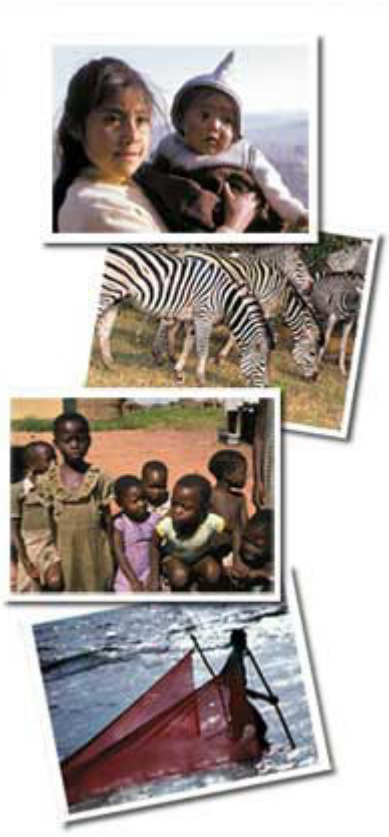
Interfaith Stewardship Alliance

An Examination of the Scientific, Ethical and Theological Implications of Climate Change Policy

By Roy W. Spencer, PhD, Paul K. Driessen, Esq. and E. Calvin Beisner, PhD



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EXECUTIVE SUMMARY

Few issues have permeated or fueled public debate like the topic of global warming. Since first registering on the public radar screen in 1988 with NASA's James Hansen's famous pronouncement of its alleged existence, the controversial subject has generated countless articles, television broadcasts and international conferences. Indeed, the Kyoto Protocol – designed to address global warming by reducing fossil fuel use and thus greenhouse gas emissions – has become a household word for citizens around the world.

Certainly the issues surrounding the discussion on climate change are multidimensional. On the one hand, it is a debate over the interpretation of complicated and incomplete scientific data, and the use of climate models to analyze complex weather and climate systems and cycles that are still not well understood. On the other, it is a discussion of energy costs and Kyoto's economic implications for nations, families and industries.

There is, however, another dynamic to this topic that is beginning to receive increasing attention – namely, the emerging assessment of the moral and religious implications of climate change policy.

Some have broached this subject in the context of pulling out all stops to halt the onset of global warming – on the assumption that climate change is occurring, it will prove catastrophic, humans are causing it, and we can avert it by reducing our reliance on fossil fuel. Other analysts, including the authors of these papers, take a decidedly different approach.

Dr. Roy Spencer is principal research scientist for the University of Alabama in Huntsville and served as senior scientist for climate studies at NASA's Marshall Space Flight Center. In his section on the science of global warming, he points out that thermometer coverage of the Earth is too sparse to calculate accurate global average temperatures for any period prior to 1950. Further, he asserts, we do not know what caused past climate changes, how much recent warming is due to humans, what our response should be, and whether future warming will be mostly beneficial, mostly harmful, or both.

Because of our limited understanding, says Spencer, we cannot model or predict future climate cycles with any confidence. However, there is strong evidence that the Earth's natural "greenhouse effect" acts like a blanket, working in conjunction with weather and hydrologic cycles to ensure long-term and global averages, despite local and short-term variations.

Many scientists believe increasing atmospheric carbon dioxide levels (due to burning fossil fuels) could result in planetary warming, perhaps of only 1-2 degrees Fahrenheit or (according to a few models) maybe as much as 10 degrees. However, higher CO2 levels and longer growing seasons would benefit plant growth, and actions to reduce energy use would adversely affect economic growth, human health and societal well-being, while doing little to affect our climate.

Paul Driessen is senior policy advisor for the Congress of Racial Equality on energy and environmental issues. In his section on the ethics of global warming, he emphasizes the need to address concerns about climate change in a responsible way that improves conditions for the poor. The Kyoto climate treaty could cost the world community $1 trillion a year – five times the estimated price of providing sanitation and clean drinking water to poor developing countries, thereby preventing millions of deaths each year.

By making energy less reliable, affordable and accessible, the treaty will drive up the costs of virtually every activity and consumer product, stifle economic growth, cost jobs, and impose especially harmful effects on the Earth's poorest people. In US Black and Hispanic communities, Kyoto could cost 1.3 million jobs in 2012 (the year it would go into effect). Sharply higher energy prices would also make it financially impossible for poor people to cool their homes during summer heat waves, causing numerous additional deaths.

In developing countries, 2 billion people still do not enjoy the basic necessities and conveniences that electricity makes possible: lighting, refrigeration, water purification and sewage treatment. The result, Driessen notes, is that four million infants, children and mothers die every year from lung infections, due to constant pollution from their fires. Six million more perish annually from intestinal diseases, caused by unsafe water and spoiled food.

However, concerns about climate change are frequently cited to justify policies that prevent poor countries from building fossil fuel power plants. And yet, even the Kyoto Protocol would result in Earth's temperature being only 0.2 degrees F less by 2050 than they would be without the treaty. A better approach would be to develop technologies that generate more energy, at lower cost and with fewer emissions – and export that technology to poor countries.

Dr. E. Calvin Beisner is associate professor of social ethics at Knox Theological Seminary, Florida, and a founding member of the Interfaith Stewardship Alliance. He lays a Biblical foundation for the moral approach advocated by Driessen and the prudent scientific caution advised by Spencer. It is imperative, Beisner says, that Christians make sure of their Biblical moorings before venturing too far in the endorsement of specific policies, particularly when the policies can have serious consequences for human life and well-being.

Our wise Creator has built multiple self-protecting and self-correcting layers into His world, contends Beisner, which we have been given to use for our benefit as responsible environmental stewards. In deciding how to manage the Earth and its resources, the Bible requires that we consider the consequences of our actions – for wildlife, our planet and the poorest among us.

Beisner outlines seven principles to guide our decision-making, in addition to the virtue of prudence which facilitates wise and effective foresight and avoidance of true risks. "It would behoove Christians who want to make a positive contribution to environmental risk assessment and reduction to learn effective ways to do it," he stresses.

The **Interfaith Stewardship Alliance (ISA)** is a coalition of religious leaders, scientists, academics, and other policy experts committed to bringing a balanced Biblical view of stewardship to the critical issues of environment and development.

Global warming: How much of a threat?

By Roy W. Spencer, PhD

Dr. Roy Spencer is a principal research scientist for the University of Alabama in Huntsville. He has served as Senior Scientist for Climate Studies at NASA's Marshall Space Flight Center and is the recipient of NASA's Medal for Exceptional Scientific Achievement and the American Meteorological Society's Special Award for his satellite-based temperature monitoring work.

Of all the potential threats to the environment, global warming is possibly the most worrisome. The effects are predicted by many scientists to be severe, global in their extent, and long-lasting.[1]

The concern originates primarily from mankind's burning of fossil fuels, which releases carbon dioxide into the atmosphere. Carbon dioxide is a "greenhouse gas," which means it acts like a blanket that prevents some of the Earth-emitted infrared (heat) radiation from escaping and cooling the Earth. A doubling of the pre-industrial carbon dioxide level of 280 parts per million sometime late in this century will no doubt have some effect on the climate of the Earth.[2]

But when we try to be more specific about *how much* effect, significant uncertainties arise. How serious is the threat of future warming? What should be our response to it? How much of the Earth's current warmth is due to mankind's activities? Will such warming be mostly beneficial, mostly harmful, or both?

Here we will briefly examine the observational and scientific basis for global warming theory, including what is known and unknown regarding the future state of the climate system.

Observational evidence

Surface thermometer data have provided our only estimate of globally averaged temperatures over the last century or so (Fig. 1). [3] The features in Figure 1 have been widely debated. First of all, thermometer coverage of the Earth is sparse to non-existent in uninhabited areas, especially the oceans. Also, while some corrections for the "urban heat island" effect have been made to the thermometer record, it is very difficult to identify spurious warming in smaller towns and rural areas that likely accompanied the gradual addition of manmade structures near the thermometer site.[4] These factors lead to great uncertainty in the strength of the upward trend implied by Figure 1.

But let's assume that the temperature variations in Figure 1 are completely accurate. What caused the substantial warming up until 1940? What caused the cooling trend from the 1940s until the 1970s? And the strong warming from the 1970s onward? Various explanations have been advanced, based upon fluctuations in the output of the sun, man-made sulfate aerosol pollution, volcanic eruptions, and increasing levels of man-made greenhouse gases. [5]

Since the warming before 1940 seemed to occur after an extended period – possibly centuries – of cool weather termed the "Little Ice Age" (1300-1650) scientists have interpreted that warming as being natural in origin. Of less certainty is the cause of the warming since the 1970s, with temperatures now reaching levels that some scientists believe is the warmest in the last 1,000 years.[6]

Unfortunately, there were very few reliable thermometer measurements before the late 1800s. Instead, "proxy" measures, such as tree rings for specific long-lived tree species from only a few land locations, are analyzed in an attempt to reconstruct past globally averaged temperatures. As you might expect, this area of science (called paleoclimatology) involves many assumptions and uncertainties. As a result, many scientists have little confidence in claims that recent warming trends are historically unique or significant.

The fact is, we really do not know how much of the current warming is natural and how much is manmade. While it is possible to assemble a possible explanation for the past 100 years of temperature variations and end up attributing the present warmth to mankind, other natural explanations for (or at least contributions to) this warmth are also possible (e.g., decreasing cloud amounts). [7] It has been a continuing source of frustration for climate scientists that natural decadal and century-scale climate cycles are known to occur, yet we do not understand what causes them. And, if we do not understand them, then we cannot predict them.

