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The Roles of Philosophical Analysis and Religious Conviction in the Climate Change Debate

MICHAEL KUNZ

In 2005 Richard Cizik, vice president for governmental affairs of the National Association of Evangelicals, began to publicly advocate for care of the environment, stating that Christians have a moral responsibility to change their lifestyle due to the threat of global warming. Given his visible position as the principle lobbyist for America's largest Evangelical organization, Cizik drew considerable attention to himself—much of it critical.

In response to Cizik's environmental advocacy, James Dobson, head of Focus on the Family, and more than twenty other well-known evangelical leaders issued a public letter in March of 2007 calling for Cizik's censure or removal from his position. They said he was bringing a left-wing political issue into the organization at a time when the science was inconclusive.¹ In part the letter read: "The existence of global warming and its implications for mankind is a subject of heated controversy throughout the world. It does appear that the earth is warming, but the disagreement focuses on why it might be happening and what should be done about it. We believe it is unwise for an NAE officer to assert conclusively that those questions have been answered, or that the membership as a whole has taken a position on a matter. Furthermore, we believe the NAE lacks the expertise to settle the controversy, and that the issue should be addressed scientifically and not theologically."²

Richard Cizik is not a climate scientist, and did not present his position as that of an expert in the field. He did argue that there was a scientific consensus on the human contribution to climate change, and that Christians have a moral obligation to respond. The open letter critical of Cizik challenged this position.

Dobson is correct in one assertion: there is no consensus over global warming in the Christian Evangelical community. A 2006 poll conducted by the Pew Forum on Religion and Public Life found that while 70 percent of white Evangelicals believed the earth was getting warmer, only 37 percent agreed there was evidence that this was a result of human activity, compared to 50 percent of all Americans surveyed. Even after controlling for variables

such as political beliefs, a significantly lower percent of white Evangelicals accepted human-induced global warming.³

The assertion that there is no consensus about climate change in the scientific community merits closer scrutiny. Elements of the Evangelical community have long challenged mainstream science over issues such as evolution and the age of the universe; debates now about climate change suggest to many that Evangelical faith is inherently at odds with science. A philosophical analysis of the science of climate change can illuminate whether or not Dobson and his cosignatories misrepresent the current state of climate science. If the science has been misrepresented, the argument that climate change is not a theological or religious issue should be called into question as well.

I will use three prominent philosophies of science to give insight into the nature of the climate-change arguments: those of Karl Popper, Thomas Kuhn, and Imre Lakatos. These represent philosophical perspectives that have shaped the philosophy of science in the middle and late twentieth century.

Falsificationism

In September 2007, thousands of university science faculty and professional scientists around the country received a mailer asking them to sign a petition denouncing the science of global warming and the political steps advanced to address it. As justification for rejecting mainstream climate science, the letters were accompanied by an offprint of a recently published journal article by Robinson et al., disproving the thesis of global warming and its anthropogenic nature.⁴

The mailer and journal article typify a common strategy used by climate contrarians. A recent study that contradicts the expectations of global warming is presented as a refutation of the mainstream arguments. For example Robinson et al., point to a study of the Sargasso Sea (a large region of the Atlantic Ocean). The current Sargasso Sea surface temperature falls in the mid-range of estimated surface temperature variation over the past 3000 years. This evidence is used to disprove arguments regarding the significance of current global warming.

This form of argument draws much of its rationale from Karl Popper, the twentieth century philosopher of science whose aim was to distinguish true science from pseudo-science. He considered theories incapable of being proven true, but argued they could be proven false. In Popper's estimation,

truly scientific theories must make risky, testable predictions. When a theory predicts a particular outcome that is contrary to what is observed, the theory is considered falsified and should be rejected.⁵

While this simplistic form of argument is frequently used, the error in Popper's logic was pointed out in the middle of the twentieth century. Any test of a theory relies on presuppositions dependent upon other theories. If those background theories cannot be proven true, then the logic of the test is likewise unproven. Simple falsificationism was rejected by historians of science who pointed out that every theory encounters data contrary to expectations, and to abandon a theory at the first evidence of contradictions would mean that no theory could ever be considered reliable.

