

It is hoped that the paper will prompt discussions on the topics of climate change, resource sustainability and risk management and will encourage members of the CIA to present more papers on these issues.

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The authors take full responsibility for the material contained and views expressed in the paper.

## **Abstract**

Actuaries are becoming more aware of the combined impact of climate change and limitations of resources—two separate and very significant issues—putting at risk the sustainability of the current socio-economic systems that support our way of life. Although actuaries do not claim professional expertise in environmental issues, they can be guided by the growing body of knowledge publicly available from reliable scientific sources. Being particularly qualified to deal with modelling financial consequences of risks and uncertainties, the actuarial profession has a duty to provide training and education on climate change and sustainability so that its members are qualified to contribute to the well-being of the society as a whole. In undertaking this exercise, the actuarial profession needs to be cognizant of the fact that even within the climate change science community there are differing views on the nature and amplitude of the risks and the profession should be aware of these differing views

Climate change is more than global warming. The rise in average temperature is only one indicator of broader changes also translating into extreme temperatures, drought, flooding, storms, rising sea levels, impacts on food production, and infectious diseases. Although the scientific community has been aware of the link between greenhouse gases (GHGs) and climate change for many years, world leaders have been slow to react and implement measures to mitigate the risks.

Key sources of information on climate change are synthesised by the successive reports of the Intergovernmental Panel on Climate Change (IPCC) created by the United Nations and the World Meteorological Organization in 1988. The prevalent view is that there is a significant anthropogenic contribution to the increase in atmospheric CO<sub>2</sub> and other GHGs resulting from fossil fuels emissions and deforestation. Unless new policies are implemented, global warming will exceed the threshold of 2°C agreed to by the parties to the UN Framework Convention on Climate Change for which Canada is a signatory.

In 1970, a paper by the Club of Rome pointed out that limited planet resources cannot support unlimited exponential growth. Even renewable resources will be depleted if they cannot be renewed fast enough. By some estimates, we are now using 50% more resources than the sustainable level. The 8 billion population projected by 2030 is twice the 4 billion the earth had to feed as recently as 1974. The pursuit of economic growth is compounding the growth in demand. Global warming is exacerbating the sustainability challenge as it may

reduce agricultural production and will result in physical damage resulting from extreme weather events, sea-level rise, etc.

Mitigating resource scarcity entails adopting new approaches such as a “circular economy”. This refers to an industrial economy that is restorative by definition. It aims to rely on renewable energy; favors recycling; minimizes, tracks, and hopefully eliminates the use of toxic chemicals; and eradicates wastes through careful design. The mitigation strategy can be guided by a new paradigm defining a planetary boundary framework providing a science-based analysis of the risk that human overuse of resources will destabilize the earth system at the planetary scale.

The potential impact on actuarial methods and assumptions, especially future growth expectations, is pervasive in the work of actuaries and affects traditional life and non-life, health and pensions areas, investment practices, and newer areas like enterprise risk management. The actuarial profession has created interest groups at the national and international levels to help deepen the understanding of the quantitative aspects of sustainability. It can collect feedback and provide critical reviews of actuarial risk models, establish standards of practice, and promote the adoption of best practices. The North American actuarial associations are jointly creating actuarial climate and risk indexes that will monitor future changes and provide comparisons of benchmarks with the data published by climate scientists.

Actuaries can examine the different scenarios for climate change and use of resources to quantify the risks and provide guidance through cost/benefit analyses. Given the multidisciplinary nature of these issues, actuaries can benefit from inputs by non-actuarial entities and work in cooperation with other professionals to serve the public interest through optimizing policy options.

## **Part 1 – Introduction**

### **1.1 Objective**

Extensive discussions are taking place throughout the world in all forms of media on the subjects of global warming and climate change. These discussions point to the global dangers posed by the earth’s warming. Discussions are also taking place on the related question of resource limitations, given the manner in which humans are using the planet’s limited resources.

The purpose of this paper is to provide some education to the members of the CIA. This will consist of providing some background to these issues, identifying some of the current and future risks involved, the possible financial and other impacts posed by these risks, and the worldwide efforts that are being made to minimize these risks. Empowered by a wider access to this knowledge, actuaries can employ their expertise in quantifying these risks and provide guidance to the different publics served by the CIA and thus enhance the well-being of society as a whole. A failure by the actuarial profession to provide advice on these risks could damage its credibility.

The different sectors of the economy have been examining these risks. A timely input by the actuarial profession would increase the visibility of the profession and create new opportunities.

## 1.2 Recognition of Risks

Due to the nature of the subject, the international discussions on climate change are driven by worldwide climate scientists. There would be a few members of the CIA who would have a good understanding of the issues involved. But the majority of actuaries may not have such understanding. As a result, actuaries have to be guided by the work done by the climate science community. No doubt, even within the climate change science community there are differing views on the nature and amplitude of the risks and actuaries should be aware of these differing views. However, considering the fact that a very large majority of that community is of the view that the risks posed by climate change are serious and could cause disastrous consequences if immediate action is not taken, actuaries have to consider these as distinct possibilities. The fact that climate science is still evolving or there are opposing views would not be a valid reason for the profession to choose to do nothing.

As understood from the work done by climate scientists, impacts of climate change will be very wide ranging—extreme climate, increased losses due to floods and storms, rising sea levels, food scarcity, clean water shortage, increased mortality and illness, devaluation of assets, constraints on energy use, and so on. The actuarial community has to obtain a good understanding of the issues involved. Just sitting there without doing anything will severely damage the profession's reputation.

The issue of climate change has been recognized by many professions. The actuarial community can benefit from finding out the perceptions of the different professions of how climate change will affect the work done by them.

A classic example of proactive action taken by the actuarial profession would be how it handled the risk of AIDS in the early 1980s. As soon as the world became aware of the AIDS risk, different actuarial bodies designed a variety of infection scenarios that enabled the life insurance industry to set up adequate reserves for the additional mortality. A similar proactive approach can be taken to address the risks posed by climate change. The methods and solutions would be different, but the first steps would be risk recognition and quantification for different scenarios.

## Part 2 – Climate Change, Process, Reasons, and Future Impacts

### 2.1 What is Climate Change?

Climate change is the subject of how weather patterns change over decades or longer. Climate change takes place due to natural and human influences. Since the Industrial Revolution (i.e., 1750), humans have contributed to climate change through the emissions of GHGs and aerosols, and through changes in land use, resulting in a rise in global temperatures.<sup>1</sup> Increases in global temperatures may have different impacts, such as an

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<sup>1</sup> [http://www.wmo.int/pages/themes/climate/causes\\_of\\_climate\\_change.php](http://www.wmo.int/pages/themes/climate/causes_of_climate_change.php)