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Global Climate Change: Should Christian's be Concerned?

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Introduction

Less than a decade ago, few people outside of the scientific community had heard about climate change. Today, climate change has become a term recognized and discussed daily in newspapers, households and boardrooms around the world. In response to concerns expressed by scientists, politicians have already agreed to a United Nations Framework Convention on Climate Change (FCCC) and have negotiated an accompanying Kyoto Protocol. If the latter is ratified, it will commit the developed world to take the first small but concrete step towards addressing the issue. Countries involved are now undergoing intense internal discussions on whether or not to ratify the Protocol. Furthermore, many sectors of industry are already beginning to seriously address their responsibilities in reducing emissions of greenhouse gases. Others are considering how they should prepare to adapt to those aspects of climate change that already appear to be inevitable.

With the exception of a few advocacy groups, the role of the Christian community in these debates, internationally and nationally, has so far been minimal. Is this appropriate? Should we leave such issues to the secular community to resolve, or should we as Christians also be concerned? If so, how can we make a difference? These are important questions that we need to face **now**, given our mandate to be good stewards of God's creation.

Before we seek answers to these questions, however, it is useful to first put them into proper context. As Christian's we accept and believe that, in the beginning, God created the heavens and the earth, and that, when He was finished, "God saw all that he had made, and it was very good" (Genesis 1:31). In our words, that means it was perfect. Furthermore, we read in Isaiah that "he who fashioned and made the earth did not create it to be empty but formed it to be inhabited (Is 45:18). This is God's world, and he entrusted it to us as our home.

The more we learn about our 'home', the more we can see how critical the earth's atmosphere is in making the earth inhabitable. It contains an adequate supply of oxygen (21%) for human and animal respiratory needs, but not too much to make biomass too flammable. It has a hydrological cycle that provides ecosystems with the moisture needed to support biological growth. The upper atmosphere includes a protective "ozone layer" that shields ecosystems and humans at the surface from harmful ultraviolet solar radiation. Finally, it functions like a thermal insulating blanket, a role commonly known as the natural greenhouse effect. This effect is caused by trace gases in the atmosphere (collectively comprising less than one percent of its volume) that are very effective in absorbing and re-radiating downward the heat energy from earth escaping towards space. These 'greenhouse gases' help to increase the planet surface temperatures by some 33°C, keeping surface climates relatively stable and largely benign for ecosystems and humans. Were this role absent, the average surface temperatures of the planet would be -19°C. That is, earth would be an ice ball.

It is the latter role that has become the focus of scientific and political attention in recent years. Reconstructions from 'archived' air bubbles extracted from ancient ice buried deep within the polar ice sheets indicate that the atmospheric concentrations of the principle naturally occurring greenhouse gases (carbon dioxide, methane and nitrous oxide) have been remarkably stable throughout the pre-industrial period of the the past 10,000 years. Furthermore, during the glacial-interglacial cycles of the past 400,000 years, their concentrations have varied with the changes in climate, but never significantly exceeded the current pre-industrial concentrations. However, during the past 200 years, the atmospheric concentration of carbon dioxide has increased by 31%. That for methane has more than doubled. Nitrous oxide concentrations have also increased by 17%. All now exceed the highest concentrations detectable for at least the past 400,000 years, and

likely the past 20 million years. There is clear evidence linking these changes to human emissions, associated primarily with agricultural activities and the combustion of coal, oil and natural gas for energy. That is, humans have begun to alter the composition of the earth's atmosphere, and in doing so have begun a global scale experiment with one of the earth's fundamental life support characteristics of Earth.

While serious scientific concerns about these changes were already being voiced in the late 1950s, the first formal communication of these concerns to politicians and other non-scientists took place in 1988, during the World Conference on the Changing Atmosphere, held in Toronto. Attended by two Prime Ministers, a prominent US senator, numerous Environment and Energy ministers from various countries, as well as many scientists, engineers, sociologists and other experts, the meeting released a formal statement that began by stating that "Humanity is conducting an unintended, uncontrolled, globally pervasive experiment whose ultimate consequences could be second only to a global nuclear war".