In the example given above, the means of estimating past temperatures in the Atlantic depends upon assumptions related to the relationship between various isotopes present in marine deposits and past temperatures. It assumes samples were collected that adequately represent the entire area. It assumes no errors were made in analyzing the samples. It assumes that the data represented in the study accurately reflect the results. And it assumes that the record of the Sargasso Sea adequately represents the global environment. A careful study of Robinson's study suggests that at a minimum, the last two of these assumptions are flawed.

Of course, acknowledgment that all conclusions from scientific experiments depend upon unprovable assumptions cuts both ways in the debate over climate change. It can just as well be argued that research supporting global warming is based upon flawed assumptions. While the average global temperature was higher at the end of the twentieth century than at its beginning, the increase was not consistent. From approximately 1940 until 1970, there was a slight decrease in global temperatures. Carbon dioxide levels, though, rose consistently over that period of time. This seems to falsify the theory that human fossil fuel use is driving climate warming.

The argument now used to explain the dip in mid-century temperatures is that carbon dioxide is only one of the emissions of fossil fuel use. Before the enactment of environmental laws around 1970, other compounds, such as sulfates, were also emitted. These other emissions produced a visible haze, while carbon dioxide is clear. The haze acted to reflect sunlight and cool the earth. When environmental laws reduced the emission of pollutants such as sulfates, the cooling trend ended and the greenhouse warming effect of carbon dioxide resumed with increased intensity. By modifying the original assumption that considered only the impact of carbon dioxide, the original

theory attributing climate change to fossil fuel use rendered itself immune to falsification.

Popper's goal of using simple falsification to reject theories ultimately failed from a philosophical vantage point. However, the goal of distinguishing testable scientific theories from untestable pseudo-science remained to many a legitimate goal. This philosophical argument suggests that science ultimately must be testable, and the scientific method requires tests to be conducted in controlled experiments. Unfortunately, a planet is not so easily manipulated.

Much of the philosophy of science has been developed by scientists like Popper whose discipline was physics—a field amenable to controlled experimentation. The older view that controlled experiments are the only legitimate method of science has largely been discarded by contemporary philosophers, though this view persists among the public and among some experimental scientists. Adherence to this narrow definition of science would by definition render entire disciplines non-science. Astronomy, geology, comparative anatomy, ecology, and paleontology are all, like climate science, disciplines that often use methodologies other than controlled experiments.⁶

To illustrate how non-experimental sciences function, consider what we think we know about past climate. In order to understand how the global climate functions today, it is necessary to understand how it behaved in the past. A challenge posed to climatologists is that few accurate records exist before the twentieth century. A long history of climate behavior also existed before human presence. In order to reconstruct past climate, climate scientists make use of “proxies.” These are variables that are known to relate to current temperatures in some understandable manner.

For example, annual growth rings from the wood of ancient Bristlecone Pines vary according to temperature and moisture. Variation in tree ring width can be used to estimate climate changes over the past 10,000 years represented by sequential sections of wood. Other proxies include the use of radioactive isotopes and stable isotopes found in ice cores, coral reefs, and marine sediments. These proxies are used to estimate climates several hundred thousand years into the past.

Each type of study indicates historic fluctuations in global climate; such change prior to the last century would of course be due to natural causes. The studies record several ice ages punctuated by inter-glacials when the temperatures resemble those of the past few millennia. Remarkably, the average global temperature during the ice-ages, when glaciers extended across much

of the Northern Hemisphere, was only 5 degrees Celsius colder than the recent climate. This suggests to those concerned about climate change that small temperature changes can have a dramatic impact on the planet. Heating the planet by a few degrees may also have catastrophic consequences.