Besides thermometer measurements, there is also anecdotal evidence of warming, at least in the Northern Hemisphere. For instance, summertime sea ice concentrations in the Arctic have decreased by about 15% since reliable satellite measurements began in 1979.[8] Again, however, natural causes are a possible explanation. For instance, a change in an atmospheric circulation pattern called the Arctic Oscillation is believed to be at least partly responsible for this decline in sea ice. [9] Sea ice around Antarctica, in contrast has actually increased somewhat during the same period of time. [10] The Greenland and Antarctic ice sheets are believed to be losing less mass than had originally been feared, due to increased snowfall rates in their interiors.[11] Most of the glaciers that are studied have also receded, although this might be the result of snowfall decreases, as well as of warming.

In summary, from an observational perspective, it appears that the Earth is indeed experiencing a period of unusual warmth. But because of poorly understood natural climate fluctuations, it is difficult to know how unusual this is or how much of this warmth is manmade.

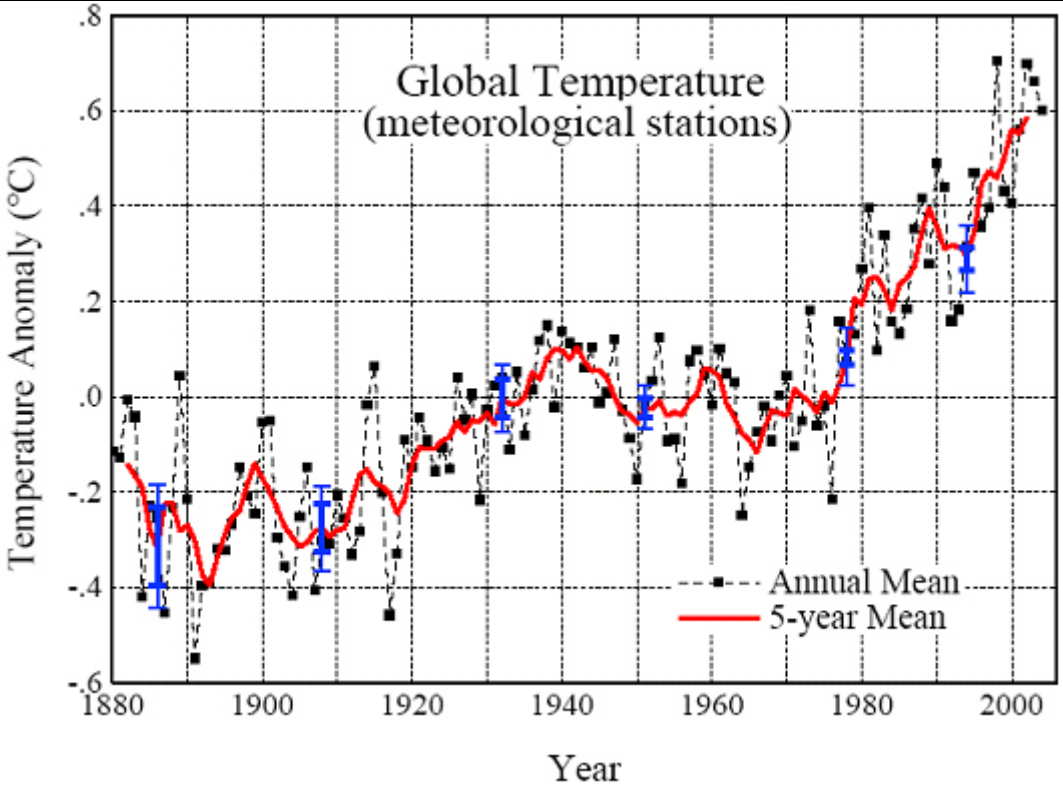

Figure 1. Global yearly surface temperature fluctuations measured by thermometers for the period 1880 – 2004 (Goddard Institute for Space Studies).

Increased storminess?

In addition to the concern over warming, there is the widespread perception that severe storms have become more frequent. However, there is little evidence, either observational or theoretical, that would support this conclusion. While tornado sightings have gradually risen over the decades, this has been attributed to increased mobility and the gradual spreading of the populace into remote areas. The frequency of intense tornadoes, which are more likely to be noticed, has not increased over the last fifty years or more.

But there are reasons why the perception of increased storminess exists. Today, the news media have the technological ability to cover every natural disaster, no matter how remote the geographic location. Also, especially in the United States, people have flocked to the coastal regions in recent decades, during a natural lull in hurricane activity. Construction has experienced explosive growth in these areas.

Hurricane forecasters have been warning for the last thirty years that it was only a matter of time before there was a return to a period of more frequent tropical cyclone activity, as was experienced from the 1930s to the 1960s. It appears we have now entered that peak once again, with 2005 having 23 named storms, breaking the old record of 21 in 1933. Also, since weather satellites have been in use for only about 40 years, it is very possible that we have underestimated the number of hurricanes and tropical storms before the satellite age. Finally, people tend to view weather events in the context of their rather short lifetimes. There is very little known about how stormy the weather was in past centuries compared to today, though historical records describe intense storminess throughout Europe during the Little Ice Age.

Nevertheless, while mostly speculative, it is theoretically *possible* that man-made warming contributed to the recent upswing in hurricane activity. But focusing too much on this possibility diverts attention from the real issue: intense hurricanes have always occurred through history' they will continue to occur in the future; and the increasing density of people and infrastructure along the Atlantic and Gulf coasts will periodically lead to a loss of life and property. However, because of our wealth, we can withstand this risk much better than a poor country like Bangladesh, where tens or even hundreds of thousands of lives are lost due to tropical cyclones.

The Earth's natural greenhouse effect

Much confusion arises about the term "greenhouse effect," since the Earth has a greenhouse effect that is entirely natural. It is mostly due to water vapor, and to a lesser extent carbon dioxide and methane. These naturally occurring greenhouse gases are strong absorbers and emitters of infrared (heat) radiation, and have a strong influence on the average temperature of the Earth. A good analogy for the greenhouse effect is that of a blanket. The blanket of water vapor, carbon dioxide, and methane traps infrared radiation and warms the lower atmosphere, while at the same time cooling the upper atmosphere. It is similar to the way a blanket keeps warm air close to your body, and at the same time keeps cooler air away from your body (although heat radiation is involved, rather than heat conduction).

Infrared radiation is just as important to our climate system as sunlight. For the temperature of the Earth to remain roughly constant from year to year, scientists believe that the amount of sunlight absorbed by the entire Earth must equal the amount of infrared radiation lost to outer space. This concept, called energy balance, is central to an understanding of the Earth's average temperature, as well as global warming theory. While this energy balance does *not* exist at any given place and time (indeed, large radiation and thus temperature imbalances drive the weather), it is believed to exist for global, long term averages.

It has been pointed out many times that the Earth's natural greenhouse effect (again, primarily due to water vapor) keeps the Earth habitably warm. [12] Indeed, were it not for this warming effect, life as we know it might not exist on Earth, as the surface would be too cold.

Global warming theory

Global warming theory, at its roots, has a sound physical basis. The burning of wood, animal dung and fossil fuels necessarily leads to carbon dioxide emissions. This is the primary manmade enhancer of the natural greenhouse effect, while lesser contributions come from methane, tropospheric ozone, and chloroflurocarbons.[13] And as can be seen in Figure 2, the atmospheric concentration of carbon dioxide has been rising steadily (routine measurements were started in 1958). Note that the atmospheric concentration is still relatively small as of 2005, only about 380 parts per million by volume.

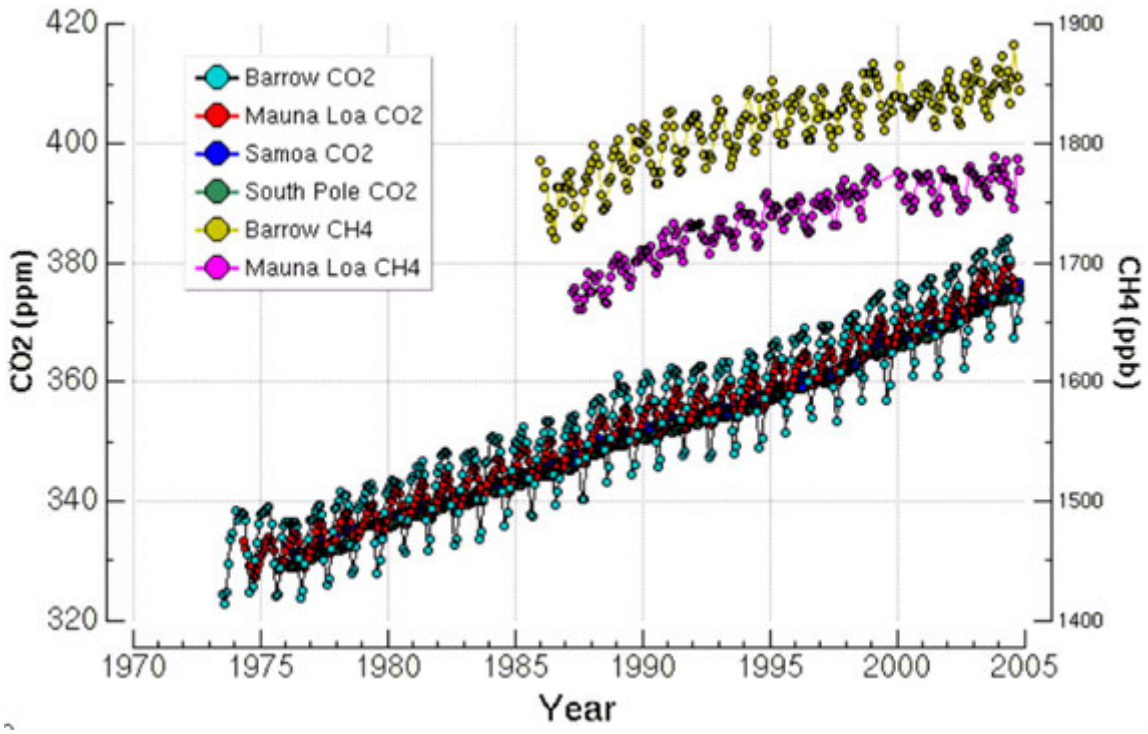

Figure 2. Carbon dioxide and methane increases since 1974 as measured at several different remote locations.