While many others at the time felt that this statement was somewhat alarmist, it did herald a new stage of intensive scientific assessment and political debate that, in the past 12 years, has generated three major international scientific assessments, the ratification of the UNFCCC and the negotiation of the Kyoto Protocol. Everyone now seems to want to discuss climate change. Unfortunately, at least within the media, confusion reigns. Few journalists or politicians are able to properly address the complex science of climate change in proper context. Many are more interested in capturing public attention through selective transfer of information that promotes a particular point of view, rather than a sound assessment. One article may report on the risks of impending disaster, while the next suggests this issue is all based on junk science. One may suggest that we need to ratify Kyoto Protocol immediately, while the next suggests doing so would cripple our economy.

The following will try to address this confusion and to consider the role of Christians in this issue by addressing a number of key questions, as follows: Why is the science community concerned? Why is the international political community concerned? What is being done about it? How should the Christian community be, and how has it been involved? and finally, What should and can you and I do?

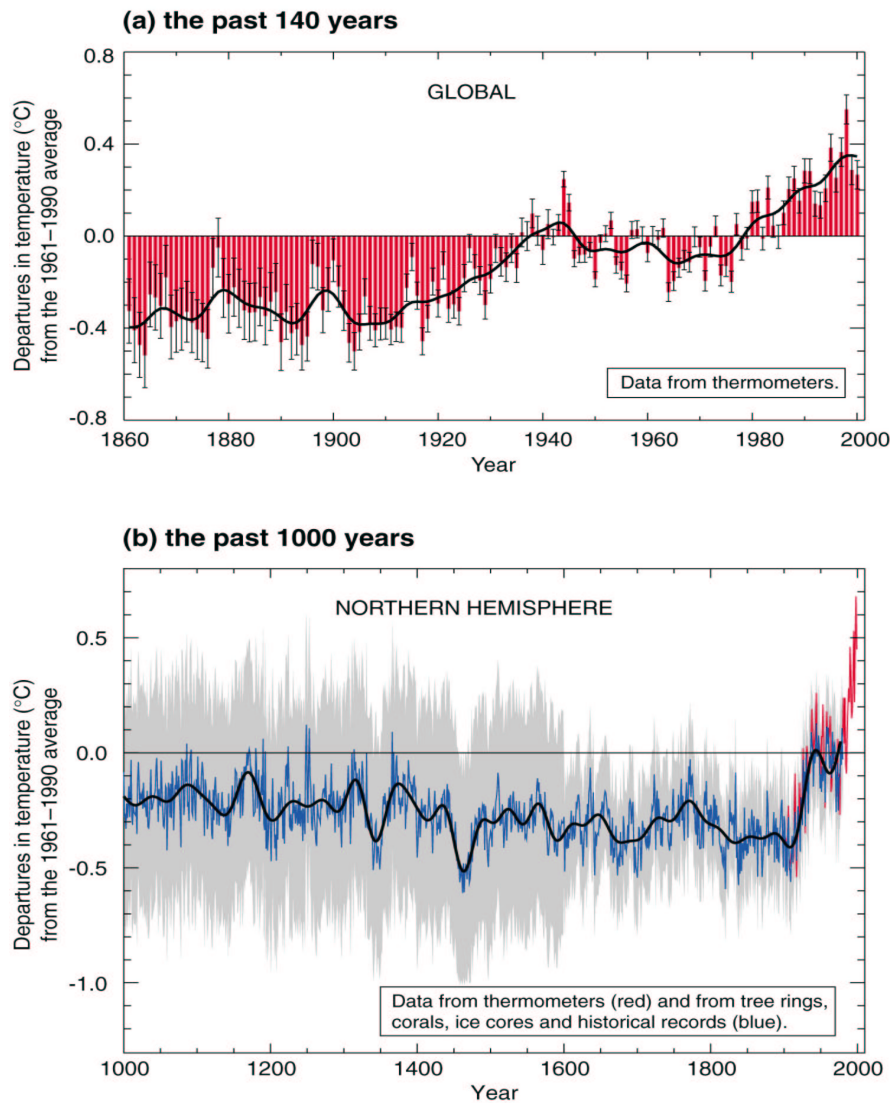
Why is the science community concerned?