From the perspective of simple falsificationism, paleoclimatology appears suspiciously pseudo-scientific. We cannot travel back in time to check the accuracy of any method. However, when several methodologies using entirely different assumptions yield very similar results, the confidence of the scientific community in the results is raised. We cannot be certain that any one methodology is correct, but it seems much more likely that the general picture presented by climate science is accurate, rather than the alternative view that all of the methods happen to be incorrect in exactly the same manner. When discrepancies do occur between proxies, more data is sought to determine which conclusion is supported by the weight of evidence.

The confidence in the reality of climate change over both the past century and over deeper time is great enough to be considered a “consensus.” Interestingly, statements by Dobson and President George W. Bush suggest they both finally accept this aspect of the consensus, even if they have arrived at their conversion only over the past year—much later than climatologists.

Competing Paradigms

For a minority of Americans, the date of August 29, 2005, is as vividly etched into memory as September 11, 2001, is for the majority. It is the date that Hurricane Katrina made landfall along the Gulf Coast. Levees designed to hold back the mighty Mississippi failed when the hurricane-forced surge of water rose up and overwhelmed the city’s defenses. The consequences were fifteen hundred lives lost and over 80 billion dollars of damage. Images of a city under water and of desperate pleas from the Superdome and Convention Center were still fresh in American minds when, less than one year later, the film *An Inconvenient Truth* was released.

The film follows former Vice President Al Gore’s global odyssey to convince the world of the perils of global warming. The devastation of New Orleans fits prominently into the film’s argument that human consumption of fossil fuels is altering the climate and leading to more extreme weather events such as Hurricane Katrina. The film’s publicity poster shows smokestacks spewing exhaust plumes that rise and form into a great hurricane cloud. But what is wrong with this picture? Perceptive viewers can see the

hurricane cloud is wrong—it is spinning clockwise while Katrina, like all Northern Hemisphere hurricanes, spun in the opposite direction. Is that symbolic of what critics of global warming suggest—folks like Al Gore have their science backward?

The scientific debate over the relationship between hurricanes, global warming, and human action has been admirably documented in the book *Storm World* by Chris Mooney.⁷ On one side are climatologists who see evidence of dramatic recent increases in hurricane intensity that verify changes predicted by theoretical models of global climate. Opposing any linkage of hurricane behavior to human behavior are meteorologists such as Bill Gray, the scientist who for decades had issued predictions regarding upcoming hurricane seasons. Toward the end of Mooney's study, he concludes that the debate is a classic illustration of Thomas Kuhn's concept of conflicting paradigms.

In what is often considered the most influential book on the philosophy of science in the twentieth century, *The Structure of Scientific Revolutions*, Kuhn defined a paradigm as the "constellation of beliefs, values, techniques, and so on, shared by the members of a given [scientific] community."⁸ When scientists hold to differing paradigms, they may be unable to reach agreement on critical issues because they value different types of data and accept the legitimacy of different methods. This, Kuhn explains, is why scientists can argue past each other, neither convinced by the evidence presented by opponents.

Hurricane forecasters like Gray have almost exclusively relied upon empirical studies that correlate hurricane behavior to other observed phenomena, such as El Nino events and moisture levels over North Africa. In doing so they follow a long positivist tradition in science that distrusts theoretical speculation in favor of repeated observation; in their estimation, hurricane behavior is simply too complex to be captured by any set of mathematical models.

The science of climatology applies physical laws and formulas in an attempt to understand, model, and predict climate. In its simplest form, it is represented by the early nineteenth century French mathematician and physicist Joseph Fourier, who pointed out the heat-trapping qualities of carbon dioxide, and by the late nineteenth century Swedish chemist Svante Arrhenius, who calculated the theoretical increase in global temperatures with increased fossil fuel use. With the advent of powerful computers in the 1980s, more specific predictions about future climate began to be issued by clima-

tologists, including predictions about storm behavior. Trust in such models has increased as the newer computer models more accurately depict current global climate and weather patterns.