A number of scientists believe this slow increase in the carbon dioxide concentration is causing a small imbalance between infrared cooling and solar heating of the Earth. This radiation imbalance has not actually been measured directly, as current satellite instrumentation has not been sufficiently accurate. A current imbalance of about 0.85 Watts per square meter has been inferred, though: a global climate model has been "tuned" to provide one possible, internally consistent physical explanation of recently observed ocean warming. [14] This study was widely reported to provide "smoking gun" evidence of manmade-global warming. However, other scientists, including myself, believe this study ignored other possible natural sources for the recent warming, for instance a small decrease in cloudiness.

But if we assume that the extra carbon dioxide does indeed cause an extra trapping of infrared radiation, a warming *tendency* in the lower atmosphere (and in the ocean) results. If the atmosphere *does not change in any other way*, the warming would theoretically proceed until the outgoing infrared radiation to outer space increases sufficiently to balance the amount of incoming sunlight, thus restoring radiative energy balance. The warming due to a doubling of carbon dioxide alone, without any other adjustments in the atmosphere, would amount to only about 1-2 degrees Fahrenheit. This doubling of CO_2 is expected to occur late in this century.

The concern over how much warming will occur in the future is not so much because of the direct warming effects of the extra CO_2, as this level of warming would be relatively small and benign – possibly even beneficial. Instead, the concern is over how various weather processes might change in *response* to the warming tendency from the extra carbon dioxide. Of particular concern is the possibility that the climate system would change in such a way that the warming is amplified. The response of other elements in the climate system to a warming tendency from the CO_2 increase is called "feedback." For instance, an increase in low clouds could offset some of the warming, which would be termed a negative feedback. In contrast, an increase in water vapor would amplify the warming, which is termed a positive feedback.

Indeed, water vapor is believed by many climate scientists to be the dominant (positive) feedback in the climate system.[15] A warming tendency should evaporate more water from the surface and, since water vapor is the dominant greenhouse gas, this causes a further warming, which causes more evaporation, et cetera. This is why water vapor feedback is generally believed to amplify the warming due to carbon dioxide alone by at least a factor of two.

In computer model simulations of the climate system, which are simplified mathematical representations of the most important weather processes, the net feedback is usually found to be positive.[16] In a few models, it is strongly positive. This is why some climate experts talk about the threat of temperature rises of 10 degrees Fahrenheit or more, in response to a doubling of carbon dioxide.

However, many feedbacks are still so poorly understood that it is difficult to predict with much confidence how much warming will occur in the future, or how much of the present warmth is due to mankind versus natural climate fluctuations. Further complicating the picture is the tendency for feedbacks to amplify one another. Thus, multiple positive feedbacks in climate models can result in very large warming estimates.

But is this really the way the climate system behaves? Is it really that sensitive to a small increase in greenhouse gases? Since we can put only those physical processes we understand into computerized climate models, this is what science focuses on. Thus, science advances explanations based upon what we do understand, and one of the few things we are pretty sure of is that carbon dioxide (CO_2) levels in the atmosphere have been slowly increasing. But the feedbacks, which end up causing most of the predicted warmth, are much less certain.

Now you can begin to see why manmade global warming is a *theory*, and not a scientific observation. How much of the current or predicted warming a scientist (or anyone else) believes is due to mankind ultimately comes down to how much faith that person has in our present understanding of what drives climate fluctuations, the computer climate models that contain that understanding, and ultimately, in how fragile or resilient is the Earth.

The Earth's thermostat

There is a simple aspect of the climate system, not yet mentioned, that many scientists believe argues against substantial future warming. It has been computed that, *even though the natural greenhouse effect "tries" to increase the surface temperature of the Earth to about 140 degrees Fahrenheit, 75% of that warming is prevented from ever occurring.*[17] Weather – clouds, rain, wind – all are the result of the atmosphere's response to incoming sunlight, short-circuiting the greenhouse effect and greatly limiting surface warming.

The reason that most of the potential surface warming is never realized is because of the amazing properties of water, combined with the continuous overturning of the atmosphere in response to the solar heating. Even though water vapor is the dominant greenhouse gas, the liquid water that was evaporated from the Earth's surface to *create* the vapor removed a large amount of heat energy, thereby cooling the surface.

Furthermore, the air currents that transport heat and water vapor upward eventually causes clouds to form. This further cools the climate, by shading some of the Earth from the sun. Some of the condensed water in the clouds then returns to the Earth as precipitation, replenishing the surface water so that the whole process, called the hydrologic cycle, can start all over again. As a result of all of the cooling processes associated with weather systems, the average surface temperature of the Earth is about 55 degrees F, rather than a scorching 140 degrees F.[18]

Thus, while the natural greenhouse effect "tries" to make the Earth's surface unbearably hot, weather and the hydrologic cycle keeps the surface temperature at a much cooler level. That is why many scientists, including me, believe this leaves open the possibility that the warming from an increase in a relatively minor atmospheric constituent (carbon dioxide) could be rather modest: perhaps 1-2 degrees F by the end of this century, or even less.

But how could it be that most of the climate models that predict large amounts of warming would be wrong? First, let us look at a feedback mechanism that is believed to be well understood: positive water vapor feedback. It is true that, if the surface warms, there will be more water evaporated from the surface, and water vapor is the Earth's dominant greenhouse gas. But upon some reflection, we realize that the amount of water vapor in the atmosphere at any given time isn't simply due to how much water is evaporated from the surface. Instead, it is the result of a *balance* between that vapor *source* (evaporation) and the vapor *sink* (precipitation). Therefore, one can not determine how atmospheric water vapor will change with warming without understanding precipitation systems.[19, 20]

Finally, how will precipitation systems change in response to warming? No one knows. A minority of scientists contend that, until we understand how precipitation processes respond to warming, we really do not know whether water vapor feedback is strongly positive, weakly positive, or zero. Yet water vapor feedback is considered by many scientists to be a "solved" problem.

Clouds, in contrast, represent a feedback that everyone agrees is very uncertain.[21] It has been calculated that only a couple percent increase in low clouds would offset the warming effects of a doubling of atmospheric carbon dioxide from fossil fuel use.

Global warming as faith

I hope the above discussion will help you realize how much faith is required to extrapolate our current level of climate understanding to predictions of future warming. Climate models are, their creators will admit, relatively crude representations of how the atmosphere works.

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

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

Benefits from warming

My belief, shared by a growing number of others in the climate field, is that the level of future warming will be modest, due to stabilizing mechanisms within the climate system. Unfortunately, the benefits of such a modest amount of global warming are seldom discussed. There is comparatively little government research money available to investigate possible benefits, and the media would rather report predictions of gloom and doom anyway.

The largest positive impact could be in agriculture. Based upon estimates of global energy use, the current rate of rise in atmospheric carbon dioxide concentration in Figure 2 is only 50% of what it should be. The other 50% is apparently being absorbed by the biosphere (plants), which uses it for food.

This fact alone has led some plant physiologists to conclude that some of the increase in agricultural productivity in recent decades is likely due to the increased fertilization of crops. Of course, most of the vegetation on Earth is non-agricultural, and it, too, is being increasingly fertilized by this extra carbon dioxide. Much research has been performed into the combined effects of extra warmth and extra CO_2 on various kinds of plants, with the bulk of the results showing net benefits to plant health and growth.[22]

Policy implications

Science does not have anything to say about the policy implications of global warming. Science, by itself, has no values or morals. While some scientists, and even scientific organizations, have their own opinions about what should be done about the global warming issue, policy changes can be instituted responsibly only by examining the human costs and benefits of those changes.

The difficulty in "doing something" about global warming is the inescapable fact that the availability of reliable, inexpensive energy is necessary for economic growth, human health and well-being. Historically, those countries that build wealth through efficient use of natural resources have the lowest levels of pollution, while the poorest countries have the worst environmental problems. If there were efficient alternative sources of energy that were cost-competitive with petroleum and coal, they would already be in widespread use, at least in those economies that, like the United States, have free markets.

Since alternative fuels are, at least for now, more expensive, mandating their use through governmental controls will come at the expense of other sectors of the economy. And any resulting economic downturn will affect the poor first, since those are the people who are living on the edge, from paycheck to paycheck. While the wealthy can absorb the extra cost of, say, a $2 increase in the cost of gasoline, many of the poor can not.

In sum, my key conclusions are these: We cannot say for certain how much the planet may be warming, how much is due to human activities versus natural cycles, or whether these changes in global temperature would be mostly good or mostly bad for the majority of people.

There is no consensus on what constitutes an "optimal climate," and it is doubtful that the enormously expensive prescriptions being advocated, like the Kyoto Protocol, will lock global climate in place.

Moreover, the costs of any such attempt would enormous – and would be borne most heavily by the poorest people on our planet: the ones who don't have electricity or other modern technologies, suffer severely as a result, and would be denied those important technologies with which to improve their lives. That would be a serious tragedy, and precisely what people of faith ought to be concerned about.