In 1988, the United Nations requested that the World Meteorological Organization and the UN Environment Programme establish the Intergovernmental panel on Climate Change (IPCC) to coordinate periodic, comprehensive assessments of the science of climate change as a scientific basis for international political negotiations to mitigate the risks of climate change. The IPCC, through the diligent work of several thousand scientific experts from more than 80 countries, has now published three major assessments and a number of supplementary reports, all extensively peer-reviewed, and all written to be 'policy relevant but not policy prescriptive'. While the IPCC also has its critics, last year a special American panel of experts, convened by the US National Academy of Sciences at the request of President Bush to answer some of his concerns, provided a ringing endorsement of the quality and credibility of the IPCC work.

Following are some key highlights of the latest IPCC assessment that are particularly relevant for today's discussion:

- Data from meteorological instruments, collected for more than a century and corrected as carefully as possible for biases due to urbanization and other non-climatic influences, suggest that the average surface temperatures around the world have warmed by between 0.4 and 0.8°C since 1860.
- Comparison with these temperature records with relevant data reconstructed from geophysical indicators of climate conditions, such as tree ring characteristics and chemical composition of polar ice cores and ocean corals, indicate that, at least in the Northern Hemisphere, the 20th century was the warmest of the past millennium, the 1990s the warmest decade, and 1998 and 2001 the two single warmest years.