This theoretical approach also has deep historical roots. Many new paradigms in science were widely accepted only when observed phenomena were given a theoretical explanation. The first evolutionary explanations received little support until theoretical mechanisms of change were offered in the nineteenth century. Early suggestions regarding continental drift were rejected until plate tectonics provided a theoretical explanation of how continents could move.

The first computer models of hurricane behavior suggested a slight increase in future hurricane intensity tied to increasing ocean temperatures because warm ocean water provides the energy for hurricane winds. More recent, refined models have predicted a greater proportion of hurricanes reaching the most destructive, Class 4 & 5, categories with only slight increases in ocean temperature. Contrary to the paper by Robinson mentioned above, most studies of the Atlantic Ocean detect a significant rise in surface temperatures that correlate quite well with the proportion of hurricanes that have reached intensely destructive levels of power.

Based upon these types of evidence, many climatologists now believe a warmer environment has already begun to manifest itself in more intense storms, while others continue to consider the types of evidence suspect. Kuhn explained the lack of consensus to be due to “incommensurable” paradigms. By this Kuhn means there is no objective standard by which to measure different views against the data; each paradigmatic community of scientists applies a different yardstick of measurement. Similar to Olympic figure skating judges who rate a given performance with decidedly different scores, we cannot simply state that one judge is wrong and the other right.

Kuhn does see an eventual resolution of sorts to scientific controversy. When the weight of anomalies within a paradigm reaches a critical mass, a crisis occurs within a discipline. The transition from old to new paradigm constitutes a revolution. Talk of “consensus” in climate science is one way of arguing that the revolution has been completed and the scientific community is united in pursuing a “normal science” that assumes humans are the cause of current global warming.

In *An Inconvenient Truth*, Al Gore presented the results of a study documenting that not a single article in a survey of peer-reviewed scientific literature disagreed with the consensus position that climate-warming has

been caused by humans. Naomi Oreskes was the author of the study quoted by Gore.⁹ She reviewed almost one thousand journal articles by using a search of the key words “global climate change.” She further pointed out in her article that almost every significant national academy of science has issued position statements in support of this same position, including the U.S. National Academy of Sciences, which issued its statement in 2001 in response to a request from President Bush to address the issue. She concludes that “there is a scientific consensus on the reality of anthropogenic climate change. Climate scientists have repeatedly tried to make this clear. It is time for the rest of us to listen.”

In spite of claims by Gore, Oreskes, and others, the issue of anthropogenic warming is not so easily settled. This is because the philosophical implications of Kuhn’s approach to science were, and are, immense. Kuhn compared the switching of paradigms akin to a religious conversion—hardly a description that builds confidence in the objectivity of the scientific community. This leads to questions regarding the reliability of scientific consensus, and to a greater emphasis on the sociology of science.

Does the lack of peer-reviewed literature opposing the theory of anthropogenic warming really mean there is no legitimate scientific opposition? Or does it only mean that the reviewers of the major scientific journals adhere to the dominant paradigm, and therefore are incapable of objectively considering alternative viewpoints? Using the analogy of the judging of figure skating, a common practice is to toss out the high and low scores. What remains after dissenting voices have been removed is then labeled “consensus.”

Sometimes the ostracized scientists establish their own journals as a venue for publication. These could be considered “peer reviewed” articles since the articles are indeed reviewed by peers. The Robinson et al., article cited above appeared in the *Journal of American Physicians and Surgeons*, but this journal is not considered a respectable publication by most scientists. It has served as a source of publication for criticisms of socialized medicine, tobacco research, and global warming research. Any article published in it would not have been included in surveys of the scientific literature conducted by Oreskes since it is not included in citation indices.