The following chapters will further explore what our attitudes about climate change should be, in terms of the relationships between people and their world, and also with an awareness of the effects that potential policy changes would have on humanity.

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Global Warming and the Poor

By Paul Driessen, Esq.

Paul Driessen is a senior policy advisor for the Congress of Racial Equality (CORE), and is the author of Eco-Imperialism: Green Power, Black Death *(www.Eco-Imperialism.com). He has written extensively on energy, development economics, climate change, and health and environmental issues.*

A persistent thread runs through many debates on global warming: that human-induced climate change will harm poor people most of all. The poor are especially vulnerable, it is argued, because they live in higher-risk areas and are least able to avoid the effects of rising sea levels, higher temperatures, more prolonged droughts, greater flooding or more intense hurricanes that some predict global climate change will cause.

One writer went so far as to claim that oil company "products and policies are a slow-moving assault on poor people of color," who are "on the front lines of climate change."[1] Others have suggested that climate change could "present serious challenges to the survival" of indigenous cultures in the Arctic or low-lying Pacific islands.[2]

Of course, climate change has been a fact of life throughout recorded history. The "Medieval Warm Period" (900-1300) enabled Vikings to colonize Greenland and grow crops along coasts where today few plants can survive.

These colonies disappeared when the "Little Ice Age" (1300-1650) caused average global temperatures to plummet several degrees. Northern sea lanes became choked with ice, and Europe was plunged into an unforgiving era of cold, wet, stormy weather that flooded cities, destroyed crops and caused widespread famines. The colder climate also brought profound changes in housing designs (fireplaces, separate rooms, brick, plaster), clothing (knitting, buttons) and social structure (better hygiene, separated social classes, the end of feudalism), as people slowly adapted to their new environment.[3]

Warmer temperatures gradually returned in the latter seventeenth century. Agriculture improved, populations grew, and a flurry of inventions and discoveries ushered in the Industrial Revolution and Modern Era. But the general return to greater warmth was marked by cyclical drops in average temperature, and by sometimes wild fluctuations in record highs and lows.[4]

Over the past 30 years, average global temperatures have again risen, perhaps by 0.2 degrees Fahrenheit. Atmospheric carbon dioxide levels have also increased. Some computer models and scientists have suggested that temperature increases of 10-12 degrees F by 2100 could bring potentially "catastrophic" climate change. However, most scientists (even those who believe human activities are exerting a "discernable" or "significant" influence on the climate) expect that temperatures are more likely to increase by 1 or 2 degrees over this century.[5]

In some regions a warmer climate could bring more floods or droughts, storms and other problems. In others, however, it would likely improve rainfall patterns, lengthen growing seasons, reduce storms, foster more robust plant growth (due to warmer temperatures and higher atmospheric CO2 levels) and bring other benefits.

The poor will certainly welcome any positive changes in their lives. But especially in impoverished Third World countries, they will tend to be more vulnerable to any weather-related problems. This is primarily because they can least afford safer homes in less risk-prone locations, and their countries lack the technological and financial wherewithal to prevent, warn of, adapt to or respond to impending dangers.

The question for policy makers is this: How should societies attempt to address these uncertainties in an ethical and responsible way that also improves conditions for the poor?

They could attempt to slow or stop future climate change. However, this could preclude the benefits, as well as thwart the negative effects. It could be as futile as King Canute trying to stop the inrushing tide – especially if the changes are due primarily to natural causes, or if major greenhouse gas emitters continue to be nations like Brazil, China and India that are working to improve economic conditions for their people and are exempt from the provisions of the Kyoto Protocol on climate change. It would also be extremely expensive.

If the Kyoto pact does not include a workable *global* carbon emissions trading system, Danish environmental analyst Bjorn Lomborg has calculated, its cost for just one year will be as much as $1 trillion. That would be almost five times "higher than the cost of providing the entire world with clean drinking water and sanitation" – something that would avoid millions of deaths and prevent half a billion people becoming seriously ill every year.[6] The US Energy Information Administration puts the economic impact of Kyoto even higher: up to $348 billion in 2012 alone just for the United States.[7]

Moreover, according to Lomborg and scientists at the National Center for Atmospheric Research (NCAR), these huge costs would result in Earth's temperature being only 0.2 degrees F less by 2050 than it would be in the absence of the Kyoto agreement. Actually controlling the theoretical rise in global temperatures would require "40 successful Kyoto treaties," each one more restrictive on energy use than its predecessor, says NCAR climatologist Jerry Mahlman.[8] Each treaty would also expand bureaucratic control over personal, community, corporate and even national transportation, heating, cooling, housing, manufacturing and other energy decisions.[9]

The role of adaptation, innovation and technology

A more practical, economical and effective approach, argue many experts, would be to emphasize what the late Julian

Simon called our "ultimate resource" – mankind's creative and technological genius – to improve our ability to adapt to a changing climate and any challenges it might bring. Our far more primitive and technologically limited ancestors did exactly that during the Little Ice Age, forging innovations whose successors are still commonplace today.

One need only compare America's heating, transportation and communication systems in 1900 with those of today, to appreciate how rapidly and extensively those technologies are likely to change and advance over the next 50-100 years. Those improvements – the products of wealthy, innovative, already technologically advanced societies – would likely result in vastly improved energy efficiency and emission reduction from fossil-fuel systems like cars and electrical generating plants, in improved nuclear and renewable energy systems, and in new technologies that few can even imagine today.

Government tax and regulatory policies can foster more rapid emission reductions and air quality improvements, by encouraging research and development – and the cost-effective upgrading or replacement of vehicles, generating plants, furnaces, machinery and other capital equipment with more efficient, less polluting technologies. Such policies have enabled the United States to create more jobs and reduce its CO2 emissions per dollar of real GDP (gross domestic product) more significantly and rapidly than France, Canada, Austria and other countries.[10]

Strong economies also enable countries to conceive, design and build new systems that safeguard cities and people against natural disasters. Following a February 1953 disaster that took 1,900 lives, the Netherlands spent $8 billion to build a modern system of dikes and movable flood gates, designed to withstand a 10,000-year flood.[11] Modern buildings are stronger, safer, more fireproof and much better able to withstand earthquakes than mud, brick and stone houses that predominate in poor countries.

By exporting advanced technologies, developed nations would help developing countries improve their environmental quality and enable their people to become wealthier, healthier and safer. As a bonus, global greenhouse gas emissions would decline significantly.[12]

By contrast, the Kyoto Protocol and other mechanisms that attempt to reduce energy consumption and pollution by rationing energy use or increasing prices impose harmful, unintended consequences. By making energy less reliable, affordable and accessible, they drive up the costs of virtually every activity and consumer product, stifle economic growth, cost jobs, and impose especially harmful effects on the Earth's poorest people. By reducing the economic vitality of developed countries, they delay the introduction of more advanced capital equipment, and reduce exports from poor countries to richer ones. They thus curtail efforts to address health and environmental problems and adapt to natural changes and disasters – whether or not they are exacerbated by changes in climate.

Kyoto: Effects on poor people in the United States

Judeo-Christian teachings emphasize "tikun olam" (healing the world), a "preferential option for the poor" and similar principles of environmental ethics and concern for the less fortunate. Putting these concepts into practice can be difficult, however, if they are defined too narrowly or their interpretation fails to identify all the likely consequences of potential policy decisions.

Sharply higher transportation costs during the 1973 OPEC oil embargo forced many minority employees to shift to public transportation, increasing their commuting times, in many cases, by hours per day. Energy price increases in 2005 likewise affected the poor much more severely than middle and upper class families. The effect of doubling or tripling prices to reduce energy use and emissions, to comply with Kyoto and subsequent climate treaties, would be incalculable.

Basing its analysis on several government studies and energy prices that prevailed in 1999, Management Information Services, Inc. assessed the likely effects that Kyoto would have on minority families in the United States, based on energy prices *five years ago*. Its report for a coalition of minority business groups concluded that the current Kyoto treaty alone could cost 1.3 million jobs in US Black and Hispanic communities in 2012.[13]

"Standards of living and quality of life would be substantially affected," it noted, and nearly 100,000 minority businesses could be forced to close nationwide. Average minority family incomes could plummet by $2,000 or more, and families could be forced to pay a much larger portion of this reduced income for food, transportation, heating and air conditioning. Family medical costs could rise by 9-11%, and economic output in states with large minority populations could plunge by at least $5 billion. State tax revenues could fall by several billion dollars a year, making less money available for welfare and unemployment benefits precisely when they are most needed.[14]

- California's gross state product (GSP or real economic output) could plummet by nearly $44 billion, its tax revenues by $2.7 billion, and its Black and Hispanic employment base by 91,000 jobs.
- In Florida, 2.3 million people are already below the poverty line and must spend over 30% of their annual household income on energy. The state's economic output could plunge by $11 billion a year. Just in the Miami area, 10,000 minority businesses could close and over 19,000 minority jobs could be lost.
- Illinois could lose 70,000 minority jobs, $16 billion in economic output and $1.3 billion in taxes.
- In Michigan, with over 1 million people below the poverty line, economic output could plunge by $8 billion a year, and 32,000 Black workers could lose their jobs.
- New York could lose 91,000 Black and Hispanic jobs, $16 billion in GSP, and $2.7 billion in tax revenues.
- In Pennsylvania, 1.3 million people are below the poverty line, including 500,000 children. Economic output could plunge by $10 billion and tax revenues by nearly $4 billion a year.
- Texas would fare even worse: 209,000 minority jobs, $44 billion in economic output and $2.7 billion in tax revenues lost (a 5.8% decline).