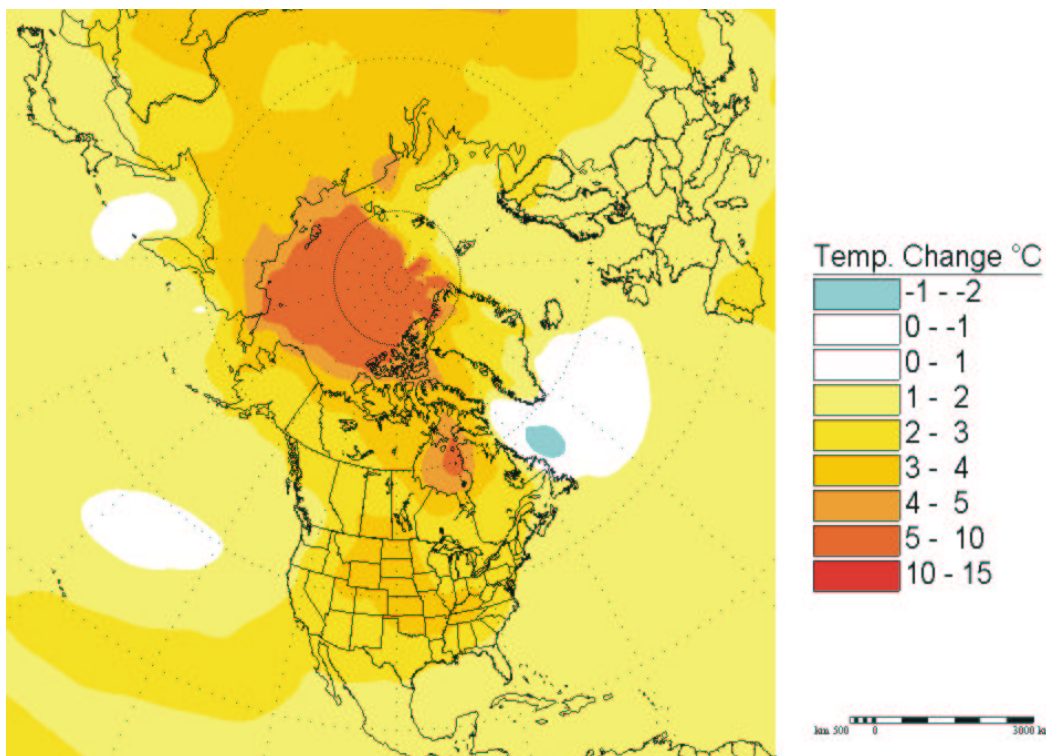
Trends in Temperature



Trends in temperature. Panel a) shows trends for global temperatures based on instrumental data for the past 140 years, with error bars shown. Panel b) shows the same for the Northern Hemisphere in comparison with proxy data reconstructions for the past 1000 years. Source: IPCC

- Retreating alpine glaciers, thinning and retreating sea ice in the Arctic Ocean, rising sea levels and other forms of proxy data support the conclusion that this change is real.
- Global economic losses to weather-related disasters, adjusted for inflation, are ten times larger today than 40 years ago. Part of this has been caused by wealthier people living in vulnerable areas, but industry experts argue that at least some of this increase in losses is because of increased frequency of extreme weather events.
- Natural climate factors, such as natural variability, changes in the intensity of the sun’s radiation or fluctuations in concentrations of dust from volcanoes that can reflect incoming sunlight, can explain some of the observed temperature changes of the early 20th century. However, for the past 50 years, the net influence of these natural factors has been towards a cooling effect, in sharp contrast to the observed rapid rise in temperatures. The IPCC concluded that "there is new and stronger evidence that most of the warming observed over the past 50 years is attributable to human activities’.

- By 2100, human activities will almost certainly cause a doubling of concentration relative to pre-industrial levels, and could cause a tripling.
- Such increases in greenhouse gas concentrations are expected to cause average global temperatures to rise by at least an additional 1.4°C, and possibly 5.8°C by 2100. Even the lower limit would be unprecedented in at least the past 10,000 years. At the upper limit, the magnitude of change would be similar to that between the peak of the last glacial maximum some 25,000 years ago and today, but at rates of change several orders of magnitude greater.



Projected changes in temperatures, as shown for the Canadian climate model simulations for 2050 AD, will be uneven, with land warming more than oceans and high latitudes more than low latitudes.

- Continents will warm more than oceans; high latitudes will warm more than low latitudes; and the hydrological cycle will become more active. The altered map of temperature distribution around the world, in turn, causes changes in wind currents (which are driven largely by temperature patterns) and hence in the distribution of rainfall. Interior continental regions of the Northern Hemisphere are expected to become drier in summer.
- Thermal expansion of ocean waters as they warm, together with melting glaciers, will add some 9 to 88 cm to ocean levels by 2100. Even greater increases in sea level rise are expected in subsequent centuries as the oceans and ice sheets very slowly respond to warmer air temperatures, even if the climate at the earth's surface becomes stabilized.

Why is the political community concerned?

A change in climate need not be harmful to humans or ecosystems if such changes are slow and moderate in magnitude. In fact, historical records provide many examples of regional changes in climate that, while disruptive, have not resulted in global disasters. Rather, the risks of danger due to climate change arise when such change is rapid or large, or if they occur in regions where ecosystems or societies are very sensitive to any change.

Climatologists use a variety of analysis tools to assess how changes in climate as projected by the climate model experiments might affect people and ecosystems, and whether such changes may pose danger. Unfortunately, while there is considerable agreement between models on the general characteristics of future change are the large, continental scale, they still disagree significantly in the details of such at the regional and local scale. Hence, impact studies at this time can only give an approximate sense of consequences, and results must still be used with caution. However, these do provide some important clues as to the risks involved. They also suggest that the consequences will be unevenly distributed. Assessments suggest the following:

- Wealthier countries in temperate to cool latitudes are expected to experience both the benefits of warmer temperatures and the hazards associated with drier interiors, possible increases in extreme weather events and other related problems. The net effects in these countries are therefore unlikely to cause major economic catastrophes unless the change in climate exceeds 2 to 3°C. The consequences will be increasingly negative above this threshold.
- In contrast, nations located in tropical regions and most small island states will not be benefited by more heat but are much more likely to be faced with danger. Furthermore, they have few resources to help them adapt, and hence are much more vulnerable to change. For example:
 - A one-meter sea level rise would threaten the very existence of small island nations such as the Maldives or Tuvalu. Within the next century, as many as 200 million additional people in countries with heavily populated coastal regions, such as Bangladesh, China, Japan and Egypt could be impacted by annual flooding due to storm surges on higher seas;
 - Food production in most tropical countries, many of which already face food shortages and have low adaptive capabilities, is expected to decrease. For societies within these countries, many of which are among the poorest in the world, almost any significant change in climate can substantially increase the risk of disaster;
 - Some studies suggest an additional 80 million people will be malnourished by 2080. Many others will also be exposed to greater risks of tropical diseases such as malaria and dengue fever.
- The larger and more rapid the change, the greater the risk of danger. This suggests that, while the causes of such change are already occurring now, the harmful consequences will largely be borne by future generations.

Canada belongs to the first group of countries. Many of the social and economic activities taking place within it are limited by cold temperatures and, for much of the year, snow covered lands and ice covered waters. Hence, climate change will clearly provide both benefits and liabilities. Warmer temperatures, for example, mean shorter and less harsh winters and longer summer growing seasons, with their attendant benefits. Offsetting these are the risks of dryer summers, lower lake and river levels in the south, risks of more frequent intense rainfall events and summer heat waves (and related health implications), and the loss of cultural activities that rely on snow and ice. Furthermore, since trees cannot uproot themselves and move with the changes in climate, major portions of Canada's forest ecosystems will likely become increasingly stressed by the warmer temperatures and drier summers. In response, the risks of insect infestations, forest dieback, wild fire and loss of ecological habitats rise substantially. Hence some regions and some economic sectors will benefit, and others will lose. Anticipation and preparation for these changes (that is, adaptation) can help to maximize the benefits and minimize the losses. However, Canada will also be impacted indirectly by disasters in developing countries because of the related need for compassionate activities such as international peace-keeping, disaster relief and the acceptance of environmental refugees.

What is being done about it?

Presented with the above evidence for the real risks of danger to ecosystems and humans, policy makers began serious international negotiations for developing an international strategy to reduce these risks in the

early 1990s. Not surprisingly, these discussions are dominated by widely diverging world-views of the member nations. Some tend to be dominated by perspectives that might be labeled as modernistic, capitalistic and/or nationalistic. These countries are generally reluctant to act, and argue for the need for scientific proof before they do so. They often suggest that technology will solve the problem if and when that is necessary, and are generally opposed to actions that might negatively affect their current national economies, irrespective of how these actions might reduce the potential for harm due to climate change to the economies of other countries or of future generations. At the other extreme are those who adopt a more global, post-modernistic and/or humanistic or ecocentric perspective, or who feel particularly threatened by the prospects of climate change. In the latter category, small island states have been particularly vocal in their pleas for action.

As a result of these negotiations, nations around the world endorsed the United Nations Framework Convention on Climate Change (FCCC) in 1992. The ultimate objective of the FCCC is to stabilize atmospheric concentrations of greenhouse gases at a level that would prevent dangerous human interference with the climate system. In the FCCC, policy makers recognized the need for three key elements of a global strategy to address this challenge: research (improving our understanding of the risks to help us better define our response); mitigation (reducing the rate of climate change through reductions in global greenhouse gas emissions; and adaptation (reducing risks by anticipating and preparing for the consequences). The Convention was ratified and came into force within the next two years, after which signatories to the Convention began meeting annually at Conferences of the Parties (CoP) to discuss concrete mitigative actions.

