

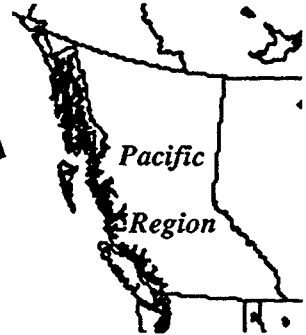


36 007 584

REF
PAES
90-2

**SCIENTIFIC
SERVICES
DIVISION**

REPORT



CLIMATE CHANGE: QUESTIONS AND ANSWERS

Eric Taylor
Scientific Services Division
Atmospheric Environment Service
Pacific Region

July 5, 1990
Report PAES-90-2

CLIMATE CHANGE QUESTIONS AND ANSWERS

Eric Taylor
Scientific Services Division
Atmospheric Environment Service, Pacific Region
July 5, 1990

INTRODUCTION

At the end of a presentation to the Vancouver Task Force on Atmospheric Change in April 1990 I was asked a number of questions regarding climate change. This report summarizes my response to the questions. Some answers have been updated with more recent information.

QUESTIONS AND ANSWERS

1. What are the implications of the time lag between the input of anthropogenic CO₂ into the atmosphere and its effect on global temperature?

CO₂ has an atmospheric lifetime of from 50 to 200 years. Anthropogenic CO₂ released today will continue to warm the atmosphere for many years to come. Relative to 1990, the globe is expected to warm by 1°C by 2030 and by more than 3°C by 2090, with larger increases in the interior of continents and near the poles. This represents a temperature rise which is unprecedented in the last 10,000 years. The impacts of this expected climate change will be borne by subsequent generations but will result from the chemical alterations that we are presently making to the atmosphere.

2. What data acquisition and research should the City request that Canada pursue in order to enable the City to make more informed decisions regarding atmospheric change?

Canada is involved in a number of research activities in the field of climate variability and change. The federal government could be requested to continue supporting these activities, some of which include:

- i) maintaining a robust climate program to monitor the variability of Canada's climate and to detect any national or regional climate changes.
- ii) contributing to the understanding of the role of the oceans, clouds and greenhouse gases in global climate.
- iii) climate modelling to help predict the global climates of the future.

3. Is stratospheric ozone depletion and global warming the same problem?

Stratospheric ozone depletion and global warming are separate issues but do have some common threads.

Firstly, CFC-11 and CFC-12, the man-made chemicals implicated in the depletion of the ozone layer (which has been most marked over Antarctica in the early spring) are also strong greenhouse gases. Their concentration is currently much lower than CO₂ but is steadily increasing. Molecule-for-molecule they are much more effective at absorbing terrestrial radiation. For example, the radiative effect of a molecule of CFC-11 is about 12 000 times as much as a molecule of CO₂.

Secondly, if the ozone layer is significantly depleted, increasing amounts of ultra-violet light would be expected to reach the troposphere and the earth's surface. This could increase the global warming potential by:

- i) producing increased amounts of tropospheric ozone, itself a significant greenhouse gas.
- ii) lowering the photosynthetic capability of plants, including forests, and thus reducing the amount of carbon sequestered in organic matter. This would lead to an increase in the atmospheric concentration of CO₂.

4. Is CO₂ responsible for the anticipated global warming?

The main natural greenhouse gases, in order of effectiveness, are water vapour, carbon dioxide, methane, nitrous oxide and tropospheric ozone. Additional man-made greenhouse gases include CFC-11, CFC-12 and HCFC-22. The *increased* warming potential during the 1980s was, in order of effectiveness, due to man-made carbon dioxide, CFCs, methane and nitrous oxide.

5. How do you sleep at night knowing that we are facing extinction? What do you tell your kids about their future environment?

No one has suggested that climate change will lead to extinction of the human race. What man could be facing is significant disruptions in many areas of the globe, disruptions that will affect all of the world's population either directly or indirectly.

As for our children, we can teach them about the changes that could occur if we continue to pollute the globe, and measures that can be taken to both arrest and to adapt to these changes. Children appear to be very environmentally conscious, and are becoming quite vocal about the misuse of the environment by previous generations. They should be encouraged to continue learning about environmental problems, including climate change, and to express their views on the subject. It is mainly *their* climate we are changing.

6. Has anyone done a complete analysis of the total economic impact of climate change on Canada, including the costs of importing food that can no longer be grown dependably on the prairies?