Research Programs and Critical Realism

Kuhn’s philosophy challenges to the objectivity and reliability of the scientific establishment regarding climate change have been intense and

broadly publicized. Though the best arbiters of “scientific consensus” have been unanimous and unequivocal in their estimation of the scientific basis of climate change, is there within the philosophy of science a cogent justification for accepting their statements as fundamentally reliable, even if mid-twentieth century philosophy has pointed to the inability of scientific community to be completely unbiased and objective, much less approach the level of proof of its theories? Is there a middle ground between discredited overconfidence of traditional views of science and the extrapolation of the relativistic implications of paradigm-speak?

The philosophical middle ground in this area has been staked out by those who label themselves critical realists, a group perhaps best exemplified by the philosopher Imre Lakatos. Concern about the relativistic implications of Kuhn’s philosophy led Lakatos to suggest an alternative model of scientific practice. That “constellation of beliefs, values and practices” that Kuhn labeled a paradigm is not a self-contained, immutable entity immune from critical evaluation. Kuhn recognized that “normal science” involves using a paradigm to generate research, but did not seem to provide a clear picture of whether a paradigm might evolve and grow, or emphasize criteria that could be used to compare competing paradigms with any degree of confidence. Lakatos points out that paradigms must continually generate productive research that supports and advances certain core tenets. To emphasize this dynamic nature of scientific process, Lakatos used the term “research program” as a replacement for paradigm.¹⁰

The crucial point for Lakatos is that there should be observable evidence of whether a research program is progressing or degenerating. Progressive research programs generate hypotheses that tend to build upon previous work. Degenerating programs address contradictory evidence by generating *ad hoc* explanations that are used to protect the core beliefs. Hypotheses are tossed out to explain discordant observations, but further analysis does not bear them out. When these fail, new explanations are advanced. If we consider the argument that “observed changes in global climate are due to natural causes” to be at the core of the climate contrarian research program, it bears all of the characteristics of a degenerating program. For example, the Robinson et al. paper cited above was the most recent of several previous papers with nearly identical facts and arguments.¹¹

Among the natural explanations of past climate change, the most important is a set of regular changes in the earth’s orbit known as Milankovitch Cycles. The earth behaves rather like a spinning top that not only makes a

looping path that changes over time, but regularly wobbles on its axis. These changes have been projected back in time and correlate closely with the waxing and waning of successive ice ages over the past several hundred thousand years. The acceptance of Milankovitch Cycles as the dominant cause of ice age onset and retreat is itself a classic example of how research programs operate. However, attempts to explain current warming is a failure. Based only upon what is known of Milankovitch Cycles and past climate changes, there should be a very slight cooling trend that began 6000 years ago and will continue for thousands of years to come.¹²

The intensity of solar energy certainly has a dominant impact on global climate. Many of the proponents of naturally-induced global warming have argued that the increase in global temperature over the past century is simply due to an increase in solar radiation. There are proxies for estimating past solar radiation, and over the time frame of hundreds of millions of years, the level of solar radiation is thought to have increased. Direct and reliable measures of solar radiation have only been in existence since satellites began measuring irradiance above the atmosphere forty years ago. While this is a relatively short time period, it does coincide with the period of time when the earth's temperature has increased significantly. Over that time frame, the change in solar irradiance has been very slight. Models of global climate change suggest that these changes would have practically no impact on global climate.

The aspect of solar behavior that has received the most attention relates to solar cycles of sunspot activity. Galileo first observed sunspots near the turn of the seventeenth century, with accurate records of sunspot behavior kept for the past two-hundred fifty years. Sunspot activity follows roughly an eleven-year cycle, but the overall number of sunspots per cycle has undergone dramatic changes through the centuries. A distinct lull in sunspot activity during the middle of the seventeenth century correlates well with a slight cooling known as the "Little Ice Age," while an increase in sunspot activity correlates nicely with a gradual warming during the first half of the twentieth century. The close correlations have led to hypotheses that might explain how this behavior could impact global climate. It has also led to media accusations of a global conspiracy among climate scientists to ignore what appears to be a strong challenge to the mainstream view.