At their third CoP meeting in Kyoto, Japan in 1997, participants agreed to the Kyoto Protocol, which commits developed nations to take the first small step towards the FCCC's ultimate objective by collectively reducing their emissions by 5.2% below 1990 levels by 2010. Individual country targets vary, with pledged reductions of 6% for Canada, 7% for the United States, and 8% collectively for the member countries of the European Union. Some countries, such as Australia, successfully argued for increases in emissions. Most of these developed countries have not as yet ratified this agreement, although the members of the European Union as well as Japan are now close to doing so. Meanwhile, the United States (which is responsible for about 25% of global emissions) has declared its intention not to ratify, but has offered its own made-at-home plan. That plan will slow down the growth rate in national emissions but falls far short of its original Kyoto target. Canada is still actively debating whether or not to ratify, and the outcome is far from certain. Emissions in Canada, in fact, are already more than 10% above 1990 levels and, without concerted efforts to reduce emissions, are projected to increase to more than 25% above its Kyoto target by 2010.

However, even a successful and complete implementation of the Kyoto Protocol agreement would only delay attaining the various climate change thresholds of the future by a decade or so. In fact, studies suggest that, to achieve stabilization of greenhouse gas concentrations in the atmosphere, total emissions for all countries would eventually need to decrease to some 50% or more below 1990 levels. The developed country commitments under the Kyoto Protocol only achieve about 10% of their contribution to that target. More importantly, emissions from developing countries, which are expected to comprise the larger share of global emissions within a few decades, are as yet not addressed in the Protocol, and hence can continue to rise unabated unless further actions are agreed to in future amendments to the Protocol.

Even if the international community were able to eventually reach agreement on how to fully stabilize concentrations at below a doubling of pre-industrial CO₂ (an enormous challenge, since this would require a major shift in energy technologies towards an almost totally renewable energy future), this is unlikely to eliminate the risks of danger due to climate change. Climate models predict that the earth would still likely warm by 2 to 3°C under these conditions. In other words, while we can reduce the risks by reducing the rates of climate change through mitigation, it is too late to stop climate change. This is a reminder that adaptation to climate change must also be a key part of response strategies. That is, the development of major long-term socio-economic infrastructures, as they are being planned or renewed, must carefully consider the possible consequences of climate change.

What about Christians and Climate Change?

Given the mandate given in Genesis to be caretakers of Creation, it would seem that Christians should be at the forefront of those addressing the risks of climate change. Not that the future of this world depends on human actions! In fact, we confess that our world belongs to our triune God, the Almighty Creator, who still sustains and upholds his Creation. Rather, God has invited us, as his children, to participate in taking care of Creation – a task he expects us to do not out of duty but out of thankfulness and love. There are several reasons, therefore, why Christians must become engaged in the debate on climate change, and must undertake actions to address the risks it poses. First, we as humans are irreversibly altering the life support characteristics of the earth's atmosphere, without fully understanding the consequences. In doing so, we are putting global ecosystems and humans at risk. We are gambling with Creation. Secondly, each species eliminated as a result of climate change, and each disaster that climate change may cause, reduces the capacity of God's creation to praise Him. Both of these are violations of his command to us to love him above all else. Third, climate change is expected to have the largest harmful effects on those who are poorest and most disadvantaged today, and on future generations. To not address this, either through reducing the cause of change or in helping them cope with those changes that are already unavoidable, is a violation of the second great commandment – to love our neighbour as ourselves.

That is a world-view radically different from those prevalent in the international and national debate today. Yet it is a worldview that Christians profess to be the correct one!