The Canadian Climate Centre has been involved in a number of studies that have focused on the effect of climate change on specific regions or economic sectors. These have been published in the periodical *Climate Change Digest* and include the following:

- i) Implication of climate change on agriculture in the prairie provinces (88-01), Saskatchewan (88-06), Ontario (87-02) and Canada in general (89-01). These studies are not completely consistent with each other.
- ii) Implication of sea level rise on St. John, New Brunswick (87-04), and Charlottetown, PEI (88-02) and downtown Vancouver (unpublished).
- iii) Implication of climate change on recreational sectors such as downhill skiing in Quebec (88-03), the golfing industry in Quebec (89-04), and tourism and recreation in general in Ontario (88-05).
- iv) Implication of climate change on natural resources (including forestry) in Quebec (88-08), Ontario (88-09) and the prairies and N.W.T. (89-02).
- v) Implication of climate change on the Great Lakes (87-03).
- vi) Regional effects of climate change on Alberta (89-05), small coastal communities of Atlantic Canada (90-01), and Prince Albert National Park (89-03).
- vii) Effects of climate change on the marine environment of Atlantic Canada (88-07).

Other studies have been completed, and more are either currently under way or being planned. However, due to the uncertainty of the timing and magnitude of anticipated temperature and precipitation changes, and to the complexity of the interactions between various ecosystems, no attempt has been made as yet to quantify the net cost (or benefit) to Canada of climate change.

7. What is your best guess on the probability that a significant global warming will occur in the next century?

There are many uncertainties in our predictions of the climate of the next century, mainly due to an incomplete understanding of the role of clouds and the ocean in climate change. However, most climatologists agree that increased concentrations of greenhouse gases will cause some additional warming in the next century and that this warming could be large.

8. How can you say the earth is warming when there was a reported cooling between 1940 and 1975?

There is a natural variability to the earth's climate. The Intergovernmental Panel on Climate Change report of May 25, 1990 addressed the issue of a reported northern hemisphere cooling from 1940-1975 by stating that:

"...we believe that a real warming of the globe of 0.3°C - 0.6°C has taken place over the last century... Much of the warming since 1900 has been concentrated in two periods, the first between about 1920 and 1940 and the other since 1975; the six warmest years on record have all been in the 1980s. The northern hemisphere cooled between the 1940s and early 1970s when southern hemisphere temperatures stayed nearly constant. The pattern of global warming since 1975 has been uneven, with some regions, mainly in the northern hemisphere, continuing to cool until recently. This regional diversity indicates that future regional temperature changes are likely to differ considerably from a global average."

9. Why do you say that the transportation sector produces 25% of the CO₂ emissions when a recent report showed that slash burning in B.C. produces the vast majority of CO₂ in this province and transportation produces well below 25%?

25% of *national* CO₂ emissions are produced by the transportation sector. A recent study of CO₂ emissions prepared for the B.C. government reported that in British Columbia slash burning emitted more CO₂ (20 million tonnes) than the transportation sector (17.4 million tonnes) annually. However, the findings of this report are in some dispute, as Forestry Canada has subsequently calculated that slash burning, both for silviculture (reforestation) and rangeland (wildlife enhancement) purposes, emits closer to 8 million tonnes of CO₂. This is about half of the B.C. transportation sector emissions. It should also be noted that if forestry slash was not burned and left to decompose, a similar amount of CO₂ would eventually enter the atmosphere. Reforestation will also remove significant quantities of carbon from the atmosphere over the lifetime of the new forest.

10. If there were no additional beneficial effects from reducing the burning of fossil fuels, is it worth trying to decrease the risk of global warming when so many uncertainties still exist?

The ramifications of climate change are too great to be ignored. If we wait until scientists are absolutely certain of global warming, it will be much too late to avert most of the changes that mankind is currently effecting. Furthermore, the uncertainty issue can cut both ways - we may be underestimating the magnitude of a global warming.

Nature is capable of producing surprises, and the climate warming that is being predicted could occur quite rapidly. An example of such a surprise is the ozone depletion question. In the early 1970s scientists were predicting that atmospheric pollution by CFCs would deplete stratospheric ozone but that this depletion would not be noticeable until the next century. Subsequent studies showed that a dramatic reduction in stratospheric ozone was frequently occurring at certain times of the year over Antarctica. In a similar way, it is not out of the question that an unexpected jump in global temperature could occur sooner than predicted. We should try to reduce the risk of this occurring.

11. We have heard that a number of studies have been completed on the impact of global warming on regions in Eastern Canada. Have any been done for British Columbia and if not, why not?

The Atmospheric Environment Service published the proceedings of the Symposium of the Impacts of Climate Variability and Change on British Columbia held in Vancouver in 1988. This publication contains several papers dealing with the impacts of climate change on various economic sectors of the province.

The Canadian Climate Centre will soon publish a University of British Columbia study on the application of global climate models to British Columbia. This study also makes an initial examination of the effects of climate change on some of the natural systems (such as the hydrological cycle) in the province.

A second study by U.B.C. (sponsored by the Canadian Climate Centre and to be published in late 1991) will examine changes in atmospheric circulation patterns brought about by global warming and the effects on precipitation and runoff in British Columbia. Other U.B.C. studies have explored the possible impacts of climate change on freshwater and saltwater fisheries in the province.

A conference on the implications of global environmental change on British Columbia will be held in Vancouver in September 1990. Plans are underway to organize a 1991 symposium dealing with climate change on forests of the Pacific Northwest, including those of British Columbia.