As a research program, the sunspot hypothesis did generate investigation into possible cause-and-effect pathways of climate change, beginning with an increase in sunspots leading to increased strength of the protective radia-

tion belts above the earth's atmosphere. This may reduce cosmic radiation reaching the atmosphere, which reduces ion formation. Ions might act as nuclei for droplets of water in clouds, so fewer clouds might lead to increased warming. However, there has been no long-term trend in cosmic radiation over time, so a clear cause-and-effect mechanism remains unclear.

Also, the correlation between sunspot activity and average global temperatures ended three decades ago. Sunspot activity has not increased since 1980—precisely the time that global temperatures have risen the most. This does not mean that sunspot activity has no effect on climate, but only that it cannot explain the steep increase in global temperatures observed over the past thirty years.¹³

According to Lakatos, degenerating research programs continue only by adding *ad hoc* explanations for their failures. An alternate correlation was proposed by Lassen and Friis-Christensen between the length of the sunspot cycle and global temperatures.¹⁴ While the cycle length is approximately eleven years, it may shorten or lengthen by several years. Lassen and Friis-Christensen presented data that closely correlated global temperatures with cycle length from 1860 to 1990. A decade later they revised their data.¹⁵ Their figures were shown to be erroneous for the period of 1970 to the present; no significant change length of the sunspot cycle correlates with the recent increase in global temperatures. Damon and Laut document similar errors and reversals regarding purported changes in cloud cover by the same authors.¹⁶ Even though this type of work has been discredited, it continues to receive popular circulation, exemplified by the documentary entitled *The Great Global Warming Swindle* shown on British and American network television in 2007.

The Intergovernmental Panel on Climate Change (IPCC) has issued reports in 1990, 1995, 2001, and most recently in 2006. Each new report reached more certain conclusions linking climate change to human induced carbon dioxide levels. The IPCC 2006 conclusion: “climate change is unequivocal,” and that they are over 90 percent confident that most of the change is due to human activity. They place the probability that natural change could account for the change at less than 5 percent.¹⁷ This is in fact an underestimate of the confidence felt by many scientists, since this is a consensus and compromise in language needed to get general agreement.

It is true that some evidence contradicts the consensus view on climate change. It is true that the paradigmatic views of many scientists may cause them to ignore alternative perspectives. It may also be true that the social

nature of science causes mainstream science to discredit criticisms of scientists like Bill Gray or view with suspicion claims like those of Lassen and Friis-Christensen. But the primary reason why each IPCC report has been more emphatic than the previous one is that no alternative research program has offered any sustained or progressive rationale for the observed increase in global temperature over the past few decades. Conversely, the consensus view attributing temperature change to increases in anthropogenic greenhouse gases is supported by a consilience of historic and ongoing research programs. The IPCC and other climate scientists must give the most credence to explanations that best fit with the greatest amount of evidence.¹⁸

The critical realist perspective recognizes that the goal of unquestioned truth in science is unattainable, yet what remains is still capable of giving us reliable insights into the reality of how nature works.

Science-Religion Interactions

When the Evangelical leaders called for Cizik's silencing, they justified their argument not only by questioning the consensus in science regarding the role of human action in causing global warming, but they followed this with a conclusion that "the issue should be addressed scientifically and not theologically." Should science and religion go their separate ways with respect to global warming? To articulate the full nature of a proper science/fait interaction is beyond the scope of this article, but as a simplistic starting point, we could do worse than to recall Einstein's dictum that "science without religion is lame; religion without science is blind."

In support of their call to address climate change "scientifically and not theologically" the signatories stated that an Evangelical focus on the issue of global warming would distract from "the great moral issues of our time." When Dobson and others speak of "the great moral issues of our time," high on that list of issues is the fate of the unborn. While abortion does indeed impact the fate of the unborn, this ironically is also a central issue for those concerned with the impact of climate change. It directly threatens the survival of future generations yet to be born, as well as the fate of those already in our midst.