During the past decade, Christians have become active, in a limited way, in influencing the debate. Within the United Nations structure, for example, there is one member – the Holy See – that has the opportunity to become a full partner in the international policy debate. While its participation through interventions at the CoP and other related meetings has been far less than one might hope for, Pope John Paul issued an appeal, prior to the 1992 Environmental Summit in Rio De Janeiro, to Christians to pray for the world leaders in their decision making during the Summit – a critical and oft overlooked role for faithful earthkeepers! Meanwhile, several international groups, particularly the World Council of Churches and the European Christian Environmental Network, have participated as advocacy groups in the corridors of the UN meeting locales and at related 'side-shows'. In their formal statements, they have called on nations to repent of their harmful behaviour and made recommendations with respect to actions both to reduce the risks of change and to help the poor adapt. Within Canada, groups such as Kairos Canada and the Christian Ecumenical Jubilee Initiative have issued similar calls for response to the Canadian governments and people. A number of Canadian denominations have also made their positions clear through statements issued through various fora. For example, the 37th General Council of the United Church of Canada, in August 2000, called on Canada to ratify the Kyoto Protocol. More recently, in collaboration with Kairos Canada, it has asked Christians in Canada to write to the Prime Minister, their Premier and other politicians to express their support for immediate ratification.

There is another less obvious but very critical manner in which Christians are involved in responding to this issue. Many members of the research and policy communities participating in climate change research and assessment and in developing strategies to deal with the risk it poses are Christians who quietly but faithfully apply their faith to their work. This in turn can significantly influence the process. They are acting as 'salt' within the secular world. One prominent example of such action is that offered by Sir John Houghton, respected scientist, influential leader, author, lecturer and Christian!

Sir John spent much of his life as a meteorologist and atmospheric scientist, culminating his public service career with the British government as head of the United Kingdom Meteorological Office. In recognition of his outstanding service, he was knighted by the Queen of Great Britain in the early 1990s. In 1988, in similar recognition of his excellent scientific and leadership credentials, the IPCC asked him to act as co-chair for the key IPCC working group responsible for assessing the scientific basis for concern about climate change. He fulfilled this role with integrity and with effective diplomacy until the completion of the third such assessment in 2001. However, already in the mid-1990s, in his excellent reference textbook on the science of climate

change, he openly acknowledged how both his scientific background and his faith have been major factors on how he perceives the climate change issue – the latter an acknowledgement that some book reviewers found inappropriate for a 'scientist', but that earned grudging respect from the secular science community.

Last year, in a lecture to a meeting in Cambridge, England of the UK's Christians in Science organization (available at www.st-edmunds.cam.ac.uk/cis/houghton), Sir John also stated why he is optimistic about the future of this world, despite his concerns about climate change. First, he notes, there is the coming together of the science community, with great commitment, to agree on a scientific assessment of likely climate change. Secondly, there is evidence that the necessary technology to address the issue is becoming available and that industry is beginning to see climate change as an issue that provides great opportunities for technical advance. Finally, he unequivocally states his belief that "God is committed to his creation?demonstrated by sending Jesus into the world to be the saviour of the human race. In delegating the care of his creation, God has not left us to do it on our own." (He adds that this belief has been a great source of strength to him in his role as IPCC co-chair – a strength that was particularly felt as he met with several others for prayer during the very demanding IPCC WG I plenary session in Shanghai in January of 2001.

So where does this leave those who profess to be 'Christian environmental practitioners'?

First, we need to recognize that all sectors of our society, and hence all aspects of our human activities, are implicated in greenhouse gas emissions. This isn't just an issue for politicians and industry to sort out. It involves each of us, personally and professionally. In Canada, for example, 27% of greenhouse gas emissions come from the transportation sector (about 43% from cars and light trucks). Another 17% is generated through the production of electricity, 17% as upstream emissions caused by the fossil fuel industry in bringing coal, oil and gas energy to the market, and 16% from the mining, manufacturing, construction and other non-energy industries. 14% is produced by the combined activities in the non-electric commercial, institutional and residential sectors, and farmers contribute an additional 9%. In our work and in our discussions, we all need to help seek and promote efficient ways of reducing these emissions.

Secondly, many practitioners are involved in services where future impacts of climate change will be important, and where we need to take anticipatory and responsive action to capitalize on the benefits and mitigate the harmful effects. This is particular true for those involved with assistance to developing countries.