Energy taxes and other mechanisms for raising energy costs have a regressive effect: they impose disproportionately

negative impacts on those who are least able to afford higher prices. As the MISI report notes:

> "It took more than 20 years to overcome the economic harm done to minority communities by the energy crisis of the 1970s…. Many people remain concerned that state and national policy makers might make serious mistakes in the name of preventing climate change or other environmental problems, without first understanding the potential adverse effects that those decisions could have on the 65 million Americans who are either Black or Hispanic – and on tens of millions of others who are on low or fixed incomes."[15]

Almost 15,000 people died in France during a 2003 heat wave; most were elderly or infirm. The cause was not global warming, but a lack of air-conditioning – a problem that soaring electricity prices would make far worse for people on low or fixed incomes. While a two or even five degree rise from global warming would be noticeable, it would be far less threatening than policies that prevent poor people from cooling their homes during 95-degree heat waves. Under Kyoto, future death tolls among the poor could increase significantly.

"God judges us by our performance, not our good intentions – particularly for actions that affect the lives of others," says Daytona Beach Rabbi Gary Perras. "Public policies that would force millions back into poverty, and worsen the plight of our poor and elderly, are inherently unjust," adds Dr. David K. Lowery, of the Dallas Theological Seminary. "They violate our most fundamental Judeo-Christian principles."[16]

Kyoto: Effects on poor people in developing countries

Kyoto's adverse effects would be felt even more significantly worldwide, even by countries that are exempted from its provisions. Because the United States' powerful economic engine drives nearly 25% of global trade, poor countries that depend on exports would lose opportunities and be forced to close factories, lay off workers, and postpone social, economic, health and environmental improvement projects.

In developing countries of Africa, Asia and Latin America, over 2 billion people still do not have electricity. Three billion people – half the world's population – struggle to survive on less than $700 per year. They never enjoy the basic necessities and conveniences that electricity makes possible: lights, radios, refrigerators, telephones, computers and televisions in homes; modern hospitals and clinics; schools, offices, shops and factories; water purification and sewage treatment.

Instead of switching on a light or appliance, millions of mothers and daughters spend hours every day collecting firewood – or collecting, drying and storing manure for cooking and heating fires. Instead of turning a faucet handle, millions spend countless more hours carrying water from distant rivers and lakes that are often tainted with parasites and bacteria. Instead of enjoying a modern kitchen, they spend hours breathing smoke from primitive hearths. Instead of going to school, children tend crops and cattle, weave carpets or pick through trash, to help put food on the table.

The health impacts of not having electricity are tragic. Four million infants, children and mothers die every year from asthma, pneumonia and tuberculosis – caused by breathing the smoke, dust, bacteria and pollutants that are a constant fixture in their homes and villages. Six million more perish annually from intestinal diseases like dysentery, caused by unsafe water and spoiled food. Few live long enough even to get cancer, much less die from it.[17]

But many activists still oppose coal and gas-fired electrical generation (out of concern about global warming), hydroelectric projects (they oppose damming rivers) and nuclear power (they worry about radioactive wastes). Others say they do so to "preserve traditional cultures."

"African villagers used to spend their days and evenings sewing clothing for their neighbors, on foot-peddle-powered sewing machines," says Earth Island Institute writer Gar Smith. "Once they get electricity, they spend too much time watching television and listening to the radio. If there is going to be electricity, I'd like it to be decentralized, small and solar-powered."[18]

Hollywood actor/activist Ed Begley, Jr. promotes solar panels, so Africans can have "electricity where they need it – on their huts." But even a photovoltaic system sufficient to power a small television, mini-refrigerator and dozen 20-Watt light bulbs costs $1,500, says Uganda-born Connie Miranda. Such systems are beyond the reach of most Third World families, and cannot possibly power hospitals, offices or manufacturing centers.

This leaves energy-deprived poor countries with little recourse, except a vague promise of eco-tourism to compensate for lost economic opportunities. Now even that is under assault.

"A growing army of concerned individuals" has declared that, "although travel to Third World countries may bring unexpected boosts to local economies and even stimulate an increase in eco-friendly tourism, the environmental price [of jet travel] can no longer be justified," a UK news story reported. "The government should take the decision away from people, to prevent climate change," one activist argued.[19]

Not surprisingly, people from developing countries take a dim view of these pronouncements. "Cute, indigenous customs aren't so charming when they make up one's day-to-day existence," says Kenya's Akinyi Arunga. "Then they mean indigenous poverty, indigenous malnutrition, indigenous disease and childhood death. I don't wish this on my worst enemy, and I wish our so-called friends would stop imposing it on us."

"Some people insist that 'renewable energy' and 'sustainable development' must be the future for Third World countries," says Barun Mitra, president of the Liberty Institute in Delhi, India. "But poor people need sustained development – not sustainable development. They need to protect their families from real, immediate, life-threatening risks – instead of being condemned to squalor and premature death, to address distant, hypothetical dangers like global warming."

Ironically, anti-energy policies also harm the environment. "People cut down our trees, because they don't have electricity," Ugandan Gordon Mwesigye points out, "and our

country loses its wildlife habitats, as well as the health and economic benefits that abundant electricity brings."

Developing nations are thus understandably intent on generating electricity and other forms of energy, to create health and prosperity for their people. Unfortunately, many are burning low grade or high sulfur coal in low-efficiency, high-emissions generating plants – and the energy and economic growth rates of large countries like China, India and Brazil portend major increases in greenhouse gases over the coming decades. These countries are not bound by the terms of the Kyoto treaty, and their emissions will more than offset any reductions by developed countries.

Conclusion

Debate continues over the extent to which Earth's climate may again be changing – and the extent to which humans are responsible for the latest changes. However, there is a growing recognition that the most frequently suggested solution to this potential problem – the Kyoto Protocol – would cause major economic disruptions, and exact particularly heavy costs on the poorest people in developed and developing nations alike.

"No country is going to cut its growth," especially fast-growing countries like China and India, British Prime Minister Tony Blair noted at the September 2005 Clinton Global Initiative in Manhattan. It was an implicit recognition that, after the current Kyoto Protocol expires in 2012, neither they nor developed nations are going to start negotiating another such treaty. "What countries will do is work together to develop the science and technology," which is the only way "we are going to tackle this problem," he emphasized.[20]

Concerned citizens, clergy, ethicists, politicians, and "socially responsible" companies and investors should therefore acknowledge that climate change is not fully understood, and is likely a mostly natural and cyclical phenomenon that brings both benefits and risks. They should recognize and embrace mankind's creative genius, the promise of technology, and our amazing ability to adapt to every climate on Earth over the ages. Most important, they must give careful consideration to the likely effects of policies that restrict or increase the cost of energy use – and listen especially to the views and concerns of people in our lowest economic strata.

Much can be done, without adopting policies that would prolong or magnify economic, health and environmental problems that already confront America's and the world's poor. For example, programs that synchronize traffic lights and encourage telecommuting would both save fuel and reduce pollution, as would continuing improvements in the efficiency and emission controls of every fossil fuels technology.

By enabling poor countries to share in these improvements, developed nations would help the world's poor reduce their reliance on wood and dung, cut pollution, improve their health and protect wildlife habitats. Their economies would grow, ensuring greater opportunity and hope. And their ability to avert natural disasters would improve, as greater wealth brings stronger buildings and better medical, transportation and early warning systems.

Meanwhile, we can continue funding climate research by scientists of every persuasion. Innovation, technology and wealth-building will enable that, too.

Perhaps most important, such approaches would be based on the moral and ethical principles of the world's great religions.

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Biblical Principles for Environmental Stewardship

By E. Calvin Beisner, PhD

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Nations throughout the world face tremendous challenges in understanding and dealing with endangered species, deforestation, desertification, global warming, infectious diseases and other environmental issues. It is thus imperative that the Christian community make sure of its Biblical moorings before venturing too far in the endorsement of specific policies, particularly when the policies can have serious consequences for human life and well-being.

Seven Biblical principles can help inform and shape thinking about creation care, or Earth stewardship, perhaps especially for one of the most controversial environmental issues of our day, global warming. In conjunction with one more principle, the Biblical virtue of prudence, they will also help assess leading policy proposals for preventing or mitigating climate change.

Seven Biblical principles for environmental stewardship

1. Creation displays Divine wisdom. Inferring from the repeated use of "and God *said*" in the creation narrative of Genesis 1, Psalm 33:6 declares, "By the *word* of the LORD the heavens were made, and by the breath of His mouth all their host." This acknowledgment of God's power in the plan of creation is also conferred on Jesus Christ, for in John 1:1-3 we read: "In the beginning was the Word [that is, the *Logos*, the reason or wisdom or logic of God], and the *Logos* was with God, and the *Logos* was God. He was in the beginning with God. All things came into being through Him, and apart from Him nothing came into being that has come into being." According to Psalm 19:1-6, the heavens and all creation proclaim the wisdom and glory of God. We should, therefore, see the marks of God's wisdom in the grand design of our environment.

Much alarm over environmental issues seems to forget this Biblical insight. Just as good engineers build multiple layers of protection into complex buildings and systems, so also the wise Creator has built multiple self-protecting and self-correcting layers into His world.