An Inconvenient Truth highlighted the impact of Hurricane Katrina on New Orleans precisely to make the point that climate impacts the human condition. The situation of New Orleans is not unique. New Orleans sits in an interesting place on the globe. It lies at 90 degrees west longitude, almost

exactly halfway between the Prime Meridian that slices through Western Europe, and the International Date Line that bisects the Pacific Ocean.

Halfway around the globe from Louisiana at 90 degrees east longitude lies a land that is in many ways its mirror image. Tucked in the armpit of India, Bangladesh is almost identical in size to Louisiana, and has as its characteristic geography the delta of a great river system where the confluence of the Ganges and Brahmaputra rivers empty into a great bay of warm ocean water. It is, like Louisiana, a low country; indeed, one half of the nation lies only a few feet above the current level of the sea. Its geography confers on it annual floods like the Mississippi bestowed upon Louisiana before the river was lined with levees. And it lies in the path of violent storms.

But in some respects Bangladesh is a very different world. In the Louisiana-sized country crowds a population half the size of the United States; at 150 million, it has the seventh largest population of the world. And it is poor. The per capita income of an average Bangladeshi is one-thirteenth that of the average Louisianan. Most rural folk farm small plots of land; a typical city-dweller, if employed, might earn a couple dollars a day in a garment factory.

In 1991 a very intense hurricane made landfall in Bangladesh. One hundred fifty-five mile per hour winds and a twenty-foot surge of water came ashore. By the time it receded, over one hundred thousand lives were lost and ten million people were homeless. Another hurricane twenty years earlier killed between three hundred thousand and half a million people.

Climate change, with its potential to alter the global environment, is not something that instills fear in the hearts of most Americans. The reason is simple: wealth provides a buffer from the waves of environmental change. When Katrina approached New Orleans and orders were given to evacuate the city, many people drove inland. Tens of thousands of people in New Orleans remained behind—some because of obstinance, but the poor, the elderly, the infirm, the ill remained behind because they had little choice. While others paid a high price in economic loss, many of these paid with their lives.

In Bangladesh, when a cyclone approaches, there are fewer avenues for escape. There are not as many governmental resources to build bigger levees, even if it were possible in that geography. If the storms become more intense due to global warming, it simply means that two, three, or ten times as many may die. As mentioned above, the impact of climate change on cyclonic storms is still uncertain, so some might argue like Dobson that it is

not a religious concern. However, other consequences of climate change are known with greater confidence, and these also impact Bangladesh.

While cyclones may or may not strike Bangladesh in any given year, monsoon rains come every year. Starting in June, as summer heats the air above southern Asia, warm winds off the Bay of Bengal bring rain over India and snow over the Himalayas. In September 1998 Bangladesh saw the most severe flooding the modern world has seen. Although only one thousand people were killed, thirty million were made homeless and one hundred-thirty thousand cattle were killed, fifty square kilometers of land were destroyed and eleven thousand km of roads were damaged or destroyed. Two-thirds of the country was underwater.

The lifeblood of Bangladesh is the Brahmaputra/Ganges delta; the delta has always flooded and some flooding is necessary to fertilize the soil. But in 1998 the level of flooding was unprecedented. And unfortunately for Bangladesh, severe flooding has become the norm over the last decade. In 2007, like the two previous years, the monsoon floodwaters were devastatingly high, killing hundreds and leaving millions more homeless. But in the intervening dry seasons, the delta water fell to below-average levels, threatening the country with drought and salty sea water intrusion. There were several reasons for the severity of the flooding. Firstly, there were unusually high monsoon rains. Secondly, in the Himalayas, the source of the rivers that feed into Bangladesh, more of the precipitation is falling as rain, which races downstream in torrents, rather than falling as snow, which melts slowly, providing a constant, slow, steady runoff throughout the year. Indeed, the glaciers of mountains all around the world are retreating, meaning rivers that previously provided water downstream in the dry season will no longer do so.