In order to properly equip ourselves to do so, we need to pursue three strategic objectives:

- We need to improve our understanding of the scientific and technical nature of the issue and seek the wisdom need to effectively use this knowledge, with integrity, in our work environment. Much of that knowledge is readily available from such sources as the IPCC web site (www.ipcc.ch) and publications available from a number of credible sources. Given the complexity of the science, we also need to be discerning about the authority of the source of knowledge, and to place all 'new' information into the proper context of existing knowledge. We need to be cautious about information generated by advocacy groups with conflicts of interest or strong biases (whether from industry, environmental groups or other) or that has not been properly peer-reviewed. The wisdom, as Solomon and others remind us, comes from the respect and love for the Creator and the study of his Word.
- We need to wisely apply this knowledge to our work environment to improve our collective stewardship of Creation, each in our own unique capacity. For some of us, that means promoting means of using energy more efficiently, or seeking energy alternatives to the use of coal, oil and gas. Others need to examine how we use our land, and whether there are more stewardly ways of food production. Yet others will apply this to waste management or manufacturing processes, building efficient structures, the transportation of people and goods, municipal planning, and so forth.
- We need to wisely apply our knowledge in our work towards mitigating the effects of climate change in Creation and in helping our 'neighbour' cope with the impacts. Anticipating the changes can help us to prepare for them through adaptive measures, such as improved water management for flood and drought

risks, infrastructure modifications and other technological and social responses. Many of these already make sense for current climate conditions.

- There is one more way that we need to respond. We need to set examples to fellow Christians and others in our personal actions. So that "men may see your good deeds and praise your Father in heaven" (Mathew 5:16). Such examples must be evident in:
 - sharing of our knowledge – it behooves those who have specialized knowledge to share this knowledge, in wisdom, with other Christians who also need to understand and acknowledge their role in faithful earth-keeping;
 - our personal behaviour – how we use – or don't use – our car, insulate and use our homes, dispose of our wastes, etc.;
 - our consumer habits – the kind of car we drive or appliance we buy, our willingness to refuse, reduce and reuse even before we consider recycling. These habits are not only an example to others, but send a powerful message to manufacturers on the need for more environmentally friendly products;
 - our voices. Most importantly, we need to set examples through our thankful worship of the Creator, who not only created but maintains and has redeemed Creation. We need to plead with the Holy Spirit to lead and guide us and our decision makers. We need to communicate with our political representatives at all levels of government to express our concerns and our desire to be good earth-keepers. Finally, we must be 'wise' in our use of the ballot boxes.

Some Concluding Thoughts

The scientific understanding of the climate system and the risks of future climate change is still constrained by inadequate understanding of the many complex processes involved and by the inherent uncertainty that will always be part of such a non-linear, somewhat chaotic system. However, the available knowledge does allow for some tentative conclusions, as follows:

- the global climate system is already changing, and changes in recent decades are likely due to humans;
- the risks of future climate change at magnitudes unprecedented in human history are real and significant;
- the potential rates and regional characteristics of such change are still poorly understood;
- climate change poses serious risks of harm to ecological species and to humans, particularly in poor and developing regions of the world;
- international objectives for mitigating greenhouse gas emissions can reduce risks by slowing down the rate of climate change;
- further climate change is unavoidable, and adaptation is an important part of the response.

Given the significance of the above conclusions for the earthly life that God has created for his pleasure and his praise, it is paramount that Christians become involved in responding. Such is an inherent part of their earth-keeping responsibilities. More importantly, it is an expression of thankfulness and love to our God and Redeemer, and a manifestation of our love for our neighbour. Finally, we bring to this challenge a hope that none others can offer. As Christ said, "take heart because I have overcome the world (John 16:33b). Apostle Peter adds that "we are looking forward to the new heavens and new earth he has promised, a world where everyone is right with God." (2 Peter 3:13).

Some Christians have begun to do so, but much remains to be done. Let's do so, in hope!