Positive and negative feedback mechanisms often minimize or quickly repair environmental damage. Irreversible, catastrophic damage is rare to nonexistent in the world's history. What we see instead is a planet capable of recovering from many events we might shortsightedly see as permanent, such as ice ages, meteor impacts, volcanoes, hurricanes, tornadoes, tsunamis, floods and droughts. When, for example, we consider the possibility of global warming, we must do so in light of a millennia-long history of natural increases and decreases in global average temperatures that dwarf those anticipated by current science – and yet did not prevent humankind from achieving its present economic development and the prospect of further improvement.[1]

This suggests that historical perspective, combined with recognition of God's wisdom in designing His world, might point toward waiting patiently for more unequivocal scientific results, before adopting any particular policy to fight global warming – especially if those policies would significantly reduce the economic growth that is essential to raising billions of people in developing countries out of poverty, misery, disease and early mortality.

2. God is owner; people are stewards. Debates over environmentalism often focus on how we should understand our world. Evangelical environmentalists frequently insist at the start that we must not perceive it as "our world," since "The earth is the LORD's, and everything in it."[2] Of course this is true, and it provides a critical premise for a Biblically grounded understanding of environmental stewardship.

However, as in many doctrinal matters, emphasizing one truth to the exclusion of a balancing truth can lead to error. In the ecological arena, evangelical environmentalists often fail to acknowledge the important balancing truth: "the earth He has given to man."

Inferring from the declaration of Genesis 1 that "In the beginning God created the heavens and the earth," Psalm 24:1-2 says, "The earth is the LORD's, and all it contains, the world, and those who dwell in it. For He has founded it . . . ." God's ownership of all creation is the basis for our speaking of mankind's environmental *stewardship* rather than outright *ownership*. A steward manages another's property according to the owner's instructions and purposes. Mankind cannot claim absolute sovereignty over creation, for it belongs to God. Yet God has extended a subordinate ownership over the Earth to human beings, as He says in Psalm 115:16: "The heavens are the heavens of the LORD, but the earth He has given to the sons of men."

All too often, though, the truth of Psalm 24:1 is presented as if it negated any claim of human ownership – and hence of decision-making prerogative – over the Earth and its creatures. But Psalm 115:16 and many other passages of Scripture (such as the commandment "Thou shalt not steal") assert or imply the reality of human ownership – albeit subordinate. Yet they also necessarily imply human freedom and responsibility to make thoughtful decisions about what will be done with the Earth.

Indeed, it is inevitable that people will make such decisions. The great questions are: Who will make them, on what grounds, and with what consequences? Will most decisions be made by individuals, private bodies or civil governments? Will they be made on utilitarian or absolutist ethical grounds, with the benefit of the individual, the human community, the natural world, or the whole biosphere in mind? To whom are people accountable for the use of creation? How and to what extent can we know and ensure the consequences of our decisions?

These questions are where the rubber meets the road in environmental decision making, and mere insistence either that the Earth belongs to God or that God has given it to men does not yield clear answers to them.

What is certain, however, is that emphasizing either of the two balancing truths without the other will lead us astray. Emphasizing only that the Earth is the Lord's – while neglecting or denying that He has given it to men – tends to lead toward making decisions at broad, societal levels. This often encroaches on people's legitimate rights to determine the use of their own property and protect their own needs and rights. The disastrous record of socialist countries on environmental protection is grim testimony to how poorly such a policy works.

However, emphasizing only that God has given the Earth to men, while neglecting or denying that it still ultimately belongs to God, tends to lead toward asserting human autonomy in the use of the Earth and exalting individual prerogative over the needs of the community. The sad environmental record of many large and small businesses shows the folly of that choice.

To respond to this dilemma adequately, Christians need to work out a sound, Biblical political philosophy that properly balances the one and the many, the community and the individual.[3]

3. The fall into sin makes abuse possible. Genesis 3:1-7 tells us that Adam and Eve committed cosmic treason under Satanic temptation, by disobeying God and grasping at moral authority belonging only to God, by seeking the fruits of dominion without submission to God's commission. From this it follows that we must always be on guard against the abuse of stewardship through sin.

This tendency toward abuse applies equally to individuals, families, voluntary associations, business enterprises, and governments. No human institution is immune. For just that reason, the founders of this country built upon a political philosophy constructed primarily by British Christians who had a highly developed doctrine of the pervasiveness and subtlety of sin. They insisted on government by covenanted consent of the governed, and on the separation and division of powers, to prevent the accumulation of too much power in one person or institution.

It should thus not be surprising that the decentralized, nearly libertarian social and economic order they devised gave birth to the most free and prosperous nation in the world. For as Adam Smith pointed out, and the twentieth century's competition between free and socialist countries demonstrated, people produce more not only for themselves but also for each other when free to pursue their own interests within the limits of justice revealed in Biblical moral law than when forced to serve a bureaucratic plan.[4]

Environmental abuses do occur. Governments, business enterprises, and individuals put toxic wastes into air, water, and land. They use mineral, plant, and animal resources wastefully. They fail to consider adequately the impact of their actions on others – or refuse to accept responsibility and restrain themselves from harmful actions, even when they are aware of the likely consequences. This is why laws for environmental protection are warranted, at least in principle, even if not to the degree some have gone.

However, it must always be remembered that those who make laws are not necessarily either more virtuous or more knowledgeable than the rest of us. Christians must therefore evaluate carefully those policies set forth for environmental protection and decide, as best they are able, whether their consequences are likely to be more beneficial than harmful to people and the rest of the planet. They cannot automatically assume that they are all positive and constructive.

4. The dominion mandate survives the Fall. In His judgment on Adam, Eve and the Satanic serpent recorded in Genesis 3:8-19, God restored proper order: the serpent was to go on his belly (representing all the beasts of the field, birds of the air, and fish of the sea over which God had given Adam and Even dominion in 1:28) and eat dust (symbolic of death), thus putting the beasts back under human dominion. Additionally, in His judgment on Adam, God said, "Cursed is the ground because of you."

Although the Fall did not permanently negate the dominion mandate given by God to mankind, God's curse did make that dominion more difficult. Although God expelled Adam and Eve from the Garden of Eden, He did not relieve them of His command in Genesis 1:28 to multiply, fill the Earth, and subdue and rule it. Indeed, in His re-creation of the world following the Noahic Flood, He repeated that mandate (Genesis 9).

5. People are a population bloom, not bomb. Genesis 1:26 says God created men and women in His own image, while Genesis 2:15 teaches that God gave Adam special instructions regarding the Garden of Eden: he was to cultivate and guard it as the tabernacle of God, the place where God dwells with men. Linking these two commissions together – cultivate and guard the Garden, and fill, subdue and rule the Earth – implies that God intended, and still intends, mankind to transform the Earth from wilderness into garden.

Indeed, as we follow the theme through the rest of Scripture, we find that the aim is to turn it into a garden city, which Revelation 21 and 22 describe as the New Jerusalem.[5] It follows that human population growth and human dominion – wise, holy and fruitful stewardship of the Earth – though they may be abused, are in principle not a curse, but a blessing. The profound truth of this principle is revealed by the great contributions of legions of scientists, inventors, engineers and others who have been a source of immense benefit to the world around them.

A truly Biblical ethic of creation care simply cannot ignore the Biblical mandate for man to fill, subdue and rule the Earth. Neither can it ignore the distinction Scripture makes between the garden and the rest of the Earth. Aside from the original Garden of Eden, which was a small, restricted part of the whole planet, the rest of the world must be understood as a work in progress – much of it magnificently beautiful, but still subject to improvement by wise human stewardship. Further, the Earth is not best untouched by human hand but wisely and righteously cultivated and guarded by people committed to God's aim of transforming the Earth into the garden city.

This Biblical principle also applies to debates over global warming. Rising atmospheric carbon dioxide concentrations might result in some increase in global average temperature. However, increasing CO2 levels also result in enhanced plant growth and reduce desertification. This fact is firmly established and must not be ignored. A large and growing body of both laboratory and field research supports the conclusion that every doubling of atmospheric CO2 concentration produces, on average, about a 35 percent increase in plant growth efficiency.

Consequently, about 10 percent of the increase in agricultural crop yields over the past sixty or so years is attributable to enhanced CO2 derived from energy use. That is an indirect benefit to human beings worth scores of billions of dollars annually – a benefit that will continue as long as enhanced CO2 levels continue and will only increase as they increase. Biblical ethicists who put high value on easing the plight of the poor must give this effect very high weight indeed.

Indeed, this indirect benefit accrues to all other parts of the biosphere, as well. Not only agricultural crops but *all* vegetation benefits from increased CO2. Plants grow more with the same amounts of sunshine, water and minerals; they become more tolerant of higher and lower temperatures and of wetter and drier conditions; they become more resistant to disease and trauma, more resilient in the face of adverse conditions. Consequently, both their population and their range increase, along the edges of deserts, for example.

In the context of global warming, an additional benefit is that increasing plant growth sequesters more carbon dioxide, thus (in theory at least) reducing the rate of elevation of atmospheric CO2 via another "feedback mechanism" by which the Earth maintains average global temperatures within certain ranges. There is yet another effect of higher CO2 concentrations that seems unquestionably and unequivocally positive. It is the greening of the planet and, through that, the enhancement of all other life, since plants are the nutrient for all animal life – fish, amphibian, reptile, mammal and fowl.

We fertilize the whole world by releasing carbon dioxide when we burn wood and other carbon-based energy sources. It is icing on the cake that the increased crop yields enable us to cultivate less land to feed the human population, thus reducing habitat loss and the negative effects that has on wildlife populations and species extinction.

I cannot help smiling at this realization. Not only does it illustrate the wisdom and common grace of our Creator in the design of our beloved planet, with all its complexity and resilience, providing one more cause to praise Him for His brilliance. It also illustrates other Biblical themes. The Bible repeatedly shows us God using ironic means to achieve His great ends. He uses the foolish in this world's eyes to confound the wise; the weak to overthrow the powerful; the poor to chasten the rich – just as it is the one who confesses his sinfulness who goes away justified, while the one who boasts he is righteous goes away condemned.