For over twenty years computer models of climate change have predicted changing patterns of precipitation. Over the last ten years, these predictions have been born out in many cases, to the detriment of many in Bangladesh, Africa, and elsewhere.

Climate change skeptics have pointed out that there have been many computer models of what might happen in a world with more atmospheric CO₂, and some times they contradict each other about whether a particular region will get wetter or drier, or even warmer or cooler. There is one conclusion that every legitimate model made: over twenty years ago climate models all predicted the most dramatic changes would occur in polar regions. The American public may be forgiven if they don't remember these twenty years

later. However, few are now unaware of what is happening in the Arctic, with rapid melting of the permafrost, dramatic lengthening of the growing season, retreat of sea ice, and the dramatic retreat of the Greenland glaciers.

Bangladesh, remember, is a country with 150 million souls living only a few feet above sea level. The calculations are not so difficult. You can measure the volume of water stored in polar glaciers, measure the surface area of the oceans, and calculate that it won't take that much of Greenland or Antarctic glaciers to melt before there is no Bangladesh. 150 million from that country will need a new home, and that is only one nation among many.

Bangladesh is only one story among hundreds that could be told. The IPCC report devotes a separate volume of its report to projected consequences. If this is not an ethical issue, then it is hard to imagine what is. Global warming is not a religious concern only if religion can ignore the second of the two commandments Jesus proclaimed to be the greatest.

Because science cannot offer absolute proof, tobacco scientists can deny the link between cancer and smoking thirty years after consensus was reached by most scientists. Warnings would never have been placed upon cigarette packages if the level of required certainty were set by tobacco scientists. Galileo's telescopic observations of sunspots were part of the set of data that impelled him to challenge geocentric cosmology, and to subsequently be censured by the Vatican. It took the Catholic Church three hundred years to recant their condemnation of Galileo's argument that the earth circled the sun.

Unfortunately, we do not have three hundred, or even thirty, years to wait for still more evidence. We must act with the knowledge we have, for delays in addressing climate change lead to ever-greater consequences if, as the preponderance of evidence suggests, we already are altering climate.

Richard Cizik's advocacy against global warming began when he attended a 2002 conference that brought together climate scientists and Christians. The story of Cizik's "conversion" is recounted in the 2006 PBS episode of *Moyers on America* entitled "Is God Green?" The conference was arranged by British climatologist Sir John Houghton, who served as the lead editor for the first three IPCC reports and must be considered among the foremost of climate scientists. He is also a founding member of the International Society for Religion and Science, and director of the John Ray Institute, an organization addressing the need for Christian concern for the environment.

Moyers asked Houghton whether at the time he realized how important Cizik was in Evangelical circles. Houghton responded that he did. "The Na-

tional Association of Evangelicals [has] ...thirty, forty million Americans within their constituency ...[I]f he, with the influential position he had, could do something about it, I was just hoping he would.”

Somewhat reminiscent of Einstein’s words, Moyers states that “it was there, on a walk in the woods with Houghton, that the scales fell from Richard Cizik’s eyes.” Impelled by his religious convictions, Cizik committed himself to action. He ended his interview with Moyers by explaining his unwillingness to back down in the face of criticism that he was advocating for a divisive issue:

[T]here were people who said, ‘Stay true to the Bible,’ in the battle over abolition and slavery in America. And both sides said ‘I appeal to the Bible.’ Was one side right and one side wrong? Of course. Why? Because at times we allow our political judgments to get ahead of our biblical value systems. We do that. It happened in the civil rights movement of the 1960s in which Evangelical Christians sat on their hands. And I’ve had to apologize, you see, for you see those Evangelicals who sat on their hands then. And today, Mr. Moyers, I am not willing to make that same mistake.¹⁹

With respect to global warming, Einstein’s dictum may hold true, or it may be shown false. Our religious beliefs may motivate us to greater action in light of scientific evidence, or they may be used to rationalize inaction. It is perhaps pertinent to note that Jesus claimed to have come that the lame might walk and the blind might see.

NOTES

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