Another of the Bible's greatest themes is that God brings life out of death – as displayed in the animal sacrifices of the Old Testament priestly worship and, climactically, in the sacrificial death and then the resurrection of the Messiah in the New Testament. While it is likely that at least some petroleum and natural gas come from deep geochemical processes in the mantle of the Earth, coal comes primarily from the death and burial of vegetation and its transformation under heat and pressure.

As spiritual life comes from the death, burial and resurrection of Jesus Christ, so, in a beautiful irony, the enhancement of physical life that we see most clearly since the start of the Industrial Revolution and the intensive use of energy in our economy comes in part from the death, burial and resurrection of vegetation. As the Apostle Paul explained, the resurrection of the dead happens this way: "It is sown a perishable body, it is raised an imperishable body; it is sown in dishonor, it is raised in glory; it is sown in weakness, it is raised in power; it is sown a natural body, it is raised a spiritual body" (1 Corinthians 15:42-44). Vegetation is sown a natural body. Then, raised from the dead as coal and burned to enhance and safeguard our lives, it becomes a spiritual body – carbon dioxide gas – that gives life to vegetation and, through that, to every other living thing.

In light of this vision, as a theologian and ethicist, I cannot but be troubled at the prospect that we might diminish or short-circuit the cycle of life from death, by embracing a policy to reduce CO2 emissions, in an effort to prevent or reduce global warming that is certainly driven in large part by natural (Creator-ordained) processes over which we have no control. Not only are there many reasons to think the net effect of a moderately warmer planet might be beneficial to mankind and the rest of the biosphere – such as longer growing seasons; the consequent increases in plant growth, crops and habitat; and much lower human mortality rates associated with heat than with cold – but also there is likewise little reason to think reducing CO2 emissions will have any significant impact on future temperatures. Indeed, there is a general recognition among climate scientists that even the many sacrifices entailed in adopting the Kyoto climate treaty will reduce planetary warming by only 0.14 degrees F by 2050, or postpone warming by only ten years.[6]

But my sorrow over these policy prescriptions rests on another observation, as well. The people who will be most burdened by the costs of emission reductions are those most in need of the benefits of added energy use – the world's poor, who live "on the edge," and whose economies are still in the early stages of development. They will suffer on both sides of the ledger: their incomes will be comparatively lower, and their costs of energy and consumer goods comparatively higher, even as their access to any form of energy other than wood, grass and animal dung is controlled by political forces in wealthy developed countries.

6. The Noahic Covenant implies God's continuing preservation of the Earth. Following the Flood, God enacted His covenant with Noah and, through him, with all the human race. God promised never again to destroy the world with a flood (Genesis 8:22), but to sustain it until the last judgment and the consummation of new heavens and a new Earth.

Therefore a Biblical theology of Earth stewardship will recognize the superintending hand of God protecting the Earth. Particularly when it is combined with our earlier observations about the resiliency of the Earth because of God's wise design, this ought to make Christians inherently skeptical of claims that this or that human action threatens permanent and catastrophic damage to the Earth.

7. Christ's redeeming work has implications for the rest of creation. The New Testament ties the restoration of the Earth from the curse to human redemption through Christ Jesus. In Romans 8:18-23, the Apostle Paul wrote,

> "I consider that the sufferings of this present time are not worthy to be compared with the glory that is to be revealed to us. For the anxious longing of the creation waits eagerly for the revealing of the sons of God. For the creation was subjected to futility, not willingly, but because of Him who subjected it, in hope that the creation itself also will be set free from its slavery to corruption into the freedom of the glory of the children of God. For we know that the whole creation groans and suffers the pains of childbirth together until now. And not only this, but also we ourselves, having the first fruits of the Spirit, even we ourselves groan within ourselves, waiting eagerly for our adoption as sons, the redemption of our body. "

On this basis, we ought to anticipate that the growth of Biblical faith, of a Biblical understanding of the world and how it works, and of Biblical ethics in piety and justice (the two tables of the Decalogue) will bear abundant fruit. We should expect increasing liberation of the Earth from God's curse, a process that should show itself in increasing human life, health and prosperity, and in increased fruitfulness of all the rest of the Earth's life systems.[7] As long-term statistical studies show, there is good reason to think that this has been happening for at least two centuries.[8]

In short, Scripture teaches us to view the world around us as the work of a wise and holy Creator, a work marred by sin but being restored by that Creator's redemptive plan, in which men and women play an important role in dominion founded in wise stewardship. Our Earth belongs to God and was created for His pleasure, but He has entrusted it to His image-bearers, to raise it to its highest potential in fruitfulness.

How shall we respond to fears of global warming?

Some computer-generated scenarios anticipate an increase of 10 to 12 degrees Fahrenheit in global average temperatures during this century. However, most climatologists and other scientists working on the subject think any increase is much more likely to be in the range of 1 to 2 degrees.[9] Nevertheless, significant numbers of policy advocates recommend a major program, via the Kyoto Protocol on climate change, to reduce energy use by developed nations (and thus their carbon dioxide emissions) to 80 percent of 1990 levels, or lower. This, they argue, is simply prudent precaution.

However, such a reduction in energy use would likely reduce global economic production by something on the order of $1 trillion per year. The effects of such a downturn would profoundly affect living standards and technological innovation everywhere, while the benefits would be minuscule. As already pointed out, even if such a policy could be implemented successfully, it would barely reduce emissions or global warming, because Brazil, China, India and other developing countries are not bound by the treaty and are rapidly expanding their energy generation, primarily with coal and petroleum, generally with facilities that pollute far more than their developed nation counterparts.

Moreover, according to internationally renowned economists who developed the "Copenhagen Consensus," a fraction of that $1 trillion per year amount would be enough to provide clean drinking water and sanitation to all the remaining areas of the world presently without them.[10] This suggests that if our concern is primarily to improve human well being, the budget for mitigating global warming would be much better spent on this and other programs that would yield much greater benefits (such as vector control to prevent the spread of pest-borne diseases). Because they would divert limited health and environmental budgets, CO2 emissions-reduction policies could quickly become a curse, rather than a blessing.

From the perspective of Biblical ethics, the implications of policy for the most vulnerable people in society are especially important. The Scriptures require special care to prevent harm to the poor.

Thus, one of the hallmarks of the Messianic King is that "He will deliver the needy when he cries for help, the afflicted also, and him who has no helper. He will have compassion on the poor and needy, and the lives of the needy He will save." (Psalm 72:12-13). Scripture teaches that "the LORD will maintain the cause of the afflicted and justice for the poor" (Psalm 140:12). The Book of Proverbs teaches, "If a king judges the poor with truth, His throne will be established forever" (Proverbs 29:14), and it instructs kings to "defend the rights of the afflicted and needy" (31:9). When the Apostle Paul reported on what the other apostles in Jerusalem asked of him at the start of his work as a missionary, he wrote: "They only asked us to remember the poor – the very thing I also was eager to do" (Galatians 2:10). Clearly Biblical ethics puts a heavy premium on considering the impact of any policy on the poor.

That is an important reason to question not only the wisdom but also the justice of curtailing energy use to fight global warming. The negative impact of such a policy even on the well-off will likely go far beyond mere minor reductions in comfort and convenience.

As long ago as 1998, the independent economic forecasting firm WEFA estimated that meeting U.S. targets under the Kyoto accords would cut annual economic output by about

$300 billion annually (or about 3.5 percent of the roughly $8.4 trillion in 1998 gross domestic product); by 2010, they would destroy more than 2.4 million jobs and reduce average annual family income by about $2,700.[11] Another economic forecasting firm, Charles River Associates, projected lower costs – about $193 billion (2.3 percent of GDP) per year – and more recent studies have reached similar conclusions.[12] However, they were based on lower energy prices that prevailed several years ago, and all agree on the fundamental point: the economic impact of any energy reduction policy would be significant, and negative.

These economic costs translate into very real human costs. Specialists in risk assessment estimate that every $5 to $10 million drop in U.S. economic output results in one additional statistical death per year.[13] At that rate, the loss of $300 billion in annual economic output entails at least an extra 30,000 premature deaths per year – perhaps as many as 60,000 – in the United States alone. At a cost of $200 billion per year for the USA (slightly above the Charles River Associates estimate but only two-thirds of the WEFA estimate), this would mean a total cost of $10 trillion and 1 million premature deaths in fifty years. Other developed countries would suffer similar impacts.

Moreover, the people in the United States and other advanced countries who would suffer the heaviest losses would be their least well-off. The rich in those countries would suffer primarily only some reduction in disposable income, comfort and convenience. But poor families would lose the most jobs, have to devote a far greater portion of their declining budgets to basic necessities (food, clothing and energy), and be able to save and invest far less than they do now.

For poor, developing countries, where the vast majority of people live at or near subsistence level, the consequences would be devastating. Wealth and health go hand in hand; so do poverty and mortality. To slow economic development by reducing energy use is to condemn the world's poor to more years of high morbidity and mortality than they otherwise would have to suffer. The lost economic growth spells added decades of suffering and premature death for the roughly 4 billion people who now live in developing countries, and for whom safe water, basic sewage and solid waste sanitation, health care and safe transportation will become impossible dreams for many additional decades.

One thing major natural disasters demonstrate again and again is that wealthy people can survive and recover from them better than poor people. The tsunami just after Christmas of 2004 killed some 140,000 in Indonesia, India, Sri Lanka, Thailand and other Asian countries. But it would likely have killed only a small fraction of that number had it hit wealthier areas, where better construction would have withstood the initial impact better, better infrastructure would have allowed quicker recovery, greater wealth would have provided quicker and more abundant medical and other supplies to the victims, and earlier warning would have enabled most people to evacuate before impact.

Around 1,000 people were killed when Hurricane Katrina hit America's Gulf coast; a similar strike on the coast of Bangladesh would have killed many times more. To put it simply, the wealthy recover from and adapt to changing environments faster and more surely than the poor.

If we wish to equip the poor to adapt to future problems better, we must put a high priority on helping them rise out of poverty. Even in the unlikely event that severe cutbacks in energy use would significantly reduce global warming, they would do nothing to avert such common and recurring problems as earthquakes, floods, droughts, hurricanes, tornadoes and tsunamis. Not only would becoming wealthier help the poor overcome *all* of those challenges. Preventing them from having access to reliable, affordable energy – and from increasing trade with now poorer developed nations – will prolong the suffering in all poor countries.

Conclusion: Applying Biblical prudence to global warming

One additional principle of Biblical ethics should also guide environmental policy: prudence. According to Proverbs 22:3, a prudent person foresees danger and hides himself. Wise and effective foresight and avoidance of risk is a Biblical virtue. It would behoove Christians who want to make a positive contribution to environmental risk assessment and reduction to learn effective ways to do it.

One important approach is sequential decision theory.[14] The approach begins with a hypothesis (e.g., that global temperatures are rising, or that species are going extinct at alarming rates, or that stratospheric ozone is disappearing) to which there are two possible responses, acceptance and rejection – and two possible errors, accepting a false hypothesis or rejecting a true one. As policy analyst Fred Smith has pointed out, the "challenge is to assess the costs of both types of errors and weigh each of them."

Assuming that we accept the hypothesis, we may respond in one of two ways (or a combination): prevention or adaptation. As we have already noted, preparation for adaptation through wealth creation and technological innovation has the added strength of being applicable to any of a wide range of possible risks. By contrast, prevention applies only to the specified risk, leaves others unaddressed, and through its costs can actually reduce our preparedness for them.

For advocates of a given hypothesis about a future risk and a given response to it to be correct, "a series of linked hypotheses must *all* be true." First, the cause must be as alleged; second, the impact must be as alleged; third, the cure must be as alleged; and fourth, the strategy for achieving the cure must work (without giving rise to significant new risks).

Given all the uncertainties of global warming, the need for applying such a sophisticated model for risk assessment and response is clear. We do not know for certain whether carbon dioxide increases or temperature increases will, on balance, bring more benefits or harms.

Under these circumstances, it is crucial that we adopt a decision process that can guide us through the labyrinth of errors to a sound outcome – one that, in particular, does not impose greater risks and harms on the most impoverished and powerless people among us.

The application of sequential decision making leads to four possible options, the outcomes of which need to be compared for both the prevention and the adaptation strategies, yielding a total of eight possible scenarios.

Prevention strategy. Under the prevention strategy, the analysis begins with two scientific options: either human activity is significantly warming the Earth, or it is not.

(A) If human activity is not significantly warming the Earth, trying to prevent global warming by reducing energy use will result in a world that is poorer in wealth and technology –
but which still has weather that is no more stable or predictable than it has ever been. In other words, we shall have bought an unnecessary insurance policy and forgone
all the benefits that the cost of that policy might have obtained, had the money been spent elsewhere.

(B) If human activity is significantly warming the Earth, two economic options are possible: the warming might be either catastrophic and imminent, or benign and gradual.

(1) If it is benign and gradual, trying to prevent global warming by reducing energy use will result in a world that is poorer in wealth and technology, but may have better weather, at least in some areas. Again, we shall have bought an unnecessary insurance policy and forgone all the other benefits that have been made unaffordable.

(2) If it is catastrophic and imminent, two political options are possible: either a global carbon-reduction policy is achievable, or it is not.

(a) If a global carbon-reduction policy is not achievable, trying to prevent global warming by reducing energy use will result in a world that is poorer in wealth and technology, and that has worse weather. We shall have bought an insurance policy from an insurance company that goes bankrupt and cannot pay off when disaster strikes. Moreover, we shall once again have forgone all the other benefits the purchase price might have obtained for us – including the ability to adapt to the worse weather.

(b) If a global carbon-reduction policy is achievable, trying to prevent global warming by reducing energy use will result in a world that is poorer in wealth and technology, but has stable weather – assuming there are no natural solar and climate cycles that cause unstable weather. That is, the insurance policy will have paid off. Yet, by buying it, we shall still have forgone all the other benefits its purchase price might have afforded – including the capacity to adapt to climate change and other future risks.

Adaptation strategy. Under the adaptation strategy, the analysis again begins with the same scientific options: either human activity is significantly warming the Earth, or it is not.

(A) If human activity is not significantly warming the Earth, preparing for adaptation through economic growth unhindered by the costs of the prevention strategy will result in a world that is richer in wealth and technology – and therefore better prepared to bear the costs of either preventing or adapting to other risks. Once again, weather may or may not be "stable," depending on natural solar, climate, oceanic and other cycles.

(B) If human activity is significantly warming the Earth, again the two economic options are possible: the warming might be either catastrophic and imminent or benign and gradual.

(1) If it is benign and gradual, preparing for adaptation through economic growth unhindered by the costs of the prevention strategy will result in a world with better weather that is richer in wealth and technology and therefore better prepared to bear the costs of either preventing or adapting to other risks.

(2) If it is catastrophic and imminent, again the two political options are possible: a global carbon-reduction policy is achievable, or it is not.

(a) If a global carbon-reduction policy is not achievable, preparing for adaptation through economic growth unhindered by the costs of the prevention strategy will result in a world that still has unpredictable weather – but in which greater wealth and technology make us better able to cope than if we had bought the prevention strategy.

(b) If a global carbon-reduction policy is achievable, preparing for adaptation through economic growth unhindered by the costs of the prevention strategy will result in a world that still has unpredictable and possibly worse weather – but in which greater wealth and technology once again make us better able to cope than if we had bought the prevention strategy.

Anyone who seeks to implement the Biblical virtue of prudence, or the proper handling of risk, needs to take this analysis seriously. For each of the two strategies – prevention and adaptation – there are four possible scenarios, for a total of eight. In seven out of those eight, the adaptation strategy is unequivocally more prudent.

In only one – on the assumption that human activity *is* significantly warming the Earth, that the warming *is* catastrophic and imminent, and that a global carbon-reduction policy *is* achievable – does the prevention strategy turn out to be a good purchase. Moreover, even in that instance, it is a wise purchase only when it is viewed in isolation from all other risks – and even then it is not apparent that it is a better purchase than the adaptation strategy. When we take those other risks into account, the adaptation strategy turns out to be more prudent than the prevention policy, even under the best-case scenario.

The wise King Solomon, to drive home the importance of diligent work, used this parable: "Go to the ant, O sluggard, observe her ways and be wise, which, having no chief, officer, or ruler, prepares her food in the summer and gathers her provision in the harvest." [Proverbs 6:6-8]

One wiser than Solomon, to illustrate the importance of counting the cost of discipleship, told two brief parables:

> "Which one of you, when he wants to build a tower, does not first sit down and calculate the cost, to see if he has enough money to complete it? Otherwise, when he has laid a foundation and is not able to finish, all who observe it begin to ridicule him, saying, "This man began to build and was not able to finish." Or what king, when he sets out to meet another king in battle, will not first sit down and consider whether he is strong enough with ten thousand men to encounter the one coming against him with twenty thousand? Or else, while the other is still far away, he sends a delegation and asks for terms of peace."[Luke 14:28-32]

Jesus Christ cautions us to think prudently, to count the cost, to foresee danger and prepare for it wisely, regarding spiritual affairs. But in stressing the importance of that, He takes it for granted that we already recognize its importance in temporal affairs. The implication is that only a fool fails to see the importance of prudence in temporal affairs.

It is imperative that Christians, before we venture to advise the world about environmental policy, first learn not only the seven Biblical principles discussed at the start of this article, and not only the general science and economics of the issue, but also how to apply the principle of prudence. When we do, we can make a credible, respectable contribution to environmental stewardship.

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2. E.g., Loren Wilkinson, ed., *Earthkeeping in the Nineties: Stewardship of Creation*, rev. ed. (Grand Rapids: Eerdmans, 1991), 317; Young, *Healing the Earth*, 88; *Evangelical Declaration on the Care of Creation*, epigram.

3. Doing that is not the purpose of this book. I have taken steps toward it in *Prosperity and Poverty: The Compassionate Use of Resources in a World of Scarcity* (Westchester, IL: Crossway Books, 1988), chapters 11-13, *Prospects for Growth: A Biblical View of Population, Resources, and the Future* (Westchester, IL: Crossway Books, 1990), chapters 2-3, 9-10, and "Classical Problems in Politics," Introductory Lecture to the Politics Segment of Interdisciplinary Studies 116, Self in Society II (Lookout Mountain, GA: Covenant College, 1994, unpublished; available from the author).

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5. I develop this theme more fully in Appendix 1, "The Garden and the Wilderness: Toward a Biblical Foundation for Environmental Ethics," of *Where Garden Meets Wilderness: Evangelical Entry Into the Environmental Debate* (Grand Rapids: Eerdmans/Acton Institute, 1997).

6. Patrick Michaels, *Meltdown: The Predictable Distortion of Global Warming by Scientists, Politicians, and the Media* (Washington: Cato Institute, 2004), 9-26. This is but a small fraction of the anticipated warming, even at the low end of the range of projected temperature increases.

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